

JOHN DEERE

COMPONENT TECHNICAL MANUAL

PowerTech® 6.8 L & 8.1 L Diesel
Engines Level 3 Electronic
Fuel System

CTM134 14MAY03 (English)



***POWERTECH*[®] 6.8 L & 8.1 L Diesel Engines**

Level 3 Electronic Fuel Systems with Bosch In-Line Pump

TECHNICAL MANUAL *POWERTECH*[®] 6.8 L & 8.1 L Diesel Engines Level 3 Electronic Fuel System

CTM134 14MAY03 (ENGLISH)

For complete service information also see:

<i>POWERTECH</i> [®] 8.1 L Diesel Engines—Base	
Engine	CTM86
<i>POWERTECH</i> [®] 4.5 L & 6.8 L Diesel Engines—	
Base Engine	CTM104
Alternators and Starter Motors	CTM77
OEM Engine Accessories	CTM67 (English Only)

John Deere Power Systems

LITHO IN U.S.A.

Introduction

Forward

This manual (CTM 134) is written for an experienced technician. Essential tools required in performing certain service work are identified in this manual and are recommended for use.

This manual covers only the Level 3 Electronic Fuel System. It is one of five volumes on 8.1 L engines. The following four companion manuals cover the repair, operation and diagnostics for the base engine and various electronic and mechanical fuel systems. These 5 volumes are included in the binder set (CTM450). In order to complete the 8.1 L set, include CTM 68 with the books in this binder. **Discard CTM134 dated 22FEB99 and replace with the following new manuals::**

- CTM68— 8.1 L—Electronic Fuel Injection Systems
- CTM86—8.1 L Base Engine
- CTM134—6.8 L & 8.1 L Level 3 Electronic Fuel Systems with Bosch In-Line Pump
- CTM243—8.1 L Mechanical Fuel Systems
- CTM255—8.1 L Level 9 Electronic Fuel Systems with Denso In-Line Pump

This new CTM134—Level 3 Electronic Fuel Systems with Bosch In-Line Pump, contains fuel system and electronic engine control repair procedures formerly in CTM86, Groups 35 and 40 (06JUL99).

CTM 134 is also one of 4 volumes on 4.5 L and 6.8 L engines. The following two companion manuals cover the base engine and mechanical fuel system repair, operation and diagnostics:

- CTM104—4.5 L & 6.8 L Base Engine
- CTM207—4.5 L & 6.8 L Mechanical Fuel Systems
- CTM134—6.8 L & 8.1 L Level 3 Electronic Fuel Systems with Bosch In-Line Pump
- CTM170—6.8L & 8.1 L Level 4 Electronic Fuel System with Bosch VP44 Pump

Other manuals will be added in the future to provide additional information on electronic fuel systems as needed.

A complete set of all these manuals covering 4.5 L and 6.8 L engines is available in a binder by ordering CTM 350 Binder Set.

Live with safety: Read the safety messages in the introduction of this manual and the cautions presented throughout the text of the manual.



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

Use this component technical manual in conjunction with the machine technical manual. An application listing in Section 01, Group 001 identifies product-model/component type-model relationship. See the machine technical manual for information on component removal and installation, and gaining access to the components.

Information is organized in sections and Groups for the various components requiring service instruction. At the beginning of each Group are summaries of the upcoming Group.

Before beginning repair on an engine, clean the engine.

This manual contains SI Metric units of measure followed immediately by the U.S. customary units of measure. Most hardware on these engines are metric sized.

Some components of this engine may be serviced without removing the engine from the machine. Refer to the specific machine technical manual for information on components that can be serviced without removing the engine from the machine and for engine removal and installation procedures.

Read each block of material completely before performing service to check for differences in procedures or specifications. Follow only the procedures that apply to the engine model number you are working on. If only one procedure is given, that procedure applies to all the engines in the manual.

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

DPSG,OUO1004,2760 -19-12MAY00-2/2

John Deere Dealers

CTM 134 is now part of a four manual binder set (CTM450) covering repair, operation and test procedures on 6.8 L and 8.1 L engines. **Discard CTM134 dated 22FEB99 and replace with the following new manuals:**

- CTM86— 8.1 L—Base Engine
- CTM134— 6.8 L and 8.1 L Diesel Engines—Level 3 Electronic Fuel Systems with Bosch In-Line Pump
- CTM243— 8.1 L—Diesel Engines—Mechanical Fuel Systems
- CTM255— 8.1 L—Diesel Engines—Level 9 Electronic Fuel Systems with Denso In-Line HPCR

IMPORTANT: The changes listed below make your CTM obsolete. Please copy this page, listing changes, and route through your service department.

CTM68— 8.1 L—Electronic Fuel Injection Systems will not be included with the early CTM450 binder sets. This book is necessary to diagnose other electronic control systems on the 8.1L engine.

This new CTM134—Level 3 Electronic Fuel Systems With Bosch Pump, contains electronically-controlled fuel system repair and electronic engine control repair procedures formerly in CTM86, Group 35 (06JUL99).

SECTION 01—Group 001 (Engine Identification)

- Updated engine model designation chart.
- Updated engine application charts.

SECTION 01—Group 002 (Fuels)

- Updated general information on diesel fuels.

SECTION 02—Group 090 (Dual Rail Electronic Fuel System Repair and Adjustments)

- Added fuel system repair procedures formerly in CTM86, Group 35.

SECTION 02—Group 110 (Electrical Engine Control Repair and Adjustment)

- Added electrical engine control repair procedures formerly in CTM100, Group 45.

SECTION 03—Group 130 (Electronic Fuel System Operation)

- Electronic fuel system operation is covered in this new Group.

SECTION 03—Group 140 (Electronic Fuel System Operation)

- Electrical control system operation is covered in this new Group.

SECTION 04—Group 150 (Observable Diagnostics and Tests)

- Revised diagnostic procedures for low pressure fuel system.

SECTION 04—Group 160 (Trouble Code Diagnostics and Tests)

- Revised trouble code diagnostic and test procedures for John Deere Level 3 electronic-controlled fuel system.

SECTION 05 (Tools and Other Materials)

- All essential tools, service tools, dealer fabricated tools and other materials listed throughout this manual are consolidated in this section for ease of reference.

SECTION 06 (Specifications)

- All repair, test and diagnostic specifications listed throughout this manual are consolidated in this section for ease of reference.

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SECTION 03—Theory of Operation

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

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A John Deere ILLUSTRATION® Manual

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Section 01 General

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Lubricity of Diesel Fuel 01-002-3

Handle Fluids Safely—Avoid Fires

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

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

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

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



TS227 -JUN-23AUG88

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

Handle Starting Fluid Safely

Starting fluid is highly flammable.

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

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

Do not incinerate or puncture a starting fluid container.



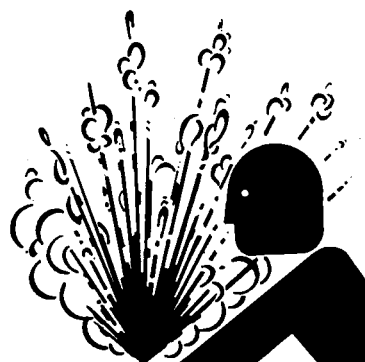
TS1356 -JUN-18MAR92

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

Service Cooling System Safely

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

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



TS281 -JUN-23AUG88

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

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Prevent Battery Explosions

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

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

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



TS204 -UN-23AUG88

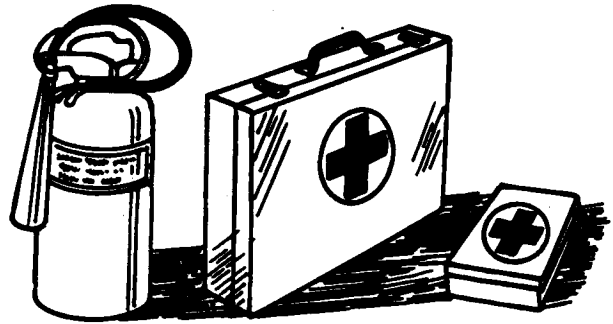
DX,SPARKS -19-03MAR93-1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 -UN-23AUG88

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

Handling Batteries Safely



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

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

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



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

Avoid the hazard by:

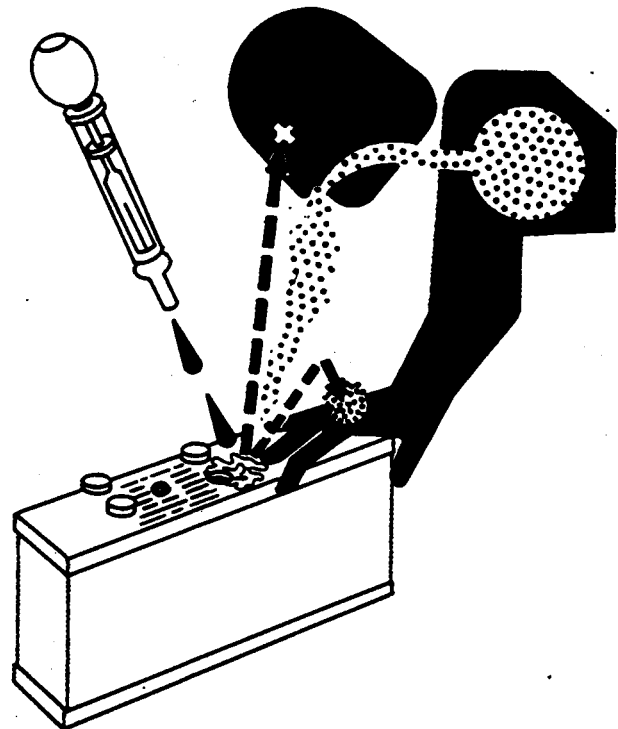
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



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

TS204 -UN-23AUG88

TS203 -UN-23AUG88

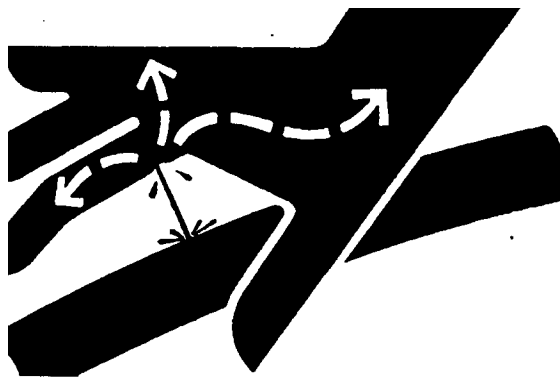
Avoid High-Pressure Fluids

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

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

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

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



X9811 -UN-23AUG88

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

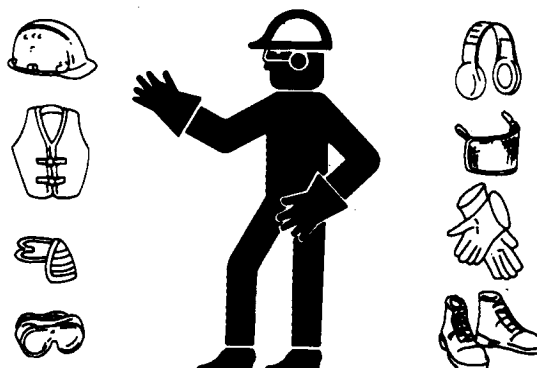
Wear Protective Clothing

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

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

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

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



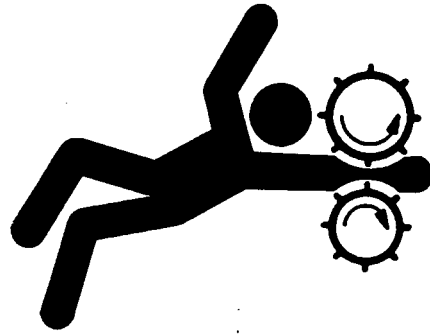
TS206 -UN-23AUG88

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

Service Machines Safely

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

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



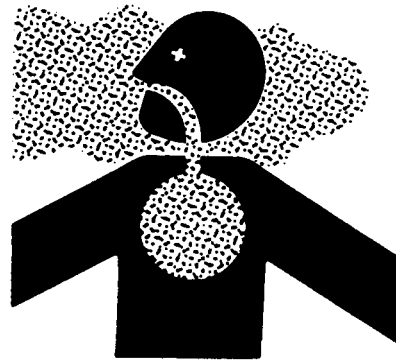
TS228 -JUN-23AUG88

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

Work In Ventilated Area

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

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



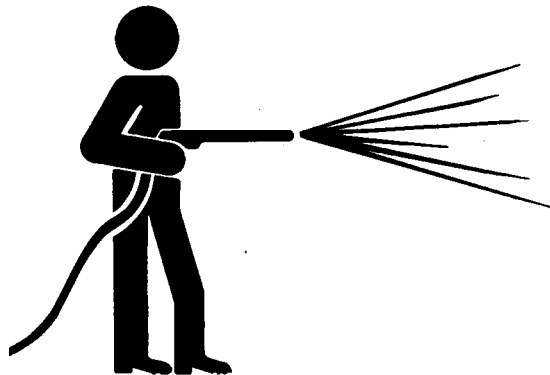
TS220 -JUN-23AUG88

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

Work in Clean Area

Before starting a job:

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



T6642EJ -JUN-18OCT88

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

Remove Paint Before Welding or Heating

Avoid potentially toxic fumes and dust.

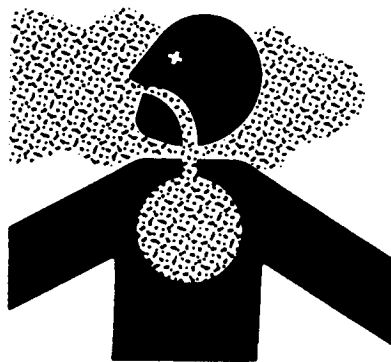
Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

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

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

Dispose of paint and solvent properly.



TS220 -UN-23AUG88

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

Avoid Heating Near Pressurized Fluid Lines

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



TS953 -UN-15MAY90

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

Illuminate Work Area Safely

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



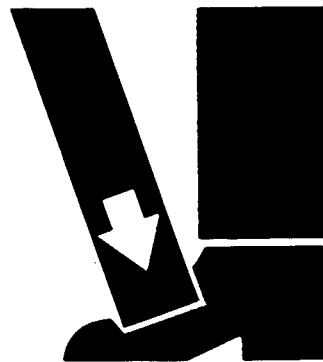
TS223 -UN-23AUG88

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

Use Proper Lifting Equipment

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

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



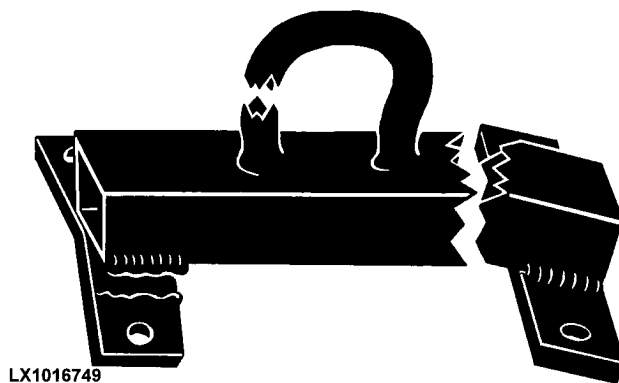
TS226 -UN-23AUG88

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

Construct Dealer-Made Tools Safely

Faulty or broken tools can result in serious injury. When constructing tools, use proper, quality materials and good workmanship.

Do not weld tools unless you have the proper equipment and experience to perform the job.



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LX1016749 -UN-01JUL97

Construct Dealer-Made Tools Safely

DPSG,OUO1004,899 -19-19MAY99-1/1

Practice Safe Maintenance

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

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

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

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

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

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



TS218 -UN-23AUG88

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

Use Proper Tools

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

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.



TS779 -UN-08NOV89

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

Dispose of Waste Properly

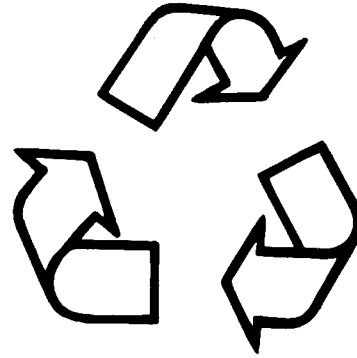
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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

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

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

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



TSL1133 -UN-26NOV90

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

Live With Safety

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



TS231 -19-07OCT88

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

Engine Application Chart (John Deere Agricultural Equipment)

Machine Model	Engine Model
DES MOINES—COTTON PICKERS	
9976 Cotton Picker	6081HN001, 003
HARVESTER—COMBINES	
9510 Low Power Combine	6081HH001
9510 High Power Combine	6081HH002
9550 Low Power Combine	6081HH008
9550 High Power Combine	6081HH009
9610 Combine	6081HH003
9650 and 9650CTS Combine	6081HH010
9650 CTS-(Europe) Combine	6081HH011
9650 STS Combine	6081HH006
9750 STS Combine	6081HH005
CTS II Combine (Europe-1998 Model Year)	6081HH003
CTS II Combine (Europe-1999 Model Year)	6081HH004
CTS II Combine (North America)	6081HH003
Amadus Peanut Combine	6081HH007
WATERLOO—TRACTORS	
7710 Tractor	6081TRW03, 05, 07
7810 Tractor	6081TRW04, 06, 08
8100 Tractor	6081HRW06
8200 Tractor	6081HRW07
8300 Tractor	6081HRW08
8400 Tractor	6081HRW01, 04
8100T (Tracks) Tractor	6081HRW10
8200T (Tracks) Tractor	6081HRW02
8300T (Tracks) Tractor	6081HRW09
8400T (Tracks) Tractor	6081HRW03
8110 Tractor	6081HRW11
8210 Tractor	6081HRW13
8310 Tractor	6081HRW15
8410 Tractor	6081HRW17
8110T (Tracks) Tractor	6081HRW12
8210T (Tracks) Tractor	6081HRW14
8310T (Tracks) Tractor	6081HRW16
8410T (Tracks) Tractor	6081HRW18
9100 4-Wheel Drive Tractor	6081HRW05
ZWEIBRUCKEN—COMBINES/FORAGE HARVESTERS	
2268 Combine	6081HZ006
6650 Self-Propelled Forage Harvester	6081HZ004

RG40854,000001B -19-01MAR01-1/1

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Engine Application Chart (John Deere Construction Equipment)

Machine Model	Engine Model
DAVENPORT	
644H Loader	6081HDW05
644H-MH Loader	6081HDW06
150LX Loader	6081HDW70
770C (Late)/770CH/772CH Motor Grader	6081HDW01
670C (Late)/670CH/672CH Motor Grader	6068HDW55, 58
DUBUQUE	
850C Crawler	6081AT002
BELL - SOUTH AFRICA	
250D, 350D Articulated Dump Truck	6081HT004

RG40854,000001A -19-01MAR01-1/1

Engine Application Chart (OEM) (Outside Equipment Manufacturers)

Application	Engine Model
OEM Engine (Tier I Emissions Certified)	6081AF001
OEM Engine (Tier I Emissions Certified)	6081HF001
OEM Engine 6068HF250 (Ag-Chem applications)	
Marine Engine	6081AFM01

RG40854,000001C -19-01MAR01-1/1

Distinguishing ECUs on 8.1 L Engines

The John Deere Level 3 ECU is used mainly on earlier 8.1 L engines. This manual (CTM 134) supports all repair, operation, and diagnostics related to the Level 3 ECU and the Bosch In-Line Pump. The Level 3 ECU has a 30-way and a 18-way ECU connector. On the fuel system, the electronically-controlled in-line injection pump has a delivery line dedicated to each cylinder. The high pressure fuel is delivered through mechanically-controlled fuel injection nozzles.

The John Deere Level 9 ECU is used on later 8.1 L engines. CTM 255 supports all repair, operation, and diagnostics related to the Level 9 ECU and the Denso In-Line Pump. The Level 9 ECU has two 30-way ECU connectors. On the fuel system, the in-line injection pump delivers fuel through 2 delivery lines to a high pressure fuel rail. The fuel enters the cylinders through electronically-controlled fuel injectors.

RG40854,0000021 -19-05MAR01-1/1

Distinguishing ECUs on 6.8 L Engines

The John Deere Level 3 ECU is used on a few 6.8 L engines. This manual (CTM 134) supports all repair, operation, and diagnostics related to the Level 3 ECU and the Bosch In-Line Pump. The Level 3 ECU has a 30-way and a 18-way ECU connector. On the fuel system, the electronically-controlled in-line injection pump has a delivery line dedicated to each cylinder. The high pressure fuel is delivered through mechanically-controlled fuel injection nozzles.

The John Deere Level 4 ECU is used on some 6.8 L engines. CTM 170 supports all repair, operation, and diagnostics related to the Level 4 ECU and Bosch VP44 Rotary Pump. The Level 4 ECU has one 68-way ECU connector. On the fuel system, the electronically-controlled rotary injection pump has a delivery line dedicated to each cylinder. The high pressure fuel is delivered through mechanically-controlled fuel injection nozzles.

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Lubricants and Coolant

NOTE: For information on lubricants and coolants, refer to Section 01, Group 002 of CTM86 Base Engine Manual for information on lubricants and coolants.

DPSG,OUO1004,2761 -19-16MAY00-1/1

Diesel Fuel

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

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

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

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

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

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

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

Sulfur content:

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

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

RG40854,0000026 -19-19MAR01-1/1

Bio-Diesel Fuel

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

Bio-diesel fuels may be used ONLY if the bio-diesel fuel properties meet the latest edition of ASTM PS121, DIN 51606 or equivalent specification.

It has been found that bio-diesel fuels may improve lubricity in concentrations up to a 5% blend in petroleum diesel fuel.

When using a blend of bio-diesel fuel, the engine oil level must be checked daily when the air temperature is -10°C (14°F) or lower. If the oil becomes diluted with fuel, shorten oil change intervals accordingly.

IMPORTANT: Raw pressed vegetable oils are NOT acceptable for use for fuel in any concentration in John Deere engines.

These oils do not burn completely, and will cause engine failure by leaving deposits on injectors and in the combustion chamber.

A major environmental benefit of bio-diesel fuel is its ability to biodegrade. This makes proper storage and handling of bio-diesel fuel especially important. Areas of concern include:

- Quality of new fuel
- Water content of the fuel
- Problems due to aging of the fuel

Potential problems resulting from deficiencies in the above areas when using bio-diesel fuel in concentrations above 5% may lead to the following symptoms:

- Power loss and deterioration of performance
- Fuel leakage
- Corrosion of fuel injection equipment
- Coked and/or blocked injector nozzles, resulting in engine misfire
- Filter plugging
- Lacquering and/or seizure of internal components
- Sludge and sediments
- Reduced service life of engine components

RG41183,0000046 -19-18DEC01-1/1

Lubricity of Diesel Fuel

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

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

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

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

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

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

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

DX,FUEL5 -19-17FEB99-1/1

Section 02

Repair and Adjustments

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Fuel System — General Information

Some 6.8 & 8.1 L engines use the Bosch P3000 and P7100 injection pumps. The Bosch pumps are similar in design, application is specified according to power output requirements.

Fuel is transferred from vehicle or engine fuel tanks with a fuel supply pump. The injection pump fuel inlet connection is located at the rear of the pump on the fuel inlet assembly, which includes the Fuel Shut-off Solenoid and the Fuel Temperature Sensor.

The fuel supply pump is plunger-type mounted on the side of the injection pump driven by the injection pump camshaft.

Engines are equipped with a round primary fuel filter/water separator and a rectangular final fuel filter.

IMPORTANT: The Injection Pump is electronically controlled. All connectors on the pump and the engine control unit (ECU) must be disconnected before any welding is accomplished on the engine, or damage to the electrical system is likely to occur.

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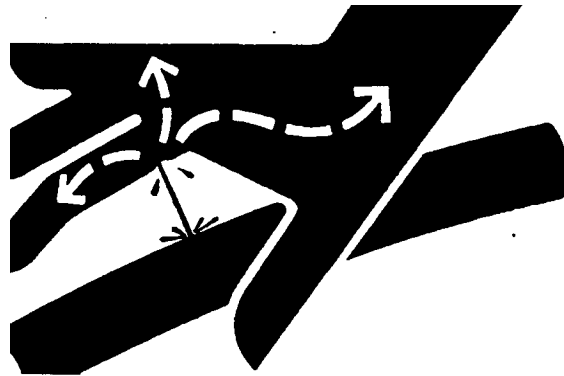
Relieve Fuel System Pressure



CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin, causing serious injury. Before disconnecting lines, be sure to relieve pressure. Before applying pressure to the system, be sure ALL connections are tight and lines, pipes and hoses are not damaged. Keep hands and body away from pinholes and nozzles which eject fluid under pressure. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.

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.

Any time the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system.



Avoid High-Pressure Fluids

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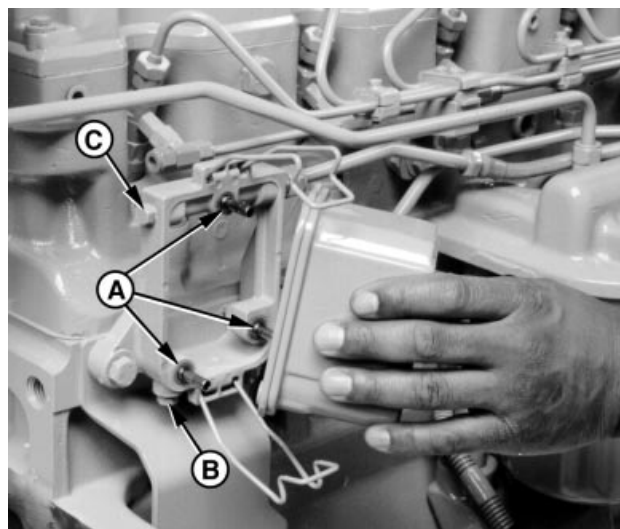
RG,RG34710,1282 -19-23OCT97-1/1

Replace Rectangular Fuel Filter Element

NOTE: Refer to your operator's manual for proper servicing and replacement (hourly) intervals.

1. Close fuel shut-off valve at bottom of fuel tank (not illustrated).
2. Loosen bleed plug (C) and remove drain plug (B). Drain fuel from filter.
3. With fuel filter held firmly against base, lift up on top retaining spring and pull down on bottom retaining spring. Pull fuel filter off guide pins (A) of fuel filter base and discard filter.

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

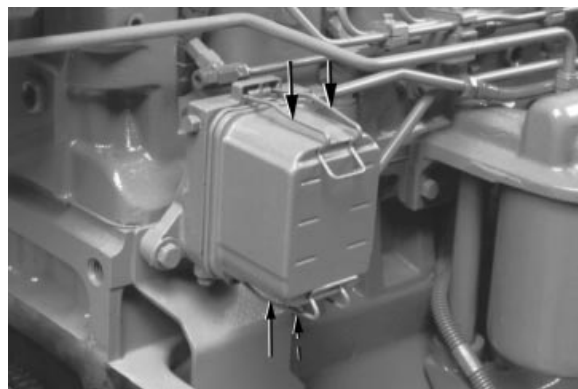


Replacing Rectangular Fuel Filter Element

RG7051 -UN-26NOV97

RG, RG34710, 1283 -19-11MAY99-1/2

4. Install fuel filter onto guide pins on fuel filter base. Hold filter against base.
5. Secure bottom retaining spring first, then secure top retaining spring. (See arrows.)
6. Apply LOCTITE® 592 Pipe Sealant with TEFLON® to drain plug and bleed plug. Install drain plug, shown installed. Tighten bleed plug and drain plug securely. Do not overtighten.
7. Open fuel shut-off valve and bleed fuel system.
8. If fuel filter base was removed from engine, reinstall and tighten cap screws to specifications.



Installing Fuel Filter Element

RG7052 -UN-26NOV97

Specification

Fuel Filter Base-to-Block
Mounting Cap Screws—Torque 35 N•m (25 lb-ft)

LOCTITE is a registered trademark of Loctite Corp.
TEFLON is a registered trademark of Du Pont Co.

RG, RG34710, 1283 -19-11MAY99-2/2

Replace Fuel Filter Check Valve

1. Drain and remove fuel filter (C) as described earlier in this group.
2. Remove fuel filter inlet line (A), (shown removed).
3. Inspect and clean fuel filter base (if needed).
4. Remove check valve assembly (B) from fuel filter base and discard.
5. Install new check valve assembly and tighten securely.
6. Install fuel inlet line and tighten connection to specifications.

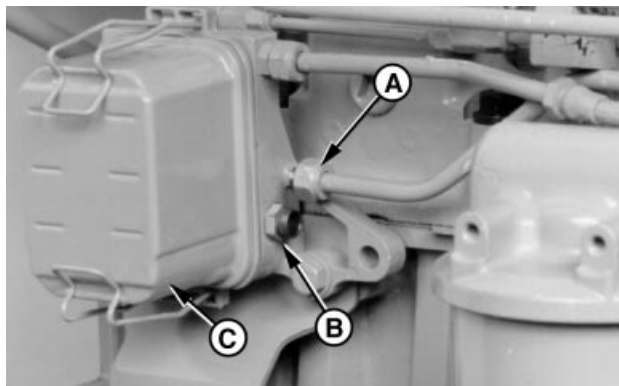
Specification

Fuel Pipe Connections at Filter

Base—Maximum Torque..... 17 N•m (12 lb-ft) (150 lb-in.)
maximum

DO NOT overtighten.

7. Install fuel filter and bleed fuel system.



Replacing Fuel Filter Check Valve

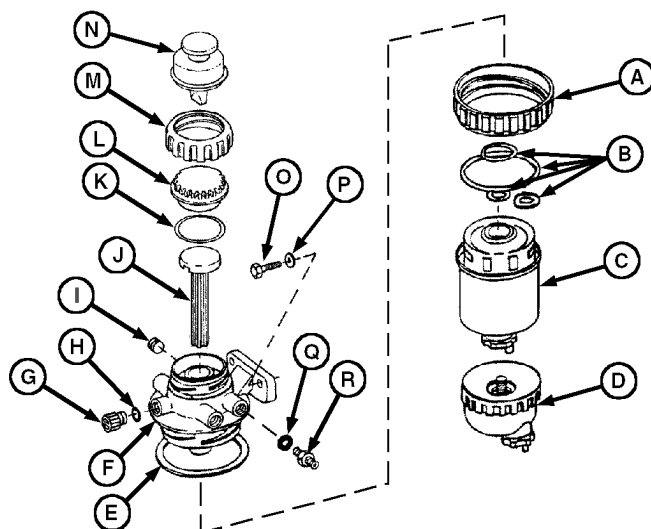
A—Fuel Filter Inlet Line
B—Check Valve Assembly
C—Fuel Filter

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RG, RG34710, 1284 -19-23OCT97-1/1

Replace Primary (Round) Fuel Filter/Water Separator



Fuel Filter/Water Separator

RG9545 -UN-06MAY99

A—Retaining Ring
B—Seal Kit
C—Filter Element
D—Water Separator Bowl
E—Seal

F—Filter Head
G—Bleed Screw
H—O-Ring
I—Plug
J—Stem

K—O-Ring
L—Cap
M—Retaining Ring
N—Primer Assembly

O—Cap Screw (2 used)
P—Washer (2 used)
Q—O-Ring
R—Fitting

NOTE: Refer to operator's manual for proper servicing and (hourly) replacement intervals. See LUBRICATION AND MAINTENANCE SERVICE INTERVAL CHART in operator's manual.

1. Thoroughly clean fuel filter/water separator assembly and surrounding area, if not previously done.

2. Connect a drain line to filter drain adapters and drain all fuel from filters.

NOTE: Lifting up on retaining ring (A) as it is rotated helps to get it past raised locators.

3. Firmly grasp the retaining ring and rotate it counterclockwise 1/4 turn. Remove ring with filter element (C).

4. Inspect filter mounting base for cleanliness. Clean as required.

5. Remove water separator bowl (D). Drain and clean separator bowl. Dry with compressed air.

6. Install water separator bowl onto new filter element. Tighten securely.

7. Thoroughly inspect filter and base seals (B). Replace as needed.

NOTE: The primary fuel filter must be indexed properly and the key on canister must be oriented in slot of mounting base for correct installation.

8. Install new filter element onto mounting base and position element using a slight rocking motion. Be sure element is properly indexed on mounting base.

9. Install retaining ring onto mounting base and tighten about 1/3 turn until ring "snaps" into the detent. DO NOT overtighten the retaining ring.

Continued on next page

DPSG,OUO1004,860 -19-28APR99-1/2

10. If removed, install fuel filter base and tighten cap screws to specifications.

Specification

Fuel Filter Base-to-Oil Filter

Base Cap Screws—Torque 61 N•m (45 lb-ft)

11. Bleed fuel system. See BLEED THE FUEL SYSTEM in Section 04, Group 150 of this manual.

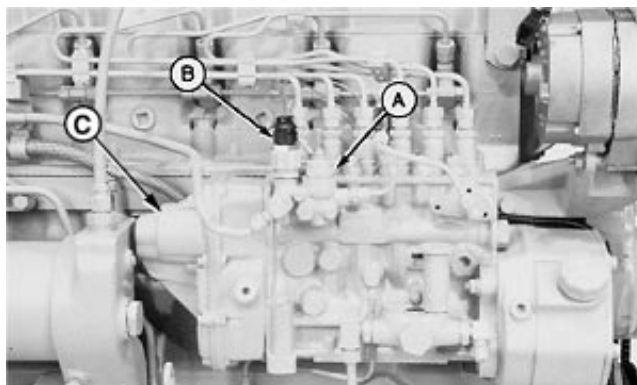
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5

Identification of Fuel Supply Pumps

The electronically controlled in-line injection system uses the same basic hydraulic pumping mechanism used in mechanically governed pumps. The mechanical governor mechanism is replaced with the actuator assembly which includes the Actuator Solenoid (C) to move the control rack, Rack Position Sensor, Primary Speed Sensor, and a toothed speed wheel. The throttle lever mechanism used on mechanical pumps is removed and its function is implemented by a throttle position sensor input to the Engine Controller. Fuel is transferred from fuel tanks with a fuel supply pump. The injection pump fuel inlet connection is located at the rear of the pump on the fuel inlet assembly, which includes the Fuel Shut-off Solenoid (A) and the Fuel Temperature Sensor (B).

Fuel supply pumps are furnished as complete assemblies for repair. Only the primer, washers, and fittings are available as separate parts.



Electronic Controlled Fuel Injection Pump

A—Fuel Shut-off Solenoid
B—Fuel Temperature Sensor
C—Actuator Solenoid

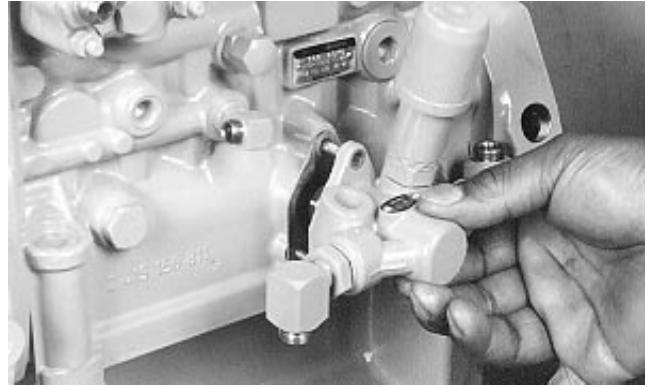
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Remove Fuel Supply Pump

NOTE: To diagnose fuel supply pump malfunctions, refer to Group 160. See **CHECK FUEL SUPPLY PUMP OPERATION** in Section 04, Group 150 of this manual.

Thoroughly clean exterior of supply pump. Also clean around supply pump mounting area on injection pump housing.

1. Disconnect fuel inlet line and outlet line, shown disconnected. Cap all line openings so contaminants do not enter fuel system.
2. Remove three supply pump mounting nuts and pull fuel supply pump straight out from mounting studs as shown.
3. Cover supply pump mounting bore so debris cannot enter injection pump housing.



Removing Fuel Supply Pump

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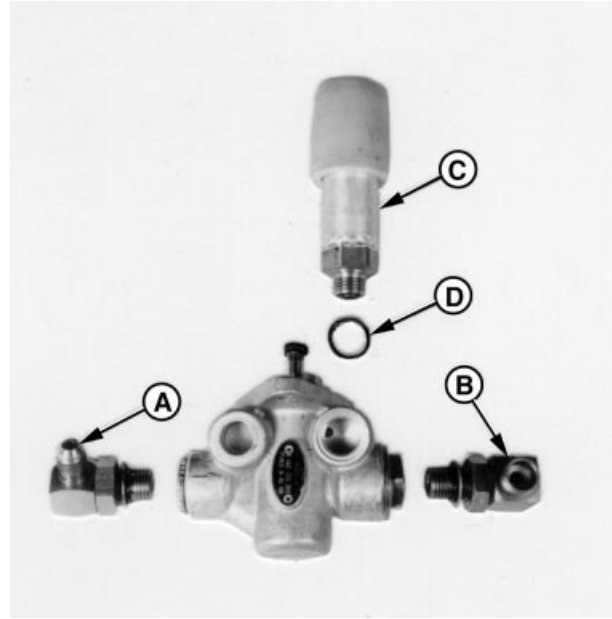
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Inspect Fuel Supply Pump

NOTE: Bosch fuel supply pump shown. Inspection procedures similar for all supply pumps.

1. Inspect supply pump housing (E) for cracks and wear. Be sure plunger or roller tappet bore is not worn or scored. Check condition of threads for inlet and outlet fittings (A and B), hand primer pump (C) and spindle guide plug.
2. Inspect plunger (F) or roller tappet for wear, scoring on O.D. and burrs. Check lands that contact plunger and fuel pump cam lobe to be sure they are flat and undamaged, or that roller tappet is not worn. Remove any deposits with a suitable solvent.
3. If pump housing or plunger/roller tappet mechanism is worn or damaged, replace pump assembly (E). Use new O-rings on fittings and new copper washer (D) on primer.

A—Inlet Elbow Fitting
B—Outlet Elbow Fitting
C—Hand Primer Pump
D—Copper Washer
E—Pump Housing



Fuel Supply Pump (Bosch Shown)

RG5909 -UN-26NOV97

RG, RG34710, 1289 -19-23OCT97-1/1

Install Fuel Supply Pump

IMPORTANT: Before installing supply pump, test pump to make sure fuel will not leak around plunger (or roller tappet) and seal. See CHECK FUEL SUPPLY PUMP OPERATION in Section 04, Group 150 of this manual.

1. Install a new gasket on supply pump mounting face and position pump over mounting studs.
2. Position supply pump on mounting studs as shown.
3. Tighten mounting stud nuts to specifications.

Specification

Fuel Supply Pump Mounting Stud

Nuts—Torque 5—7 N•m (4—5 lb-ft) (45—60 lb-in.)

4. Install fuel inlet and outlet lines and tighten to specifications.

Specification

Fuel Supply Pump Inlet and

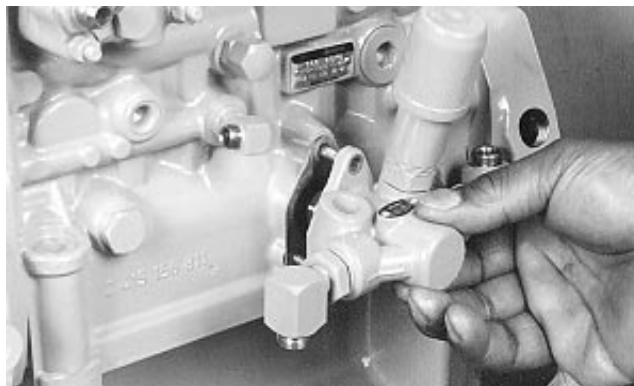
Outlet Lines—Torque 10 N•m (7 lb-ft)

Specification

Fuel Supply Pump Elbow Lock

Nuts—Torque 35 N•m (26 lb-ft)

5. Bleed fuel system. See BLEED THE FUEL SYSTEM in Section 04, Group 150 of this manual.



Installing Fuel Supply Pump

RG7053 -UN-10AUG94

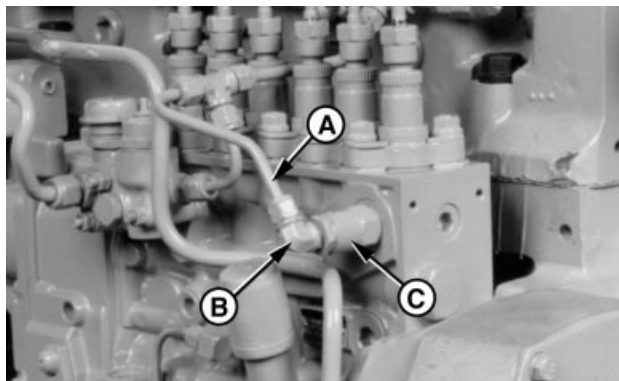
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Service Injection Pump Overflow Valve

NOTE: Overflow valve can be serviced with injection pump installed.

1. Remove leak-off line (A) from elbow (B). Remove elbow from overflow valve assembly (C).
2. Remove valve assembly from pump.

A—Leak-Off Line
B—Elbow
C—Overflow Valve Assembly



Removing Injection Pump Overflow Valve

RG, RG34710, 1295 -19-11MAY99-1/2

3. Remove reducer (A) and copper washer (B) from valve body (C). Discard copper washer.
4. Unscrew for spring seat (D); then remove spring (E) and valve (F).
5. Inspect for foreign material imbedded in seat of nylon valve.
6. Check spring to see that it is not weak or broken.
7. Wash all parts in solvent and air dry.

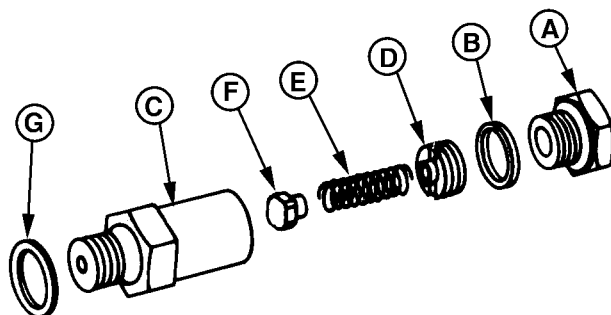
NOTE: There is no adjustment on valve to regulate housing pressure. If suspected that valve is malfunctioning, replace valve to restore proper operation.

Specification

Fuel Injection Pump Overflow

Valve—Opening Pressure 130—180 kPa (1.3—1.8 bar)
(19—26 psi)

8. Reverse order of removal for reassembly of overflow valve. Install new copper washers.



Inspecting Injection Pump Overflow Valve

A—Reducer
B—Washer
C—Valve Body
D—Spring Seat
E—Spring
F—Valve
G—Washer

RG, RG34710, 1295 -19-11MAY99-2/2

Identification of In-Line Fuel Injection Pumps

The in-line fuel injection pumps used on 6.8 L & 8.1 L engines with the John Deere Level 3 ECU are either P-Series 3000 or 7100 Bosch pumps. The type of pump is easily determined by the pump identification plate.



Bosch Fuel Injection Pump Identification Plate

- A—Bosch Pump Serial Number
- B—Bosch Part Number
- C—Bosch Identification Number
- D—John Deere Part Number (Bosch)
- E—Motorpal Identification Number
- F—Motorpal Pump Serial Number
- G—John Deere Part Number (Motorpal)

BOSCH INJECTION PUMP IDENTIFICATION NUMBER

A-76417 00136 B	Pump Serial Number
B-0 402 796 813	Bosch Part Number
C-PES6P120A720RS7356	
PES	Injection Pump With Housing Flange
6	Number of plungers
P	Type or Size of Pump
120	Plunger Diameter in mm (120 is 12 mm)
A	Letter Designating Design Change
000	Three Numbers Denoting an Assembly
R	Right-Hand Rotation (Viewed From Drive End)
S	Production Pump
0000	Pump Identification Number
D-RE 61 658	John Deere Part Number

To summarize pump applications:

P-Series Bosch Pumps	P3000 optional 6081T and A; P7100 optional on 6081A; standard on 6081H.

RG, RG34710, 1297 -19-11MAY99-1/1

Service of Fuel Injection Pumps

Have an authorized diesel repair station perform any internal service or test stand calibration required on injection pumps.

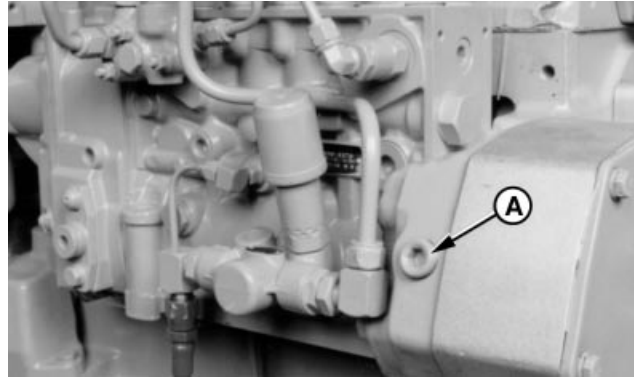
For diagnostics and tests of the John Deere Level 3 ECU, see Section 04, of this manual.

RG, RG34710, 1298 -19-23OCT97-1/1

Remove Fuel Injection Pump

IMPORTANT: Never steam clean or pour cold water on an injection pump while pump is running, or while it is still warm. To do so may cause seizure of pump parts.

1. Clean injection lines and area around the injection pump with cleaning solvent or a steam cleaner.
2. Remove timing hole plug (A).
3. Rotate engine flywheel (in normal running direction) with JDG820 Flywheel Turning Tool until No. 1 piston is at "TDC" of its compression stroke. At this point, JDE81-4 Timing Pin should enter hole in flywheel.
4. Timing marks on injection pump drive hub and fixed timing pointer should be aligned.



Injection Pump Timing Access Hole

A—Timing Hole Plug

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DPSG,OUO1004,863 -19-29APR99-1/4

5. Remove injection pump drive gear cover (shown removed), remove and discard all gasket material or O-ring.

NOTE: If removal of pump drive gear cap screw is difficult due to interference from the radiator, fan or fan belt, perform the following step:

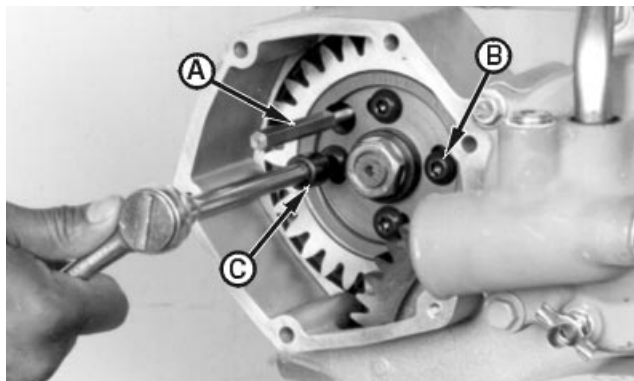
6. Remove JDG81-4 Timing Pin from flywheel and rotate engine until cap screw (B) at 5 o'clock position is clearly accessible. Remove cap screw using a T45 TORX® adapter.

Rotate engine with JDG820 Flywheel Turning Tool until JDE81-4 Timing Pin enters flywheel at No. 1 cylinder's compression stroke.

IMPORTANT: To assure that accurate injection pump timing is maintained when pump is removed and reinstalled, is it recommended that JDG886 Injection Pump Timing Pin (A) is used prior to removal and installation of injection pump. If injection pump will be serviced at an authorized repair station, remove timing pin prior to shipping for service.

NOTE: It may be necessary to rotate injection pump drive hub slightly to install timing pin.

7. Install JDG886 Timing Pin (A) through hole in injection pump drive gear. Thread timing pin into injection pump hub until it bottoms.
8. Remove remaining injection pump drive gear cap screws using a T45 TORX® adapter (C) and remove drive gear from pump drive hub.



Installing Timing Pin and Removing Pump Gear

A—Timing Pin
B—Cap Screw
C—Adapter

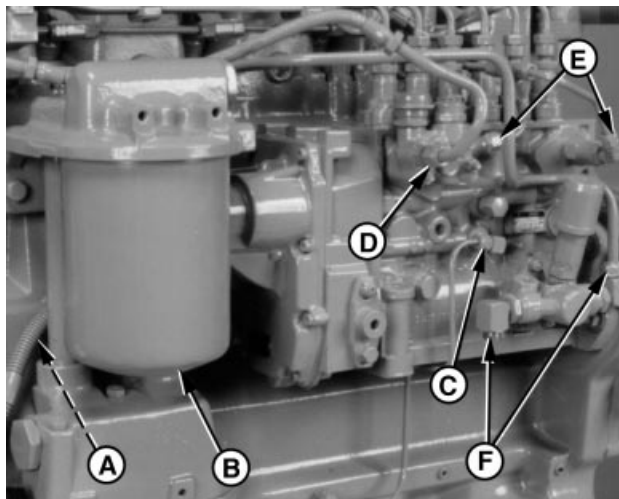
TORX is a registered trademark of Camcar/Textron

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DPSG,OUO1004,863 -19-29APR99-2/4

9. Remove engine oil filter (B) from filter base.
10. Disconnect governor pigtail connectors (A) from main wiring harness. Disconnect fuel shut-off solenoid wiring lead (shown disconnected and capped).
11. Remove injection pump lube line (C) from elbow fitting.
12. Remove fuel inlet (D) from shut-off solenoid. Remove fuel leak-off line assembly (E).
13. Disconnect fuel supply pump lines (F). (Photo shows outlet line only.)

Cap all openings on pump and line connections so contaminants do not enter fuel system.



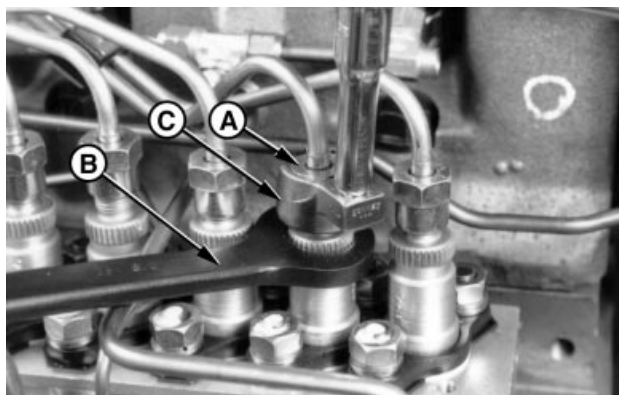
Removing Injection Pump

- A—Governor Pigtail Connectors
- B—Oil Filter
- C—Injection Pump Lube Line
- D—Fuel Inlet Line
- E—Leak-off Line Assembly
- F—Fuel Supply Pump Lines

DPSG,OUO1004,863 -19-29APR99-3/4

IMPORTANT: DO NOT move delivery valve fittings while loosening line nuts. If a delivery valve and barrel housing rotates while loosening or tightening a fuel line nut, injection pump must be recalibrated on a test stand. Use a backup wrench. On Bosch “P” pumps, JDE90 Serrated Wrench (B) **MUST BE** used.

14. Remove injection line nuts (A) from injection pump delivery valves. On Bosch “P” pumps, use JDE90 Serrated Wrench (B) along with either JDF22 Crowsfoot Wrench (C) or a standard 3/4-in. line wrench.
15. Disconnect throttle linkage from pump.
16. Remove four injection pump mounting stud nuts.
17. Carefully remove injection pump and place it on a clean flat surface.
18. Cap all delivery valve fittings.



Removing Lines (Bosch “P” Pump Shown)

- A—Injection Line Nuts
- B—Serrated Wrench
- C—Crowsfoot Wrench

DPSG,OUO1004,863 -19-29APR99-4/4

Install Fuel Injection Pump

1. If engine was rotated after injection pump was removed, rotate flywheel until timing pin enters flywheel at No. 1 cylinder's "TDC" compression stroke.

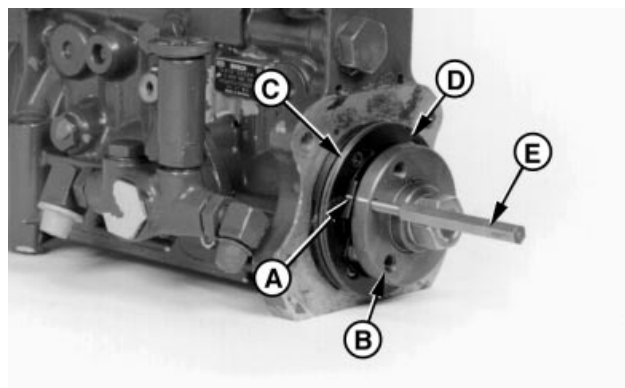
NOTE: When No.1 cylinder is at "TDC" compression stroke, intake and exhaust valves for No. 1 cylinder will be closed and both rocker arms will be loose.

2. Rotate injection pump drive hub until marks on drive hub (B) and pointer (A) are aligned.

NOTE: It may be necessary to rotate pump hub slightly to get timing pin (E) to enter bearing plate.

3. Thread JDG886 Timing Pin (E) into drive hub, as shown, and tighten until it bottoms against bearing plate (D).
4. Install a new O-ring (C) on pump mounting hub. Lightly lubricate O-ring with AR54749 Soap Lubricant to aid in pump installation and prevent O-ring damage.

NOTE: Place injection pump drive gear in timing gear housing (if previously removed) with chamfered side of gear toward injection pump. Chamfer is at outer edge of bore for easier installation of gear to pump drive hub.



Preparing Injection Pump for Installation

A—Pointer
B—Drive Hub
C—O-Ring
D—Bearing Plate
E—JDG886 Timing Pin

RG7741 -UN-28NOV97

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RG, RG34710, 1300 -19-11MAY99-1/5

5. Install injection pump using moderate forward pressure and slight rocking motion to work O-ring into mounting bore.

Injection pump flange should seat solidly against cylinder block and injection pump drive hub nut should be positioned in I.D. of pump drive gear.

6. Install mounting stud nuts and tighten to specifications.

Specification

Injection Pump-to-Cylinder Block

Stud Nuts—Torque..... 47 N•m (35 lb-ft)

7. Carefully install drive gear on pump drive hub, position gear so mounting cap screws are approximately centered in mounting slots. This will allow for minor adjustment of pump timing, should the need arise.

8. Install four drive gear-to-pump hub cap screws and tighten to specifications using a T45 TORX® adapter (B).

Specification

Injection Pump Drive

Gear-to-Pump Hub Cap Screw—

Torque 61 N•m (45 lb-ft)

9. Remove JDG886 Timing Pin (A) from injection pump hub. Install timing hole plug using LOCTITE® 242 (TY9370) Thread Lock and Sealer, tighten plug securely.

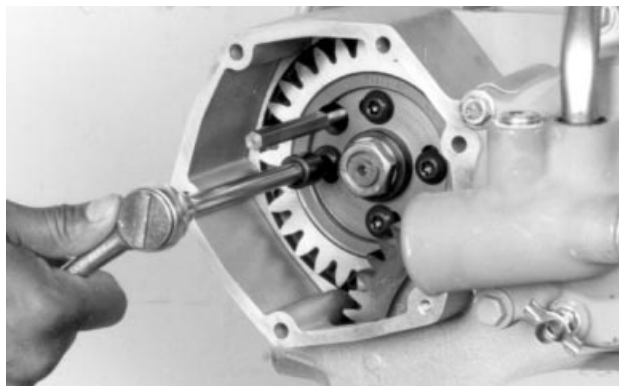
NOTE: Also remove timing pin from engine flywheel (if installed).

10. Install injection pump drive gear cover using a new gasket or O-ring. Tighten cap screws to specifications.

Specification

Injection Pump Drive Gear Cover

Cap Screws—Torque 27 N•m (20 lb-ft)



Installing Pump Drive Gear

A—Timing Pin

B—Adapter

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LOCTITE is a registered trademark of Loctite Corp.

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RG, RG34710, 1300 -19-11MAY99-2/5

NOTE: Remove protective caps and plugs that were installed on fuel system components during injection pump removal.

11. Connect fuel delivery line nuts (A) to injection pump delivery valve fittings using two wrenches as shown. On Bosch "P" pumps, use JDE90 Serrated Wrench (B) and JDF22 Crowsfoot Wrench (C). Tighten line nuts to specifications.

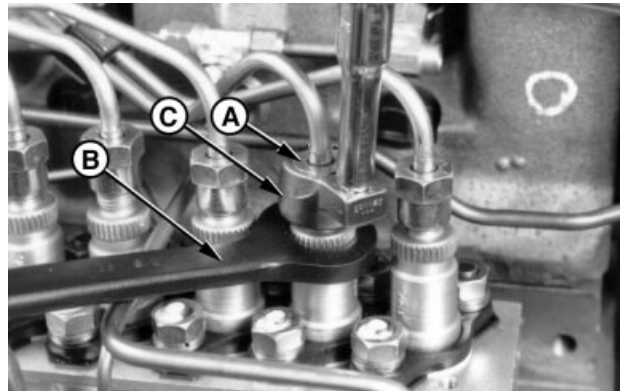
Specification

Fuel Delivery Line Connectors @

Delivery Valves and Nozzles—

Torque 27 N•m (20 lb-ft)

IMPORTANT: DO NOT move delivery valve fittings while tightening line nuts. If delivery valve and barrel housing rotates while tightening a fuel line nut, injection pump fuel delivery will be altered. The injection pump will have to be recalibrated on a test stand by an authorized diesel repair station.



Installing Lines (Bosch "P" Pump Shown)

A—Fuel Delivery Line Nuts

B—Serrated Wrench

C—Crowsfoot Wrench

Continued on next page

RG, RG34710, 1300 —19–11MAY99–3/5

IMPORTANT: Tighten all fuel system connections securely to avoid leakage and air entering system.

12. Install fuel leak-off line assembly (E) onto pump connectors and tighten all connections

to specifications.

Specification

Fuel Leak-Off Lines-to-Injection
Pump Connectors—Torque..... 13 N•m (10 lb-ft)

13. Connect fuel supply pump lines (F) and fuel inlet line (D) at fuel shut-off solenoid.

Specification

Fuel Supply Pump
Lines-to-Injection Pump—Torque..... 10 N•m (7 lb-ft)

Specification

Fuel Inlet Line-to-Injection
Pump—Torque 10 N•m (7 lb-ft)

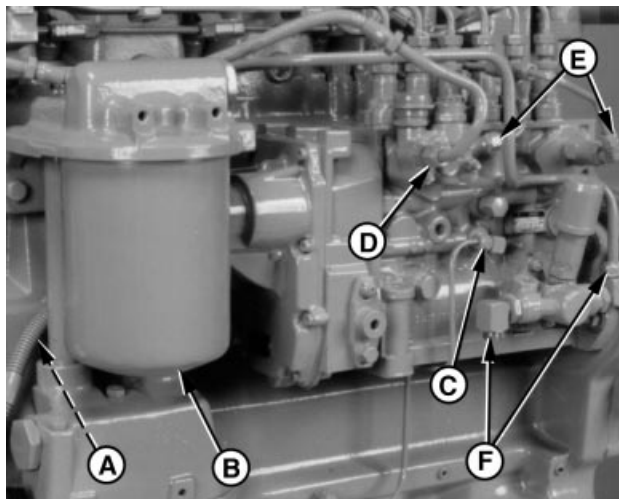
14. Connect injection pump lube line (C) to cylinder block fitting.

Specification

Injection Pump Lube Line—
Torque 4.5 N•m (3 lb-ft) (36 lb-in.)

15. Connect governor pigtail connectors (A) to wiring harness.

16. Install engine oil filter (B).



Installing Injection Pump

A—Governor Pigtail Connectors
B—Oil Filter
C—Injection Pump Lube Line
D—Fuel Inlet Line
E—Leak-off Line Assembly
F—Supply Pump Lines

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Continued on next page

RG, RG34710, 1300 -19-11MAY99-4/5

IMPORTANT: NEVER operate injection pump without engine lubricating oil in pump housing. Doing so may cause damage to internal pump rotating parts.

17. Remove oil fill plug (A) and add enough clean engine oil until oil comes out fill hole. Engine should be level when checking oil level. Tighten plug to specifications.

Specification

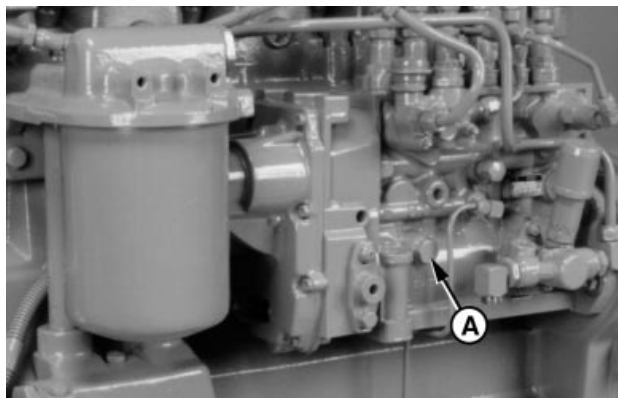
Injection Pump Housing Oil Fill
Plug—Torque..... 25 N•m (18 lb-ft)

18. Also add clean engine oil to pump rear governor housing by removing plug (B) at top. Add 0.1 Liter (1/5 quart). Tighten plug to specifications.

Specification

Injection Pump Governor Housing
Oil Fill Plug—Torque 40 N•m (30 lb-ft)

19. Service fuel filter and water separator as needed.
20. Bleed fuel system. See BLEED THE FUEL SYSTEM in Section 04, Group 150 of this manual.



Adding Oil to Pump Housings

A—Oil Fill Plug
B—Governor Oil Fill Plug

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RG, RG34710, 1300 -19-11MAY99-5/5

Remove Fuel Injection Nozzles



CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin, causing serious injury. Before disconnecting lines, be sure to relieve pressure. Before applying pressure to the system, be sure ALL connections are tight and lines, pipes, and hoses are not damaged. Keep hands and body away from pinholes and nozzles which eject fluid under pressure. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.

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.

IMPORTANT: Cap or plug all fuel lines as they are disconnected to prevent dirt and debris from entering fuel system. Debris in fuel system can plug injectors which affects engine performance.

Injection nozzles on 8.1 L engines basic design and procedures are combined on the following pages. Nozzle types and size tips are as follows:

Specification

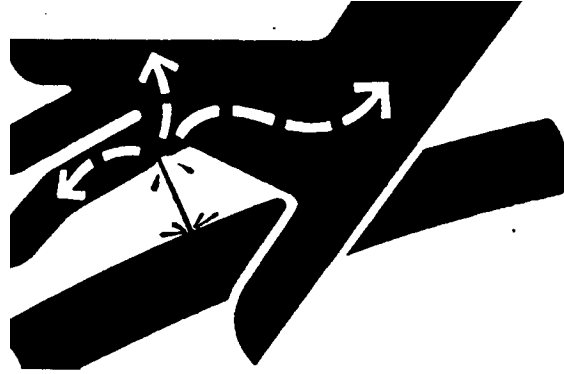
Fuel Injection Nozzle—Type 21 mm with 7 mm tip

Specification

Fuel Injection Nozzle¹—Tip Hole

Sizes 7 hole x 0.208—0.255 mm ID x
148° Spray Angle

¹ Nozzle tips available in various ID hole sizes: 0.208, 0.220, 0.236, 0.240, 0.244 and 0.255 mm.



Avoid High-Pressure Fluids

X9811 -UN-23AUG88

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To test injection nozzles before removal, see Group 150.
See CYLINDER MISFIRE TEST in Section 04, Group 150 of this manual.

1. Thoroughly clean area around injection pump and nozzles, including all line connections, using compressed air.

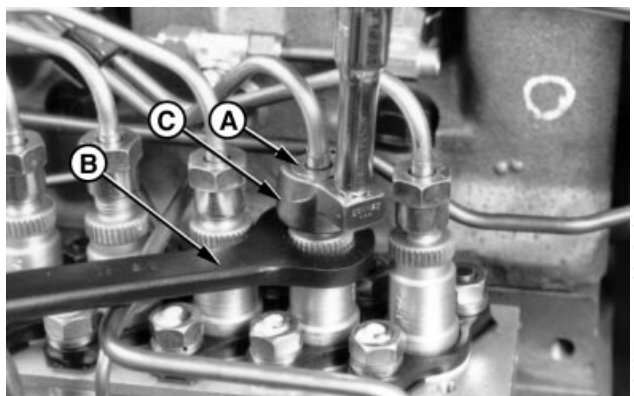
RG, RG34710, 1301 -19-22JUN01-2/5

IMPORTANT: On Bosch "P" pumps, JDE90 Serrated Wrench (B) **MUST BE** used to keep delivery valve fittings stationary while loosening line nuts. If a delivery valve and barrel housing rotates while loosening or tightening a fuel line nut, injection pump must be recalibrated on a test stand.

2. Disconnect injection line nuts (A) from injection pump delivery valves as follows:

Use JD90 Serrated Wrench (B) and JDF22 Crowsfoot Wrench (C) or a standard 3/4-in. line wrench on Bosch "P" pumps.

3. Disconnect fuel delivery lines from injection nozzles. Lift injection line assembly from engine.
4. Disconnect fuel leak-off line from injection nozzle leak-off assembly.



RG5877 -UN-26NOV97

Disconnecting Injection Nozzle Line (Bosch "P" Pump Shown)

A—Injection Line Nuts
B—Serrated Wrench
C—Crowsfoot Wrench

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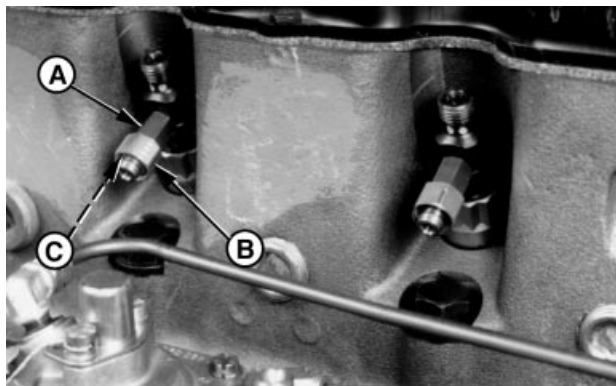
RG, RG34710, 1301 -19-22JUN01-3/5

5. Remove packing (C) (if equipped) and line nuts (B) from each leak-off connector. Discard packing.

NOTE: Engines with metal leak-off lines have O-rings (C) between leak-off connector and nozzle. Engines with nylon leak-off lines have O-rings in groove of connector body on line nut end.

6. Remove leak-off connector (A) and O-rings from each injection nozzle.

A—Leak-Off Connector
B—Line Nuts
C—Packing

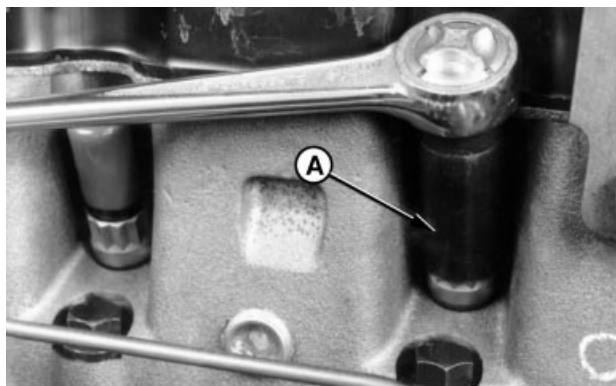


Engine with Metal Leak-Off Lines Shown

RG, RG34710, 1301 -19-22JUN01-4/5

NOTE: The socket portion of JDE92 Nozzle Wrench (A) may be used to remove nozzles from cylinder head.

7. If JDE92 Nozzle Wrench is not used, use a 24 mm (15/16-in.) deep socket on nozzles gland nut to remove nozzles. Gland nut will act as a jack screw to raise nozzle out of cylinder head bore. Remove hardened steel washer from injection nozzle bore if it does not come out with nozzle.
8. To prevent debris from entering combustion chamber after nozzles are removed, insert a 12.7 mm (1/2 in.) hardwood dowel in nozzle bore.



Removing Injection Nozzles

A—JDE92 Nozzle Wrench

RG, RG34710, 1301 -19-22JUN01-5/5

Test Fuel Injection Nozzles



CAUTION: Nozzle tip should always be directed away from operator. Fuel from spray orifices can penetrate skin and clothing, causing serious personal injury. Enclosing nozzle in a transparent cover, or glass beaker is recommended.

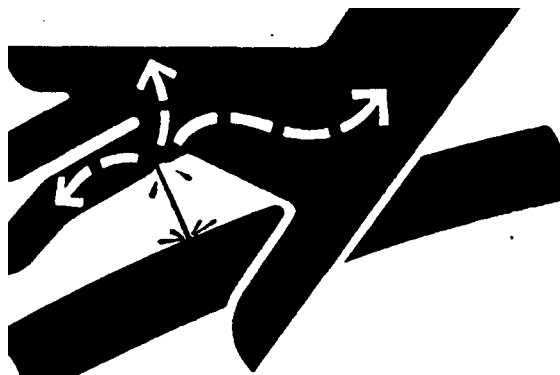
Before applying pressure to nozzle tester, be sure all connections are tight and fittings are not damaged. Fuel escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood rather than your hands, to search for suspected leaks.

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.

Before disassembling, test injection nozzles with clean filtered fuel to determine its condition.

Test for:

- Opening Pressure
- Leakage
- Chatter
- Spray Pattern



Avoid High-Pressure Fluids

X9811 -UN-23AUG88

RG, RG34710, 1303 -19-23OCT97-1/1

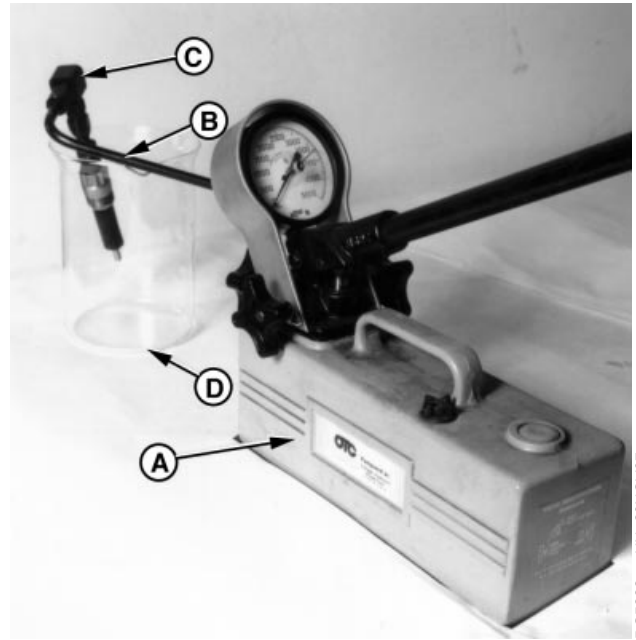
Perform Opening Pressure Test

1. Connect injection nozzle to D01109AA Nozzle Tester (Y900) (A), using No. Y900-2A Fuel Line (B) and Y900-7 and Y90-15 Straight Adapters (C).

Y900-21 90° Adapter may also be used. Place a glass beaker (D) around nozzle.

2. Pump handle several times to flush out nozzle fittings. Tighten fittings.
3. Expel air from nozzle by operating pump handle several strokes. Then raise pressure until valve opens.
4. Recheck by completely releasing pressure, then gradually building pressure until valve opens.

IMPORTANT: Nozzle tester should be checked periodically for accuracy.



Testing Nozzle Opening Pressure

A—Nozzle Tester
B—Fuel Line
C—Adapter
D—Glass Beaker

RG, RG34710, 1304 -19-23 OCT 97-1/1

Injection Nozzle Opening Pressure Specifications

A new nozzle or a used nozzle with a new spring (A), should open at approximately the following pressures. A used nozzle that has been rebuilt with a new spring and/or valve should be reset to same pressures as a new nozzle. New nozzle opening pressures are:

Specification

New Injection Nozzle (All Tip Sizes)—Opening Pressure 29 000 kPa (290 bar) (4200 psi) minimum

On nozzles which have been in service, spring and spring seat (B) will have taken a normal set. In this case, opening pressure is satisfactory if it meets or exceeds used nozzle minimum opening pressure given below, but does not exceed new opening pressure given above. Used nozzle minimum opening pressures are:

Specification

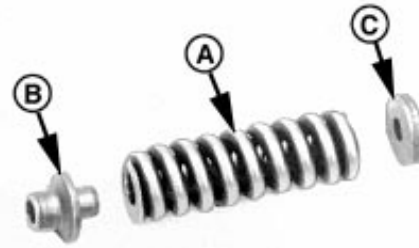
Used Injection Nozzle (All Tip Sizes)—Opening Pressure 26 200 kPa (262 bar) (3800 psi) minimum

IMPORTANT: ALWAYS use John Deere nozzle adjusting shims which are specially hardened. Other shims will not be satisfactory.

Shims (C) of different thicknesses are available for changing opening pressure adjustment. Each 0.05 mm (0.002 in.) of shim thickness changes opening pressure approximately 700 kPa (7 bar) (100 psi).

If nozzle opening pressures are not correct, disassemble injection nozzles (as described in this group) and change shims until nozzles open at proper **new** nozzle pressure given above.

The difference in nozzle opening pressures between cylinders in an engine should not exceed 350 kPa (3.5 bar) (50 psi).

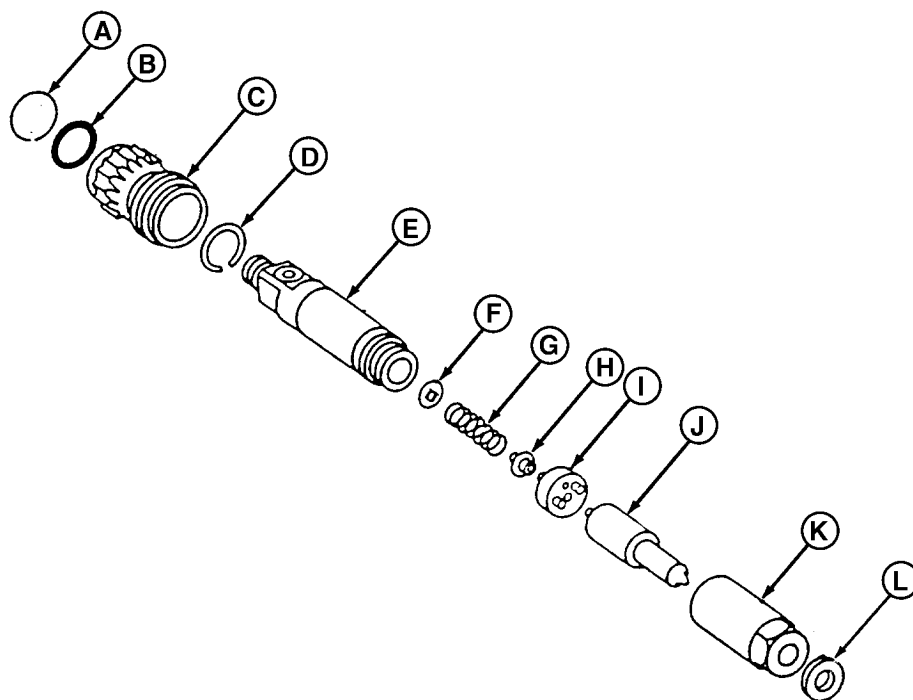


Injection Nozzle Spring and Pressure Adjusting Shims

A—Spring
B—Spring Seat
C—Shim

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Perform Nozzle Leakage Test



RG6184 -UN-26NOV97

Bosch Injection Nozzle (Nippondenso Similar)

A—Upper Snap Ring (Bosch only)
B—Gland Nut O-Ring
C—Gland Nut

D—Lower Snap Ring
E—Nozzle Holder
F—Shim

G—Nozzle Valve Spring
H—Spring Seat
I—Intermediate Plate

J—Nozzle and Valve
K—Nozzle Retaining Nut
L—Washer

1. Wipe nozzle dry.
2. Bring pressure up slowly to 1970 kPa (20 bar) (285 psi) below the opening pressure. Watch for an accumulation of fuel from spray orifice, indicating a bad seat.

If nozzle drips within 10 seconds, replace nozzle and valve (J).

3. Check for leakage around nozzle retaining nut (K) thread connection with nozzle holder (E).

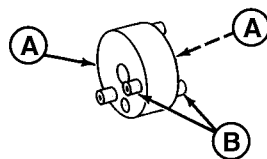
Leakage indicates a bad seat either between nozzle and intermediate plate (I) or between nozzle holder and intermediate plate.

Continued on next page

RG, RG34710, 1306 -19-23OCT97-1/2

RG2248 -UN-22NOV97

IMPORTANT: Do not lap the machined surfaces (A) of the intermediate plate in an attempt to stop fuel leakage at these locations. Dowels (spring pins) (B) in plate have to be removed before surfaces can be lapped. Removing dowels is not recommended as removal is likely to damage them, and replacement dowels are not available as service parts.



Nozzle Intermediate Plate

A—Machined Surfaces
B—Dowels

If leakage is observed, tighten nozzle retaining nut to a maximum of 79 N•m (58 lb-ft). Replace injection nozzle if leakage continues.

RG, RG34710, 1306 -19-23OCT97-2/2

Perform Chatter and Spray Pattern Test

1. Injection nozzle should chatter very softly, and only when hand lever movement is very rapid (four to six downward movements per second). Failure to chatter may be caused by a binding or bent nozzle valve.
2. Until chattering range is reached, the test oil emerges as non-atomized streams. When lever movement is accelerated, sprays should be very broad and finely atomized.

A partially clogged or eroded orifice will usually cause spray to deviate from the correct angle. Spray will also be steady rather than finely atomized.

3. Disassemble nozzle for cleaning or reconditioning if it fails to chatter or spray properly.

RG, RG34710, 1307 -19-23OCT97-1/1

Disassemble Fuel Injection Nozzle

General Nozzle Repair Notes:

NOTE: *Disassembly of nozzles is not recommended unless servicing is indicated by nozzle operation and testing.*

Since dirt and water are the worst contaminants in fuel injection systems, working area, tools, and cleaning materials must be kept spotlessly clean. Whenever possible, work in an isolated, dust-free area.

Cover workbench with clean paper before disassembly of injection nozzles.

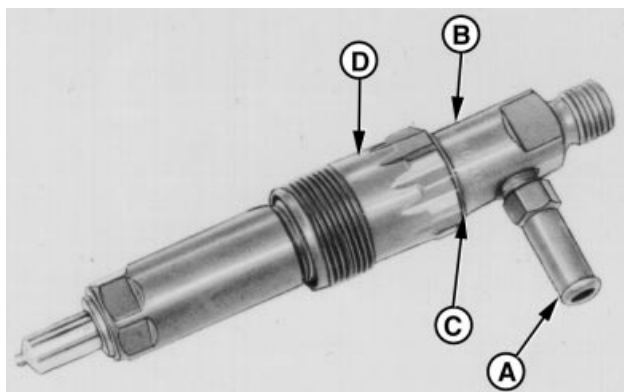
As parts are disassembled, place them in a pan of clean diesel fuel and leave there until needed. Do not permit parts to strike each other.

Use a separate pan of clean diesel fuel for washing parts before assembly.

NOTE: *Bosch KDEL injection nozzles are metric design. Use only metric tools to service nozzles.*

1. Use an 11 mm box or open-ended wrench and unscrew leak-off connector (A) (if not removed previously) out of nozzle holder (B).
2. Clamp flats of nozzle holder in a soft-jawed vise. Remove upper snap ring (C) from nozzle holder.
3. Slip gland nut (D) off nozzle holder.

NOTE: *Bosch nozzles have a snap ring and O-ring at top of gland nut that must be removed before gland nut can be removed.*



Disassembly of Injection Nozzle

- A—Leak-off Connector
B—Nozzle Holder
C—O-Ring and Upper Snap Ring
D—Gland Nut

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RG, RG34710, 1308 -19-23OCT97-1/2

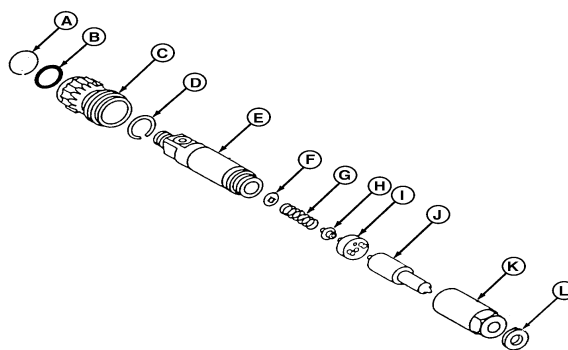
4. Remove lower snap ring (D).
5. Clamp the two flats of the nozzle holder (fuel inlet end) in a soft-jawed vise and remove nozzle retaining nut (K), using a 12-point 19 mm wrench.
6. Remove nozzle and valve assembly (J).
7. Pull off intermediate plate (I).
8. Remove spring seat (H), spring (G), and shims (F).
9. Remove gland nut O-ring (B).



CAUTION: Use nozzle cleaning fluids in accordance with manufacturer's instructions.

10. Withdraw nozzle valve from nozzle. If valve is stuck, it may be necessary to soak nozzle assembly in Bendix cleaner, acetone, or other commercial cleaners sold especially for freeing stuck valves.

Do not permit lapped surfaces of valve and nozzle to come in contact with any hard substance. DO NOT touch valve unless your hands are wet with fuel.



Bosch Injection Nozzle

- A—Upper Snap Ring (Bosch only)
- B—Gland Nut O-Ring
- C—Gland Nut
- D—Lower Snap Ring
- E—Nozzle Holder
- F—Shim
- G—Nozzle Valve Spring
- H—Spring Seat
- I—Intermediate Plate
- J—Nozzle and Valve
- K—Nozzle Retaining Nut
- L—Washer

RG6184 -19-

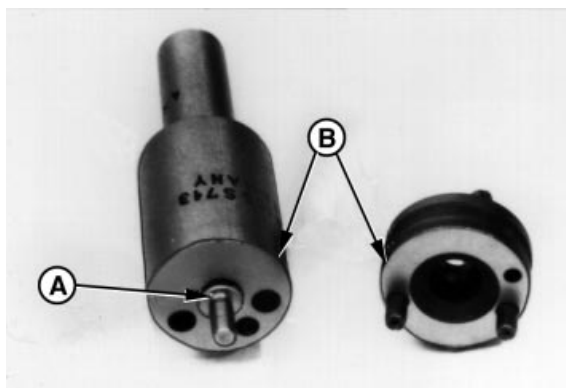
RG, RG34710, 1308 -19-23OCT97-2/2

Clean and Inspect Fuel Injection Nozzle Assembly

IMPORTANT: Never use a steel brush to clean nozzles. Steel brush may damage injection nozzles.

1. Remove anti-corrosive coating from new or reconditioned nozzles by washing them thoroughly with diesel fuel.
2. Remove carbon from used nozzles and clean by washing them in diesel fuel. If parts are coated with hardened carbon or lacquer, it may be necessary to use a brass wire brush.
3. After removing carbon or lacquer from nozzle exterior, inspect lapped surface for nicks or scratches. Replace if not in good condition.
4. Inspect piston part of nozzle valve (A) to see that it is not scratched or scored. If any of these conditions are present, replace nozzle assembly.
5. Inspect nozzle valve seat, nozzle, and intermediate plate. Contact area of parts (B) must not be scored or pitted. Use inspection magnifier in JDF13 (JDE105) Nozzle Cleaning Kit to aid inspection.

NOTE: A bad nozzle valve seat will cause fuel to drip from nozzle. This condition will usually be noted when making the "Leakage Test".



Inspecting Nozzle Parts

A—Nozzle Valve

B—Fuel Injection Nozzle Assembly

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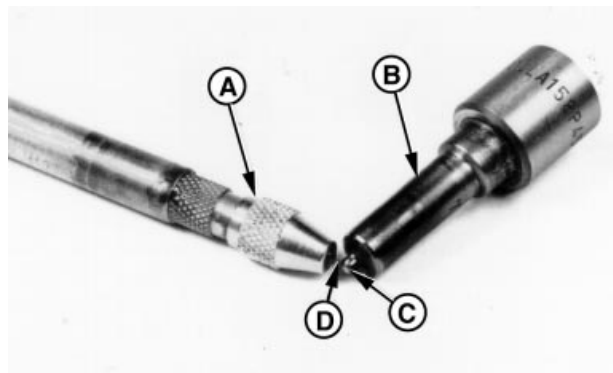
RG, RG34710, 1309 -19-06MAY99-1/1

Clean Spray Orifices

1. Begin with cleaning wire (D) 0.07—0.10 mm (0.003—0.004 in.) from JDE105 Nozzle Cleaning Kit.

NOTE: *Stoning wire to provide a flat surface on one side will help in reaming carbon from clogged hole.*

2. Clamp cleaning wire in pin vise (A). Wire should not protrude from vise more than 0.8 mm (1/32 in.).
3. Insert wire into orifice (C) and rotate.
4. For final cleaning, use cleaning wire 0.03 mm (0.01 in.) smaller than orifice size. Follow previous steps until orifices are clean of any carbon deposits.



Cleaning Nozzle Spray Orifices

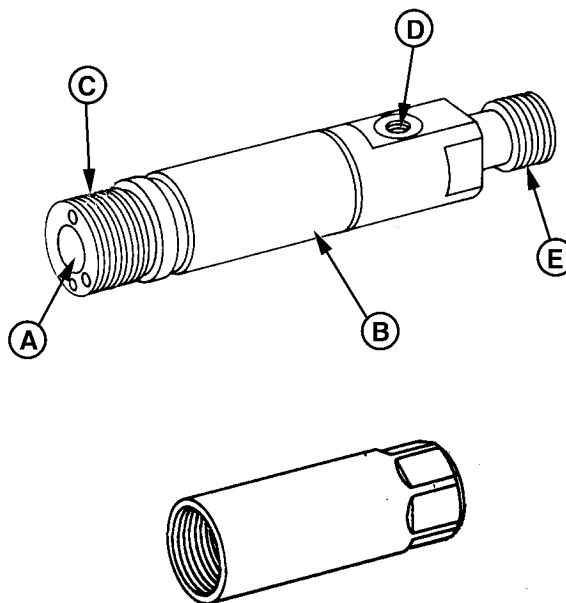
A—Pin Vise
B—Nozzle
C—Orifice
D—Cleaning Wire

RG5954 -UN-26NOV97

RG, RG34710, 1311 -19-23OCT97-1/1

Inspect Nozzle Holder

1. Inspect lapped surface (A) on bottom end of nozzle holder (B) for nicks or scratches. Replace holder if not in good condition.
2. Inspect threads M19 x 0.75 (C), M6 x 1.0 (D), and M14 x 1.5 (E) on nozzle holder for general condition. Threads that are nicked slightly may be "dressed-up". Replace holder if threads cannot be restored to a serviceable condition.
3. Check fuel passages in nozzle holder to make sure they are open. Clean with compressed air.
4. Remove carbon deposits on both inner and outer surfaces of nozzle retaining nut.
5. Inspect retaining nut for cracks caused by overtightening or a damaged lower seating surface. A seat may be restored by rubbing surface with emery cloth. Any nozzle nut which cannot be reconditioned, must be replaced.



RG2247

Inspecting Nozzle Holder

A—Lapped Surface
B—Nozzle Holder
C—M19 x 0.75
D—M6 x 1.0
E—M14 x 1.5

RG3413 -UN-22NOV97

RG2247 -UN-20DEC88

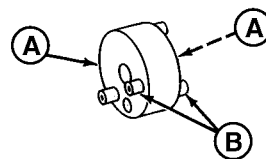
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RG, RG34710, 1312 -19-23OCT97-1/3

RG2248 -UN-22NOV97

6. Examine lapped surfaces on intermediate plate (A) for nicks, scratches, or worn areas which would permit fuel to leak past.

IMPORTANT: Do not lap the machined surfaces of the intermediate plate. Dowel pins (B) in plate have to be removed before surfaces can be lapped. Removing dowels is not recommended as removal is likely to damage them, and replacement dowels are not available as service parts.



Inspecting Nozzle Intermediate Plate
RG2249 -UN-20APR89



RG2249

Inspecting Nozzle Spring Seat

7. Replace intermediate plate if lapped surfaces are worn or damaged.
8. Inspect spring seat for splitting, cracking, or excessive wear.

Replace seat if any of these conditions are evident.

A—Intermediate Plate
B—Dowel Pins

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RG, RG34710, 1312 -19-23OCT97-2/3

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9. Examine spring and shims for pitting or excessive wear.

Replace as necessary.

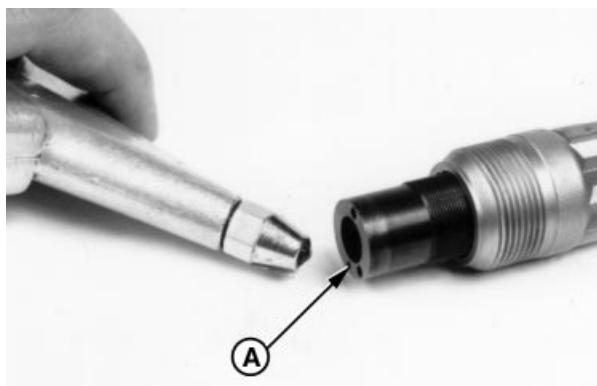
NOTE: The edge-type filter is pressed into nozzle holder and is not removable for service.

10. Clean filter by applying compressed air to nozzle holder fuel passage (A) at nozzle end.

A—Nozzle Holder Fuel Passage



Inspecting Nozzle Spring and Shims



Cleaning Nozzle Filter

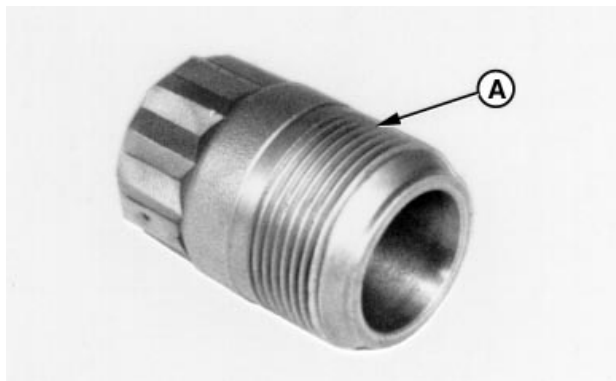
RG, RG34710, 1312 -19-23OCT97-3/3

Inspect Gland Nut

1. Inspect nozzle holder gland nut for general condition; be sure that it is not cracked or split.
2. Inspect M28 x 1.5 threads (A) for general condition. Threads which are slightly nicked or damaged may be "dressed up".

Replace gland nut if unable to restore to a serviceable condition.

A—Gland Nut Threads



Inspecting Nozzle Gland Nut

Continued on next page

RG, RG34710, 1313 -19-23OCT97-1/2

3.

Check passage in leak-off connector to see that is open.

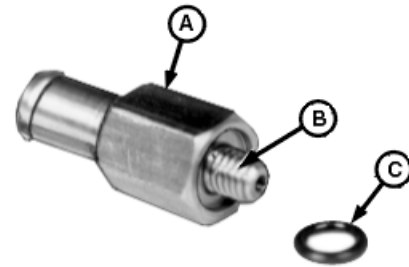
4. Blow through connector passage with compressed air.

5. Inspect the M6 x 1 threads (B) for general condition. Replace connector if threads are damaged and cannot be restored to a serviceable condition.

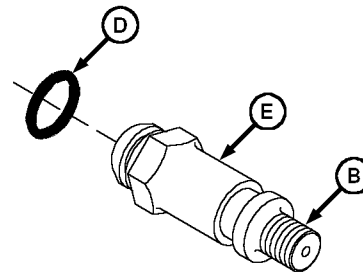
NOTE: Engines with metal leak-off lines have O-rings (C) between leak-off connector and nozzle. Engines with nylon leak-off lines have O-rings in groove of connector body on line nut end.

6. Replace O-rings (C) or (D).

- A—Connector Body (Metal Lines)
- B—Leak-Off Threads
- C—O-Ring (Metal Lines)
- D—O-Ring (Nylon Lines)
- E—Connector Body (Nylon Lines)



Leak-Off Connector (Metal Lines)



Leak-Off Connector (Nylon Lines)

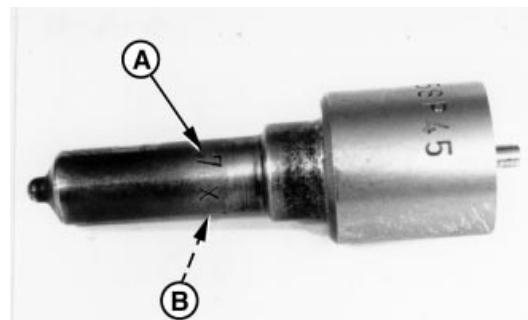
RG, RG34710, 1313 -19-23OCT97-2/2

Assemble Fuel Injection Nozzle

IMPORTANT: Be sure to install correct nozzle assembly on nozzle holder. Do not intermix different size nozzle assemblies.

To help determine correct nozzle assembly for each application, note markings on lower part of nozzle.

The illustration shows a nozzle marked 7 x 0.23. The number "7" (A) indicates the number of orifices and "0.23" (B) indicates the size of each orifice in millimeters.



Markings on Nozzle Tip

- A—Number "7"
- B—"0.23"

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RG10229 -UN-24JUN99

RG10228 -UN-15JUN99

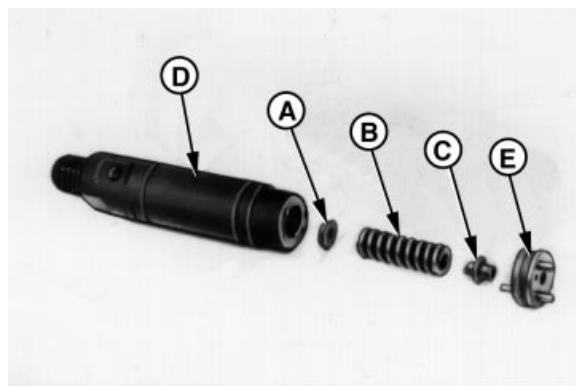
RG5958 -UN-26NOV97

IMPORTANT: Immerse parts in clean fuel before assembly. DO NOT dry parts with towels or compressed air. Dust particles might collect and stay on pressure faces of nozzle valve and nozzle holder.

1. Place shims (A), spring (B), and spring seat (C) in nozzle holder (D) while still wet with diesel fuel.

NOTE: Make sure intermediate plate (E) is free of any foreign material before reassembling.

A—Shims
B—Spring
C—Spring Seat
D—Nozzle Holder
E—Intermediate Plate



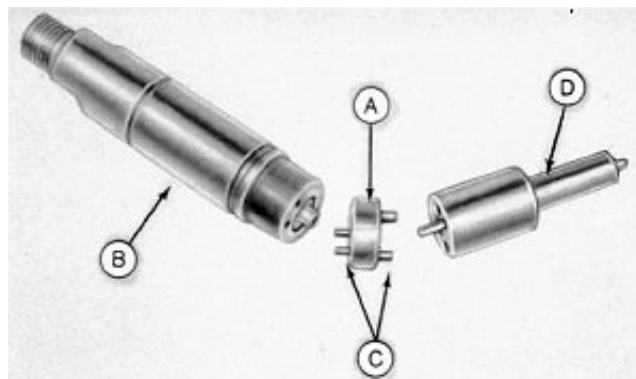
RG3415 -UN-22NOV97

Assembling Nozzle Holder Parts

RG, RG34710, 1314 -19-23OCT97-2/4

2. Position intermediate plate (A) on nozzle holder (B). Dowel pins (C) in plate will permit installation only one way.
3. Insert nozzle valve into nozzle (D) while holding parts below diesel fuel level in pan.

A—Intermediate Plate
B—Nozzle Holder
C—Dowel Pins
D—Nozzle and Valve

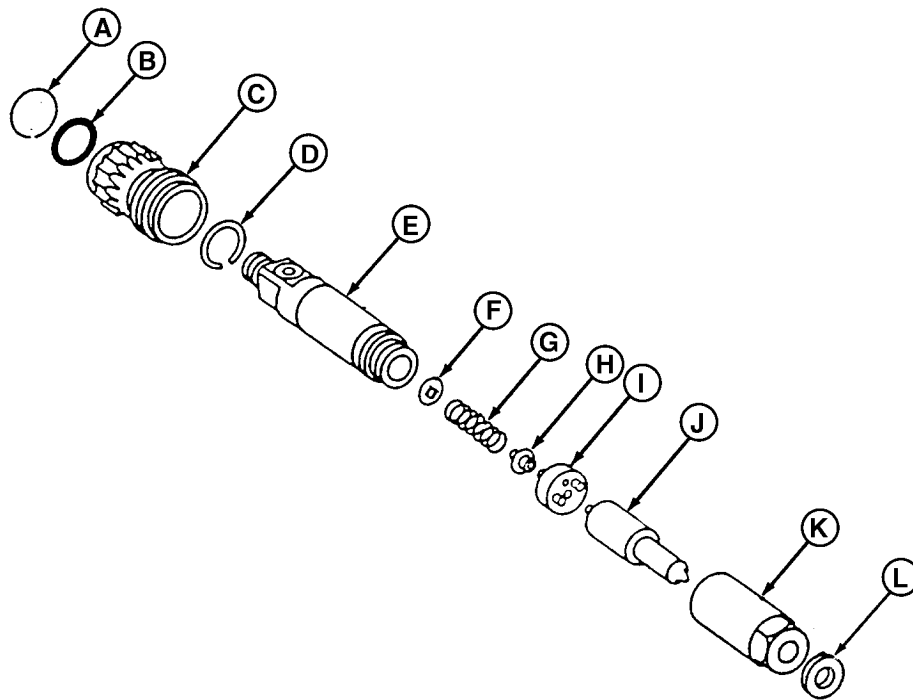


RG2254 -UN-29NOV88

Assembling Nozzle Valve Parts

Continued on next page

RG, RG34710, 1314 -19-23OCT97-3/4



RG6184 -UN-26NOV97

Bosch Injection Nozzle

A—Upper Snap Ring (Bosch only)	D—Lower Snap Ring	G—Nozzle Valve Spring	J—Nozzle and Valve
B—Gland Nut O-Ring	E—Nozzle Holder	H—Spring Seat	K—Nozzle Retaining Nut
C—Gland Nut	F—Shim	I—Intermediate Plate	L—Washer

4. Install nozzle assembly on nozzle holder (E) and secure with nozzle retaining nut (K).

5. Clamp nozzle holder in a soft-jawed vise. Tighten nozzle retaining nut to specifications.

Specification

Fuel Injection Nozzle Retaining
Nut—Torque 60—80 N•m (44—59 lb-ft)

6. Install lower snap ring (D) on nozzle holder.

7. Coat bore of gland nut (C) liberally with PT569 NEVER-SEEZ® compound to prevent gland nut from seizing on holder body.

8. Install upper snap ring (A) on nozzle holder (Bosch only) and position O-ring (B) against gland nut.

9. Install leak-off connector on nozzle holder (E) using a new O-ring.

NOTE: Leak-off connector and O-ring should be installed on nozzle holder even though they will have to be removed to install injection nozzle in cylinder head. This will prevent misplacement of connector and washer before installation on engine.

Engines with metal leak-off lines have O-rings between the connector and nozzle. Engines with nylon leak-off lines have O-rings in groove of connector body on line nut end.

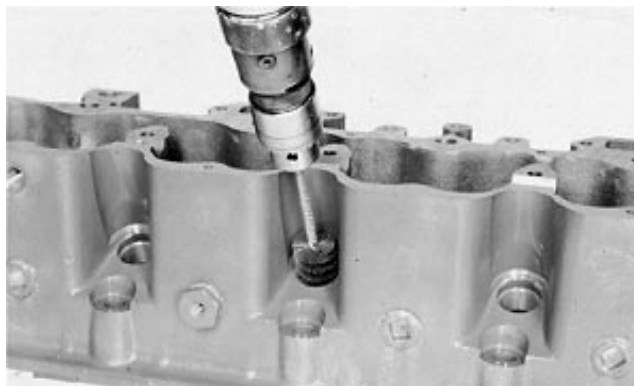
Inspect and Clean Cylinder Head Nozzle Bore

1. Inspect condition of threads for gland nut. Threads are metric (M28 x 1.5).
2. Inspect condition of nozzle seating in cylinder head.

Cylinder head threads and nozzle seating surface must be free of debris and carbon deposits.

IMPORTANT: If injection nozzle gland nut threads are not clean, a false torque wrench reading may be obtained when injection nozzle is installed. This may prevent injection nozzle from seating properly in cylinder head.

3. Clean threads which have light foreign deposits using an electric drill and D17030BR Thread Cleaning Brush. Work brush up and down several times to clean threads.



Cleaning Nozzle Bores in Cylinder Head

RG5251 -UN-14DEC88

RG, RG34710, 1316 -19-23OCT97-1/2

4. Clean threads with heavy foreign deposits or clean up damaged threads by using JDF5 Tap (M28 X 1.5 mm). Be sure to start tap straight to avoid possible cross-threading. A light coat of grease on tap will help collect foreign deposits on tap and prevent them from falling into nozzle bore.
5. After cleaning threads, insert a 13 mm (1/2 in.) tapered hardwood dowel to plug nozzle tip bore.
6. Blow out debris from nozzle cavity with compressed air; then remove wood dowel.



Using Tap to Clean Threads in Nozzle Bores

R28263N -UN-20DEC88

RG, RG34710, 1316 -19-23OCT97-2/2

Inspect and Clean Nozzle Seating Surface

1. Inspect nozzle seating surface for carbon deposits.
2. If seat is not clean, use the JDG609 Nozzle Seat Reamer to remove carbon. Stop using tool when seat comes clean.
3. Insert a 13 mm (1/2 in.) tapered hardwood dowel to plug the nozzle tip bore.
4. Blow out debris from nozzle cavity with compressed air; then remove wood dowel.



Cleaning Nozzle Seats in Head

RG10227 -UN-18JUN99

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RG, RG34710, 1317 -19-23OCT97-1/1

Install Fuel Injection Nozzles

1. Apply PT569 NEVER-SEEZ® Compound to gland nut threads and nozzle barrel (arrows). Be sure that NEVER-SEEZ® compound was also applied to inside bore of gland nut during assembly.

NOTE: Applying NEVER-SEEZ® Compound at these locations will help prevent possible seizure of gland nut to holder body.

IMPORTANT: Do not intermix injection nozzles of different suppliers or different tip sizes within a single engine.

2. Install a new special steel washer (A) on tip end of assembled injection nozzle.



Preparing Nozzle for Installation

A—Special Steel Washer

RG5888 -UN-26NOV97

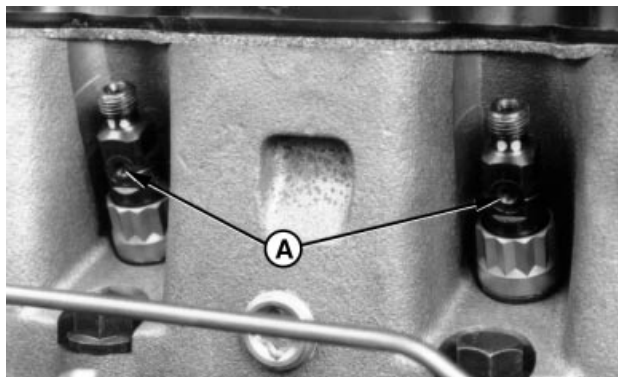
NEVER-SEEZ is a registered trademark of Emhart Chemical Group.

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RG, RG34710, 1318 -19-23OCT97-1/8

3. Insert injection nozzle into cylinder head. Turn gland nut by hand to make sure it is threaded straight in cylinder head.
4. Use outer socket of JDE92 Nozzle Socket and turn gland nut down to remove most of the looseness.
5. Rotate nozzle holder so holes for leak-off connector threads (A) are facing straight out from cylinder head.

A—Leak-Off Connector Threads



Installing Injection Nozzles in Cylinder Head

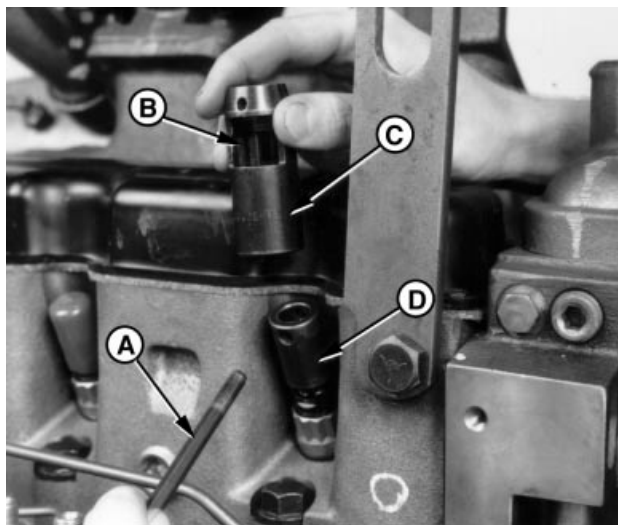
RG5889 -UN-26NOV97

RG, RG34710, 1318 -19-23OCT97-2/8

6. Position inner socket (D) of JDE92 Nozzle Socket over nozzle holder and engage with flats at top of nozzle holder.
7. Place outer socket (C) on gland nut with socket "window" (B) facing outward.
8. Insert handle (A) through window into inner socket. Ball detent in handle will keep it secured to inner socket.

NOTE: Handle simulates position of leak-off connector, which must be square with engine to permit proper installation of leak-off lines.

A—Handle
B—Window
C—Outer Socket
D—Inner Socket



Indexing of Injection Nozzle

RG5758 -UN-26NOV97

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RG, RG34710, 1318 -19-23OCT97-3/8

9. Tighten injection nozzle gland nut to specifications.
Keep handle (A) pointing straight out while tightening.

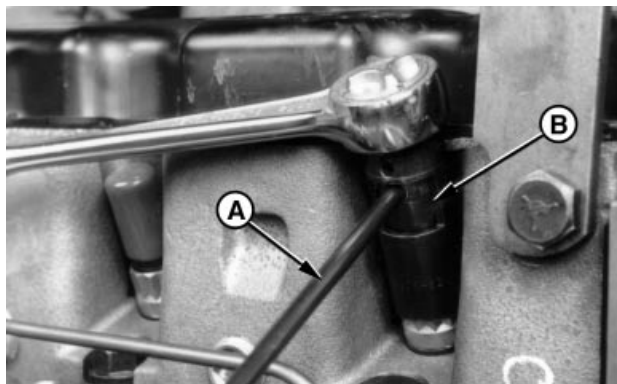
Specification

Fuel Injection Nozzle Gland
Nut-to-Cylinder Head—Torque..... 88 N•m (65 lb-ft)

Socket window (B) is cut deep enough to obtain a new
“bite” without removing inner socket.

10. Be sure O-ring is positioned against injection nozzle
gland nut.

A—Handle
B—Socket Window



Torquing Nozzle Gland Nut

RG, RG34710, 1318 -19-23OCT97-4/8

NOTE: Engines with metal leak-off lines have O-rings
between the connector and nozzle. Engines with
nylon leak-off lines have O-rings in groove of
connector body on line nut end.

11.

On engines with nylon leak off lines only, clean
threads on end of connector and apply LOCTITE®
242 Thread Lock and Sealer to threads.

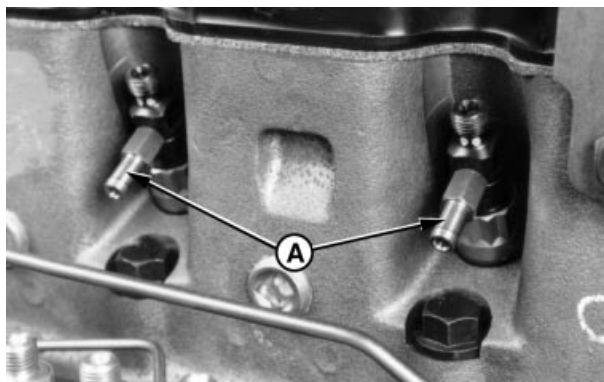
12. Install leak-off connectors (A) with O-rings on injection
nozzles. Tighten leak-off connectors to the following
specifications.

Specification

Fuel Injection Nozzle Leak-Off
Connectors (Metal Lines)—
Torque 7.5 N•m (5.5 lb-ft) (66 lb-in.)

Specification

Fuel Injection Nozzle Leak-Off
Connectors (Nylon Lines)—
Torque 15 N•M (11 lb-ft) (133 lb in.)



Engine with Metal Leak-Off Lines Shown

A—Nozzle Leak-off Connectors

LOCTITE is a registered trademark of Loctite Corp.

Continued on next page

RG, RG34710, 1318 -19-23OCT97-5/8

13. Perform the following on engines with metal leak-off lines:

Loosen all leak-off line fittings (A), remove pipes (B), and inspect packings (C). Discard packings that are worn or cut.

NOTE: Mark each leak-off before disassembly to assure assembly in correct location.

Check all pipes and fittings for wear or damage and replace as necessary.

Reinstall new packings (if needed), and pipes into T-Fittings. Tighten all connections securely.

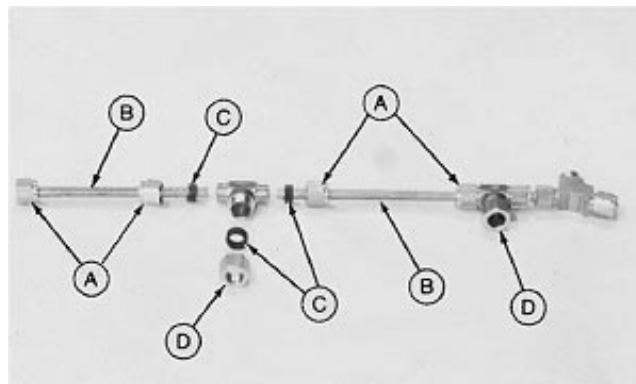
Install nuts (D) and packings onto leak-off connectors. Install complete assembly over appropriate leak-off line connectors.

14. Tighten all leak-off line nuts-to-connectors to specifications.

Specification

Fuel Leak-Off Line

Nuts-to-Connectors—Torque..... 11 N•m (8 lb-ft) (97 lb-in.)



Installing Nozzle Leak-off Lines (Metal)

A—Fittings
B—Pipes
C—Packings
D—Nuts

RG5091 -UN-14DEC88

Continued on next page

RG, RG34710, 1318 -19-23OCT97-6/8

15. Perform the following on engines with nylon leak-off lines:

IMPORTANT: The nylon leak-off line assembly is not repairable. DO NOT attempt to separate lines from connections. Replace entire assembly if unserviceable.

Check all nylon lines for cracks or damage and replace assembly as necessary.

Reinstall new packings (C), if needed.

Install nuts (A) and O-rings (B) onto leak-off connectors. Lubricate O-rings with petroleum jelly.

Lubricate bores of connectors (E) with petroleum jelly and install complete assembly over appropriate leak-off line connectors.

16. Tighten all leak-off line nuts-to-connectors to specifications.

Specification

Fuel Leak-Off Line
Nuts-to-Connectors—Torque..... 11 N•m (8 lb-ft) (97 lb-in.)

17. Connect leak-off line at injection pump and tighten to specifications.

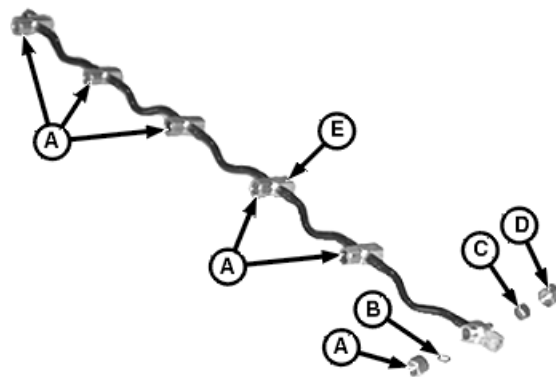
Specification

Fuel Leak-Off Line-to-Injection
Pump—Torque 13 N•m (10 lb-ft) (115 lb-in.)

If removed, install plug at end of leak-off line assembly and tighten to specifications.

Specification

Fuel Leak-Off Line End Plug—
Torque 16 N•m (12 lb-ft) (142 lb-in.)



Installing Nozzle Leak-off Lines (Nylon)

A—Nuts
B—O-Rings (Installed in Groove on Connector Body)
C—Packings
D—Nuts

RG10230 -UN-24JUN99

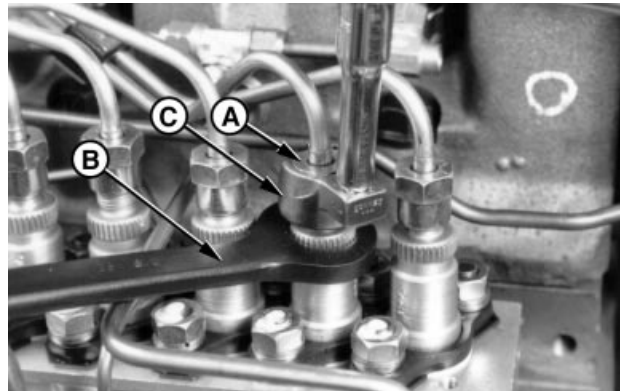
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RG, RG34710, 1318 -19-23OCT97-7/8

18. Remove protective caps and plugs, that were installed during disassembly, from injection lines, nozzles, and delivery valves.

IMPORTANT: On Bosch "P" pumps, use JDE90 Serrated Wrench (B) to keep delivery valve fittings stationary while tightening fuel line nuts. If a delivery valve and barrel housing rotates while tightening a fuel line nut, injection pump fuel delivery will be altered, and pump will have to be recalibrated on a test stand.



Connecting Injection Lines (Bosch "P" Pump Shown)

A—Fuel Injection Line Nuts
B—JDE90 Serrated Wrench
C—JDF22 Crowsfoot Wrench

19. Install and connect injection line assembly at each respective injection nozzle and delivery valve.
20. Tighten line nuts (A) at delivery valves to specification below as follows:

Use JD90 Serrated Wrench (B) and JDF22 Crowsfoot Wrench (C) or a standard 3/4-in. line wrench on Bosch "P" pumps.

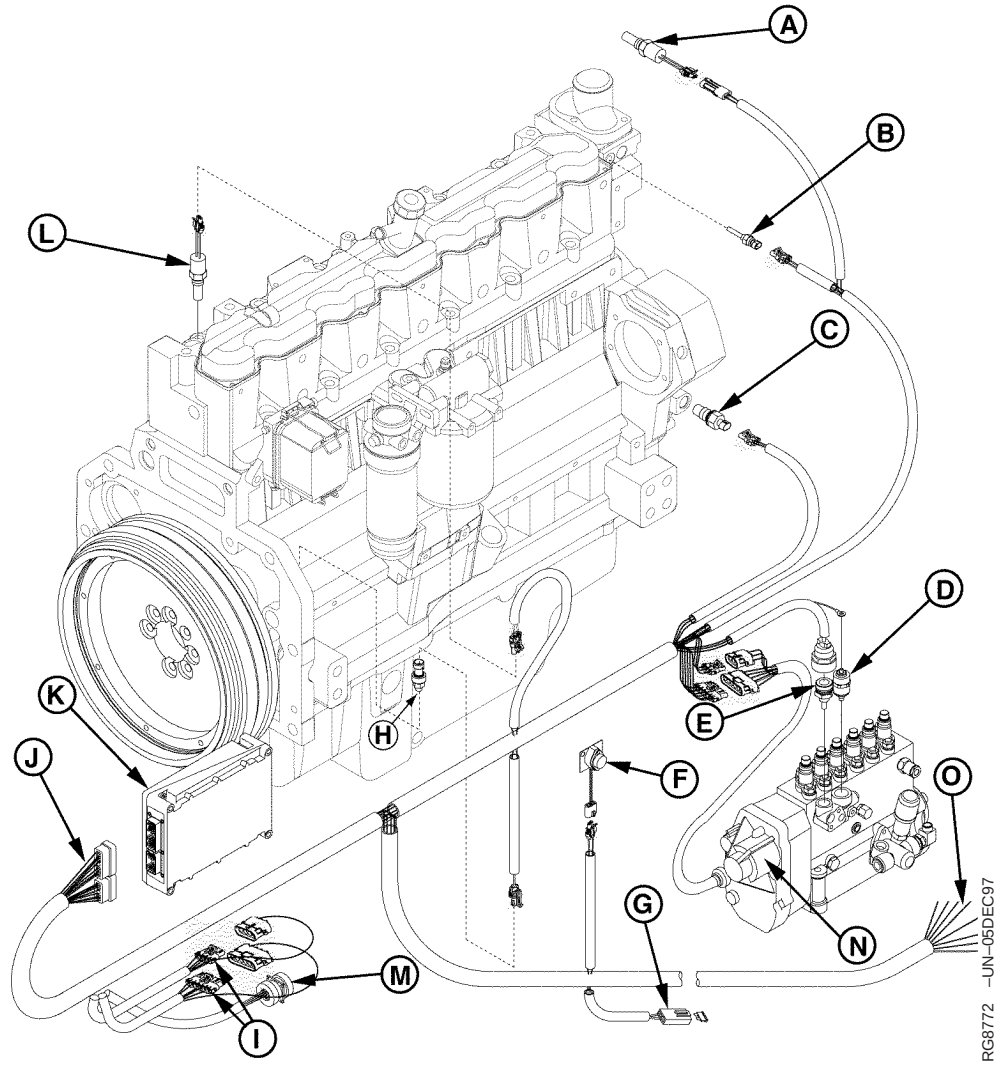
Specification

Fuel Injection Line Nuts at
Delivery Valves—Torque..... 27 N•m (20 lb-ft)

21. Bleed the fuel system. See BLEED THE FUEL SYSTEM in Section 04, Group 150 of this manual.

RG, RG34710, 1318 -19-23OCT97-8/8

John Deere Level 3 Electronic Engine Control System and Sensors



John Deere Level 3 Electronic Engine Control System and Sensors

A—Manifold Air Temperature (MAT) Sensor

B—Engine Coolant Temperature Sensor
C—Auxiliary Engine Speed Sensor
D—Fuel Shut-off Solenoid
E—Fuel Temperature Sensor
F—Transient Voltage Protection (TVP) Module

G—Fuse
H—Engine Oil Pressure Sensor
I—Diagnostic and Service Connectors
J—Electronic Wiring Harness

K—Engine Control Unit (ECU)
L—Loss of Coolant Sensor
M—CAN Bus Connector
N—Rack Actuator Assembly
O—Taped Wires¹

¹ These wires do not have terminal ends attached. They are to be spliced and used per application requirements.

Continued on next page

RG, RG34710, 1324 -19-21APR99-1/2

IMPORTANT: DO NOT pressure wash the Engine Control Unit (ECU).

Before welding on engines with ECU, protect the ECU from high-current damage as follows:

1. Disconnect ECU-to-vehicle frame ground connection.
2. Disconnect all other connectors from ECU.

3. Connect welder ground close to welding point and make sure ECU and other electrical components are not in the ground path.

NOTE: For diagnosis and testing of the electronic engine control and sensors, refer to the following manuals: Earlier Bosch ECU systems—CTM68. Later John Deere ECU systems—CTM134.

RG, RG34710, 1324 -19-21APR99-2/2

Remove and Install Sensors

Refer to the diagram on previous page to identify and locate the various sensors on the engine which feed signals to the electronic control system.

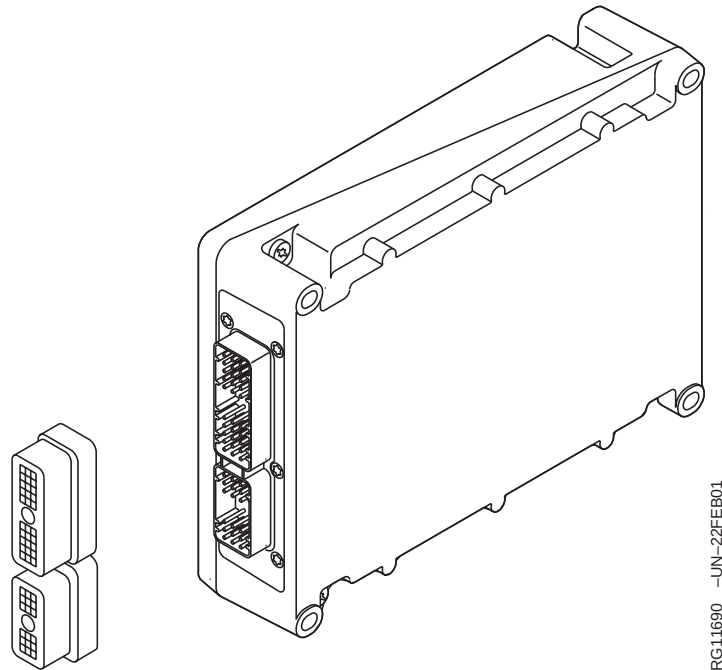
1. Disconnect sensor wiring connector.
2. Remove sensor from bore.
3. Coat sensor O-ring with JDT405 High Temperature Grease and install sensor in its bore.
4. Tighten sensors securely, or to following torques:

Specification

Coolant Temperature Sensor—
Torque 14 N•m (10 lb-ft)
Fuel Shut-off Solenoid (on
Injection Pump)—Torque..... 50 N•m (37 lb-ft)

5. Install sensor wire connector.

RG, RG34710, 1325 -19-23OCT97-1/1

Engine Control Unit (ECU)**IMPORTANT: DO NOT OPEN ENGINE CONTROL UNIT.**

NOTE: The sealed ECU assembly is the system component LEAST likely to fail. Insure it is isolated and identified as the defective component, before replacing. See operation and test manual for proper troubleshooting procedures.

The Engine Control Unit is not repairable. If it is found to be defective, replace it as a unit.

IMPORTANT: If an Engine Control Unit (ECU) is not programmed identically with the original (failed) Control Unit, misleading diagnostic messages, poor performance, or engine damage can occur.

The wiring connector for the Engine Control Unit is repairable. For later Deere ECUs, see REPLACE (Pull Type) METRI-PACK® CONNECTORS later in this Group. For earlier Bosch ECU's, refer to CTM68, Electronic Fuel Injection Systems.

RG, RG34710, 1326 -19-23OCT97-1/1

Transient Voltage Protection (TVP) Module

The TVP module is not repairable. If the TVP module is defective, the unit must be replaced. The connector on the TVP module wiring harness is repairable. See REPLACE (Pull Type) METRI-PACK® CONNECTORS later in this Group.



Transient Voltage Protection (TVP module)

RG, RG34710, 1327 -19-23OCT97-1/1

Connectors

Connectors are devices that provide for assembly and disassembly of systems. Connectors should always be serviced using tools designed for that type of connector. A good crimp is important to mechanical and electrical soundness. Repaired connectors should be physically tested by pulling to be sure the contact is firmly attached to the conductor.

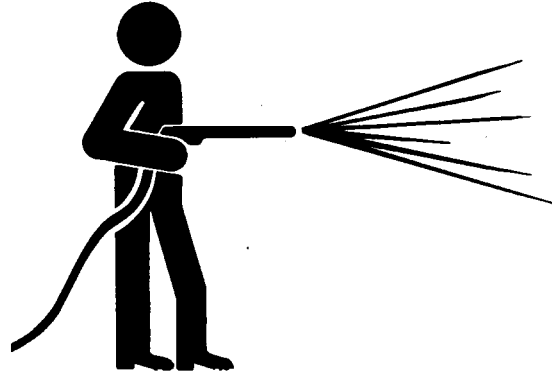
IMPORTANT: If for some reason the connectors are not connected, such as when the high pressure fuel pump is removed, it is important to protect the connectors from debris.

Refer to the procedures which follow for repair of various types of connectors.

RG, RG34710, 1328 -19-23OCT97-1/1

Using High-Pressure Washer

IMPORTANT: Reduce pressure when directing pressurized water at electronic or electrical components and connectors as this may cause the components to malfunction. Always reduce pressure, and spray at a 45 to 90 degree angle.



Using High-Pressure Washer

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RG, RG34710, 1329 -19-23OCT97-1/1

Repair WEATHERPACK™ Connector

1. Disconnect WEATHERPACK™ connector. Remove the tie bands and tape.
2. Open the secondary lock on the back of the connector.
3. Identify wire color/number to the connector cavity. Make sure each wire goes back to the correct cavity location.
4. Insert JDG364 Extraction Tool¹ over terminal contact in connector body. Extraction tool needs to be fully seated to unlock terminal tangs from the connector body. When tool is seated, gently pull the wire from the back of the connector. If the wire(s) or terminal(s) are being repaired, go to step 5. If the wires and terminals are OK and only the connector is being replaced, go to step 9.
5. Using JDG145 Universal Electrical Pliers², cut off wire directly behind the terminal seal crimp. If any part of the seal is still on the wire, dispose of it.
6. Using JDG145 Universal Electrical Pliers², strip 6 mm (1/4 in.) insulation from end of wire.



TS0128 -UN-23AUG88

WEATHERPACK is a trademark of Packard Electric

¹ Included in JT07195B Electrical Repair Kit

² Included in JDG155 Electrical Repair Tool Kit

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AG,OUOD008,296 -19-06MAR02-1/4

7. Select correct size of seal. Slide the seal over the wire insulation with the smaller diameter side facing the end of the wire. Small diameter side of seal should line up with the outer edge of the insulation.

IMPORTANT: The seal must fit snug over the cable insulation without a gap between the cable seal and the insulation.

NOTE: Cable seals are color coded for three sizes of wire:

- Green - 18—20 Gauge Wire
- Gray - 14—16 Gauge Wire
- Blue - 10—12 Gauge Wire



TS0136 -UN-23AUG88

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AG,OUOD008,296 -19-06MAR02-2/4

8. Select correct size terminal on wire and crimp in position with a W-type crimp using a JDG783 WEATHER PACK™ Crimping Tool.

NOTE: Terminals have numbered identification for two sizes of wire:

- #15 - 14—16 Gauge Wire
- #19 - 18—20 Gauge Wire



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WEATHER PACK is a trademark of Packard Electric

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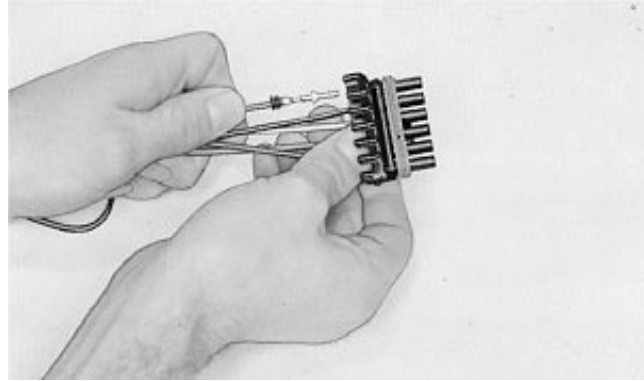
9. Insert terminal into connector. Terminal should click when it is fully seated. Make sure the wire is inserted into the correct connector cavity.

IMPORTANT: Terminal tangs must be carefully spread to ensure good seating on connector body. If terminal is being reused in a new connector, make sure tangs are spread.

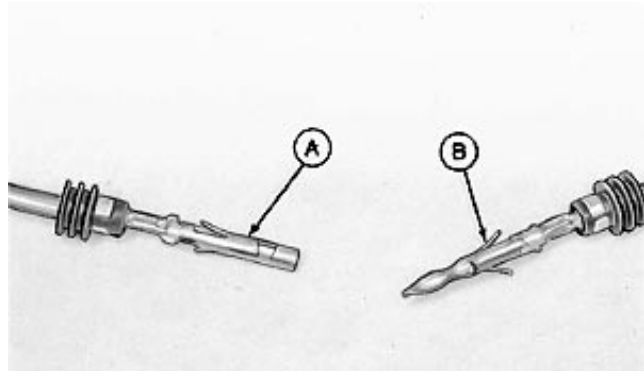
NOTE: Connector bodies are "keyed" for correct terminals. Be sure terminals are correctly aligned.

Correct terminal installation for sleeve (A) and pin (B) is illustrated.

10. Gently pull on wire to insure that the terminal is locked in position.
11. Repair or transfer remaining wires.
12. Close the secondary lock on the back of the connector.
13. Retape wires and add the required tie bands to the harness.



TS0130 -UN-23AUG88



TS0139 -UN-02DEC88

A—Sleeve
B—Pin

AG,OUOD008,296 -19-06MAR02-4/4

Install WEATHER PACK™ Contact

NOTE: Cable seals are color coded for three sizes of wire:

- Green - 18 to 20 gauge wire
- Gray - 14 to 16 gauge wire
- Blue - 10 to 12 gauge wire

Push correct size cable seal on wire.

IMPORTANT: The seal must fit snug over the cable insulation, without a gap between the cable seal and the insulation.

Strip insulation from wire to expose 6 mm (1/4 in.) and align cable seal with edge of insulation.



WEATHER PACK™ Contact

TS0136 -JUN-23AUG88

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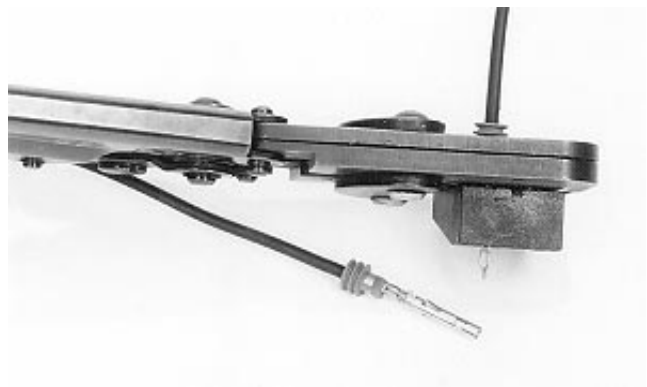
WEATHER PACK is a trademark of Packard Electric.

RG, RG34710, 1331 -19-23OCT97-1/4

NOTE: Contacts have numbered identification for two sizes of wire:

- #15 for 14 to 16 gauge wire
- #19 for 18 to 20 gauge wire

Put correct size contact on wire and crimp in place with a W-type crimp using a JDG783 WEATHER PACK™ Crimping Tool.



Crimping WEATHER PACK™ Connector to Wire

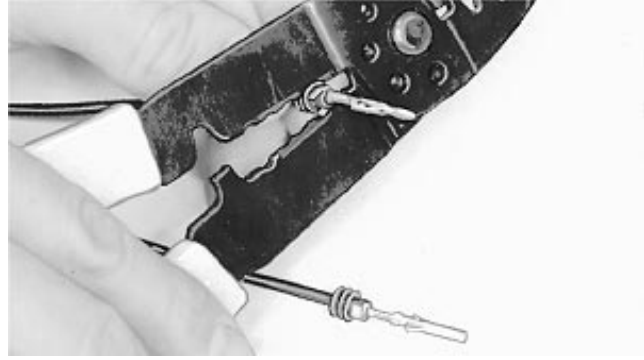
TS1623 -JUN-02NOV94

WEATHER PACK is a trademark of Packard Electric

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RG, RG34710, 1331 -19-23OCT97-2/4

Secure cable seal to contact using a JDG783 WEATHER PACK™ Crimping Tool.



TS0138 -UN-23AUG88

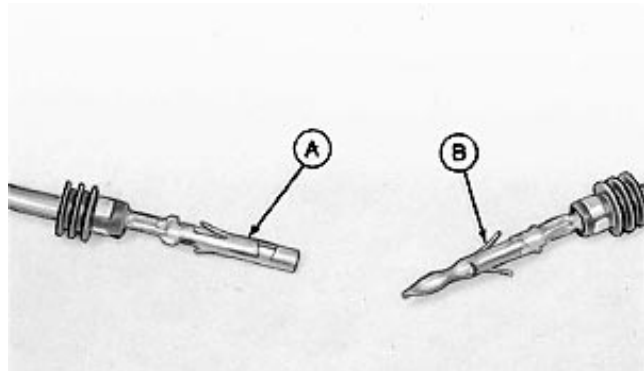
Securing Cable Seal to Contact

WEATHER PACK is a trademark of Packard Electric.

RG, RG34710, 1331 -19-23OCT97-3/4

IMPORTANT: Correct contact installation for sleeve (A) and pin (B) is illustrated.

A—Sleeve
B—Pin



TS0139 -UN-02DEC88

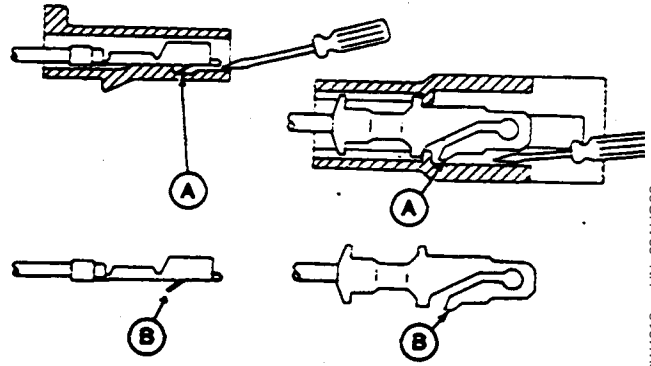
Correct WEATHER PACK™ Installation

RG, RG34710, 1331 -19-23OCT97-4/4

Remove Blade Terminals from Connector Body

NOTE: Use JDG776 Extraction Tool with 56, 280, and 630 Series METRI-PACK terminals. Use JDG777 Extraction Tool with 150 Series METRI-PACK terminals.

1. Insert JDG776 or JDG777 Terminal Extraction Tool¹ into connector body pushing the terminal locking tang inward.
2. Gently pull wire and remove terminal from connector.
3. Adjust the locking tang on the terminal to it's original position before installing into a connector.



RW4218 -UN-23AUG88

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¹Included in JT07195B Electrical Repair Kit

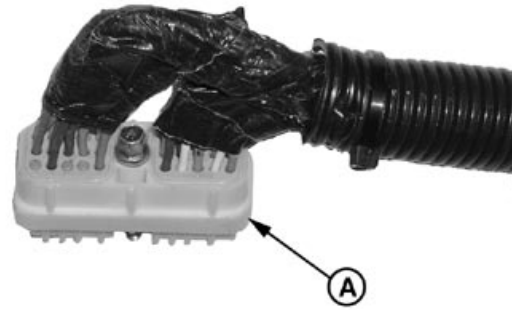
Repair (Pull Type) METRI-PACK™ Connectors

1. Disconnect the METRI-PACK connector (A) from the ECU.
2. Remove tie bands and tape from the wiring harness behind the connector.
3. Identify wire color/number to the connector cavity. Make sure each wire goes back to the correct cavity location.
4. Using JDG776 Terminal Extraction Tool (C)¹, carefully remove the connector seal (B) from the back of the connector.

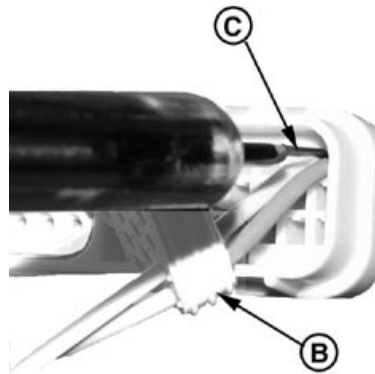
IMPORTANT: Make sure no damage to the seal occurs or water and contaminants will corrode terminals.

NOTE: Extraction tool must be used from the back of the connector.

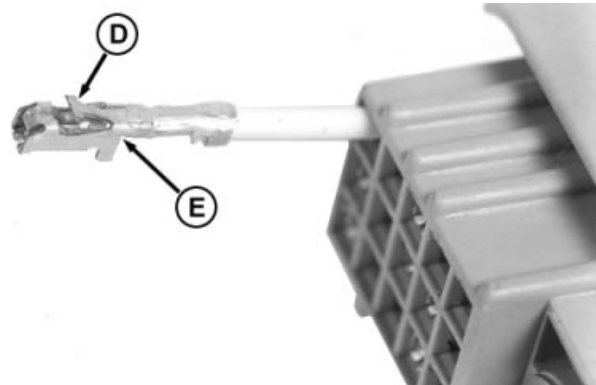
5. Using JDG776 Terminal Extraction Tool (C), angle the tip so it slides along the top edge of the connector. Make sure the extraction tool is centered in the connector cavity and push the tool in until resistance is felt.
6. With extraction tool inserted into the connector, gently rotate tool clockwise and counter-clockwise (no more than 1/8 turn each direction) to depress the terminal locking tang (D).
7. Remove extraction tool from back of connector.
8. Push wire until terminal has extracted from the front of the connector. If terminal does not extract, repeat steps 4-6.



RG12231A -UN-13MAR02



RG12232A -UN-13MAR02



RW16935A -UN-05AUG98

A—Connector
B—Connector Seal
C—JDG776 Terminal Extraction Tool
D—Terminal Locking Tang
E—Terminal

METRI-PACK is a trademark of Delphi Packard Electric Systems

¹ Included JT07195B Electrical Repair Kit

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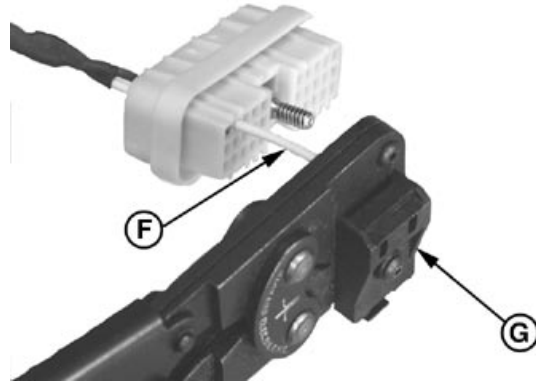
9. Using JDG145 Universal Electrical Pliers¹, cut off wire directly behind the terminal.

IMPORTANT: Save as much wire as possible. If only a couple of wires are shorter than the rest, all of the strain will be placed on them. Damage to the harness may occur.

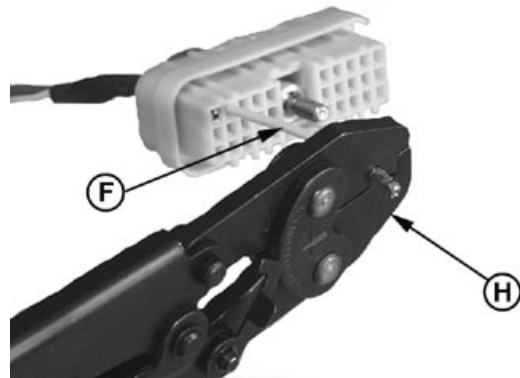
10. Using JDG145 Universal Electrical Pliers¹, strip 6 mm (1/4 in.) insulation from end of wire.
11. If wire has been removed from the connector, make sure the wire is fed through the connector (F) and in the correct cavity.
12. Using either JDG783 (G) or JDG707 (H) Crimping Pliers, crimp a new terminal on the wire.
13. Make sure terminal locking tang (D) on new terminal is in outward position. Pull wire back into connector cavity until terminal locks.

NOTE: Terminal will seat only one way. If terminal does not pull into the connector body socket, check for correct terminal alignment (E).

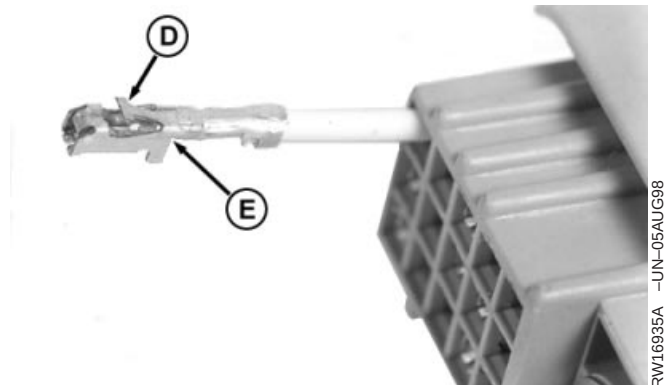
14. Push on the wire to make sure terminal is locked into the connector.
15. Slide the connector seal back into the connector. Make sure seal is in it's original position.
16. Retape the wires and add the required tie bands to the harness.



RG12234A -UN-13MAR02



RG12233A -UN-13MAR02



RW16935A -UN-05AUG98

D—Terminal Locking Tang
E—Correct Terminal Orientation
F—Wire
G—JDG783 Terminal Crimping Tool
H—JDG707 Terminal Crimping Tool

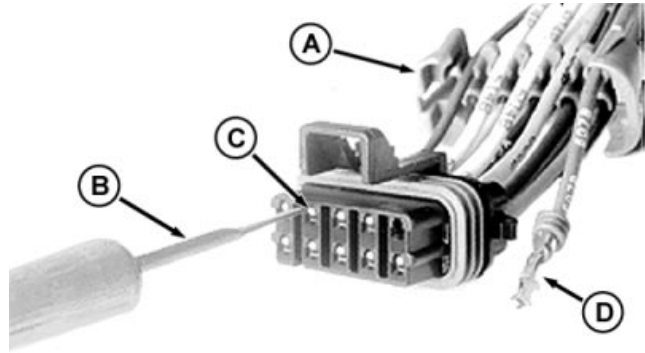
¹Included in JDG155 Electrical Repair Tool Kit

Repair (Push Type) METRI-PACK™ Connectors

1. Disconnect the METRI-PACK connector. Remove the tie bands and tape.
2. Remove secondary lock (A).
3. Identify wire color/number to the connector cavity. Make sure each wire goes back to the correct cavity location.
4. Insert JDG776 or JDG777 Terminal Extraction Tool¹ (B) into connector cavity (C) pushing the terminal locking tab inward.

NOTE: Use JDG776 Extraction Tool with 56, 280, and 630 Series METRI-PACK terminals. Use JDG777 Extraction Tool with 150 Series METRI-PACK terminals.

5. Remove extraction tool and pull wire from the back of the connector.
6. Using JDG145 Universal Electrical Pliers², cut off wire directly behind the terminal.
7. Using JDG145 Universal Electrical Pliers² strip 6 mm (1/4 in.) insulation from end of wire.
8. Select correct size of seal. Slide the seal over the wire insulation with the smaller diameter side facing the end of the wire. Small diameter side of seal should line up with the outer edge of the insulation.



A—Connector Secondary Lock
B—Extraction Tool
C—Connector Body Socket
D—Terminal

METRI-PACK is a trademark of Delphi Packard Electric Systems

¹Included in JT07195B Electrical Repair Kit

²Included in JDG155 Electrical Repair Tool Kit

Continued on next page

AG,OUOD008,299 -19-06MAR02-1/3

IMPORTANT: The seal must fit snug over the cable insulation, without a gap between the cable seal and the insulation.

NOTE: Cable seals are color coded for three sizes of wire:

- Green - 18—20 Gauge Wire
- Gray - 14—16 Gauge Wire
- Blue - 10—12 Gauge Wire

9. Select correct size contact for wire.

Continued on next page

AG,OUOD008,299 -19-06MAR02-2/3

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10. Crimp contact (A) on wire with a "W" type crimp using JDG865 Crimping Tool (B).

11. Crimp cable seal (C) on contact using JDG865 Crimping Tool (B).

12. Make sure locking tang (D) on the new terminal is in the outward position.

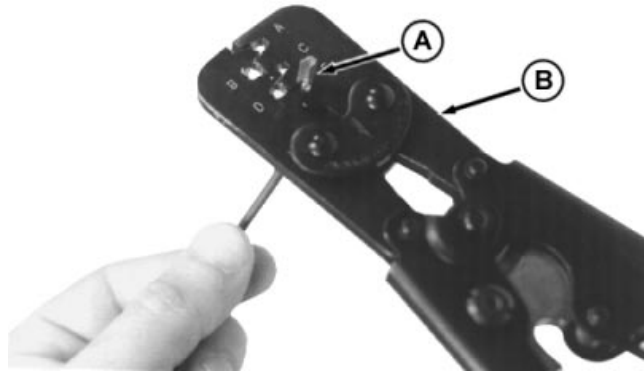
13. Push terminal into the correct connector cavity until terminal locks.

14. Gently pull on wire to verify terminal is locked into the connector.

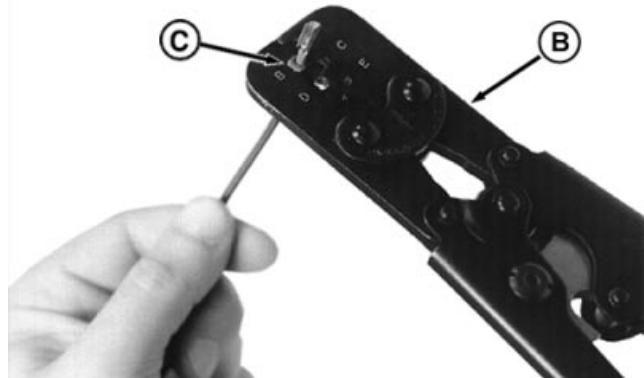
15. Place the secondary lock back on the connector.

16. Retape the wires and add the required tie bands to the harness.

A—Contact
B—Tool
C—Cable Seal
D—Terminal Locking Tang



RW77139 -UN-07DEC98



RW77138A -UN-15MAR02



RW77140A -UN-15MAR02

AG,OUOD008,299 -19-06MAR02-3/3

Use Electrical Insulating Compound

Apply AT66865 Compound directly to the terminals between the wire seal and connector body. This provides a moisture barrier, especially in wet and humid conditions.

RG,RG34710,1335 -19-23OCT97-1/1

Repair DEUTSCH™ Connectors

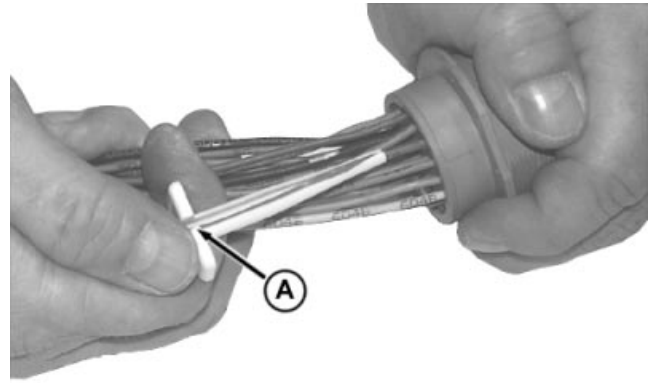
1. Disconnect the Deutsch connector. Remove the tie bands and tape.
2. Identify wire color/number to the connector cavity. Make sure each wire goes back to the correct cavity location.
3. Select correct size extractor tool for size of wire to be removed:

- JDG361 Extractor Tool - 12—14 Gauge Wire¹
- JDG362 Extractor Tool - 16—18 Gauge Wire¹
- JDG363 Extractor Tool - 20 Gauge Wire²
- JDG785 Extractor Tool - 6-8 Gauge Wire³

4. Start inserting the wire into the handle end (A) of the correct size extraction tool.
5. Slide extraction tool rearward along wire until tool tip snaps onto wire.

IMPORTANT: DO NOT twist tool when inserting in connector.

6. Slide extraction tool along wire into connector body until tool is positioned over terminal contact.
7. Pull wire from connector body using extraction tool.
8. Using JDG145 Universal Electrical Pliers⁴ cut off wire directly behind the terminal.
9. Using JDG145 Universal Electrical Pliers⁴, strip 6 mm (1/4 in.) insulation from end of wire.



A—Handle

RW77142 -UN-07DEC98

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DEUTSCH is a trademark of Deutsch Company

¹Included in JT07195B Electrical Repair Tool Kit and JDG359 DEUTSCH Electrical Repair Kit

²Included in JDG359 DEUTSCH Electrical Repair Kit

³Included in JT07195B Electrical Repair Tool Kit

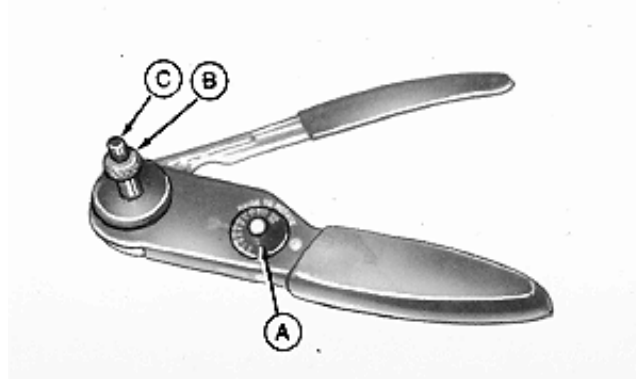
⁴Included in JDG155 Electrical Repair Tool Kit

Continued on next page

AG,OUOD008,304 -19-26MAR02-1/4

10. Adjust selector (A) on JDG360 Crimping Tool¹ for correct wire size .
11. Loosen lock nut (B) and turn adjusting screw (C) in until screw stops.

A—Selector
B—Lock Nut
C—Adjusting Screw



TS117 -UN-23AUG88

¹Included in JDG359 Electrical Repair Kit

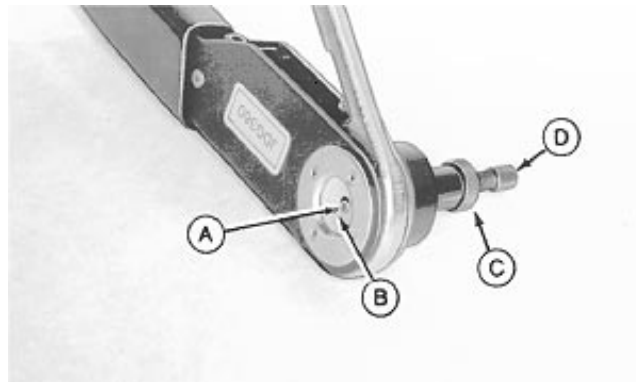
AG,OUOD008,304 -19-26MAR02-2/4

12. Insert terminal (A) and turn adjusting screw (D) until terminal is flush with cover (B).

IMPORTANT: Select correct size terminal to fit connector body.

13. Tighten lock nut (C).

A—Terminal
B—Cover
C—Lock Nut
D—Adjusting Screw



TS0134 -UN-23AUG88

Continued on next page

AG,OUOD008,304 -19-26MAR02-3/4

14. Insert wire in terminal and crimp until handle contacts stop.

IMPORTANT: Terminal must remain centered between indenters while crimping.

15. Release handle and remove terminal.

16. Inspect terminals to ensure all wires are in crimped barrel.

IMPORTANT: If all wire strands are not crimped into terminal, cut off wire at terminal and repeat terminal installation procedures.

NOTE: Readjust crimping tool for each crimping procedure.

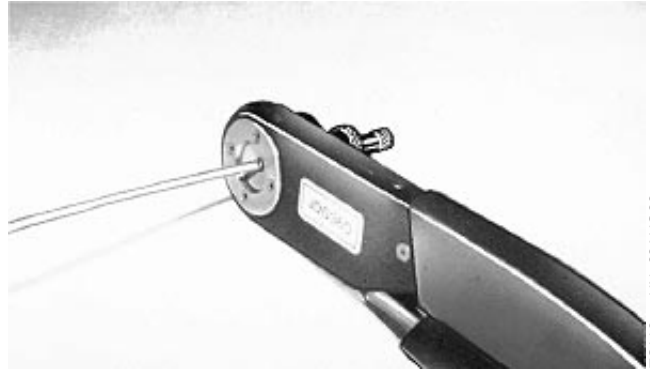
17. Push terminal straight into correct connector cavity until positive stop is felt.

IMPORTANT: Install terminal in correct connector cavity using correct size grommet.

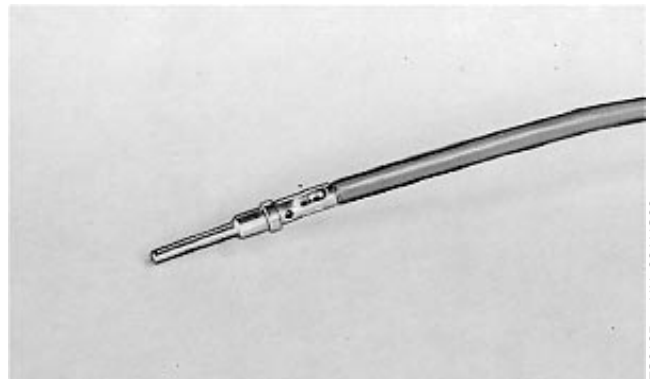
18. Gently pull on wire to verify terminal is locked into the connector.

19. Transfer remaining wires to correct cavity in new connector.

20. Retape the wires and add the required tie bands to the harness.



TS118 -UN-23AUG88



TS0135 -UN-23AUG88



RW77141 -UN-07DEC88

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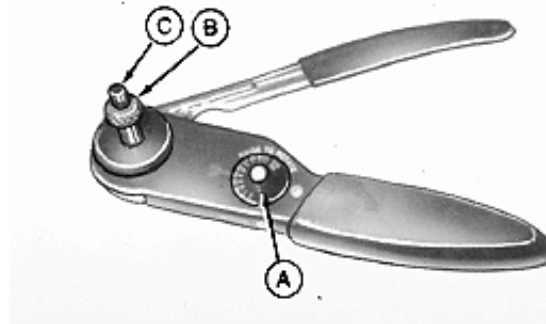
Install DEUTSCH™ Contact

Strip 6 mm (1/4 in.) insulation from wire.

Adjust selector (A) on JDG360 Crimper¹ for correct wire size.

Loosen lock nut (B) and turn adjusting screw (C) in until screw stops.

- A—Selector
B—Lock Nut
C—Adjusting Screw



Crimping DEUTSCH™ Contact

TS117 –UN-23AUG88

DEUTSCH is a trademark of Deutsch Co.

¹Included in JDG359 DEUTSCH Electrical Repair Kit

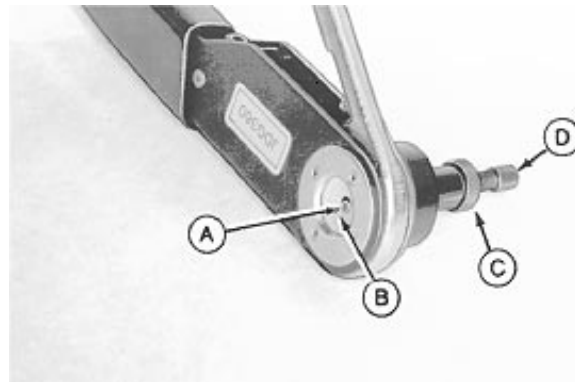
RG, RG34710,1337 –19-23OCT97-1/4

IMPORTANT: Select correct size contact sleeve or pin to fit connector body.

Insert contact (A) and turn adjusting screw (D) until contact is flush with cover (B).

Tighten lock nut (C).

- A—Contact
B—Cover
C—Lock Nut
D—Adjusting Screw



Inserting Contact into Crimping Tool

TS0134 –UN-23AUG88

RG, RG34710,1337 –19-23OCT97-2/4

IMPORTANT: Contact must remain centered between indentors while crimping.

Insert wire in contact and crimp until handle touches stop.

Release handle and remove contact.



Crimping DEUTSCH™ Contact

TS118 –UN-23AUG88

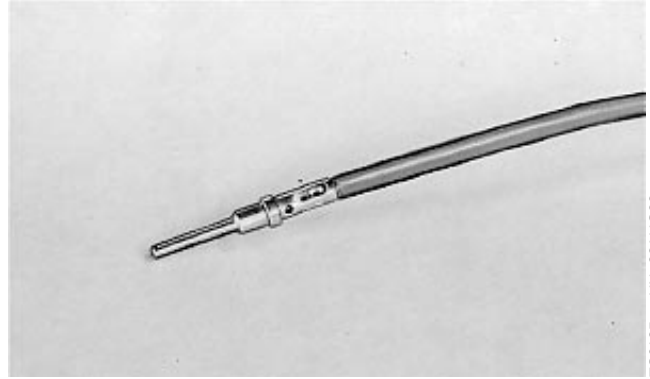
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RG, RG34710,1337 –19-23OCT97-3/4

IMPORTANT: If all wire strands are not crimped into contact, cut off wire at contact and repeat contact installation procedures.

NOTE: Readjust crimping tool for each crimping procedure.

Insert contact to be certain all wires are in crimped barrel.



DEUTSCH™ Connector Replaced

TS0135 -UN-23AUG88

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RG, RG34710, 1337 -19-23OCT97-4/4

Section 03 Theory of Operation

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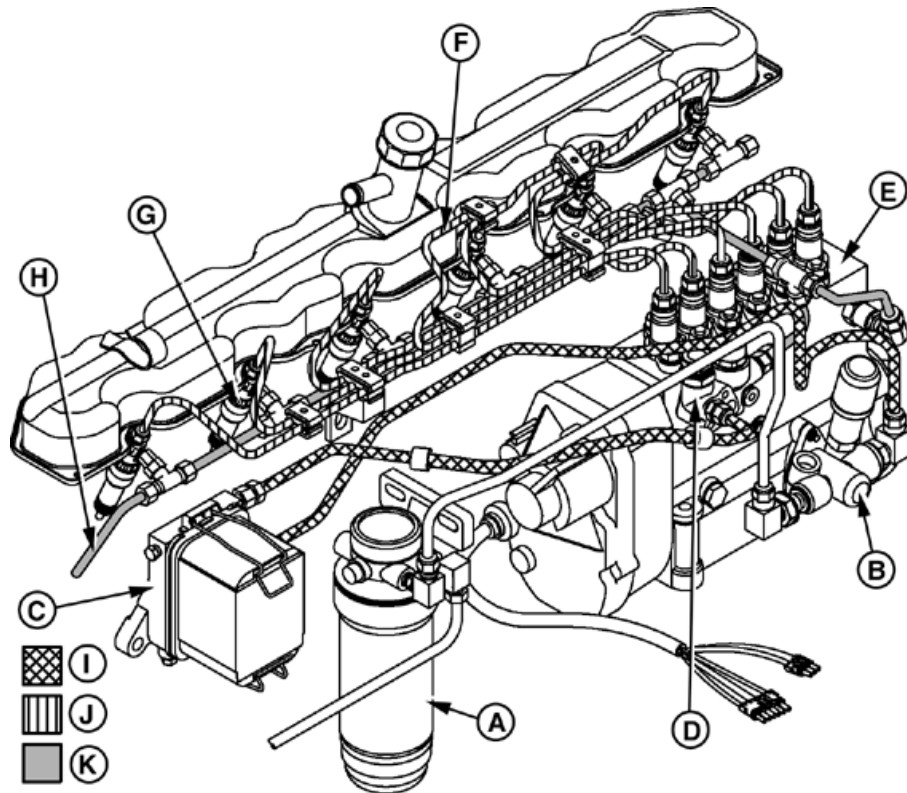
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Fuel System Overview



RG9707 -JUN-04DEC98

A—Primary Fuel Filter/Water Separator
B—Supply Pump

C—Final Fuel Filter
D—Fuel Inlet Housing
E—Injection Pump

F—Injection Pressure Lines
G—Injection Nozzles
H—Leak-off Line Assembly

I—Supply Pump Pressure Fuel
J—Injection Pressure Fuel
K—Return Fuel

The supply pump (B) draws fuel from the vented fuel tank through the optional pre-filter and primary filter/water separator (A). The supply pump pressurizes the fuel so that it flows through the final filter (C), enters the fuel injection pump (E) through a connection on the pump fuel inlet housing (D), and on to the fuel gallery in the pump housing. Supply pump output pressure (I) will vary depending on load and application.

The in-line injection pump has six plungers that pressurize the fuel further. The timing that the plungers deliver fuel is based off the injection pump camshaft. The timing of the injection pump camshaft is connected to the engine camshaft and crankshaft of the engine through timing gears. The engine camshaft

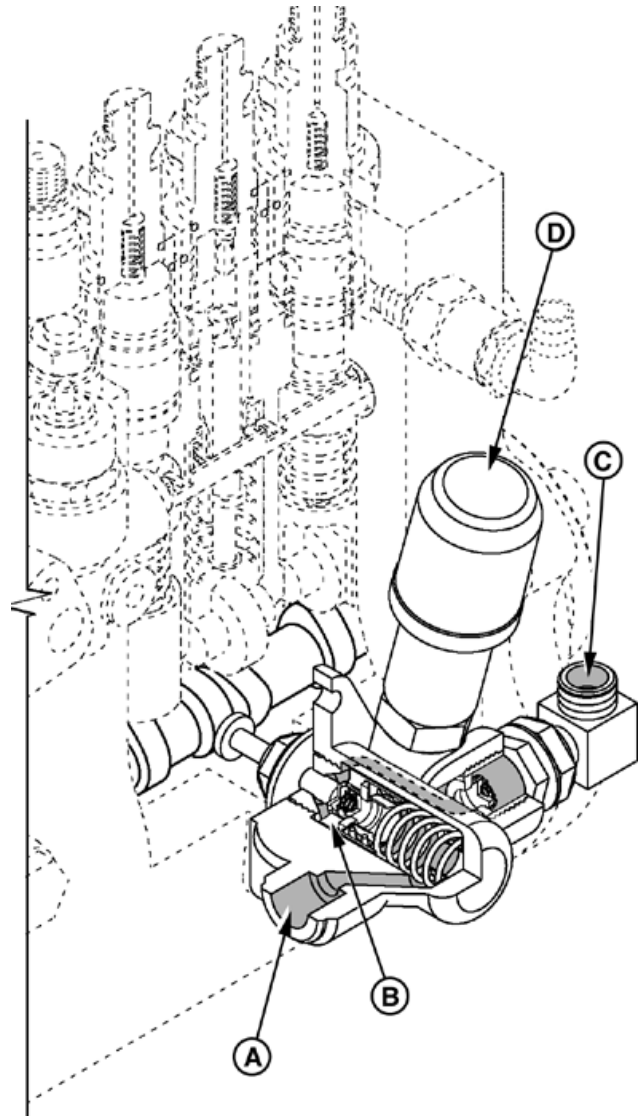
(which drives the injection pump) rotates at one-half the crankshaft speed. The amount of fuel delivered depends on the rack, which is controlled by the governor. Injection pressure lines (F) route the fuel to the nozzles (G). The high-pressure fuel (J) opens the nozzle valve and forces fuel out the small orifices in the nozzle tip. This atomizes the fuel as it enters the combustion chamber.

There are two sources of excess fuel incorporated into the system. The supply pump supplies more fuel to the pump than is required by the engine, and the nozzle requires excess fuel to lubricate the nozzle valve. A leak-off line assembly (H) returns this excess fuel (K) to the tank from both the pump and nozzles.

Fuel Supply Pump Operation

A plunger-type fuel supply pump is used on 6.8 L & 8.1 L engines with a Bosch electronically-controlled inline injection pump. The supply pump is mounted on the side of the injection pump housing and is driven by the injection pump camshaft. Fuel enters the supply pump at (A), is pressurized by the plunger (B), and discharged through outlet (C). The hand primer (D) provides manual pump operation for bleeding air from the fuel system.

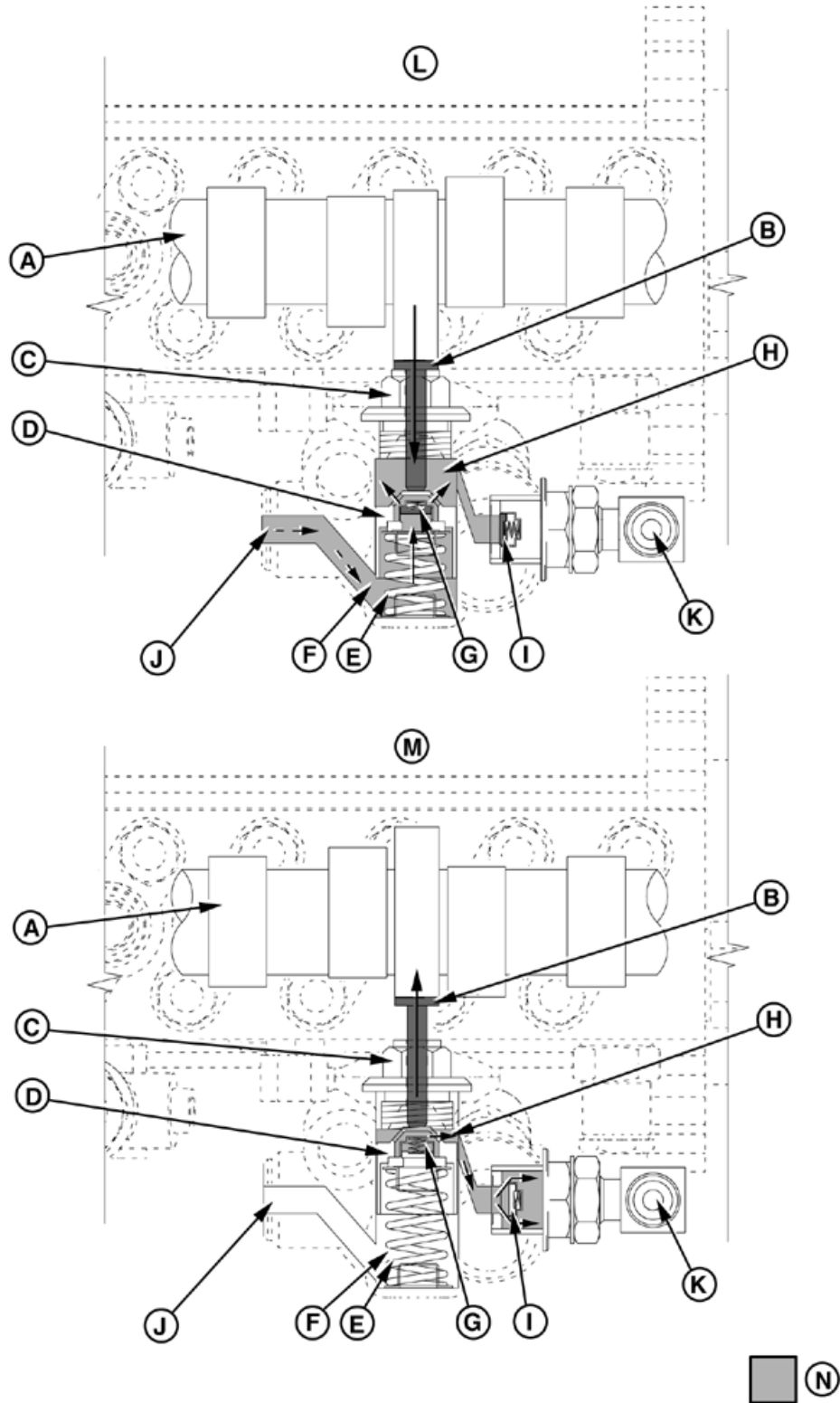
- A—Fuel Inlet
- B—Plunger
- C—Fuel Outlet
- D—Hand Primer



RG9741 -UN-04DEC98

RG,CTM86,115,4 -19-16SEP94-1/1

Fuel Supply Pump Operation - Continued



RG9712 -UN-04DEC98

Continued on next page

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A—Injection Pump Camshaft
B—Roller Tappet
C—Pressure Spindle
D—Plunger

E—Plunger Spring
F—Suction Chamber
G—Pressure Valve
H—Pressure Chamber

I—Suction Valve
J—Fuel Inlet
K—Fuel Outlet
L—Intermediate Stroke Position

M—Suction and Discharge Stroke Position
N—Fuel Flow

As the pump camshaft (A) rotates toward the “high cam” intermediate stroke position (L), the roller tappet (B) and pressure spindle (C) cause the plunger (D) to move against and compress the plunger spring (E).

Plunger movement forces the fuel out of the suction chamber (F), through the pressure valve (G), and into the pressure chamber (H). The amount of fuel discharged from the suction chamber is equal to the amount of fuel delivered for each stroke of the plunger. Towards the end of the intermediate stroke, the spring-loaded pressure valve closes again.

As the camshaft rotates toward the “low cam” or suction and discharge position (M), plunger spring pressure causes the plunger, pressure spindle, and roller tappet to follow the camshaft.

Movement of the plunger pushes the fuel from the pressure chamber, and delivers it to the fuel filters and

injection pump. At the same time, plunger suction pressure is permitting fuel to enter the suction chamber through the suction valve (I). With the suction chamber charged with fuel, the pumping cycle begins again.

Fuel is allowed to flow in around the pressure spindle to lubricate the spindle as it moves back and forth in housing. To prevent the fuel from entering the pump crankcase, a rubber O-ring is positioned in the spindle bore of housing at the roller tappet end.

Pulling upward on the hand primer pump causes the suction valve to open and fuel to flow into the suction chamber. When the hand plunger is pushed downward, the suction valve closes, and fuel is forced out of the pressure valve.

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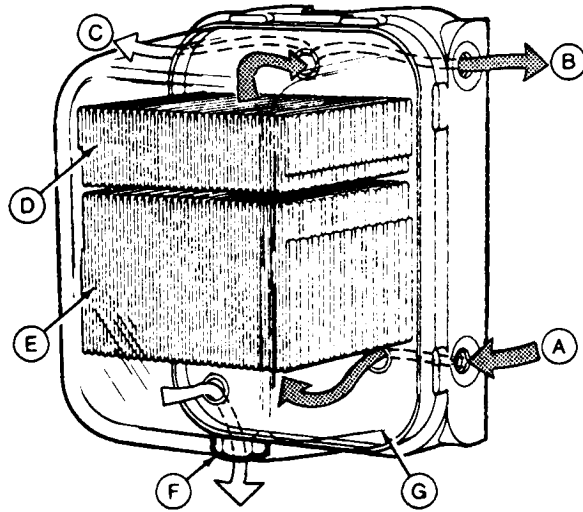
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Rectangular Final Fuel Filter Operation

Fuel enters the filter at (A) and flows through a first stage filtering media (E) and a second stage filtering media (D) before flowing through outlet (B) to the injection pump. The filtering media is housed in the metal sediment bowl (G) and epoxied to the bowl as one assembly.

Since water and other contaminants may settle to the bottom of the sediment bowl, a drain plug (F) is provided to permit their removal.

An air vent (C) enables air in the fuel system to be expelled to the outside through the filters when bleed plug is loosened while pumping hand primer on fuel supply pump or primary fuel filter.



- A—Inlet
- B—Outlet
- C—Air Vent
- D—Second Stage Filtering Media
- E—First Stage Filtering Media
- F—Drain Plug
- G—Sediment Bowl

R26812 -UN-28APR89

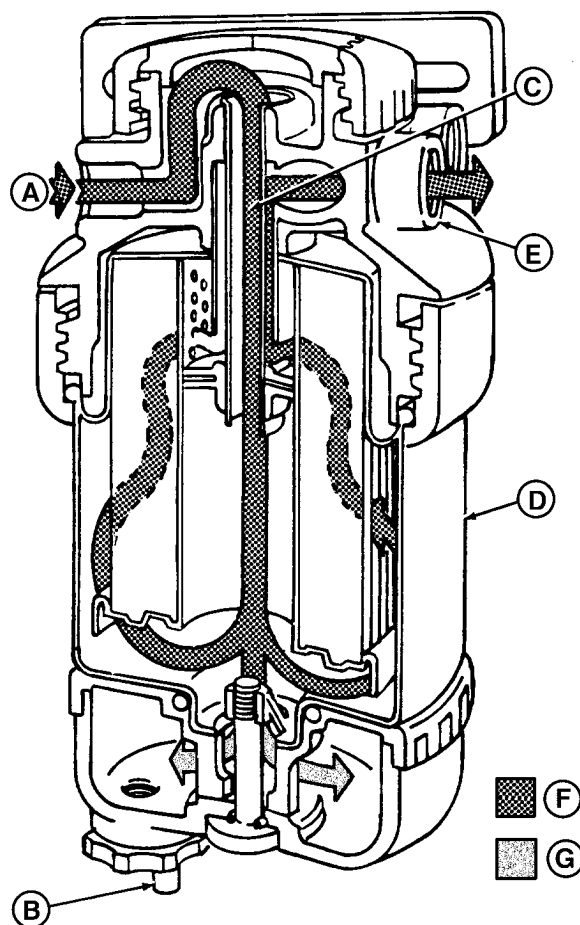
RG,CTM61,115,24 -19-13MAY93-1/1

Round Primary Fuel Filter/Water Separator Operation

The primary fuel filter/water separator is a single-stage filter. Fuel enters the filter at the inlet (A), then flows to the center port (C), travels to the bottom of the filter element (D), onward to the outboard side of the filter, up the sides and back inward through the media before exiting filter through outlet (E) to the fuel supply pump. The filter element is attached to the base with a threaded (detent) ring.

Water and contaminants settle at the bottom of the water separator (clear sediment bowl). A drain plug (B) is provided to drain these contaminants from system.

- A—Fuel Inlet
- B—Drain Plug
- C—Center Port
- D—Filter Element
- E—Fuel Outlet
- F—Fuel
- G—Water and Contaminants



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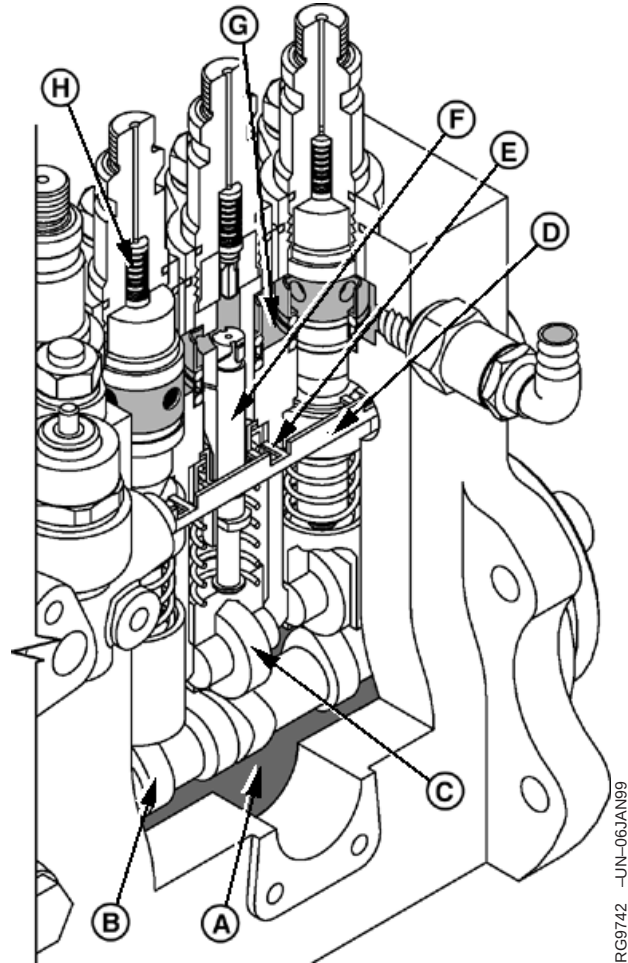
Fuel Injection Pump Operation

The 6.8 L & 8.1 L engines with a John Deere Level 3 ECU use a Bosch injection pump. Filtered fuel under pressure by the supply pump fills the injection pump fuel gallery (G). As the camshaft rotates, roller tappets (C) riding on the camshaft lobes (B) operate the plungers (F) to supply high pressure fuel through the delivery valves (H) to the injection nozzles.

An electronically-controlled governor operates control rack (D). The rack is connected to the control sleeves (E) and plungers to regulate the quantity of fuel delivered to the engine.

Engine lubricating oil is piped to the injection pump crankcase (A) to provide splash lubrication of the working parts. Two drain holes at the front end of the pump determine the level of oil maintained in the crankcase. Excess oil drains out these holes and returns back to the engine through the timing gear housing.

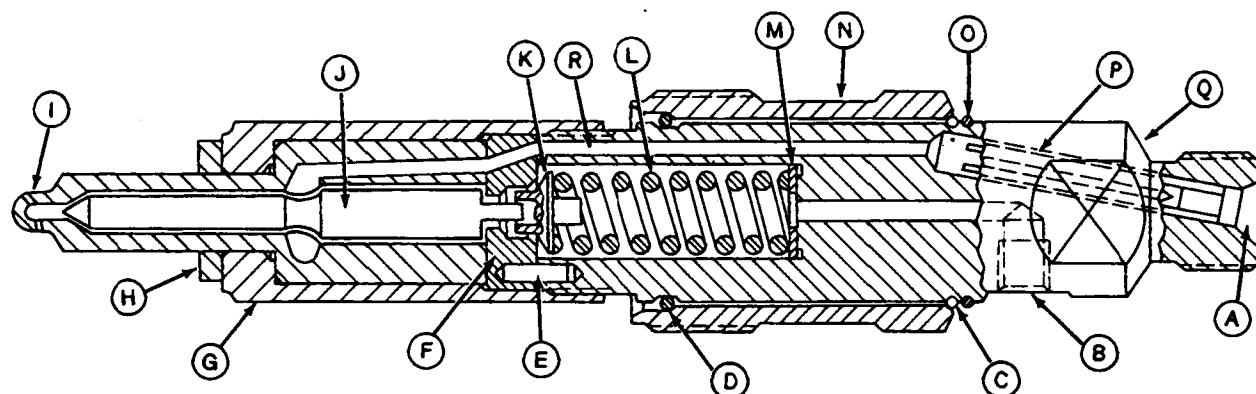
- A—Crankcase
- B—Camshaft
- C—Roller Tappet
- D—Control Rack
- E—Control Sleeve
- F—Plunger
- G—Fuel Gallery
- H—Delivery Valve



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RG,CTM86,115,12 -19-16SEP94-1/1

Fuel Injection Nozzle Operation



RG2242

RG2242 -UN-14DEC88

A—Fuel Inlet
B—Leak-Off Connection
C—O-Ring
D—Snap Ring
E—Dowel Pin

F—Intermediate Plate
G—Nozzle Retaining Nut
H—Washer
I—Nozzle
J—Valve

K—Spring Seat
L—Spring
M—Shims
N—Gland Nut

O—Snap Ring
P—Edge-Type Filter
Q—Nozzle Holder
R—Fuel Passage

The nozzle valve (J) is held on its seat by a spring (L). Shims (M) are used to regulate the nozzle opening pressure.

The nozzle (I) and valve fit together by precision lapping. These parts are referred to as a nozzle assembly, and are not serviced separately.

Correct alignment of the nozzle assembly with its holder is essential so that the atomized fuel will be sprayed into the combustion chamber at the angle and location intended by design. KDEL holders use an intermediate plate (F) with dowel pins (E) on both sides to insure alignment.

A retaining nut (G) is used to fasten the nozzle assembly to the holder body. The diameter of the holder body is 21 mm, and from this dimension the fuel injection nozzles are known as 21 mm nozzles.

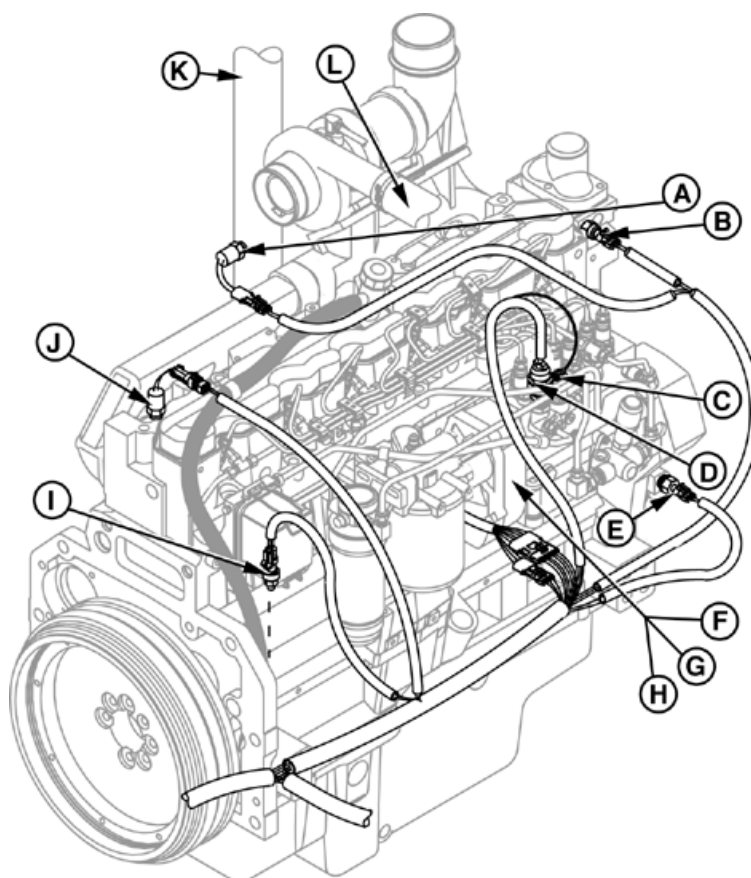
An edge-type filter (P) is placed in the fuel inlet of the nozzle holder. Its purpose is to prevent coarse, foreign particles from damaging the nozzle assembly or plugging the orifices. Finer particles pass through the filter without harm. The filter is not removable.

To provide a seal between the injection nozzle and the engine cylinder head, a steel washer (H) is used at the base of the nozzle retaining nut.

DPSG, RG34710, 12 -19-03DEC98-1/1

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Electronic Control System Overview



RG9773 -UN-11JAN99

A—Charge Air Temperature Switch
B—ECT Sensor
C—Fuel Shut-off Solenoid
D—Fuel Temperature Sensor

E—Engine Speed Sensor
F—Rack Position Sensor
G—Injection Pump Speed Sensor
H—Rack Actuator Solenoid

I—Oil Pressure Sensor
J—Loss of Coolant Temperature Switch
K—Intake Air Returning From Charge Air Cooler (not shown)

L—Turbocharged Air Heading Toward Charge Air Cooler (not shown)

NOTE: Some of the components shown are optional and not used on all applications.

The software program inside the ECU determines the rack position based on three system inputs: throttle command, engine speed, and fuel temperature. Controlling the rack position allows the ECU to control the delivery of fuel to the engine. Other inputs provide the ECU with information relevant to engine protection.

- Excellent fuel metering capabilities
- Improved starting
- More precise torque (curve) control
- Improved smoke control and transient response (improved emissions)
- Improved engine load response
- Power output is independent of fuel temperature
- Isochronous response for power bulge
- Easy installation with no external linkages

An electronic-controlled governor allows for:

Electronic Control System Terminology

AAT	Ambient Air Temperature (sensor).
Actuator	A device controlled by the ECU to perform a certain function.
Analog	Signal which has a continuous range of possible voltages. Usually 0 to 5 volts or 0 to 12 volts.
BOB	Break-Out-Box. A BOB tees into the engine wiring harness and allows easy voltage checks on control system circuits even while the system is operating. Voltage, resistance, and ground feed measurements can be made without having to back probe into connectors. See USING THE JT07349 BREAK-OUT-BOX (BOB) in Section 04, Group 160 of this manual for more information.
Boost	Pressurized air in the intake manifold.
CAN	Controller Area Network. The network on vehicles that allows communication between controllers.
DTC	Diagnostic Trouble Code. This is a code that is stored in the ECU's memory when it detects a problem in the electronic control system. There are two types of codes: Active and Stored.
Digital	A signal which consists of only two-volt levels — usually 0 volts and +5 volts.
DST	Diagnostic Scan Tool. The tool used to read and clear DTCs, read sensor and actuator data, and perform engine tests. The DST consists of an Windows ('95, '98, '00) or NT compatible computer and 2 kits available from John Deere Distribution Service Center (DSC): JDIS121 - ECU Communication Hardware Kit, and JDIS122 - ECU Communication Software Kit.
ECT	Engine Coolant Temperature (sensor). Measure the temperature of the engine coolant.
ECU	Engine Control Unit. Computer that controls the fuel, air, and ignition systems on the engine.
FMI	Failure Mode Identifier. The second part of a two-part code that identifies control system fault codes according to the J1939 standard. The FMI identifies the type of failure that has occurred. The first half of the code is the Suspect Parameter Number (SPN).
J1939	The Society of Automotive Engineers (SAE) standard for communication between the electronic controllers on heavy-duty vehicles, both on- and off-highway.
MAT	Manifold Air Temperature (sensor). Measures the temperature of the air in the intake manifold. See MEASURING TEMPERATURE later in this Group.
Multi-State	A type of throttle that allows the engine to run between 1-3 set engine speeds.
PDM	Parallel Data Module. Device used as part of the DST or SERVICE ADVISOR™ that allows communication with the ECU.
PROM	Programmable, Read-Only Memory. A computer chip that contains the calibration information for the engine control system.
PWM	Pulse Width Modulation. A digital electronic signal (not analog) which consists of a pulse generated at a fixed frequency. When an actuator is controlled by a PWM signal, the on-time of the signal is increased or decreased (modulated) to increase or decrease the output of the actuator.
RAM	Random Access Memory. The RAM is the portion of the computer memory within the ECU that changes as the engine is running and is stored while engine is off.

Sensor	Device used by the ECU to monitor various engine parameters.
SPN	Suspect Parameter Number. The first half of a two-part code that identifies control system fault codes according to the J1939 Standard. The SPN identifies the system or component that has the failure. The second half of the code is the Failure Mode Identifier (FMI).
TPS	Throttle Position Sensor. The TPS measures the position of the throttle, which is controlled by the machine operator. See MEASURING THROTTLE POSITION later in this Group.
WIF	Water In Fuel Sensor. The WIF detects water in fuel in the water separator bowl on the fuel filter housing.

DPSG, RG33894,4 -19-22OCT98-2/2

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3

Electronic Control System Operation

Engine Starting Mode

When the key is turned to the "ON" position, a switched power voltage is sent to the ECU allowing the ECU to energize. This allows the ECU to "boot-up" and ready itself for engine start.

NOTE: If a wiring problem prevents the key ON signal from getting to the ECU, the engine will not start.

When the ignition switch is turned to the "ON" position, the engine controller receives power and the fuel shut-off solenoid is powered, opening the valve.

When the ignition switch is turned to the "START" position, the controller powers the actuator solenoid moving the rack to the starting fuel position based on fuel temperature and engine speed. This starting mode

is triggered either by a controller input, which senses the ignition switch "START" position or by an engine speed greater than 60 rpm. Starting fuel quantity is not affected by throttle position.

Engine Running Mode

Once the engine has started, the ECU controls fuel delivery based on various inputs (primarily throttle and engine speed).

The ECU controls rack position by adjusting the current level to the actuator solenoid until the rack position signal from the injection pump matches the command signal. When no fuel is desired, the controller turns off current to the actuator solenoid. If a problem occurs where the controller can not control rack position, the fuel shut-off solenoid is turned off in addition to the rack actuator solenoid being turned off.

DPSG, RG33894,7 -19-23OCT98-1/1

Monitoring Engine Parameters

In order for the electronic control system to deliver fuel according to a given set of operating conditions and, on some applications to provide engine protection, the following engine parameters are monitored by the ECU:

- Engine Coolant Temperature (ECT)
- Manifold Air Temperature (MAT)
- Ambient Air Temperature (AAT)
- Fuel Temperature
- Throttle Position
- Oil Pressure
- Injection Pump Speed
- Engine Speed
- Rack Position

DPSG,RG33894,10 -19-19NOV98-1/1

Measuring Temperature

The Engine Coolant Temperature (ECT) sensor, the Manifold Air Temperature (MAT) sensor, the Ambient Air Temperature (AAT), and the fuel temperature sensor are all temperature sensitive variable resistors. The sensors' resistance goes down as the temperature it is exposed to goes up (negative temperature coefficient). The Engine Control Unit (ECU) sends 5 volts to the sensor, monitors the voltage drop across the sensor, then compares the voltage drop to preprogrammed values in the ECU's memory to determine temperature. In addition to temperature sensors, some applications use several temperature switches. The loss of coolant temperature switch and the charge air temperature switch are examples. Temperature switches close when a specific temperature is reached.

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DPSG,RG33894,15 -19-19NOV98-1/5

ECT (Engine Coolant Temperature) Sensor

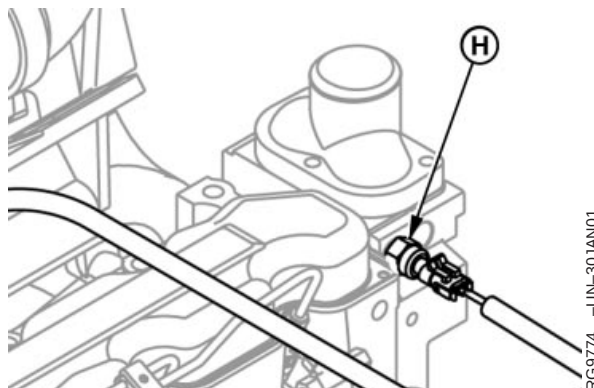
The ECT (Engine Coolant Temperature) sensor (A) is an optional component not used on all applications. When used, it is located on the thermostat housing. The ECU monitors coolant temperature for engine protection purposes. See ENGINE PROTECTION later in this Group for more information.

MAT (Manifold Air Temperature) Sensor

The MAT (Manifold Air Temperature) sensor is an optional component typically used on engines with an air-to-air aftercooler. When used, it is located on or near the intake manifold. The ECU monitors manifold air temperature for engine protection purposes.

AAT (Ambient Air Temperature) Sensor

The AAT (Ambient Air Temperature) sensor is an optional component typically used on engines with intake air heaters. When used, the AAT sensor is located in the intake pipe usually between the air cleaner and turbocharger (if equipped). The ECU monitors ambient air temperature in order to control the intake air heater properly. See INTAKE AIR HEATER OPERATION later in this Group for more information.



A—ECT Sensor

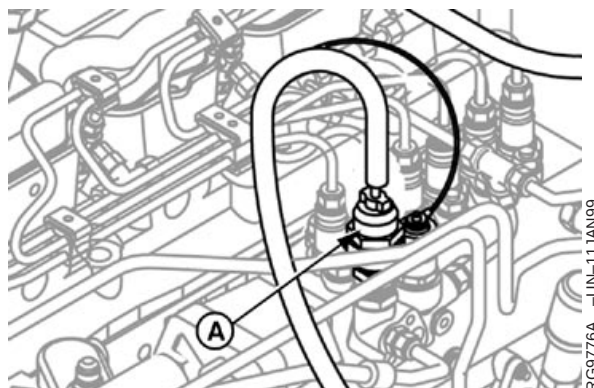
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DPSG,RG33894,15 -19-19NOV98-2/5

Fuel Temperature Sensor

The fuel temperature sensor (A) is located in the fuel inlet housing. Using the fuel temperature measurement, the ECU will determine fuel density and adjust fuel delivery accordingly. In addition, on some applications the fuel temperature reading is used to protect the injection pump from damage due to high temperature fuel. See ENGINE PROTECTION later in this Group for more information.

A—Fuel Temperature Sensor

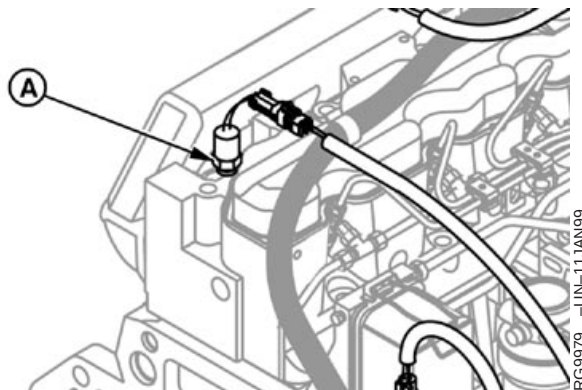


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DPSG,RG33894,15 -19-19NOV98-3/5

Loss of Coolant Temperature Switch

The loss of coolant temperature switch (A) is an optional component not included on all applications. It is a normally open temperature sensitive switch. The switch is located near the back of the cylinder head. When engine coolant is at the proper level, the temperature sensitive end of the switch is submerged in coolant, and the switch contacts will be open. If coolant level drops, the switch will no longer be submerged causing the temperature of the switch to raise beyond the point that causes the switch contacts to close. The ECU will detect that the switch is closed, and protect the engine from overheating damage by derating or shutting down the engine. See ENGINE PROTECTION later in this Group for more information.

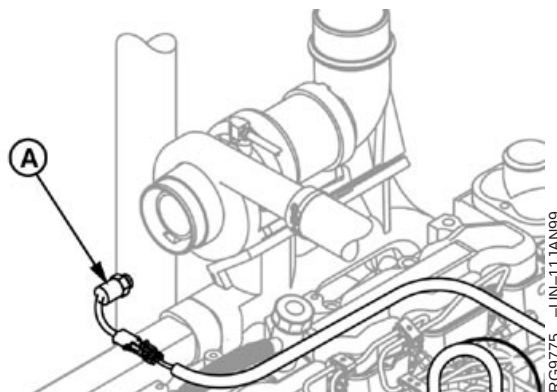


A—Loss of Coolant Temperature Switch

DPSG,RG33894,15 -19-19NOV98-4/5

Charge Air Temperature Switch

The charge air temperature switch (A) is an optional component typically used on engines with an air-to-air aftercooler. It is a normally open temperature sensitive switch. The switch is mounted in the intake air duct between the charge air cooler and the intake manifold. When charge air is at a safe temperature, the switch contacts will be open. If charge air temperature raises to 94°C (201°F), the switch contacts will close. The ECU will detect that the switch is closed, and will protect the engine by derating. See ENGINE PROTECTION later in this Group for more information.



A—Charge Air Temperature Switch

DPSG,RG33894,15 -19-19NOV98-5/5

Water In Fuel Sensor

The water in fuel sensor is used on marine applications that is located in the water separator bowl in the fuel filter. The ECU monitors this for engine protection purposes. See ENGINE PROTECTION later in this Group.

DPSG,RG40854,456 -19-14OCT99-1/1

Measuring Throttle Position

6.8 L & 8.1 L engines with the John Deere Level 3 ECU have the option of operating with a pulse-width-modulated (PWM) throttle signal, an analog throttle position sensor signal, a tri-state throttle signal, or a multi-state throttle. In addition, throttle inputs can come from sensors wired directly to the ECU or from messages from other controllers on the machine's Controller Area Network (CAN). Applications that use an analog throttle have the option of using two sensors. One is referred to as the analog throttle (A) and the other is referred to as analog throttle (B).

- **Pulse-Width-Modulated (PWM) Throttle**

The PWM throttle signal is sent to the ECU by another controller. The PWM signal is a square wave signal with a constant frequency. The pulse width of the signal varies and indicates the desired throttle position.

- **Analog Throttle (A)**

An analog throttle (A) signal comes from a potentiometer-type sensor. The ECU converts the voltage returning from the potentiometer into a percent of full throttle signal.

- **Analog Throttle (B)**

The analog throttle (B) is an optional component not used on all applications. It also is a potentiometer-type sensor, and is used as a backup in case the analog throttle (A) fails or is used with another function such as cruise control. See CRUISE CONTROL OPERATION later in this Group for more information.

- **Tri-State Throttle**

The tri-state throttle is only used when a maximum of three fixed engine speeds are desired.

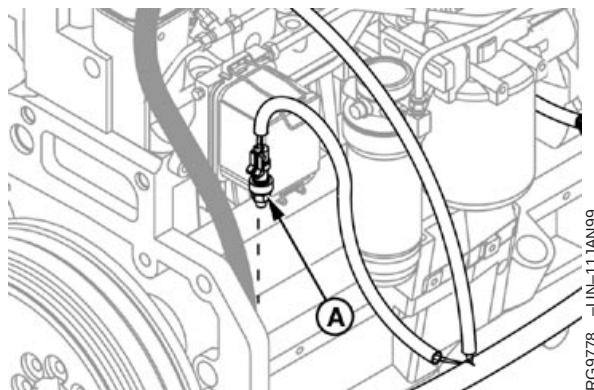
- **Multi-state Throttle**

This throttle is similar to tri-state throttle with a few fixed engine speeds.

DPSG,RG34710,5 -19-02DEC98-1/1

Measuring Oil Pressure

The oil pressure sensor (A) is an optional component not used on all applications. The oil pressure sensor is a pressure sensitive variable resistor mounted near the rear of the main oil galley. As the oil pressure sensor is exposed to changes, sensor resistance changes. The ECU sends a 5 volt reference to the sensor, then monitors the voltage on the sensor signal circuit. The voltage is then compared to preprogrammed values in the ECU's memory to determine oil pressure. The ECU monitors oil pressure for engine protection purposes. See ENGINE PROTECTION later in this Group for more information.



A—Oil Pressure Sensor

DPSG,RG40854,59 -19-05JAN99-1/1

Measuring Engine Speed

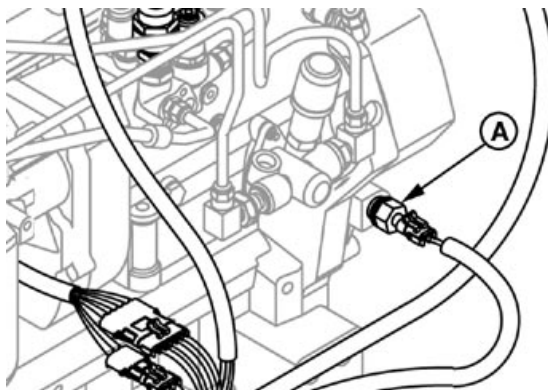
An important input for the control system is engine speed. Engine speed measurement is achieved with an engine speed sensor on all applications, and a back up pump speed sensor on some applications. Both sensors are inductive-type pickup sensors that detect notches or teeth on a timing wheel. As teeth on the camshaft drive gear rotate past the engine speed sensor, and notches on the pump timing wheel rotate past the pump speed sensor, AC signals are generated. The frequency of these signals is proportional to engine speed.

Continued on next page

DPSG,RG39774,26 -19-08JAN99-1/3

Engine Speed Sensor

The engine speed sensor (A) is mounted in the timing gear cover and detects the teeth on the camshaft drive gear. The engine speed sensor is the primary speed sensor used by the ECU. If the engine speed sensor were to fail, and the particular application has a pump speed sensor, the ECU will set a diagnostic trouble code and use the pump speed sensor input to continue to run normally. If the engine speed sensor were to fail and application does not have a pump speed sensor, a diagnostic trouble code will set, the engine will die, and will not restart until the failure is repaired.



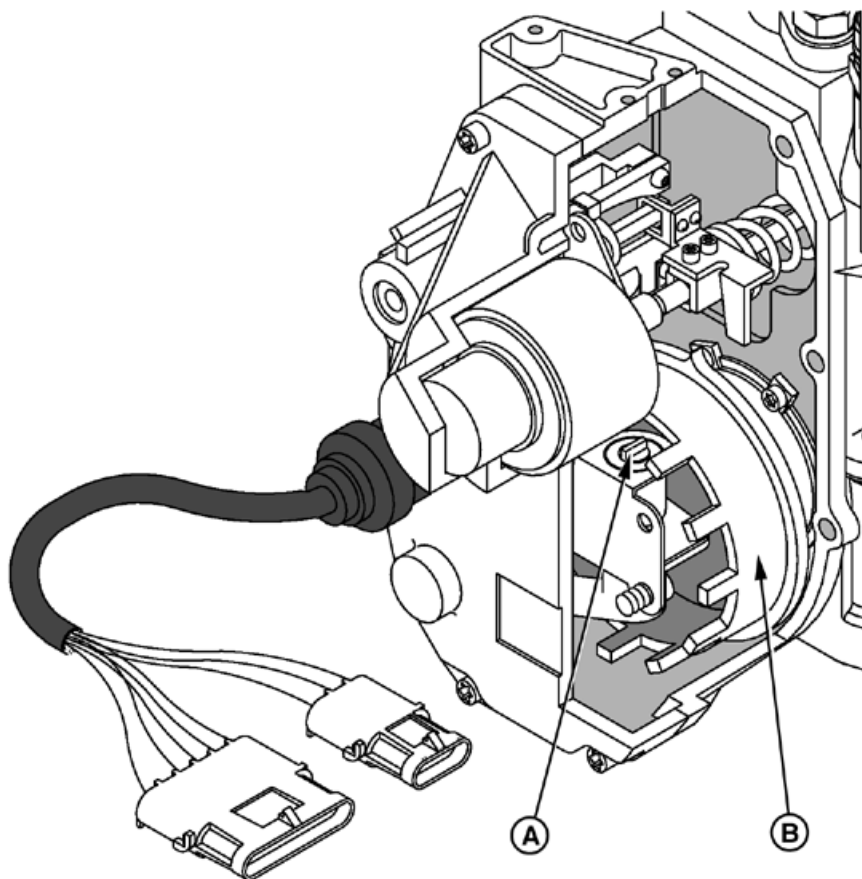
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A—Engine Speed Sensor

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A—Pump Speed Sensor

B—Pump Timing Wheel

Injection Pump Speed Sensor

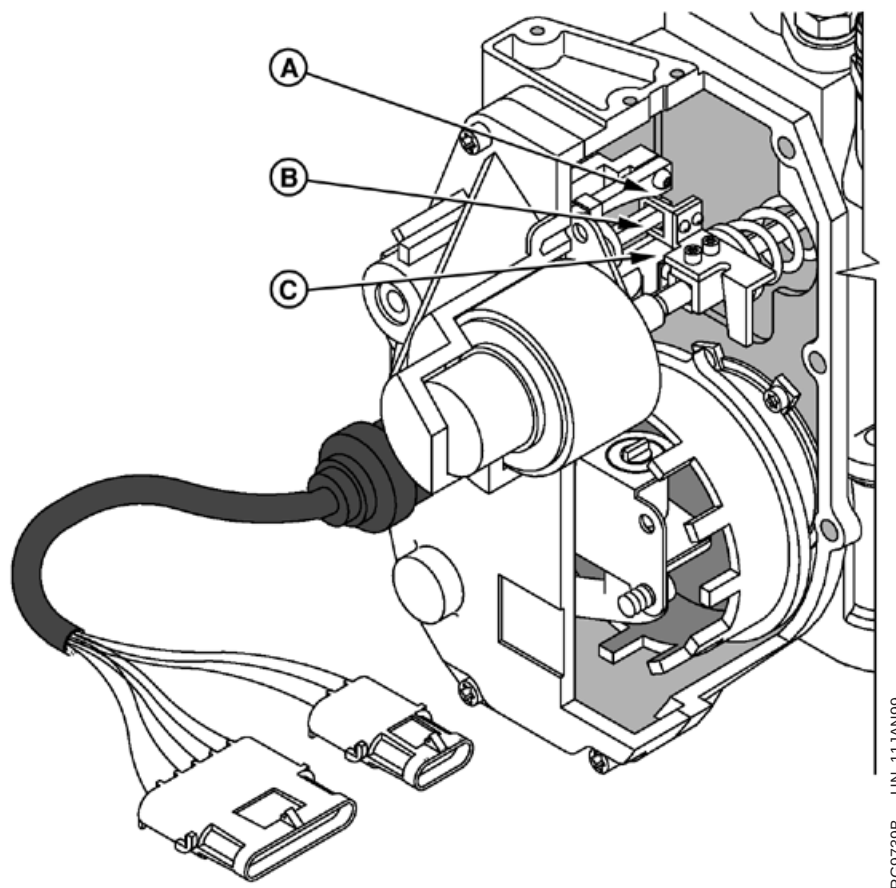
The injection pump speed sensor (A) is located within the injection pump actuator housing and detects notches on the pump timing wheel (B). The pump speed sensor is a backup to the engine speed sensor;

its input would be used by the ECU if the engine speed sensor were to fail.

Since the injection pump speed sensor is located inside the actuator housing, it can only be serviced by an authorized repair shop.

DPSG, RG39774, 26 -19-08JAN99-3/3

Measuring Rack Position



A—Rack Position Sensor

B—Rack Position Coil

C—Rack Reference Coil

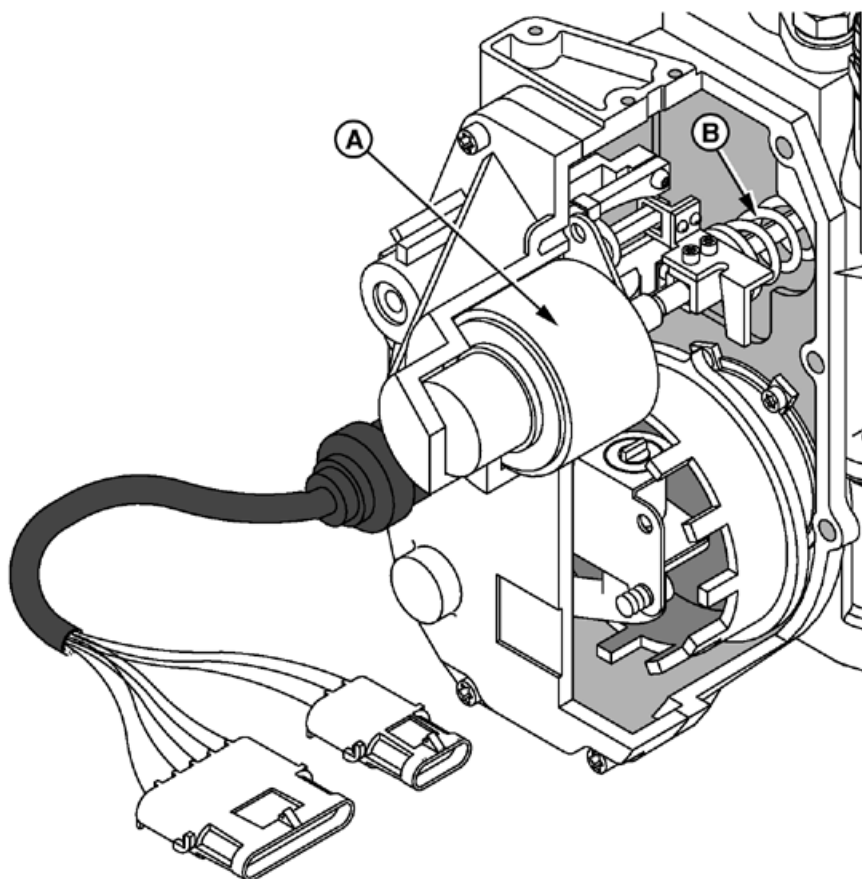
The rack position sensor (A) located inside the injection pump, provides feedback information to the ECU of the actual position of the rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded. The rack position sensor consists of two inductive coils, the rack position coil (B), and rack reference coil (C). Each coil provides an input voltage

to the ECU. The ECU processes these voltages and translates them into an actual position of the rack. If this critical sensor were to fail, the ECU would be forced to shut down the engine due to loss of control.

An authorized shop is required to service the rack position sensor because recalibration is required when the actuator housing is removed from the pump.

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Actuator Solenoid



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A—Rack Actuator Solenoid

B—Rack Spring

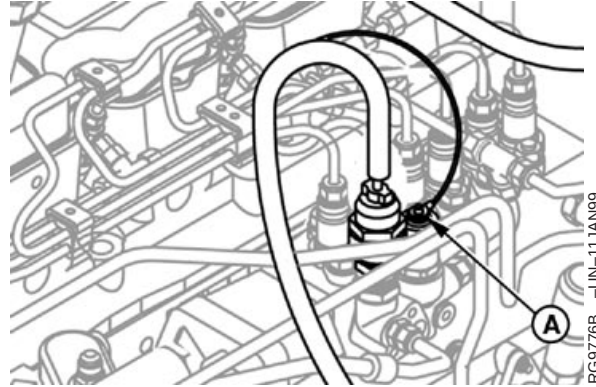
The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (A) to achieve a specific position of the rack. The rack spring (B) loads the rack to the zero fuel delivery position. Therefore, when the ECU supplies no current to the actuator solenoid, the injection pump delivers no fuel. When the ECU does supply current to the actuator solenoid, the rack is driven out, as current flow increases, the rack is driven toward full fuel delivery position. The ECU is able to obtain a specific

rack position by allowing a specific current flow to the actuator solenoid. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded. See MEASURING RACK POSITION earlier in this Group for more information.

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Fuel Shut-off Solenoid

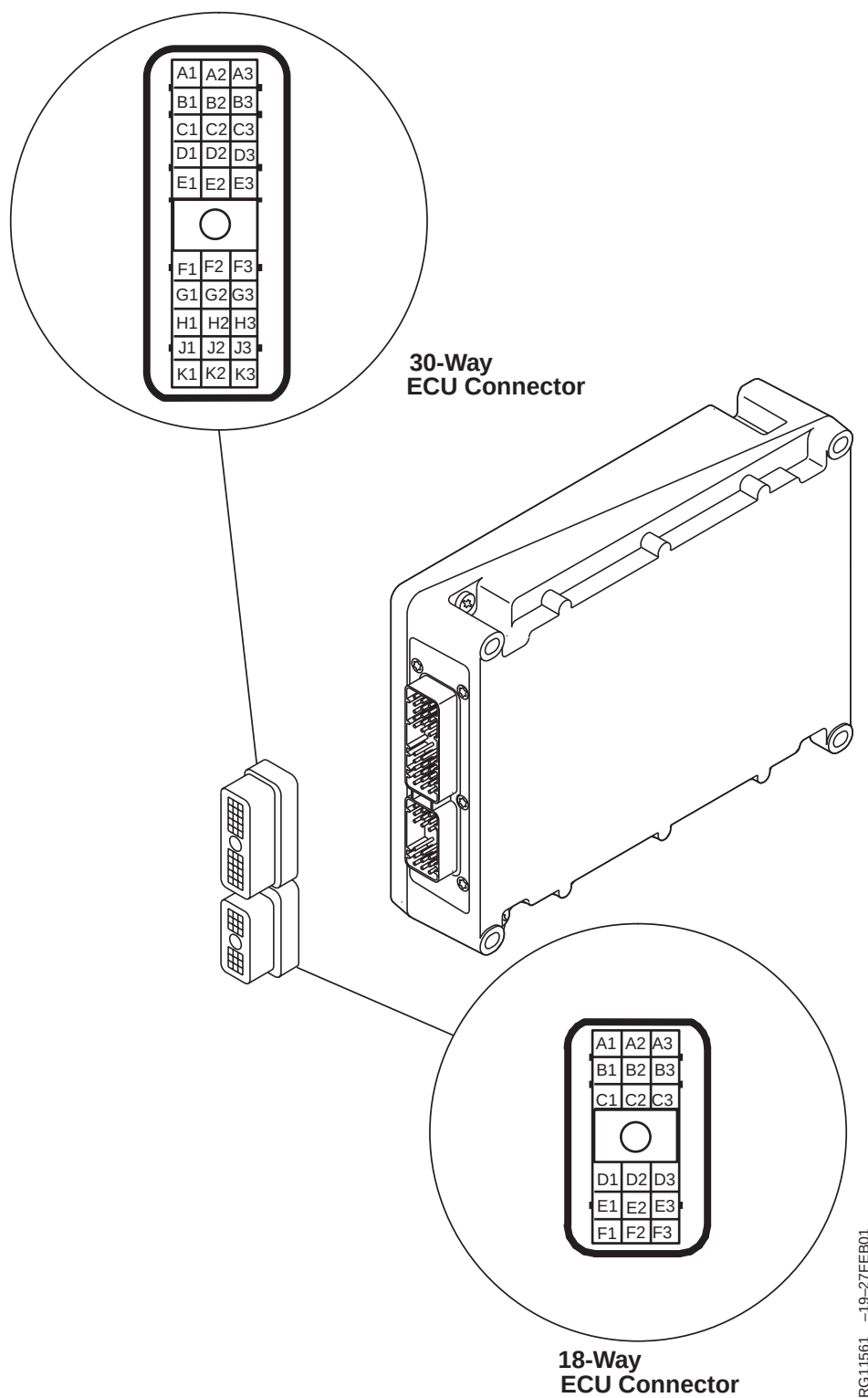
Located on the fuel inlet housing of the injection pump, the fuel shut-off solenoid (A) serves as a back-up method for the ECU to shut the engine off. The ECU controls operation of the fuel shut-off solenoid by energizing and de-energizing the solenoid. During a normal engine shut down, when the ignition switch is turned to OFF, the engine shuts down because the de-energized rack actuator solenoid causes the spring loaded rack to move to the zero fuel delivery position. In the event that de-energizing the rack actuator solenoid does not cause the rack to move to zero fuel, the ECU will de-energize the fuel shut-off solenoid to cut-off the injection pump's fuel supply.



A—Fuel Shut-off Solenoid

RG40854,0000067 -19-22JAN01-1/1

Engine Control Unit (ECU)



The Engine Control Unit (ECU) is the “brains” of the Electronic Control System. The ECU is a self-contained unit containing electronic circuitry and

computer software which together perform the following functions:

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- Converts the electrical signals from the various sensors into digital signals
- Makes decisions of optimum fuel quantity and injection timing based on information from various sensors
- Limits maximum fuel for operation on multiple power curves
- Commands rack position in the injection pump for desired fuel delivery
- Provides all-speed governing
- Performs self diagnosis on the control system
- Stores trouble codes in memory

The ECU connects to the wiring harness through 30-way and 18-way connectors. These connectors are marked by terminal numbers.

The ECU is composed of the following subsystems:

Analog/Digital Converters

This portion of the ECU converts the analog voltage signals from the various sensors into digital signals that the central processing unit can "understand".

Central Processing Unit (CPU)

The central processing unit performs the mathematical computations and logical functions that are necessary

in controlling injection fuel quantity and injection timing. The CPU also controls the self diagnostic system.

Memory

The ECU contains 3 different types of memory:

— Random Access Memory - RAM

The RAM is like the working desk top of the ECU. Data from the various sensors and the results of various calculations are temporarily stored in RAM. Information in RAM is lost when battery voltage to the ECU is removed.

— Read Only Memory - ROM

The ROM contains programmed information. Information in ROM can only be read, not changed. ROM information is retained when battery voltage is removed.

— Electrical Erasable Programmable Read Only Memory - EEPROM

The EEPROM contains information programmed in at the factory including engine specific data, and application data. Information in the EEPROM is retained when battery voltage is removed.

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Cruise Control Operation

The ECU is available with and without the cruise control function. It is an off-road cruise control that maintains constant engine speed under varying load conditions. This function is especially intended for field applications where an operator faces the need to turn the vehicle around at the end of each row. This cruise control allows the driver to use the throttle and/or brake to turn the vehicle around. When ready to resume field operations, the operator brings the engine speed above 1300 rpm and activates the Cancel/Resume function again to resume cruise speed. An internal timer gives the operator one minute to complete the turnaround maneuver.

The cruise control has the normal functions of:

- Cruise control power "ON" or "OFF"
- "Set" or "Bump Up" engine speed
- "Resume" or "Bump Down" engine speed
- Vehicle brake or clutch pedal to disengage cruise control

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

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Intake Air Heater Operation

An optional function not included in all ECUs, the intake air heater is used to increase intake manifold air temperature to improve cold starting. When the operator turns the key from "OFF" to "ON", the ECU uses temperature sensors to determine engine temperature and ambient air temperature, turns on the "Wait to Start" light on the dash, and energizes the air heater relay.

The air heater relay will in turn energize the air heater coils located in the intake manifold. The ECU will keep the air heater relay energized for an amount of time that is determined by the measured temperatures. When the ECU has determined that the preheat time is adequate, it will turn off the "Wait to Start" light and de-energize the air heater relay. The operator would then turn the ignition from "ON" to "START", and the engine would crank and start. The ECU would then re-energize the air heater relay during the time the

engine is running up to low idle speed. As soon as the engine reaches low idle, the air heater relay will again be de-energized. At this time, the ECU will use the engine speed sensor to determine if the engine is misfiring by looking for engine speed variations. If severe engine speed variations are detected, the ECU will cycle the air heater relay on and off until the engine begins to run smoothly.

If the operator turns the key from "START" to "ON" without waiting for the "Wait to Start" light to turn off, the ECU will de-energize the air heater relay and a key-off/key-on cycle would be required before preheating is allowed again.

Anytime the engine cranks but does not start, a key-off/key-on cycle will be required before preheating is allowed again.

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Engine Protection

NOTE: These programs are only available for electronically controlled engines.

There are two levels of engine protection:

- **Warning** — The fault lamp (if equipped) flashes or blinks.

Causes:

- Lower than normal oil pressure.
- Higher than normal coolant temperatures.
- Higher than normal charge air temperatures.
- Water in fuel continuously detected
- Power derates.

- **Shutdown** — The fault lamp (if equipped) is continuously “ON”.

Causes:

- Extremely low oil pressure.
- Extremely high coolant temperatures.
- Loss of coolant.

There are three different engine protection programs available:

- **No Protection** — The operator must reduce the speed of engine when a “Warning” fault light is on, and shutdown the engine when a “Shutdown” fault light is on. The ECU will not derate or shut down the engine.

- **Engine Protection WITHOUT Shutdown** — The engine will derate either due to a “Warning” or a “Shutdown” fault light. If a “Shutdown” fault light occurs, it is the responsibility of the operator to shut down the engine.
- **Engine Protection with Shutdown** — The engine will derate either due to a “Warning” or a “Shutdown” fault light. If a “Shutdown” fault light is detected, the ECU will shut down the engine in 30 seconds. If the problem is corrected within the 30 second delay period, the power will increase at a particular rate until full power is reached. The fault lamp will continue to flash until the power returns to normal, then it will shut off.

Shutdown Override

NOTE: Holding the Shutdown Override Switch continuously “ON” will not reset the 30 second timer.

The engine protection shutdowns can be overridden for 30 seconds at a time. This can be used to move a vehicle to a safe location. Each time the switch is pushed, the shutdown timer is reset to 30 seconds, and the engine will run in a derated power mode.

Different Derate Programs

NOTE: The derate programs shown below apply to OEM engine applications that contain engine protection. Other applications may have similar derate programs. Refer to specific machine manual for application derate programs.

Low Oil Pressure Protection

- **Warning:** A power derate of 2% per minute with a maximum derate of 20% of rated power will start if the "Warning" fault is set. If the oil pressure increases over the "Warning" fault pressure, the power will increase at the rate of 2% per minute until full power is reached.
- **Shutdown:** A power derate of 20% per minute with a maximum derate of 40% of rated power occurs if the oil pressure becomes lower than the "Shutdown" fault pressure. If this fault stays on for 30 seconds, the engine will shut down. If the oil pressure begins to increase above the "Shutdown" fault pressure, the "Warning" fault will activate. The power derate will revert to the "Warning" fault.

NOTE: Shutdown only occurs on engines that have the option in their ECU.

High Engine Coolant Temperature Protection

- **Warning:** A power derate of 2% per minute with a maximum derate of 20% of rated power occurs if the coolant temperature exceeds the "Warning" fault temperature. If the coolant temperature decreases past the "Warning" fault temperature, power will begin to increase at the rate of 2% per minute until full power is reached.
- **Shutdown:** A power derate of 20% per minute with a maximum derate of 40% of rated power occurs if

the coolant temperature exceeds the "Shutdown" fault temperature. If the temperature does not decrease below the "Shutdown" fault temperature within 30 seconds, the engine will shut down. If the coolant temperature decreases below "Shutdown" fault temperature within 30 seconds, the power derate will divert to the Warning curve.

Loss of Coolant Protection

- **Shutdown:** A power derate of 20% per minute with a maximum derate of 40% of rated power occurs if the coolant level becomes low. If the loss of coolant switch does not reset within 30 seconds, the engine will shutdown. If the switch resets within 30 seconds, the power increases at 20% per minute until full power is reached.

High Charge Air Temperature Protection ("H" Engines Only)

- The charge air temperature switch is set at 94°C (201°F). At and above this temperature, the switch connects the "Torque Curve Select" input to ground and a derate power curve is selected. The ECU will turn on a blinking fault lamp. There is no additional derate nor is there a shutdown function for high charge air temperature. If charge air temperature goes below 94°C (201°F), normal power is immediately available.

High Fuel Temperature Protection

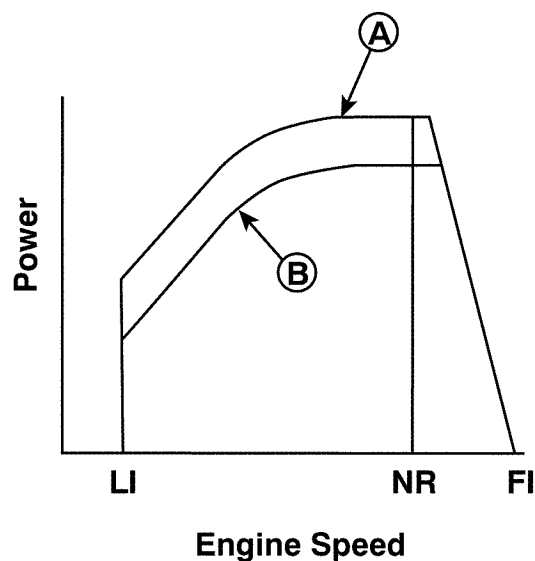
- If fuel temperature starts to exceed 70°C (158°F), the ECU will start reducing fuel delivery until at 80°C (176°C). The ECU is only allowing the engine to run at 75% of rated power.

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Multiple Torque Curve Selection

The ECU has the ability to limit the maximum fuel quantity such that multiple torque curves can be individually selected while the engine is running. The selection of multiple torque curves is determined by either switch inputs into the ECU's torque curve select terminal, or by messages from other controllers on the machine's Controller Area Network (CAN). In most applications one torque curve is used for "normal" operation. Several other derated torque curves will be used to protect vehicle axles, hitches, and transmissions, etc. under certain operating conditions.

For example: a machine can choose multiple torque curves using a simple switching arrangement. A simple on/off toggle switch and resistor can be used to switch between torque curve 1 (maximum power), and any one of the other curves. When the switch is open, the ECU will command torque curve 1. When the switch is closed, the ECU will command one of the other curves depending on the resistance in the line. See **TORQUE CURVE SELECTION** in Section 06, Group 210 for torque curve selection specifications.



A—Normal Power Curve
B—Derated Power Curve
LI—Low (Slow) Idle
NR—Normal Rated
FI—Fast Idle

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Governor Droop Mode Selection

The electronic control system has the ability to provide two types of governing; all-speed governing and min-max speed governing. When operating in the all-speed governor mode, the Engine Control Unit (ECU) controls the engine speed based on the analog throttle input or the PWM throttle input. When operating in the min-max speed governor mode, the ECU provides the same minimum (low idle) and maximum (fast idle) speed governing as with the all-speed governor. However, in between the minimum and maximum speeds, the analog throttle input or PWM throttle input is used by the ECU to select a fuel quantity. Thus, the throttle commands fuel quantity rather than engine speed in the min-max governor mode.

The ECU also has the ability to provide two types of droop; normal and isochronous (0% droop). The

normal droop gives a drop in engine speed with an increase in load or an increase in engine speed with a decrease in load. When in isochronous, the droop is set at 0%, and there is a no change in engine speed with changing loads until engine's torque limit is reached. The factory low idle speed is always set for isochronous governing. Droop selection is determined by either switch inputs into the ECU's droop select terminal, or by messages from other controllers on the machine's Controller Area Network (CAN).

See GOVERNOR DROOP MODE SELECTION in Section 06, Group 210 of this manual for governor droop mode specifications.

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Engine Control Unit (ECU) Self-diagnosis Operation

The Engine Control Unit (ECU) has the ability to detect problems internally and in the electronic control system. This includes determining if any sensor input voltages are too high or too low. 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
- Stored

Active DTCs indicate that the failure is occurring. These type of failures are sometimes called "hard" failures.

Stored DTCs indicate that a failure has occurred in the past, but is not currently occurring. This type of DTC can be caused by an "intermittent" failure. These could be problems such as a bad connection or a wire intermittently shorting to ground.

There are several different methods for displaying both stored and active DTCs from the ECU.

2 or 3-Digit Codes

Most John Deere applications display DTCs as 2-digit codes read from an on-board display. In addition, some applications have the ability to display 2-digit

codes using JT05829 Electronic Governor Tester. On some later Deere applications, the codes are displayed in 3-digits.

SPN/FMI Codes

SPN/FMI codes are written from the SAE J1939 standard as a two part code. The first part is called the Suspect Parameter Number (SPN). Typically, it contains between 2 and 4 digits. The SPN identifies the system or the component that has the failure; for example SPN 110 indicates a failure in the engine coolant temperature circuit. The second part of the code is called the Failure Mode Identifier (FMI) code. The FMI contains 2 digits. The FMI identifies the type of failure that has occurred; for example FMI 3 indicates value above normal. In order to determine the exact failure, both the SPN and FMI are required. Combining SPN 110 with FMI 3 yields engine coolant temperature input voltage high.

On all applications with the Level 3 Engine Control Unit (ECU), the ECU transmits SPN/FMI codes over the Controller Area Network (CAN). This allows for service tools such as the DST, SERVICE ADVISOR™, and the Diagnostic Gauge to display active and stored DTCs. When using DST or SERVICE ADVISOR™ the codes will be displayed in a 000000.00 format. For example, SPN 110 FMI 3 will be displayed as 000110.03.

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SERVICE ADVISOR

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Section 04

Diagnostics

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About This Group of the Manual

This group of the manual contains necessary information for observable diagnostics and fuel-related test procedures. Use this information in conjunction with the 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104) or the 8.1 L Diesel Engines Base Engine Manual (CTM 86) depending on displacement of engine being used with the John Deere Level 3 ECU. Group 150 is divided into two areas: diagnosing malfunctions and test procedures. The diagnosing malfunctions area is further divided into the following headings, containing the following observable symptoms:

- **(E) Diagnosing General Engine Malfunctions:**
 - E1 - Engine cranks/won't start
 - E2 - Engine misfires/runs irregularly
 - E3 - Engine does not develop full power
 - E4 - Engine emits excessive white exhaust smoke
 - E5 - Engine emits excessive black or gray exhaust smoke
 - E6 - Engine will not crank
 - E7 - Engine idles poorly
 - E8 - Abnormal engine noise
- **(F) Diagnosing Low Pressure Fuel System Malfunctions**
 - F1 - Fuel supply system check
 - F2 - Excessive fuel consumption
 - F3 - Fuel in oil
- **(D) Diagnosing Diagnostic Communication Malfunctions:**

- D1 - ECU does not communicate with DST or SERVICE ADVISOR™.
- D2 - Diagnostic gauge does not communicate with ECU
- D3 - Error codes on electronic governor tester (JT05829)

Procedures for diagnosing some of the above symptoms are formatted such that a test or repair is recommended, then based on the results another test or repair is recommended. Other symptoms are formatted in a symptom - problem - solution format. In these symptoms, the problems are arranged in the most likely or easiest to check problems first. Symptoms arranged in both formats refer to testing procedures in the second part of this section. The second part of this section of the manual contains the following testing procedures:

- **Fuel System Testing Procedures:**
 - Check Fuel Supply Quality
 - Measure Fuel Supply Pump Pressure
 - Check Fuel Supply Pump Operation
 - Bleed The Fuel System
 - Cylinder Misfire Test (Engine Running)
 - Test For Fuel Drain Back
 - Test For Air In Fuel
 - Check For Restricted Fuel Return Line
 - Check And Adjust Injection Pump Static Timing

E1 - Engine Cranks/Won't Start

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E1 - Engine Cranks/Won't Start Diagnostic Procedure

-- -1/1

① E1 - Preliminary Check

1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.
2. Ensure engine cranking speed is OK.
 - **On 8.1 L engines**, see CHECK ENGINE CRANKING SPEED in Section 04, Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
 - **On 6.8 L engines**, see TEST ENGINE CRANKING SPEED in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

Problem solved: No further investigation is required.

Problem still exists:
GO TO ②

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② Active DTC Check

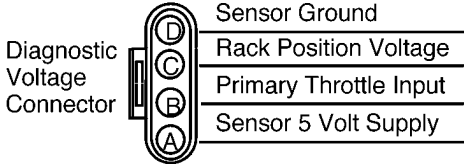
1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ in Group 160 later in this manual.
2. Ignition ON, engine off
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™

No active DTCs present:
GO TO ③

Active DTCs present:
Proceed to appropriate diagnostic procedure in Group 160 of this manual.

SERVICE ADVISOR is a trademark of Deere & Company

-- -1/1

③ Injection Pump Rack Start Fuel Position Check	1. Read rack position voltage using the DST SERVICE ADVISOR™ <i>NOTE: If DST or SERVICE ADVISOR™ is not available, go to step 2.</i> 2. Using a multimeter, measure rack position voltage between terminal C (+) and terminal D (-) in the diagnostic voltage connector while the engine is cranking for at least 4 seconds.  RG9887 -19-20JAN99	Voltage greater than 2.0 volts. GO TO ⑥ Voltage less than 1.0 volts. GO TO ④ Voltage between 1.0 - 2.0 volts. GO TO ⑤
SERVICE ADVISOR is a trademark of Deere & Company -- -1/1		
④ ECU Power Check	1. Disconnect 30 and 18-way (if used) connectors at the ECU. 2. Using a multimeter, measure voltage from terminal A1 (+) to B1 (-) in the harness end of the ECU 30-way connector. 3. Ignition ON	Voltage greater than 7.5 volts (12 volt systems); greater that 12.0 volts (24 volt systems): Replace ECU Voltage less than 7.5 volts (12 volt systems); less that 12.0 volts (24 volt systems): Determine ECU power supply problem -- -1/1

5 Injection Pump Rack Actuator Solenoid Check

CAUTION: During the following test, be careful to keep the jumper leads isolated so that battery voltage is not shorted to ground. Also, if the rack actuator is functioning correctly, about 20 amps of current will be conducted during this check and a spark will occur when the circuit is broken. This condition should not be continued beyond a few seconds, as overheating of the actuator solenoid will occur.

1. Disconnect pump 3-way connector.
2. Locate the diagnostic voltage connector.
3. Ignition ON, engine OFF
4. Using a multimeter, measure voltage from terminal C (+) to terminal D (-) in the diagnostic voltage connector.
5. Ignition OFF
6. Connect a 12 gauge or larger jumper wire between terminal B in the harness end of the pump 3-way connector **and** a good ground
7. Connect a second jumper wire between terminal C in the harness end of the pump 3-way connector **and** battery voltage
8. Ignition ON, engine OFF
9. While the above connection is made, measure voltage between terminals C (+) and D (-) in the diagnostic voltage connector

Voltage changed from about 0.5 volt in first measurement to 4.0 volts or greater in second measurement:
Replace ECU

Voltage DID NOT change from about 0.5 volt in first measurement to 4.0 volts or greater in second measurement:
Have injection pump repaired by authorized diesel repair station or replace pump.

-- -1/1

6 Fuel Present At Injection Nozzle Check

Perform following procedure to check for fuel at injection nozzle:

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Keep hands and body away from pinholes and nozzles which could inject fluids under high pressure.

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

1. Using two open-end wrenches, loosen fuel line connection at one of the injection nozzles.
2. Crank engine while monitoring loosened connection for consistent squirts of fuel.
3. Retighten connection at nozzle to specification.

Specification

Fuel Injection Nozzle Delivery Lines—

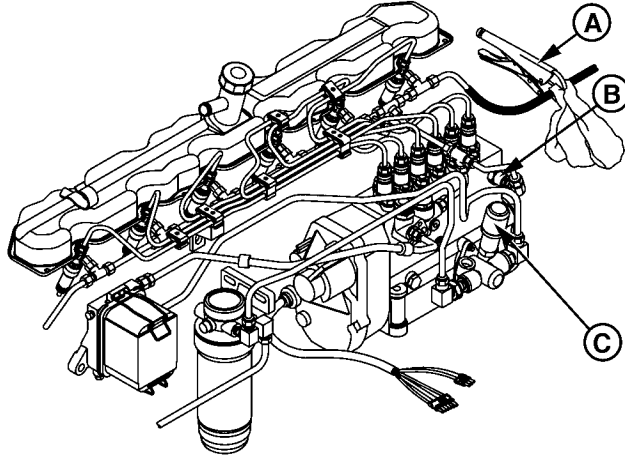
Torque 27 N•m (20 lb-ft)

Consistent squirts of fuel observed:
GO TO **11**

Don't see consistent squirts of fuel:
GO TO **7**

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**7 Injection Pump
Air-Lock Check**



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1. Pinch-off return fuel line (A).
2. Disconnect fuel line from injection pump overflow valve (B).
3. Loosen overflow valve body (B) from where valve threads into injection pump.
4. Turn ignition switch to "ON" position.
5. Operate hand primer (C) on fuel supply pump until fuel flows out the overflow valve fitting location. If fuel flow out the hole cannot be obtained, retighten all fittings and GO TO 8.
6. Simultaneously continue priming while tightening loose overflow valve fitting at the pump to specification.

Specification

Overflow Valve—Torque 30 N•m (22 lb-ft)

7. Release pinch-off from return line hose, retighten all fuel fittings, and retry engine start.

Engine starts:

Injection pump was air-locked.

Fuel does not flow out loose overflow valve:
GO TO 8

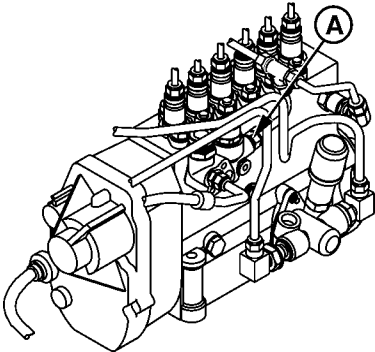
Fuel flows out loose overflow valve, but engine still doesn't start:

Faulty injection pump. Have injection pump repaired by authorized diesel repair station or replace pump.

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8 Return Fuel Check



RG9988A -UN-19JAN99

1. Disconnect fuel return line (A) from fuel shut-off solenoid housing.
2. Ignition ON, engine OFF
3. Operate hand primer looking for fuel from bleed orifice in fuel shut-off solenoid housing.

Fuel leaks out bleed orifice:

Replace fuel shut-off valve and retest.

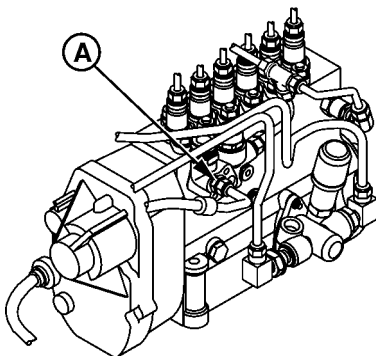
No fuel out bleed orifice:
GO TO 9

-- -1/1

9 Fuel Inlet Check

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Keep hands and body away from pinholes and nozzles which could inject fluids under high pressure.

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



RG9988 -UN-19JAN99

1. Ignition ON, engine OFF.
2. Loosen fuel inlet line fitting (A) at the fuel shut-off solenoid housing at injection pump.

NOTE: Fuel may spray if pressurized

3. If fuel is not pressurized, gently pump hand primer several strokes.

Fuel is pressurized and leaks out of loose fitting:

Remove fuel shut-off solenoid housing, clean out bleed orifice, reinstall housing and retest.

Fuel is NOT pressurized. No significant fuel flow from loose fitting:

Check the fuel system between the tank and the fuel inlet housing to determine why fuel is not getting to the injection pump. See CHECK FUEL SUPPLY PUMP OPERATION later in this Group.

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10 Fuel Supply System Check

Check the fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK later in this Group.

Fuel supply system OK:
GO TO **11**

Fuel supply system problem found:
Repair fuel supply system problem and retest.

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Observable Diagnostics and Tests

11 Intake and Exhaust Restriction Check	Check for intake and exhaust restrictions. • On 8.1 L engines, see CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Section 04, Group 150 of 8.1 L Diesel Engines Manual (CTM 86). • On 6.8 L engines, see CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Manual (CTM 104).	No restrictions are found: GO TO 12 Restrictions found: Repair or replace components as needed. ---1/1
12 Injection Pump Timing Check	Check injection pump timing. See CHECK AND ADJUST INJECTION PUMP STATIC TIMING later in this Group.	Timing is correct: GO TO 13 Timing is incorrect: Follow adjustment procedure in timing check procedure. ---1/1
13 Compression Pressure Check	Check compression pressure. • On 8.1 L engines, see TEST ENGINE COMPRESSION PRESSURE in 8.1 L Diesel Engines Base Engine Manual (CTM 86). • On 6.8 L engines, see TEST ENGINE COMPRESSION PRESSURE in 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	Compression pressure within specification: GO TO 14 Compression pressure is below specification: Investigate problems related to low compression. ---1/1

04
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7

14 Fuel Injection Nozzle Check

Test fuel injection nozzles. See TEST FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.

Injection nozzles test good:

Have injection pump repaired by authorized diesel repair station or replace pump. See REMOVE FUEL INJECTION PUMP in Section 02, Group 090 of this manual.

Faulty injection nozzle(s) found:

Repair or replace injection nozzles. See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.

E2 - Engine Misfires/Runs Irregularly**E2 - Engine Misfires/Runs Irregularly Diagnostic Procedure**

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① E2 - Preliminary Check	Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.	No problem found: GO TO ② Problem found: Repair and retest.
② Cylinder Misfire Check	Check cylinders for misfire. See CYLINDER MISFIRE TEST later in this Group.	Single cylinder misfire: GO TO ③ Random or all cylinder misfire: See F1 - FUEL SUPPLY SYSTEM CHECK later in this Group.
③ Head Gasket Check	Check for head gasket joint failures. • On 8.1 L engines, see CHECK FOR HEAD GASKET FAILURES in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM86). • On 6.8 L engines, see CHECK FOR HEAD GASKET FAILURES in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).	No sign of head gasket failure: GO TO ④ Signs of head gasket failure found: Replace head gasket and retest.

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Observable Diagnostics and Tests

4 Fuel Delivery Line Check	Perform the following steps to determine if a suspected fuel delivery line is restricted: 1. Disconnect the suspected fuel delivery line on the injection nozzle end and injection pump end. 2. Force air through one end of the delivery line. 3. If the delivery line is not restricted, the compressed air should flow freely out the other side. 4. If air does not flow freely, there are restrictions in the fuel line.	Lines are not restricted: GO TO 5 Lines are restricted: Repair or replace lines and retest. -- -1/1
5 Compression Pressure Check	Check compression pressure. • On 8.1 L engines, see TEST ENGINE COMPRESSION PRESSURE in 8.1 L Diesel Engines Base Engine Manual (CTM 86). • On 6.8 L engines, see TEST ENGINE COMPRESSION PRESSURE in 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	Compression pressure is within specification: GO TO 6 Compression pressure is not within specification: GO TO 7 -- -1/1
6 Fuel Injection Nozzle Check	Test fuel injection nozzles. See TEST FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.	Injection nozzles test good: Have injection pump repaired by authorized diesel repair station or replace pump. See REMOVE FUEL INJECTION PUMP in Section 02, Group 090 of this manual. Faulty injection nozzle(s) found: Repair or replace injection nozzles. See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual. -- -1/1

Observable Diagnostics and Tests

7 Piston Ring Check	1. Apply oil to ring area of piston through injection nozzle bore IMPORTANT: DO NOT use too much oil. DO NOT get oil on the valves. 2. Retest the compression pressure	Compression pressure is within specification: GO TO 10 Compression pressure is not within specification: GO TO 8
8 Valve Lash Check	Check valve lash. • On 8.1 L engines, see CHECK AND ADJUST VALVE CLEARANCE SERIAL NUMBER (—199,999) in Section 02, Group 020 of 8.1 L Diesel Engines Base Engine Manual (CTM86). • On 6.8 L engines, see CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).	Valve lash is within specification: GO TO 9 Valve lash on one or more valves out of specification: Adjust valve lash and retest.
9 Valve Lift Check	Check valve lift. • On 8.1 L engines, see MEASURE VALVE LIFT SERIAL NUMBER (—199,000) in Section 02, Group 020 of 8.1 L Diesel Engines Base Engine Manual (CTM86). • On 6.8 L engines, see MEASURE VALVE LIFT in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).	Lift on all valves within specification: GO TO 10 Valve lift on one or more valves is out of specification: Reset clearance to specification after measuring lift. On 8.1 L engines, see CHECK AND ADJUST VALVE CLEARANCE SERIAL NUMBER (—199,999) in Section 02, Group 020 of 8.1L Diesel Engines Base Engine Manual (CTM86) OR On 6.8 L engines, see CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM104).

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Observable Diagnostics and Tests

10 Pistons, Rings, Cylinder Liners Check

At this point, the most likely cause of the low engine compression pressure is one of the following failures in the pistons, rings, and/or cylinder liners or in the valve guides. Check the most likely items as needed.

- Oil control rings worn or broken
- Scored cylinder liners or pistons
- Piston ring grooves excessively worn
- Piston rings sticking in ring grooves
- Insufficient piston ring tension
- Piston ring gaps not staggered
- Cylinder liners glazed (insufficient load during engine break-in)
- Worn valve guides or stems
- Cylinder head may need reconditioning

Problem found with pistons, rings, and/or liners or valve guides:
Repair problem as necessary.

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E3 - Engine Does Not Develop Full Power**E3 - Engine Does Not Develop Full Power Diagnostic Procedure**

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❶ E3 - Preliminary Check	1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. 2. Check for restricted or plugged air filter.	No problem found: GO TO ❷ Problem found: Repair and retest. -- -1/1
❷ Active DTC Check	1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ in Group 160 later in this manual. 2. Ignition ON, engine off 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™	No active or stored engine DTCs found: GO TO ❸
<i>SERVICE ADVISOR is a trademark of Deere & Company</i> -- -1/1		
❸ Exhaust Emission Check	1. Operate engine at full load rated speed 2. Under these conditions, determine type of exhaust emitted.	Small amount or no exhaust smoke: GO TO ❹ Heavy white exhaust smoke: See E4 - ENGINE EMITS EXCESSIVE WHITE EXHAUST SMOKE later in this Group. Heavy gray or black exhaust smoke: See E5 - ENGINE EMITS EXCESSIVE BLACK OR GRAY EXHAUST SMOKE later in this Group. -- -1/1

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4 Torque Curve Selection Check

NOTE: This check is not required for applications that either don't select multiple torque curves or use torque curve selection over the Controller Area Network (CAN). For these applications, GO TO 5

The ECU on engines has the ability to operate on multiple torque curves. To check that the engine is operating on the correct torque curve under the operating conditions where there is a low power complaint:

1. Recreate the conditions of the low power complaint.
2. Using the DST or SERVICE ADVISOR™, read the Torque Curve Parameter.
3. Compare the torque curve number with the one shown in TORQUE CURVE SELECTION in Section 06, Group 210.

NOTE: If the DST is unavailable, see DETERMINING TORQUE CURVE SELECTION USING THE BREAK-OUT-BOX (BOB) in Section 04, Group 160 of this manual.

Torque curve selection operating correctly:
GO TO 5

Torque curve selection NOT operating correctly:
Refer to machine manual to determine components that if faulty could prevent the correct torque curve from being selected
OR
Faulty torque curve select wiring

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5 Governor Droop Mode Selection Check

NOTE: This check is not required for applications that either don't select different droop modes or use droop mode selection over the Controller Area Network (CAN). For these applications, GO TO 6.

1. Operate engine and attempt to recreate the low power condition.
2. Using the DST or SERVICE ADVISOR™, read the Desired Speed Governor parameter and the Maximum Speed Governor parameter.
3. Compare governor selection to the appropriate chart governor mode chart. See GOVERNOR DROOP MODE SELECTION in Section 06, Group 210.

NOTE: If the DST or SERVICE ADVISOR™ is unavailable, see DETERMINING GOVERNOR DROOP MODE SELECTION USING THE BREAK-OUT-BOX (BOB) in Section 04, Group 160 of this manual.

Governor selection is correct:
GO TO 6

Governor selection is incorrect:
Refer to machine manual to determine components that if faulty could prevent the correct governor from being selected.
OR
Faulty governor select wiring.

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6 Turbocharger Boost Pressure Check

Check turbo boost pressure.

- **On 8.1 L engines**, see MEASURE INTAKE MANIFOLD PRESSURE (TURBO BOOST) in Section 04, Group 150 of 8.1 L Diesel Engines Manual (CTM 86).
- **On 6.8 L engines**, see MEASURE INTAKE MANIFOLD PRESSURE (TURBO BOOST) in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Manual (CTM 104).

Pressure within specification:
GO TO 7

Pressure below specification:
GO TO 8

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Observable Diagnostics and Tests

7 Excessive Parasitic Load Check	At this point it appears that the engine is producing the correct power. The low power complaint is most likely a result of excessive parasitic load on the engine. The excessive load could be caused by incorrect vehicle ballasting, faulty hydraulic pump, faulty transmission, etc. Investigate problems associated with excessive parasitic load.	Excessive parasitic load found: Repair cause of excessive load and retest. -- -1/1
8 Throttle Test	<i>NOTE: This check is not required for applications that use a Pulse-Width-Modulated (PWM) throttle or a Controller Area Network (CAN) throttle. For these applications, GO TO 9.</i> 1. Operate engine at full load rated speed 2. Using the DST or SERVICE ADVISOR™, read the Percent Throttle data parameter at these operating conditions. <i>NOTE: If the diagnostic software is unavailable, see MEASURING FULL THROTTLE VOLTAGE VALUES in Section 04, Group 160 of this manual.</i>	97% or above: GO TO 9 Below 97%: Refer to machine manual and perform the throttle calibration procedure and retest.
<i>SERVICE ADVISOR is a trademark of Deere & Company</i> -- -1/1		
9 Fuel Supply System Check	Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK later in this Group.	Fuel supply system is OK: GO TO 10 Fuel supply system problem found: Repair fuel supply system problem and retest. -- -1/1
10 Intake and Exhaust Restriction or Air Leak Check	Check for intake and exhaust restrictions and air leaks. • On 8.1 L engines, see CHECK FOR INTAKE AND EXHAUST RESTRICTIONS, TEST FOR INTAKE AIR LEAKS and CHECK FOR EXHAUST AIR LEAKS (TURBOCHARGED ENGINES) in Section 04, Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86). • On 6.8 L engines, see CHECK FOR INTAKE AND EXHAUST RESTRICTIONS, TEST FOR INTAKE AIR LEAKS and CHECK FOR EXHAUST AIR LEAKS (TURBOCHARGED ENGINES) in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	No restrictions or leaks found: GO TO 11 Restrictions or found Repair and replace components as needed. -- -1/1

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Observable Diagnostics and Tests

11 Injection Pump Timing Check	Check injection pump timing. See CHECK AND ADJUST INJECTION PUMP STATIC TIMING later in this Group.	Timing is correct: GO TO 12 Timing is incorrect: Follow adjustment procedure found in above check. -- -1/1
12 Turbocharger Failure Check	Check for turbocharger failures. • On 8.1 L engines, see TURBOCHARGER INSPECTION in Section 02, Group 080 of 8.1 L Diesel Engines Base Engine Manual (CTM86). • On 6.8 L engines, see TURBOCHARGER SEVEN-STEP INSPECTION in Section 02, Group 080 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).	No turbocharger failure found: GO TO 13 Failure found: Follow appropriate repair procedure: On 8.1 L engines, see REPAIR TURBOCHARGER Section 02, Group 080 of 8.1 L Diesel Engines Base Engine Manual (CTM86). OR On 6.8 L engines, see REPAIR TURBOCHARGER Section 02, Group 080 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104) -- -1/1
13 Valve Lash Check	Check valve lash. • On 8.1 L engines, see CHECK AND ADJUST VALVE CLEARANCE SERIAL NUMBER (—199,999) in Section 02, Group 020 of 8.1L Diesel Engines Base Engine Manual (CTM86). • On 6.8 L engines, see CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM104).	Valve lash on all valves within specification: GO TO 14 Valve lash on one or more valves out of specification. Adjust valve lash and retest. -- -1/1

Observable Diagnostics and Tests

14 Fuel Injection Nozzle Check	Test fuel injection nozzles. See TEST FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.	Injection nozzles test good: GO TO 15 Faulty injection nozzle(s) found: Repair or replace injection nozzles. See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual. -- -1/1
15 Injection Pump Check	Remove injection pump and have checked by authorized diesel repair station. See REMOVE FUEL INJECTION PUMP in Section 02, Group 090 of this manual.	Low power symptom is no longer present: Cause of low power problem found Low power symptom still present. Replace ECU. -- -1/1

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E4 - Engine Emits Excessive Exhaust Smoke

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E4 - Engine Emits Excessive White Exhaust Smoke Diagnostic Procedure

NOTE: This procedure should be used if the engine emits excessive white exhaust smoke. This type of exhaust smoke causes a burning sensation to the eyes. If engine emits a less heavy, bluish exhaust smoke:

On 8.1 L engines, see L1 - EXCESSIVE OIL CONSUMPTION diagnostic procedure in Section 04, Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM86).

OR

On 6.8 L engines, see L1 - EXCESSIVE OIL CONSUMPTION diagnostic procedure in Section 04, Group 150 of 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM104)

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① E4 - Preliminary Check

1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.
2. Ensure engine coolant temperature isn't extremely low.

No problem found:
GO TO ②

Problem found: Repair and retest.

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② Failed Head Gasket Check

Check for a failed head gasket.

- **On 8.1 L engines**, see CHECK FOR HEAD GASKET FAILURES in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM86).
- **On 6.8 L engines**, see CHECK FOR HEAD GASKET FAILURES in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).

No signs of head gasket failure:
GO TO ③

Signs of head gasket failure found:
On 8.1 L engines, see HEAD GASKET INSPECTION AND REPAIR SEQUENCE SERIAL NUMBER (— 199,000) in Section 02, Group 020 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
OR
On 6.8 L engines, see HEAD GASKET INSPECTION AND REPAIR SEQUENCE SERIAL NUMBER (— 199,000) in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

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Observable Diagnostics and Tests

③ Injection Pump Timing Check	Check injection pump timing. See CHECK AND ADJUST INJECTION PUMP STATIC TIMING later in this Group.	Timing is correct: GO TO ④ Timing is incorrect: Adjust timing. -- -1/1
④ Compression Pressure Check	Check compression pressure. • On 8.1 L engines, see TEST ENGINE COMPRESSION PRESSURE in 8.1 L Diesel Engines Base Engine Manual (CTM 86). • On 6.8 L engines, see TEST ENGINE COMPRESSION PRESSURE in 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	Compression pressure within specification: GO TO ⑤ Compression pressure below specification: Investigate problems related to low compression. -- -1/1
⑤ Fuel Injection Nozzle Check	Test fuel injection nozzles. See TEST FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.	Injection nozzles test good: Have injection pump repaired by authorized diesel repair station or replace pump. See REMOVE FUEL INJECTION PUMP in Section 02, Group 090 of this manual. Faulty injection nozzle(s) found. Repair or replace injection nozzles. See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual. -- -1/1

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E5 - Engine Emits Excessive Black or Gray Exhaust Smoke

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E5 - Engine Emits Excessive Black or Gray Exhaust Smoke Diagnostic Procedure

NOTE: This procedure should be used if the engine emits excessive black or gray exhaust smoke. If engine emits a less heavy, bluish exhaust smoke:

On 8.1 L engines, see L1 - EXCESSIVE OIL CONSUMPTION diagnostic procedure in Section 04, Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM86).

OR

On 6.8 L engines, see L1 - EXCESSIVE OIL CONSUMPTION diagnostic procedure in Section 04, Group 150 of 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM104).

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① E5 - Preliminary Check	1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. 2. Ensure engine is not excessively loaded. 3. Ensure air filter is not restricted or plugged.	No problem found: GO TO ② Problem found: Repair and retest. -- -1/1
② Intake and Exhaust Restriction or Air Leak Check	Check for intake and exhaust restrictions and air leaks. • On 8.1 L engines, see CHECK FOR INTAKE AND EXHAUST RESTRICTIONS, TEST FOR INTAKE AIR LEAKS and CHECK FOR EXHAUST AIR LEAKS (TURBOCHARGED ENGINES) in Section 04, Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86). • On 6.8 L engines, see CHECK FOR INTAKE AND EXHAUST RESTRICTIONS, TEST FOR INTAKE AIR LEAKS and CHECK FOR EXHAUST AIR LEAKS (TURBOCHARGED ENGINES) in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	No restrictions or leaks found: GO TO ③ Restrictions or leaks found: Repair and replace components as needed. -- -1/1
③ Injection Pump Timing Check	Check injection pump timing. See CHECK AND ADJUST INJECTION PUMP STATIC TIMING later in this Group.	Timing is correct: GO TO ④ Timing is incorrect: Adjust timing -- -1/1

4 Turbocharger Check	Check for turbocharger failure. • On 8.1 L engines, see TURBOCHARGER INSPECTION in Section 02, Group 080 of 8.1 L Diesel Engines Base Engine Manual (CTM86). • On 6.8 L engines, see TURBOCHARGER SEVEN-STEP INSPECTION in Section 02, Group 080 of 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM104).	No turbocharger failure found: GO TO 5 Failure found: Follow appropriate repair procedure: On 8.1 L engines, see REPAIR TURBOCHARGER Section 02, Group 080 of 8.1 L Diesel Engines Base Engine Manual (CTM 86). OR On 6.8 L engines, see REPAIR TURBOCHARGER Section 02, Group 080 of 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM 104). -- -1/1
5 Valve Lash Check	Check valve lash. • On 8.1 L engines, see CHECK AND ADJUST VALVE CLEARANCE SERIAL NUMBER (—199,999) in Section 02, Group 020 of 8.1L Diesel Engines Base Engine Manual (CTM86). • On 6.8 L engines, see CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM104).	Valve lash on all valves within specification: GO TO 6 Valve lash on one or more valves out of specification: Adjust valve lash and retest. -- -1/1
6 Fuel Injection Nozzle Check	Test fuel injection nozzles. See TEST FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.	Injection nozzles test good: Have injection pump checked by authorized diesel repair station or replace pump. See REMOVE FUEL INJECTION PUMP in Section 02, Group 090 of this manual. Faulty injection nozzle(s) found: Repair or replace injection nozzles. See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual. -- -1/1

E6 - Engine Will Not Crank

Symptom	Problem	Solution
E6 - Engine Will Not Crank	Weak battery	Replace battery.
	Corroded or loose battery connections	Clean battery terminals and connections.
	Defective main switch or start safety switch	Repair switch as required.
	Starter solenoid defective	Replace solenoid.
	Starter defective	Replace starter.
	Starter Circuit Defective	Check for faulty wiring, fuses, or relays.

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E7 - Engine Idles Poorly

Symptom	Problem	Solution
E7 - Engine Idles Poorly	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Air leak on suction side of air intake system	Check hose and pipe connections for tightness; repair as required. On 8.1 L engines , see GROUP 080 - AIR INTAKE AND EXHAUST SYSTEM REPAIR SPECIFICATIONS in Section 06, Group 200 of 8.1 L Diesel Engines Base Engine Manual (CTM86). OR On 6.8 L engines , see AIR INTAKE AND EXHAUST SYSTEM SPECIFICATIONS in Section 06, Group 200 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).
	Electronic control system problem or basic engine problem	See E2 - ENGINE MISFIRES/RUNS IRREGULARLY earlier in this Group.

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E8 - Abnormal Engine Noise

Symptom	Problem	Solution
E8 - Abnormal Engine Noise	Worn main or connecting rod bearings	Determine bearing clearance. On 8.1 L engines , see INSPECT AND MEASURE CONNECTING ROD BEARINGS in Section 02, Group 030 of 8.1 L Diesel Engines Base Engine Manual or CHECK MAIN BEARING OIL CLEARANCE in Section 02, Group 040 of 8.1 L Diesel Engines Base Engine Manual (CTM86). OR On 6.8 L engines , see INSPECT AND MEASURE CONNECTING ROD BEARINGS in Section 02, Group 030 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104) or CHECK MAIN BEARING OIL CLEARANCE in Section 02, Group 040 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).
	Excessive crankshaft end play	Check crankshaft end play. On 8.1 L engines , see CHECK CRANKSHAFT END PLAY in Section 02, Group 040 of 8.1 L Diesel Engines Base Engine Manual (CTM86). OR On 6.8 L engines , see CHECK CRANKSHAFT END PLAY in Section 02, Group 040 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).

Continued on next page

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Symptom	Problem	Solution
	Loose main bearing caps	Check bearing clearance; replace bearings and bearing cap screws as required. On 8.1 L engines, see CHECK MAIN BEARING OIL CLEARANCE in Section 02, Group 040 of 8.1 L Diesel Engines Base Engine Manual (CTM86) OR On 6.8 L engines, see CHECK MAIN BEARING OIL CLEARANCE in Section 02, Group 040 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104)
	Worn connecting rod bushings and piston pins	Inspect piston pins and bushings. On 8.1 L engines, see INSPECT PISTON PINS AND BUSHINGS in Section 02, Group 030 of 8.1 L Diesel Engines Base Engine Manual (CTM86). OR On 6.8 L engines, see INSPECT PISTON PINS AND BUSHINGS in Section 02, Group 030 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).
	Scored pistons	Inspect pistons. On 8.1 L engines, see PRELIMINARY LINER, PISTON, AND ROD CHECKS in Section 02, Group 030 of 8.1 L Diesel Engines Base Engine Manual (CTM86). OR On 6.8 L engines, see PRELIMINARY LINER, PISTON, AND ROD CHECKS in Section 02, Group 030 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).

Symptom	Problem	Solution
	Worn timing gears or excess back lash	Check timing gear back lash. On 8.1 L engines, see GROUP 050 - CAMSHAFT, AND TIMING GEAR TRAIN REPAIR SPECIFICATIONS in Section 06, Group 200 of 8.1 L Diesel Engines Base Engine Manual (CTM86). OR On 6.8 L engines, see CAMSHAFT, BALANCER SHAFTS AND TIMING GEAR TRAIN SPECIFICATIONS in Section 06, Group 200 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).
	Excessive valve clearance	Check and adjust valve clearance. On 8.1 L engines, see CHECK AND ADJUST VALVE CLEARANCE SERIAL NUMBER (—199,999) in Section 02, Group 020 of 8.1 L Diesel Engines Base Engine Manual (CTM86) OR On 6.8 L engines, see CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).
	Worn camshaft	Inspect camshaft. On 8.1 L engines, see VISUALLY INSPECT CAMSHAFT in Section 02, Group 050 of 8.1 L Diesel Engines Base Engine Manual (CTM86). OR On 6.8 L engines, see VISUALLY INSPECT CAMSHAFT in Section 02, Group 050 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).

Continued on next page

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Symptom	Problem	Solution
	Worn rocker arm shaft(s)	Inspect rocker arm shafts. On 8.1 L engines, see DISASSEMBLE AND INSPECT ROCKER ARM SHAFT ASSEMBLY SERIAL NUMBER (—199,000) in Section 02, Group 020 of 8.1 L Diesel Engines Base Engine Manual (CTM86). OR On 6.8 L engines, see DISASSEMBLE AND INSPECT ROCKER ARM SHAFT ASSEMBLY in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).
	Insufficient engine lubrication	On 8.1 L engines, see L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM86). OR On 6.8 L engines, see L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM86).
	Turbocharger noise	On 8.1 L engines, see TURBOCHARGER INSPECTION in Section 02, Group 080 of 8.1 L Diesel Engines Base Engine Manual (CTM86) OR On 6.8 L engines, see TURBOCHARGER SEVEN-STEP INSPECTION in Section 02, Group 080 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).

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04
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F1 - Fuel Supply System Check

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F1 - Fuel Supply System Check Diagnostic Procedure

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① F1 - Preliminary Check

1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.
2. Inspect all fuel lines and fittings for ruptures or leaks.
3. If fuel system has recently been opened, bleed fuel system. See BLEED THE FUEL SYSTEM later in this Group.

No problem found:
GO TO ②**Problem found:** Repair and retest.

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② Air In Fuel Check

Check for air in the fuel. See TEST FOR AIR IN FUEL later in this Group.

No air found in fuel system:
GO TO ③**Air found in fuel system:** Bleed fuel system. See BLEED THE FUEL SYSTEM later in this Group.

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③ Fuel Supply Pressure Check

Check fuel supply pressure. See MEASURE FUEL SUPPLY PUMP PRESSURE later in this Group.

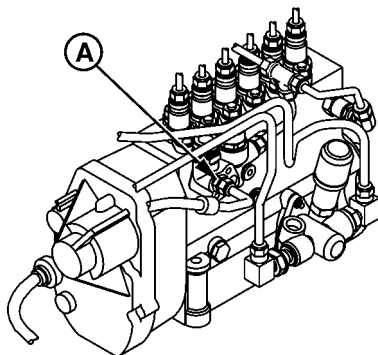
Pressure within specification:
GO TO ⑦**Pressure is below specification:**
GO TO ④

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Observable Diagnostics and Tests

4 Fuel Filter Test	1. Replace final fuel filter and retest. 2. Replace primary fuel filter (if equipped) and retest.	Problem solved: No further investigating is needed. Problem still exist: GO TO 5 -- -1/1
5 Fuel Supply Lines Check	Remove fuel supply lines and determine if there are any internal restrictions.	No restrictions found: GO TO 6 Restrictions found: Repair or replace components as needed. -- -1/1
6 Fuel Supply Pump Check	At this point, the most likely cause for low fuel pressure is one of the following failures in the fuel supply pump. Check the most likely items as needed. IMPORTANT: Visually inspect the fuel inlet fitting and pump filter for possible plugging before disassembling pump to determine cause of malfunction. 1. Test Fuel Supply Pump for leaks. See CHECK FUEL SUPPLY PUMP OPERATION later in this Group. 2. Hand primer not screwed down tight, allowing dirt to enter hand primer plunger chamber. 3. Worn or pitted valves. 4. Missing or broken spring(s). 5. Hand primer lever left in upward position.	No supply pump problems found: GO TO 7 Supply pump problems found: Refer to Section 02, Group 090 of this manual for repair. -- -1/1

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**7 Restricted
Pre-Injection Pump
Fuel Line Check**

RG9988 -UN-19JAN99

This check will help determine if the pre-injection pump fuel line (A) is restricted.

1. Disconnect fuel line from the final filter.
2. Disconnect fuel line from injection pump.
3. Force air through the fuel line.
4. If the fuel line is not restricted, the compressed air should freely flow out the other side.
5. If air does not flow freely, there are restrictions in the fuel line.

No restrictions found:
GO TO **8**

Restrictions found:
Repair or replace
components as needed.

-- -1/1

**8 Fuel Injection Pump
Check**

NOTE: If you are here because engine does not develop full power, return to E3 - ENGINE DOES NOT DEVELOP FULL POWER earlier in this Group and proceed with diagnostics.

Have injection pump repaired by an authorized diesel repair station or replace pump.
See Section 02, Group 090 of this manual.

-- -1/1

F2 - Excessive Fuel Consumption

Symptom	Problem	Solution
F2 - Excessive Fuel Consumption	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Engine overloaded	Reduce engine load.
	Air cleaner restricted or dirty	Replace air cleaner element as required.
	Compression too low	Determine cause of low compression and repair as required.
	Leaks in fuel supply system	Locate source of leak and repair as required.

DPSG, RG41221,25 -19-17MAY00-1/1

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31**F3 - Fuel in Oil**

Symptom	Problem	Solution
F3 - Fuel in Oil	Cracked cylinder head	Locate crack, repair/replace components as required.

DPSG, RG41221,38 -19-19MAY00-1/1

ECU 30-WAY CONNECTOR



This diagnostic procedure should be used if communication between the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™ and the Engine Control Unit (ECU) cannot be established.

RG11358 -19-15DEC00

DPSG,RG40854,324 -19-21NOV00-1/1

D1 - ECU Does Not Communicate with DST or SERVICE ADVISOR

OUO1004,0000C7A -19-08JAN01-1/1

D1 - ECU Does Not Communicate with DST or SERVICE ADVISOR™ Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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33**❶ Intermittent Fault Test**

NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.

1. Connect the DST or SERVICE ADVISOR™.
2. Ignition ON
3. Start the ECU Communication Software

Can not communicate with ECU:
GO TO ❷

Communicates with ECU: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, in Group 160.

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❷ Sensor Voltage Test

NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.

1. Ignition OFF
2. Disconnect any of the following:
 - ECT sensor
 - MAT sensor
3. Ignition ON.
4. Using a multimeter, measure the voltage between both terminals of the selected sensor harness connector.

4.5 V or above:
GO TO ❹

Below 4.5 V:
GO TO ❸

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Observable Diagnostics and Tests

③ Power Supply Test	<i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.</i> 1. Ignition OFF 2. Disconnect ECU 30-way connector 3. Ignition ON 4. Using a multimeter, measure the voltage between a good ground and terminal A1 in the harness end of the ECU 30-way connector.	10.0 V or above: Faulty ECU power fuse OR Faulty ECU power wiring OR Faulty ECU Below 10.0 V: Key-on signal wire open or shorted to ground OR Faulty ignition switch OR Faulty key-on power fuse

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④ PDM Power Light Test	<i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.</i> 1. Ignition ON 2. Note the power light on the Parallel Data Module (PDM)	Power light ON: GO TO ⑥ Power light OFF: GO TO ⑤

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⑤ Open in Diagnostic Connector Ground Wire Test	<i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.</i> 1. Ignition OFF 2. Disconnect the diagnostic cable from the diagnostic connector 3. Probe terminal A in the diagnostic connector with a test light connected to battery voltage.	Light ON: Open or short to ground in diagnostic connector switched power wire. Light OFF: Open in diagnostic connector ground wire.

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Observable Diagnostics and Tests

⑥ Open in Harness Circuit Test	<i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.</i> 1. Ignition OFF 2. Disconnect ECU 30-way connector and diagnostic cable from the diagnostic connector 3. Using a multimeter, measure resistance on the harness end of both connectors between: • Terminal C in the diagnostic connector and terminal D3 in the ECU 30-way connector • Terminal D in the diagnostic connector and terminal C2 in the ECU 30-way connector	All measurements 5 ohms or less: GO TO ⑦ One or more measurements greater than 5 ohms: Open in harness circuit OR Connector terminals in wrong position

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⑦ CAN Resistance Test	<i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.</i> 1. Ignition OFF 2. ECU 30-way and diagnostic connector still disconnected 3. Using a multimeter, measure resistance between terminals C and D in the harness end of the diagnostic connector.	Between 45 - 75 ohms: GO TO ⑧ Less than 45 or greater than 75 ohms: Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness

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8 CAN High and Low Voltage Test

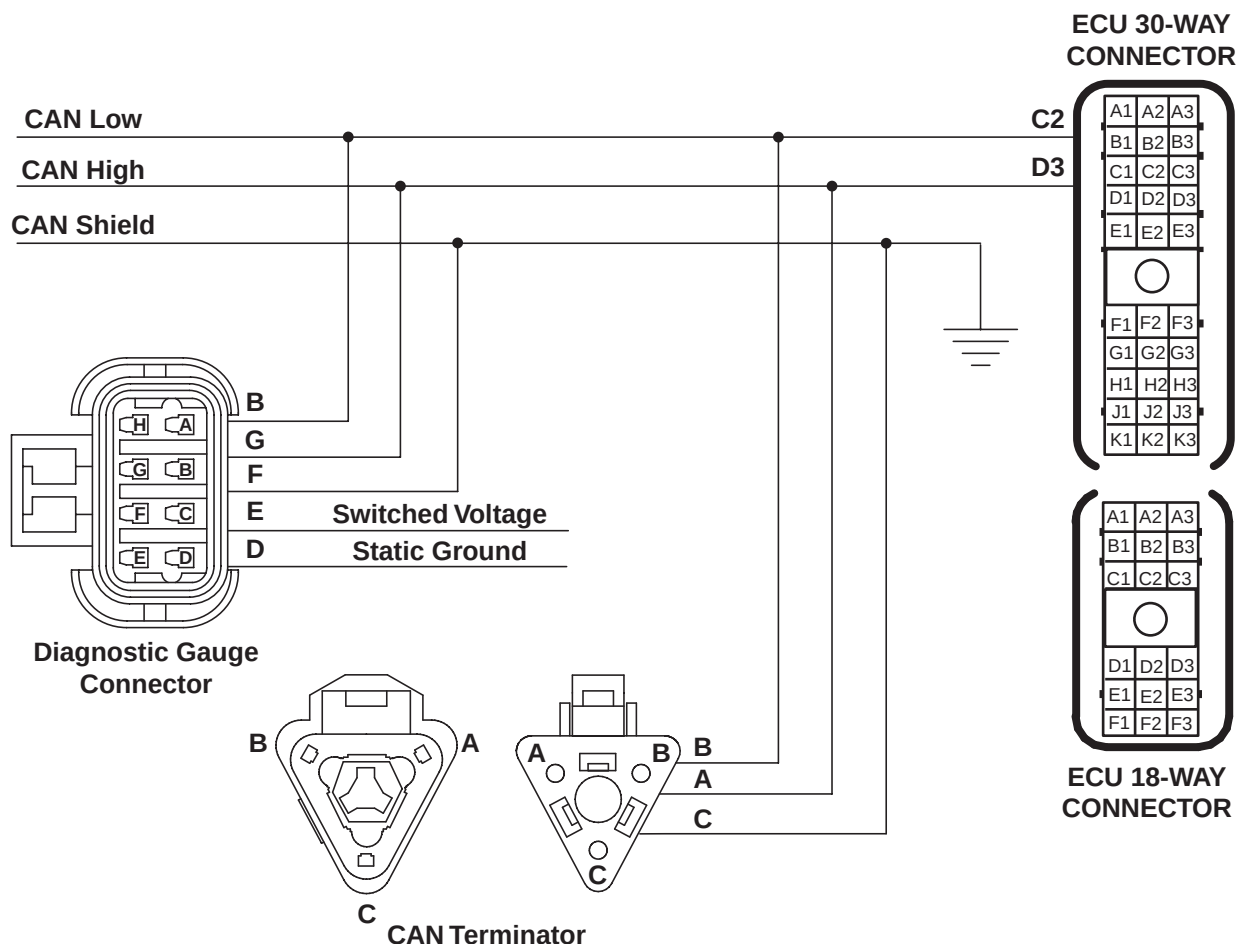
NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.

1. Ignition OFF
2. Reconnect ECU 30-way connector
3. Ignition ON
4. Using a multimeter, measure voltage between a good chassis ground and:
 - Terminal C in the diagnostic connector
 - Terminal D in the diagnostic connector

Both measurements between 1.5 - 3.5 V:
Faulty ECU 30-way connector
OR
Faulty diagnostic cable
OR
Faulty diagnostic connector
OR
Faulty Parallel Port Data Module (PDM)
OR
Faulty diagnostic software/computer configuration
OR
Faulty ECU

Either measurement less than 1.5 V or greater than 2.5 V:
CAN wiring shorted to ground or voltage
OR
Faulty ECU

D2 - ECU Does Not Communicate with Diagnostic Gauge



IMPORTANT: Do not force probes into connector terminals or damage will result. Use the JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Internal Diagnostic Gauge Errors

- The D2 - ECU Does Not Communicate with Diagnostic Gauge diagnostic procedure should be followed if the diagnostic gauge shows the following error codes or it can not communicate with the ECU:
 - EE-error
 - ACP-Err/No Addr
 - ACP-Err/Bus EP
 - ACP-Err/Bus Error

RG11648 -19-23JAN01

RG40854,000005C -19-11JAN01-1/1

D2 - ECU Does Not Communicate with Diagnostic Gauge

RG40854,000005D -19-12JAN01-1/1

D2 - ECU Does Not Communicate with Diagnostic Gauge Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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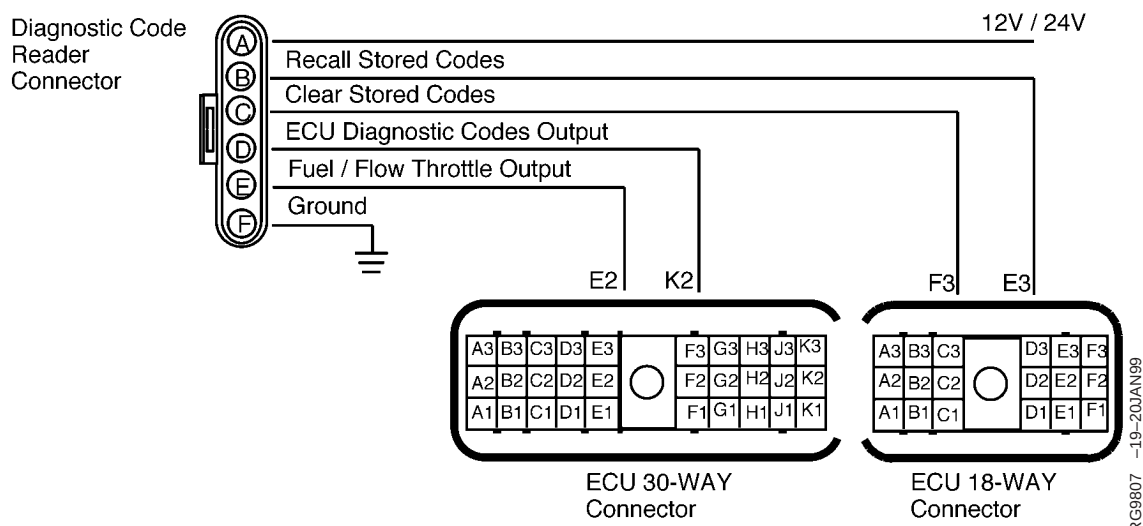
① Intermittent Fault Test	<i>NOTE: For wiring and theory of operation information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.</i> 1. Ignition OFF 2. Ignition ON	Error or no power found in diagnostic gauge: GO TO ② No error found and power present in diagnostic gauge: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, in Group 160.
② Sensor Voltage Test	<i>NOTE: For wiring and theory of operation information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.</i> 1. Ignition OFF 2. Disconnect any of the following: • ECT sensor • MAT sensor 3. Ignition ON. 4. Using a multimeter, measure the voltage between both terminals of the selected sensor harness connector.	4.5 V or above: GO TO ④ Below 4.5 V: GO TO ③
③ Power Supply Test	<i>NOTE: For wiring and theory of operation information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.</i> 1. Ignition OFF 2. Disconnect ECU 30-way connector 3. Ignition ON 4. Using a multimeter, measure the voltage between a good ground and terminal A1 in the harness end of the ECU 30-way connector.	10.0 V or above: Faulty ECU power fuse OR Faulty ECU power wiring OR Faulty ECU Below 10.0 V: Key-on signal wire open or shorted to ground OR Faulty ignition switch OR Faulty key-on power fuse

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Observable Diagnostics and Tests

4 Diagnostic Gauge Power Test	<i>NOTE: For wiring and theory of operation information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.</i> 1. Ignition ON 2. View diagnostic gauge	Gauge has power: GO TO 6 Gauge does not have power: GO TO 5 -- -1/1
5 Open in Diagnostic Connector Ground Wire Test	<i>NOTE: For wiring and theory of operation information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.</i> 1. Ignition OFF 2. Disconnect the diagnostic gauge connector 3. Probe terminal D in the diagnostic gauge connector with a test light connected to battery voltage.	Light ON: Open or short to ground in diagnostic gauge switched power wire. Light OFF: Open in diagnostic gauge connector ground wire. -- -1/1
6 Open in Harness Circuit Test	<i>NOTE: For wiring and theory of operation information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.</i> 1. Ignition OFF 2. Disconnect ECU 30-way connector and diagnostic gauge connector 3. Using a multimeter, measure resistance on the harness end of both connectors between: • Terminal B in the diagnostic gauge connector and terminal C2 in the ECU 30-way connector • Terminal G in the diagnostic gauge connector and terminal D3 in the ECU 30-way connector	All measurements 5 ohms or less: GO TO 7 One or more measurements greater than 5 ohms: Open in harness circuit OR Connector terminals in wrong position -- -1/1
7 CAN Resistance Test	<i>NOTE: For wiring and theory of operation information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.</i> 1. Ignition OFF 2. 30-way ECU and diagnostic gauge connector still disconnected 3. Using a multimeter, measure resistance between terminals B and G in the harness end of the diagnostic connector.	Between 45 - 75 ohms: GO TO 8 Less than 45 or greater than 75 ohms: Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness -- -1/1

8 CAN High and Low Voltage Test	<i>NOTE: For wiring and theory of operation information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.</i> 1. Ignition OFF 2. Reconnect ECU 30-way connector 3. Ignition ON 4. Using a multimeter, measure voltage between a good chassis ground and: • Terminal B in the diagnostic gauge connector • Terminal G in the diagnostic gauge connector	Both measurements between 1.5 - 3.5 V: Faulty ECU 30-way connector OR Faulty diagnostic gauge connector OR Faulty instrument panel connector OR Faulty diagnostic gauge OR Faulty ECU Either measurement less than 1.5 V or greater than 2.5 V: CAN wiring shorted to ground or voltage OR Faulty ECU -- -1/1

D3 - Error Codes on Electronic Governor Tester (JT05829)

IMPORTANT: Do not force probes into connector terminals or damage will result. Use the JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

NOTE: Only follow this procedure if DTCs 71, 72, 73, or 74 are read on the electronic governor tester. If other codes are read on the electronic governor tester, see LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) ON ECU in Group 160 of this manual..

DTC Output or Fuel Flow/Throttle Output Circuit

- Both the diagnostic trouble code output and fuel flow/throttle circuits are dedicated wires between the ECU and another controller, the diagnostic code reader connector, or both. The ECU outputs square wave signals on both wires that either translates into

a specific DTC or the current flow and percent throttle values.

DTC 71, 72, 73, or 74 will set if:

- If DTC 71 or 72 sets, another controller or the diagnostic code reader detects the diagnostic trouble code circuit is open, shorted, or grounded.
- If DTC 73 or 74 sets, another controller or the diagnostic code reader detects the fuel flow/throttle output circuits are open, shorted, or grounded.

If DTC 71, 72, 73, or 74 sets, the following will occur:

- If DTC 71 or 72 sets, the ECU will be unable to communicate any DTCs to other controllers or the diagnostic code reader.
- If DTC 73 or 74 sets, the ECU will be unable to communicate fuel flow and percent throttle values to other controllers or the diagnostic code reader.

DPSG, RG39774, 11 -19-22JUN01-1/1

D3 - Error Codes on Electronic Governor Tester (JT05829)**D3 - Error Codes on Electronic Governor Tester (JT05829) Diagnostic Procedure**

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	<i>NOTE: For wiring and theory of operation information, see D3 - ERROR CODES ON ELECTRONIC GOVERNOR TESTER (JT05829) supporting information</i> 1. Ignition ON, engine OFF 2. Make note of all DTCs off of the electronic governor tester, then clear all DTCs 3. Ignition ON, engine OFF 4. Using the electronic governor tester, monitor DTCs	DTCs 71, 72, 73, or 74 reoccur(s): GO TO ❷ DTCs 71, 72, 73, or 74 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group. Other DTC occurs: See LISTING OF DIAGNOSTIC TROUBLE CODES ON ECU
❷ ECU Powered Test	<i>NOTE: For wiring and theory of operation information, see D3 - ERROR CODES ON ELECTRONIC GOVERNOR TESTER (JT05829) supporting information</i> 1. Ignition OFF 2. Disconnect the ECU 30-way connector 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between terminals A1 and B1 in the harness end of the ECU 30-way connector	Battery voltage with DTC 71 or 72: GO TO ❸ Battery voltage with DTC 73 or 74: GO TO ❹ Less than battery voltage: Faulty ECU power supply wiring

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Observable Diagnostics and Tests

③ ECU Diagnostic Codes Output Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see D3 - ERROR CODES ON ELECTRONIC GOVERNOR TESTER (JT05829) supporting information</i> - Obtain wiring information for this application and determine where the diagnostic trouble codes output circuit routes to. On OEM engines, it routes to the diagnostic code reader connector - Ignition OFF - Disconnect the ECU 30-way connector - Using a multimeter, measure resistance between terminal K2 in the harness end of the ECU 30-way connector and the terminal at the other end of the diagnostic trouble codes output circuit. <i>NOTE: On OEM applications, this is terminal D in the diagnostic code reader connector</i>	Less than 5.0 ohms: GO TO ④ 5.0 ohms or greater: Open in diagnostic code output circuit
④ ECU Diagnostic Codes Output Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see D3 - ERROR CODES ON ELECTRONIC GOVERNOR TESTER (JT05829) supporting information</i> - Ignition OFF - Disconnect the ECU 30-way and 18-way (if equipped) connector(s) - Using a multimeter, measure resistance between terminal K2 in the harness end of the ECU 30-way connector and all other terminals in the ECU 30-way and 18-way (if equipped) connectors	All measurements greater than 2000 ohms: GO TO ⑤ Any measurement less than 2000 ohms: Short to another circuit in diagnostic code output circuit
⑤ ECU Diagnostic Codes Output Circuit Shorted Test	<i>NOTE: On OEM engines, this check is not needed.</i> <i>NOTE: For wiring and theory of operation information, see D3 - ERROR CODES ON ELECTRONIC GOVERNOR TESTER (JT05829) supporting information</i> - Obtain wiring information for this application and determine if the Diagnostic Trouble Codes output circuit goes to another controller on the vehicle - Disconnect the vehicle controller connector - Using a multimeter, measure the resistance between the Diagnostic Trouble Codes output circuit and all other terminals of the connector.	All Using a multimeter, measurements greater than 2000 ohms: Faulty vehicle controller OR Faulty ECU Any measurement less than 2000 ohms: Short to another circuit in diagnostic code output circuit

Observable Diagnostics and Tests

6 Fuel Flow And Throttle Output Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see D3 - ERROR CODES ON ELECTRONIC GOVERNOR TESTER (JT05829) supporting information</i> 1. Obtain wiring information for this application and determine where the fuel flow and throttle output circuit routes to. On OEM engines, it routes to the diagnostic code reader connector 2. Ignition OFF 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminal E2 in the harness end of the ECU 30-way connector and the terminal at the other end of the Diagnostic Trouble Codes output circuit. On OEM applications, this is terminal E in the diagnostic code reader connector	Less than 5.0 ohms: GO TO 7 5.0 ohms or greater: Open in fuel flow and throttle output circuit
7 Fuel Flow And Throttle Output Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see D3 - ERROR CODES ON ELECTRONIC GOVERNOR TESTER (JT05829) supporting information</i> 1. Ignition OFF 2. Disconnect the ECU 30-way and 18-way (if equipped) connector(s) 3. Using a multimeter, measure resistance between terminal E2 in the harness end of the ECU 30-way connector and all other terminals in the ECU 30-way and 18-way (if equipped) connectors	All measurements greater than 2000 ohms: GO TO 8 Any measurement less than 2000 ohms: Short to another circuit in fuel flow and throttle output circuit
8 Fuel Flow And Throttle Output Circuit Shorted Test	<i>NOTE: On OEM engines, this check is not needed.</i> <i>NOTE: For wiring and theory of operation information, see D3 - ERROR CODES ON ELECTRONIC GOVERNOR TESTER (JT05829) supporting information</i> 1. Obtain wiring information for this application and determine if the fuel flow and throttle output circuit goes to another controller on the vehicle 2. Disconnect the vehicle controller connector 3. Using a multimeter, measure the resistance between the fuel flow and throttle output circuit and all other terminals of the connector	All measurements greater than 2000 ohms: Faulty vehicle controller OR Faulty ECU Any measurement less than 2000 ohms: Short to another circuit in fuel flow and throttle output circuit

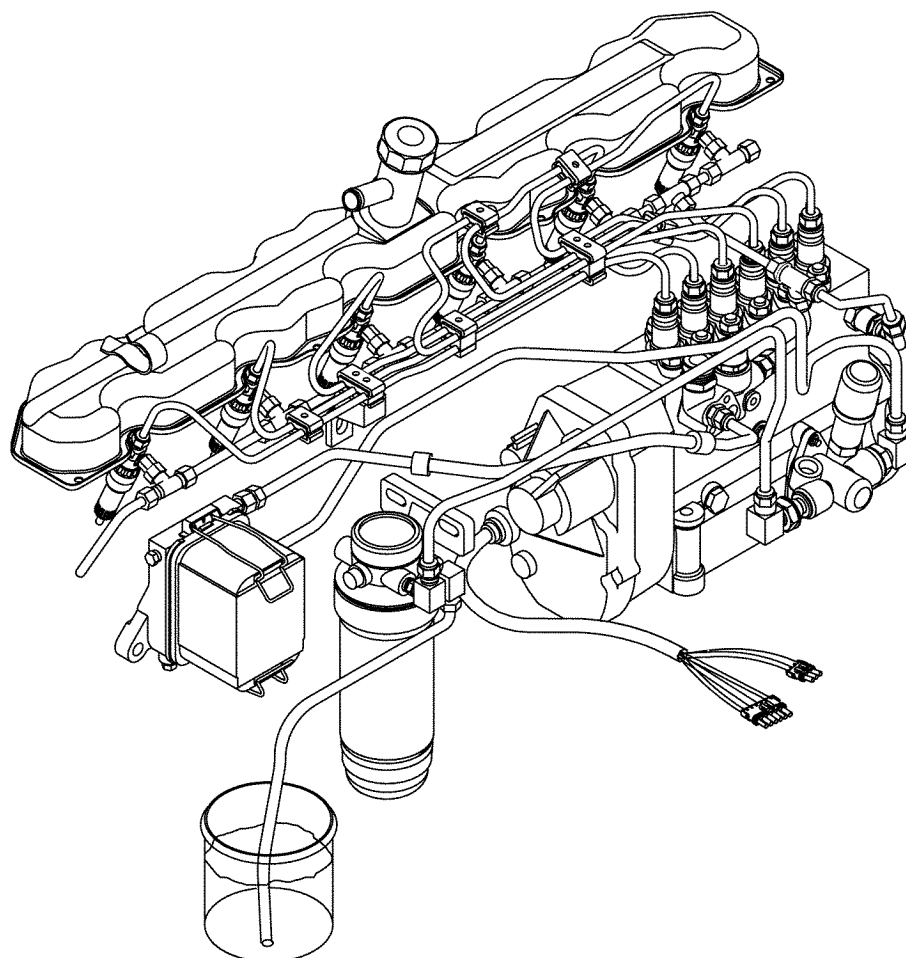
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Check Fuel Supply Quality



RG9722 -UN-04DEC98

The quality of diesel fuel effects engine performance. Check your operator's manual for correct fuel specifications.

If poor quality or contaminated fuel is suspected, perform the following:

1. Check primary (if equipped) and final fuel filters for serviceability. If filter is equipped with a water separator, empty and clean separator bowl.
2. Start engine and operate under load, observing engine performance.
3. Disconnect fuel line from inlet side of primary fuel filter or from the inlet side of supply pump on engine without a primary filter.

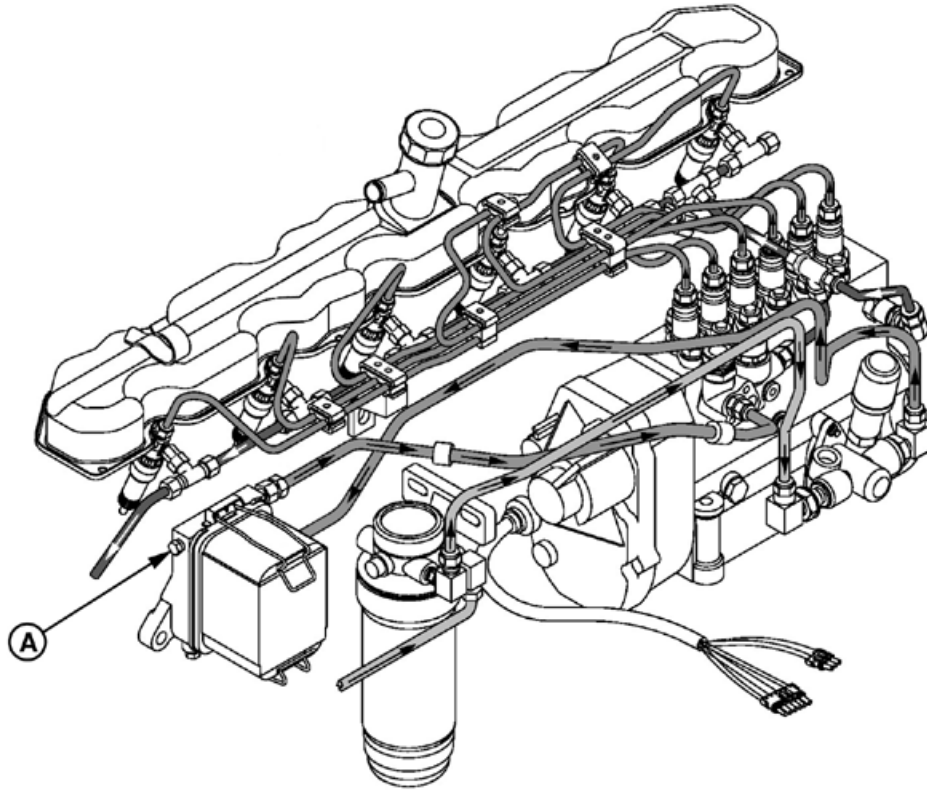
4. Connect a hose inlet port.

5. Submerge hose in a container of clean, good quality fuel meeting engine specifications.

6. Operate engine under load and observe performance.

If performance improves, fuel is contaminated or not of the proper grade. Check fuel source.

Measure Fuel Supply Pump Pressure



RG9727 -UN-04DEC98

A—Bleed Plug

IMPORTANT: Before disconnecting any fuel line, completely clean any debris from around the fitting. DO NOT allow debris to enter the fuel line.

1. Remove bleed plug (A) at final fuel filter and connect a 0—400 kPa (0—4 bar) (0—60 psi) pressure gauge. All air must be out of system.
2. Start engine and run at low idle. On Bosch P3000 injection pumps, supply pump minimum outlet pressure should be above 200 kPa (2.0 bar) (29 psi). On Bosch P7100 injection pumps, supply pump minimum outlet pressure should be above 227 kPa (2.27 bar) (33 psi).
3. If pressure is below the minimum specified and no restriction is visible in any of the fuel lines, replace primary and final fuel filters and recheck pressure.
4. If pressure is still low, connect the primary filter inlet line to temporary fuel tank and recheck pressure. If pressure increases to specification, check the fuel supply line, the pre-filter strainer (if equipped), the fuel tank, and the fuel tank vent for any possible restrictions.
5. If pressure does not increase, repair/replace the fuel supply pump and retest.

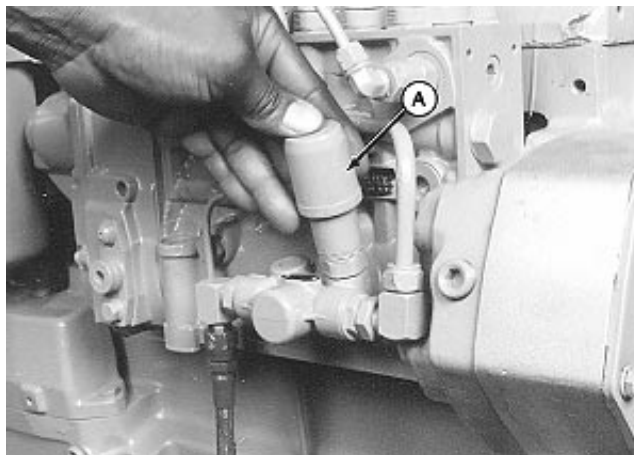
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Check Fuel Supply Pump Operation

NOTE: The following procedure can best be performed under moderate air temperature conditions to reduce electrical loads when cranking the engine is required.

1. Make a preliminary inspection of the supply pump. Thoroughly clean area around pump. All connections must be tight and not leaking.
2. Start engine and bring to operating temperature. Turn ignition to "OFF" position.

NOTE: Hand primer (A) is spring loaded to remain in the fully extended position. If fuel leaks around a hand primer while seated in the extended position, replace the hand primer.



A—Hand Primer

RG7071 -UN-07SEP94

Check operation of hand primer:

With ignition at "OFF" position, operate hand primer through several strokes.

Moderate to heavy leakage of fuel between plunger and barrel indicates seal is defective. Replace hand primer.

NOTE: Appearance of a slight quantity of fuel around the plunger is normal.

Test operation of suction side of pump:

1. Disconnect suction and discharge lines at pump.
2. Drain all fuel from pump by operating hand primer. Then, reconnect suction line to pump.

NOTE: When operating hand primer, a moderate resistance should be felt. When only a slight resistance (or no resistance) occurs, replace hand primer or repair pump (valves may be defective).

3. Operate hand primer until fuel flows from pump outlet (discharge).

Fuel should flow within 15-25 strokes. If not, the suction line may be obstructed or be leaking air, (replace in-line filter when used).

Continued on next page

DPSG, RG40854, 20 -19-25NOV98-1/2

If fuel does not flow and if no leak or obstruction is found, pump is defective. It must be repaired or replaced.

Test operation of discharge side of pump:

1. Suction line must be connected and discharge (pressure) line disconnected.
2. Place injection pump fuel shut-off control in "STOP" position to prevent engine from starting.
3. Crank engine with starting motor.

Fuel should flow from pump outlet within 10 seconds. If not, the suction line may be obstructed (replace in-line filter when used), or leaking air.

Test pump output pressure while cranking:

1. Connect a 0-400 kPa (0-4 bar) (0-60 psi) pressure gauge to one end of a pressure hose about 250-300 mm (10-12 in.) long. Connect other end of hose to pump outlet. All air must be out of system.
2. Crank engine for 10 seconds with starting motor (approximately 300 engine rpm). Supply pump minimum outlet pressure should be 200 kPa (2.0 bar) (29.0 psi).

IMPORTANT: The starting motor must crank the engine at normal cranking speed. Use booster batteries if necessary.

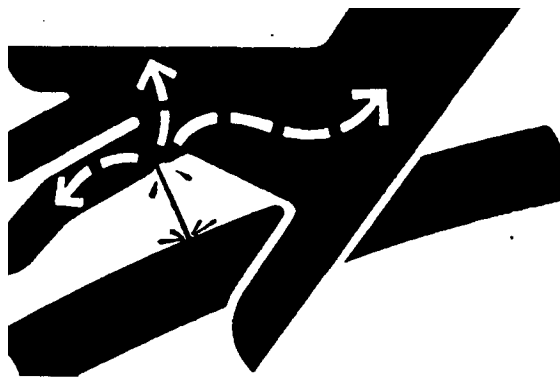
3. Compare measured output with the minimum pressure specifications.

If pressure is below the minimum specified and if no obstruction or leak is found, repair or replace the pump.

Bleed the Fuel System



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



X9811 -UN-23AUG88

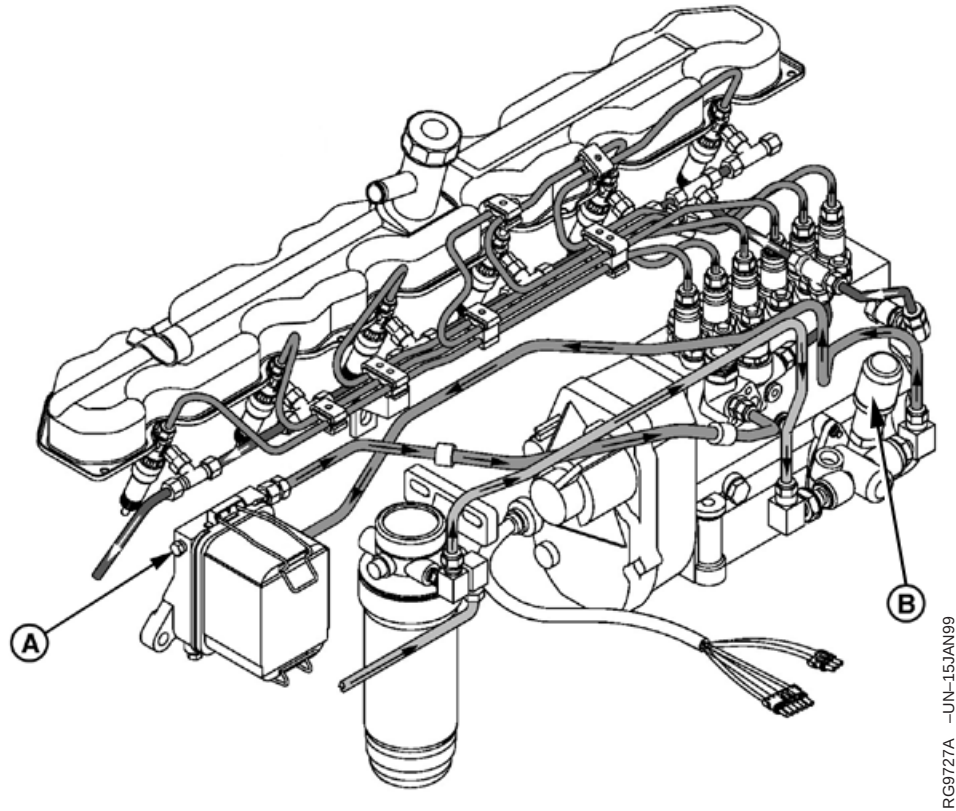
If ANY fluid is injected into the skin, a doctor familiar with this type of injury must surgically remove it within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

Whenever the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system.

The fuel system may be bled at one of several locations. On some engine applications it may be necessary to consult your operator's manual and choose the location best for your engine/machine application.

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DPSG, RG40854, 21 -19-25NOV98-1/4



A—Bleed Plug

B—Hand Primer

At Final Fuel Filter:

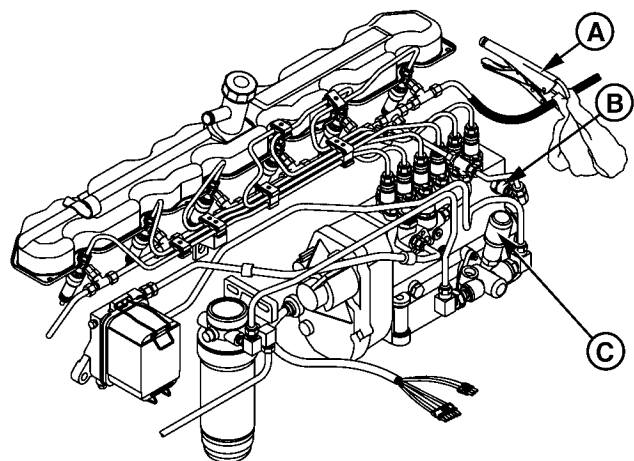
1. Turn ignition switch to "ON" position.
2. Use a shop towel or pan to catch escaping fuel.
3. Loosen bleed plug (A) on side of fuel filter base.
4. Operate the hand primer (B) on fuel supply pump until a smooth flow of fuel, free of bubbles, comes out of the filter plug hole.
5. Tighten bleed plug and start engine.

Continued on next page

DPSG, RG40854, 21 -19-25NOV98-2/4

At Fuel Injection Pump:

1. Pinch-off return fuel line (A).
2. Use a shop towel to catch escaping fuel.
3. Disconnect fuel line from injection pump overflow valve (B).
4. Loosen overflow valve body (B) from where valve threads into injection pump.
5. Turn ignition switch to "ON" position.
6. Operate the hand primer (C) on fuel supply pump until fuel free from air bubbles flows out of injection pump at the overflow valve fitting location.
7. Simultaneously, continue to operate hand primer (C) while tightening overflow valve on injection pump to specification.



A—Return Line Hose Pinched-off
 B—Overflow Valve
 C—Hand Primer

RG9748 -UN-26JAN99

Specification

Overflow Valve—Torque 30 N•m (22 lb-ft)

8. Operate the hand primer on fuel supply pump until moderate resistance is felt.
9. Release pinch-off from return line hose.

Continued on next page

DPSG, RG40854, 21 -19-25NOV98-3/4

At Fuel Injection Nozzles:

1. Place throttle lever in half-throttle position. On engines equipped with electronic fuel shut-off solenoid, energize solenoid.

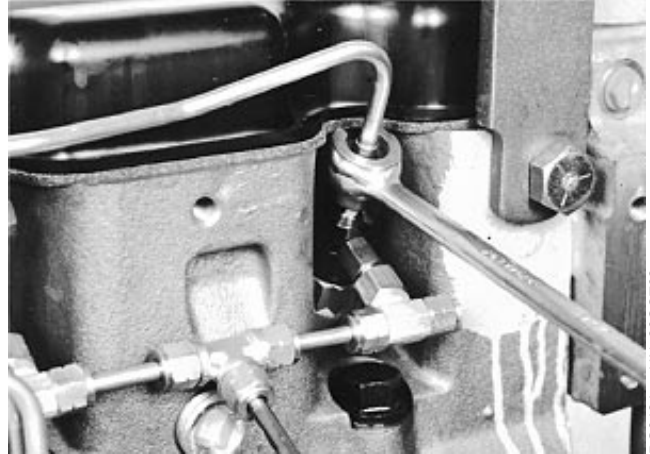
IMPORTANT: Always use a backup wrench when loosening or tightening fuel lines at nozzles and/or injection pump to avoid damage.

2. Place a shop towel around fuel line-to-nozzle connection to catch escaping fuel.
3. Using two open-end wrenches, loosen fuel line connection at injection nozzles.
4. Crank engine over with starting motor, (but do not start engine), until fuel free from bubbles flows out of loosened connection. Retighten connection to specifications.

Specification

FUEL INJECTION NOZZLE
DELIVERY LINES—Torque 27 N•m (20 lb-ft)

5. Repeat procedure for remaining injection nozzles (if necessary) until all air has been removed from fuel system.



RG6484 -UN-26OCT92

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Cylinder Misfire Test



CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Keep hands and body away from pinholes and nozzles which could inject fluids under high pressure.

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

1. Operate engine at intermediate speed with no load.
2. Place a shop towel around nozzle-to-line connection to absorb escaping fuel.
3. Slowly loosen the fuel pressure line at one of the nozzles until fuel escapes at the connection (fuel not opening nozzle valve).
 - If engine speed changes, the cylinder is probably working satisfactory.
 - If engine speed does not change, a cylinder is faulty.
4. Repeat test for each remaining cylinder.
5. Tighten fuel lines to specifications.

Specification

FUEL INJECTION NOZZLE
DELIVERY LINES—Torque 27 N•m (20 lb-ft)

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Test for Fuel Drain Back

Fuel draining back through the fuel system may cause hard starting. This procedure will determine if air is entering the system connections and allowing fuel to siphon back to the fuel tank.

1. Disconnect fuel supply line and fuel return line at fuel tank.

IMPORTANT: Fuel return line MUST extend below fuel level in fuel tank before performing this test. Fill fuel tank if necessary.

2. Drain all fuel from the system, including the fuel transfer pump, fuel injection pump, fuel filters, and water separator (if equipped).
3. Securely plug off the end of the fuel return pipe.
4. Using a low-pressure air source, pressurize the fuel system at the fuel supply line.



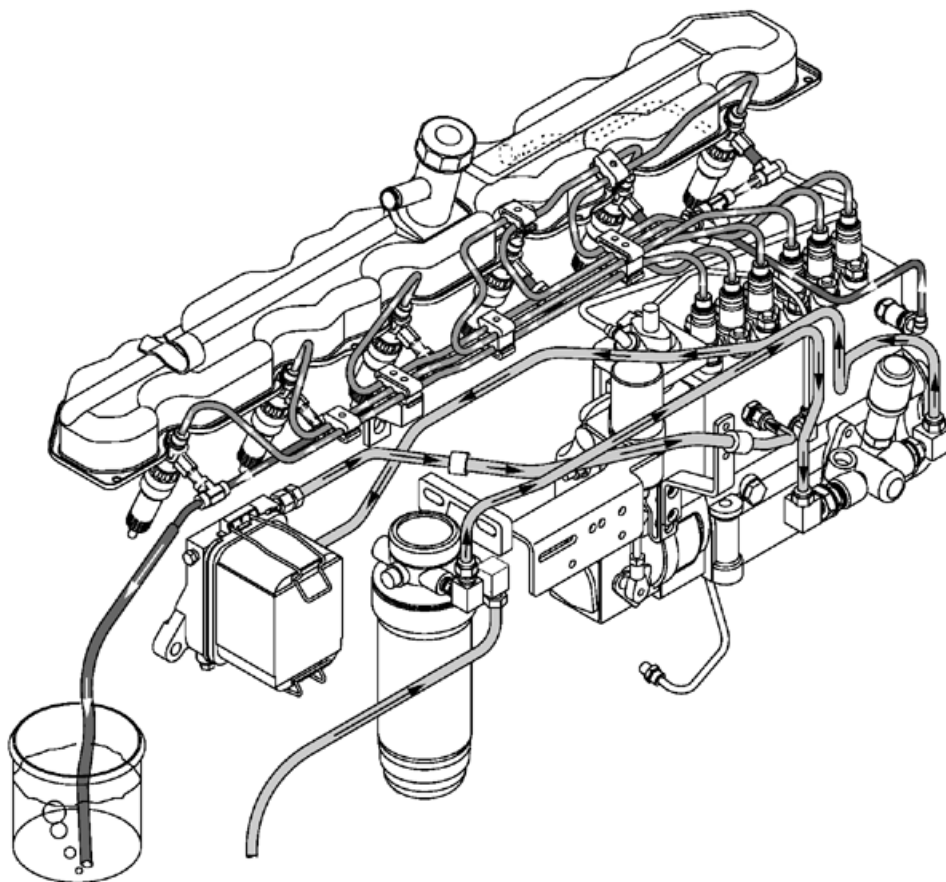
CAUTION: Maximum air pressure should be 100 kPa (1 bar) (15 psi) when performing this test.

5. Apply liquid soap and water solution to all joints and connections in the fuel system and inspect for leaks.

NOTE: Connections may allow air to enter the system without allowing fuel to leak out.

6. If any leaks are found, take necessary steps to repair.
7. Reconnect supply and return lines and prime system.
8. Start engine and run for approximately 10 minutes.
9. Allow engine to sit overnight and try starting the following morning.

Test for Air in Fuel



RG9705 -UN-04DEC98

Air in the fuel system will make the engine hard to start, run rough, misfire or produce low power. Additionally, it can cause excessive smoke and knocking.

Whenever the fuel system is opened for repair, it must be bled to remove any air that has entered the system.

1. Disconnect hose from end of fuel leak-off line assembly. Connect a hose to end of leak-off line assembly and place opposite end of hose in a suitable container filled with fuel as shown.
2. Operate engine and check for air bubbles in container. If bubbles are present, bleed the fuel

system and repeat test. See BLEED THE FUEL SYSTEM in this Group.

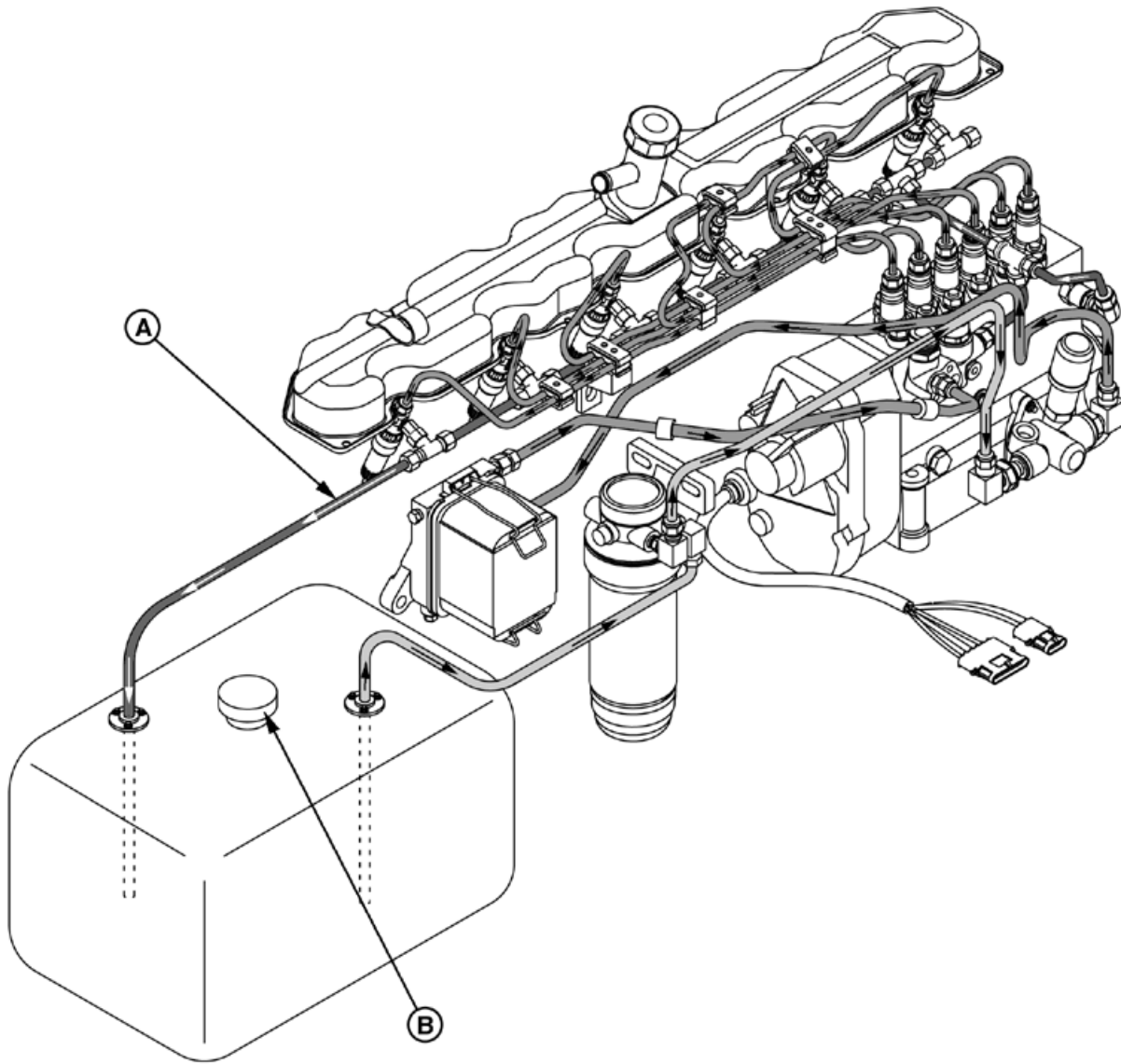
3. If bubbles are still present, check the following:

- Check for loose fuel fittings from the suction side of the fuel supply pump to the fuel tank to include all lines and filters.
- Check fuel tank suction tube (if equipped) and welded joints for cracks and holes.

Perform any necessary repairs, bleed fuel system and repeat test.

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Check for Restricted Fuel Return Line



A—Fuel Return Line

B—Fuel Tank Cap

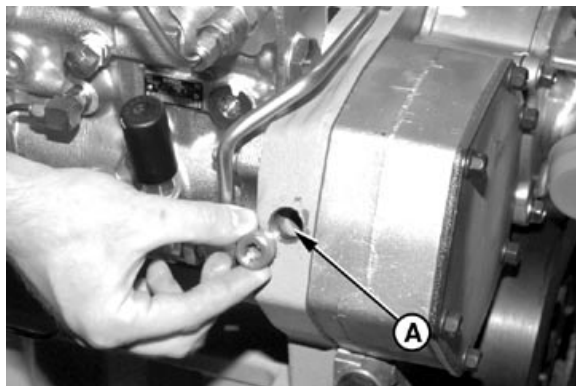
This check will help determine if the fuel return line is restricted.

1. Disconnect the fuel return line (A) from the fuel leak-off line at the engine.
2. Remove fuel tank cap (B).
3. Force compressed air through the fuel return line while listening at the fuel tank filler neck.
4. If the return line isn't restricted, the compressed air bubbling into the fuel tank should be audible through the tank filler neck.
5. If no air bubbling through the tank is audible, completely check the fuel return line for any possible restrictions.

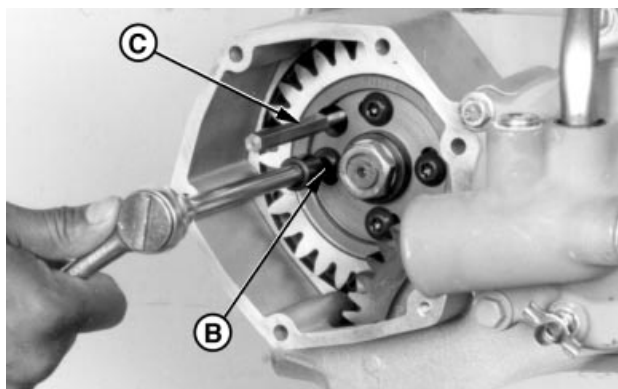
RC9706A -JUN-02FEB99

Check and Adjust Injection Pump Static Timing

1. Rotate engine flywheel (in normal running direction) until No. 1 piston is at "TDC" of it's compression stroke. At this point, JDE81-4 Timing Pin should enter hole in flywheel.
2. Remove timing hole plug (A).
3. Timing marks on injection pump drive hub and fixed pointer should be aligned. If timing mark on injection pump drive hub is not visible, remove JDE81-4 Timing Pin from flywheel and rotate engine (in normal running direction) one more revolution, and reinstall JDE81-4 Timing Pin in flywheel. Look again to see if timing mark aligns with fixed pointer.
4. If timing mark and fixed pointer are aligned, injection pump is correctly timed. If they don't align, remove injection pump drive gear cover and O-ring.
5. Loosen drive gear-to-pump hub cap screws (B) and rotate hub slightly until JDG866 Injection Pump Timing Pin (C) threads into drive hub and bottoms out.
6. Tighten drive gear-to-pump hub cap screws to specification.



RG9732 -UN-04DEC98



RG7740E -UN-02FEB99

Specification

Injection Pump Drive
 Gear-to-Pump Hub Cap Screws—
 Torque 61 N•m (45 lb-ft)

7. Remove JDG866 Injection Pump Timing Pin from injection pump hub.
8. Install injection pump drive gear cover using a new O-ring, if needed. Tighten cap screws to specification.

Specification

Injection Pump Drive Gear
 Cover—Torque 27 N•m (20 lb-ft)

9. Remove JDE81-4 Timing Pin from flywheel.

About This Group the Manual

This group of the manual contains necessary information to diagnose the electronic control system. Use this information in conjunction with the 8.1 L DIESEL ENGINES BASE ENGINE (CTM86) or 4.5 L & 6.8 L DIESEL ENGINES BASE ENGINE (CTM104).

See the CTM 86 or CTM 104 for:

- Removal of components
- Repair procedures
- Disassembly
- Inspection
- Assembly
- Base engine diagnostics and tests

Parts such as sensors, actuators, connectors, and wiring harnesses are serviceable and available.

IMPORTANT: Not under any circumstances, should the Engine Control Unit (ECU) be opened.

NOTE: Instruction is given throughout the diagnostic charts to make resistance and voltage measurements in the ECU connectors. Note that these measurements are always made in the harness end of the connector. Measurements should never be made in the ECU end of the connection.

Electrical Concept

Tests will include making measurements of voltage and resistance and making checks for open circuits and short circuits. An understanding of the following concepts is required to use the diagnostic procedures:

- Voltage (volts)
- Current (amps)
- Resistance (ohms)
- Open Circuit
- Short Circuit

DPSG,RG40854,34 -19-15DEC98-1/1

Electrical Circuit Malfunctions

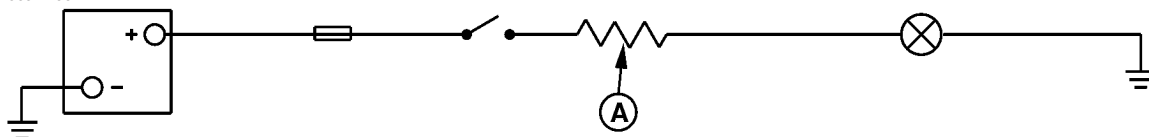
Circuit Malfunctions

There are four major circuit malfunctions. They are:

1. High-resistance circuit
2. Open circuit
3. Grounded circuit
4. Shorted circuit

DPSG,RG40854,37 -19-15DEC98-1/6

RG9891 -UN-06JAN99



A—Unwanted Resistance

Definition of Circuit Malfunctions

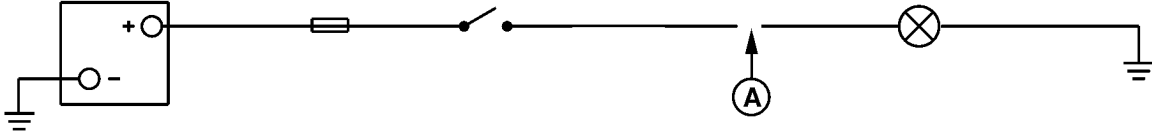
1. High Resistance Circuit:

A circuit having unwanted resistance (A) that causes a voltage drop and reduces current flow.

Continued on next page

DPSG,RG40854,37 -19-15DEC98-2/6

RG9892 -UN-06JAN99



A—Break or Separation in Circuit

2. Open Circuit:

A circuit having a break or a separation (A) that prevents current from flowing in the circuit.

DPSG, RG40854,37 -19-15DEC98-3/6

RG9893 -UN-06JAN99



A—Voltage Wire in Contact with Machine Frame

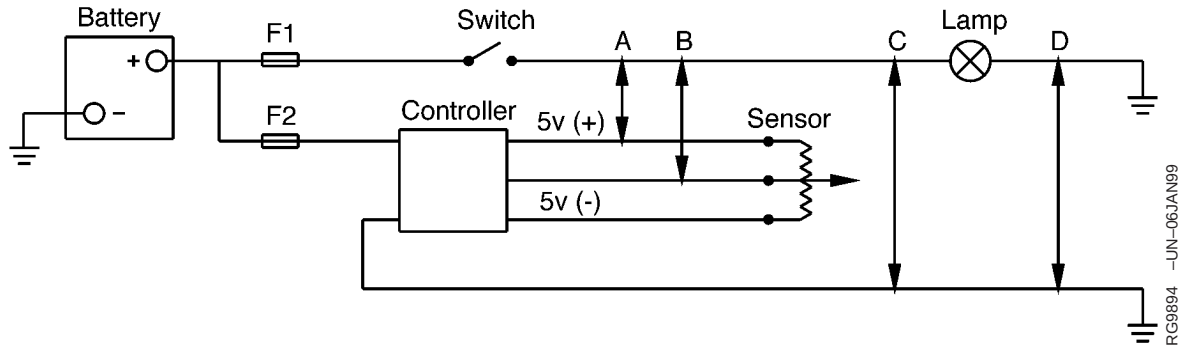
3. Grounded Circuit:

A voltage wire in contact with the machine frame (A), providing continuity with the battery ground terminal.

Continued on next page

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4. Shorted Circuit:

A wire-to-wire contact of two adjacent wires that provides unwanted continuity between the two wires. The following are types of short circuits:

- Voltage wire shorted to another voltage wire (wires of equal or unequal voltage).
- Voltage wire shorted to a sensor signal wire (wires of unequal voltage).
- Voltage wire shorted to a ground wire (wires of battery voltage or regulated voltage, shorted to a

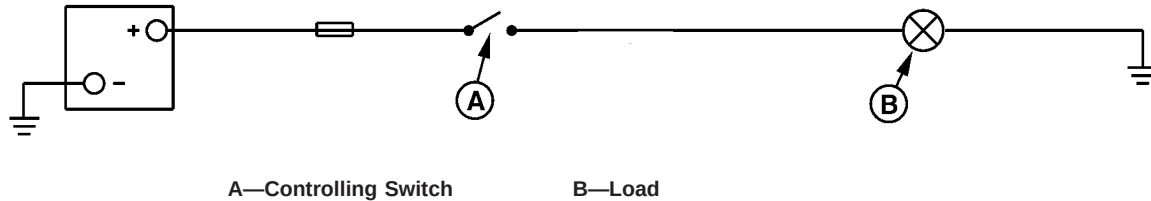
ground wire connecting a component to the battery negative terminal).

- Ground wire shorted to another ground wire (wires of zero voltage).

NOTE: This type of short does not create an observable malfunction. Therefore, no further explanation for trouble shooting is necessary.

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RG9895 -UN-06JAN99



Locations of Circuit Malfunctions:

In a “Simple Electrical Circuit” the circuit malfunctions occur at only three locations. They are:

1. Before the controlling switch (A).
2. Between the controlling switch (A) and the load (B).
3. After the load (B).

Electrical components can become faulty with the same four circuit malfunctions. Sometimes component malfunctions can easily be confused with circuit

malfunctions. Therefore, care must be exercised when isolating the cause of the problem.

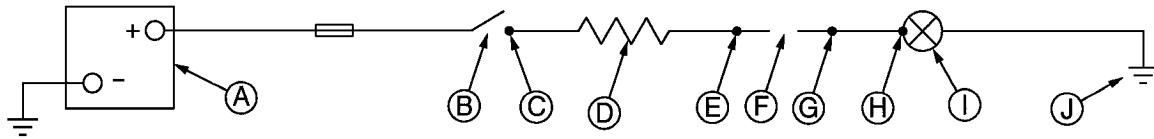
Example: A component may not operate before disconnecting an electrical connection, but it operates after reconnecting the connector.

Reason: Oxidation of the terminals created “High Resistance” and a voltage drop that prevents the proper amount of current flow to the component. Disconnecting and reconnecting the connector, removed some oxidation and re-established good continuity through the connector.

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Troubleshooting Circuit Malfunctions

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A—Battery

B—Switch

C—Component Terminal

D—Unwanted Resistance

E—Circuit Connector

F—Open Circuit

G—Circuit Connector

H—Component Terminal

I—Load (Lamp)

J—Ground

1. High Resistance Circuit:

A “High Resistance” circuit can result in slow, dim or no component operation (for example: loose, corroded, dirty or oily terminals, gauge of wire too small or broken strands of wire).

proper voltage at a location easily accessible between (C) and (H).

- If voltage is low, move toward the voltage source (A) to locate the point of voltage drop.
- If voltage is correct, move toward the load (I) and ground terminal (J) to locate the voltage drop.

2. Open Circuit:

An “Open” circuit results in no component operation because the circuit is incomplete (for example: broken wire, terminals disconnected, open protective device or open switch).

NOTE: The example shows high resistance (D) between (C) and (E) and the open circuit (F) between (E) and (G).

Do the following to isolate the location of a “High Resistance” or “Open” circuit:

- With the controlling switch (B) closed (on) and the load (I) connected into the circuit, check for

- Repair the circuit as required.

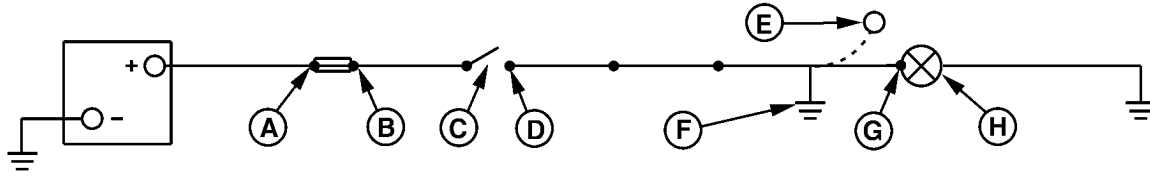
- Perform an operational check-out on the component after completing the repair.

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A—Fuse “A” Terminal
B—Fuse “B” Terminal

C—Switch
D—Component Terminal

E—Wire Terminal
F—Grounded Circuit

G—Component Terminal
H—Load (Lamp)

3. Ground Circuit:

A “Grounded” circuit (F) results in no component operation and the fuse or circuit breaker opens (for example: a power wire contacting the machine frame, chassis or component housing).

Do the following to isolate the location of a “Grounded” circuit:

- a. Switch (C) must be open (off). Check for continuity to ground between (B) and (C).
 - If there is continuity, there is a grounded circuit between (B) and (C). Repair the circuit.
 - No continuity, go to step b.

- b. Disconnect the load (H) at component terminal (G).

- c. With the controlling switch (C) open (off), check for continuity to ground between (D) and (E).

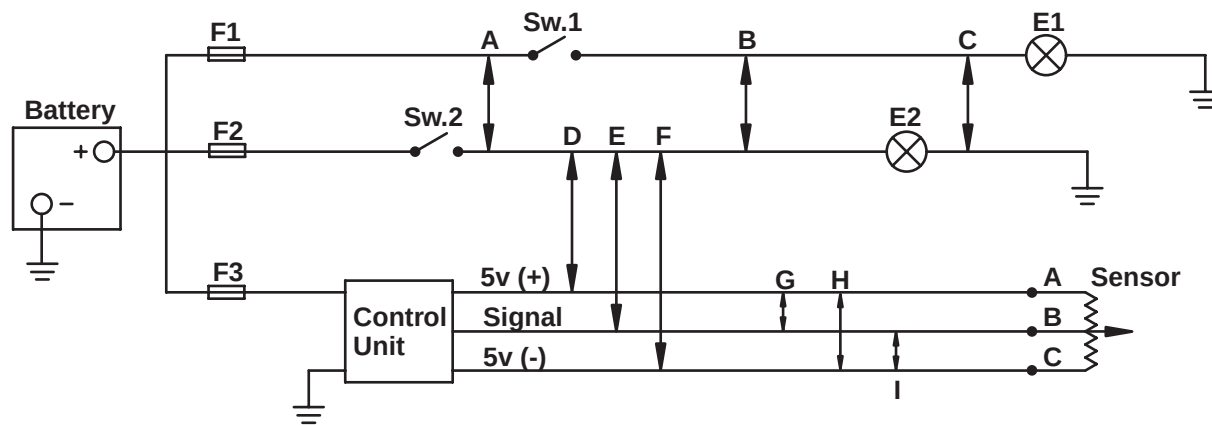
- If there is continuity, there is a grounded circuit between (D) and (E). Repair the circuit.

NOTE: The example is grounded between (D) and (E) at (F).

- Perform an operational check-out on the component after completing the repair.

Continued on next page

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RG11399 -UN-29NOV00

4. Shorted Circuit:

Machines equipped with several electronic control devices contain wiring harnesses that can become shorted by one of the following ways shown above.

1. Battery wire from fuse (F1) is shorted at (A) to another battery wire after switch (Sw.2).
 - Result: Lamp (E1) is on all of the time.
2. Battery wire from fuse (F1) is shorted at (B) to another battery wire after switches (Sw.1 & 2).
 - Result: Both lamps (E1 & E2) operate on either switch (Sw. 1 or 2).
3. Battery wire from fuse (F1) is shorted at (C) to a ground wire.
 - Result: Fuse (F1) opens after closing switch (Sw. 1)
4. Battery wire from switch (Sw. 2) is shorted at (D) to a regulated voltage wire.
 - Result: The sensor signal voltage is distorted.¹
5. Battery wire from switch (Sw. 2) is shorted at (E) to the sensor signal voltage wire.
 - Result: The sensor signal is distorted.¹
6. Battery wire from switch (Sw. 2) is shorted at (F) to the sensor ground wire.

- Result: Fuse (F2) opens after closing switch (Sw. 2) and the sensor signal is distorted.¹

7. Controller regulated voltage wire is shorted at (G) to the sensor signal voltage wire.
 - Result: The sensor signal is distorted.
8. Controller regulated voltage wire is shorted at (H) to the sensor ground wire.
 - Result: The sensor signal is distorted.¹
9. Sensor voltage wire is shorted at (I) to the sensor ground wire.
 - Result: The sensor signal is distorted.¹

Do the following to isolate a "Shorted Circuit:"

- a. Review the machine electrical schematic to identify the circuits for the component that does not operate.
- b. Disconnect the components at each end of the circuits, to single out the affected wires.
- c. To prevent damage to connector terminals, obtain mating connector terminals from repair parts. DO NOT force meter probes into connector terminals.

¹The sensor signal voltage goes out of range and a fault code may be restored. The controller may shut down or provide limited operation for its function.

d. Connect the meter leads across two of the affected circuits. The meter should show no continuity between the two circuits. Repeat the check across another combination of two circuits until all affected circuits have been checked.

e. Then, connect a meter lead to each affected circuit one at a time and touch the other meter leads to all terminals in the connector. The meter should show no continuity between any two circuits.

Example: A 37 pin connector contains three wires to a sensor. With one meter probe attached to each of the three wires, one at a time, touch the other meter probe to the remaining 36 wires. If there is continuity between any two wires, the circuit is shorted. Repair the circuit.

f. Alternate Method to Check for Shorted Circuit.

With the components disconnected at each end of the suspected circuits, turn the key switch on.

Connect one meter lead to a good frame ground. With the other meter probe, touch each of the suspected circuits one at a time. If there is a voltage reading, the circuit is shorted to another voltage wire. Repair the circuit.

g. Repair the "Shorted Circuit" as follows:

- Wires not in a loom: Wrap individual wires with electrical tape or replace the damaged wire and band as required.
- Wires in a loom: If hot spots exist in shorted area of the harness, replace the harness. If hot spots are not noticeable, install a new wire of proper gauge between the last two connections. Use tie bands to secure the wire to outside of the harness.

h. Perform an operational check-out on the component after completing the repair.

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Using a Digital Multimeter

It is recommended that a digital multimeter (JT07306 or equivalent with an analog display) be used to make the required measurements in the diagnostic procedures. A knowledge of the operation of the particular meter used is assumed.

Instructions for measuring voltages take the following form:

- Measure voltage from Point A (+) to Point (B) (-)

In this example, the positive test lead from the volt-ohm input of the meter should be connected to Point A and the negative test lead from the common input of the meter should be connected to Point B.

Unless otherwise stated, all voltage measurements are direct current (D.C.).

In making a resistance measurement, be careful to use the correct resistance range on the meter. Disconnect appropriate connectors or turn off key switch, as directed by diagnostic procedures later in this group.



Digital Multimeter

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Using the JT07349 Break-Out-Box (BOB)

The diagnostic procedures on the following pages are written such that diagnosis can be made using the JT07349 Break-Out-Box (BOB) [D] in conjunction with the JT07306 Digital Multimeter (or an equivalent multimeter).

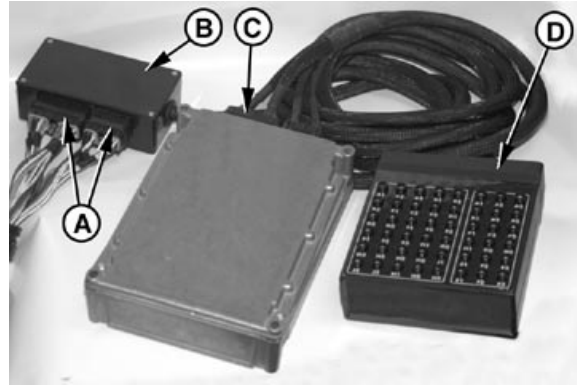
IMPORTANT: Make sure that probes are inserted into the BOB sockets that the diagnostic procedures instruct or engine control system circuitry may be damaged. NEVER install jumper wires between BOB sockets.

To use the JT07349 Break-Out-Box (BOB):

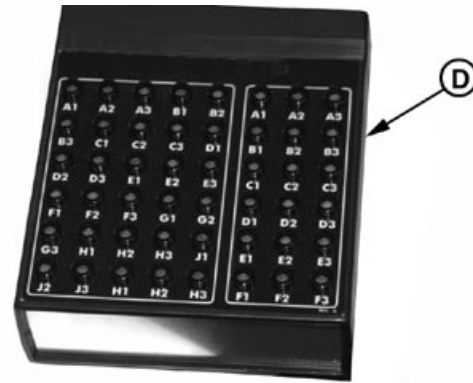
1. With the ignition OFF, disconnect the ECU connectors (A).
2. Connect the male end of the BOB connector (B) to the wiring harness.
3. Connect the female end of the BOB connector (C) to the ECU.

The BOB is now teed into the ECU wiring. The numbers on the face of the BOB (D) correspond to the individual ECU connector terminals. The diagnostic procedures will instruct voltage measurements to be made from certain positive (+) BOB sockets to certain negative (-) BOB sockets.

NOTE: If resistance measurements are made at the BOB, disconnect the BOB from the ECU or faulty readings may result.



ECU Connected to BOB



Break-Out-Box Display

A—ECU Connectors
B—Male End of BOB Connector
C—Female End of BOB Connector
D—JT07349 BOB

RG9820 -UN-11JAN99

RG9822 -UN-22JAN99

Determining Torque Curve Selection Using the Break-Out-Box (BOB)

The John Deere Level 3 ECU has the ability to operate multiple torque curves. Because of this capability, it is important to be able to monitor the selection with respect to the current conditions. In order to check that the engine is running on the correct torque curve at a specified condition:

1. Connect the BOB to the ECU and wiring harness. See USING THE JT07349 BREAK-OUT-BOX (BOB) earlier in this Group.
2. Recreate the specified condition.
3. Under this condition, measure voltage between the BOB pins with the multimeter.

NOTE: For all non-OEM applications, refer to vehicle manuals for pin information.

For OEM applications ONLY, measure voltage between pins:

- 30-way C1 (-)
- 30-way F2 (+)

4. Compare the observed voltage readings to the chart. See TORQUE CURVE SELECTION in Section 06 , Group 210 of this manual.

For OEM applications with John Deere Level 3 ECU, compare readings with the chart below:

Torque Curve Selection for OEM Applications		
Torque Curve on DST	Conditions	Voltage Value Between Torque Curve Select and Sensor Ground
0	High Power 224kW (300hp)	Greater than 4.25 volts
1	Medium Power 204kW (273hp)	3.0—4.0 volts
2	Low Power 187kW (250hp)	1.25—2.5 volts
3	High Power with 80% derate used for high MAT	Less than 0.9 volts

5. Determine if the selected torque curve corresponds with the conditions for each application listed. See TORQUE CURVE SELECTION in Section 06, Group 210.

NOTE: For OEM applications, the conditions that correspond with each torque curve are dependent on each specific application. Thus, they are not provided in this manual.

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Determining Governor Droop Mode Selection Using the Break-Out-Box (BOB)

The John Deere Level 3 ECU has the ability to operate multiple governor droop modes. Because of this capability, it is important to be able to monitor the selection with respect to the current conditions. In order to check that the engine is running on the correct governor droop mode at a specified condition:

1. Connect the BOB to the ECU and wiring harness. See USING THE JT07349 BREAK-OUT-BOX (BOB) earlier in this Group.
2. Recreate the specified condition.
3. Under this condition, measure voltage between the BOB pins with the multimeter.

NOTE: For all non-OEM applications, refer to vehicle manuals for pin information.

For OEM applications ONLY, measure voltage between pins:

- 30-way C1 (-)
- 18-way F2 (+)

4. Compare the observed voltage readings to the chart. See GOVERNOR DROOP MODE SELECTION in Section 06, Group 210 of this manual.

For OEM applications with the John Deere Level 3 ECU, compare readings with the chart below:

Governor Mode Selection for OEM (6081 A,H,T) Engines	
Governor Mode	Voltage Value
Normal	2.0 Volts or more
Isochronous	Less than 0.6 Volts

5. Determine if the selected governor droop mode corresponds with the conditions for each application listed. See GOVERNOR DROOP MODE SELECTION in Section 06, Group 210 of this manual.

NOTE: For OEM applications, the conditions that correspond with each governor droop mode are dependent on each specific application. Thus, they are not provided in this manual.

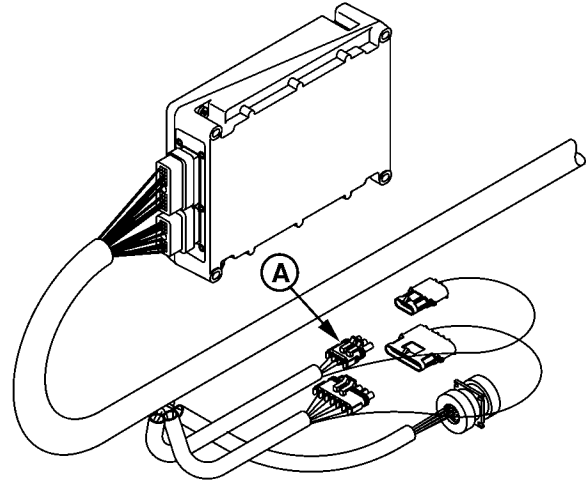
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Measuring Full Throttle Voltage Values Using Diagnostic Voltage Connector

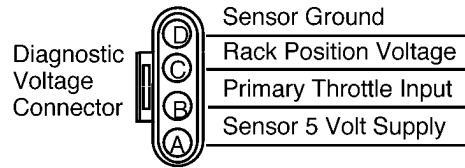
NOTE: Illustration shows location of diagnostic voltage connector on OEM engine applications. For location information on non-OEM engines, refer to machine manual.

For applications that use an analog throttle, a voltage reading can verify that full throttle has been reached. This can be done by measuring voltage at the diagnostic voltage connector (A). To measure full throttle voltage:

1. With the ignition ON, engine OFF, move the throttle to the full-throttle position.
2. Under this condition, using a multimeter, measure voltage between terminal B (+) and terminal D (-) in the diagnostic voltage connector.
3. Compare the observed voltage readings to the chart below for the appropriate application.



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RG10016 -JUN-09FEB99

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Full Throttle Input Voltage Value for Applications with Analog Throttle	
Application	Full Throttle Input Voltage Value
6650 Self-Propelled Forage Harvester	4.5 — 4.75 Volts
OEM (6081 A,H,T Engines)	4.0 — 4.75 Volts

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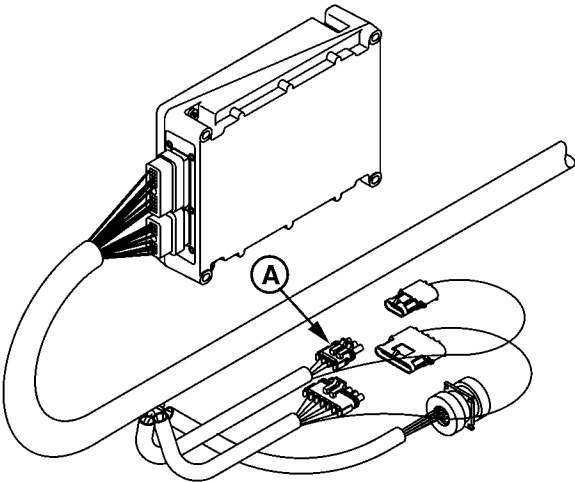
Measuring Rack Position Voltage Using the Diagnostic Voltage Connector

NOTE: Illustration shows location of diagnostic voltage connector on OEM engine applications. For location information on non-OEM engines, refer to machine manual.

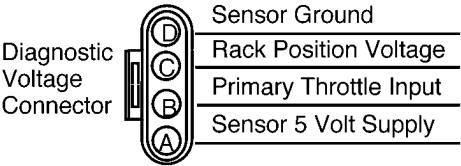
The rack position voltage, available for measurement at the diagnostic voltage connector (A), is useful diagnostic information on the electronic control system. The signal is proportional to the injection pump rack position and can, therefore, be used to determine if the control system is moving the rack to the proper range for a given set of operating conditions. The relationship between the rack position voltage and rack position (in mm) is as follows:
$$\text{Rack Position (mm)} = (\text{Rack Voltage} - 0.5) / 0.2$$

To measure rack position voltage, using a multimeter, measure voltage between terminal C (+) and terminal D (-) in the diagnostic voltage connector. The following table indicates what rack position voltages should be present for certain operating conditions:

Operating Condition	Rack Position Voltage
Ignition ON, engine OFF	0.4 — 0.6
Cranking, fuel temperature less than 10°C (50°F)	3.5 — 4.5
Cranking, fuel temperature greater than 10°C (50°F)	2.4 — 4.5
Full load, rated speed	2.3 — 2.9
Engine idling	1.0 — 1.5



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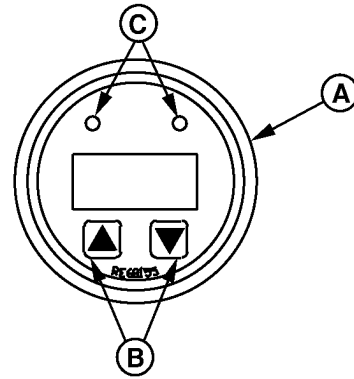
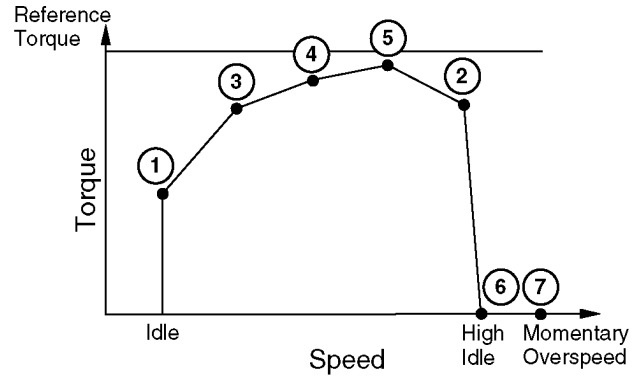
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Engine Configuration Data Parameters on Diagnostic Gauge

Accessing Engine Configuration Data Parameters:

1. Scroll through the main menu of engine parameters by pressing **either** the right or the left touch switch
2. Select “E-Config” sub-menu by **simultaneously** pressing the right and the left touch switch.
3. Scroll through the “E-Config” sub-menu to view Engine Configuration Parameters by pressing **either** the right or the left touch switch until desired parameter is found. The numbers next to the parameters correspond to the number on the graph.
4. In order to exit “E-Config” sub-menu, **simultaneously** press the right and left touch switch

A—Diagnostic Gauge
B—Touch Switches
C—Lights



RG11647 -19-19JAN01

RG10031 -JUN-28OCT99

Continued on next page

DPSG,OUOD007,2842 -19-21OCT99-1/2

Engine Configuration Parameter Description

Parameter Displayed on Diagnostic Gauge	Units	Description
Speed 1	RPM	Stationary low idle speed of engine which includes influences due to engine temperature and other stationary changes. This is point 1 on the engine configuration map.
Torque 1	%	Torque 1 equals the desired torque of the ECU divided by the reference torque.
Speed 2	RPM	Engine speed at point 2 of the engine configuration map. This is defined as the kick-in point for which torque is reduced to zero.
Torque 2	%	Torque 2 equals the desired torque of the ECU divided by the reference torque.
Speed 3	RPM	Engine speed at point 3 of the engine configuration map. Points 3, 4, and 5 are optional and can be located anywhere between points 1 and 2.
Torque 3	%	Torque 3 equals the desired torque of the ECU divided by the reference torque.
Speed 4	RPM	Engine speed at point 4 of the engine configuration map. Points 3, 4, and 5 are optional and can be located anywhere between points 1 and 2.
Torque 4	%	Torque 4 equals the desired torque of the ECU divided by the reference torque.
Speed 5	RPM	Engine speed at point 5 of the configuration map. Points 3, 4, and 5 are optional and can be located anywhere between points 1 and 2.
Torque 5	%	Torque 5 equals the desired torque of the ECU divided by the reference torque.
Speed 6	RPM	Engine speed of high idle.
Torque 6	%	Torque 6 equals the desired torque of the ECU divided by the reference torque.
Gov Gain	%	Equals the change of torque between points 2 and 6 divided by the change of engine speed between points 2 and 6.
Ref Torque	Nm (ft-lbs)	This parameter is the 100% reference value for all defined indicated engine torque parameters. It is only defined once and doesn't change if a difference engine torque map becomes valid.
Speed 7	RPM	The maximum engine speed above point 6 allowed by the engine control during a momentary high idle override. This duration is limited by the maximum momentary override time limit.
Time Limit	sec	The maximum time limit allowed to override the engine's high idle speed.
Lo Limit	RPM	The minimum engine speed that the engine will allow when operating in a speed control/limit mode.
Hi Limit	RPM	The maximum engine speed that the engine will allow when operating in a speed control/limit mode.
Low Limit	%	The minimum engine torque that the engine will allow when operating in a torque control/limit mode.
Hi Limit	%	The maximum engine torque that the engine will allow when operating in a torque control/limit mode.

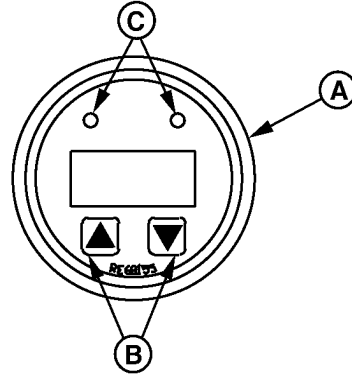
04
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DPSG,OUOD007,2842 -19-21OCT99-2/2

Viewing Active DTCs on Diagnostic Gauge

Accessing Active Diagnostic Trouble Codes (DTCs):

1. Scroll through the main menu of engine parameters by pressing **either** the right or the left touch switch
2. Select "SrvCodes" sub-menu by **simultaneously** pressing the right and the left touch switch.
3. Scroll through the "Srv Codes "sub-menu to view active DTCs by pressing **either** the right or the left touch switch until all codes are found.
4. In order to exit "SrvCodes" sub menu, **simultaneously** press the right and left touch switch



A—Diagnostic Gauge
B—Touch Switches
C—Lights

RG10031 -UN-28OCT99

DPSG,OUOD007,2842 -19-15NOV00-1/1

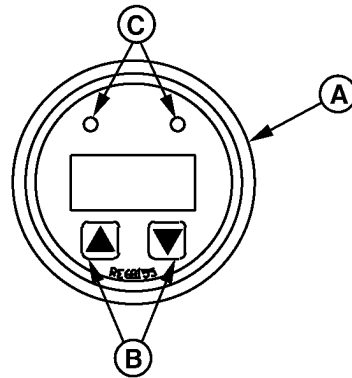
Viewing Stored DTCs on Diagnostic Gauge

Accessing Stored Diagnostic Trouble Codes (DTCs):

1. Scroll through the main menu of engine parameters by pressing **either** the right or the left touch switch
2. Select "DM2Codes" sub-menu by **simultaneously** pressing the right and the left touch switch.
3. Scroll through the "DM2Codes"sub-menu to view stored DTCs by pressing **either** the right or the left touch switch until all codes are found.

NOTE: If "No Data" is on the gauge, there are no stored codes.

4. In order to exit "DM2Codes" sub menu, **simultaneously** press the right and left touch switch



A—Diagnostic Gauge
B—Touch Switches
C—Lights

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

Clearing Stored DTCs on Diagnostic Gauge

Clearing Stored Diagnostic Trouble Codes (DTCs):

1. Scroll through the main menu of engine parameters by pressing **either** the right or the left touch switch
2. Select "DM2Codes" sub-menu by **simultaneously** pressing the right and the left touch switch.
3. Scroll through the "DM2Codes" sub-menu to view stored DTCs by pressing **either** the right or the left touch switch until all codes are found.

NOTE: If "No Data" is on the gauge, there are no stored codes.

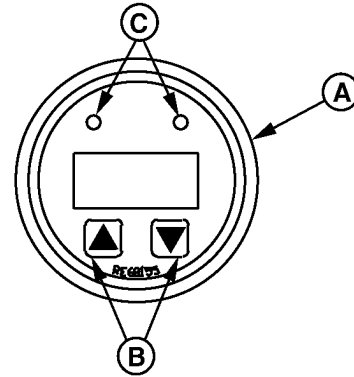
4. In order to clear codes, **simultaneously** press the right and left switch for at least 8 seconds.

NOTE: If the switches are held for less than 8 seconds, the sub menu will be exited.

5. If the display reads "*****", press the right switch for at least 8 seconds.

NOTE: If the switch is held for less than 8 seconds, the sub menu will be exited.

6. If the display reads "** Send * **DM3 **", the codes have been cleared.



A—Diagnostic Gauge
B—Touch Switches
C—Lights

RG10031 -JUN-28OCT99

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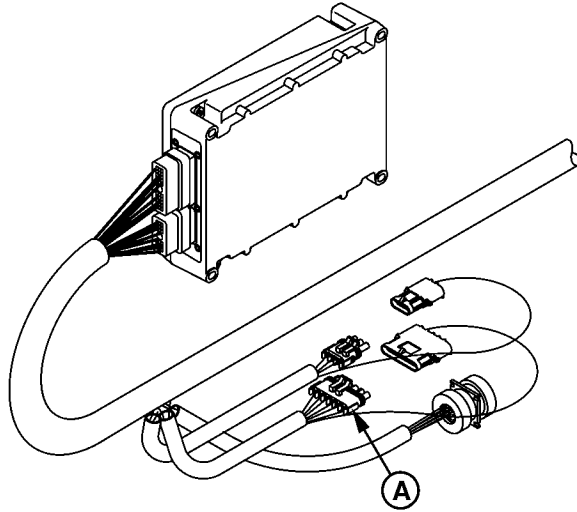
RG40854,000006A -19-22JUN01-1/1

Blinking DTCs Using the Diagnostic Code Reader Connector

NOTE: Illustration shows location of diagnostic code reader connector (A) on OEM applications. For location information on non-OEM engines, refer to machine manual.

On OEM applications that have a Fault Lamp, the ECU has the ability to display DTCs using blinking sequences of the fault lamp. To retrieve DTCs from the ECU using the "blink code" method:

NOTE: The ECU blinks the codes in 2-digit codes only. In order to convert the codes to SPN/FMI codes, see **LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) ON ECU** later in this Group.



RG10016A -UN-19FEB99

1. Locate and uncap the 6-way WEATHER PACK™ diagnostic reader connector (A).
2. Using a short piece of wire, jump terminals B and F in the diagnostic reader connector together.
3. Turn the ignition switch "ON".
4. The Fault Lamp will begin to flash a code number. For example, flash three times...short pause...flash two times...long pause. This example is code 32.
5. The ECU begins the flashing sequence by flashing a code 32, this indicates the start of blinking active codes. If there are any active DTCs, the ECU will flash it's 2-digit number. If there is more than one active DTC, the ECU will flash each code in numerical order. If there are no active DTCs, the Fault Lamp will flash a code 88.
6. Following the active codes, the Fault Lamp will flash a code 33, this indicates the start of blinking stored codes. If there are any stored DTCs, the Fault Lamp will flash it's 2-digit number. If there is more than one stored DTC, the ECU will flash each code in numerical order. If there are no stored DTCs, the Fault Lamp will flash a code 88.

7. Once complete, this sequence will repeat.
8. When complete, turn ignition "OFF", remove jumper wire, and recap the diagnostic reader connector.

As an example, if an engine had an active DTC 18 and stored DTC 53, the flashing sequence would be: flash three times...short pause...flash two times...long pause...flash one time...short pause...flash eight times...long pause...flash three times...short pause...flash three times...long pause...flash five times...short pause...flash three times.

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RG40854,000000E -19-20FEB01-2/2

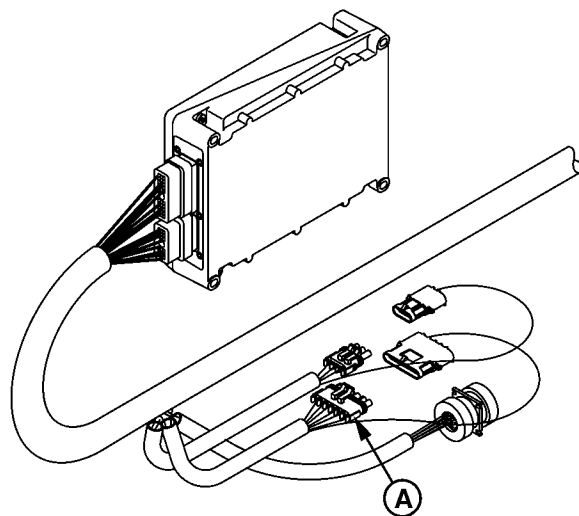
Clearing Stored Codes Using the Diagnostic Code Reader Connector

On OEM applications, the ECU has the ability to clear DTCs by following the method below:

1. Ignition OFF
2. Using 2 jumper wires, connect terminals B and F

NOTE: Step 4 must be done right after step 3 in order for the codes to be cleared.

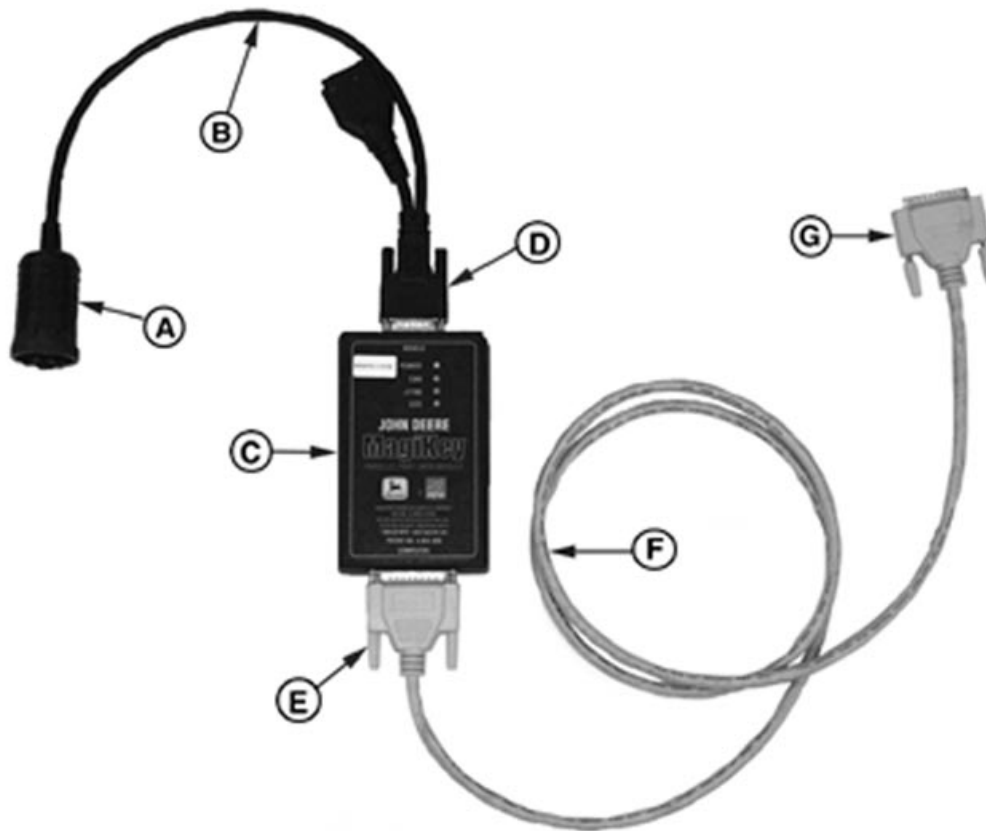
3. Ignition ON, engine OFF
4. With terminals B and F still connected, connect a jumper wire from F to C.
5. Ignition OFF
6. Remove jumper wires



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RG40854,000000F -19-22JUN01-1/1

Connecting to Diagnostic Scan Tool (DST) or SERVICE ADVISOR™



Connecting to the DST or SERVICE ADVISOR™

A—Diagnostic Connector Mate
B—John Deere Controller Cable

C—MagiKey
D—26 Pin MagiKey Connector

E—25 Pin MagiKey Connector
F—PC Cable

G—PC Connector

DS10023 ECU Communication Hardware Kit or JDIS121 - ECU Communication Hardware Kit is required to connect the DST or SERVICE ADVISOR™ to the ECU. Please refer to your John Deere Dealer website for obtaining the latest version of software.

The diagnostic connector is a black, circular connector with a square mounting flange and a dust cap. There are nine available pins. Depending on application, the location of the diagnostic connector may vary. On OEM the connector is located near the ECU on the engine wiring harness.

1. Locate diagnostic connector on engine and remove dust cap.

2. Connect John Deere Controller Cable (B) to the diagnostic connector on the engine harness using the diagnostic connector mate (A).
3. Connect the other end of the John Deere Controller Cable (B) to the MagiKey (C) module at the 26 pin MagiKey connector (D).
4. Connect the PC cable (F) to the MagiKey (C) module at the 25 pin MagiKey connector (E).
5. Connect the PC cable (F) to the computer with the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™ installed through the PC connector (G).
6. Key ON, engine off or running, verify that power light on MagiKey is illuminated green.
7. Start the diagnostic software and select the appropriate application.

RG11737A -UN-18MAY01

8. Connect to the application. The CAN light on the MagiKey should illuminate red when the connection to the ECU is made.
9. If DST or SERVICE ADVISOR™ does not connect see D1 - ECU DOES NOT COMMUNICATE WITH

- DST OR SERVICE ADVISOR™ DIAGNOSTIC
PROCEDURE in Group 150 of this manual.
10. Replace the dust cap on the diagnostic connector.

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Data Parameter Description

Following is a list of the data parameters that can be read on the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.

Parameter	Units	Description
Injection Pump Speed Sensor	rpm	The speed of the injection pump. This should be 1/2 the speed of the engine speed sensor
Engine Coolant Temperature	°C (°F)	Engine Coolant Temperature value. <i>NOTE: If there is an active fault for the ECT circuit, the ECT value displayed will be the "limp-home" value.</i>
Engine Speed	rpm	The speed that the engine speed sensor detects the crankshaft to be moving at.
Fuel Temperature	°C (°F)	<i>NOTE: If there is an active fault for the fuel temperature circuit, the fuel temperature value displayed will be the "limp-home" value.</i>
Actual Rack Position	mm	The rack position sensor determines where the rack is at a given point in time. The ECU converts voltage into the position value.
Fuel Commanded	mg/stroke	Desired fuel that the ECU determines to be necessary at given conditions
Commanded Rack Position	mm	The position that the ECU determines the rack should be in to give the engine the necessary amount of fuel for given conditions.
Intake Manifold Temperature	°C (°F)	Manifold Air Temperature value.
Fuel Limit	mg/stroke	The maximum amount of fuel that the ECU can command for given conditions.
Percent Throttle	%	Displays percentage of full throttle that the ECU is reading.
Engine Speed Sensor	rpm	The speed that the engine speed sensor detects the crankshaft to be moving at.
Torque Curve Number	N/A ^a	On some applications, the ECU limits the max fuel on multiple torque curves. This displays the torque curve the ECU is currently using to limit maximum fuel. The torque curve is dependent on application. See TORQUE CURVE SELECTION in Section 06, Group 210 of this manual.
Percent of Max. Allowed Fuel	%	The percent load of the load for a given torque curve at a given engine speed.
Desired Speed Governor	N/A ^a	The mode selected is dependent on the application. See GOVERNOR DROOP MODE SELECTION in Group 210 of this manual.
Maximum Speed Governor	N/A ^a	The mode selected is dependent on the application. See GOVERNOR DROOP MODE SELECTION in Section 06, Group 210 of this manual.

^aN/A = Not Applicable

Reprogramming Engine Control Unit (ECU)

John Deere Ag and Construction dealers are able to reprogram ECUs using SERVICE ADVISOR™. See REPROGRAMMING ENGINE CONTROL UNIT USING SERVICE ADVISOR later in this Group.

OEM Distributors are able to to reprogram ECUs using Diagnostic Scan Tool (DST). See REPROGRAMMING ENGINE CONTROL UNIT USING DST later in this Group.

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Downloading Payload File For DST

IMPORTANT: The Engine Serial Number (ESN) for the engine that this instruction is to be performed on is required for downloading the proper payload file.

NOTE: An Internet connection will be needed for steps 1 - 12.

1. Start Internet browser (Internet Explorer version 5.5 or later).

RG41221,0000097 -19-04NOV02-1/11



Web Address

2. In the address line (A) type in "http://sds.deere.com" and press the "Enter" key. Log in as required.

Continued on next page

RG41221,0000097 -19-04NOV02-2/11

Menu	Description	Action
HELP	The ECU Software Delivery System (SDS) is designed to support remote programming of ECUs. To download an ECU payload, click on the Download button.	Download
LOG OFF		☒
SDS HOME	A valid license is required to program an ECU. To validate an existing license or get a new license, click the License button.	License
		☒

RG12629 -19-19SEP02

Obtaining Valid License

Menu	Description
HELP	License information required for programming an ECU is being validated. Please wait...
LOG OFF	
SDS HOME	

RG12630 -19-19SEP02

Validating License

NOTE: Steps 3 - 5 only need to be completed the first time this instruction is performed.

permissions. Click on "License"(B). A screen will appear while validating license.

3. A license file is required for each computer that will reprogram ECUs. Download the license file to gain

RG41221,0000097 -19-04NOV02-3/11



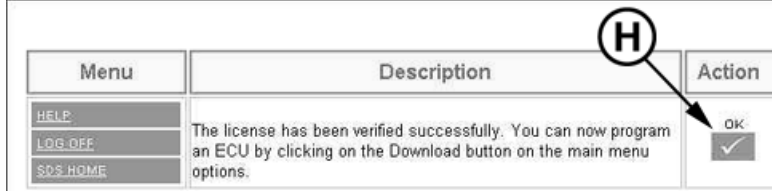
RG12613 -19-20SEP02

Grant Always Screen

4. Click on "Grant Always" (G).

Continued on next page

RG41221,0000097 -19-04NOV02-4/11

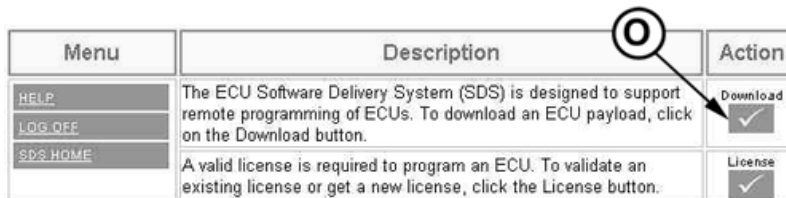


RG12631 -19-19SEP02

Verification Successful

- Click "OK" (H) when license verification has completed.

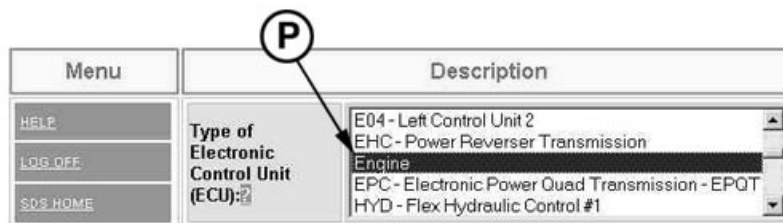
RG41221,0000097 -19-04NOV02-5/11



RG12579 -19-06SEP02

- Click on "Download" button (O). A screen will appear as the system verifies that a valid license file is present.

RG41221,0000097 -19-04NOV02-6/11



RG12632 -19-19SEP02

Selecting Engine for ECU Type

- Scroll down and click on "Engine" (P).

Continued on next page

RG41221,0000097 -19-04NOV02-7/11

Menu	Description		Action
HELP	Engine Serial Number: ²	(e.g. RG6081H144792)	Download ☐
LOG OFF	Replacing the ECU? ² (if so, enter the new, replacement ECU serial number e.g. 110112)	☐ Yes	
SDS HOME			

RG12618 -19-18SEP02

Enter Engine Serial Number (ESN)

8. Click once in the ESN text box (Q) so the cursor is in the box. Type in the ESN into the text field. If you are replacing the current ECU, GO TO 9. If you are

reprogramming the existing ECU, click "Download" (R) and GO TO 11.

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Menu	Description		Action
HELP	Engine Serial Number: ²	RG6081H200029	Download ☐
LOG OFF	Replacing the ECU? ² (if so, enter the new, replacement ECU serial number e.g. 110112)	☒ 110112	
SDS HOME			

RG12701A -19-14OCT02

Replacing ECU

9. If the current machine is being replaced, check the "Replacing the ECU" box (E).

current ECU, the software will tie the engine serial number to the new ECU serial number.

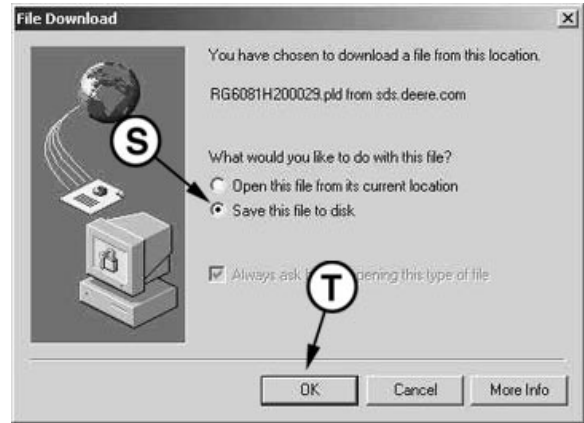
NOTE: Sometimes the original ECU will not be available for reprogramming. When a new ECU is being programmed to replace the

10. Enter in the new ECU's serial number (F) located on the ECU label and click "Download".

Continued on next page

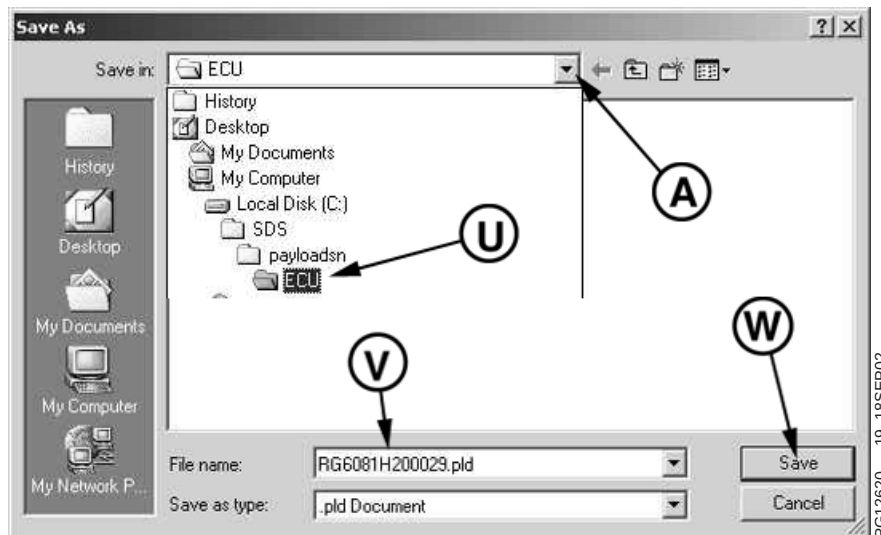
RG41221,0000097 -19-04NOV02-9/11

11. In the "File Download" window ensure that the "Save this file to disk" button (S) is selected and click "OK" (T).



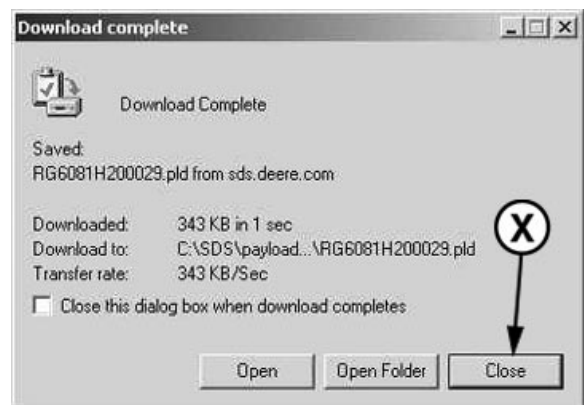
File Download

RG41221,0000097 -19-04NOV02-10/11



Save As Window

12. The "Save As" window will appear. The file must be saved in "C:\SDS\PAYLOADS\IECU" folder. Click on the pull down menu arrow (A) and navigate to the ECU folder (U). Ensure that file name (V) is the correct number and click "Save" (W). When the file has been successfully downloaded the "Download Complete" window will appear, click "OK" (X). Close the Internet browser.



Download Complete

RG41221,0000097 -19-04NOV02-11/11

Reprogramming Engine Control Unit (ECU) With DST

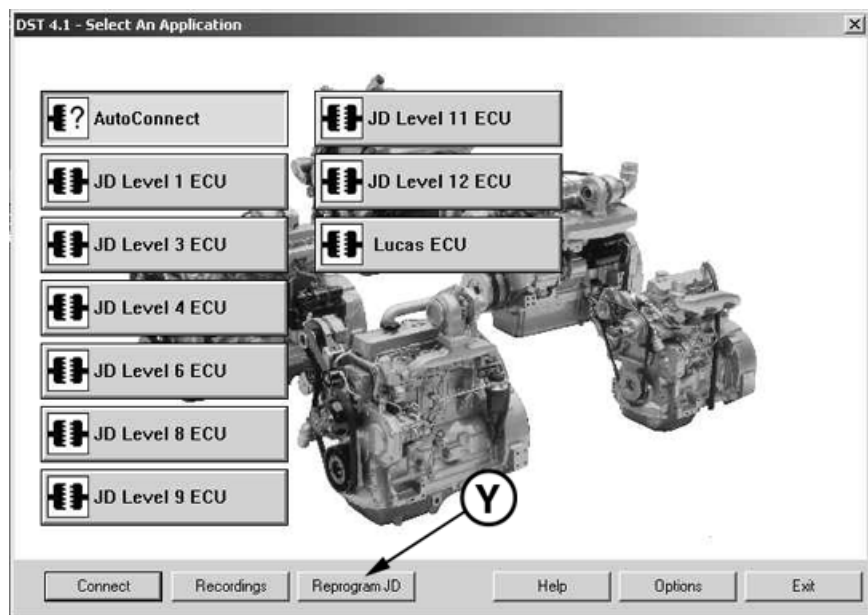
IMPORTANT: Diagnostic Scan Tool (DST) Version 4.1 or later must be installed prior to performing the following instructions.

NOTE: Internet connection is not required to program an engine control unit.

1. If payload file has not been downloaded to computer, download now. See DOWNLOADING PAYLOAD FILE FOR DST earlier in this Group.
2. Ignition ON, engine OFF.
3. Connect computer with DST to the Diagnostic Connector on the engine.

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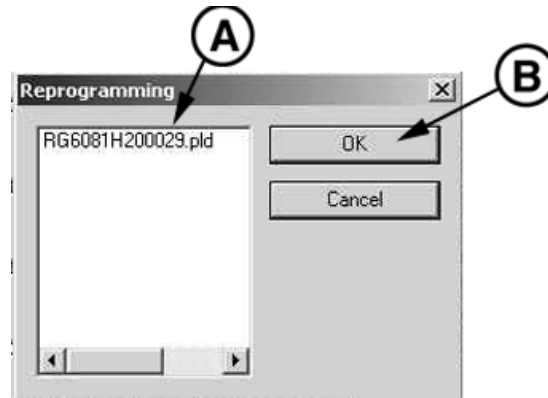
DST Main Screen

4. Start the DST software. Click on “Reprogram JD” (Y).

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RG41221,0000098 -19-04NOV02-2/9

5. Click on the proper payload (A) and click OK (B).

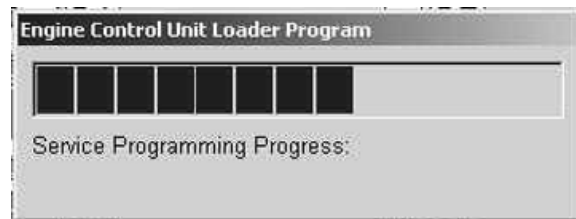


Selecting Payload file for Reprogramming

RG12623 -19-18SEP02

RG41221,0000098 -19-04NOV02-3/9

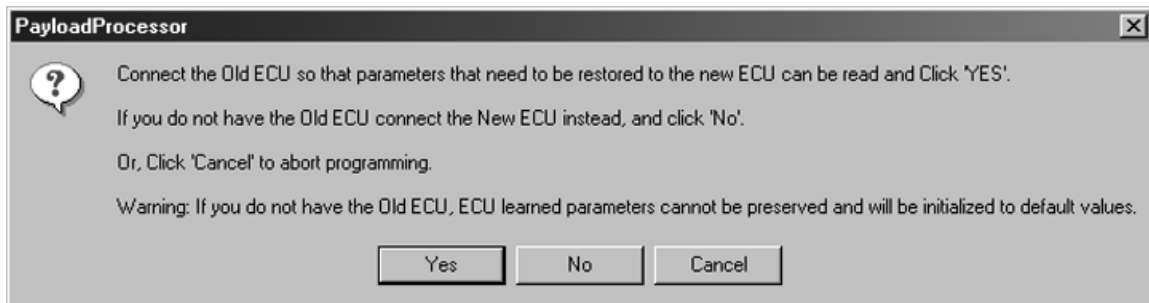
6. A progress bar will appear while reprogramming the ECU. If the engine is equipped with warning alarms, these may come on while in process of reprogramming and should be ignored.



Status Bar

RG12624 -19-18SEP02

RG41221,0000098 -19-04NOV02-4/9



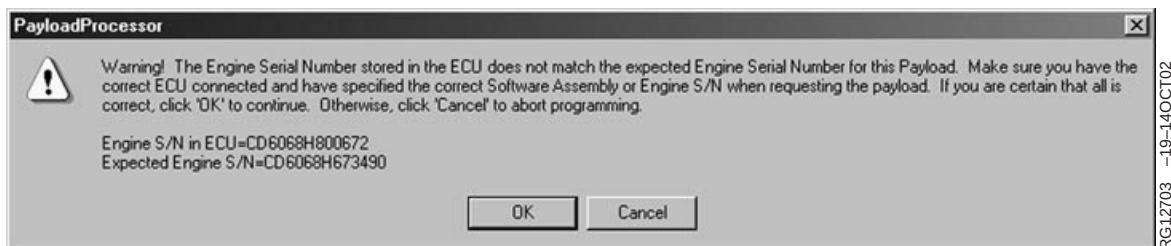
RG12702 -19-11OCT02

7. If the ECU is being replaced, the above message will appear. If you have the old ECU, connect to it

and click YES. If the old ECU is not available, click NO.

Continued on next page

RG41221,0000098 -19-04NOV02-5/9



8. If the ECU is being replaced, the software will notice that the engine serial number does not match the ECU serial number. This message lets

the user know that the ECU expects a different engine serial number to match its ECU serial number. Click "OK" to continue.

RG41221,0000098 -19-04NOV02-6/9

9. When reprogramming the ECU has been successfully completed, the Payload Processor window will appear. Click "OK".



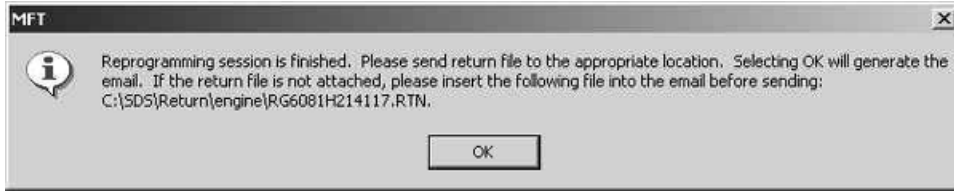
Payload Processor Completed

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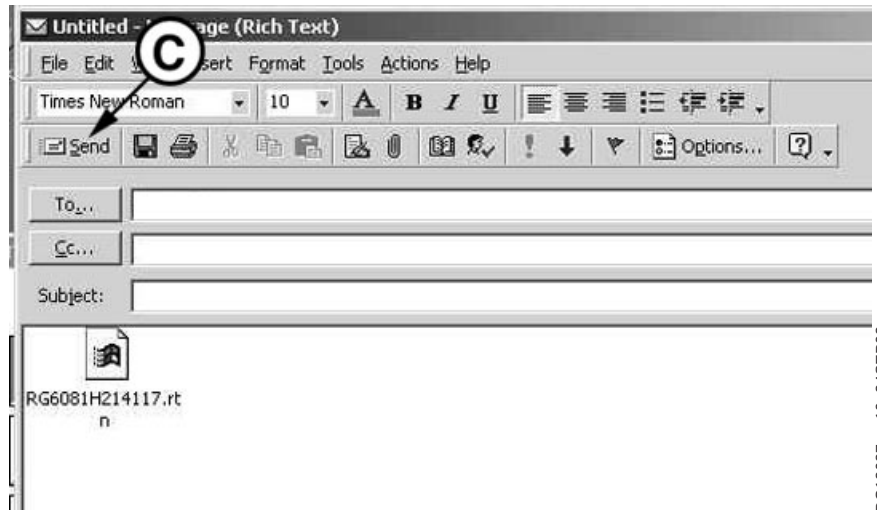
RG41221,0000098 -19-04NOV02-7/9

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RG12626 -19-18SEP02



Return File Message



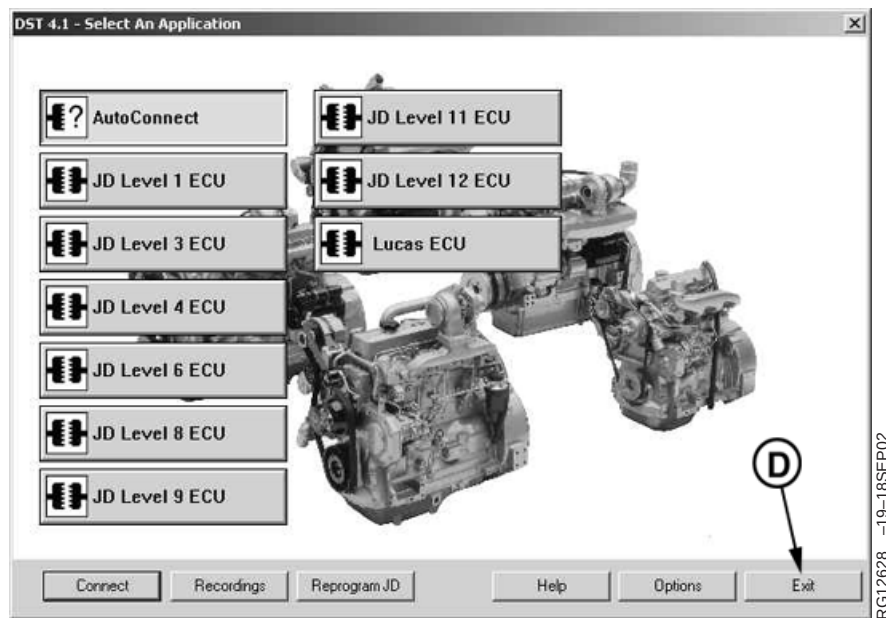
Automatic E-mail Generated

10. A return file is created when reprogramming an ECU is completed. The MFT window will appear showing the return file to send back. Click "OK". This will automatically generate an E-mail

message with the proper E-mail address. Click "Send" (C). The next time the mail application is connected to the mail server the message will be sent.

Continued on next page

RG41221,0000098 -19-04NOV02-8/9



Exit DST Software

11. Once the E-mail has been successfully sent, click "Exit" (D) to close DST.
12. Disconnect computer from diagnostic connector and start engine to ensure proper operation.

RG41221,0000098 -19-04NOV02-9/9

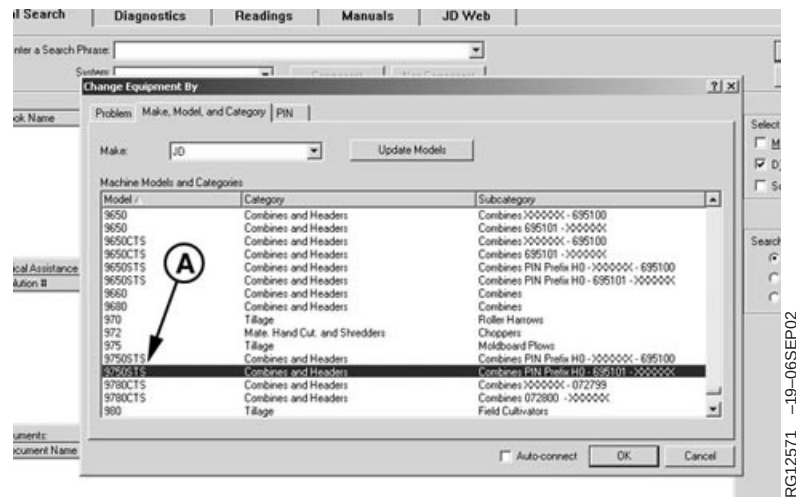
Downloading Payload File For SERVICE ADVISOR™

NOTE: An Internet connection will be needed for steps 1 - 15.

1. Start SERVICE ADVISOR™

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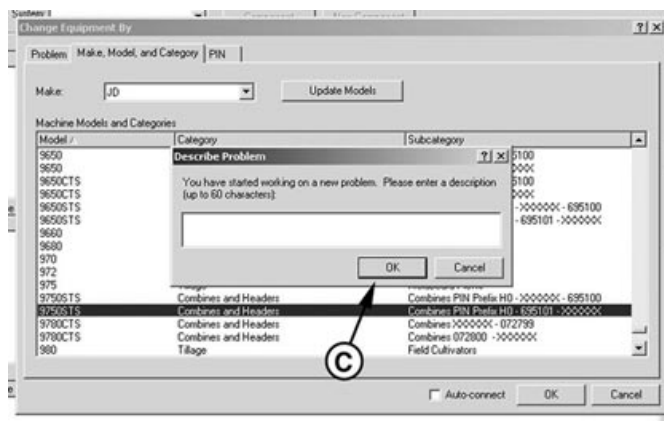
RG41221,0000094 -19-04NOV02-1/16



2. Select vehicle model (A) with the proper serial number range or if PIN is known select the PIN tab and enter PIN number. Click OK.

Continued on next page

RG41221,0000094 -19-04NOV02-2/16



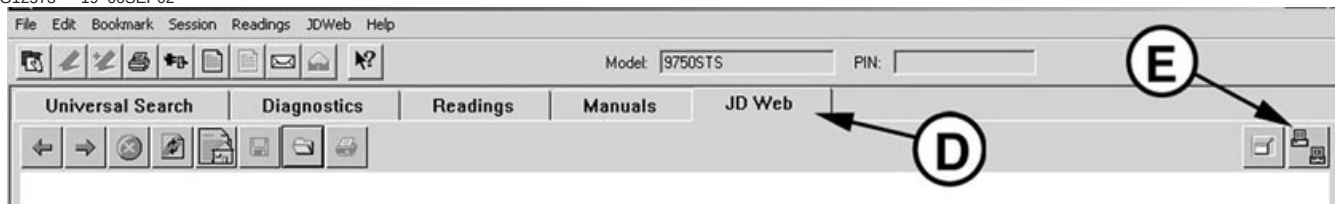
RG12572 -19-06SEP02

3. Describe Problem window will appear, click OK (C).

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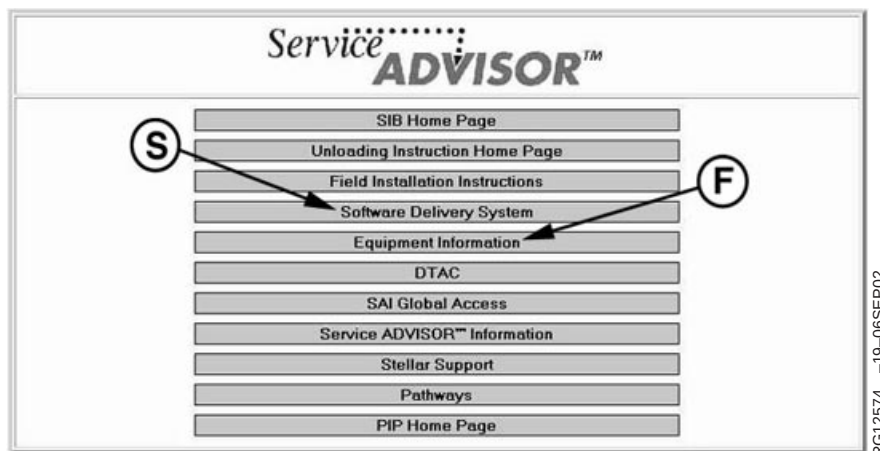
RG12573 -19-06SEP02



4. Click on "JD Web" tab (D). In the upper right hand corner click on "Connect to Network" button (E). Select network connection type and click OK.

Continued on next page

RG41221,0000094 -19-04NOV02-4/16



RG12574 -19-06SEP02

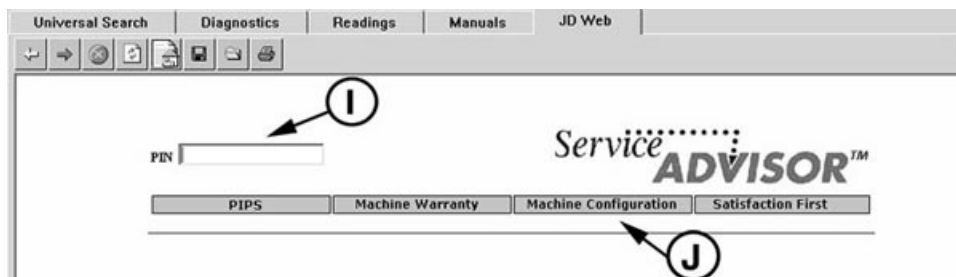
NOTE: Menu options may vary on the SERVICE ADVISOR™ menu.

to step 10. With the PIN number only available click on "Equipment Information" (F) button.

5. If the Engine Serial number (ESN) is available click on "Software Delivery System" button (S) and skip

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RG12575 -19-06SEP02

6. Enter PIN number (I) if not already filled in, and select "Machine Configuration" (J). Equipment detail

information for this vehicle will appear on the screen.

Continued on next page

RG41221,0000094 -19-04NOV02-6/16

Major Components

Row(s) returned: 11

Status	Serial Number	Component	Install Date (YYYY-MM-DD)
O	CEGB3TT103875	GEAR BOX	2001-12-17
O	CETM3HU106470	TRANS	2001-12-17
O	HOGW001133562	MOIST	2001-12-17
O	PGT02C261227	RCVR	2001-12-17
O	PCGU02E101415	DSPLAY	2001-12-17
O	PCGV02D114500	MAP	2001-12-17
O	RG6081H201773	6081HF ENG	2001-12-17
O	1001043355	TRANS,HYD	2001-12-17
O	1101049865	PUMP,H,YD	2001-12-17
O	2034U	MOTOR,H,FD	2001-12-17
O	2037U	MOTOR,H,FD	2001-12-17

RG12576 -19-06SEP02

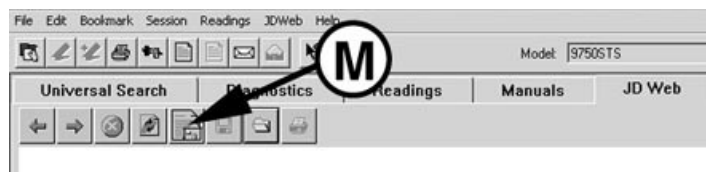
7. Hold left mouse button down and drag across the ESN so that it is highlighted. Click the right mouse

button and select "Copy" (L) or record the ESN for later use.

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8. Click on the "Home" button (M) within SERVICE ADVISOR™ to go back to the menu.

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9. Click on "Software Delivery System" button (S). Login if necessary.



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Continued on next page

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SDS - Software Delivery System

Menu	Description	Action
HELP	The ECU Software Delivery System (SDS) is designed to support remote programming of ECUs. To download an ECU payload, click on the Download button.	Download
LOG OFF		✓
SDS HOME	A valid license is required to program an ECU. To validate an existing license or get a new license, click the License button.	License
Service ADVISOR™		✓

(B)

RG12612 -19-06SEP02

Obtaining Valid License

SDS - Software Delivery System

Menu	Description
HELP	License information required for programming an ECU is being validated. Please wait...
LOG OFF	
SDS HOME	
Service ADVISOR™	

RG12614 -19-06SEP02

Validating License

SDS - Software Delivery System

Menu	Description	Action
HELP	The ECU Software Delivery System (SDS) is designed to support remote programming of ECUs. To download an ECU payload, click on the Download button.	Download
LOG OFF		
SDS HOME		
Service ADVISOR™		

(C)

RG12616 -19-06SEP02

Figure B

NOTE: Steps 10 - 12 only need to be completed the first time this instruction is performed.

10. A license file is required for each computer that will reprogram ECUs. Download the license file to

gain permissions. Click on "License" (B). A screen will appear while validating license. If the screen appears as "Figure B" allowing the option to download only, then skip to Step 13.

Continued on next page

RG41221,0000094 -19-04NOV02-10/16

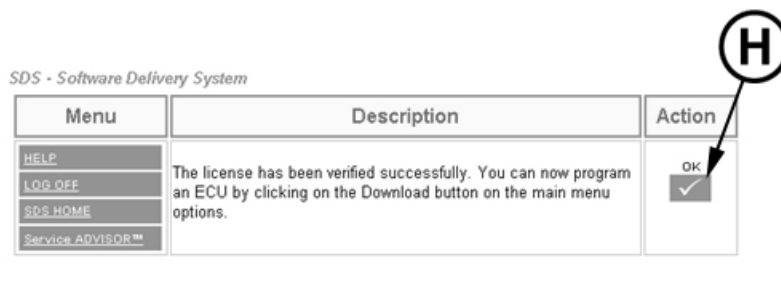


RG12613 -19-20SEP02

11. Click on "Grant Always" (G).

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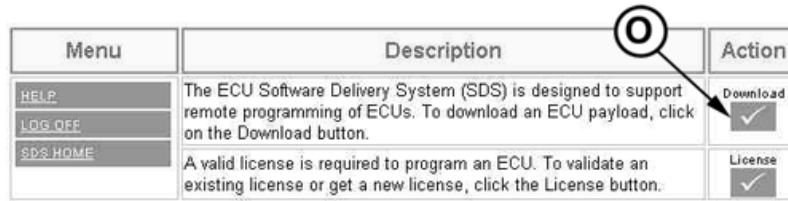


RG12615 -19-06SEP02

12. Click "OK" (H) when license verification has been completed.

Continued on next page

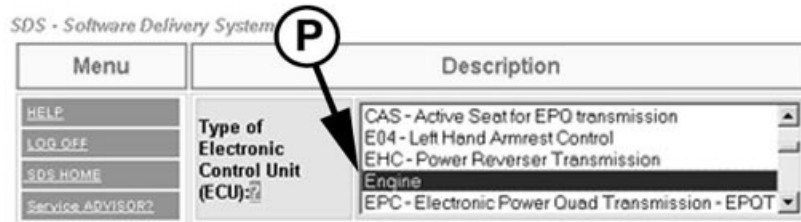
RG41221,0000094 -19-04NOV02-12/16



RG12579 -19-06SEP02

13. Click on "Download" button (O). A screen will appear as the system verifies that a valid license file is present.

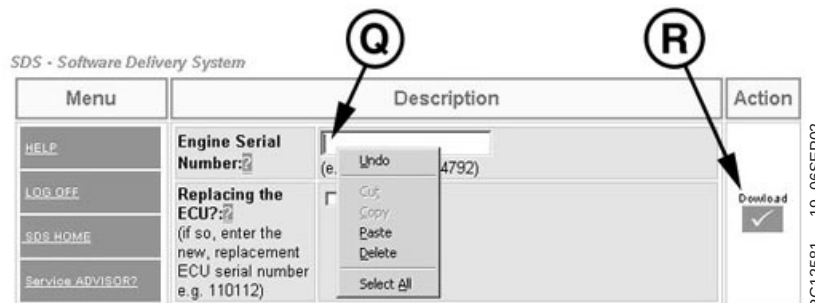
RG41221,0000094 -19-04NOV02-13/16



RG12580 -19-06SEP02

14. Scroll down and click on "Engine" (P).

RG41221,0000094 -19-04NOV02-14/16



RG12581 -19-06SEP02

15. Click once in the ESN text box (Q) so the cursor is in the box. Type in the ESN or Right click and select "Paste" to copy the ESN into the text field.

If you are replacing the ECU, go to step 16. If you reprogramming the existing ECU, click "Download" (R) and go to step 18.

Continued on next page

RG41221,0000094 -19-04NOV02-15/16

Menu	Description		Action
HELP	Engine Serial Number:?	RG6081H200029	 Download
LOG OFF	Replacing the ECU?:?	☒	
SDS HOME	(if so, enter the new, replacement ECU serial number e.g. 110112)	110112	

RG12701A -19-14OCT02

Replacing ECU

16. If the current machine is being replaced, check the "Replacing the ECU" box (E).

IMPORTANT: Service ADVISOR™ software must be closed and reopened prior to programming the ECU.

NOTE: Sometimes the original ECU will not be available for reprogramming. When a new ECU is being programmed to replace the current ECU, the software will tie the engine serial number to the new ECU serial number.

18. After downloading the ECU payload to the computer, exit SERVICE ADVISOR™

17. Enter in the new ECU's serial number (F) located on the ECU label and click "Download".

04
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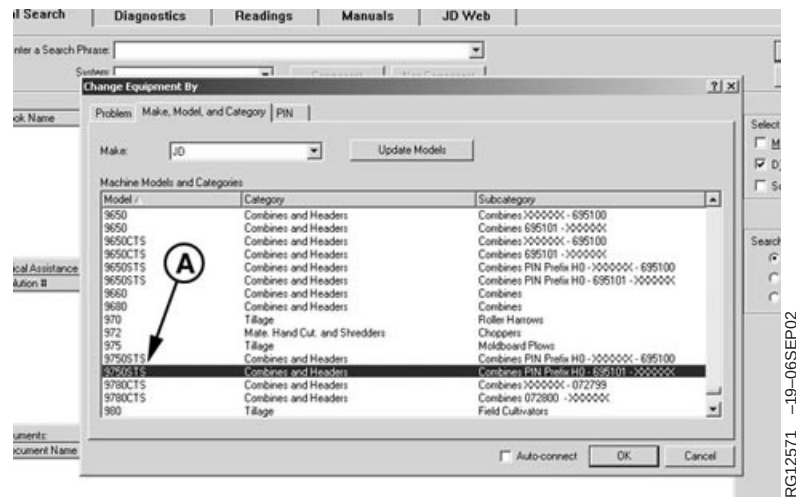
Reprogramming Engine Control Unit (ECU) With SERVICE ADVISOR™

IMPORTANT: Ignition ON, engine OFF.

Connect computer with SERVICE ADVISOR™ to the Diagnostic Connector in the cab or on the engine.

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RG41221,0000099 -19-04NOV02-1/8



NOTE: Internet connection is not required to program an engine control unit.

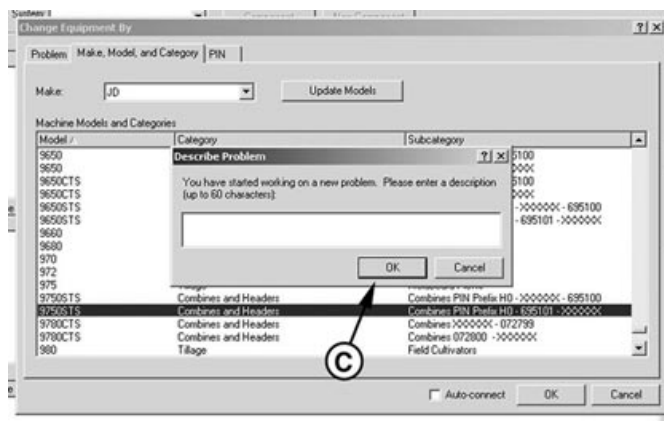
known select the PIN tab and enter PIN number. Click OK.

1. Start SERVICE ADVISOR™. Select vehicle model (A) with the proper serial number range or if PIN is

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Continued on next page

RG41221,0000099 -19-04NOV02-2/8

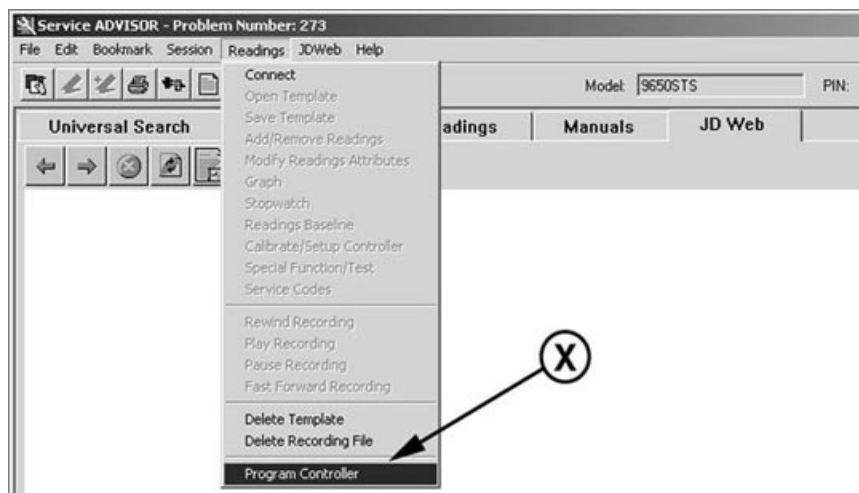


RG12572 -19-06SEP02

2. Describe Problem window will appear, click OK (C).

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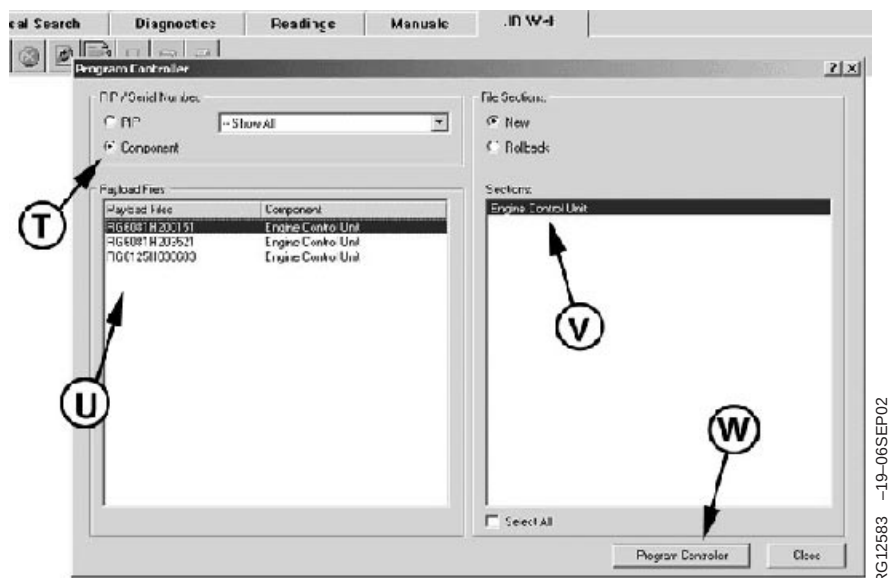


RG12582 -19-06SEP02

3. Click on "Readings" pull down menu and select "Program Controller" (X).

Continued on next page

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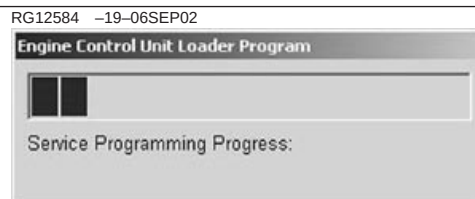


4. Select radio button for "Component" (T). Select the proper payload file for engine ECU (U).

5. Click once on "Engine Control Unit" (V) and click on "Program Controller" (W).

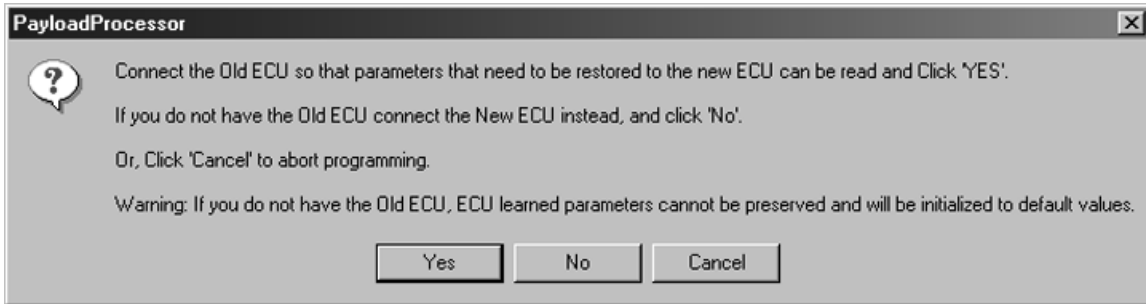
RG41221,0000099 -19-04NOV02-5/8

6. A progress bar will appear while reprogramming the ECU. The engine warning light may come on and a warning may sound while in process of reprogramming and should be ignored.



Continued on next page

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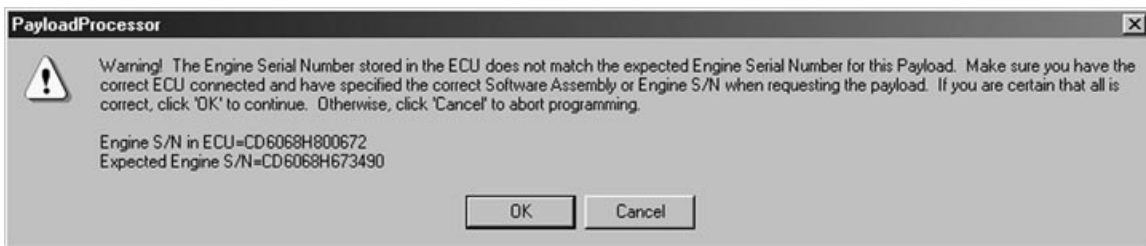
RG12702 -19-11OCT02

7. If the ECU is being replaced, the above message will appear. If you have the old ECU, connect to it

and click YES. If the old ECU is not available, click NO.

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RG12703 -19-14OCT02

8. If the ECU is being replaced, the software will notice that the engine serial number does not match the ECU serial number. This message lets the user know that the ECU expects a different engine serial number to match its ECU serial number. Click "OK" to continue.

9. Disconnect computer from diagnostic connector and start vehicle to ensure proper operation.

RG41221,0000099 -19-04NOV02-8/8

Diagnostic Trouble Codes (DTCs)

There are several different methods for displaying both stored and active DTCs from the ECU.

2 or 3 Digit Codes

Most John Deere applications display DTCs as 2-digit codes read from an on-board display. In addition, some applications have the ability to display 2-digit codes using JT05829 Electronic Governor Tester. On some later Deere applications, the display will show 3-digit codes.

SPN/FMI Codes

SPN/FMI codes are written from the SAE J1939 standard as a two part code. The first part is called the Suspect Parameter Number (SPN). Typically, it contains between 2 and 4 digits. The SPN identifies the system or the component that has the failure; for example SPN 110 indicates a failure in the engine coolant temperature circuit. The second part of the code is called the Failure Mode Identifier (FMI) code. The FMI contains 2 digits. The FMI identifies the type of failure that has occurred; for example FMI 3 indicates value above normal. In order to determine the exact failure, both the SPN and FMI are required. Combining SPN 110 with FMI 3 yields engine coolant temperature input voltage high.

On all applications with the Level 3 Engine Control Unit (ECU), the ECU transmits SPN/FMI codes over the Controller Area Network (CAN). This allows for service tools such as the DST, SERVICE ADVISOR™, and the Diagnostic Gauge to display active and stored

DTCs. When using DST or SERVICE ADVISOR™ the codes will be displayed in a 000000.00 format. For example, SPN 110 FMI 3 will be displayed as 000110.03.

Viewing Active/Stored Codes

DTCs can be viewed on the Diagnostic Scan Tool (DST), SERVICE ADVISOR™, through the diagnostic gauge on the John Deere instrument panel, or by blinking the codes through the diagnostic code reader connector. For directions on how to view active or stored DTCs:

- See VIEWING ACTIVE DTCS ON DIAGNOSTIC GAUGE earlier in this Group.
- See VIEWING STORED DTCS ON DIAGNOSTIC GAUGE earlier in this Group.
- See BLINKING DTCS USING THE DIAGNOSTIC CODE READER CONNECTOR earlier in this Group.

Clearing Stored Codes

Stored DTCs can be cleared through the DST, SERVICE ADVISOR™, through the diagnostic gauge on the John Deere instrument panel, or through the diagnostic code reader connector. For directions on how to clear stored DTCs:

- See CLEARING STORED DTCS ON DIAGNOSTIC GAUGE earlier in this Group.
- See CLEARING STORED CODES USING THE DIAGNOSTIC CODE READER CONNECTOR earlier in this Group.

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Listing of Diagnostic Trouble Codes (DTCs) on ECU

Ascending SPN/FMI Codes

SPN	FMI	2 or 3-Digit Code	Definition
000028	03	N/A ^a	Throttle Voltage High.
	04	N/A ^a	Throttle Voltage Low.
000029	03	N/A ^a	Throttle Voltage High.
	04	N/A ^a	Throttle Voltage Low.
000051	02	N/A ^a	Throttle Invalid.
000091	03	N/A ^a	Throttle Voltage High.
	04	N/A ^a	Throttle Voltage Low.
	08	N/A ^a	PWM Throttle Abnormal Pulse Width.
	09	N/A ^a	Throttle Invalid.
000097	00	N/A ^a	Water in Fuel Continuously Detected
	16	N/A ^a	Water in Fuel Detected
	31	N/A ^a	Water in Fuel Detected
000100	01	64, 65	Engine Oil Pressure Extremely Low
	03	23	Engine Oil Pressure Input Voltage High
	04	24	Engine Oil Pressure Input Voltage Low
	18	64	Engine Oil Pressure Moderately Low
000105	00	47	Derated Torque Curve Selected
	03	25	Manifold Air Temperature Input Voltage High
	04	26	Manifold Air Temperature Input Voltage Low
	09	26	Manifold Air Temperature Invalid
	16	66	Manifold Air Temperature Moderately High
000107	00	N/A ^a	Air Filter Restriction High
000110	00	62, 63	Engine Coolant Temperature Extremely High
	03	18	Engine Coolant Temperature Input Voltage High
	04	19	Engine Coolant Temperature Input Voltage Low
	09	19	Engine Coolant Temperature Invalid
	16	62	Engine Coolant Temperature Moderately High
000111	01	61	Engine Coolant Level Low
000158	02	54, 41	Intermittent Loss of ECU Power Supply
000160	02	88	Wheel Speed Input Noise
000171	03	16	Ambient Air Temperature Input Voltage High
	04	17	Ambient Air Temperature Input Voltage Low
000174	00	81	Fuel Temperature Moderately High
	03	37	Fuel Temperature Input Voltage High
	04	38	Fuel Temperature Input Voltage Low
	16	81	Fuel Temperature Moderately High
000177	02	94	Transmission Oil Temperature Erratic
	09	93	Transmission Oil Temperature Invalid
000189	00	69	Engine Speed Derate
000190	00	42	Engine Overspeed Extreme
	02	44	Engine Speed Input Noise
	03	87	Engine Speed Input Voltage High
	04	86	Engine Speed Input Voltage Low
	05	85	Engine Speed Circuit Open
	14	45	Engine Speed/Pump Speed Out of Sync
	16	42	Engine Overspeed Moderate
000191	02	39	Pump Speed Input Noise

^aN/A = Not applicable

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Trouble Code Diagnostics and Tests

	14	45	Engine Speed/Pump Speed Out of Sync
	16	42	Engine Overspeed Extreme
000620	03	21	Sensor Supply Voltage High
	04	22	Sensor Supply Voltage Low
000629	13	28	ECU Error
000632	11	48	Fuel Shut-off Circuit Fault
000638	02	53	Rack Instability
	07	34	Rack Position Error
000639	00	55	CAN Error
	02	55	CAN Error
	13	55	CAN Error
000640	11	49	Engine Shutdown Signal Invalid
	31	52	Auxiliary Engine Shutdown Switch Active
000723	02	44	Engine Speed Input Noise
000733	02	31	Rack Position Error with Engine Off
	03	35	Rack Position Voltage High
	04	36	Rack Position Voltage Low
000833	00	253	Rack Position Calibration Error
	01	251	Rack Position Calibration Error
	02	31	Rack Position Error with Engine Off
	03	35	Rack Position Voltage High
	04	36	Rack Position Voltage Low
	07	79	Rack Position Calibration Error
	15	254	Rack Position Calibration Error
	17	252	Rack Position Calibration Error
000834	02	53	Rack Instability
	03	77	Rack Actuator Circuit Shorted to Power
	05	75	Rack Actuator Circuit Open
	06	76	Rack Actuator Circuit Grounded
	07	34	Rack Position Error
000898	09	194	Vehicle Speed Invalid
000970	00	52	Auxiliary Engine Shutdown Switch Active
	11	49	Engine Shutdown Signal Invalid
	31	52, 83	Auxiliary Engine Shutdown Switch Active
001041	02	0, 41	Start Signal Missing
	03	46	Start Signal Always Active
001069	09	96	Tire Size Invalid
	31	89	Tire Size Error
001082	09	95, 195	Engine Coolant Load Increase Invalid
001109	14	67	Engine Shutdown
001110	31	67	Engine Shutdown
001568	02	29	Torque Curve Selection Invalid
	09	196	Torque Curve Selection Invalid
001569	31	68, 47	Fuel Derate
001639	01	56	Fan Speed Input Missing
	02	59	Fan Speed Input Noise
	16	58	Fan Speed Higher than Expected
	18	57	Fan Speed Lower than Expected
002000	09	N/A	Vehicle ID Missing
	13	78	Security Violation

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2 or 3-Digit Codes

2 or 3-Digit Code	SPN	FMI	Definition
11	N/A ^a	N/A ^a	Throttle Voltage High
12	N/A ^a	N/A ^a	Throttle Voltage Low
13	N/A ^a	N/A ^a	Throttle Voltage High
14	N/A ^a	N/A ^a	Throttle Voltage Low
15	000091	08	PWM Abnormal Pulse Width
16	000171	03	Ambient Air Temperature Input Voltage High
17	000171	04	Ambient Air Temperature Input Voltage Low
18	000110	03	Engine Coolant Temperature Input Voltage High
19	000110	04	Engine Coolant Temperature Input Voltage Low
	000110	09	Engine Coolant Temperature Invalid
21	000620	03	Sensor Supply Voltage High
22	000620	04	Sensor Supply Voltage Low
23	000100	03	Engine Oil Pressure Input Voltage High
24	000100	04	Engine Oil Pressure Input Voltage Low
25	000105	03	Manifold Air Temperature Input Voltage High
26	000105	04	Manifold Air Temperature Input Voltage Low
	000105	09	Manifold Air Temperature Invalid
27	000091	09	Throttle Invalid
28	000629	13	ECU Error
29	001568	02	Torque Curve Selection Invalid
31	000833	02	Rack Position Error with Engine Off
34	000834	07	Rack Position Error
35	000833	03	Rack Position Voltage High
36	000833	04	Rack Position Voltage Low
37	000174	03	Fuel Temperature Input Voltage High
38	000174	04	Fuel Temperature Input Voltage Low
39	000191	02	Pump Speed Input Noise
41	001041	02	Start Signal Always Active
42	000190	00	Engine Overspeed Extreme
		16	Engine Overspeed Moderate
43	000091	08	PWM Abnormal Pulse Width
44	000190	02	Engine Speed Input Noise
45	000190	14	Engine Speed/Pump Speed Out of Sync
46	001041	03	Start Signal Always Active
47	000105	00	Derated Torque Curve Selected
48	000632	11	Fuel Shut-off Circuit Fault
49	000970	11	Engine Shutdown Signal Invalid
52	000970	31	Auxiliary Engine Shutdown Switch Active
53	000834	02	Rack Instability
54	000158	02	Intermittent Loss of ECU Power Supply
55	000639	00, 02, 13	CAN Error
56	001639	01	Fan Input Speed Missing
57	001639	18	Fan Speed Lower than Expected
58	001639	16	Fan Speed Higher than Expected
59	001639	02	Fan Speed Input Noise
61	000111	01	Engine Coolant Level Low
62	000110	00	Engine Coolant Temperature Extremely High
	000110	16	Engine Coolant Temperature Moderately High
63	000110	00	Engine Coolant Temperature Extremely High
64	000100	18	Engine Oil Pressure Moderately Low

^aN/A = Not applicable

Continued on next page

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Trouble Code Diagnostics and Tests

65	000100	01	Engine Oil Pressure Extremely Low
66	000105	16	Manifold Air Temperature Moderately High
67	001110	31	Engine Shutdown
68	001569	31	Fuel Derate
69	000189	00	Engine Speed Derate
71	N/A ^a	N/A ^a	See D3 - Error Codes on Diagnostic Code Reader (JT05829) in Group 150 of this manual.
72	N/A ^a	N/A ^a	See D3 - Error Codes on Diagnostic Code Reader (JT05829) in Group 150 of this manual.
73	N/A ^a	N/A ^a	See D3 - Error Codes on Diagnostic Code Reader (JT05829) in Group 150 of this manual.
74	N/A ^a	N/A ^a	See D3 - Error Codes on Diagnostic Code Reader (JT05829) in Group 150 of this manual.
75	000834	05	Rack Actuator Circuit Open
76	000834	06	Rack Actuator Circuit Grounded
77	000834	03	Rack Actuator Circuit Shorted to Power
78	002000	13	Security Violation
79	000833	07	Rack Calibration Error
81	000174	16	Fuel Temperature Moderately High
83	000970	31	Auxiliary Engine Shutdown Switch Active
85	000190	05	Engine Speed Circuit Open
86	000190	04	Engine Speed Input Voltage Low
87	000190	03	Engine Speed Input Voltage High
88	000160	02	Wheel Speed Input Noise
89	001069	31	Tire Size Error
93	000177	09	Transmission Oil Temperature Invalid
94	000177	02	Transmission Oil Temperature Erratic
95	001082	09	Engine Coolant Load Increase Invalid
96	001069	09	Tire Size Invalid
194	000898	09	Vehicle Speed Invalid
195	001082	09	Engine Coolant Load Increase Invalid
196	001568	09	Torque Curve Selection Invalid
251	000833	01	Rack Position Calibration Error
252	000833	17	Rack Position Calibration Error
253	000833	00	Rack Position Calibration Error
254	000833	15	Rack Position Calibration Error

^aN/A = Not applicable

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Diagnostic Procedure

Diagnosis of the electronic control system should be performed according to the following procedure:

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly.
2. Using the DST, SERVICE ADVISOR™ or other code reading tool, read and record DTC(s).
3. If code is displayed in 2 or 3-digit, convert the proper diagnostic procedure using the LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU earlier in this Group into an SPN/FMI.

NOTE: Earlier versions of ECUs used different DTCs in SPN/FMI format than do later ECUs. There may be some DTCs that are not found within the table of contents in this manual. In order to identify earlier DTCs, refer to the index in the back of the book or to the listing of Diagnostic Trouble codes above.

4. Go to the diagnostic procedure that the codes listing page refers to.

5. If no DTC(s) are present, proceed to Group 150 earlier in this Section to find the appropriate observable diagnostic procedure.
6. After any repairs are made, recheck to make sure all DTC(s) have been eliminated.

IMPORTANT: Care should be used during the diagnostic procedures to avoid damaging the terminals of connectors, sensors, and actuators. Probes should not be poked into or around the terminals or damage will result. Probes should only be touched against the terminals to make measurements. It is recommended that JT07328 Connector Adapter Test Kit be used to make measurements in connectors, sensors, and actuators. These adapters will ensure that terminal damage does not occur.

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Intermittent Fault Diagnostics

Intermittent faults are problems that periodically “go away”. A problem such as a loose terminal that intermittently doesn’t make contact is a likely cause of 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 ECU is the component LEAST likely to fail.

Suggestions for diagnosing intermittent faults:

- 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 for new fault codes.
- To check the connection between the harness and a sensor or the harness and the ECU, use JT07328 Connector Adapter Test Kit. Insert the male end of the appropriate test adapter into the female end of the ECU or sensor connector terminal. There should be moderate resistance when the test adapter is inserted into the terminal. If the connection is loose, replace the female terminal.

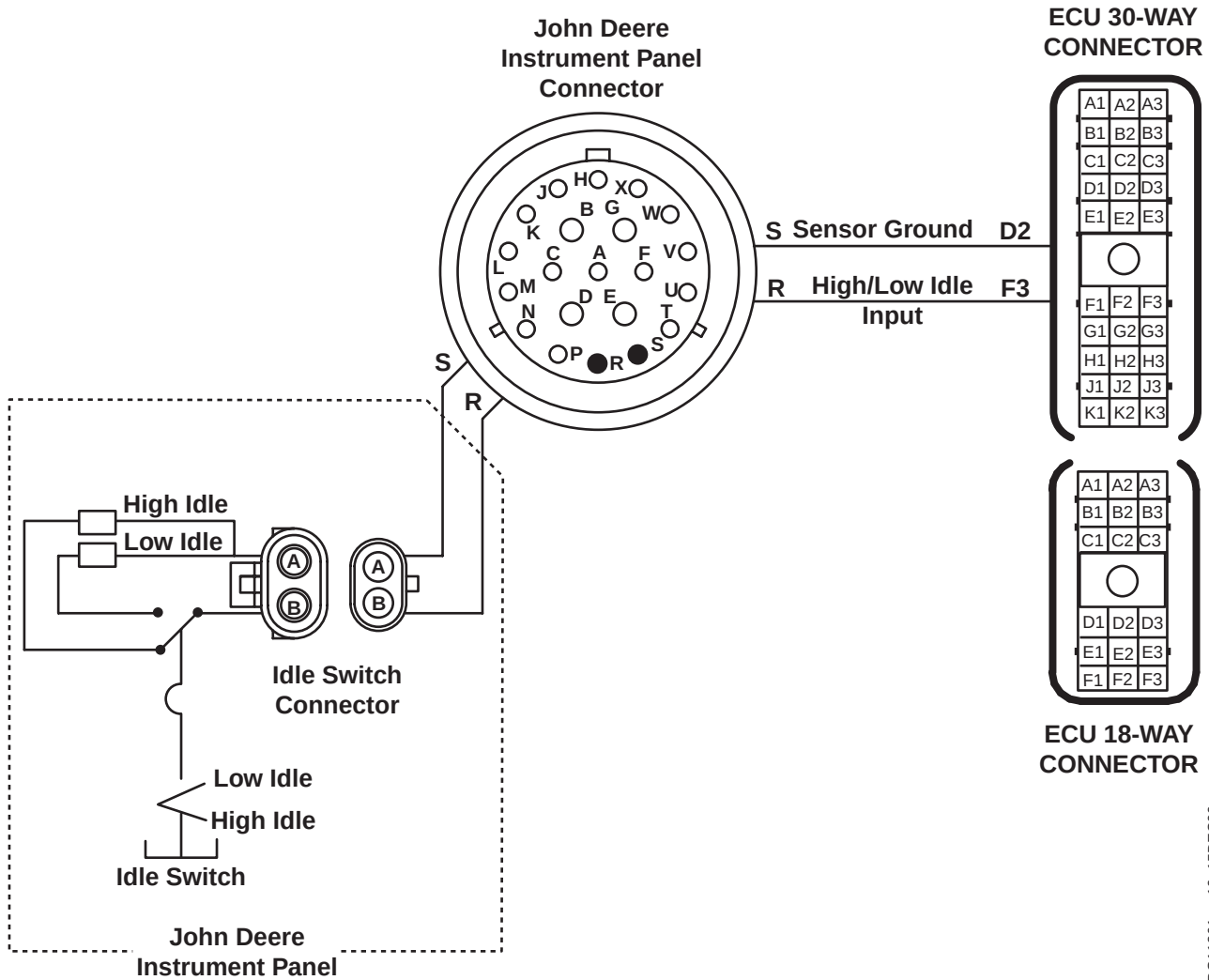
Possible causes of intermittent faults:

- Faulty connection between sensor or actuator and harness.
- Faulty contact between terminals in connector.
- Faulty terminal/wire connection.
- Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc. can cause faulty signals to be sent to the ECU.

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T1 - Multi-state Throttle Input High



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Multi-state Throttle Switch

Multi-state throttle is composed of an idle switch that allows engine speed to be at high or low idle. On some applications, there is a bump up and a bump down feature. This allows for high and low idle to be controlled.

On certain applications, an additional throttle is used in addition to the multi-state throttle. If the desired engine speed of the additional throttle is greater than the multi-state throttle, the multi-state throttle will be overridden. When the desired engine speed of the multi-state throttle is greater than the additional throttle, the multi-state throttle will be in total control.

This code will set if:

- The multi-state throttle input voltage exceeds the maximum threshold. The voltage is higher than what is physically possible for the throttle lever to achieve.

RG11361 -19-15DEC00

Continued on next page

DPSG, RG40854, 298 -19-26AUG99-1/2

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the multi-state throttle, and will use the input values from another throttle.
- If the multi-state throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

DPSG,RG40854,298 -19-26AUG99-2/2

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T1 - Multi-state Throttle Input High

RG40854,0000012 -19-25JUN01-1/1

T1 - Multi-state Throttle Input High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector and the multistate throttle connector looking for dirty, damaged, or poorly positioned terminals.

-- -1/1

① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ in Group 160 later in this manual.
2. Ignition ON, engine OFF
3. Start the ECU communication software
4. Make note of any DTCs, then clear all DTCs
5. Ignition ON, engine OFF
6. Move the multistate switch through all the positions
7. Read DTCs using the DST or SERVICE ADVISOR™.

000028.03 reoccurs:
GO TO ②

000028.03 doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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-- -1/1

② Throttle Position Input Shorted Test

NOTE: For wiring and theory of operation information, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information

1. Ignition OFF
2. Disconnect multistate throttle switch at two wire connector behind instrument panel.
3. Install a jumper wire between both terminals of the switch harness connector
4. Clear all DTCs
5. Ignition ON, engine OFF
6. Read DTCs

000028.03 reoccurs:
GO TO ③

000028.04 occurs:
Faulty multistate throttle switch connector
OR
Faulty multistate throttle switch

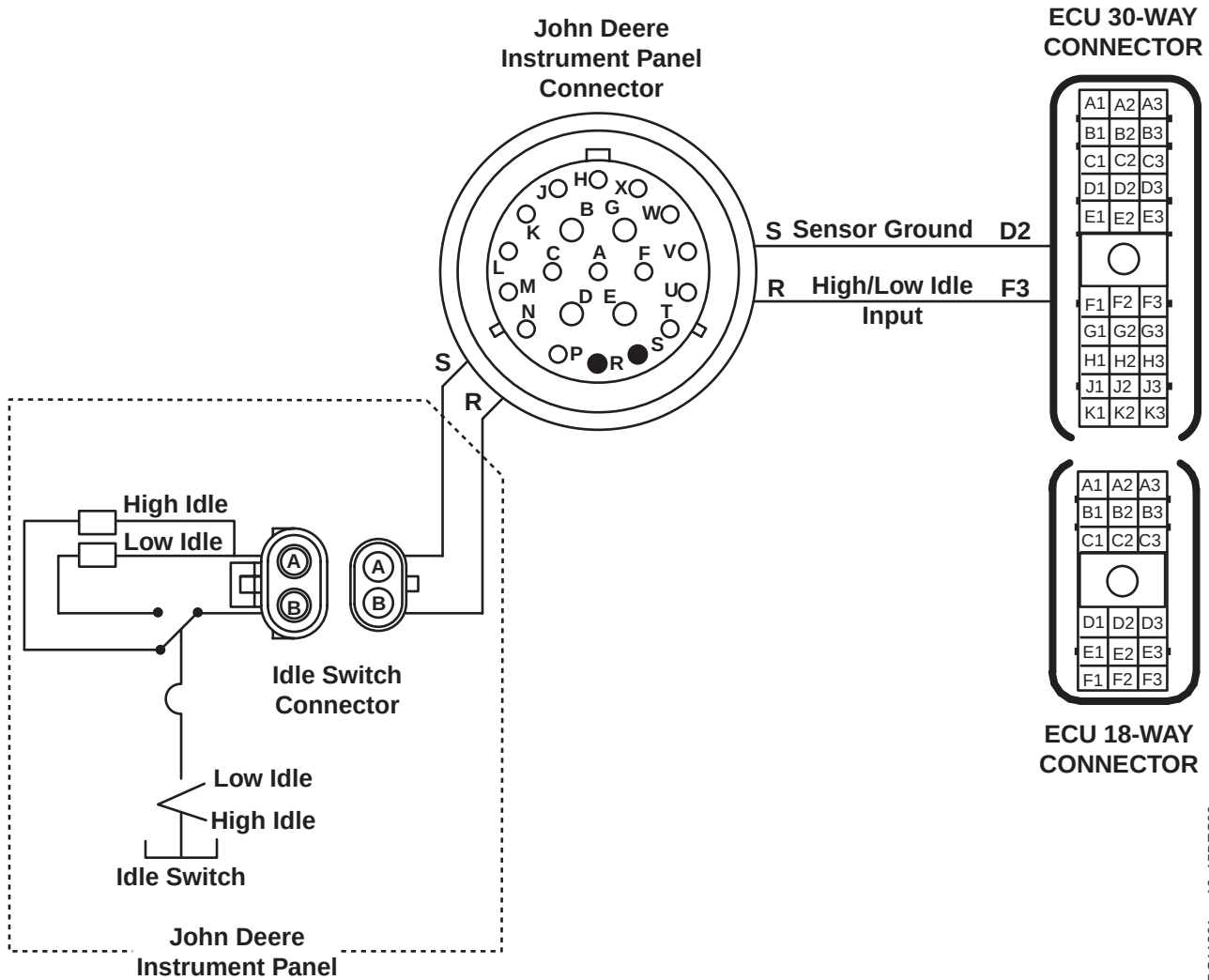
-- -1/1

③ Throttle Position Ground Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information</i> 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between multistate switch 5 V input terminal and a good chassis ground	4.0 - 6.0 V: Open in multistate switch ground circuit OR Faulty ECU 30-way connector OR Faulty ECU Below 4.0 V: Open in multistate switch input circuit OR Faulty ECU 30-way connector OR Faulty ECU

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-- -1/1

T2 - Multi-state Throttle Input Low



RG11361 -19-15DEC00

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Multi-state Throttle Switch

Multi-state throttle is composed of an idle switch that allows engine speed to be at high or low idle. On some applications, there is a bump up and a bump down feature. This allows for high and low idle to be controlled.

On certain applications, an additional throttle is used in addition to the multi-state throttle. If the desired engine speed of the additional throttle is greater than the multi-state throttle, the multi-state throttle will be overridden. When the desired engine speed of the multi-state throttle is greater than the additional throttle, the multi-state throttle will be in total control.

This code will set if:

- The multi-state throttle input voltage drops below the minimum threshold. The voltage is lower than what is physically possible for the throttle lever to achieve.

Continued on next page

DPSG, RG40854, 299 -19-26AUG99-1/2

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the multi-state throttle, and will use the input values from another throttle.
- If the multi-state throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

DPSG,RG40854,299 -19-26AUG99-2/2

04
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T2 - Multi-state Throttle Input Low

RG40854,0000018 -19-25JUN01-1/1

T2 - Multi-state Throttle Input Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector and the multistate throttle connector looking for dirty, damaged, or poorly positioned terminals.

-- -1/1

① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start the ECU communication software
4. Make note of any DTCs, then clear all DTCs
5. Ignition ON, engine OFF
6. Move the multistate switch through all the positions
7. Read DTCs using the DST or SERVICE ADVISOR™.

000028.04 reoccurs:
GO TO ②

000028.04 doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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-- -1/1

② Throttle Position Wiring Test

NOTE: For wiring and theory of operation information, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information

1. Ignition OFF
2. Disconnect multistate throttle switch at two wire connector behind instrument panel.
3. Clear all DTCs
4. Ignition ON, engine OFF
5. Read DTCs

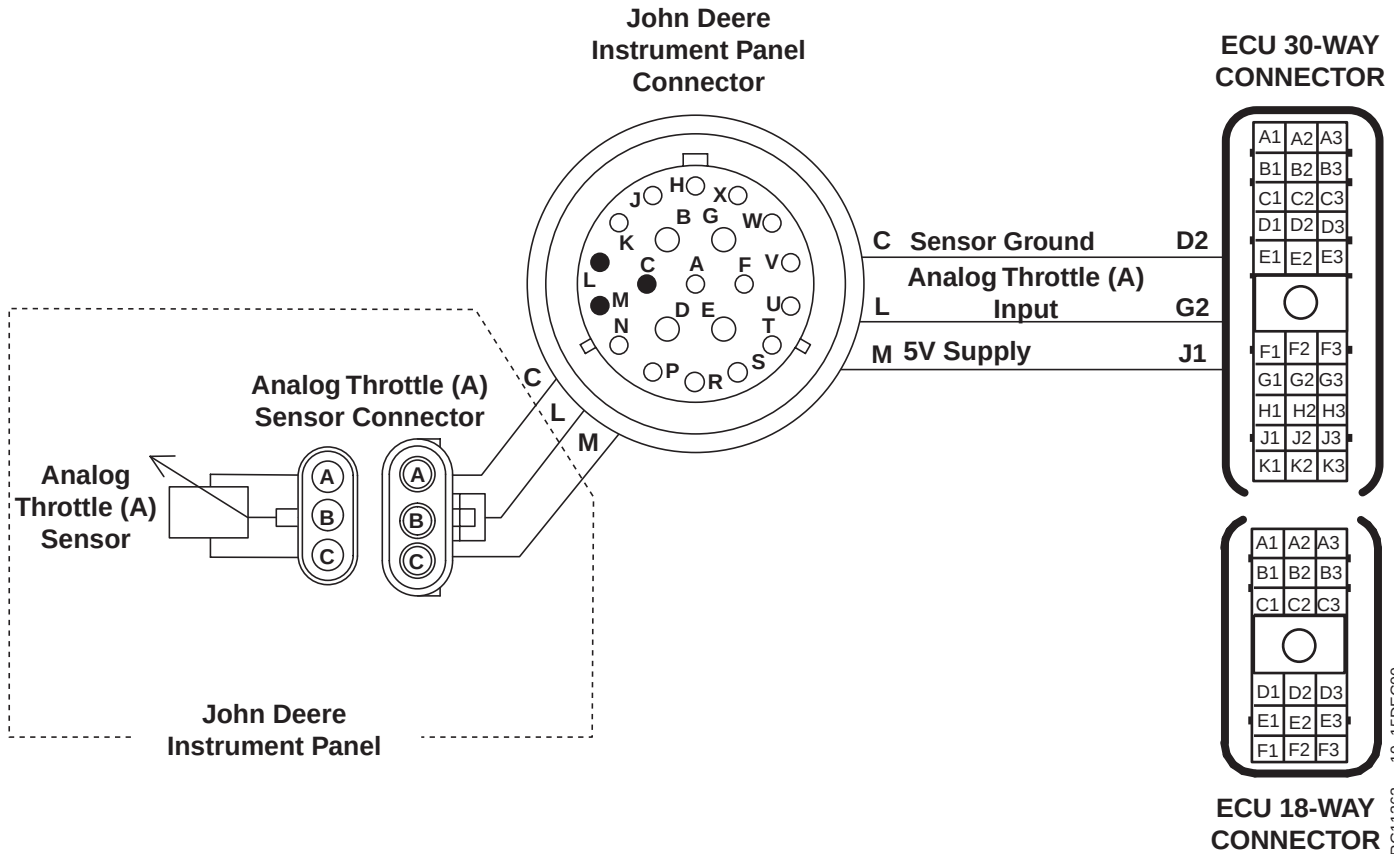
000028.04 reoccurs:
Short to ground in multistate input circuit
OR
Faulty ECU

000028.03 occurs:
Faulty multistate throttle switch connector
OR
Faulty multistate throttle switch

-- -1/1

04
160
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T3 - Analog Throttle (A) Input High



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Analog Throttle (A) Position Sensor

- The analog throttle (A) position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 0.5 and 4.0 volts depending on throttle position. Analog throttle (A) voltage will be approximately 0.5 volts at low idle and approximately 4.0 volts at high idle.

Code will set if:

- The analog throttle (A) input voltage exceeds the maximum threshold. This voltage is higher than what is physically possible for the throttle lever to achieve.

If code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle (A), and will use the input values from another throttle.
- If the analog throttle (A) is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

T3 - Analog Throttle (A) Input High

RG40854,0000019 -19-25JUN01-1/1

T3 - Analog Throttle (A) Input High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the primary throttle sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

NOTE: Depending on release date of John Deere Level 3 ECU, either DTC 000091.03 OR DTC 000029.03 will be set in this diagnostic procedure.

04
160
65

-- -1/1

① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see T3 - ANALOG THROTTLE (A) VOLTAGE INPUT HIGH supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Connect the ECU communication software.
4. Analog throttle (A) in the idle position
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs using the DST or SERVICE ADVISOR™.

000091.03 OR 000029.03 reoccurs:
GO TO ③

000091.03 OR 000029.03 cleared:
GO TO ②

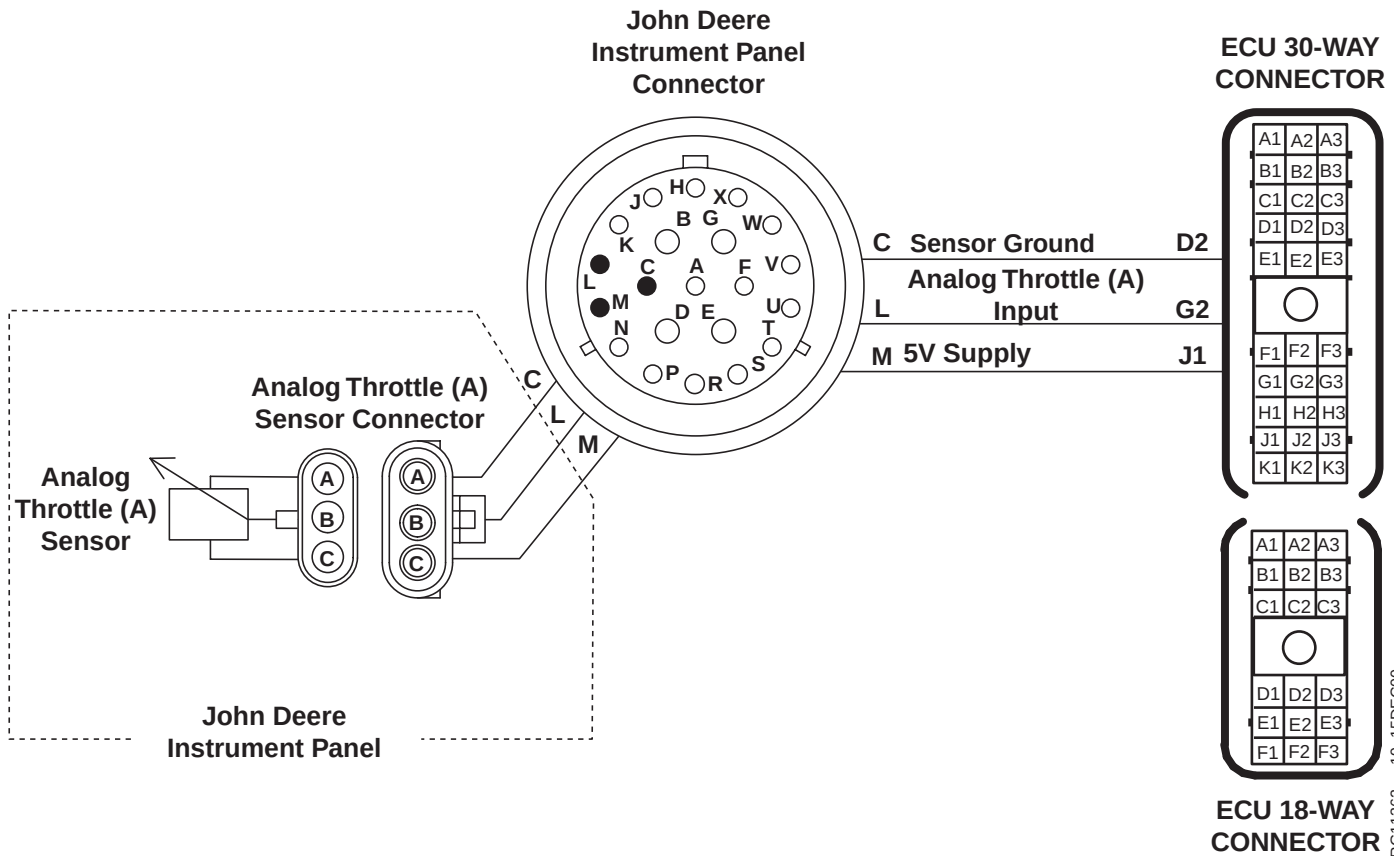
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-- -1/1

Trouble Code Diagnostics and Tests

② Analog Throttle (A) Travel Voltage Test	<i>NOTE: For wiring and theory of operation information, see T3 - ANALOG THROTTLE (A) VOLTAGE INPUT HIGH supporting information</i> Slowly operate the analog throttle (A) through full travel while monitoring DTCs	000091.03 OR 000029.03 reoccurs: Faulty analog throttle (A) sensor connector OR Open in analog throttle (A) sensor ground circuit OR Faulty analog throttle (A) sensor 000091.03 OR 000029.03 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group. -- -1/1
③ Throttle Position Input Shorted Test	<i>NOTE: For wiring and theory of operation information, see T3 - ANALOG THROTTLE (A) VOLTAGE INPUT HIGH supporting information</i> 1. Ignition OFF 2. Disconnect analog throttle (A) position sensor connector 3. Read DTCs 4. Make note of all DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	000091.04 OR 000029.04 occurs: GO TO ④ 000091.03 OR 000029.03 reoccurs: Short to voltage in analog throttle (A) input circuit OR Faulty ECU -- -1/1
④ Throttle Position Ground Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see T3 - ANALOG THROTTLE (A) VOLTAGE INPUT HIGH supporting information</i> 1. Ignition OFF 2. Probe ground terminal in analog throttle (A) sensor harness connector with a test light connected to battery voltage	Light ON Faulty analog throttle (A) sensor connector OR Faulty analog throttle (A) sensor Light OFF Open in analog throttle (A) ground circuit -- -1/1

T4 - Analog Throttle (A) Input Low



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Analog Throttle (A) Position Sensor

- The analog throttle (A) position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 0.5 and 4.0 volts depending on throttle position. Analog throttle (A) voltage will be approximately 0.5 volts at low idle and approximately 4.0 volts at high idle.

Code will set if:

- The analog throttle (A) input voltage drops below the minimum threshold. This voltage is lower than what is physically possible for the throttle lever to achieve.

If the code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle (A), and will use the input values from another throttle.
- If the analog throttle (A) is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

T4 - Analog Throttle (A) Voltage Input Low

RG40854,000001A -19-25JUN01-1/1

T4 - Analog Throttle (A) Input Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the analog throttle (A) sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

NOTE: Depending on release date of John Deere Level 3 ECU, either DTC 000091.04 OR DTC 000029.04 will be set in this diagnostic procedure.

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-- -1/1

① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see T4 - ANALOG THROTTLE (A) VOLTAGE TOO LOW supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start the ECU communication software.
4. Analog throttle (A) in the idle position
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000091.04 OR 000029.04 reoccurs:
GO TO ③

000091.04 OR 000029.04 cleared:
GO TO ②

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-- -1/1

Trouble Code Diagnostics and Tests

② Throttle Travel Voltage Test

NOTE: For wiring and theory of operation information, see T4 - ANALOG THROTTLE (A) VOLTAGE TOO LOW supporting information

Using the DST, slowly operate the analog throttle (A) through full travel while monitoring DTCs on the active code display parameter

000091.04 OR 000029.04

reoccurs:

Faulty analog throttle (A) sensor connector
OR
Faulty analog throttle (A) sensor
OR
Faulty ECU

000091.04 OR 000029.04

cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

-- -1/1

③ Analog Throttle (A) Position Wiring Test

NOTE: For wiring and theory of operation information, see T4 - ANALOG THROTTLE (A) VOLTAGE TOO LOW supporting information

1. Ignition OFF
2. Disconnect analog throttle (A) sensor
3. Install a jumper wire between throttle 5 V supply and throttle input in the analog throttle (A) harness connector
4. Read DTCs
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON
7. Read DTCs

000091.04 OR 000029.04

reoccurs:

GO TO ④

000091.03 OR 000029.03

occurs:

Faulty analog throttle (A) sensor connector
OR
Faulty analog throttle (A) sensor

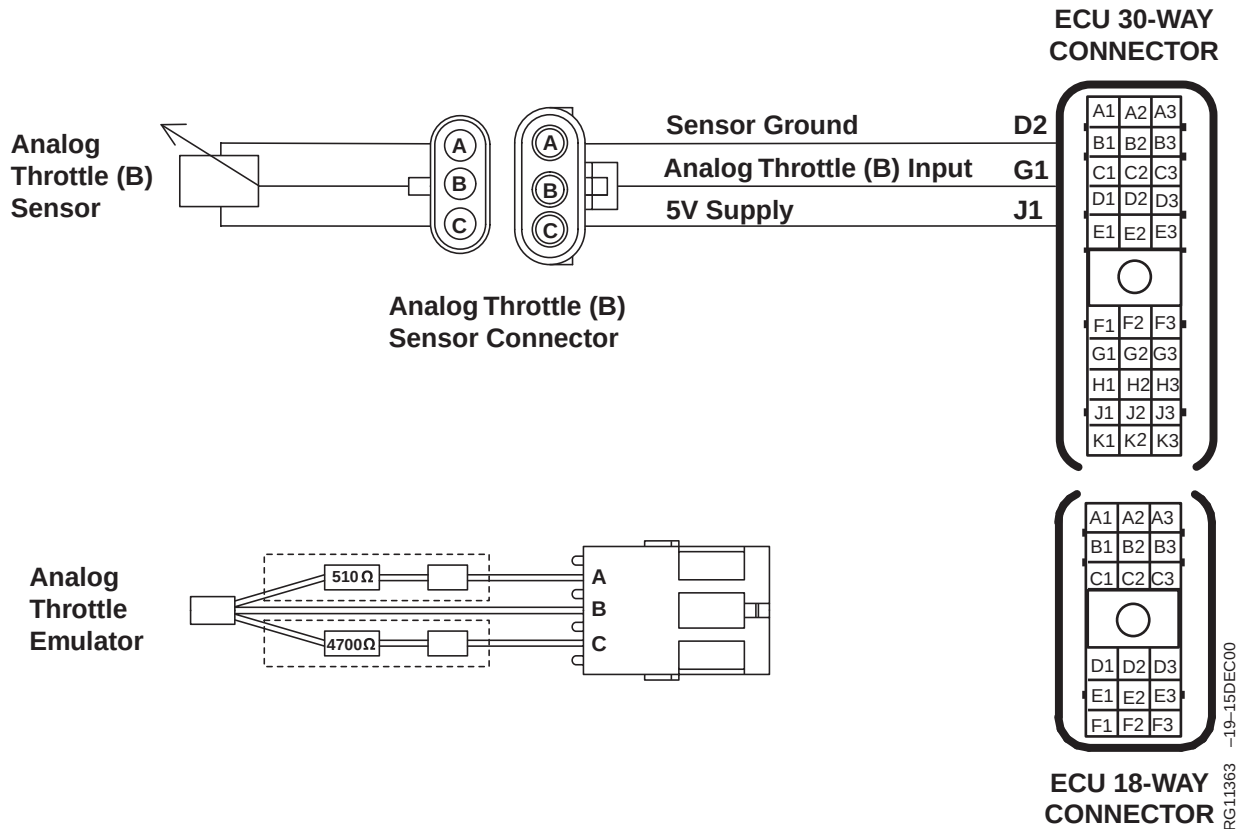
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Trouble Code Diagnostics and Tests

4 Analog Throttle (A) Position 5 V Supply Test	<i>NOTE: For wiring and theory of operation information, see T4 - ANALOG THROTTLE (A) VOLTAGE TOO LOW supporting information</i> 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON 4. Using a multimeter, measure voltage between throttle (A) 5 V supply terminal and throttle ground terminal in analog throttle harness connector	4.0 - 6.0 V: Open in analog throttle (A) input circuit OR Short to ground in analog throttle (A) input circuit OR Faulty ECU connector OR Faulty ECU Below 4.0 V: Open in analog throttle (A) 5 V supply circuit OR Short to ground in analog throttle (A) 5 V supply circuit OR Faulty ECU connector OR Faulty ECU -- -1/1

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T5 - Analog Throttle (B) Input High



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Analog Throttle (B) Position Sensor

- The analog throttle (B) position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 0.5 and 4.0 volts depending on throttle position. Analog throttle (B) voltage will be

approximately 0.5 volts at low idle and approximately 4.0 volts at high idle.

The code will set if:

- The analog throttle (B) input voltage exceeds the maximum threshold. This voltage is higher than what is physically possible for the throttle lever to achieve.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle (B), and will use the input values from another throttle.
- If the analog throttle (B) is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

T5 - Analog Throttle (B) Input High

RG40854,000001B -19-25JUN01-1/1

T5 - Analog Throttle (B) Input High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the secondary throttle sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

NOTE: Depending on release date of John Deere Level 3 ECU, either DTC 000029.03 OR DTC 000028.03 will be set in this diagnostic procedure.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start the ECU communication software.
4. Analog throttle (B) in the idle position
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000029.03 OR 000028.03 reoccurs:
GO TO ③

000029.03 OR 000028.03 cleared:
GO TO ②

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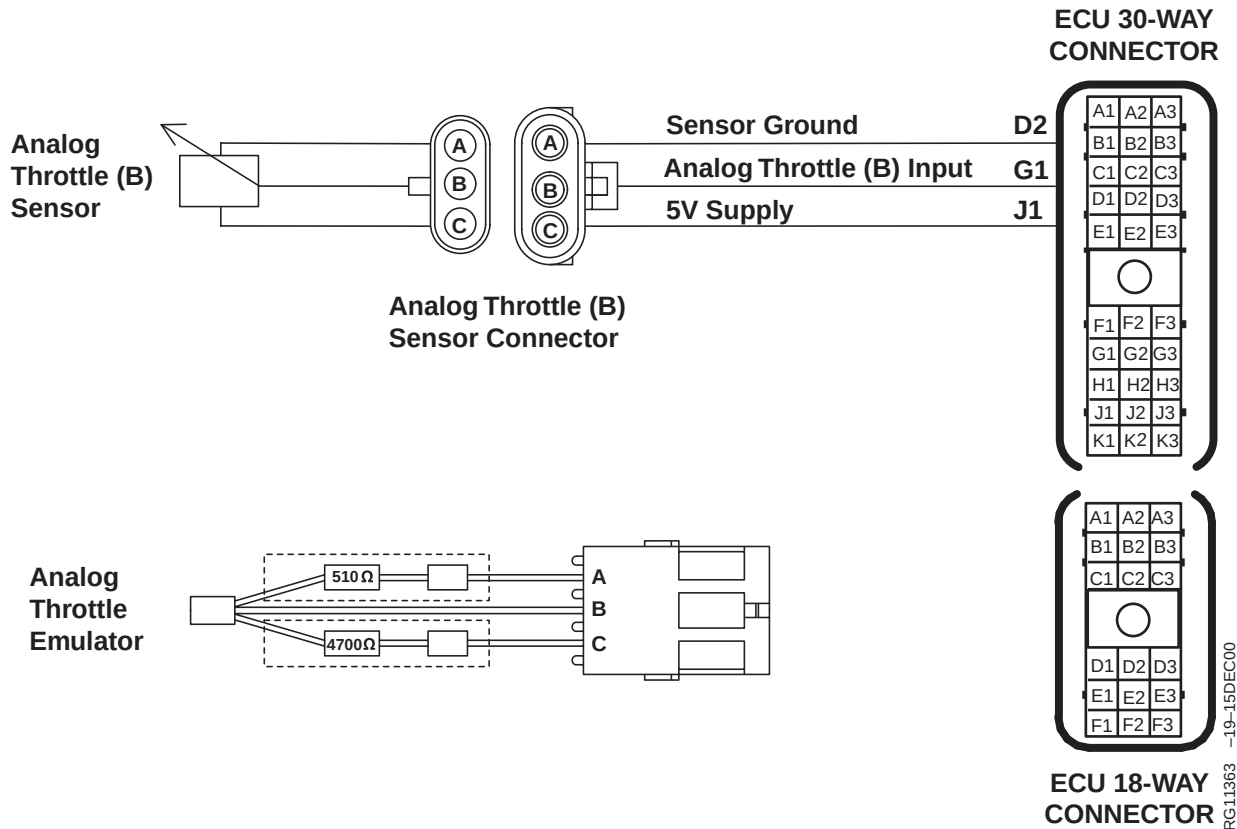
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Trouble Code Diagnostics and Tests

② Analog Throttle (B) Travel Voltage Test	<i>NOTE: For wiring and theory of operation information, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information</i> Read DTCs while slowly operate the analog throttle (B) through full travel while	000029.03 OR 000028.03 reoccurs: Faulty analog throttle (B) sensor connector OR Open in analog throttle (B) sensor ground circuit OR Faulty analog throttle (B) sensor 000029.03 OR 000028.03 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group. -- -1/1
③ Analog Throttle (B) Position Input Shorted Test	<i>NOTE: For wiring and theory of operation information, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information</i> 1. Ignition OFF 2. Disconnect analog throttle (B) position sensor connector 3. Read DTCs 4. Make note of all DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	000029.04 OR 000028.04 occurs: GO TO ④ 000029.03 OR 000028.03 reoccurs: Short to voltage in analog throttle (B) input circuit OR Faulty ECU -- -1/1
④ Analog Throttle (B) Position Ground Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information</i> 1. Ignition OFF 2. Probe ground terminal in analog throttle (B) sensor harness connector with a test light connected to battery voltage	Light ON Faulty analog throttle (B) sensor connector OR Faulty analog throttle (B) sensor Light OFF Open in analog throttle (B) ground circuit -- -1/1

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T6 - Analog Throttle (B) Input Low



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Analog Throttle (B) Position Sensor

- The analog throttle (B) position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 0.5 and 4.0 volts depending on throttle position. Analog throttle (B) voltage will be

approximately 0.5 volts at low idle and approximately 4.0 volts at high idle.

Code will set if:

- The analog throttle (B) input voltage drops below the minimum threshold. This voltage is lower than what is physically possible for the throttle lever to achieve.

If code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle (B), and will use the input values from another throttle.
- If the analog throttle (B) is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

T6 - Analog Throttle (B) Input Low

RG40854,000001C -19-04JAN01-1/1

T6 - Analog Throttle (B) Input Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the secondary throttle sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

NOTE: Depending on release date of John Deere Level 3 ECU, either DTC 000029.04 OR DTC 000028.04 will be set in this diagnostic procedure.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group
2. Ignition ON, engine OFF
3. Start the ECU communication software.
4. Analog throttle (B) in the idle position
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000029.04 OR 000028.04 reoccurs:
GO TO ③

000029.04 OR 000028.04 cleared:
GO TO ②

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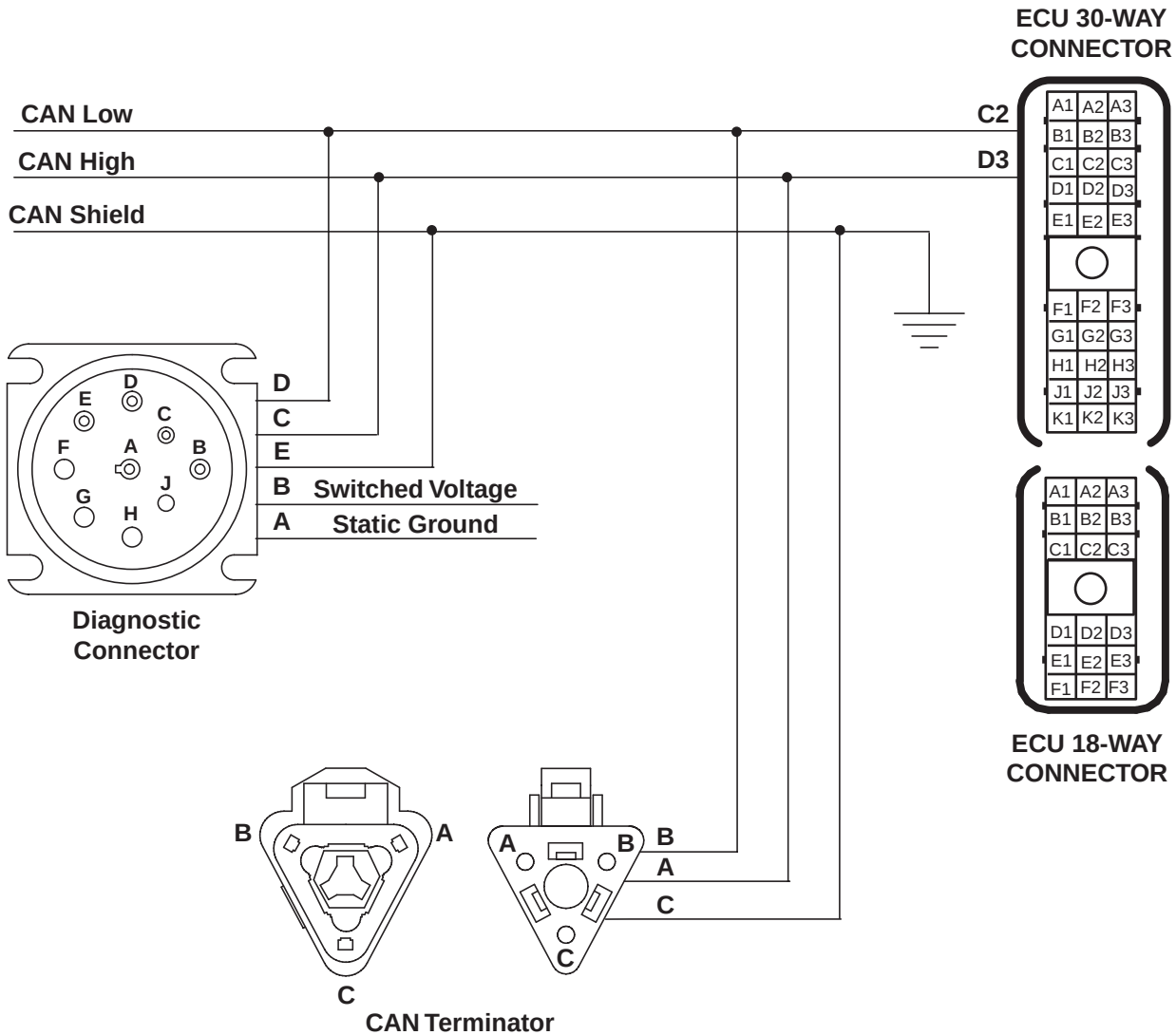
Trouble Code Diagnostics and Tests

② Analog Throttle (B) Travel Voltage Test	<i>NOTE: For wiring and theory of operation information, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information</i> Read DTCs while slowly operate the analog throttle (B) through full travel.	000029.04 OR 000028.04 reoccurs: Faulty analog throttle (B) sensor connector OR Faulty analog throttle (B) sensor OR Faulty ECU 000029.04 OR 000028.04 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group. -- -1/1
③ Analog Throttle (B) Position Wiring Test	<i>NOTE: For wiring and theory of operation information, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information</i> 1. Ignition OFF 2. Disconnect analog throttle (B) sensor 3. Install a jumper wire between throttle 5 V supply and throttle input in the analog throttle (B) harness connector 4. Read DTCs 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON 7. Read DTCs	000029.04 OR 000028.04 reoccurs: GO TO ④ 000029.03 OR 000028.03 occurs: Faulty analog throttle (B) sensor connector OR Faulty analog throttle (B) sensor -- -1/1

4 Analog Throttle (B) Position 5 V Supply Test	<i>NOTE: For wiring and theory of operation information, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information</i> 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON 4. Using a multimeter, measure voltage between analog throttle (B) 5 V supply terminal and analog throttle (B) ground terminal in analog throttle (B) harness connector	4.0 - 6.0 V: Open in analog throttle (B) input circuit OR Short to ground in analog throttle (B) input circuit OR Faulty ECU 30-way connector OR Faulty ECU Below 4.0 V: Open in analog throttle (B) 5 V supply circuit OR Short to ground in analog throttle (B) 5 V supply circuit OR Faulty ECU 30-way connector OR Faulty ECU -- -1/1

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T7 - CAN Throttle Invalid



RG11358 -19-15DEC00

CAN (Controller Area Network) Throttle

- CAN (Controller Area Network) throttle is information sent to the ECU by another controller over CAN of the desired throttle position.

Code will set if:

- The ECU either does not receive throttle information over CAN, or the information received is not valid.

If code sets, the following will occur:

- The ECU will use a default "limp-home" throttle value that will only allow low idle engine speed.
- If application uses only uses CAN throttle, the ECU will use a default "limp-home" throttle value that will only allow low idle engine speed.
- If a backup analog throttle or a PWM throttle input is included, the ECU will ignore the CAN throttle and use either the backup analog throttle or PWM throttle input.

T7 - CAN Throttle Invalid

RG40854,0000020 -19-05MAR01-1/1

T7 - CAN Throttle Invalid Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

-- -1/1

❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see T7 - CAN THROTTLE Invalid supporting information 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON 7. Read DTCs	Code reoccurs: GO TO ❷ Code cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.
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❷ Check Other Controllers For CAN Related DTCs	NOTE: For wiring and theory of operation information, see T7 - CAN THROTTLE Invalid supporting information If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs	No CAN related DTCs found on other controllers: GO TO ❸ Did find CAN related DTCs on other controllers: Refer to machine manual to diagnose and repair the cause of DTC.

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Trouble Code Diagnostics and Tests

③ CAN Resistance Test

*NOTE: For wiring and theory of operation information, see T7 - CAN THROTTLE
Invalid supporting information*

1. Ignition OFF
2. Disconnect ECU 30-way connector
3. Using a multimeter, measure resistance between terminals C2 and D3 in the harness end of the ECU 30-way connector

Between 55 - 65 ohms:

Faulty ECU 30-way
connector
OR
Faulty ECU

**Less than 55 or greater
than 65 ohms:**

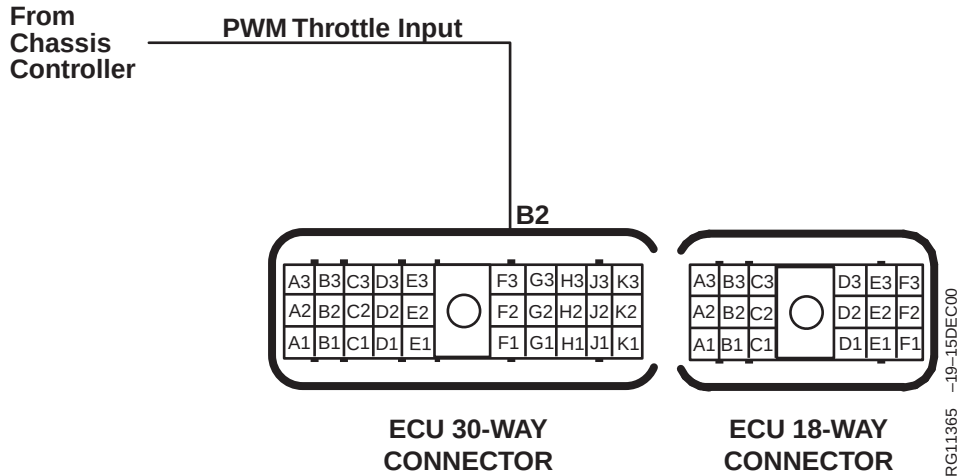
Open or short in CAN
communication circuit

-- -1/1

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82

04
160
83

T8 - PWM Throttle Input High



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

PWM (Pulse Width Modulated) Throttle Position Input

- The PWM throttle signal is sent to the ECU by the Chassis Computer. The PWM signal is a square wave signal with a constant frequency. The pulse-width of the signal (amount of time the signal is high) varies as throttle input from the Chassis Computer varies.

This code will set if:

- The pulse-width of the PWM signal is greater than the normal operating range of the signal.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the PWM throttle, and will use the input values from another throttle.
- If the PWM throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,000000B -19-20DEC00-1/1

T8 - PWM Throttle Input High

RG40854,000001D -19-04JAN01-1/1

T8 - PWM Throttle Input High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of ECU 30-way connector and the throttle sensor connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see T8 - PWM THROTTLE INPUT HIGH supporting information 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software. 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000091.03 reoccurs: GO TO ❷ 000091.03 doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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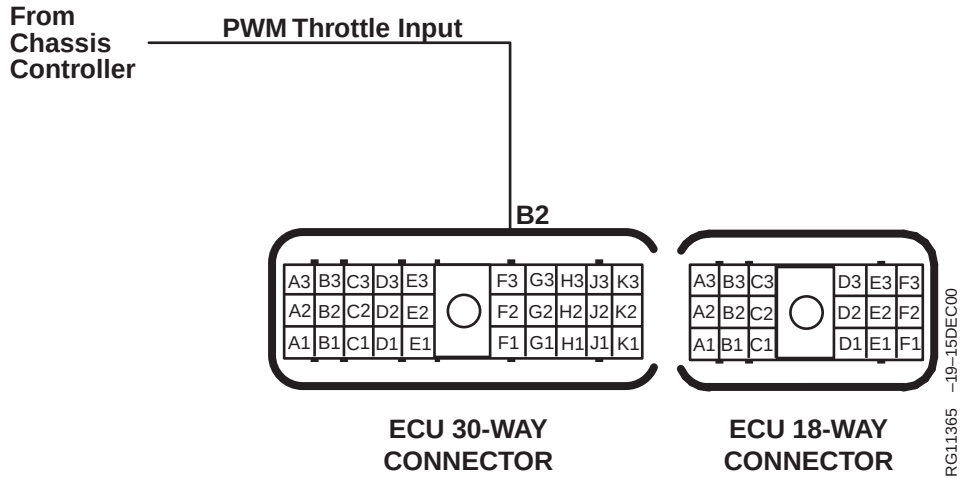
❷ Application Related DTCs Test	NOTE: For wiring and theory of operation information, see T8 - PWM THROTTLE INPUT HIGH supporting information Check other controllers on application for related DTCs if PWM throttle signal originates from another controller	Other controllers report no throttle related DTCs: GO TO ❸ Other controllers do report a throttle related DTC: Refer to diagnostic procedures for controller. Repair cause of throttle related DTC and retest.

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Trouble Code Diagnostics and Tests

③ Open in PWM Signal Wire Test	<i>NOTE: For wiring and theory of operation information, see T8 - PWM THROTTLE INPUT HIGH supporting information</i> 1. Ignition OFF 2. Disconnect ECU 30-way connector 3. Obtain wiring information for this application and determine the source of the PWM throttle signal 4. Disconnect the connector that outputs the PWM throttle signal 5. Using a multimeter, measure the resistance between terminal B2 of the ECU 30-way connector and the terminal of originating PWM throttle signal.	5 ohms or less: GO TO ④ Greater than 5 ohms: Open in PWM throttle signal wire -- -1/1
④ Short in PWM Circuit Test	<i>NOTE: For wiring and theory of operation information, see T8 - PWM THROTTLE INPUT HIGH supporting information</i> 1. Ignition OFF 2. ECU 30-way connector and the other signal source controller still disconnected 3. Using a multimeter measure resistance between terminal B2 in the harness end of the ECU 30-way connector and: • All other terminals in that connector • A good chassis ground	All measurements greater than 2000 ohms: GO TO ⑤ Any measurement less than 2000 ohms: Short in PWM circuit -- -1/1
⑤ PWM Throttle Source Controller Connector Test	<i>NOTE: For wiring and theory of operation information, see T8 - PWM THROTTLE INPUT HIGH supporting information</i> 1. Ignition OFF 2. ECU 30-way connector still disconnected 3. Reconnect PWM signal source connector 4. Ignition ON 5. Using a multimeter, measure voltage while operating the throttle, between terminal B2 in the harness end of the ECU 30-way connector and a good chassis ground.	Between 0.5 V and 4.8V: Faulty PWM signal source controller OR Wrong ECU for the vehicle OR Faulty ECU 30-way connector OR Faulty ECU Less than 0.5 V or greater than 4.8V: Faulty PWM throttle signal source controller connector OR Faulty PWM throttle signal source controller -- -1/1

T9 - PWM Throttle Input Low



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

PWM (Pulse Width Modulated) Throttle Position Input

- The PWM throttle signal is sent to the ECU by the Chassis Computer. The PWM signal is a square wave signal with a constant frequency. The pulse-width of the signal (amount of time the signal is high) varies as throttle input from the Chassis Computer varies.

This codes will set if:

- The ECU senses that the pulse-width of the PWM signal is lower than the normal operating range of the signal.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the PWM throttle, and will use the input values from another throttle.
- If the PWM throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,000000C -19-20DEC00-1/1

T9 - PWM Throttle Input Low

RG40854,000001E -19-04JAN01-1/1

T9 - PWM Throttle Input Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of ECU 30-way connector and the throttle sensor connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see T9 - PWM THROTTLE INPUT LOW supporting information 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000091.04 reoccurs: GO TO ❷ 000091.04 doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.
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❷ Application Related DTCs Test	NOTE: For wiring and theory of operation information, see T9 - PWM THROTTLE INPUT LOW supporting information Check other controllers on application for related DTCs if PWM throttle signal originates from another controller	Other controllers report no throttle related DTCs: GO TO ❸ Other controllers do report a throttle related DTC: Refer to diagnostic procedures for controller. Repair cause of throttle related DTC and retest

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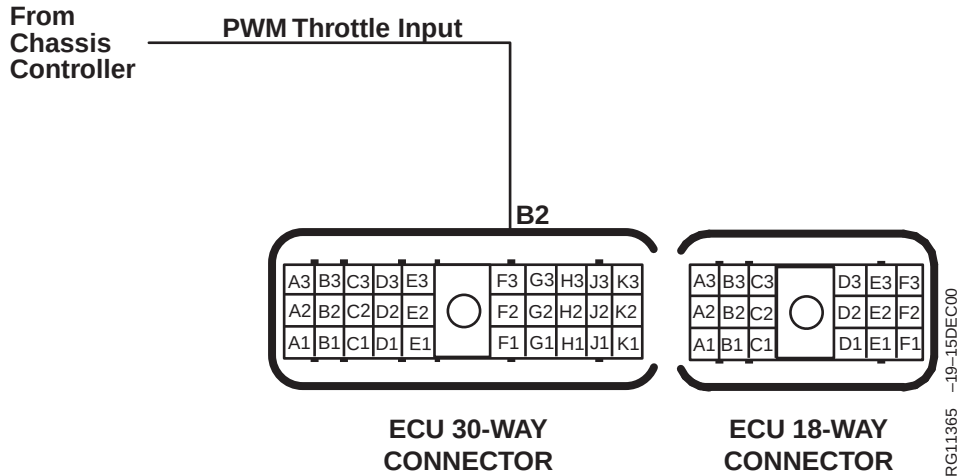
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Trouble Code Diagnostics and Tests

③ Open in PWM Signal Wire Test	<i>NOTE: For wiring and theory of operation information, see T9 - PWM THROTTLE INPUT LOW supporting information</i> 1. Ignition OFF 2. Disconnect ECU 30-way connector 3. Obtain wiring information for this application and determine the source of the PWM throttle signal 4. Disconnect the connector that outputs the PWM throttle signal 5. Using a multimeter, measure the resistance between terminal B2 of the ECU 30-way connector and the terminal of originating PWM throttle signal.	5 ohms or less: GO TO ④ Greater than 5 ohms: Open in PWM throttle signal wire -- -1/1
④ Short in PWM Circuit Test	<i>NOTE: For wiring and theory of operation information, see T9 - PWM THROTTLE INPUT LOW supporting information</i> 1. Ignition OFF 2. ECU 30-way connector and the other signal source controller still disconnected 3. Using a multimeter measure resistance between terminal B2 in the harness end of the ECU 30-way connector and: • All other terminals in that connector • A good chassis ground	All measurements greater than 2000 ohms: GO TO ⑤ Any measurement less than 2000 ohms: Short in PWM circuit -- -1/1
⑤ PWM Throttle Source Controller Connector Test	<i>NOTE: For wiring and theory of operation information, see T9 - PWM THROTTLE INPUT LOW supporting information</i> 1. Ignition OFF 2. ECU 30-way connector still disconnected 3. Reconnect PWM signal source connector 4. Ignition ON 5. Using a multimeter, measure voltage while operating the throttle between terminal B2 in the harness end of the ECU 30-way connector and a good chassis ground	Between 0.5 V and 4.8V: Faulty PWM signal source controller OR Wrong ECU for the vehicle OR Faulty ECU 30-way connector OR Faulty ECU Less than 0.5 V or greater than 4.8V: Faulty PWM throttle signal source controller connector OR Faulty PWM throttle signal source controller -- -1/1

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T10 - PWM Abnormal Pulse Width



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Pulse-Width-Modulated (PWM) Throttle Position Input

- The PWM throttle signal is sent to the ECU by another controller on the machine. The PWM signal is a square wave signal with a constant frequency. The pulse width (amount of time the signal is high) of the signal to the ECU varies as throttle input to the other controller varies.

Code will set if:

- The PWM throttle signal is missing or erratic.

If this code sets, the following will occur:

- If the only throttle input to the ECU is the PWM throttle, the ECU will only allow low idle engine speed.
- If the ECU has an analog throttle in addition to the PWM throttle, the ECU will ignore the PWM input, and use the analog throttle input to control the engine.

DPSG, RG39774, 60 -19-23NOV98-1/1

T10 - PWM Abnormal Pulse Width

RG40854,000001F -19-04JAN01-1/1

T10 - PWM Abnormal Pulse Width Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 30-way and 18-way (if equipped) ECU connector(s) looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	<i>NOTE: For wiring and theory of operation information, see T10 - PWM ABNORMAL PULSE WIDTH supporting information</i> 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000091.08 reoccurs: GO TO ❷ 000091.08 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Application Related DTCs Test	<i>NOTE: For wiring and theory of operation information, see T10 - PWM ABNORMAL PULSE WIDTH supporting information</i> If PWM throttle signal originates from another controller, check that controller for throttle related DTCs	Controller reports no throttle related DTCs: GO TO ❸ Controller does report a throttle related DTC: Refer to diagnostic procedures for controller Repair cause of throttle related DTC and restart

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Trouble Code Diagnostics and Tests

③ Open in PWM Signal Wire Test

NOTE: For wiring and theory of operation information, see T10 - PWM ABNORMAL PULSE WIDTH supporting information

1. Ignition OFF
2. Disconnect ECU 30-way connector
3. Obtain wiring information for this application and determine the source of the PWM throttle signal
4. Disconnect the connector that outputs the PWM throttle signal
5. Using a multimeter, measure resistance between the PWM throttle input terminal in the harness end of the ECU 30-way connector **and** originating PWM throttle signal terminal

5.0 ohms or less:
GO TO ④

Greater than 5.0 ohms:
Open in PWM throttle signal circuit

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④ PWM Throttle Short Circuit Test

NOTE: For wiring and theory of operation information, see T10 - PWM ABNORMAL PULSE WIDTH supporting information

1. Ignition OFF
2. Using a multimeter, measure resistance between PWM throttle input terminal in the harness end of the ECU 30-way connector, all other terminals in the connector, and ground
3. Using a multimeter, measure resistance between originating PWM throttle signal terminal and:
 - All terminals in the ECU 30-way and 18-way connectors
 - A good ground

5.0 ohms or less:
PWM throttle signal circuit shorted to another circuit in the wiring harness or to ground

Greater than 5.0 ohms:
Faulty ECU
OR
Faulty PWM throttle signal source

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000028.03 — Throttle Voltage High

Throttle voltage is above the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
OEM (early ECUs) ^a	T5 - Analog Throttle (B) Input High
OEM (later ECUs) ^b	T1 - Multi-state Throttle Input High
^a Early ECUs = Earlier than January 2000	
^b Later ECUs = Later than January 2000	

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RG41221,00000D9 -19-22JAN03-1/1

000028.04 — Throttle Voltage Low

Throttle voltage is below the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
OEM (early ECUs) ^a	T6 - Analog Throttle (B) Input Low
OEM (later ECUs) ^b	T2 - Multi-state Throttle Input Low
^a Early ECUs = Earlier than January 2000	
^b Later ECUs = Later than January 2000	

RG41221,00000DA -19-22JAN03-1/1

000029.03 — Throttle Voltage High

Throttle voltage is above the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Grader	T5 - Analog Throttle (B) Input High
Loader	T3 - Analog Throttle (A) Input High
Marine	T5 - Analog Throttle (B) Input High
OEM (early ECUs) ^a	T3 - Analog Throttle (A) Input High
OEM (later ECUs) ^b	T5 - Analog Throttle (B) Input High
Tractor	T5 - Analog Throttle (B) Input High
^a Early ECUs = Earlier than January 2000	
^b Later ECUs = Later than January 2000	

RG41221,00000DB -19-22JAN03-1/1

000029.04 — Throttle Voltage Low

Throttle voltage is below the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Grader	T6 - Analog Throttle (B) Input Low
Loader	T4 - Analog Throttle (A) Input Low
Marine	T6 - Analog Throttle (B) Input Low
OEM (early ECUs) ^a	T4 - Analog Throttle (A) Input Low
OEM (later ECUs) ^b	T6 - Analog Throttle (B) Input Low
Tractor	T6 - Analog Throttle (B) Input Low
^a Early ECUs = Earlier than January 2000	
^b Later ECUs = Later than January 2000	

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RG41221,00000DC -19-22JAN03-1/1

000051.02 — Throttle Invalid

ECU received invalid or missing throttle information.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Loader	T7 - CAN Throttle Invalid

RG41221,00000E1 -19-22JAN03-1/1

000091.03 — Throttle Voltage High

Throttle voltage is above the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Articulated Dump Truck	T8 - PWM Throttle Input High
Combine	T3 - Analog Throttle (A) Input High
Crawler	T3 - Analog Throttle (A) Input High
Grader	T5 - Analog Throttle (B) Input High
Loader	T3 - Analog Throttle (A) Input High
Grader	T6 - Analog Throttle (B) Input Low
Loader	T4 - Analog Throttle (A) Input Low
Loader	T8 - PWM Throttle Input High
Marine	T3 - Analog Throttle (A) Input High
OEM (later ECUs) ^a	T3 - Analog Throttle (A) Input High
Self Propelled Forage Harvester	T3 - Analog Throttle (A) Input High
Tractor	T3 - Analog Throttle (A) Input High
^a Later ECUs = Later than January 2000	

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RG41221,00000DD -19-22JAN03-1/1

000091.04 — Throttle Voltage Low

Throttle voltage is below the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Articulated Dump Truck	T9 - PWM Throttle Input Low
Combine	T4 - Analog Throttle (A) Input Low
Crawler	T4 - Analog Throttle (A) Input Low
Grader	T6 - Analog Throttle (B) Input Low
Loader	T4 - Analog Throttle (A) Input Low
Loader	T9 - PWM Throttle Input Low
Marine	T4 - Analog Throttle (A) Input Low
OEM (later ECUs) ^a	T4 - Analog Throttle (A) Input Low
Self Propelled Forage Harvester	T4 - Analog Throttle (A) Input Low
Tractor	T4 - Analog Throttle (A) Input Low
^a Later ECUs = Later than January 2000	

RG41221,00000DE -19-22JAN03-1/1

000091.08 — PWM Throttle Abnormal Pulse Width

ECU senses that the the frequency of the PWM signal is not within range.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Articulated Dump Truck	T10 - PWM Abnormal Pulse Width
Loader	T10 - PWM Abnormal Pulse Width
Tractor	T10 - PWM Abnormal Pulse Width

RG41221,00000DF -19-22JAN03-1/1

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000091.09 — Throttle Invalid

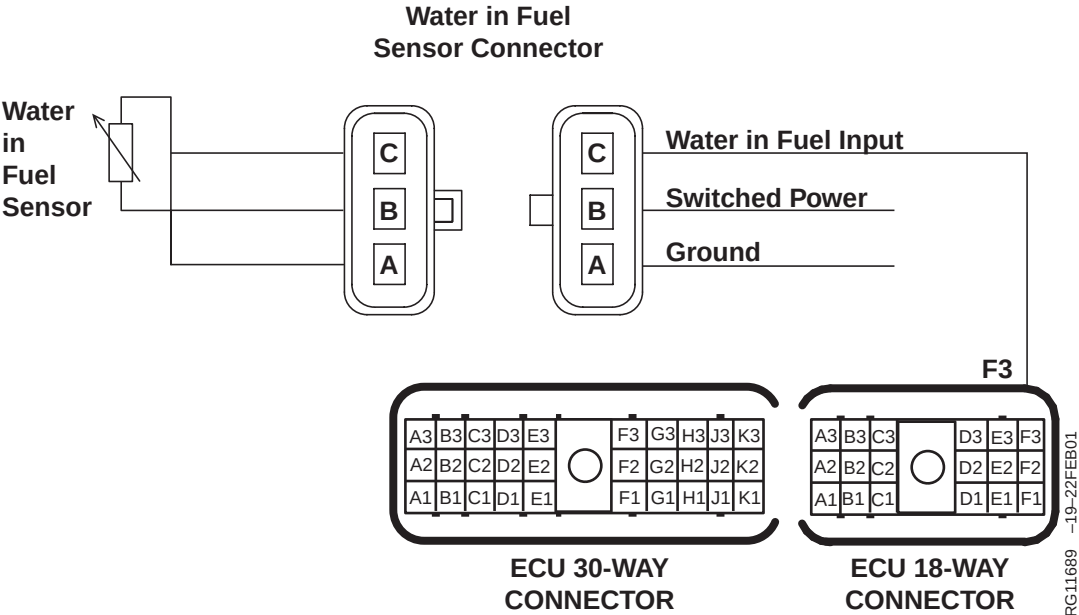
ECU received invalid or missing throttle information.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Combine	T7 - CAN Throttle Invalid
Loader	T7 - CAN Throttle Invalid
Tractor	T7 - CAN Throttle Invalid

RG41221,00000E0 -19-22JAN03-1/1

000097.00 — Water in Fuel Continuously Detected



NOTE: Wiring diagram shows Marine engine applications. For wiring information on non-Marine engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, the water in fuel sensor will read a lower voltage when water is present than when it is not present.

000097.00 will set if:

- The WIF is above a predetermined quantity for an extended period of time.

If 000097.00 sets, the following will occur:

NOTE: The derate information shown in this section are for OEM applications only. For non-OEM engine derate information, refer to machine manual.

- ECUs that have engine protection with shutdown will derate the engine 20% per minute (DTC 001569.31 will also be present). If WIF is not removed within 30 seconds, the ECU will shut down the engine.
- ECUs that have engine protection without shutdown will derate the engine 20% per minute until the engine has been derated by 40 % of rated power (DTC 001569.31 will also be present).
- ECUs that have no engine protection will not derate or shut the engine down.

000097.00 — Water in Fuel Continuously Detected

The WIF is above a predetermined quantity for an extended period of time.

RG40854,0000020 -19-04JAN01-1/1

000097.00 Water in Fuel Continuously Detected Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 18-way connector and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Moisture Buildup Test	NOTE: For wiring and theory of operation information, see 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Key OFF 3. Drain sediment bowl on the bottom of the primary fuel filter until all the water is out 4. Operate engine in normal use 5. Start ECU communication software 6. Read DTCs using DST or SERVICE ADVISOR™.	000097.00 reoccurs: GO TO ❷ 000097.00 doesn't reoccur: Problem is was most likely caused by moisture build up over time. Monitor the sediment bowl for moisture periodically, drain as needed.

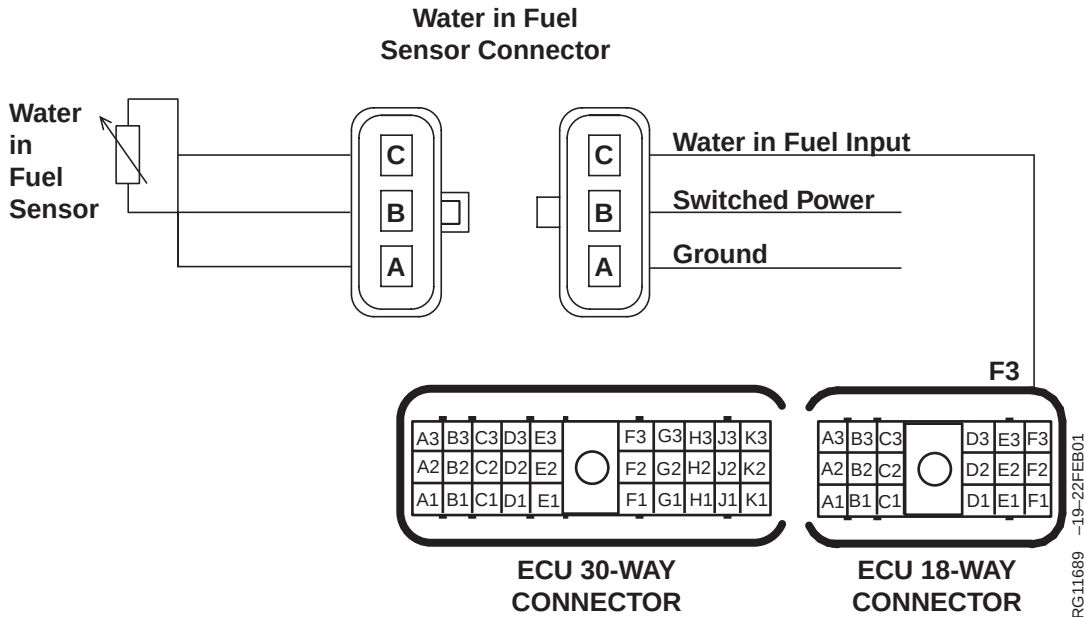
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❷ Water in Fuel (WIF) Circuit and Sensor Test	NOTE: For wiring and theory of operation information, see 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information Check the following items that can cause water in the fuel: • Poor fuel quality or water in fuel storage tank • Loose fuel tank cap • Missing or damaged fuel tank cap seal • Excessive condensation build up in fuel tank • Loose or damaged fuel filter or sediment bowl	Cause of water in fuel located: Repair problem, drain sediment bowl, and retest No cause of water in fuel located: Verify that WIF sensor input and ground circuits are OK. If WIF sensor circuits are OK, replace WIF sensor and retest

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000097.16 — Water in Fuel Detected



NOTE: Wiring diagram shows Marine engine applications. For wiring information on non-Marine engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, water in fuel sensor will read a lower voltage when water is present than when it is not present.

DTC 000097.16 will set if:

- The WIF is above a predetermined quantity at any given time.

If DTC 000097.16 sets, the following will occur:

NOTE: The derate information shown in this section are for OEM applications only. For non-OEM engine derate information, refer to machine manual.

- ECUs that have engine protection will derate the engine 2% per minute until the engine has been derated by 20% of rated power (DTC 001569.31 will also be present). If WIF is detected for an extended period of time, the ECU will set a DTC 000097.00, and a more severe derate and/or shutdown will go into effect.

RG40854,000000F -19-21DEC00-1/1

000097.16 — Water in Fuel Detected

The WIF is above a predetermined quantity at any given time.

RG40854,000002B -19-05JAN01-1/1

000097.16 Water in Fuel Detected Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 18-way connector and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.

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① Moisture Buildup Test

NOTE: For wiring and theory of operation information, see DTC 000097.16 WATER IN FUEL DETECTED supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Key OFF
3. Drain sediment bowl on the bottom of the primary fuel filter until all the water is out
4. Operate engine in normal use
5. Start ECU communication software
6. Read DTCs using DST or SERVICE ADVISOR™.

000097.16 reoccurs:
GO TO ②

000097.16 doesn't reoccur:
Problem is was most likely caused by moisture build up over time
Monitor the sediment bowl for moisture periodically, drain as needed

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② Water in Fuel (WIF) Circuit and Sensor Test

NOTE: For wiring and theory of operation information, see DTC 000097.16 WATER IN FUEL DETECTED supporting information

Check the following items that can cause water in the fuel:

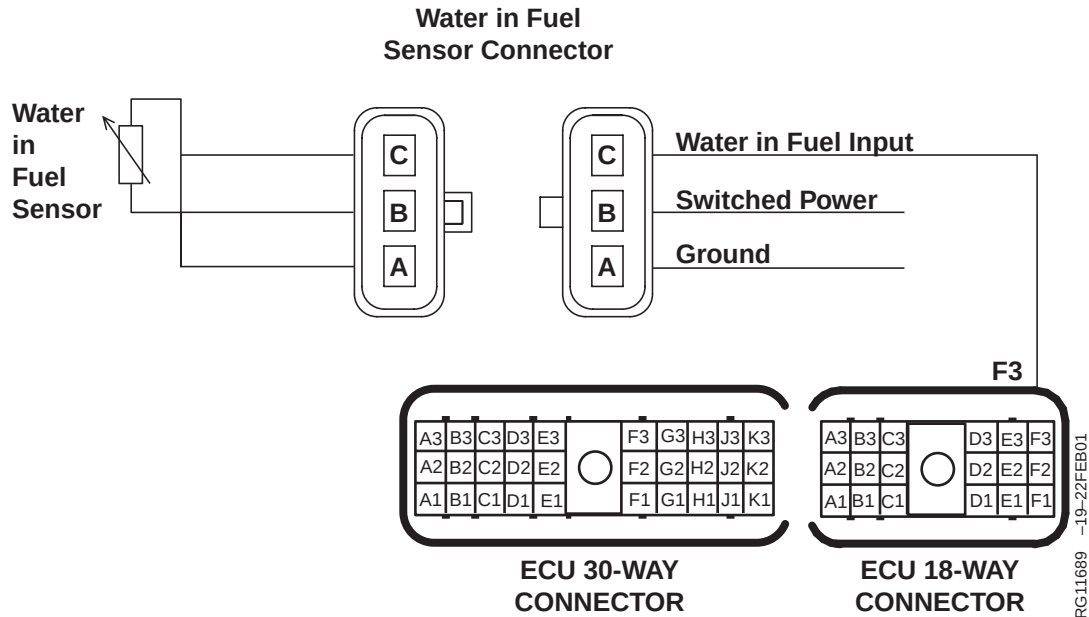
- Poor fuel quality or water in fuel storage tank
- Loose fuel tank cap
- Missing or damaged fuel tank cap seal
- Excessive condensation build up in fuel tank
- Loose or damaged fuel filter or sediment bowl

Cause of water in fuel located:
Repair problem, drain sediment bowl, and retest

No cause of water in fuel located:
Verify that WIF sensor input and ground circuits are OK.
If WIF sensor circuits are OK, replace WIF sensor and retest

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000097.31 — Water in Fuel Detected



NOTE: Wiring diagram shows Marine engine applications. For wiring information on non-Marine engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, water in fuel sensor will read a lower voltage when water is present than when it is not present.

DTC 000097.31 will set if:

- The WIF is above a predetermined quantity at any given time.

If DTC 000097.31 sets, the following will occur:

NOTE: The derate information shown in this section are for OEM/Marine applications only. For non-OEM engine derate information, refer to machine manual.

- ECUs that have engine protection will derate the engine 2% per minute until the engine has been derated by 20% of rated power (DTC 001569.31 will also be present). If WIF is detected for an extended period of time, the ECU will set a DTC 000097.00, and a more severe derate and/or shutdown will go into effect.

RG40854,000000F -19-21DEC00-1/1

000097.31 — Water in Fuel Detected

The WIF is above a predetermined quantity at any given time.

RG40854,000002C -19-05JAN01-1/1

000097.31 Water in Fuel Detected Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 18-way connector and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.

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① Moisture Buildup Test

NOTE: For wiring and theory of operation information, see DTC 000097.31 WATER IN FUEL DETECTED supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Key OFF
3. Drain sediment bowl on the bottom of the primary fuel filter until all the water is out
4. Operate engine in normal use
5. Start ECU communication software
6. Read DTCs using DST or SERVICE ADVISOR™.

000097.31 reoccurs:
GO TO ②

000097.31 doesn't reoccur:
Problem is was most likely caused by moisture build up over time
Monitor the sediment bowl for moisture periodically, drain as needed

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② Water in Fuel (WIF) Circuit and Sensor Test

NOTE: For wiring and theory of operation information, see DTC 000097.31 WATER IN FUEL DETECTED supporting information

Check the following items that can cause water in the fuel:

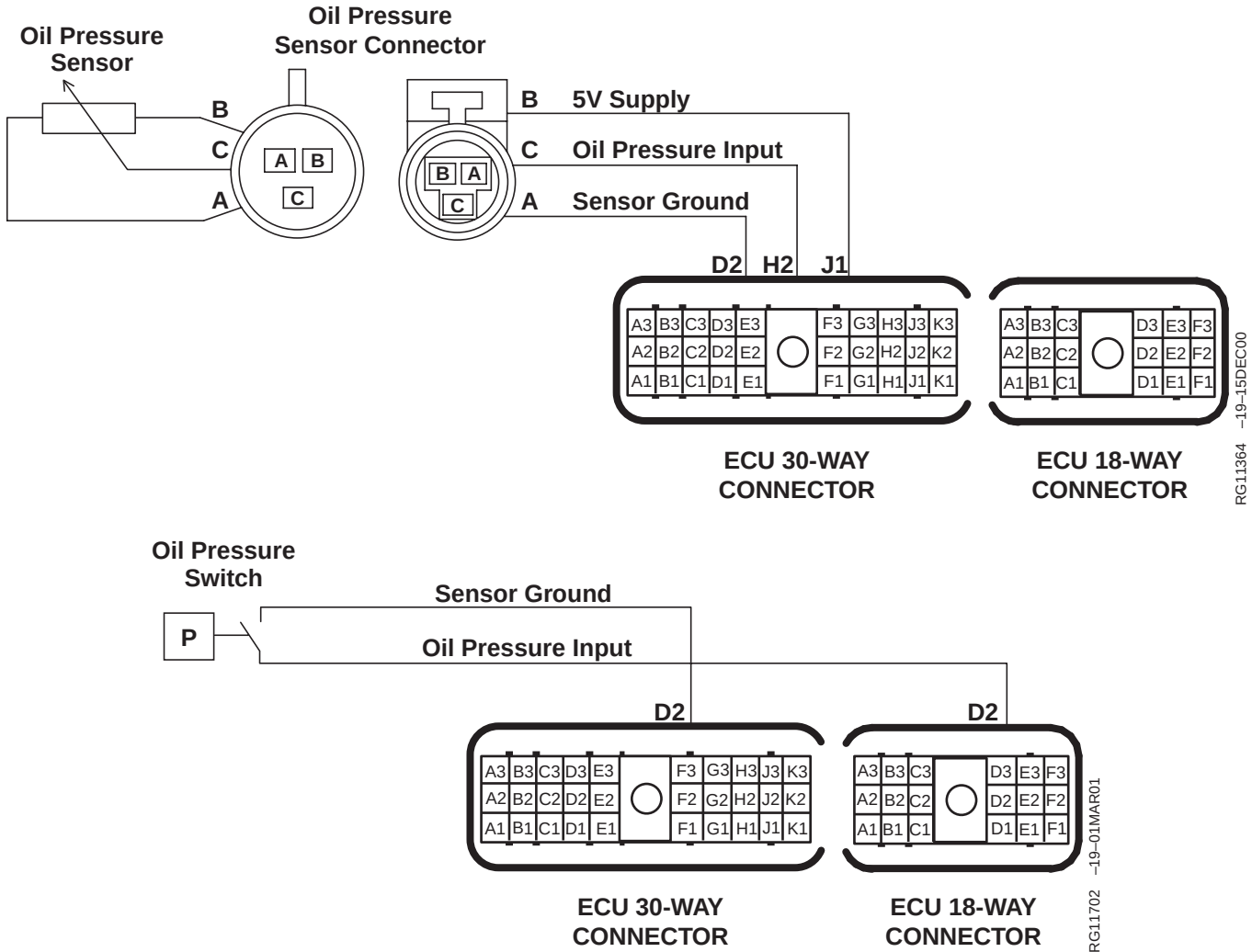
- Poor fuel quality or water in fuel storage tank
- Loose fuel tank cap
- Missing or damaged fuel tank cap seal
- Excessive condensation build up in fuel tank
- Loose or damaged fuel filter or sediment bowl

Cause of water in fuel located:
Repair problem, drain sediment bowl, and retest

No cause of water in fuel located:
Verify that WIF sensor input and ground circuits are OK.
If WIF sensor circuits are OK, replace WIF sensor and retest

-- -1/1

000100.01 — Engine Oil Pressure Extremely Low



NOTE: Wiring diagrams cover OEM engine applications for the oil pressure sensor and some Harvester applications for the oil pressure switch. For wiring information on other applications, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Oil Pressure Sensor or Switch

- The oil pressure sensor is a pressure transducer connected to the engine's main oil gallery. The oil pressure input voltage varies as oil pressure varies. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING OIL PRESSURE in Section 03, Group 140 of this manual.

Continued on next page

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- On some applications, an oil pressure switch is used to detect a loss of oil pressure. Oil pressure causes the contacts in the switch to close when oil pressure drops below the minimum oil pressure threshold. When the engine is not running, the switch is open.

DTC 000100.01 will set if:

- For engines with an oil pressure sensor, the ECU senses an oil pressure below the shutdown value set point in the ECU. The shutdown value set point is dependent on engine speed.
- For engines with an oil pressure switch, the ECU senses that the oil pressure switch is open after the engine is above cranking RPM for several seconds.

If DTC 000100.01 sets, the following will occur:

NOTE: The derate information shown in this section are for OEM applications only. For non-OEM engine derate information, refer to machine manual.

- ECUs that have engine protection with shutdown will derate the engine 20% per minute (DTC 001569.31 will also be present). If oil pressure does not increase above the shutdown value set point within 30 seconds, the ECU will shut down the engine.
- ECUs that have engine protection without shutdown will derate the engine 20% per minute until the engine has been derated by 40 % of rated power (DTC 001569.31 will also be present).
- ECUs that have no engine protection will not derate or shut the engine down.

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,109

DPSG,RG39774,74 -19-23NOV98-2/2

000100.01 — Engine Oil Pressure Extremely Low

The ECU senses an oil pressure below the shutdown value set point in the ECU or the ECU senses that the oil pressure switch is open after the engine is above cranking RPM for several seconds.

RG40854,000002E -19-08JAN01-1/1

000100.01 Engine Oil Pressure Extremely Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the oil pressure sensor or switch connector, and the ECU 30-way and 18-way connectors looking for dirty, damaged, or poorly positioned terminals.

-- -1/1

1 Engine Oil Pressure Check

NOTE: For wiring and theory of operation information, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information.

Under the conditions where DTC 000100.01 occurs, measure engine oil pressure.

- On 8.1 L engines, see CHECK ENGINE OIL PRESSURE in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).
- On 6.8 L engines, see CHECK ENGINE OIL PRESSURE in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

Oil pressure below specification:

Low oil pressure problem.
On 8.1 L engines, see L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).
OR
On 6.8 L engines, see L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

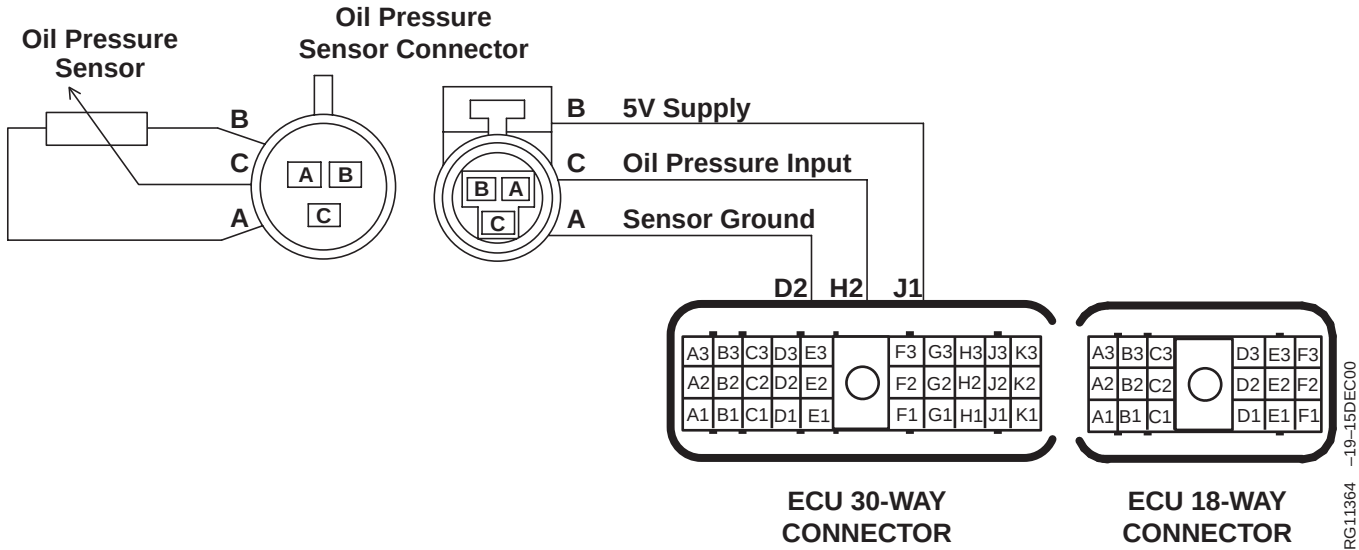
Oil pressure within specification:

Verify that oil pressure wiring is OK for application.
If oil pressure circuits are OK, replace oil pressure sensor or switch and retest

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,111

000100.03 — Engine Oil Pressure Input Voltage High



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the engine's main oil gallery. The oil pressure input voltage varies as oil pressure varies. As engine oil pressure increases, the oil pressure

sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING OIL PRESSURE in Section 03, Group 140 of this manual.

DTC 000100.03 will set if:

- The oil pressure input voltage exceeds 4.9 volts. This voltage corresponds to a pressure that is higher than what is physically possible for oil pressure.

If DTC 000100.03 sets, the following will occur:

- ECU's low oil pressure engine protection feature disabled.

000100.03 — Engine Oil Pressure Input Voltage High

The oil pressure input voltage exceeds 4.9 volts. This voltage corresponds to a pressure that is higher than what is physically possible for oil pressure.

RG40854,000002F -19-08JAN01-1/1

000100.03 Engine Oil Pressure Input Voltage High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the oil pressure sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Warm engine 3. Start ECU communication software. 4. Ignition ON, engine OFF 5. Read DTCs using DST or SERVICE ADVISOR™. 6. Make note of all DTCs, then clear all DTCs 7. Ignition ON, engine running 8. Read DTCs	000100.03 reoccurs: GO TO ❷ 000100.03 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Oil Pressure Input Shorted Test	NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information 1. Ignition OFF 2. Disconnect oil pressure sensor connector 3. Read DTCs 4. Make note of all DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	000100.04 occurs: GO TO ❸ 000100.03 reoccurs: Short to voltage in oil pressure input circuit OR Faulty ECU

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Trouble Code Diagnostics and Tests

③ Oil Pressure Ground
Circuit Open Test

NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE
OIL PRESSURE INPUT VOLTAGE HIGH supporting information

1. Ignition OFF
2. Probe ground terminal in oil pressure sensor harness connector with a test light connected to battery voltage

Light ON:
Faulty ECU 30-way
connector
OR
Faulty oil pressure sensor

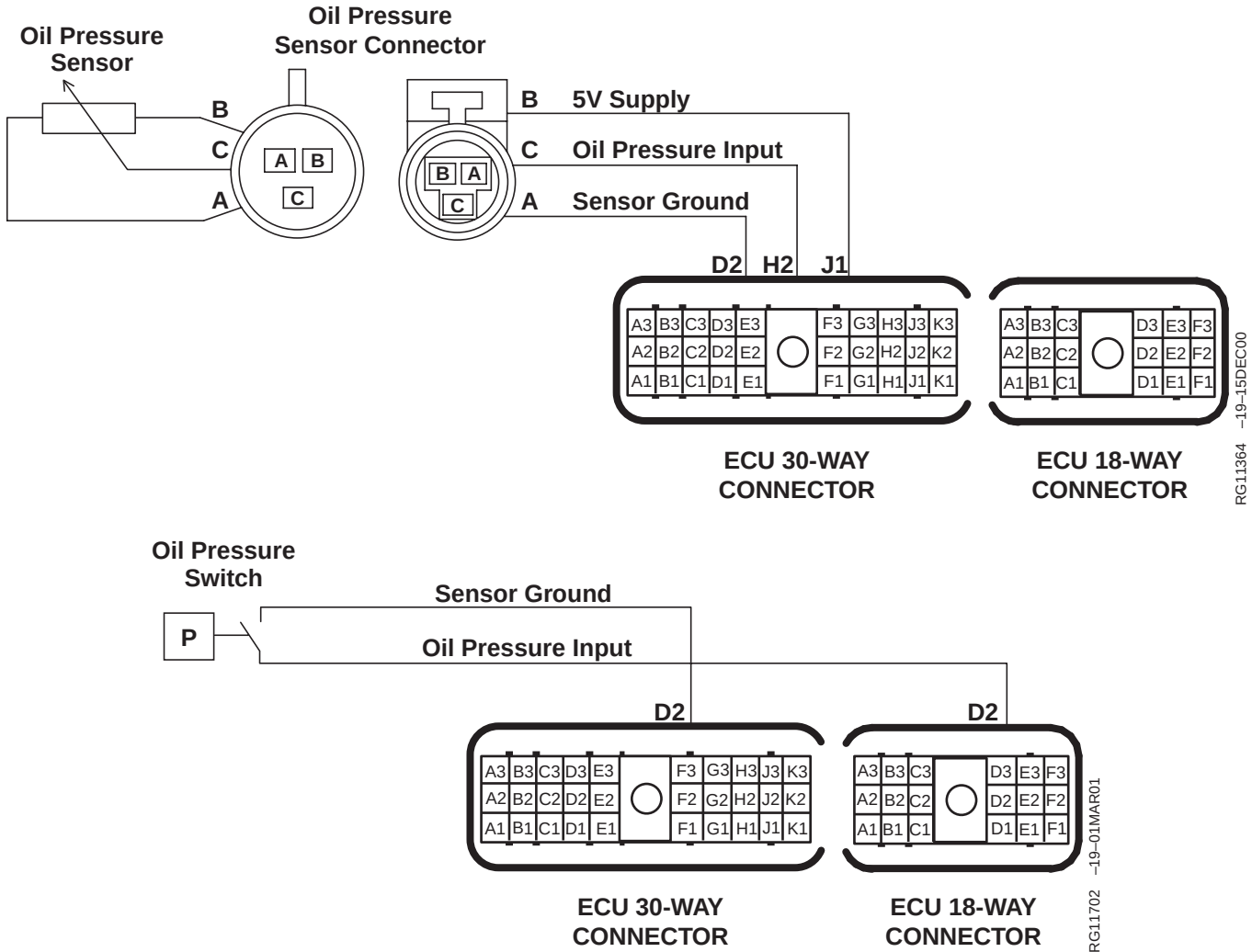
Light OFF:
Open in oil pressure
ground circuit

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000100.04 — Engine Oil Pressure Input Voltage Low



NOTE: Wiring diagrams cover OEM engine applications for the oil pressure sensor and some Harvester applications for the oil pressure switch. For wiring information on other applications, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Oil Pressure Sensor or Switch

- The oil pressure sensor is a pressure transducer connected to the engine's main oil gallery. The oil pressure input voltage varies as oil pressure varies. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING OIL PRESSURE in Section 03, Group 140 of this manual.

Continued on next page

DPSG, RG39774, 47 -19-23NOV98-1/2

- On some applications, an oil pressure switch is used to detect oil pressure. Oil pressure causes the contacts in the switch to close when oil pressure drops below the minimum oil pressure threshold. When the engine is not running, the switch is open.

DTC 000100.04 will set if:

- For engines with an oil pressure sensor, the oil pressure input voltage drops below 0.1 volts. This voltage corresponds to a pressure that is lower than what is physically possible for oil pressure.

- For engines with an oil pressure switch, the oil pressure switch is closed when key is on and there is no engine speed.

If DTC 000100.04 sets, the following will occur:

- For engines with an oil pressure sensor, the ECU's low oil pressure engine protection feature will be disabled.
- For engines with an oil pressure switch, the vehicle will display a warning fault light.

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DPSG,RG39774,47 -19-23NOV98-2/2

000100.04 — Engine Oil Pressure Input Voltage Low

The oil pressure input voltage drops below 0.1 volts or the oil pressure switch is closed when key is on and there is no engine speed.

RG40854.0000030 -19-08JAN01-1/1

000100.04 Engine Oil Pressure Input Voltage Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the oil pressure sensor or switch connector, and the ECU 30-way and 18-way connectors looking for dirty, damaged, or poorly positioned terminals.

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1 Intermittent Fault Test

- NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.
1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
 2. Warm engine
 3. Ignition ON, engine OFF
 4. Start ECU communication software
 5. Read DTCs using DST or SERVICE ADVISOR™.
 6. Make note of all DTCs, then clear all DTCs
 7. Ignition ON, engine running
 8. Read DTCs

000100.04 reoccurs:
GO TO 2

000100.04 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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2 Oil Sensor Check

- NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.
- Determine whether an oil pressure sensor or an oil pressure switch is being used.

Oil pressure sensor being used:
GO TO 3

Oil pressure switch being used:
GO TO 5

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Trouble Code Diagnostics and Tests

③ Oil Pressure Sensor Wiring Test	<i>NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Disconnect oil pressure sensor connector 3. Install a jumper wire between oil pressure 5 V supply and oil pressure input in harness sensor connector 4. Using the DST, monitor DTCs on the active code display parameter 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Using the DST, monitor DTCs on the active code display parameter	000100.04 reoccurs: GO TO ③ 000100.03 occurs: Faulty oil pressure sensor connector OR Faulty oil pressure sensor
④ Oil Pressure Sensor 5 V Supply Test	<i>NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between oil pressure 5 V supply terminal and a good chassis ground	4.0 - 6.0 V: Open in oil pressure input circuit OR Short to ground in oil pressure input circuit OR Faulty ECU 30-way connector OR Faulty ECU Below 4.0 V: Open in oil pressure 5 V supply circuit OR Short to ground in oil pressure 5 V supply circuit OR Faulty ECU 30-way connector OR Faulty ECU

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**5 Oil Pressure Switch
Short in Wire Check**

NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.

1. Ignition OFF
2. Disconnect oil pressure switch connector and ECU 30-way and 18-way connectors
3. Using a multimeter, measure the resistance between terminal D2 in the ECU 18-way connector and:
 - All other terminals in the ECU 30-way and 18-way connectors
 - A good ground

All measurements greater than 2000 ohms:
Faulty oil pressure switch
OR
Faulty ECU

Any measurement less than 2000 ohms:
Short in oil pressure input circuit

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,121

RG11364 -19-15DEC00

000100.18 — Engine Oil Pressure Moderately Low

The ECU senses an oil pressure below the warning value set point in the ECU. The warning value set point is dependent on engine speed.

RG40854,0000031 -19-08JAN01-1/1

000100.18 Engine Oil Pressure Moderately Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the oil pressure sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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1 Engine Oil Pressure Check

NOTE: For theory of operation and wiring information, see DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information.

Under the conditions where DTC 000100.18 occurs, measure engine oil pressure.

- On 8.1 L engines, see CHECK ENGINE OIL PRESSURE in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).
- On 6.8 L engines, see CHECK ENGINE OIL PRESSURE in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

Oil pressure below specification:
Low oil pressure problem.

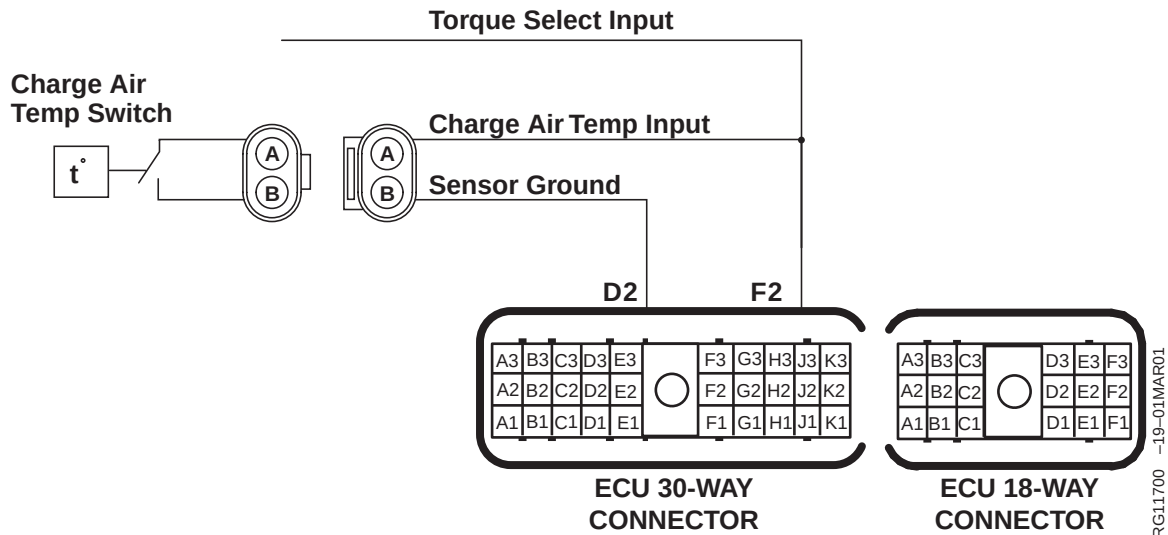
On 8.1 L engines, see L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).
OR

On 6.8 L engines, see L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

Oil pressure within specification:
Verify that oil pressure 5 V supply, input, and ground circuits are OK. If oil pressure circuits are OK, replace oil pressure sensor and retest.

-- -1/1

000105.00 — Derated Torque Curve Selected



The torque curve select input is pulled to ground.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Torque Curve Selection

- The ECU has the ability operate the engine on multiple torque curves. Individual curves are selected based on input voltage at the ECU torque curve select terminal. The OEM application uses a charge air temperature switch connected to the ECU's torque curve select input that will close to ground when charge air temperature becomes excessive.

DTC 000105.00 will set if:

- The torque curve select input is pulled to ground.

If DTC 000105.00 sets, the following will occur:

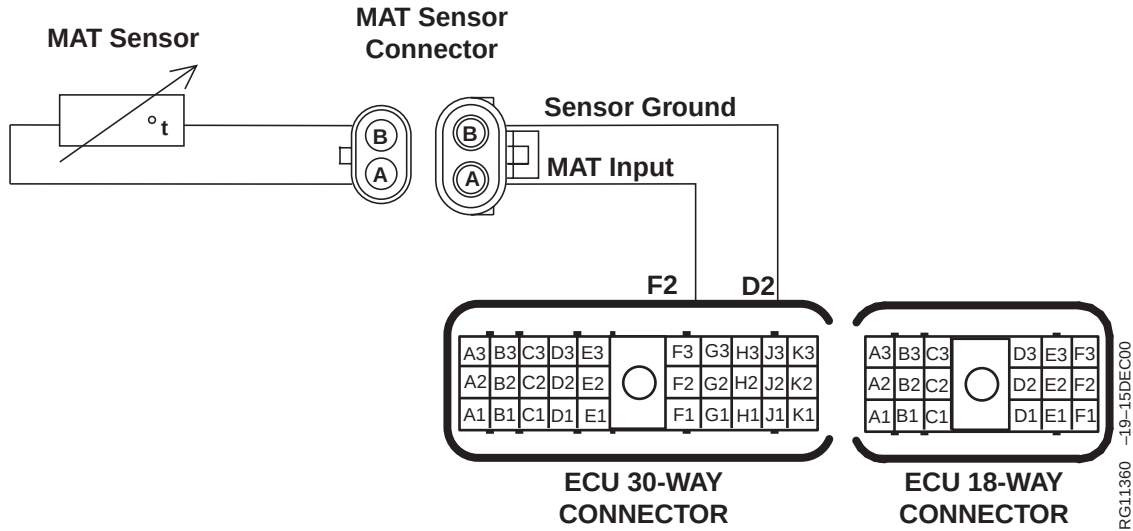
- ECU will operate on a lower power torque curve.
- Engine power output will be lowered significantly.

If DTC 000105.00 sets:

- On air-to-air aftercooled ("H" engines) OEM applications, if charge air temperature exceeds 94°C (201°F), DTC 000105.00 will result. Check for:
 - Excessively high ambient air temperature
 - Restricted, dirty, or damaged charge air cooler
 - Loose cooling fan belt
 - Malfunctioning cooling fan
 - Restricted or damaged intake air piping
 - Damaged cooling fan shroud
- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
- Start the ECU communication software.
- Read DTCs using DST or SERVICE ADVISOR™. If codes are present, go to appropriate diagnostic procedure.
- Check for faulty derated torque curve wiring. A short to ground will put derate into effect.

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,125

000105.03 — Manifold Air Temperature Input Voltage High



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. For further MAT sensor information, see

MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000105.03 will set if:

- The MAT input voltage exceeds 4.9 volts. This voltage corresponds to a temperature that is lower than what is physically possible for manifold air.

If DTC 000105.03 sets, the following will occur:

- The ECU will use a default "limp-home" MAT value of 50°C (122°F).
- ECU's high manifold air temperature engine protection feature disabled.

DPSG, RG39774, 48 -19-23NOV98-1/1

000105.03 — Manifold Air Temperature Input Voltage High

The MAT input voltage exceeds 4.9 volts. This voltage corresponds to a temperature that is lower than what is physically possible for manifold air.

RG40854,0000033 -19-08JAN01-1/1

000105.03 Manifold Air Temperature Input Voltage High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the MAT sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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,127

① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Warm engine
3. Ignition ON, engine OFF
4. Start ECU communication software.
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000105.03 reoccurs:
GO TO ②

000105.03 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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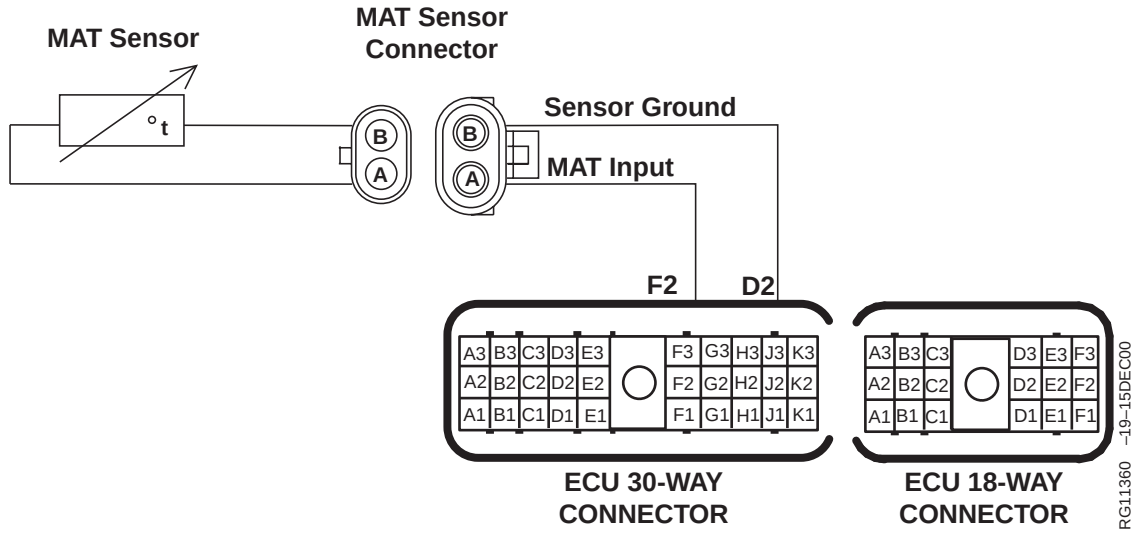
-- -1/1

Trouble Code Diagnostics and Tests

② MAT Wiring Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Disconnect MAT sensor connector 3. Install a jumper wire between both terminals in the MAT sensor harness connector 4. Read DTCs 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000105.03 reoccurs: GO TO ③ 000105.04 occurs: Faulty MAT sensor connector OR Faulty MAT sensor -- -1/1
③ MAT Ground Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between MAT 5 V supply terminal and a good chassis ground	4.0 - 6.0 V: Open in MAT ground circuit OR Faulty ECU 30-way connector OR Faulty ECU Below 4.0 V: Open in MAT input circuit OR Faulty ECU 30-way connector OR Faulty ECU -- -1/1

04
160
,129

000105.04 — Manifold Air Temperature Input Voltage Low



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. For further MAT sensor information, see

MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000105.04 will set if:

- The MAT input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for manifold air.

If DTC 000105.04 sets, the following will occur:

- The ECU will use a default "limp-home" MAT value of 50°C (122°F).
- ECU's high manifold air temperature engine protection feature disabled.

DPSG, RG39774, 49 -19-23NOV98-1/1

000105.04 — Manifold Air Temperature Input Voltage Low

The MAT input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for manifold air.

RG40854,0000034 -19-08JAN01-1/1

000105.04 Manifold Air Temperature Input Voltage Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the MAT sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Warm engine 3. Ignition ON, engine OFF 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000105.04 reoccurs: GO TO ❷ 000105.04 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ MAT Input Circuit Grounded Test	NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information. 1. Ignition OFF 2. Disconnect MAT sensor connector 3. Read DTCs 4. Make note of all DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	000105.04 reoccurs: Short to ground in MAT input circuit OR Faulty ECU 000105.03 occurs: Faulty MAT sensor

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000105.09 — Manifold Air Temperature Invalid

The ECU either does not receive manifold air temperature information over CAN, or the information received is not valid.

CAN (Controller Area Network) Manifold Air Temperature

- CAN (Controller Area Network) manifold air temperature is information sent to the ECU by another controller over CAN of the manifold air temperature measured by the other controller.

DTC 000105.09 will set if:

- The ECU either does not receive manifold air temperature information over CAN, or the information received is not valid.

If DTC 000105.09 sets, the following will occur:

- ECU's high manifold air temperature engine protection feature disabled.

If DTC 000105.09 sets:

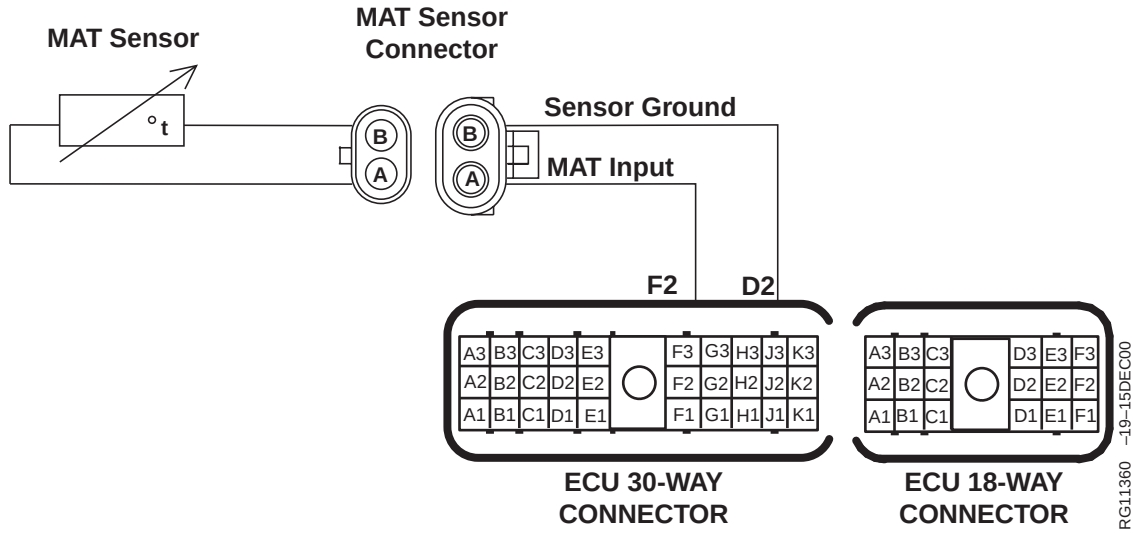
- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
- Start the ECU communication software.
- Read DTCs using DST or SERVICE ADVISOR™. If DTC 000639.00, 000639.02 or 000639.13 also, occur, see DTC 000639.13 CAN ERROR later in this Group.
- Check to see if any other controllers on the machine have any active or stored CAN or manifold air temperature sensor related DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN or manifold air temperature sensor related DTCs are found in the ECU or other controllers, replace the ECU and retest.

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DPSG,RG39774,78 -19-06JAN00-1/1

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,133

000105.16 — Manifold Air Temperature Moderately High



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Manifold Air Temperature Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. On some applications, the ECU receives manifold air temperature information over CAN (Controller Area Network) from another controller. The other controller measures manifold air temperature with a temperature sensor in the intake air system and sends the measured temperature as

a message to the ECU over CAN. The ECU in turn monitors this temperature and executes an engine protection derate if the temperature becomes excessive.

DTC 000105.16 will set if:

- The ECU senses a manifold air temperature above the warning value set point in the ECU. In most applications, the maximum value set point is 88°C (190°F).

If DTC 000105.16 sets, the following will occur:

- The ECU will derate the engine (DTC 001569.31 will also be present) until manifold air temperature decreases below the warning value maximum value set point. At that time, power will be increased until either back up to full power or manifold air temperature again raises above the maximum value set point.

DPSG,RG39774,75 -19-23NOV98-1/1

000105.16 — Manifold Air Temperature Moderately High

The ECU senses a manifold air temperature above the warning value set point in the ECU.

RG40854,0000035 -19-08JAN01-1/1

000105.16 Manifold Air Temperature Moderately High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the MAT sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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,135

① Check For Causes Of High Manifold Air Temperature

NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.

Check the following items that can cause high intake air temperature:

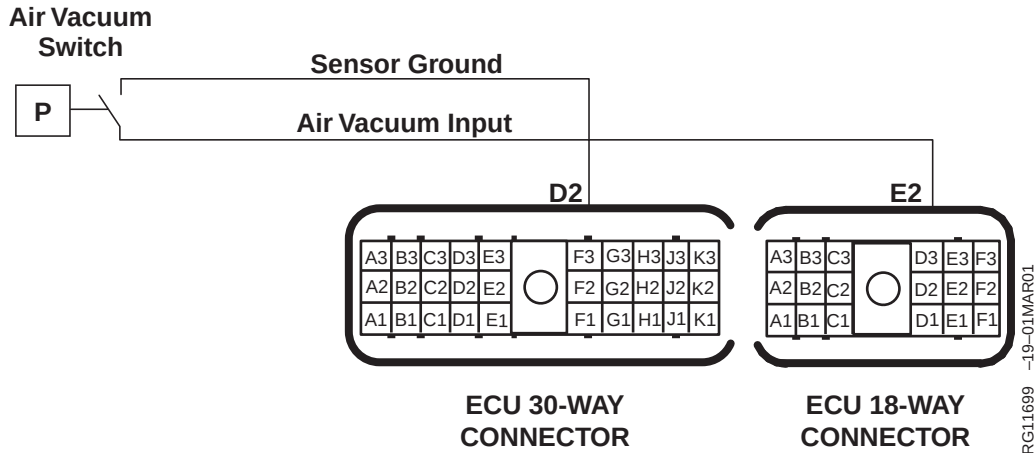
- Excessively high ambient air temperature
- Restricted, dirty, or damaged charge air cooler
- Loose cooling fan belt
- Malfunctioning cooling fan
- Restricted or damaged intake air piping
- Damaged cooling fan shroud

Cause of high intake air temp located:
Repair problem and retest

No cause of high intake air temp located
Verify that MAT input and ground circuits are OK
If MAT circuits are OK, replace MAT sensor and retest

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000107.00 — Air Filter Restriction High



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Air Vacuum Switch

- The air vacuum switch is located on the clean side of the air filter. Higher air pressure causes the contacts on the air vacuum switch to close.

DTC 000107.00 will set if:

- The ECU senses a high air pressure from the air vacuum switch.

If DTC 000107.00 sets, the following will occur:

- ECU's that have engine protection:
 - Will derate the engine (DTC 001569.31 will also be present) 2% per minute to a maximum derate of 20%. When air filter restriction drops back below the maximum value set point, power will be increased 2% per minute until either full power is reached or if the maximum value set point is surpassed again.

NOTE: The derate program shown applies to OEM engine applications that contain engine protection. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.

000107.00 — Air Filter Restriction High

The ECU senses a high air pressure from the air vacuum switch.

RG40854,000001E -19-01MAR01-1/1

000107.00 Air Filter Restriction High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way and 18-way connectors and the air pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.

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① Air Intake Restriction Test

NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER RESTRICTION HIGH supporting information.

Under the conditions where DTC 000107.00 occurs, inspect air intake system on suction side of turbo. Looking specifically at the air filter element and for any source of blockage of the air intake system.

- **On 8.1 L engines**, see CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Section 04, Group 150 of 8.1L Diesel Engines Base Engine (CTM86).
- **On 6.8 L engines**, see CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine (CTM104).

Restriction found in intake system:

Replace, repair, or clean components as needed.

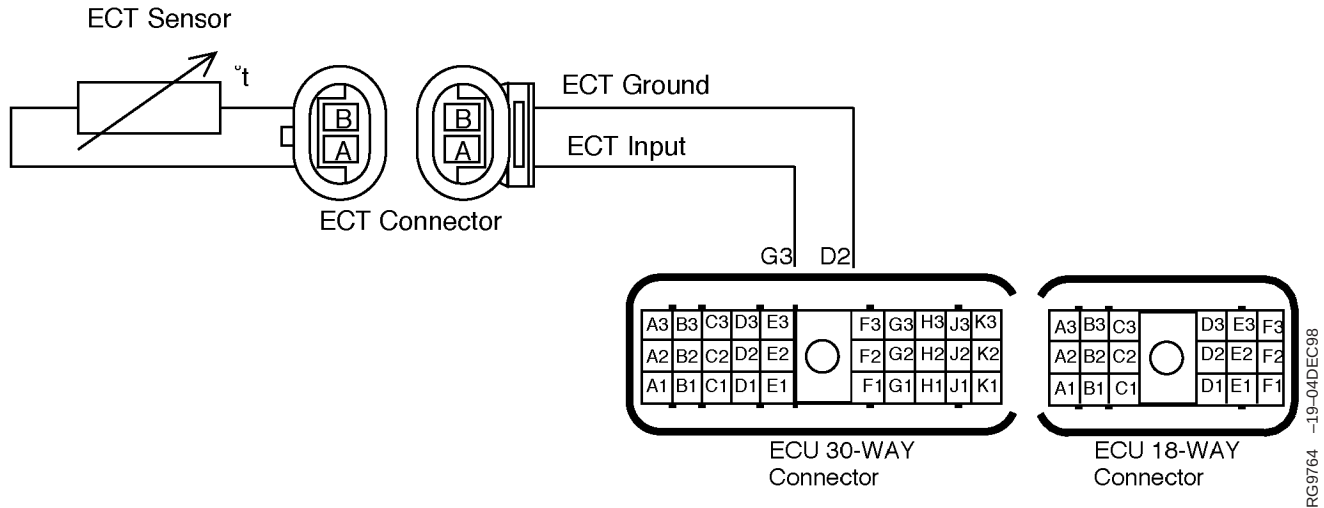
No problem found with intake system:

Verify that air pressure sensor 5 V supply, input, and ground circuits are OK.

If air pressure sensor circuits are OK, replace air pressure sensor and retest

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000110.00 — Engine Coolant Temperature Extremely High



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

ECT (Engine Coolant Temperature) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the ECU; lower temperatures result in higher voltages. On some applications, the ECU receives engine coolant temperature information over CAN (Controller Area Network) from another controller. The other controller measures coolant temperature with a temperature sensor in the thermostat housing and sends the measured temperature as a message to the ECU over CAN. The ECU in turn monitors this temperature and executes an engine protection derate if the temperature indicates an engine overheat condition. For further ECT sensor

information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

NOTE: The temperature value and derate information shown in this section are for OEM applications only. For the non-OEM engine temperature value and derate information, refer to machine manual.

DTC 000110.00 will set if:

- On OEM engines, the ECU senses a coolant temperature of 115°C (239°F).

If DTC 000110.00 sets, the following will occur:

- ECUs that have engine protection with shutdown will derate the engine at 20% per minute (DTC 001569.31 will also be present). If engine coolant temperature does not go below the extremely high specification within 30 seconds, the ECU will shut down the engine.
- ECUs that have engine protection without shutdown will derate the engine 20% per minute until the engine has been derated by 40% of rated power (DTC 001569.31 will also be present).
- ECUs that have no engine protection will not derate or shut the engine down.

000110.00 — Engine Coolant Temperature Extremely High

On OEM engines, the ECU senses a coolant temperature of 115° C (239° F).

RG40854,0000036 -19-08JAN01-1/1

000110.00 Engine Coolant Temperature Extremely High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECT sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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1 Engine Coolant Temperature Check

NOTE: For wiring and theory of operation information, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH supporting information.

Under the conditions where DTC 000110.00 occurs, use a temperature gauge and verify that engine coolant temperature is above the extremely high ECT specification.

NOTE: On OEM applications, the extremely high ECT specification is 115° C (239° F). Other applications may have the same or a similar temperature value. Refer to machine manual for extremely high ECT specification.

ECT above extremely high specification:

Engine overheating problem.

On 8.1 L engines, see C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).

OR

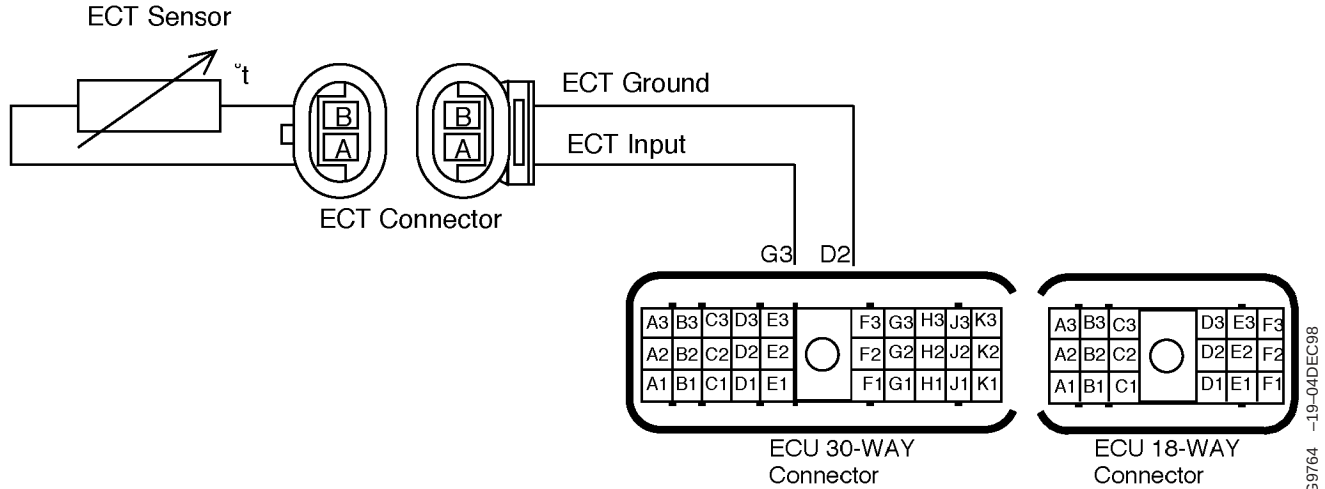
On 6.8 L engines, see C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104)

ECT significantly less than extremely high specification:

Verify that ECT input and ground circuits are OK
If both circuits are OK, replace ECT sensor and retest

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000110.03 — Engine Coolant Temperature Input Voltage High



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

ECT (Engine Coolant Temperature) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to

the ECU; lower temperatures result in higher voltages. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000110.03 will set if:

- The ECT input voltage exceeds 4.9 volts. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant.

If DTC 000110.03 sets, the following will occur:

- The ECU will use a default "limp-home" ECT value of 95°C (203°F).
- ECU's high coolant temperature engine protection feature disabled.

000110.03 — Engine Coolant Temperature Input Voltage High

The ECT input voltage exceeds 4.9 volts. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant.

RG40854,0000001 -19-13FEB01-1/1

000110.03 Engine Coolant Temperature Input Voltage High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECT sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Warm engine
3. Ignition ON, engine OFF
4. Start ECU communication software.
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000110.03 reoccurs:
GO TO ②

000110.03 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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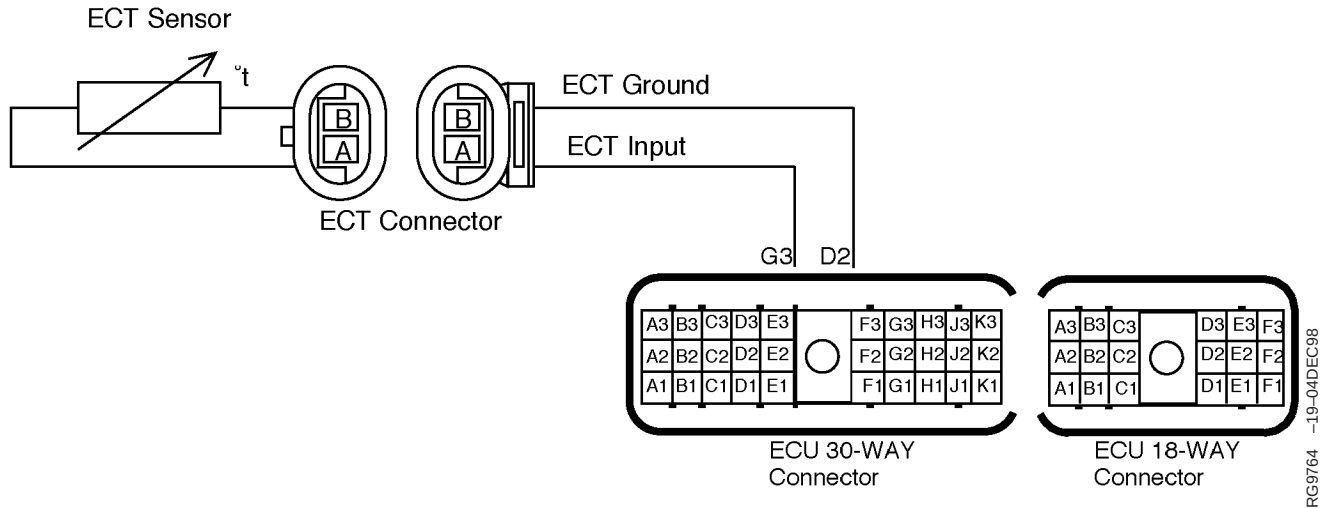
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Trouble Code Diagnostics and Tests

② ECT Wiring Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information</i> 1. Ignition OFF 2. Disconnect ECT sensor connector 3. Install a jumper wire between both terminals in the ECT sensor harness connector 4. Read DTCs 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000110.03 reoccurs: GO TO ③ 000110.04 occurs: Faulty ECT sensor connector OR Faulty ECT sensor -- -1/1
③ ECT Ground Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information</i> 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between ECT 5 V supply terminal and a good chassis ground	4.0 - 6.0 V: Open in ECT ground circuit OR Faulty ECU 30-way connector OR Faulty ECU Below 4.0 V: Open in ECT input circuit OR Faulty ECU 30-way connector OR Faulty ECU -- -1/1

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000110.04 — Engine Coolant Temperature Input Voltage Low



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

ECT (Engine Coolant Temperature) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to

the ECU; lower temperatures result in higher voltages. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000110.04 will set if:

- The ECT input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.

If DTC 000110.04 sets, the following will occur:

- The ECU will use a default "limp-home" ECT value of 95°C (203°F).
- ECU's high coolant temperature engine protection feature disabled.

DPSG, RG39774, 43 -19-23NOV98-1/1

000110.04 — Engine Coolant Temperature Input Voltage Low

The ECT input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.

RG40854,0000037 -19-08JAN01-1/1

000110.04 Engine Coolant Temperature Input Voltage Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECT sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Warm engine 3. Ignition ON, engine OFF 4. Start ECU communication software. 5. Read DTCs using DST or SERVICE ADVISOR™. 6. Make note of all DTCs, then clear all DTCs 7. Ignition ON, engine running 8. Read DTCs	000110.04 reoccurs: GO TO ❷ 000110.04 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ ECT Input Circuit Grounded Test	NOTE: For wiring and theory of operation, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information. 1. Ignition OFF 2. Disconnect ECT sensor connector 3. Read DTCs 4. Make note of all DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	000110.04 reoccurs: Short to ground in ECT input circuit OR Faulty ECU 000110.03 occurs: Faulty ECT sensor

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000110.09 — Engine Coolant Temperature Invalid

The ECU either does not receive coolant temperature information over CAN, or the information received is not valid

CAN (Controller Area Network) Engine Coolant Temperature

- CAN (Controller Area Network) engine coolant temperature is information sent to the ECU by another controller over CAN of the engine coolant temperature measured by the other controller.

DTC 000110.09 will set if:

- The ECU either does not receive coolant temperature information over CAN, or the information received is not valid.

If DTC 000110.09 sets, the following will occur:

- ECU's high coolant temperature engine protection feature disabled.

If DTC 000110.09 sets:

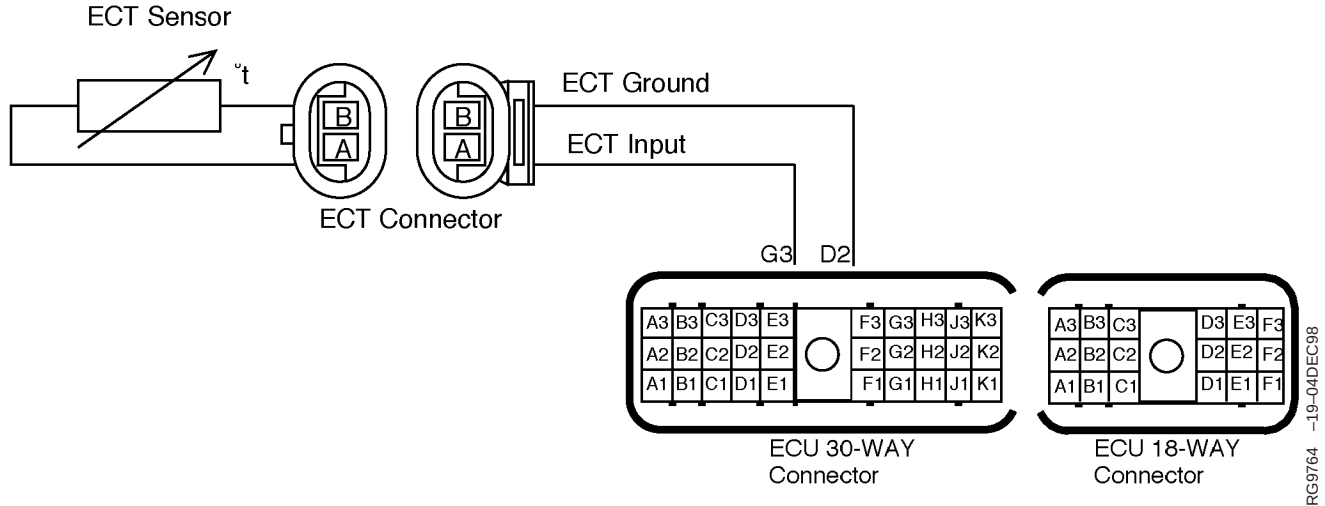
- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
- Ignition ON, engine OFF
- Start ECU communication software
- Read DTCs using DST or SERVICE ADVISOR™. If DTC 000639.00, 000639.02 or 000639.13 also, occur, see DTC 000639.13 CAN ERROR later in this Group.
- Check to see if any other controllers on the machine have any active or stored CAN or coolant temperature sensor related DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN or coolant temperature sensor related DTCs are found in the ECU or other controllers, replace the ECU and retest.

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DPSG, RG39774, 78 -19-06JAN00-1/1

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000110.16 — Engine Coolant Temperature Moderately High



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

ECT (Engine Coolant Temperature) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the ECU; lower temperatures result in higher voltages. On some applications, the ECU receives engine coolant temperature information over CAN (Controller Area Network) from another controller. The other controller measures coolant temperature with a temperature sensor in the thermostat housing and sends the measured temperature as a message to the ECU over CAN. The ECU in turn monitors this temperature and executes an engine protection derate if the temperature indicates an engine overheat condition.

NOTE: The temperature value and derate information shown in this section are for OEM applications only. For the non-OEM engine temperature value and derate information, refer to machine manual.

DTC 000110.16 will set if:

- On OEM engines, the ECU senses a coolant temperature of 108°C (226°F).

If DTC 000110.16 sets, the following will occur:

- ECUs that have engine protection will derate the engine 2% per minute until the engine has been derated by 20% of rated power (DTC 001569.31 will also be present). If engine coolant temperature goes above the extremely high temperature value, the ECU will set a DTC 000110.00, and a more severe derate and/or shutdown will go into effect. If engine coolant temperature goes below the moderately high temperature value, power will be increased at 2% per minute until full power is achieved.
- ECUs that have no engine protection will not derate or shut down the engine.

000110.16 — Engine Coolant Temperature Moderately High

On OEM engines, the ECU senses a coolant temperature of 108°C (226°F).

RG40854,0000038 -19-08JAN01-1/1

000110.16 Engine Coolant Temperature Moderately High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECT sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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1 Engine Coolant Temperature Check

NOTE: For wiring and theory of operation information, see DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH supporting information.

Under the conditions where DTC 000110.16 occurs, use a temperature gauge and verify that engine coolant temperature is above the moderately high ECT specification.

NOTE: On OEM engine applications, the moderately high ECT specification is 108°C (226°F). Other applications may have the same or a similar temperature value. Refer to machine manual for the moderately high ECT specification.

At or greater than ECT moderately high specification:

Engine overheating problem.

On 8.1 L engines, see C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).

OR

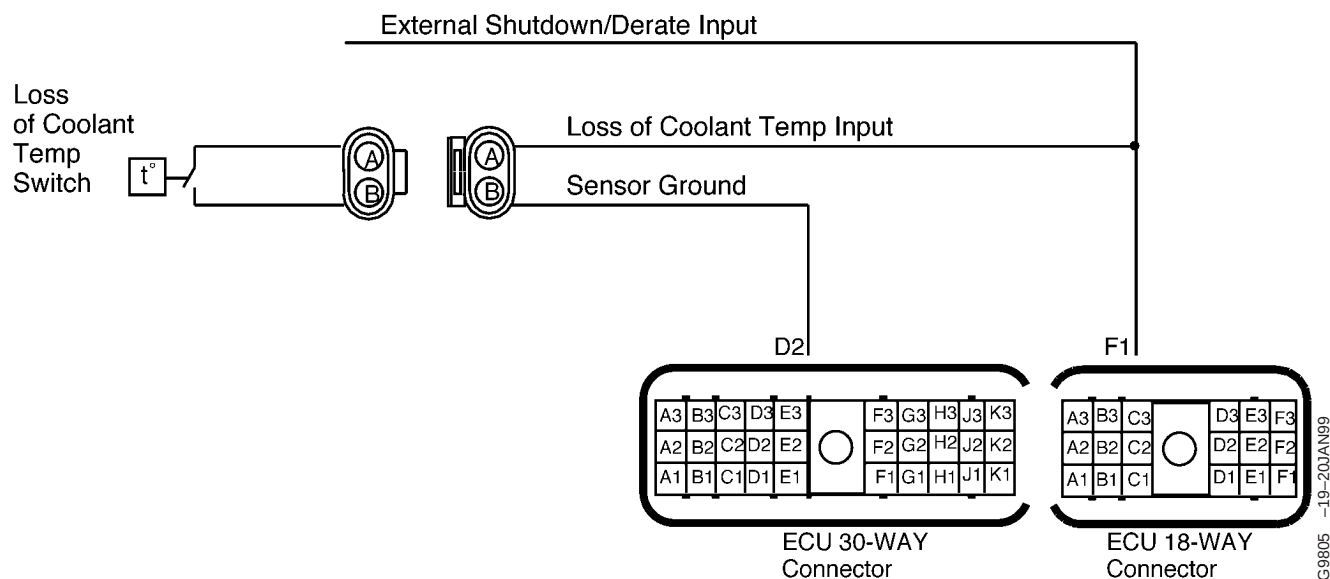
On 6.8 L engines, see C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).

Significantly less than ECT moderately high specification:

Verify that ECT input and ground circuits are OK. If both circuits are OK, replace ECT sensor and retest.

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000111.01 — Engine Coolant Level Low



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Loss of Coolant Temperature Switch

- The loss of coolant temperature switch is a normally open temperature sensitive switch. The switch is located near the back of the cylinder head. The switch contacts are open when they are submerged in coolant. When the coolant level drops, the switch contacts close due to increasing temperature. On some applications, loss of coolant detection is accomplished by the ECU monitoring the CAN (Controller Area Network) engine coolant temperature information sent to the ECU by another controller over CAN. For further loss of coolant temperature information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000111.01 will set if:

- The loss of coolant temperature switch contacts close causing the ECU to sense continuity to ground through the external shutdown/derate input terminal.

If DTC 000111.01 sets, the following will occur:

NOTE: The derate information shown in this section is for OEM applications only. For non-OEM engine derate information, refer to machine manual.

- ECUs that have engine protection with shutdown will derate the engine at 20% per minute (DTC 001569.31 will also be present). If the loss of coolant temperature switch does not reset within 30 seconds, the engine will shut down.
- ECUs that have engine protection without shutdown will derate the engine 20% per minute until the engine has been derated by 40% of rated power (DTC 001569.31 will also be present).
- ECUs that have no engine protection will not derate or shut the engine down.

000111.01 — Engine Coolant Level Low

The loss of coolant temperature switch contacts close causing the ECU to sense continuity to ground through the external shutdown/derate input terminal.

RG40854,0000039 -19-08JAN01-1/1

000111.01 Engine Coolant Level Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECT sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Coolant Level Check	 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. Check coolant level	Coolant level OK: GO TO ❷ Coolant level low: Determine cause of low coolant level, repair problem and retest
❷ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software. 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON 7. Read DTCs	000111.01 reoccurs: GO TO ❸ 000111.01 cleared and doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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Trouble Code Diagnostics and Tests

③ Loss Of Coolant
Switch Test

NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information.

1. Ignition OFF
2. Disconnect loss of coolant temperature switch connector
3. Read DTCs
4. Make note of all DTCs, then clear all DTCs
5. Ignition ON
6. Read DTCs

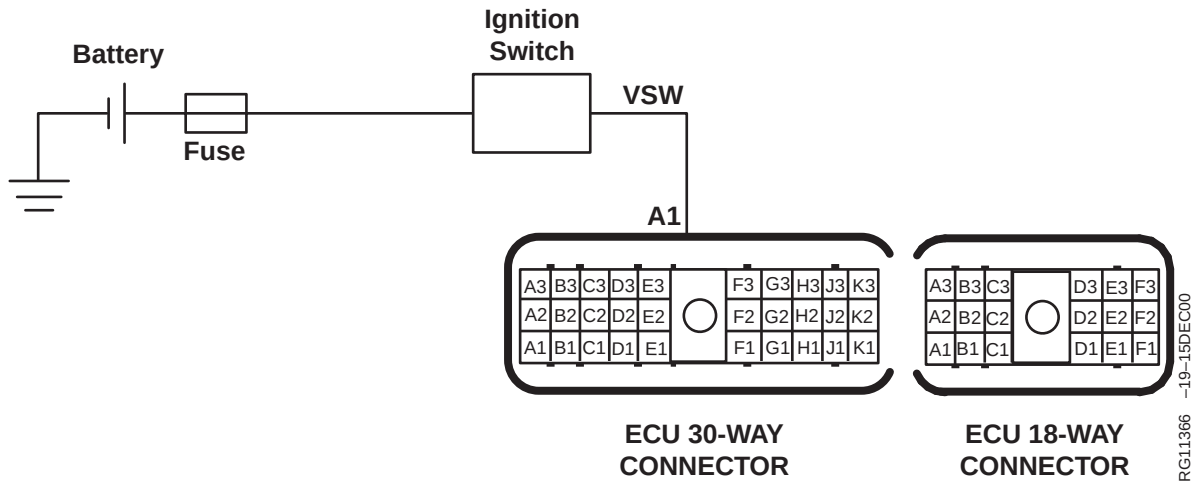
000111.01 reoccurs:
Short to ground in loss of coolant temperature input circuit

000111.01 cleared and doesn't reoccur:
Faulty loss of coolant temperature switch

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000158.02 — Intermittent Loss of ECU Power Supply



The ECU detects an intermittent loss of power supply.

NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

ECU Power Supply

- Power is supplied to the ECU through terminal A1 in the ECU 30-way connector.

DTC 000158.02 will set if:

- The ECU detects an intermittent loss of power supply.

If DTC 000158.02 sets, the following will occur:

- The ECU doesn't alter engine operation when fault code DTC 000158.02 occurs. But, when the ECU loses power, the rack actuator inside the injection pump goes to the zero fuel delivery position. With an intermittent loss of power to the ECU, the engine may run poorly.

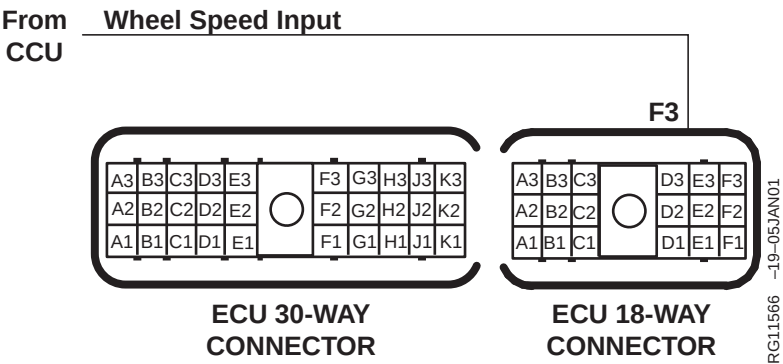
If DTC 000158.02 sets:

- Check the wiring supplying power to the ECU for possible opens, shorts, and grounds.
- Check for loose, dirty, or disconnected connectors, fuses, and relays.
- Inspect connectors looking for wires that have pulled out of connector terminals, damaged connectors, poorly positioned terminals, and corroded or damaged terminals.

DPSG,RG39774,29 -19-12JAN99-1/1

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000160.02 — Wheel Speed Input Noise



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Wheel Speed Sensor

- The wheel speed sensor is an inductive type sensor that is mounted on the rear axle. As teeth on the

axle rotate past the sensor, AC signals are generated. The frequency of these signals are proportional to the wheel speed.

DTC 000160.02 will set if:

- The ECU detects noise on the wheel speed input.

If DTC 000160.02 sets, the following will occur:

- ECU limits engine speed to 1950 rpm

RG40854,0000002 -19-14DEC00-1/1

000160.02 — Wheel Speed Input Noise

The ECU detects noise on the wheel speed input.

RG40854,000002D -19-08JAN01-1/1

000160.02 Wheel Speed Input Noise Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 18-way connector and the wheel speed sensor connector looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Warm engine
3. Ignition ON, engine OFF
4. Start ECU communication software
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs.

000160.02 reoccurs:
GO TO ②

000160.02 doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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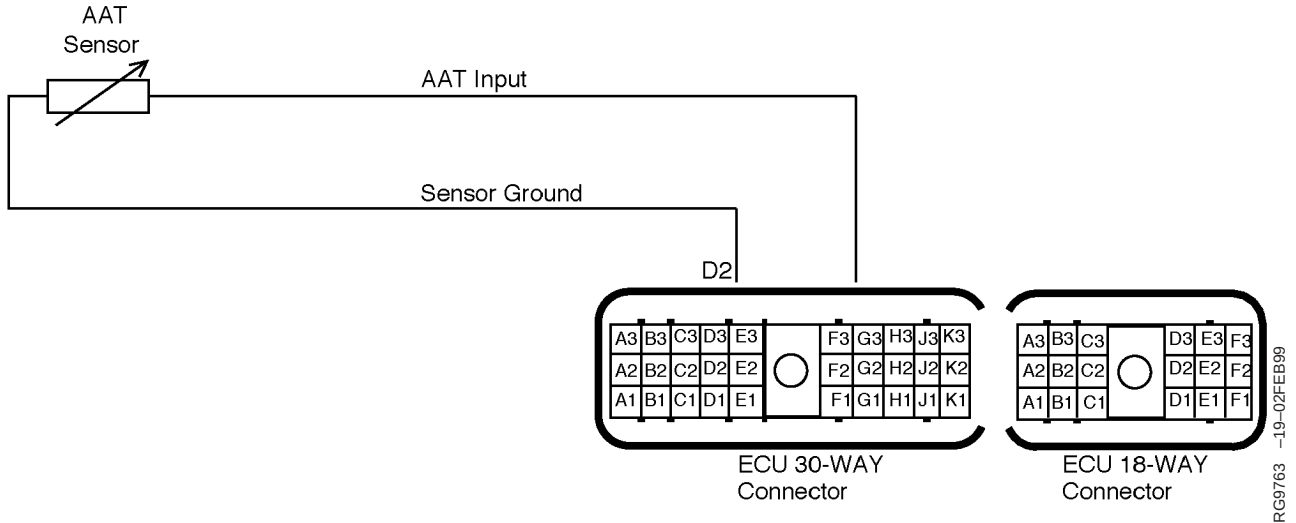
② Noise Detection Test

NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.

1. 000160.02 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections anywhere on the machine. Things to check:
 - All harness connectors
 - Alternator connections
 - Chassis ground connections, battery ground connection
 - Corrosion, dirt, or paint can cause intermittent and "noisy" connections
 - Check the wiring for intermittent open and short circuits; particularly the cam sensor wiring
 - Check wiring for proper pin location in the cam sensor and ECU connectors
2. Other possible causes of 000160.02:
 - Electromagnetic interference (EMI) from an incorrectly installed 2-way radio
 - Interference from some radar source
 - Possible burrs on the camshaft notches, should be clean, square edges

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000171.03 — Ambient Air Temperature Input Voltage High



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

AAT (Ambient Air Temperature) Sensor

- The AAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake air duct. The AAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher temperatures result in lower AAT input voltages to the ECU; lower temperatures result in higher

voltages. The AAT sensor is used by the ECU to control the air heater in applications that use this optional feature.

DTC 000171.03 will set if:

- The AAT input voltage exceeds the maximum threshold. This voltage corresponds to a temperature that is lower than what is physically possible for ambient air.

If DTC 000171.03 sets, the following will occur:

- Air heater operation will be affected.

DPSG, RG39774, 9 -19-23NOV98-1/1

000171.03 — Ambient Air Temperature Input Voltage High

The AAT input voltage exceeds the maximum threshold. This voltage corresponds to a temperature

that is lower than what is physically possible for ambient air.

RG40854,000003A -19-08JAN01-1/1

000171.03 Ambient Air Temperature Input Voltage High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the AAT sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Warm engine
3. Ignition ON, engine OFF
4. Start ECU communication software.
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000171.03 reoccurs:
GO TO ②

000171.03 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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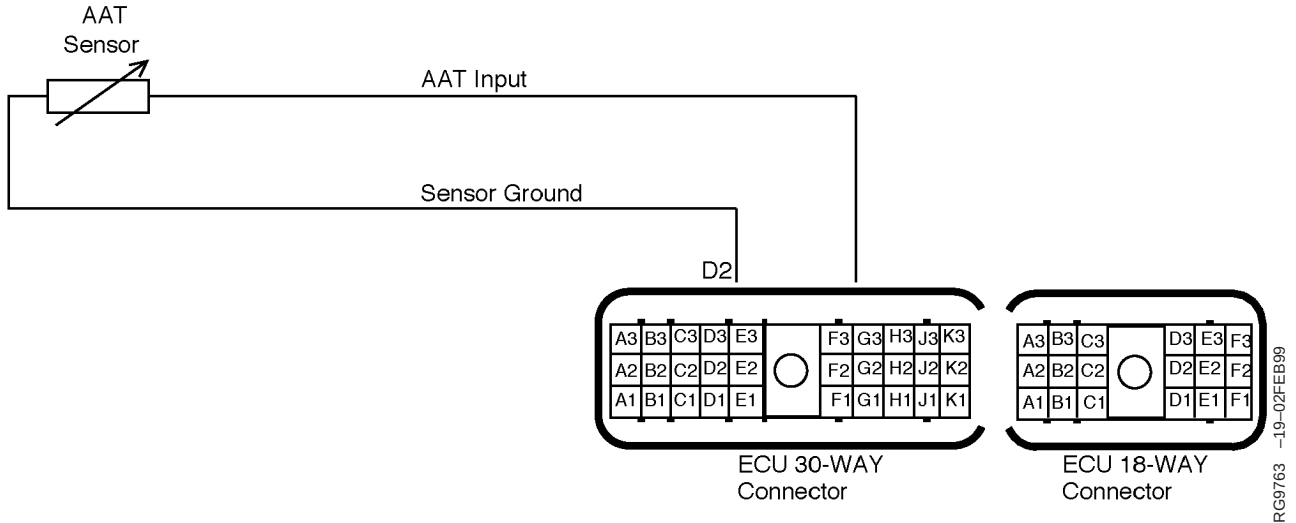
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Trouble Code Diagnostics and Tests

② Air Temperature Wiring Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Disconnect AAT sensor connector 3. Install a jumper wire between both terminals in the AAT sensor harness connector 4. Read DTCs 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000171.03 reoccurs: GO TO ③ 000171.04 occurs: Faulty AAT sensor connector OR Faulty AAT sensor -- -1/1
③ Air Temperature Ground Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between AAT 5 V supply terminal and a good chassis ground	4.0 - 6.0 V: Open in AAT ground circuit OR Faulty ECU 30-way connector OR Faulty ECU Below 4.0 V: Open in AAT input circuit OR Faulty ECU 30-way connector OR Faulty ECU -- -1/1

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000171.04 — Ambient Air Temperature Input Voltage Low



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

AAT (Ambient Air Temperature) Sensor

- The AAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake air duct. The AAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher temperatures result in lower AAT input voltages to the ECU; lower temperatures result in higher

voltages. The AAT sensor is used by the ECU to control the air heater in applications that use this optional feature.

DTC 000171.04 will set if:

- The AAT input voltage drops below the minimum threshold. This voltage corresponds to a temperature that is higher than what is physically possible for ambient air.

If DTC 000171.04 sets, the following will occur:

- Air heater operation will be affected.

DPSG, RG39774, 41 -19-23NOV98-1/1

000171.04 — Ambient Air Temperature Input Voltage Low

The AAT input voltage drops below the minimum threshold. This voltage corresponds to a temperature

that is higher than what is physically possible for ambient air.

RG40854,000003B -19-08JAN01-1/1

000171.04 Ambient Air Temperature Input Voltage Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the AAT sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000171.04 AMBIENT AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Warm engine
3. Ignition ON, engine OFF
4. Start ECU communication software.
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000171.04 reoccurs:
GO TO ②

000171.04 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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Trouble Code Diagnostics and Tests

**② Air Temperature Input
Circuit Grounded
Test**

NOTE: For wiring and theory of operation information, see DTC 000171.04 AMBIENT AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.

1. Ignition OFF
2. Disconnect AAT sensor connector
3. Read DTCs using DST or SERVICE ADVISOR™
4. Make note of all DTCs, then clear all DTCs
5. Ignition ON, engine running
6. Read DTCs

000171.04 reoccurs:
Short to ground in AAT
input circuit
OR
Faulty ECU

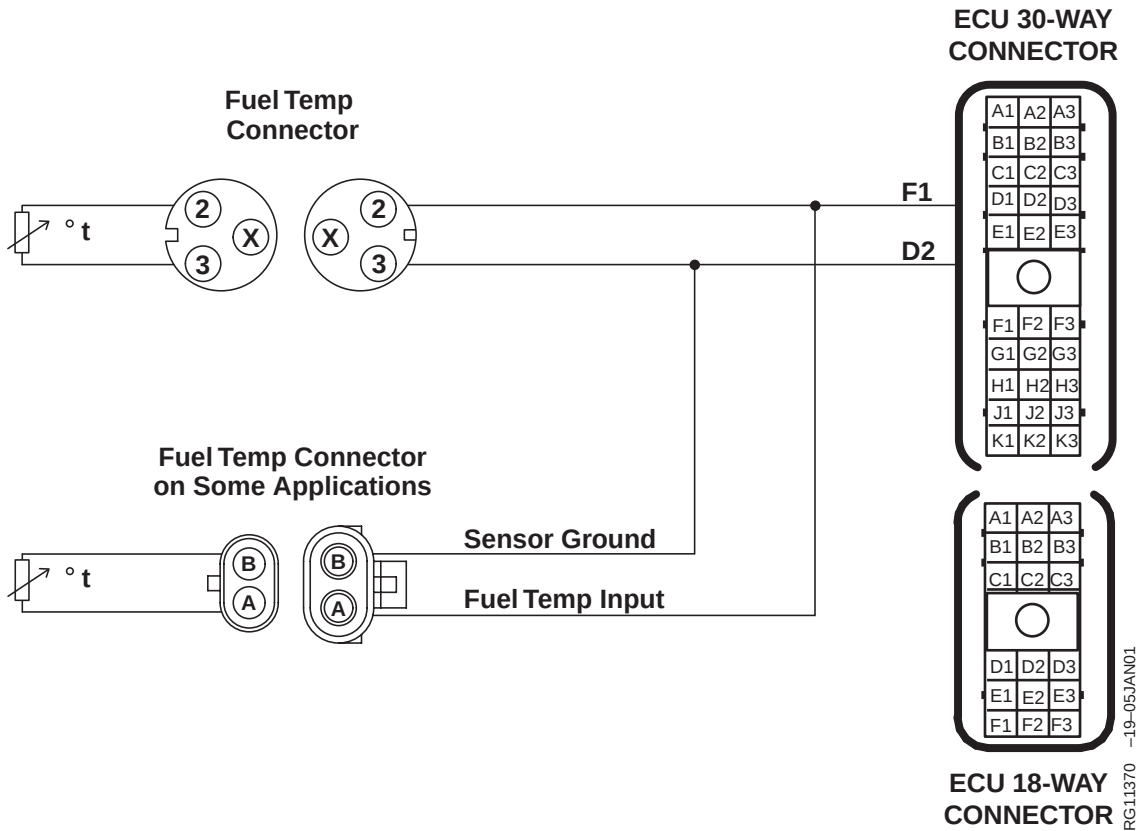
000171.03 occurs:
Faulty AAT sensor

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000174.00 — Fuel Temperature Moderately High



Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the injection pump fuel inlet housing. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for the variations in fuel density caused by varying fuel temperatures. For more fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

NOTE: The temperature value and derate information shown apply to OEM engine applications.

Refer to machine manual for high fuel temperature value and derate information.

DTC 000174.00 will set if:

- On OEM engines, the ECU senses a fuel temperature of 70°C (158°F).

If DTC 000174.00 sets, the following will occur:

- As fuel temperature starts to exceed 70°C (158°F), the ECU will start reducing fuel delivery until at 80°C (176°F) the ECU is only allowing 75% of full power.
- While DTC 000174.00 is occurring, if the fuel temperature sensor is disconnected, DTC 000174.00 will remain and the ECU will only allow 50% fuel delivery.

000174.00 — Fuel Temperature Moderately High

On OEM engines, the ECU senses a fuel temperature of 70°C (158°F).

RG41183,00000B9 -19-03MAR03-1/1

000174.00 Fuel Temperature Moderately High Diagnostic Procedure

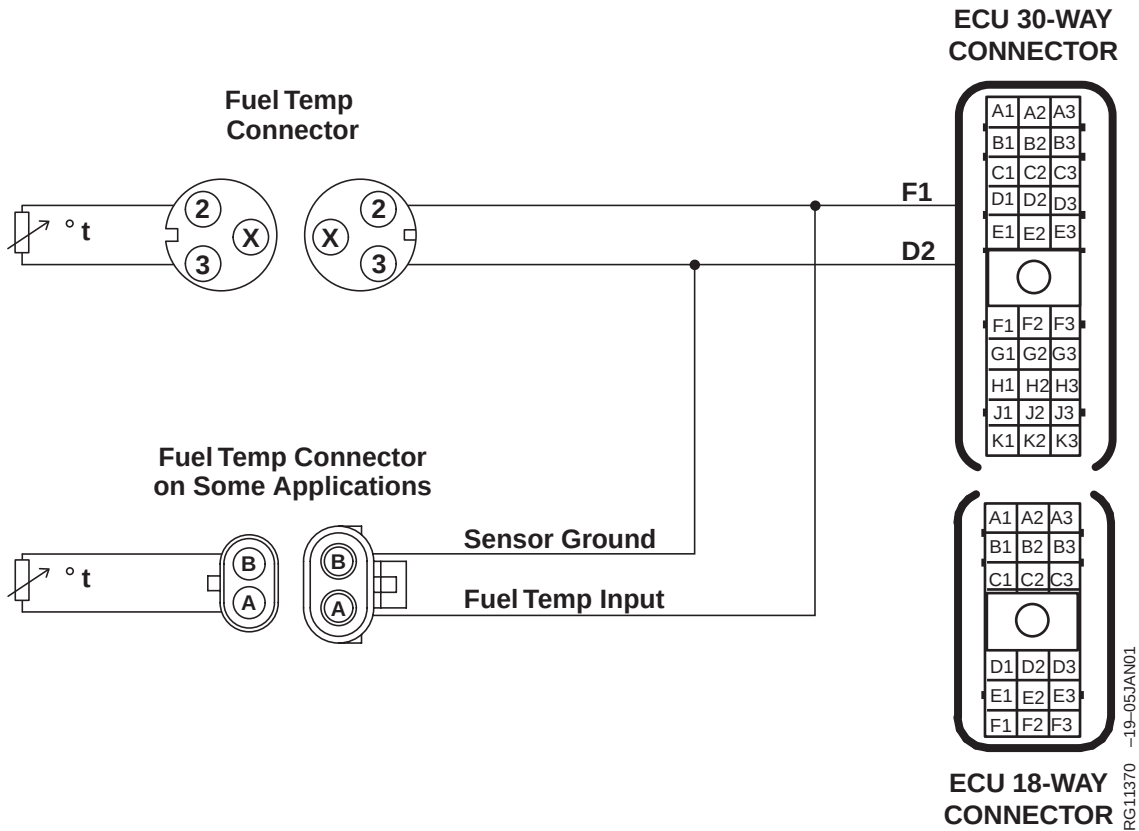
NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the fuel temp sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Fuel Level Check	NOTE: For wiring and theory of operation, see DTC 000174.00 FUEL TEMPERATURE MODERATELY HIGH supporting information Ensure that the fuel level in the fuel tank isn't extremely low. This can cause excessive fuel temperature.	Fuel level not low: GO TO ❷ -- -1/1
❷ Measure Fuel Pressure	NOTE: For wiring and theory of operation, see DTC 000174.00 FUEL TEMPERATURE MODERATELY HIGH supporting information Determine fuel pressure. See MEASURE FUEL SUPPLY PUMP PRESSURE in Group 150 of this manual.	Fuel pressure within specification: GO TO ❸ Fuel pressure below specification: Determine cause of low supply pressure as outlined in fuel supply pressure measurement procedure, repair problem and retest -- -1/1
❸ Restricted Fuel Return Line Check	NOTE: For wiring and theory of operation, see DTC 000174.00 FUEL TEMPERATURE MODERATELY HIGH supporting information Check return fuel line for restriction. See RESTRICTED FUEL RETURN LINE CHECK in Group 150 of this manual.	Fuel return line NOT restricted: Verify that fuel temperature input and ground circuits are OK If both circuits are OK, replace fuel temperature sensor and retest Restriction found in fuel return line: Determine cause of restricted fuel return line, repair problem and retest -- -1/1

000174.03 — Fuel Temperature Input Voltage High



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the injection pump fuel inlet housing. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for the

variations in fuel density caused by varying fuel temperatures. For more fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000174.03 will set if:

- The fuel temperature input voltage exceeds 4.9 volts. This voltage corresponds to a temperature that is lower than what is physically possible for fuel.

If DTC 000174.03 sets, the following will occur:

- The ECU will use a "limp-home" fuel temperature value of -20°C (-4°F) during cranking, and 40°C (104°F) during running.
- Engine power will be slightly derated.

000174.03 — Fuel Temperature Input Voltage High

*The fuel temperature input voltage exceeds 4.9 volts.
This voltage corresponds to a temperature that is
lower than what is physically possible for fuel.*

RG40854,000003C -19-08JAN01-1/1

000174.03 Fuel Temperature Input Voltage High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the fuel temp sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Warm engine
3. Ignition ON, engine OFF
4. Start ECU communication software.
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000174.03 reoccurs:
GO TO ②

000174.03 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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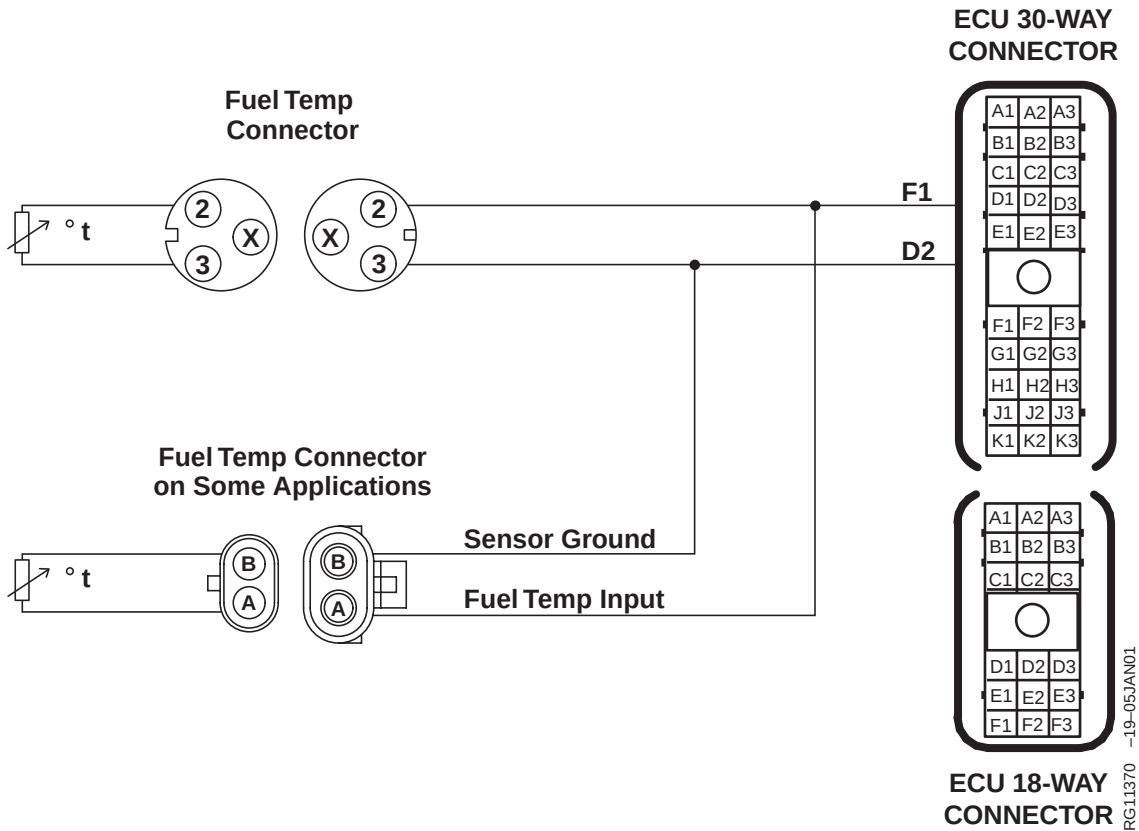
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Trouble Code Diagnostics and Tests

② Fuel Temperature Wiring Open Test	<i>NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Disconnect fuel temp sensor connector 3. Install a jumper wire between both terminals in the fuel temp sensor harness connector 4. Read DTCs 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000174.03 reoccurs. GO TO ③ 000174.04 occurs. Faulty fuel temp sensor connector OR Faulty fuel temp sensor -- -1/1
③ Fuel Temperature Ground Circuit Open Test	<i>NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between fuel temp 5 V supply terminal and a good chassis ground	4.0 - 6.0 V: Open in fuel temp ground circuit OR Faulty ECU 30-way connector OR Faulty ECU Below 4.0 V: Open in fuel temp input circuit OR Faulty ECU 30-way connector OR Faulty ECU -- -1/1

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000174.04 — Fuel Temperature Input Voltage Low



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the injection pump fuel inlet housing. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for the

variations in fuel density caused by varying fuel temperatures. For more fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000174.04 will set if:

- The fuel temperature input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for fuel.

If DTC 000174.04 sets, the following will occur:

- The ECU will use a "limp-home" fuel temperature value of -20°C (-4°F) during cranking, and 40°C (104°F) during running.
- Engine power will be slightly derated.

000174.04 — Fuel Temperature Input Voltage Low

The fuel temperature input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for fuel.

RG40854,000003D -19-08JAN01-1/1

000174.04 Fuel Temperature Input Voltage Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the fuel temp sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Warm engine 3. Ignition ON, engine OFF 4. Start ECU communication software. 5. Read DTCs using DST or SERVICE ADVISOR™. 6. Make note of all DTCs, then clear all DTCs 7. Ignition ON, engine running 8. Read DTCs	000174.04 reoccurs: GO TO ❷ 000174.04 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

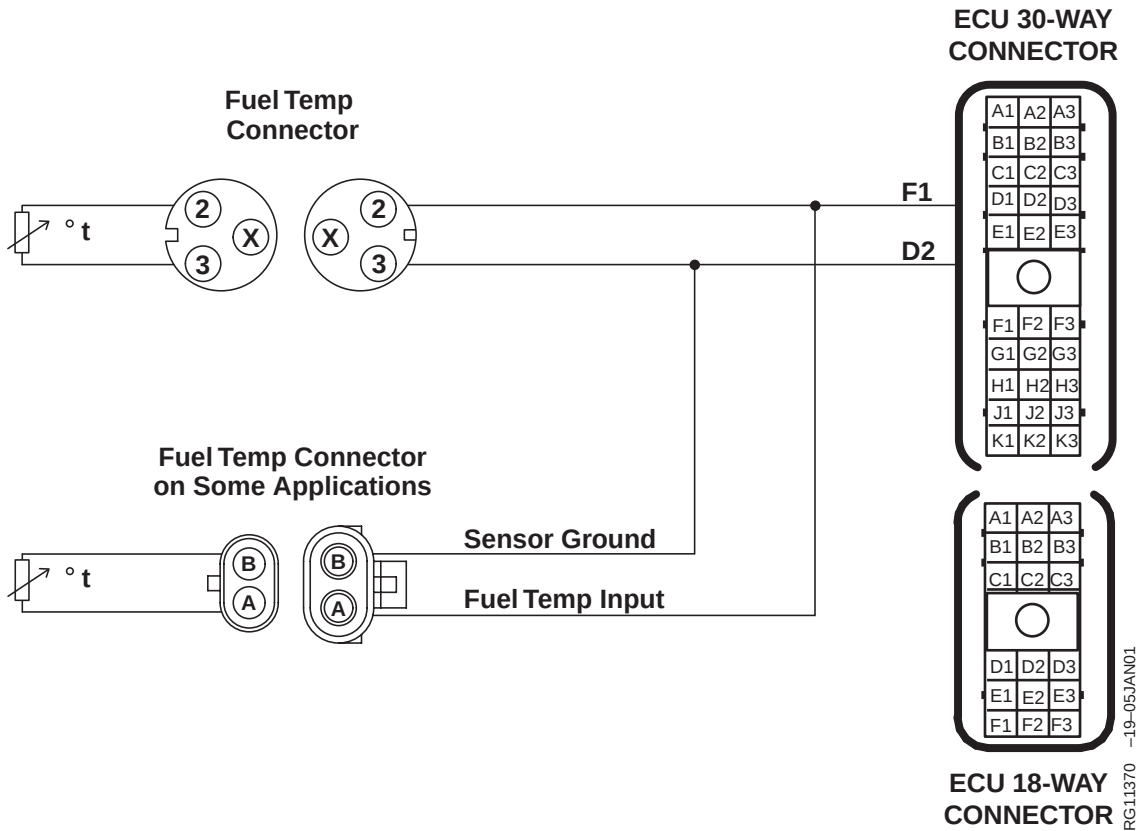
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❷ Fuel Temperature Input Circuit Grounded Test	NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information. 1. Ignition OFF 2. Disconnect fuel temp sensor connector 3. Read DTCs 4. Make note of all DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	000174.04 reoccurs: Short to ground in fuel temp input circuit OR Faulty ECU 000174.03 occurs: Faulty fuel temp sensor

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000174.16 — Fuel Temperature Moderately High



Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the injection pump fuel inlet housing. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for the variations in fuel density caused by varying fuel temperatures. For more fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

NOTE: The temperature value and derate information shown apply to OEM engine applications.

Refer to machine manual for high fuel temperature value and derate information.

DTC 000174.16 will set if:

- On OEM engines, the ECU senses a fuel temperature of 70°C (158°F).

If DTC 000174.16 sets, the following will occur:

- As fuel temperature starts to exceed 70°C (158°F), the ECU will start reducing fuel delivery until at 80°C (176°C) the ECU is only allowing 75% of full power.
- While DTC 000174.16 is occurring, if the fuel temperature sensor is disconnected, DTC 000174.16 will remain and the ECU will only allow 50% fuel delivery.

000174.16 — Fuel Temperature Moderately High

On OEM engines, the ECU senses a fuel temperature of 70°C (158°F).

RG40854,000003E -19-08JAN01-1/1

000174.16 Fuel Temperature Moderately High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the fuel temp sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Fuel Level Check	NOTE: For wiring and theory of operation, see DTC 000174.16 FUEL TEMPERATURE MODERATELY HIGH supporting information Ensure that the fuel level in the fuel tank isn't extremely low. This can cause excessive fuel temperature.	Fuel level not low: GO TO ❷ -- -1/1
❷ Measure Fuel Pressure	NOTE: For wiring and theory of operation, see DTC 000174.16 FUEL TEMPERATURE MODERATELY HIGH supporting information Determine fuel pressure. See MEASURE FUEL SUPPLY PUMP PRESSURE in Group 150 of this manual.	Fuel pressure within specification: GO TO ❸ Fuel pressure below specification: Determine cause of low supply pressure as outlined in fuel supply pressure measurement procedure, repair problem and retest -- -1/1
❸ Restricted Fuel Return Line Check	NOTE: For wiring and theory of operation, see DTC 000174.16 FUEL TEMPERATURE MODERATELY HIGH supporting information Check return fuel line for restriction. See RESTRICTED FUEL RETURN LINE CHECK in Group 150 of this manual.	Fuel return line NOT restricted: Verify that fuel temperature input and ground circuits are OK If both circuits are OK, replace fuel temperature sensor and retest Restriction found in fuel return line: Determine cause of restricted fuel return line, repair problem and retest -- -1/1

000177.02 — Transmission Oil Temperature Erratic

The ECU receives an erratic transmission oil temperature over CAN from the RCU.

CAN (Controller Area Network) Transmission Oil Temperature

- The ECU receives engine coolant temperature information over CAN (Controller Area Network) from the RCU (Reverser Control Unit). The RCU measures transmission oil temperature with a temperature sensor and sends the measured temperature as a message to the ECU over CAN. The ECU in turn monitors this temperature and executes an default value for temperature to protect the transmission in case of an overheat condition.

DTC 000177.02 will set if:

- The ECU receives an erratic transmission oil temperature over CAN from the RCU.

If DTC 000177.02 sets, the following will occur:

- The ECU defaults the transmission oil temperature to a high value.
- The cooling fan runs in an attempt to prevent an overheat condition.

If DTC 000177.02 sets:

- If DTC 000110.00, DTC 000110.16, or DTC 000111.01 occur, diagnose those codes first. Determine cause of high coolant temperature.
 - **On 8.1 L engines**, see C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).
 - **On 6.8 L engines**, see C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).
- If trouble codes on the RCU occur, diagnose those trouble codes.

RG40854,0000010 -19-21DEC00-1/1

000177.09 — Transmission Oil Temperature Invalid

The ECU either does not receive coolant temperature information over CAN, or the information received is not valid.

CAN (Controller Area Network) Transmission Oil Temperature

- The ECU receives engine coolant temperature information over CAN (Controller Area Network) from the RCU (Reverser Control Unit). The RCU measures transmission oil temperature with a temperature sensor and sends the measured temperature as a message to the ECU over CAN. The ECU in turn monitors this temperature and executes an default value for temperature to protect the transmission in case of an overheat condition.

DTC 000177.09 will set if:

- The ECU either does not receive coolant temperature information over CAN, or the information received is not valid.

If DTC 000177.09 sets, the following will occur:

- The ECU defaults the transmission oil temperature to a high value.

- The cooling fan runs in an attempt to prevent an overheat condition.

If DTC 000177.09 sets:

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
- Ignition ON, engine OFF
- Start ECU communication software
- Read DTCs using DST or SERVICE ADVISOR™. If DTC 000639.00, 000639.02 or 000639.13 also, occur, see DTC 000639.13 CAN ERROR later in this Group.
- Check to see if any other controllers on the machine have any active or stored CAN or coolant temperature sensor related DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN or coolant temperature sensor related DTCs are found in the ECU or other controllers, replace the ECU and retest.

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RG40854,0000011 -19-21DEC00-1/1

000189.00 — Engine Speed Derate

The ECU detects a condition that requires an engine speed derate.

Speed Derate

- The speed derate fault code is information to the operator that the ECU has detected a condition and because of this condition is derating engine speed in order to protect the engine from damage.

DTC 000189.00 will set if:

- The ECU detects a condition that requires an engine speed derate.

- The ECU will limit engine speed in an attempt to protect the engine.

If DTC 000189.00 sets:

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
- Ignition ON, engine OFF
- Start ECU communication software
- Read DTCs using DST or SERVICE ADVISOR™

If DTC 000189.00 sets, the following will occur:

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DPSG, RG39774, 23 -19-17DEC98-1/1

000190.00 — Engine Overspeed Extreme

The engine speed as measured by the engine speed sensor (and on some applications the pump speed sensor) is greater than a pre-programmed value in the ECU's memory.

Engine Overspeed

- The ECU measures the speed of the engine with the engine speed sensor, which is located on the timing gear cover. On some applications, a pump speed sensor, which is located in the injection pump can measure engine speed.

DTC 000190.00 will set if:

- The engine speed as measured by the engine speed sensor (and on some applications the pump speed sensor) is greater than a pre-programmed value in the ECU's memory.

If DTC 000190.00 sets, the following will occur:

- The ECU will command zero fuel delivery position of the injection pump rack.
- If zero fuel delivery rack position can not be obtained, DTC 000834.07 (on some applications, DTC 000638.07 will be set) will also be set and the ECU will shut off the fuel shut-off solenoid.

If DTC 000190.00 sets:

NOTE: With DTC 000190.00, there may or may not be a problem with the electronic control system.

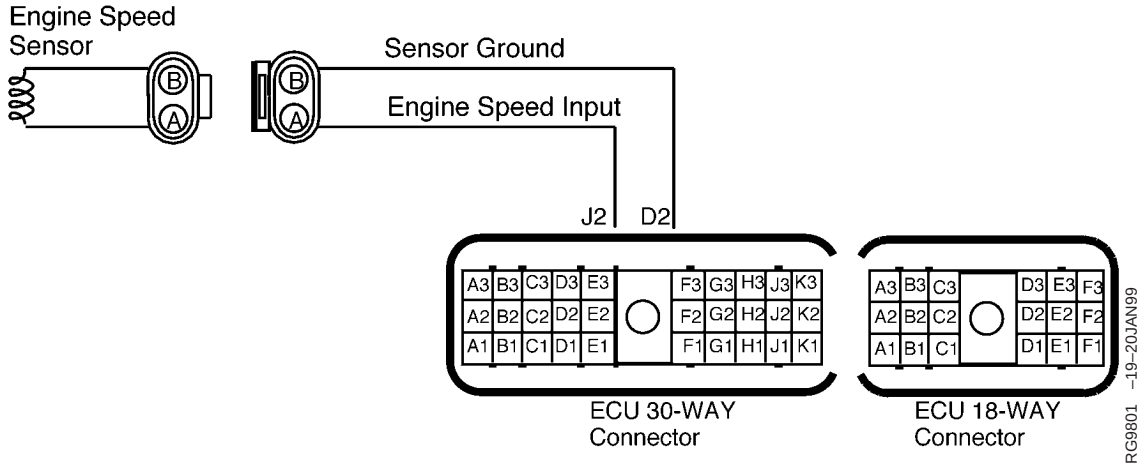
- Read DTCs using DST or SERVICE ADVISOR™. If DTC is not found in this manual, see LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) ON ECU earlier in this Group. If there are other codes, go to the appropriate diagnostic procedure.
- If there are no other stored or active DTCs, clear DTC 000190.00 and monitor codes to see if DTC 000190.00 reoccurs.

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DPSG, RG39774, 59 -19-22JUN01-1/1

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000190.02 — Engine Speed Input Noise



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Engine Speed Sensor

- The engine speed sensor is an inductive-type pickup sensor mounted in the timing gear cover. The sensor detects the teeth on the camshaft drive gear. As teeth rotate past the sensor, an AC signal is generated. The frequency of this signal is proportional to engine speed. The ECU uses the engine speed sensor as its primary engine speed input. For more engine speed sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140 of this manual.

DTC 000190.02 will set if:

- The engine speed sensor input becomes erratic while the pump speed sensor input continues to be valid.

If DTC 000190.02 sets, the following will occur:

- The engine may hesitate momentarily while the ECU changes from the engine speed sensor input to the pump speed sensor input but should continue to run normally.
- If DTC 000191.02 occurs along with DTC 000190.02, the engine will die and won't restart until at least one of the two codes is repaired.

DPSG, RG39774, 61 -19-23NOV98-1/1

000190.02 — Engine Speed Input Noise

The engine speed sensor input becomes erratic while the pump speed sensor input continues to be valid.

RG40854,000003F -19-08JAN01-1/1

000190.02 Engine Speed Input Noise Diagnostic Procedure

NOTE: On 644 Loaders with DTC 000190.02, see DTC 000191.02 PUMP SPEED INPUT NOISE later in this Group.

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the engine speed sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation see DTC 000190.02 ENGINE SPEED INPUT NOISE supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Warm engine 3. Ignition ON, engine OFF 4. Start ECU communication software 5. Read DTCs using DST or SERVICE ADVISOR™. 6. Make note of all DTCs, then clear all DTCs 7. Ignition ON, engine running 8. Read DTCs	000190.02 reoccurs: GO TO ❷ 000190.02 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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② Engine Speed Input
Noise Check

NOTE: For wiring and theory of operation see DTC 000190.02 ENGINE SPEED INPUT NOISE supporting information.

DTC 000190.02 is mostly likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections any where on the machine. Things to check:

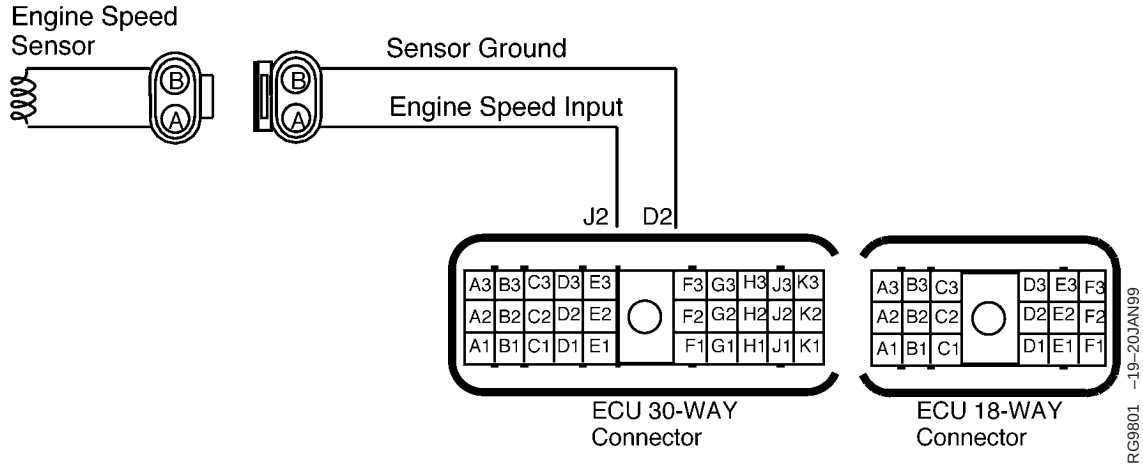
- All harness connectors
- Alternator connections
- Chassis ground connections, battery ground connection
- Corrosion, dirt, or paint can cause intermittent and "noisy" connections
- Check the wiring harness for intermittent open and short circuits, particularly the engine speed sensor wiring

Other possible causes of DTC 000190.02:

- Electromagnetic interference (EMI) from an incorrectly installed 2-way radio
- Interference from some radar source

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000190.03 — Engine Speed Input Voltage High



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Engine Speed Sensor

- The engine speed sensor is an inductive-type pickup sensor mounted in the timing gear cover. The sensor detects the teeth on the camshaft drive gear. As teeth rotate past the sensor, an AC signal is generated. The frequency of this signal is proportional to engine speed. On most applications, there is a speed sensor inside the injection pump used as the back up in the event of an engine speed sensor failure. On some applications, the engine

speed sensor is the only speed sensor. For more engine speed sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140 of this manual.

DTC 000190.03 will set if:

- The ECU detects a short to power in the engine speed input circuit.

If DTC 000190.03 sets, the following will occur:

- Applications with back up pump speed sensor:
 - ECU will start using the pump speed sensor; engine will continue to run normally.
- Applications without back up pump speed sensor:
 - Engine will die and will not restart.

DPSG, RG39774, 21 -19-17DEC98-1/1

000190.03 — Engine Speed Input Voltage High

The ECU detects a short to power in the engine speed input circuit.

RG40854,0000040 -19-08JAN01-1/1

000190.03 Engine Speed Input Voltage High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the engine speed sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	<i>NOTE: For wiring and theory of operation, see DTC 000190.03 ENGINE SPEED INPUT VOLTAGE HIGH supporting information.</i> 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON, engine running 7. If engine won't start, crank engine for 10 seconds 8. Read DTCs	000190.03 reoccurs: GO TO ❷ DTC 000190.03 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Engine Speed Sensor Resistance Test	<i>NOTE: For wiring and theory of operation, see DTC 000190.03 ENGINE SPEED INPUT VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Disconnect engine speed sensor connector 3. Using a multimeter, measure the resistance between both terminals of the engine speed sensor	2500 - 3500 ohms: GO TO ❸ Below 2500 or above 3500: Faulty engine speed sensor

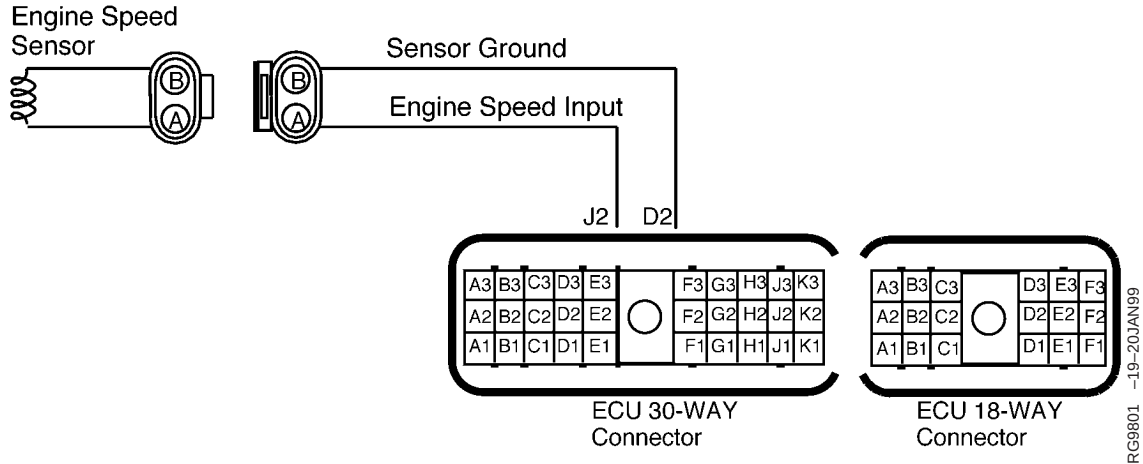
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③ Engine Speed Input Circuit Shorted Test	<i>NOTE: For wiring and theory of operation, see DTC 000190.03 ENGINE SPEED INPUT VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Engine speed sensor still disconnected 3. Also disconnect the ECU 30-way and 18-way (if equipped) connectors 4. Using a multimeter, measure resistance between terminal J2 in the harness end of the ECU 30-way connector and: • All other terminals in the 30-way and 18-way (if equipped) connectors • A good ground	All measurements greater than 2000 ohms: Faulty engine speed sensor connector OR Faulty ECU 30-way connector OR Faulty ECU Any measurement less than 2000 ohms: Short in engine speed input circuit -- -1/1

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000190.04 — Engine Speed Input Voltage Low



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Engine Speed Sensor

- The engine speed sensor is an inductive-type pickup sensor mounted in the timing gear cover. The sensor detects the teeth on the camshaft drive gear. As teeth rotate past the sensor, an AC signal is generated. The frequency of this signal is proportional to engine speed. On most applications, there is a speed sensor inside the injection pump used as the back up in the event of an engine speed sensor failure. On some applications, the engine speed sensor is the only speed sensor. For more

engine speed sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140 of this manual.

DTC 000190.04 will set if:

- The ECU detects a short to ground in the engine speed input circuit.

If DTC 000190.04 sets, the following will occur:

- Applications with back up injection pump speed sensor:
 - ECU will start using the pump speed sensor; engine will continue to run normally.
- Applications without back up injection pump speed sensor:
 - Engine will die and will not restart.

DPSG, RG39774, 20 -19-17DEC98-1/1

000190.04 — Engine Speed Input Voltage Low

The ECU detects a short to ground in the engine speed input circuit.

RG40854,0000041 -19-08JAN01-1/1

000190.04 Engine Speed Input Voltage Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the engine speed sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.04 ENGINE SPEED INPUT VOLTAGE LOW supporting information.</i> 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON, engine running 7. If engine won't start, crank engine for 10 seconds 8. Read DTCs	000190.04 reoccurs: GO TO ❷ 000190.04 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Engine Speed Sensor Resistance Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.04 ENGINE SPEED INPUT VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Disconnect engine speed sensor connector 3. Using a multimeter, measure the resistance between both terminals of the engine speed sensor	2500 - 3500 ohms: GO TO ❸ Below 2500 or above 3500: Faulty engine speed sensor

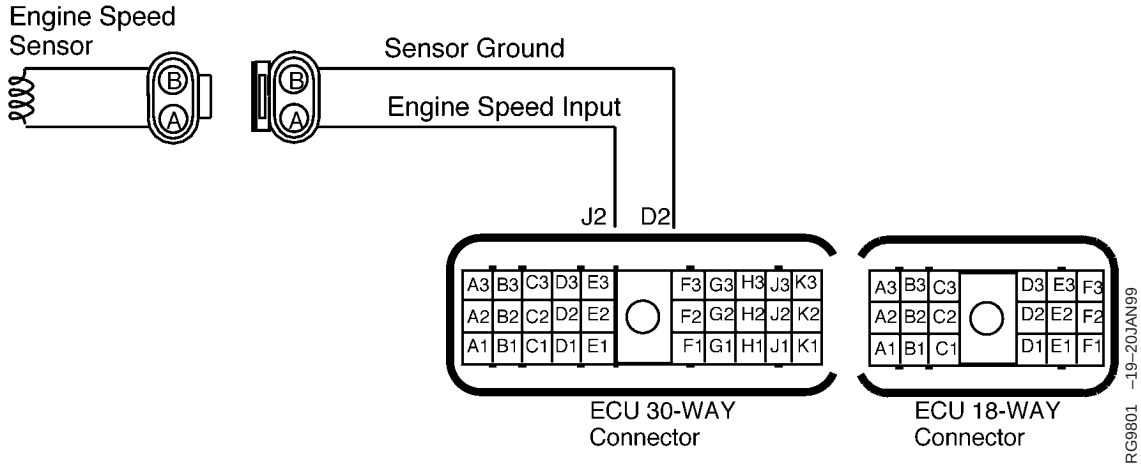
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③ Engine Speed Input Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.04 ENGINE SPEED INPUT VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Engine speed sensor still disconnected 3. Also disconnect the ECU 30-way and 18-way (if equipped) connectors 4. Using a multimeter, measure resistance between terminal J2 in the harness end of the ECU 30-way connector and: • All other terminals in the ECU 30-way and 18-way (if equipped) connectors • A good ground	All measurements greater than 2000 ohms: Faulty engine speed sensor connector OR Faulty ECU 30-way connector OR Faulty ECU Any measurement less than 2000 ohms: Short in engine speed input circuit -- -1/1

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000190.05 — Engine Speed Sensor Circuit Open



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Engine Speed Sensor

- The engine speed sensor is an inductive-type pickup sensor mounted in the timing gear cover. The sensor detects the teeth on the camshaft drive gear. As teeth rotate past the sensor, an AC signal is generated. The frequency of this signal is proportional to engine speed. On most applications, there is a speed sensor inside the injection pump used as the back up in the event of an engine speed sensor failure. On some applications, the engine speed sensor is the only speed sensor. For more

engine speed sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140 of this manual.

DTC 000190.05 will set if:

- The ECU detects an open in the engine speed input circuit.

If DTC 000190.05 sets, the following will occur:

- Applications with back up injection pump speed sensor:
 - ECU will start using the pump speed sensor; engine will continue to run normally.
- Applications without back up injection pump speed sensor:
 - Engine will die and will not restart.

DPSG, RG39774, 19 -19-17DEC98-1/1

000190.05 — Engine Speed Sensor Circuit Open

The ECU detects an open in the engine speed input circuit.

RG40854,0000042 -19-08JAN01-1/1

000190.05 Engine Speed Sensor Circuit Open Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the engine speed sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see DTC 000190.05 ENGINE SPEED SENSOR CIRCUIT OPEN supporting information 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Read DTCs using DST or SERVICE ADVISOR™. 4. Make note of all active DTCs, then clear all DTCs 5. Ignition ON, engine running 6. If engine won't start, crank engine for 10 seconds 7. Read DTCs	000190.05 reoccurs: GO TO ❷ 000190.05 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Engine Speed Sensor Resistance Test	NOTE: For wiring and theory of operation information, see DTC 000190.05 ENGINE SPEED SENSOR CIRCUIT OPEN supporting information 1. Ignition OFF 2. Disconnect engine speed sensor connector 3. Using a multimeter, measure the resistance between both terminals of the engine speed sensor	2500 - 3500 ohms: GO TO ❸ Below 2500 or above 3500: Faulty engine speed sensor

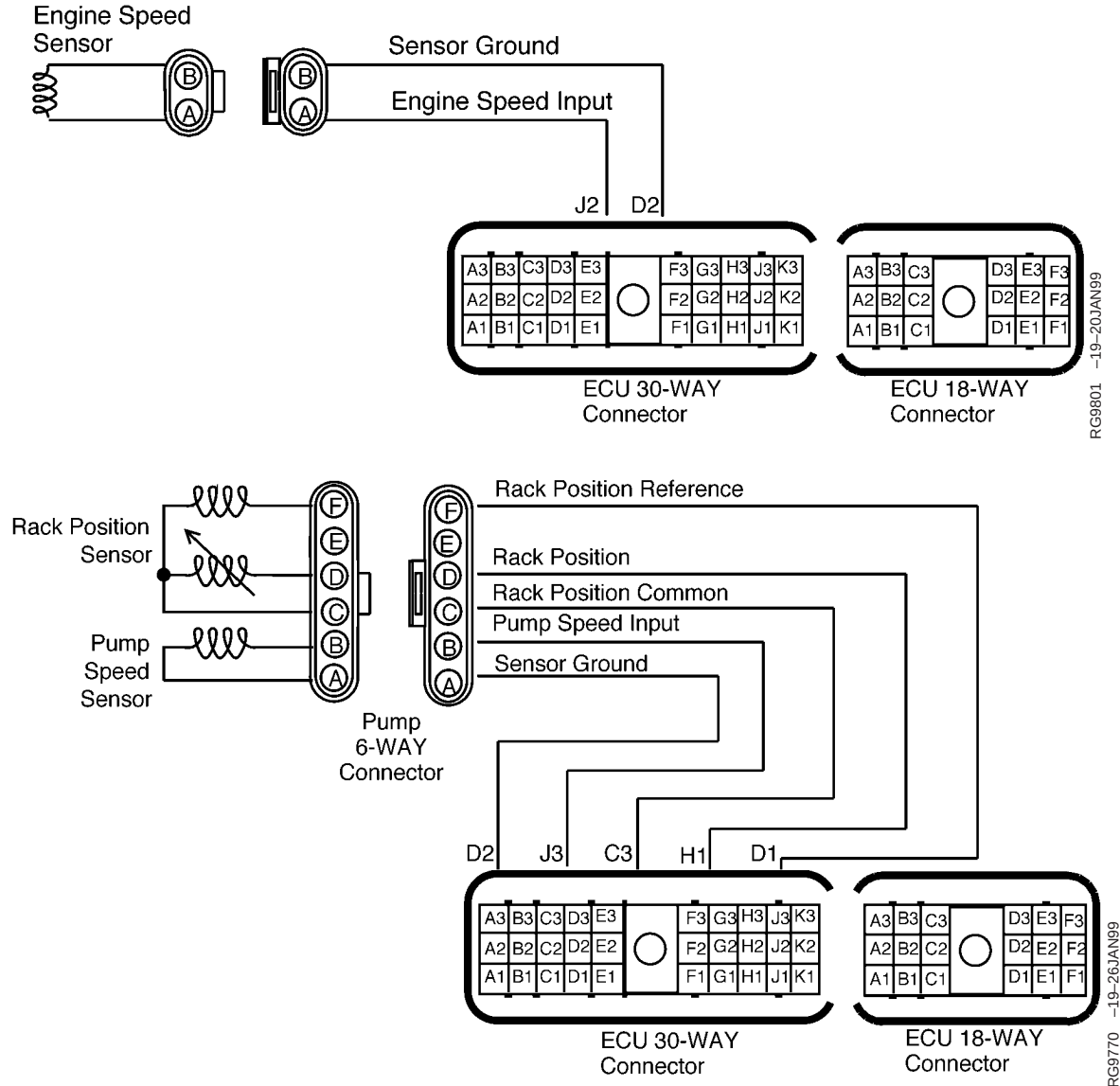
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Trouble Code Diagnostics and Tests

③ Engine Speed Input Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.05 ENGINE SPEED SENSOR CIRCUIT OPEN supporting information</i> 1. Ignition OFF 2. Engine speed sensor still disconnected 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminal J2 in the harness•end of the ECU 30-way connector and terminal A in the harness end of the engine speed sensor connector	5.0 ohms or less: GO TO ④ Greater than 5.0 ohms: Open in engine speed input circuit -- -1/1
04 160 ,194 ④ Engine Speed Input Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.05 ENGINE SPEED SENSOR CIRCUIT OPEN supporting information</i> 1. Ignition OFF 2. Using a multimeter, measure resistance between•terminal D2 in the harness end of the ECU 30-way connector and terminal B in the harness end of the engine speed sensor connector	5.0 ohms or less: Faulty engine speed sensor connector OR Faulty ECU 30-way connector OR Faulty ECU Greater than 5.0 ohms: Open in engine speed ground circuit -- -1/1

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000190.14 — Engine Speed/Pump Speed Out of Sync



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Engine Speed and Pump Speed Sensors

- The engine speed and pump speed sensors are inductive-type pickup sensors. The engine speed sensor is mounted in the timing gear cover and the

pump speed sensor is located inside the injection pump. As teeth on the camshaft drive gear rotate past the engine speed sensor, and notches on the pump timing wheel rotate past the pump speed sensor, AC signals are generated. The frequency of these signals are proportional to engine speed. The ECU uses the engine speed sensor as it's primary engine speed input and the pump speed sensor input as a back up to the engine speed sensor input.

DTC 000190.14 will set if:

Continued on next page

DPSG, RG39774, 62 -19-23NOV98-1/2

- Either the engine speed sensor or pump speed sensor does not indicate a speed reading while the other sensor does.

If DTC 000190.14 sets, the following will occur:

- If the fault is related to the engine speed sensor, the engine may hesitate momentarily while the ECU

changes from the engine speed sensor input to the pump speed sensor input but should continue to run normally.

- If the fault is related to the pump speed sensor, there should be no noticeable difference in engine operation.

DPSG,RG39774,62 -19-23NOV98-2/2

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,197

000190.14 — Engine Speed/Pump Speed Out of Sync

Either the engine speed sensor or pump speed sensor does not indicate a speed reading while the other sensor does.

RG40854.0000043 -19-08JAN01-1/1

000190.14 Engine Speed/Pump Speed Out of Sync Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump, the engine speed, and the ECU 30-way connectors looking for dirty, damaged, or poorly positioned terminals.

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1 Intermittent Fault Test

- NOTE: For wiring and theory of operation information, see DTC 000190.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information
1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™earlier in this Group.
 2. Ignition ON, engine OFF
 3. Start ECU communication software
 4. Read DTCs using DST or SERVICE ADVISOR™.
 5. Make note of all DTCs, then clear all DTCs
 6. Ignition ON, engine running
 7. Read DTCs

000190.14 reoccurs:
GO TO 2

000190.14 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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2 Speed Sensor Check

- NOTE: For wiring and theory of operation information, see DTC 000190.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information
1. Ignition OFF
 2. Disconnect the engine speed sensor and secure harness connector so that it cannot contact any moving parts
 3. Start engine, and observe engine operation

Engine starts and runs normally:
GO TO 6

Engine will not start, or runs erratically:
GO TO 3

-- -1/1

Trouble Code Diagnostics and Tests

③ Pump Speed Sensor Resistance Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Disconnect the pump 6-way connector 3. Using a multimeter, measure resistance between terminals A and B of the pump end of the pump 6-way connector	700 - 1200 ohms: GO TO ④ Below 700 or above 1200 ohms: Faulty pump speed sensor inside injection pump. Have pump repaired or replace pump -- -1/1
④ Pump Speed Wiring Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Install a secure fitting jumper wire between terminals A and B in the harness end of the pump 6-way connector 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminals J3 and D2 in the harness end of the ECU 30-way connector	5.0 ohms or less: GO TO ⑤ Greater than 5.0 ohms: Open in pump speed input wire OR Open in pump speed ground wire -- -1/1
⑤ Pump Speed Wiring Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Remove jumper wire from pump 6-way connector 3. Using a multimeter, measure resistance between ECU 30-way connector terminal J3 and a good ground 4. Using a multimeter, measure resistance between ECU 30-way connector terminal J3 and all other terminals in the ECU 30-way and 18-way connectors	All measurements greater than 2000 ohms: Faulty pump speed sensor inside injection pump. Have pump repaired or replace pump OR Faulty ECU Any measurement less than 2000 ohms: Faulty pump speed wiring in harness -- -1/1
⑥ Engine Speed Sensor Resistance Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Disconnect engine speed sensor connector 3. Using a multimeter, measure resistance between both terminals of the engine speed sensor	2500 - 3500 ohms: GO TO ⑦ Below 2500 or above 3500 ohms: Faulty engine speed sensor -- -1/1

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Trouble Code Diagnostics and Tests

7 Engine Speed Wiring Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Install a secure fitting jumper wire between both terminals in the engine speed sensor harness connector 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminals J2 and D2 in the harness end of the ECU 30-way connector	5.0 ohms or less: GO TO 8 Greater than 5.0 ohms: Open in engine speed input wire OR Open in engine speed ground wire -- -1/1
8 Engine Speed Wiring Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000190.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Remove jumper wire from engine speed sensor harness connector 3. Using a multimeter, measure resistance between ECU 30-way connector terminal J2 and: • All terminals in the ECU 30-way and 18-way connectors • A good ground	All measurements greater than 2000 ohms: Damaged or incorrectly installed engine speed sensor OR Faulty ECU Any measurement less than 2000 ohms: Faulty engine speed wiring in harness -- -1/1

000190.16 — Engine Overspeed Moderate

The engine speed as measured by the engine speed sensor (and on some applications the pump speed sensor) is greater than a pre-programmed value in the ECU's memory.

Engine Overspeed

- The ECU measures the speed of the engine with the engine speed sensor (and on some applications the pump speed sensor, located inside the injection pump) and the engine speed sensor, located on the timing gear cover.

DTC 000190.16 will set if:

- The engine speed as measured by the engine speed sensor (and on some applications the pump speed sensor) is greater than a pre-programmed value in the ECU's memory.

If DTC 000190.16 sets, the following will occur:

- The ECU will command zero fuel delivery position of the injection pump rack.
- If zero fuel delivery rack position can not be obtained, DTC 000834.07 (on some applications DTC 000638.07 will be set) will also be set and the ECU will shut off the fuel shut-off solenoid.

If DTC 000190.16 sets:

NOTE: With DTC 000190.00, there may or may not be a problem with the electronic control system.

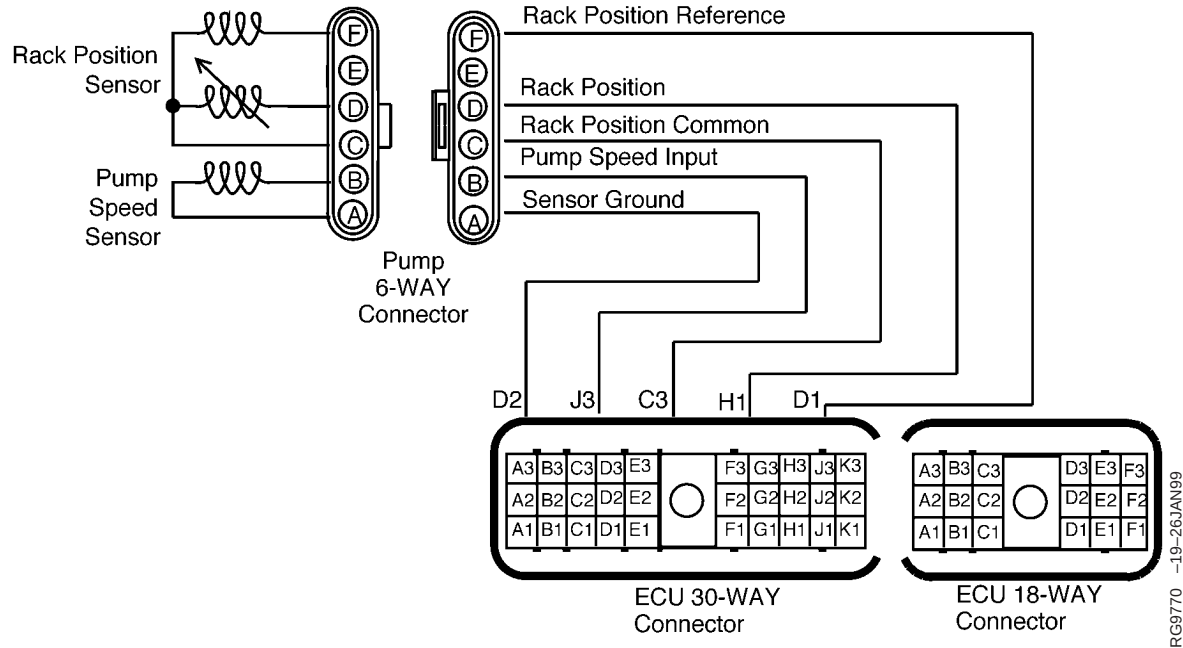
- Read DTCs using DST or SERVICE ADVISOR™. If DTC is not found in this manual, see LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) ON ECU earlier in this Group. If there are other codes, go to the appropriate diagnostic procedure.
- If there are no other stored or active DTCs, clear DTC 000190.16 and monitor codes to see if DTC 000190.16 reoccurs.

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RG40854,000001F -19-02MAR01-1/1

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,201

000191.02 — Pump Speed Input Noise



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Pump Speed Sensor

- The pump speed sensor is an inductive-type pickup sensor located inside the injection pump. The sensor detects notches on the pump timing wheel, also located inside the pump. As notches rotate past the sensor, an AC signal is generated. The frequency of this signal is proportional to the speed of the injection pump. The pump speed sensor input is a back up to the engine speed sensor input. In the event that there is a problem with the engine speed

input, the ECU will start using the input from the pump speed sensor in order to allow the engine to continue running. For more pump speed sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

DTC 000191.02 will set if:

- The pump speed sensor input becomes erratic while the engine speed sensor input continues to be valid.

If DTC 000191.02 sets, the following will occur:

- The engine may hesitate momentarily but should then continue to run normally.
- If DTC 000190.02 occurs with DTC 000191.02, the engine will die and won't restart until at least one of the two codes is repaired.

DPSG, RG39774, 57 -19-23NOV98-1/1

000191.02 — Pump Speed Input Noise

The pump speed sensor input becomes erratic while the engine speed sensor input continues to be valid.

RG40854,0000044 -19-08JAN01-1/1

000191.02 Pump Speed Input Noise Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump and the ECU 30-way connectors looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000191.02 PUMP SPEED INPUT NOISE supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Warm engine
3. Ignition ON, engine OFF
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

000191.02 reoccurs:
GO TO ❷

000191.02 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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② Pump Speed Input Noise Check

NOTE: For wiring and theory of operation information, see DTC 000191.02 PUMP SPEED INPUT NOISE supporting information.

DTC 000191.02 is mostly likely cased by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections any where on the machine. Things to check:

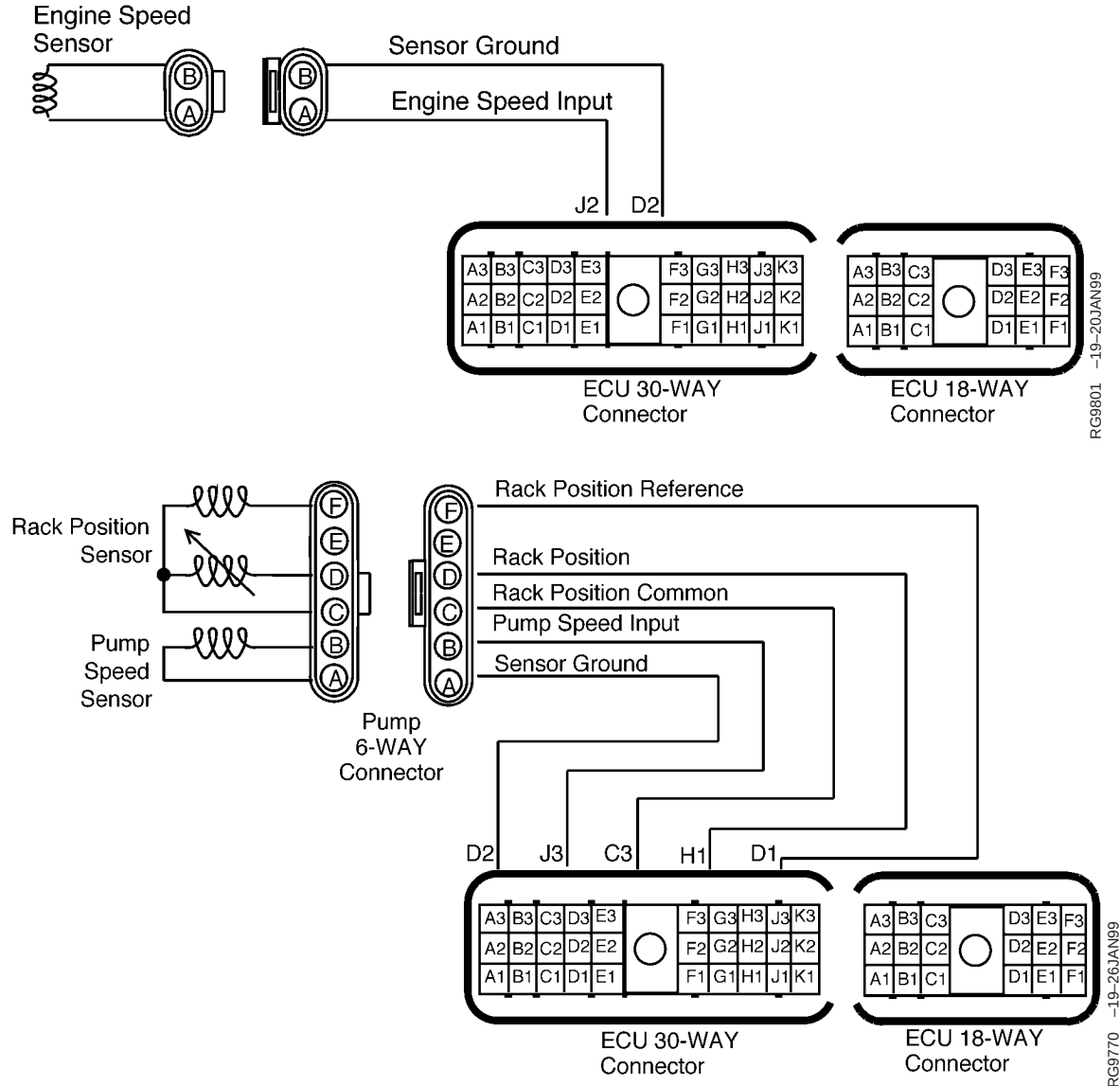
- All harness connectors
- Alternator connections
- Chassis ground connections, battery ground connection
- Corrosion, dirt, or paint can cause intermittent and "noisy" connections
- Check the wiring harness for intermittent open and short circuits, particularly the pump speed sensor wiring

Other possible causes of DTC 000191.02:

- Electromagnetic interference (EMI) from an incorrectly installed 2-way radio
- Interference from some radar source

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000191.14 — Engine Speed/Pump Speed Out of Sync



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Engine Speed and Pump Speed Sensors

- The engine speed and pump speed sensors are inductive-type pickup sensors. The engine speed sensor is mounted in the timing gear cover and the

pump speed sensor is located inside the injection pump. As teeth on the camshaft drive gear rotate past the engine speed sensor, and notches on the pump timing wheel rotate past the pump speed sensor, AC signals are generated. The frequency of these signals are proportional to engine speed. The ECU uses the engine speed sensor as it's primary engine speed input and the pump speed sensor input as a back up to the engine speed sensor input.

DTC 000191.14 will set if:

Continued on next page

RG41183,00000BA -19-03MAR03-1/2

- Either the engine speed sensor or pump speed sensor does not indicate a speed reading while the other sensor does.

If DTC 000191.14 sets, the following will occur:

- If the fault is related to the engine speed sensor, the engine may hesitate momentarily while the ECU

changes from the engine speed sensor input to the pump speed sensor input but should continue to run normally.

- If the fault is related to the pump speed sensor, there should be no noticeable difference in engine operation.

RG41183,00000BA -19-03MAR03-2/2

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000191.14 — Engine Speed/Pump Speed Out of Sync

Either the engine speed sensor or pump speed sensor does not indicate a speed reading while the other sensor does.

RG41183,00000BB -19-03MAR03-1/1

000191.14 Engine Speed/Pump Speed Out of Sync Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump, the engine speed, and the ECU 30-way connectors looking for dirty, damaged, or poorly positioned terminals.

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1 Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000191.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™earlier in this Group.
2. Ignition ON, engine OFF
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

000191.14 reoccurs:
GO TO 2

000191.14 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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2 Speed Sensor Check

NOTE: For wiring and theory of operation information, see DTC 000191.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information

1. Ignition OFF
2. Disconnect the engine speed sensor and secure harness connector so that it cannot contact any moving parts
3. Start engine, and observe engine operation

Engine starts and runs normally: GO TO 6

Engine will not start, or runs erratically:
GO TO 3

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Trouble Code Diagnostics and Tests

③ Pump Speed Sensor Resistance Test	<i>NOTE: For wiring and theory of operation information, see DTC 000191.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Disconnect the pump 6-way connector 3. Using a multimeter, measure resistance between terminals A and B of the pump end of the pump 6-way connector	700 - 1200 ohms: GO TO ④ Below 700 or above 1200 ohms: Faulty pump speed sensor inside injection pump. Have pump repaired or replace pump -- -1/1
④ Pump Speed Wiring Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000191.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Install a secure fitting jumper wire between terminals A and B in the harness end of the pump 6-way connector 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminals J3 and D2 in the harness end of the ECU 30-way connector	5.0 ohms or less: GO TO ⑤ Greater than 5.0 ohms: Open in pump speed input wire OR Open in pump speed ground wire -- -1/1
⑤ Pump Speed Wiring Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000191.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Remove jumper wire from pump 6-way connector 3. Using a multimeter, measure resistance between ECU 30-way connector terminal J3 and a good ground 4. Using a multimeter, measure resistance between ECU 30-way connector terminal J3 and all other terminals in the ECU 30-way and 18-way connectors	All measurements greater than 2000 ohms: Faulty pump speed sensor inside injection pump. Have pump repaired or replace pump OR Faulty ECU Any measurement less than 2000 ohms: Faulty pump speed wiring in harness -- -1/1
⑥ Engine Speed Sensor Resistance Test	<i>NOTE: For wiring and theory of operation information, see DTC 000191.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Disconnect engine speed sensor connector 3. Using a multimeter, measure resistance between both terminals of the engine speed sensor	2500 - 3500 ohms: GO TO ⑦ Below 2500 or above 3500 ohms: Faulty engine speed sensor -- -1/1

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Trouble Code Diagnostics and Tests

7 Engine Speed Wiring Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000191.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Install a secure fitting jumper wire between both terminals in the engine speed sensor harness connector 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminals J2 and D2 in the harness end of the ECU 30-way connector	5.0 ohms or less: GO TO 8 Greater than 5.0 ohms: Open in engine speed input wire OR Open in engine speed ground wire -- -1/1
8 Engine Speed Wiring Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000191.14 ENGINE SPEED/PUMP SPEED OUT OF SYNC supporting information</i> 1. Ignition OFF 2. Remove jumper wire from engine speed sensor harness connector 3. Using a multimeter, measure resistance between ECU 30-way connector terminal J2 and: • All terminals in the ECU 30-way and 18-way connectors • A good ground	All measurements greater than 2000 ohms: Damaged or incorrectly installed engine speed sensor OR Faulty ECU Any measurement less than 2000 ohms: Faulty engine speed wiring in harness -- -1/1

000191.16 — Engine Overspeed Extreme

The engine speed as measured by the engine speed sensor (and on some applications the pump speed sensor) is greater than a pre-programmed value in the ECU's memory.

Engine Overspeed

- The ECU measures the speed of the engine with the engine speed sensor, which is located on the timing gear cover. On some applications, a pump speed sensor, which is located in the injection pump can measure engine speed.

DTC 000191.16 will set if:

- The engine speed as measured by the engine speed sensor (and on some applications the pump speed sensor) is greater than a pre-programmed value in the ECU's memory.

If DTC 000191.16 sets, the following will occur:

- The ECU will command zero fuel delivery position of the injection pump rack.
- If zero fuel delivery rack position can not be obtained, DTC 000834.07 (on some applications, DTC 000638.07 will be set) will also be set and the ECU will shut off the fuel shut-off solenoid.

If DTC 000191.16 sets:

NOTE: With DTC 000191.16, there may or may not be a problem with the electronic control system.

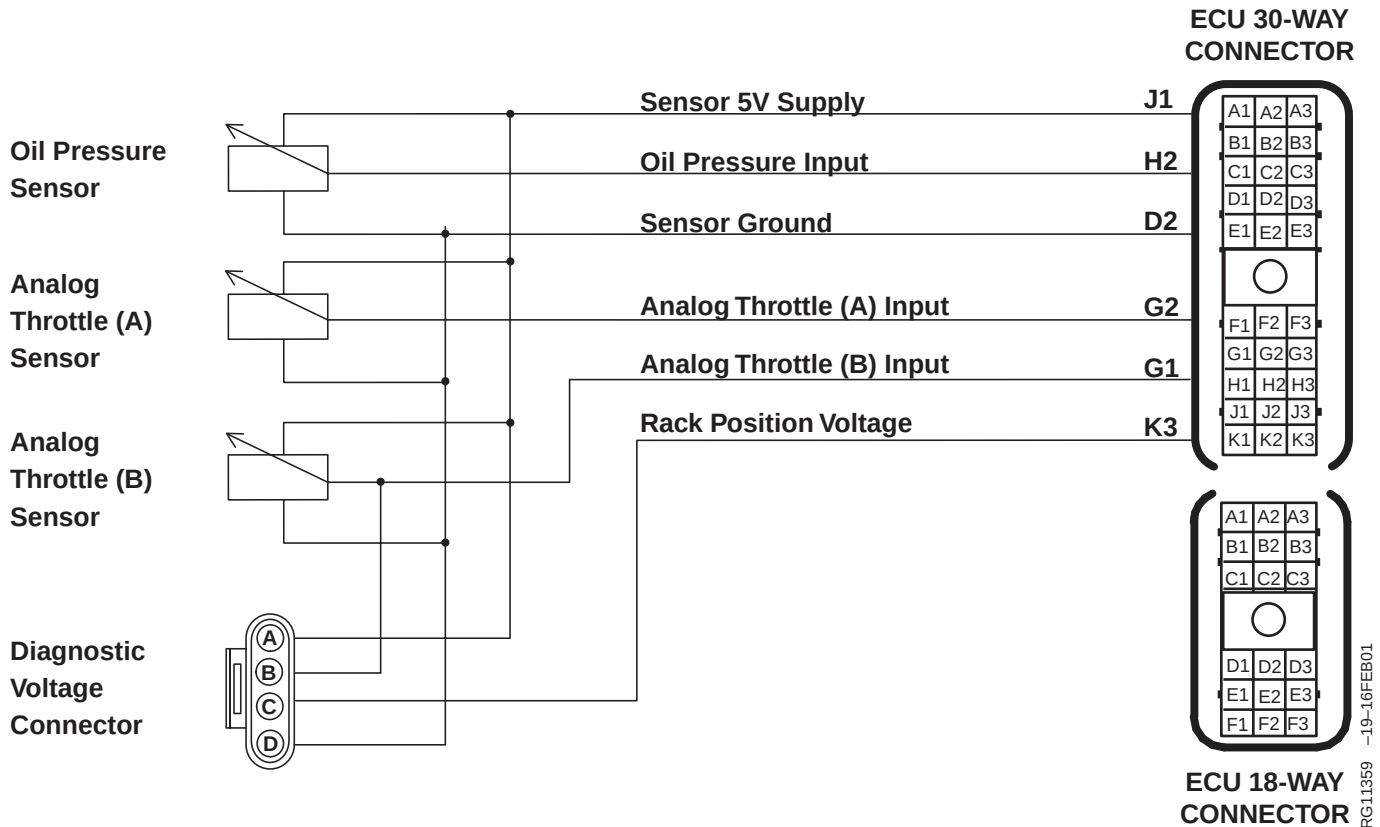
- Read DTCs using DST or SERVICE ADVISOR™. If DTC is not found in this manual, see LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) ON ECU earlier in this Group. If there are other codes, go to the appropriate diagnostic procedure.
- If there are no other stored or active DTCs, clear DTC 000191.16 and monitor codes to see if DTC 000191.16 reoccurs.

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RG41183.00000BC -19-03MAR03-1/1

000620.03 — Sensor Supply Voltage High



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Sensor Supply Voltage

- The temperature and throttle position (if used) sensors are supplied 5 volts by the ECU. The ECU then monitors the drop in voltage that the sensor causes and compares that drop to preprogrammed values in the ECU's memory to determine the value

of the parameter the sensor was measuring. In addition, the ECU monitors the exact voltage on the 5 volt supply circuit in order to ensure accurate readings.

DTC 000620.03 will set if:

- The ECU detects that there is a voltage greater than 5 volts on the ECU 5 volt supply circuit.

If DTC 000620.03 sets, the following will occur:

- Depending on the number of sensors the ECU is supplying 5 volts to, and the cause of the fault, engine operation may not be affected, or there may be problems with the sensors supplied 5 volts by the ECU.

000620.03 — Sensor Supply Voltage High

The ECU detects that there is a voltage greater than 5 volts on the ECU 5 volt supply circuit.

RG40854,0000045 -19-08JAN01-1/1

000620.03 Sensor Supply Voltage High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of each sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	<i>NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.</i> 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000620.03 reoccurs: GO TO ❷ 000620.03 cleared and doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Sensor 5 V Supply Voltage Test	<i>NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Disconnect ECU 30-way connector 3. Ignition ON 4. Using a multimeter, measure voltage between terminal J1 in the harness end of the ECU 30-way connector and a good ground	0.5 volts or less: GO TO ❸ Greater than 0.5 volts: Short to power in sensor 5 volt supply circuit

-- -1/1

Trouble Code Diagnostics and Tests

③ **Sensor 5 V Supply
Short to Battery
Voltage Supply Test**

NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.

1. Ignition OFF
2. Using a multimeter, measure resistance between terminals J1 and A1 in the harness end of the ECU 30-way connector

Greater than 10,000 ohms:
Faulty ECU connector
OR
Faulty ECU

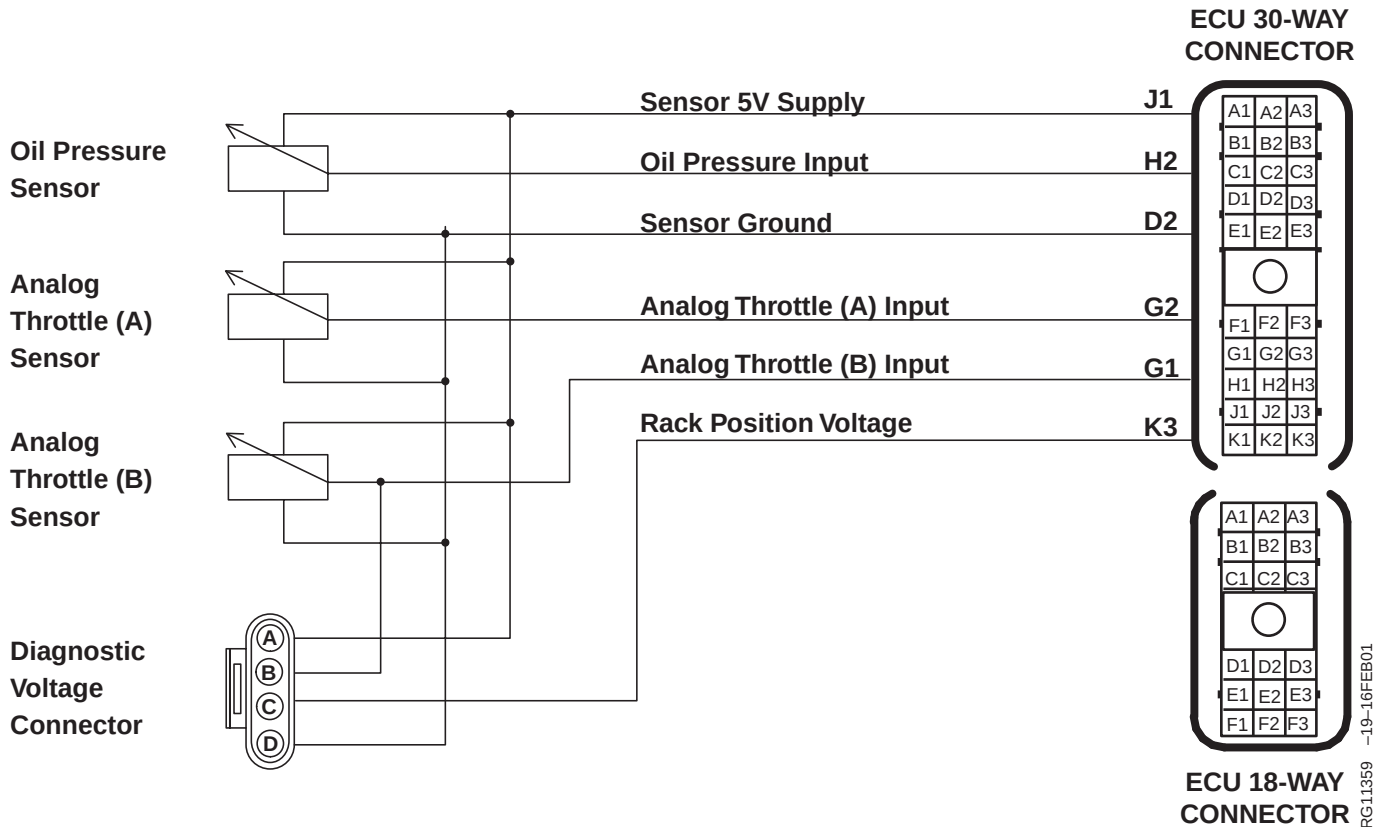
10,000 ohms or less:
Sensor 5 volt supply
circuit shorted to ECU
battery voltage supply
circuit

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000620.04 — Sensor Supply Voltage Low



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Sensor Supply Voltage

- The temperature and throttle position (if used) sensors are supplied 5 volts by the ECU. The ECU then monitors the drop in voltage that the sensor causes and compares that drop to preprogrammed values in the ECU's memory to determine the value

of the parameter the sensor was measuring. In addition, the ECU monitors the exact voltage on the 5 volt supply circuit in order to ensure accurate readings.

DTC 000620.04 will set if:

- The ECU is not able to maintain 5 volts on the sensor 5 volt supply circuit.

If DTC 000620.04 sets, the following will occur:

- Depending on the number of sensors the ECU is supplying 5 volts to, and the cause of the fault, engine operation may not be affected, or there may be problems with the sensors supplied 5 volts by the ECU.

000620.04 — Sensor Supply Voltage Low

The ECU is not able to maintain 5 volts on the sensor 5 volt supply circuit.

RG40854,0000046 -19-08JAN01-1/1

000620.04 Sensor Supply Voltage Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of each sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition OFF
3. Disconnect the sensors supplied voltage by ECU terminal J1. On the OEM application: oil pressure sensor, primary analog throttle, and secondary analog throttle sensors
4. Ignition ON, engine OFF
5. Start ECU communication software
6. Read DTCs using DST or SERVICE ADVISOR™.
7. Make note of all active DTCs, then clear all DTCs
8. Ignition ON, engine running
9. Read DTCs

000620.04 reoccurs:
GO TO ③

000620.04 cleared and doesn't reoccur:
GO TO ②

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Trouble Code Diagnostics and Tests

② Sensor Shorted Test

NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.

Read DTCs after each disconnected sensor is reconnected.

000620.04 reoccurs:

Sensor that caused DTC 000620.04 to reoccur when it was reconnected is shorted. Replace sensor and retest

000620.04 cleared and doesn't reoccur:

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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③ Sensor Supply Short to Ground Test

NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.

1. Ignition OFF
2. Disconnect ECU 30-way connector
3. Using a multimeter, measure resistance between terminal J1 and the following other terminals in the harness end of the ECU 30-way connector:
 - B1
 - C1
 - D2

Greater than 10,000 ohms:

Faulty ECU connector
OR
Faulty ECU

10,000 ohms or less:

Sensor 5 volt supply circuit shorted to ECU ground circuit
OR
Sensor 5 volt supply circuit shorted to sensor ground circuit

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000629.13 — ECU Error

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Engine Control Unit (ECU)

- The ECU error fault code can only occur because of an incorrectly programmed ECU or a faulty ECU.

DTC 000629.13 will set if:

- The ECU detects an internal problem.

If DTC 000629.13 sets, the following will occur:

- Depending on the severity of the problem, the engine may not run or engine operation may not be adversely affected.

DPSG,RG39774,50 -19-23NOV98-1/1

000629.13 — ECU Error

The ECU detects an internal problem.

RG40854,0000047 –19–08JAN01–1/1

000629.13 ECU Error Diagnostic Procedure

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000629.13 ECU ERROR supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON, engine OFF
7. Read DTCs

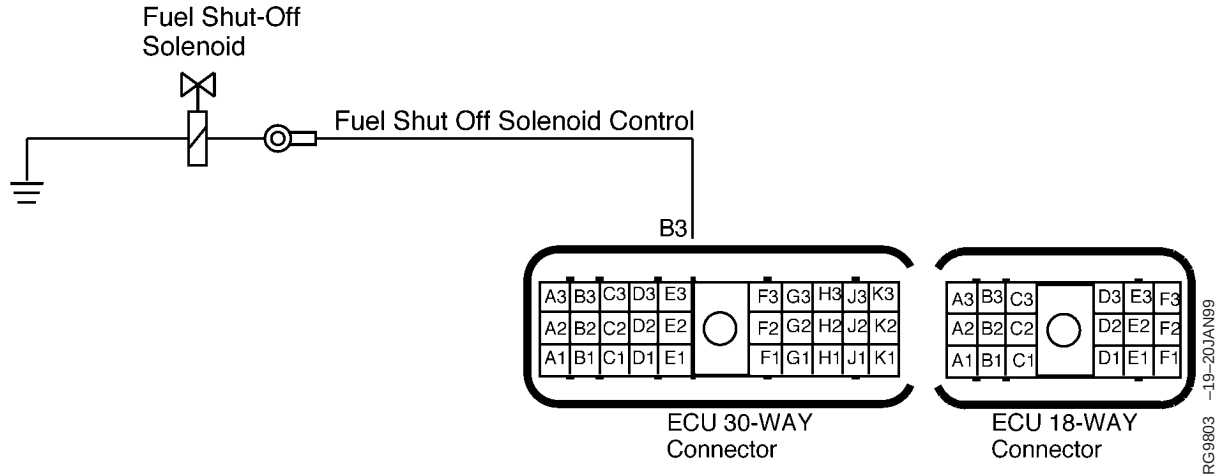
000629.13 reoccurs:
Faulty ECU

000629.13 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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000632.11 — Fuel Shut-Off Circuit Fault



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Fuel Shut-off Solenoid

- Located on the fuel inlet housing of the injection pump, the fuel shut-off solenoid (A) serves as a back-up method for the ECU to shut the engine off. The ECU controls operation of the fuel shut-off solenoid by energizing and de-energizing the solenoid. During a normal engine shut down, when the key switch is turned to OFF, the engine shuts down because the de-energized rack actuator solenoid causes the spring loaded rack to move to the zero fuel delivery position. In the event that de-energizing the rack actuator solenoid does not cause the rack to move to zero fuel, the ECU will

de-energize the fuel shut-off solenoid to cut-off the injection pump's fuel supply. For more fuel shut-off solenoid information, see FUEL SHUT-OFF SOLENOID in Section 03, Group 140 of this manual.

DTC 000632.11 will set if:

- The ECU detects an abnormally high current flow, because of a short, or an abnormally low current flow, because of an open in the fuel shut-off solenoid circuit.

If DTC 000632.11 sets, the following will occur:

- The most likely cause of DTC 000632.11 is an open in the fuel shut-off solenoid circuit. In this case the ECU will not be able to energize the shut-off solenoid, and the engine will not start.
- If the circuit fails such that the shut-off solenoid wire is shorted to voltage, the ECU can no longer use the shut-off solenoid as backup method to shut-off fuel.

DPSG, RG39774, 65 -19-23NOV98-1/1

000632.11 — Fuel Shut-off Circuit Fault

The ECU detects an abnormally high current flow, because of a short, or an abnormally low current flow, because of an open in the fuel shut-off solenoid circuit.

RG40854,0000048 -19-08JAN01-1/1

000632.11 Fuel Shut-off Circuit Fault Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see DTC 000632.11 FUEL SHUT-OFF CIRCUIT FAULT 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON 7. Read DTCs	000632.11 reoccurs: GO TO ❷ 000632.11 cleared and doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Fuel Shut-off Voltage Test	NOTE: For wiring and theory of operation information, see DTC 000632.11 FUEL SHUT-OFF CIRCUIT FAULT 1. Ignition ON 2. Using a multimeter, measure voltage between fuel shut-off solenoid threaded stud (+) and an unpainted area on the fuel inlet housing (-)	Less than battery voltage: GO TO ❹ Battery voltage: GO TO ❸

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Trouble Code Diagnostics and Tests

③ Shut-off Solenoid Resistance Test	<i>NOTE: For wiring and theory of operation information, see DTC 000632.11 FUEL SHUT-OFF CIRCUIT FAULT</i> 1. Ignition OFF 2. Remove wire from solenoid threaded stud 3. Using a multimeter, measure resistance between threaded stud and an unpainted area on the fuel inlet housing	7 - 15 ohms: Faulty fuel shut-off solenoid connector OR Faulty ECU Less than 7 or greater than 15 ohms: Faulty fuel shut-off solenoid -- -1/1
④ Fuel Shut-off Control Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000632.11 FUEL SHUT-OFF CIRCUIT FAULT</i> 1. Ignition OFF 2. Remove wire from solenoid threaded stud 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between fuel shut-off wire eyelet and terminal B3 in the harness end of the ECU 30-way connector	Less than 5.0 ohms: GO TO ⑤ 5.0 ohms or greater: Open in fuel shut-off control circuit -- -1/1
⑤ Fuel Shut-off Control Circuit Grounded Test	<i>NOTE: For wiring and theory of operation information, see DTC 000632.11 FUEL SHUT-OFF CIRCUIT FAULT</i> 1. Wire still removed from shut-off solenoid 2. Using a multimeter, measure resistance between terminal B3 in the harness end of the ECU 30-way connector and a good ground	Greater than 10,000 ohms: Faulty ECU connector OR Faulty ECU 10,000 ohms or less: Short to ground in fuel shut-off control circuit -- -1/1

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000638.02 — Rack Instability

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Position

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also

located inside the injection pump, provides feedback information to the ECU of the actual position of the rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded.

DTC 000638.02 will set if:

- Rack position as measured by the rack position sensor is unstable.

If DTC 000638.02 sets, the following will occur:

- Depending on the cause of DTC 000638.02, the engine may feel "sluggish" or the engine may run normally.

RG41183,00000BD -19-03MAR03-1/1

000638.02 — Rack Instability

Rack position as measured by the rack position sensor is unstable.

RG41183,00000BE -19-03MAR03-1/1

000638.02 Rack Instability Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 3-way pump•connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Bleed the Fuel System at the Injection Pump

NOTE: For theory of operation information, see DTC 000638.02 RACK INSTABILITY supporting information

DTC 000638.02 could be caused by air in the injection pump especially if fuel system has been recently opened (filter changed, line removed, etc.). Following the steps below to verify that there is no air in the pump:

1. Perform bleed procedure at injection pump. See BLEED THE FUEL SYSTEM - AT THE INJECTION PUMP in Group 150 of this manual to ensure there is no air in the injection pump.
2. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
3. Ignition ON, engine OFF
4. Start ECU communication software
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all active DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000638.02 reoccurs:
GO TO ❷

000638.02 does not reoccur:
Problem resolved.

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Trouble Code Diagnostics and Tests

② Intermittent Fault Test

NOTE: For theory of operation information, see DTC 000638.02 RACK INSTABILITY supporting information

1. Check for an intermittent faulty connection. Pay particularly close attention to the rack position wiring and the 6-way pump connector. See INTERMITTENT FAULT DIAGNOSTICS earlier in this Group

NOTE: Intermittent DTC 000638.02 is an indication that an intermittent connection is the cause of DTC 000638.02.

2. Ignition ON, engine OFF
3. Read DTCs
4. Make note of all active DTCs, then clear all DTCs
5. Ignition ON, engine running
6. Read DTCs

000638.02 reoccurs:

If DTC 000638.02 repeatedly occurs and none of the above problems are found, the most likely cause is a stuck rack inside the injection pump
Have the pump repaired or replace the pump

000638.02 does not reoccur:

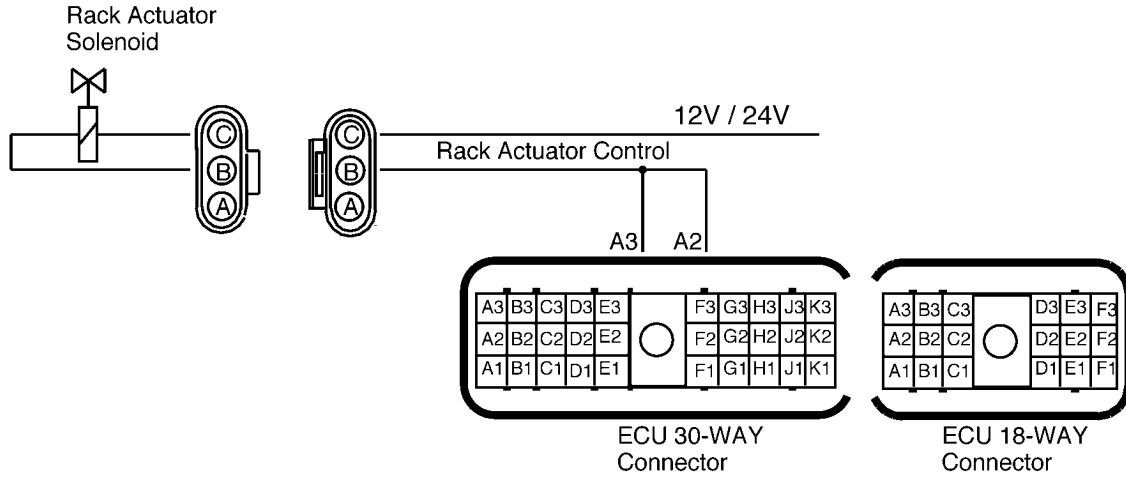
Problem resolved.

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000638.07 — Rack Position Error



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Position

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the rack. Information from the rack position sensor

indicates to the ECU if the rack actually went to the position the ECU commanded. For more rack actuator information, see ACTUATOR SOLENOID in Section 03, Group 140 of this manual.

DTC 000638.07 will set if:

- The position of the rack as measured by the rack position sensor is not the position that the ECU commanded.

If DTC 000638.07 sets, the following will occur:

- The ECU attempts to shut the engine off by turning off current to the actuator solenoid and to the fuel shut-off solenoid.
- Engine may run erratically or may shut down. Engine should restart, but will likely exhibit the same symptoms as before.

000638.07 — Rack Position Error

The position of the rack as measured by the rack position sensor is not the position that the ECU commanded.

RG41183,00000C0 -19-03MAR03-1/1

000638.07 Rack Position Error Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 3-way and 6-way pump connectors and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Active/Stored DTC Check	NOTE: For wiring and theory of operation information, see DTC 000638.07 RACK POSITION ERROR supporting information 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Read active DTCs and stored DTCs using DST or SERVICE ADVISOR™. IMPORTANT: If DTC 000833.03 or 4 (on some applications, DTC 000733.03 or 000733.04) are stored or active, DO NOT continue with this procedure. • For DTC 000733.03 or DTC 000833.03, see DTC 000833.03 RACK POSITION VOLTAGE HIGH earlier in this Group. • For DTC 000733.04 or DTC 000833.04, see DTC 000833.04 RACK POSITION VOLTAGE LOW earlier in this Group.	Only stored or active 000638.07: GO TO ④ Stored or active 000638.07 AND 000190.00 or 16: GO TO ② Stored or active DTCs OTHER than 000638.07 See appropriate procedure, diagnose and repair cause of DTC

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② Rack Actuator Grounded Test	NOTE: For wiring and theory of operation information, see DTC 000638.07 RACK POSITION ERROR supporting information 1. Ignition OFF 2. Disconnect pump 3-way connector 3. Using a multimeter, measure resistance between terminal B in the pump end of the 3-way pump connector and pump housing	Greater than 5.0 ohms: GO TO ③ 5.0 ohms or less: Faulty rack actuator inside injection pump. Have pump repaired or replace pump.

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Trouble Code Diagnostics and Tests

③ Rack Actuator Control Circuit Grounded Test	<i>NOTE: For wiring and theory of operation information, see DTC 000638.07 RACK POSITION ERROR supporting information</i> 1. Ignition OFF 2. Disconnect pump 3-way connector 3. Using a multimeter, measure resistance between terminal B in the harness end of the 3-way pump connector and a good ground	Greater than 5.0 ohms: Faulty ECU 5.0 ohms or less: Short to ground in rack actuator control circuit -- -1/1
④ Engine Start Check	<i>NOTE: For wiring and theory of operation information, see DTC 000638.07 RACK POSITION ERROR supporting information</i> 1. Ignition ON, engine OFF 2. Read active DTCs and stored DTCs. 3. Make note of all active and stored DTCs, then clear all DTCs 4. With ignition ON, attempt to start engine 5. Read active DTCs and stored DTCs.	Engine doesn't start and 000638.07 occurred during cranking: GO TO ⑥ Engine starts and runs normally: GO TO ⑤ -- -1/1
⑤ Engine Operation Check	<i>NOTE: For wiring and theory of operation information, see DTC 000638.07 RACK POSITION ERROR supporting information</i> Operate engine at varying speeds and loads while reading active DTCs and stored DTCs.	Stored or active 000638.07 ONLY: Faulty injection pump OR Faulty ECU Stored or active DTCs other than codes 000638.07: See appropriate procedure, diagnose and repair cause of DTC -- -1/1
⑥ Rack Actuator Resistance Test	<i>NOTE: For wiring and theory of operation information, see DTC 000638.07 RACK POSITION ERROR supporting information</i> 1. Ignition OFF 2. Disconnect pump 3-way connector 3. Using a multimeter, measure resistance between terminals B and C in the pump end of the 3-way pump connector	Between 0.5 and 1.5 ohms: GO TO ⑦ Less than 0.5 ohms or greater than 1.5 ohms: Faulty rack actuator inside injection pump. Have pump repaired or replace pump -- -1/1

Trouble Code Diagnostics and Tests

7 Rack Actuator Control Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000638.07 RACK POSITION ERROR supporting information</i> 1. Ignition OFF 2. 3-way pump connector still disconnected 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminal A2 in the harness end of the ECU 30-way connector and terminal B in the harness end of the 3-way pump connector	5.0 ohms or less: GO TO 8 Greater than 5.0 ohms: Open in rack actuator control circuit -- -1/1
8 Rack Actuator Control Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000638.07 RACK POSITION ERROR supporting information</i> 1. Ignition OFF 2. 3-way pump connector still disconnected 3. ECU 30-way connector still disconnected 4. Using a multimeter, measure resistance between terminals A2 and A3 in the harness end of the ECU 30-way connector	5.0 ohms or less: GO TO 9 Greater than 5.0 ohms: Open in rack actuator control circuit -- -1/1
9 Rack Actuator Power Test	<i>NOTE: For wiring and theory of operation information, see DTC 000638.07 RACK POSITION ERROR supporting information</i> 1. Ignition OFF 2. Pump 3-way connector still disconnected 3. Reconnect ECU 30-way connector 4. Ignition ON, engine OFF 5. Using a multimeter, measure voltage between terminal C in the harness end of pump 3-way connector and a good ground	Battery voltage: GO TO 10 Less than battery voltage: Open in rack actuator power circuit -- -1/1

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10 Rack Actuator Solenoid Test

IMPORTANT: During the following test, be careful to keep the jumper leads isolated so that battery voltage is not shorted to ground. Also, if the rack actuator is functioning correctly, about 20 amps of current will be conducted during this check and a spark will occur when the circuit is broken. This condition should not be continued beyond a few seconds, as overheating of the actuator solenoid will occur.

NOTE: For wiring and theory of operation information, see DTC 000638.07 RACK POSITION ERROR supporting information

1. Ignition OFF
2. Pump 3-way connector still disconnected
3. Locate the diagnostic voltage connector
4. Ignition ON
5. Using a multimeter, measure voltage between terminals C (+) and D (-) in the diagnostic voltage connector
6. Connect a jumper wire between terminal B in the pump end of the pump 3-way connector **and** a good ground
7. Connect a second jumper wire between terminal C in the pump end of the pump 3-way connector **and** battery voltage
8. While the above connection is made, measure voltage between terminals C (+) and D (-) in the diagnostic voltage connector

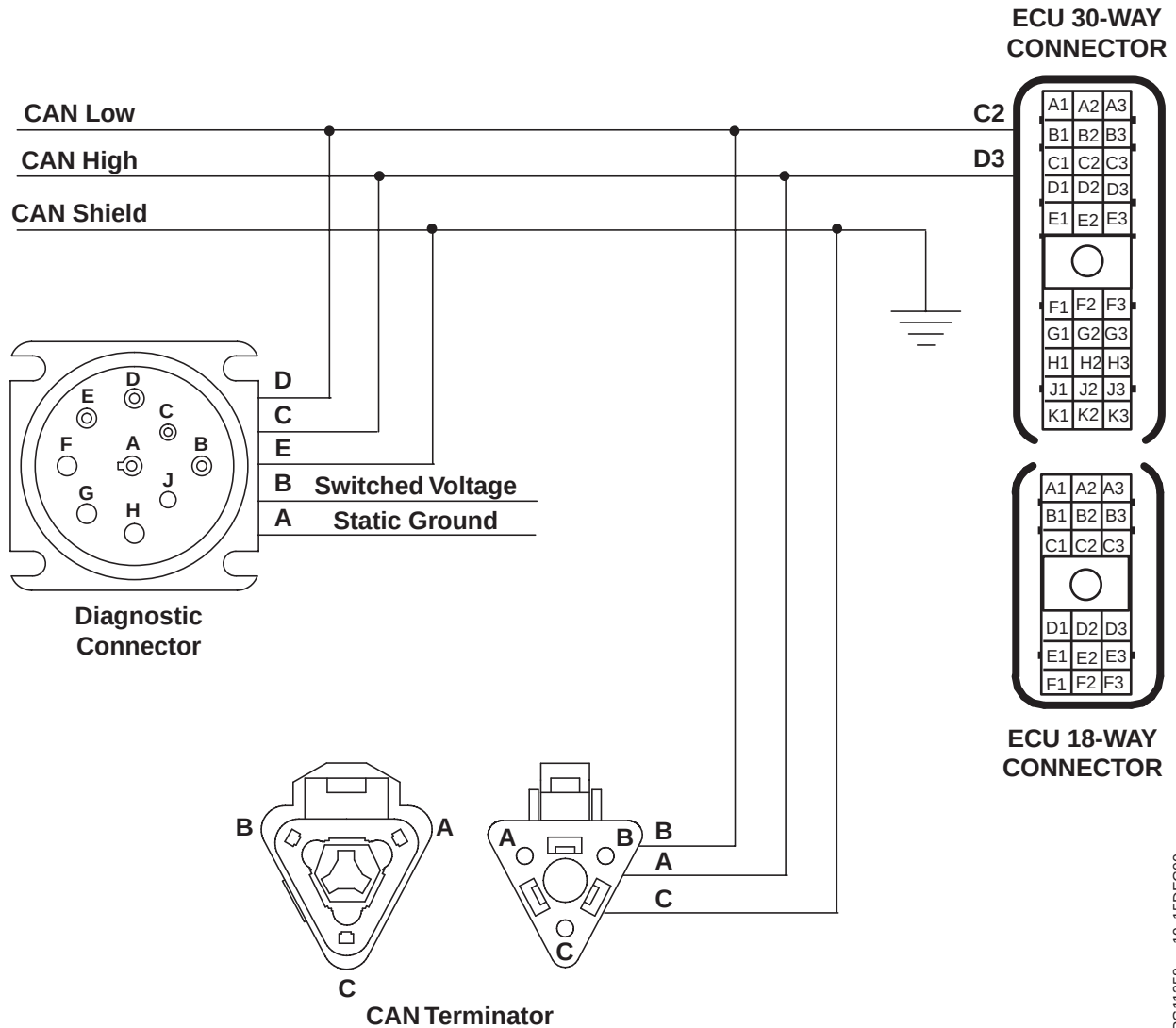
Voltage changed from about 0.5 volt first measurement to 4.0 volts or greater second:

Faulty 3-way pump connector
OR
Faulty ECU connector
OR
Faulty ECU

Voltage DID NOT change from about 0.5 volt first measurement to 4.0 volts or greater second:

Faulty injection pump.
Have pump repaired or replace pump

000639.00 — CAN Error



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RG11358 -19-15DEC00

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Controller Area Network (CAN)

- CAN is the network in which the individual controllers on a machine communicate with each other. The number of controllers communicating on CAN depends on the application. On some

applications, the ECU is the only controller on CAN; on other applications, there are many controllers on CAN.

DTC 000639.00 will set if:

- The ECU detects a problem communicating on CAN.

If DTC 000639.00 sets, the following will occur:

- Depending on the application, engine operation may or may not be effected.

000639.00 — CAN Error

The ECU detects a problem communicating on CAN.

RG41183,00000C2 -19-03MAR03-1/1

000639.00 CAN Error Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of each sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000639.00 CAN ERROR supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TODIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON
7. Read DTCs

DTC 000639.00 reoccurs:
GO TO ②

DTC 000639.00 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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② Check Other Controllers For CAN Related DTCs

NOTE: For wiring and theory of operation information, see DTC 000639.00 CAN ERROR supporting information

If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs

No CAN related DTCs found on other controllers:
GO TO ③

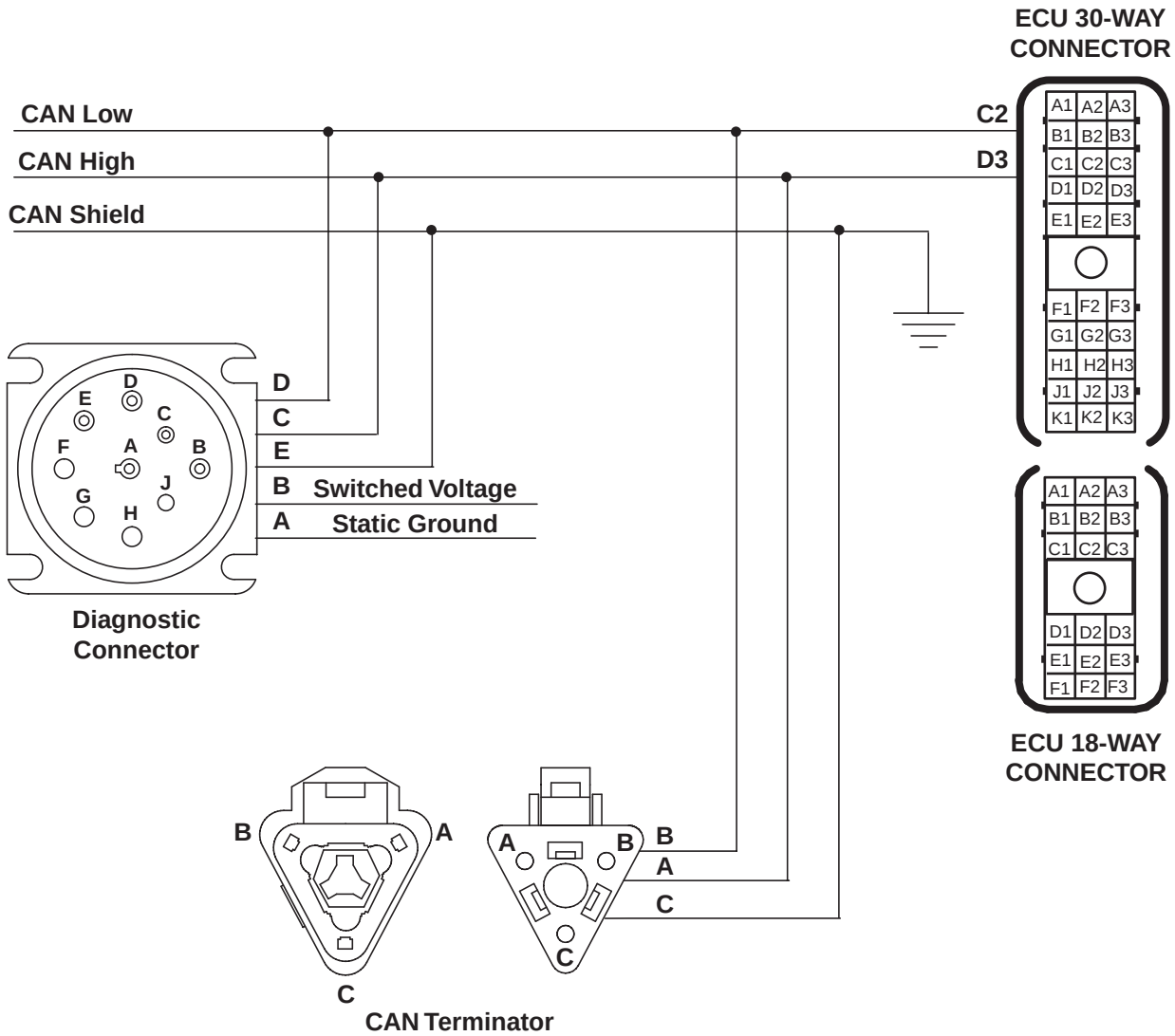
Did find CAN related DTCs on other controllers:
Refer to machine manual to diagnose and repair the cause of DTC, then determine if DTC 000639.00 reoccurs

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③ CAN Resistance Test	<i>NOTE: For wiring and theory of operation information, see DTC 000639.00 CAN ERROR supporting information</i> 1. Ignition OFF 2. Disconnect ECU 30-way connector 3. Using a multimeter, measure resistance between terminals C2 and D3 in the harness end of the ECU 30-way connector	Between 55 - 65 ohms: Faulty ECU 30-way connector OR Faulty ECU Less than 55 or greater than 65 ohms: Open or short in CAN communication circuit --1/1

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,237

000639.02 — CAN Error



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Controller Area Network (CAN)

- CAN is the network in which the individual controllers on a machine communicate with each other. The number of controllers communicating on CAN depends on the application. On some

applications, the ECU is the only controller on CAN; on other applications, there are many controllers on CAN.

DTC 000639.02 will set if:

- The ECU detects a problem communicating on CAN.

If DTC 000639.02 sets, the following will occur:

- Depending on the application, engine operation may or may not be effected.

RG11358 -19-15DEC00

000639.02 — CAN Error

The ECU detects a problem communicating on CAN.

RG41183,00000C4 -19-03MAR03-1/1

000639.02 CAN Error Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of each sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see DTC 000639.02 CAN ERROR supporting information 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TODIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON 7. Read DTCs	DTC 000639.02 reoccurs: GO TO ❷ DTC 000639.02 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Check Other Controllers For CAN Related DTCs	NOTE: For wiring and theory of operation information, see DTC 000639.02 CAN ERROR supporting information If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs	No CAN related DTCs found on other controllers: GO TO ❸ Did find CAN related DTCs on other controllers: Refer to machine manual to diagnose and repair the cause of DTC, then determine if DTC 000639.02 reoccurs

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Trouble Code Diagnostics and Tests

③ CAN Resistance Test

NOTE: For wiring and theory of operation information, see DTC 000639.02 CAN ERROR supporting information

1. Ignition OFF
2. Disconnect ECU 30-way connector
3. Using a multimeter, measure resistance between terminals C2 and D3 in the harness end of the ECU 30-way connector

Between 55 - 65 ohms:

Faulty ECU 30-way connector
OR
Faulty ECU

Less than 55 or greater than 65 ohms:

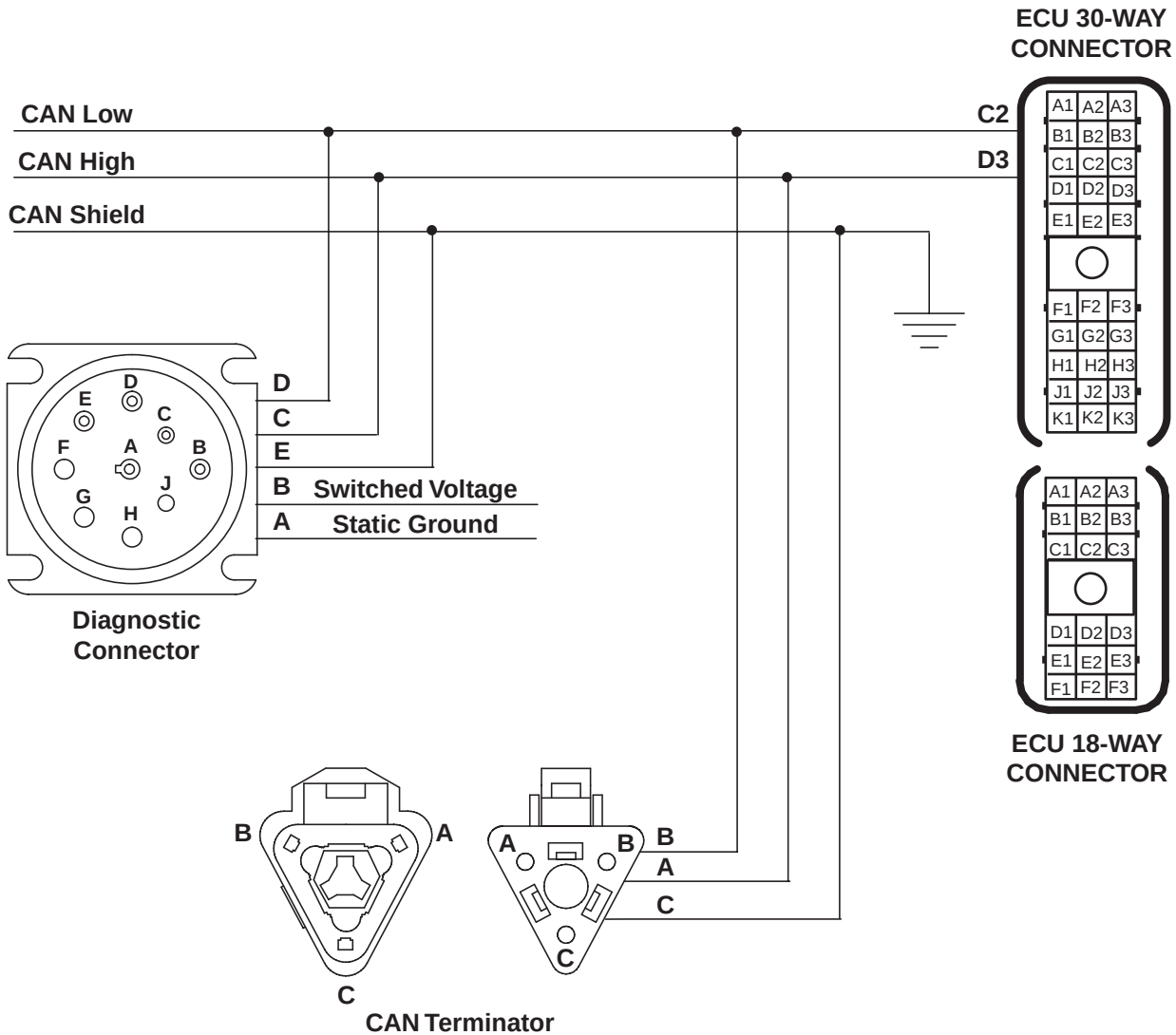
Open or short in CAN communication circuit

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000639.13 — CAN Error



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Controller Area Network (CAN)

- CAN is the network in which the individual controllers on a machine communicate with each other. The number of controllers communicating on CAN depends on the application. On some

applications, the ECU is the only controller on CAN; on other applications, there are many controllers on CAN.

DTC 000639.13 will set if:

- The ECU detects a problem communicating on CAN.

If DTC 000639.13 sets, the following will occur:

- Depending on the application, engine operation may or may not be effected.

RG11358 -19-15DEC00

000639.13 — CAN Error

The ECU detects a problem communicating on CAN.

RG40854,0000049 -19-08JAN01-1/1

000639.13 CAN Error Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of each sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN ERROR supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TODIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON
7. Read DTCs

DTC 000639.13 reoccurs:
GO TO ❷

DTC 000639.13 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Check Other Controllers For CAN Related DTCs

NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN ERROR supporting information

If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs

No CAN related DTCs found on other controllers:
GO TO ❸

Did find CAN related DTCs on other controllers:
Refer to machine manual to diagnose and repair the cause of DTC, then determine if DTC 000639.13 reoccurs

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Trouble Code Diagnostics and Tests

③ CAN Resistance Test

NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN ERROR supporting information

1. Ignition OFF
2. Disconnect ECU 30-way connector
3. Using a multimeter, measure resistance between terminals C2 and D3 in the harness end of the ECU 30-way connector

Between 55 - 65 ohms:

Faulty ECU 30-way connector
OR
Faulty ECU

Less than 55 or greater than 65 ohms:

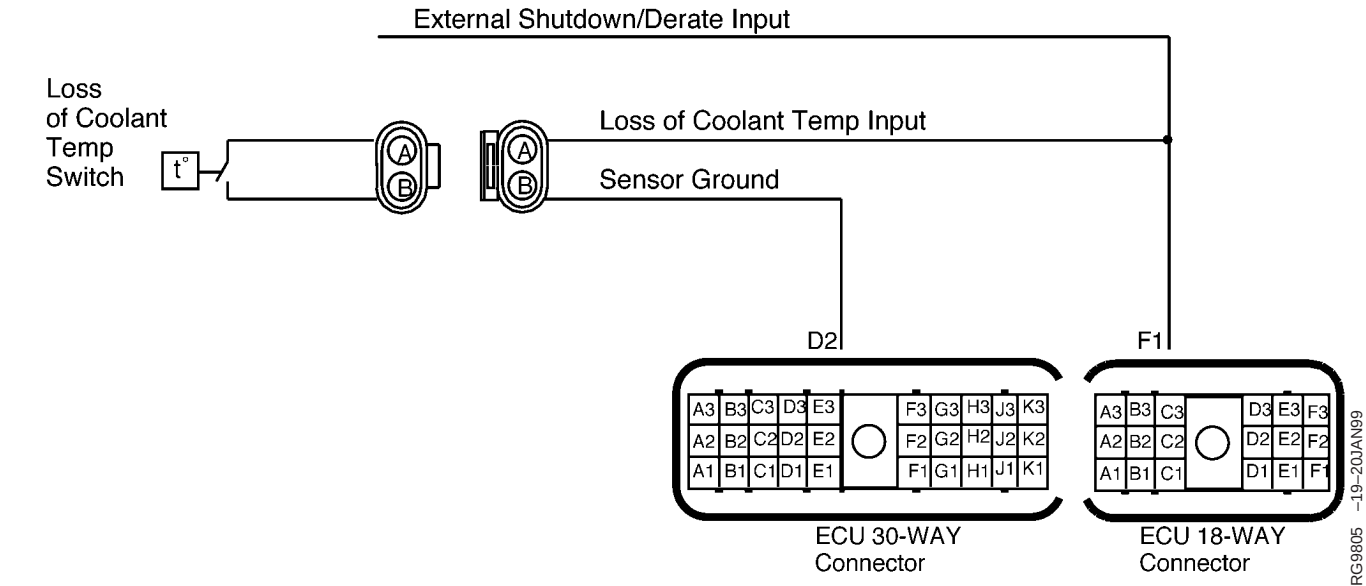
Open or short in CAN communication circuit

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000640.11 — Engine Shutdown Signal Invalid



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Engine Shutdown Signal

- The shutdown signal is an input to the ECU that will because of certain operating conditions, cause the ECU to shut the engine down.

DTC 000640.11 will set if:

- The ECU receives an engine shutdown input voltage which is either out of range high or out of range low.

RG41183,00000C5 -19-03MAR03-1/1

000640.11 — Engine Shutdown Signal Invalid

The ECU receives an engine shutdown input voltage which is either out of range high or out of range low.

RG41183,00000C6 -19-03MAR03-1/1

000640.11 Engine Shutdown Signal Invalid Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 30-way and 18-way (if equipped) ECU connector(s) looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000640.11 ENGINE SHUTDOWN SIGNAL INVALID supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start the ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

000640.11 reoccurs:
GO TO ②

000640.11 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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Trouble Code Diagnostics and Tests

② Engine Shutdown Signal Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000640.11 ENGINE SHUTDOWN SIGNAL INVALID supporting information.</i> 1. Ignition OFF 2. Disconnect ECU 30-way and 18-way (if equipped) connectors 3. Obtain wiring information for this application and determine the source of the engine shutdown signal 4. Disconnect the connector that outputs the shutdown signal 5. Using a multimeter, measure resistance between the shutdown signal terminal in the harness end of the ECU 30-way connector and originating shutdown signal terminal	5.0 ohms or less: GO TO ③ Greater than 5.0 ohms: Open in engine shutdown signal circuit -- -1/1
③ Engine Shutdown Signal Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000640.11 ENGINE SHUTDOWN SIGNAL INVALID supporting information.</i> 1. Ignition OFF 2. Using a multimeter, measure resistance between shutdown signal input terminal in the harness end of the ECU 30-way connector and: • All other terminals in the ECU connector • A good ground 3. Using a multimeter, measure resistance between originating shutdown signal input terminal in the vehicle connector and: • All other terminals in the vehicle connector • A good ground	All measurements greater than 5.0 ohms: Faulty ECU OR Faulty engine shutdown signal source Any measurement less than 5.0 ohms: Engine shutdown signal circuit shorted to another circuit in the wiring harness or to ground -- -1/1

000640.31 — Auxiliary Engine Shutdown Switch Active

The ECU receives an engine shutdown input voltage that is within the necessary voltage range to shut the engine down. On some applications, the ECU receives an engine shutdown request from another controller over CAN.

Engine Shutdown Signal

- The external shutdown signal is an input to the ECU that will because of certain operating conditions, cause the ECU to shut the engine down. On some applications, an engine shutdown request is sent over CAN(Controller Area Network) to the ECU from another controller.

DTC 000640.31 will set if:

- The ECU receives an engine shutdown input voltage that is within the necessary voltage range to shut the engine down. On some applications, the ECU receives an engine shutdown request from another controller over CAN.

If DTC 000640.31 sets, the following will occur:

- The engine will shutdown.

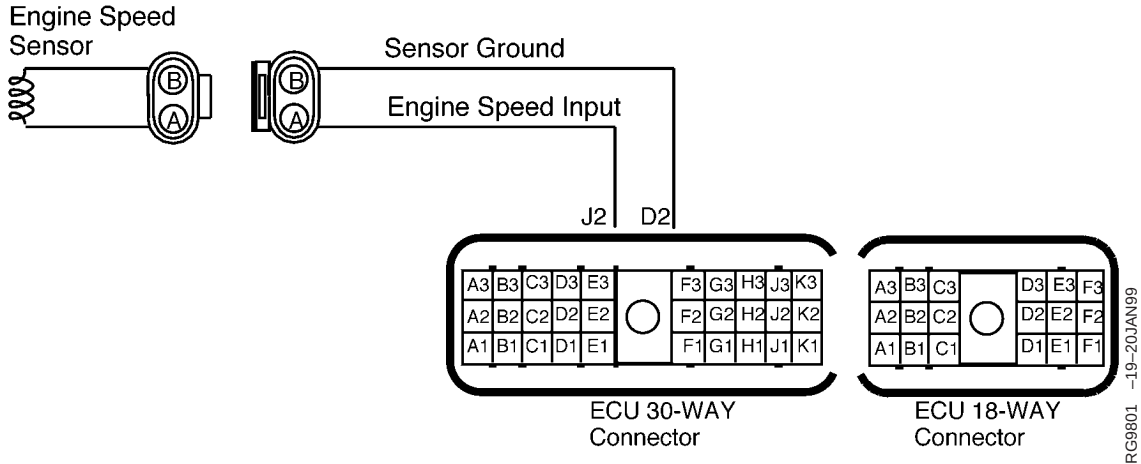
If DTC 000640.31 sets:

- Check for other stored or active fault codes on the ECU and, if equipped, other controllers on the machine that indicate the reason for the engine shutdown.

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RG41183,00000D8 -19-03MAR03-1/1

000723.02 — Engine Speed Input Noise



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Engine Speed Sensor

- The engine speed sensor is an inductive-type pickup sensor mounted in the timing gear cover. The sensor detects the teeth on the camshaft drive gear. As teeth rotate past the sensor, an AC signal is generated. The frequency of this signal is proportional to engine speed. The ECU uses the engine speed sensor as its primary engine speed input. For more engine speed sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140 of this manual.

DTC 000723.02 will set if:

- The engine speed sensor input becomes erratic while the pump speed sensor input continues to be valid.

If DTC 000723.02 sets, the following will occur:

- The engine may hesitate momentarily while the ECU changes from the engine speed sensor input to the pump speed sensor input but should continue to run normally.
- If DTC 000191.02 occurs along with DTC 000723.02, the engine will die and won't restart until at least one of the two codes is repaired.

RG41183,00000C7 -19-03MAR03-1/1

000723.02 — Engine Speed Input Noise

The engine speed sensor input becomes erratic while the pump speed sensor input continues to be valid.

RG41183,00000C8 -19-03MAR03-1/1

000723.02 Engine Speed Input Noise Diagnostic Procedure

NOTE: On 644 Loaders with DTC 000723.02, see DTC 000191.02 PUMP SPEED INPUT NOISE later in this Group.

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the engine speed sensor connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation see DTC 000723.02 ENGINE SPEED INPUT NOISE supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Warm engine
3. Ignition ON, engine OFF
4. Start ECU communication software
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000723.02 reoccurs:
GO TO ②

000723.02 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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② Engine Speed Input
Noise Check

NOTE: For wiring and theory of operation see DTC 000723.02 ENGINE SPEED INPUT NOISE supporting information.

DTC 000190.02 is mostly likely cased by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections any where on the machine. Things to check:

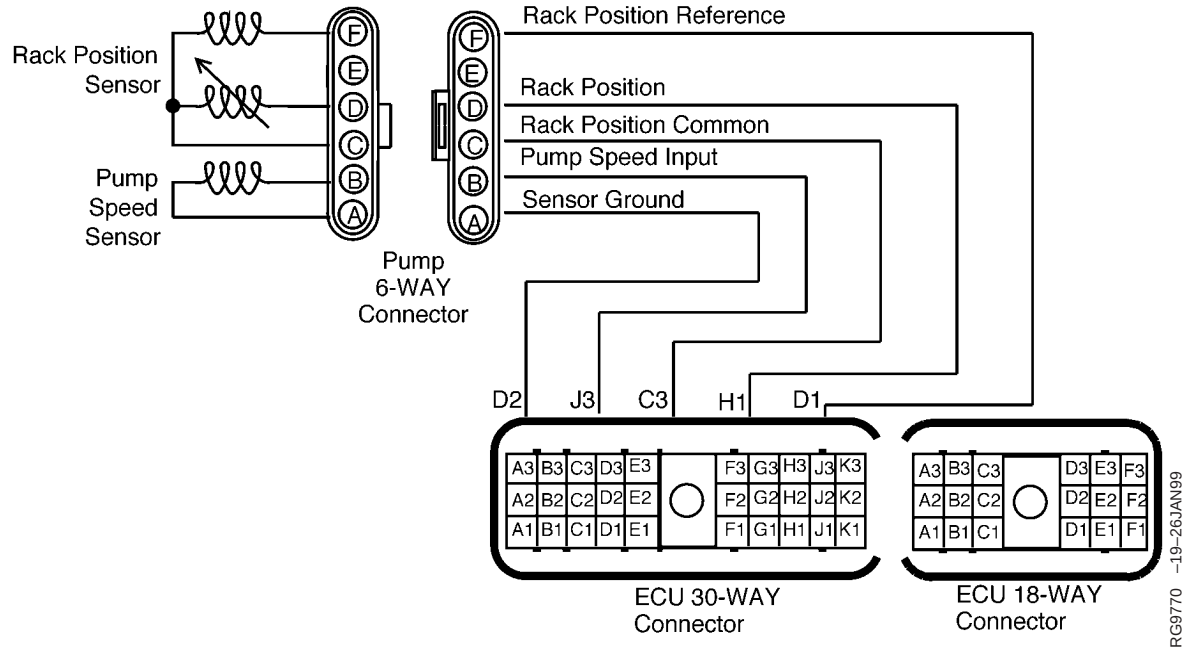
- All harness connectors
- Alternator connections
- Chassis ground connections, battery ground connection
- Corrosion, dirt, or paint can cause intermittent and "noisy" connections
- Check the wiring harness for intermittent open and short circuits, particularly the engine speed sensor wiring

Other possible causes of DTC 000723.02:

- Electromagnetic interference (EMI) from an incorrectly installed 2-way radio
- Interference from some radar source

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000733.02 — Rack Position Error with Engine Off



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Position

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback

information to the ECU of the actual position of the rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded.

DTC 000733.02 will set if:

- With the ignition ON and the engine OFF, the position of the rack as measured by the rack position sensor is not at the zero fuel delivery position.

If DTC 000733.02 sets, the following will occur:

- Depending on the cause of DTC 000733.02, the engine may deliver lower power than normal or the engine may run normally.

000733.02 — Rack Position Error with Engine Off

With the ignition ON and the engine OFF, the position of the rack as measured by the rack position sensor is not at the zero fuel delivery position.

RG41183,00000CA -19-03MAR03-1/1

000733.02 Rack Position Error with Engine Off Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Cold Engine Start Aborted Check

NOTE: For wiring and theory of operation information, see DTC 000733.02 RACK POSITION ERROR WITH ENGINE OFF supporting information.

In extremely cold temperatures, DTC 000733.02 could occur if an engine start is attempted and then aborted. If this may have occurred follow the steps below:

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Start engine and warm to operating temperature
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all active DTCs, then clear all DTCs
6. Read DTCs

000733.02 reoccurs:
GO TO ❷

000733.02 does not reoccur:
Problem resolved.

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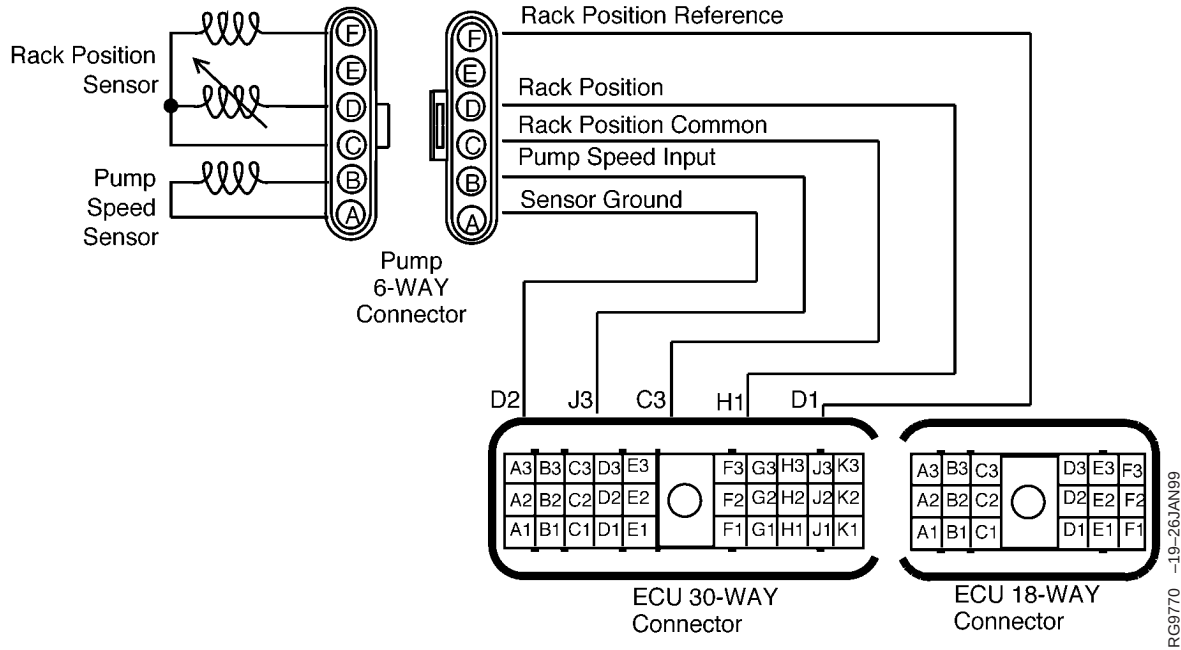
-- -1/1

Trouble Code Diagnostics and Tests

② Air in Injection Pump Check	<i>NOTE: For wiring and theory of operation information, see DTC 000733.02 RACK POSITION ERROR WITH ENGINE OFF supporting information.</i> DTC 000833.02 could be caused by air in the injection pump especially if fuel system has been recently opened (filter changed, line removed, etc.). Following the steps below to verify that there is no air in the pump: 1. Perform bleed procedure at injection pump. See BLEED THE FUEL SYSTEM - AT THE INJECTION PUMP in Group 150 of this manual to ensure there is no air in the injection pump. 2. Ignition ON, engine OFF 3. Read DTCs 4. Make note of all active DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	000733.02 reoccurs: GO TO ③ 000733.02 does not reoccur: Problem resolved. -- -1/1
③ Intermittent Fault Test	<i>NOTE: For wiring and theory of operation information, see DTC 000733.02 RACK POSITION ERROR WITH ENGINE OFF supporting information.</i> 1. Check for an intermittent faulty connection. Pay particularly close attention to the rack position wiring and the 6-way pump connector. See INTERMITTENT FAULT DIAGNOSTICS earlier in this Group <i>NOTE: Intermittent DTC 000733.03 and DTC 000733.04 are an indication that an intermittent connection is the cause of DTC 000733.02.</i> 2. Ignition ON, engine OFF 3. Read DTCs 4. Make note of all active DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	000733.02 reoccurs: If DTC 000733.02 repeatedly occurs and none of the above problems are found, the most likely cause is a stuck rack inside the injection pump Have the pump repaired or replace the pump 000733.02 does not reoccur: Problem resolved. -- -1/1

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000733.03 — Rack Position Voltage High



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Position Sensor

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the

position the ECU commanded. The rack position sensor consists of two inductive coils, the rack position coil, and rack reference coil. Each coil provides an input voltage to the ECU. The ECU processes these voltages and translates them into an actual position of the rack. For more rack position sensor information, see MEASURING RACK POSITION in Section 03, Group 140 of this manual.

DTC 000733.03 will set if:

- The rack position voltage (an internal voltage in the ECU) is higher than the normal operating range.

If DTC 000733.03 sets, the following will occur:

- The ECU attempts to shut the engine off by turning off current to the actuator solenoid and to the fuel shut-off solenoid.
- Engine will die, and won't restart.

000733.03 — Rack Position Voltage High

The rack position voltage (an internal voltage in the ECU) is higher than the normal operating range.

RG41183.00000CC -19-03MAR03-1/1

000733.03 Rack Position Voltage High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see DTC 000733.03 RACK POSITION VOLTAGE HIGH supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000733.03 reoccurs: GO TO ❷ 000733.03 cleared and doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Rack Position Sensor Resistance Test	NOTE: For wiring and theory of operation information, see DTC 000733.03 RACK POSITION VOLTAGE HIGH supporting information. 1. Ignition OFF 2. Disconnect 6-way pump connector 3. Using a multimeter, measure resistance between: • Terminals C and F in the pump end of the 6-way connector • Terminals C and D in the pump end of the 6-way connector	Both measurements 14 - 26 ohms: GO TO ❸ Either measurement less than 14 or greater than 26 ohms: Open or short in rack position sensor inside injection pump. Repair/replace injection pump

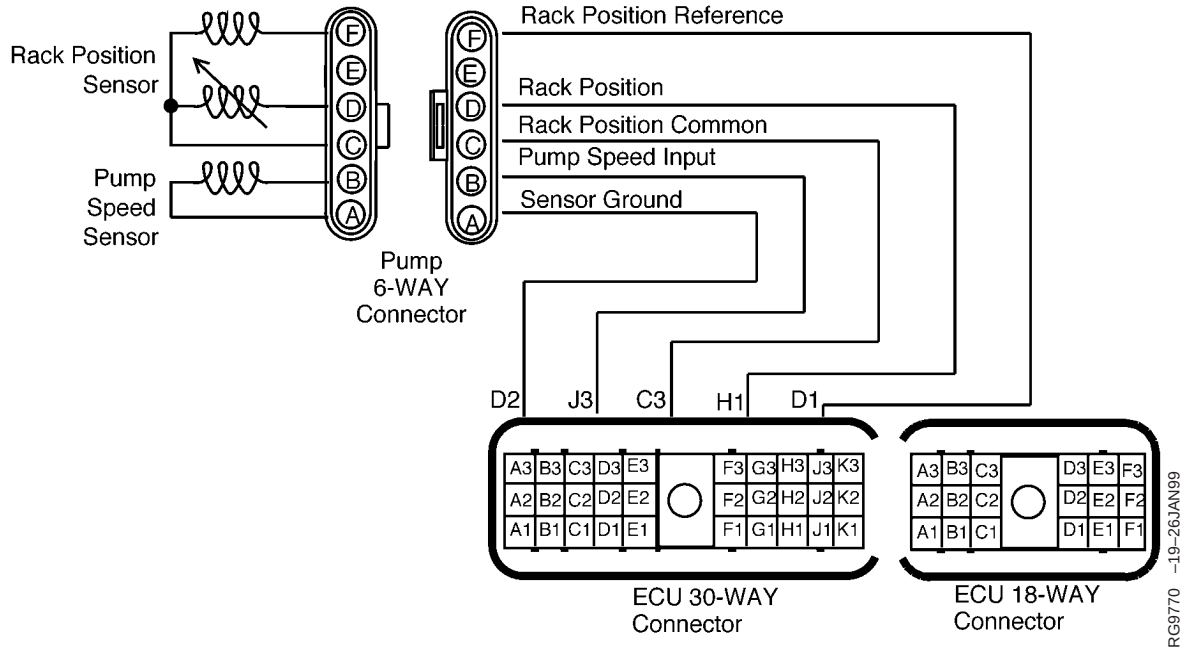
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Trouble Code Diagnostics and Tests

③ Rack Position Sensor Grounded Test	<i>NOTE: For wiring and theory of operation information, see DTC 000733.03 RACK POSITION VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Using a multimeter, measure resistance between terminal C in the pump end of the 6-way connector and: • Terminal A • Terminal B • Pump housing	All measurements greater than 2000 ohms: GO TO ④ Any measurement less than 2000 ohms: Short in rack position sensor inside injection pump. Repair/replace injection pump
④ Rack Position Circuit Grounded Test	<i>NOTE: For wiring and theory of operation information, see DTC 000733.03 RACK POSITION VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Leave 6-way pump connector disconnected 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminal H1 in the harness end of the ECU 30-way connector and a good ground 5. Using a multimeter, measure resistance between terminals D1 in the harness end of the ECU 30-way connector and a good ground	Both measurements greater than 2000 ohms: GO TO ⑤ Either measurement less than 2000 ohms: Short to ground in circuit with measurement less than 2000 ohms
⑤ Rack Position Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000733.03 RACK POSITION VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Leave 6-way pump connector and ECU 30-way connector disconnected 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between a good ground and the following: • Terminal H1 in the harness end of the ECU 30-way connector • Terminal D1 of the harness end of the ECU 30-way connector • Terminal C3 of the harness end of the ECU 30-way connector	All measurements less than 0.1 volts: GO TO ⑥ Any measurement greater than 0.1 volts: Short to voltage in circuit with measurement greater than 0.1 volts
⑥ Rack Position Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000733.03 RACK POSITION VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Reconnect the 6-way pump connector 3. Leave the ECU 30-way connector disconnected 4. Using a multimeter, measure resistance between terminal C3 in the harness end of the ECU 30-way connector and all other terminals in the connector (except D1 and H1)	All measurements greater than 2000 ohms: Faulty 6-way pump connector OR Faulty ECU connector OR Faulty ECU Any measurement less than 2000 ohms: Short in circuit with measurement less than 2000 ohms

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000733.04 — Rack Position Voltage Low



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Position Sensor

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the

position the ECU commanded. The rack position sensor consists of two inductive coils, the rack position coil, and rack reference coil. Each coil provides an input voltage to the ECU. The ECU processes these voltages and translates them into an actual position of the rack. For more rack position sensor information, see MEASURING RACK POSITION in Section 03, Group 140 of this manual.

DTC 000733.04 will set if:

- The rack position voltage (an internal voltage in the ECU) is lower than the normal operating range.

If DTC 000733.04 sets, the following will occur:

- The ECU attempts to shut the engine off by turning off current to the actuator solenoid and to the fuel shut-off solenoid.
- Engine will die, and won't restart.

000733.04 — Rack Position Voltage Low

The rack position voltage (an internal voltage in the ECU) is lower than the normal operating range.

RG41183.00000CE -19-03MAR03-1/1

000733.04 Rack Position Voltage Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation, see DTC 000733.04 RACK POSITION VOLTAGE LOW supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000733.04 reoccurs: GO TO ❷ 000733.04 cleared and doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❷ Rack Position Sensor Resistance Test	NOTE: For wiring and theory of operation, see DTC 000733.04 RACK POSITION VOLTAGE LOW supporting information. 1. Ignition OFF 2. Disconnect 6-way pump connector 3. Using a multimeter, measure resistance between: • Terminals C and F in the pump end of the 6-way connector • Terminals C and D in the pump end of the 6-way connector	Both measurements 14 - 26 ohms: GO TO ❸ Either measurement less than 14 or greater than 26 ohms: Open or short in rack position sensor inside injection pump. Repair/replace injection pump

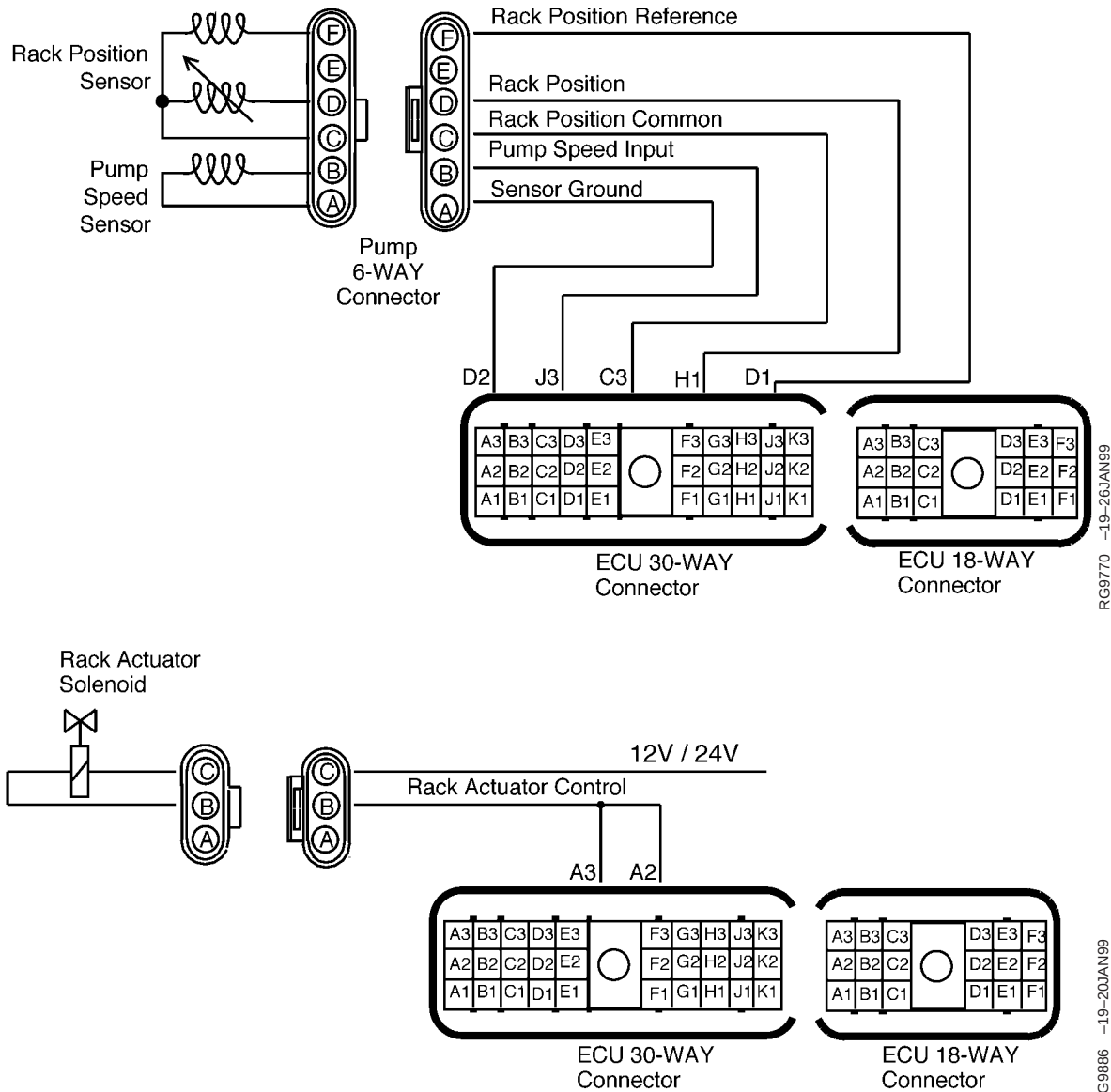
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Trouble Code Diagnostics and Tests

③ Rack Position Sensor Grounded Test	<i>NOTE: For wiring and theory of operation, see DTC 000733.04 RACK POSITION VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Using a multimeter, measure resistance between terminal C in the pump end of the 6-way connector and: • Terminal A • Terminal B • Pump housing	All measurements greater than 2000 ohms: GO TO ④ Any measurement less than 2000 ohms: Short in rack position sensor inside injection pump. Repair/replace injection pump -- -1/1
④ Rack Position Circuit Open Test	<i>NOTE: For wiring and theory of operation, see DTC 000733.04 RACK POSITION VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Install a secure fitting jumper wire between terminals C and F in the harness end of the 6-way pump connector 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminals C3 and D1 in the harness end of the ECU 30-way connector	5.0 ohms or less: GO TO ⑤ Greater than 5.0 ohms: Open in rack position reference circuit OR Open in rack position common circuit -- -1/1
⑤ Rack Position Circuit Open Test	<i>NOTE: For wiring and theory of operation, see DTC 000733.04 RACK POSITION VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Reposition jumper wire to terminals C and D in the harness end of the 6-way pump connector 3. Using a multimeter, measure resistance between terminals C3 and H1 in the harness end of the ECU 30-way connector	5.0 ohms or less: GO TO ⑥ Greater than 5.0 ohms: Open in rack position circuit -- -1/1
⑥ Rack Position Common Circuit Grounded Test	<i>NOTE: For wiring and theory of operation, see DTC 000733.04 RACK POSITION VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Remove jumper wire and reconnect the 6-way pump connector 3. Leave the ECU 30-way connector disconnected 4. Using a multimeter, measure resistance between terminal C3 in the harness end of the ECU 30-way connector and a good ground	Greater than 2000 ohms: Faulty 6-way pump connector OR Faulty ECU connector OR Faulty ECU Less than 2000 ohms: Short to ground in rack position common circuit -- -1/1

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000833.00 — Rack Position Calibration Error



Rack Position Sensor and Actuator Solenoid

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the

rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded. The rack position sensor consists of two inductive coils, the rack position coil, and rack reference coil. Each coil provides an input voltage to the ECU. The ECU processes these voltages and translates them into an actual position of the rack. For more rack position sensor information, see MEASURING RACK POSITION in Section 03, Group 140 of this manual.

DTC 000833.00 will set if:

Continued on next page

RG41183,00000CF -19-03MAR03-1/2

- The ECU determines that the injection pump rack position is out of calibration when the ECU measures the difference between commanded rack position and actual rack position.

- On most applications, the ECU will severely derate the engine (DTC 001569.31 will also be present) by 20% per minute until the engine has been derated by 40%, but will not shut the engine down.

If DTC 000833.00 sets, the following will occur:

RG41183,00000CF -19-03MAR03-2/2

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000833.00 — Rack Position Calibration Error

The ECU determines that the injection pump rack position is out of calibration when the ECU measures

the difference between commanded rack position and actual rack position.

RG41183,00000D0 -19-03MAR03-1/1

000833.00 Rack Position Calibration Error Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector, the 3-way pump connector, and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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1 Intermittent Fault Test

NOTE: For theory of operation, see DTC 000833.00 RACK CALIBRATION ERROR supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all active DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

000833.00 reoccurs:
GO TO 2

000833.00 cleared and doesn't reoccur:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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2 Connector Check

NOTE: For theory of operation, see DTC 000833.00 RACK CALIBRATION ERROR supporting information.

Check all connectors in the wiring harness between the ECU and injection pump for a poor connection.

No faulty connection found:
GO TO 3

Faulty connection found:
Repair or replace faulty terminal and retest.

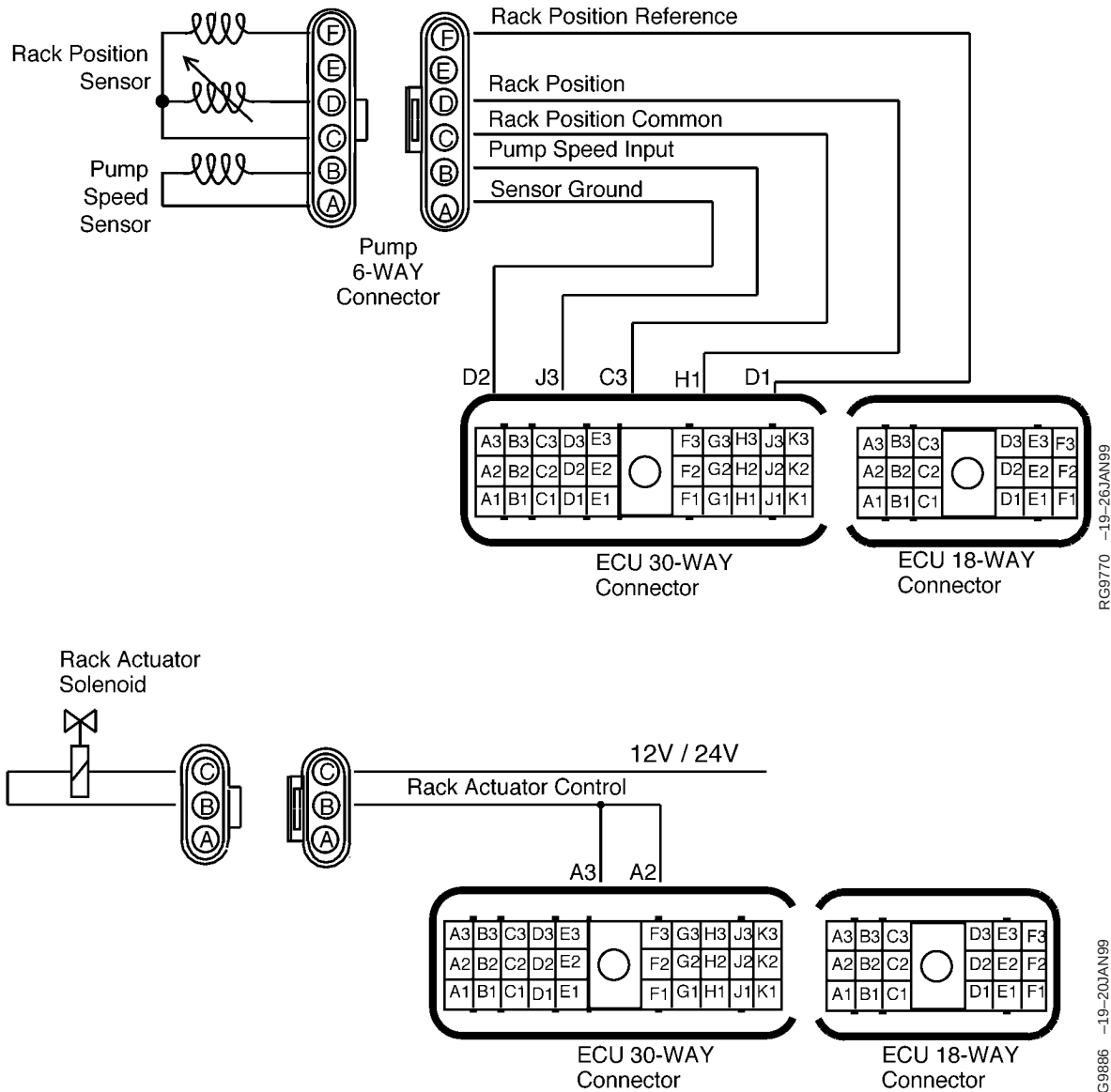
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Trouble Code Diagnostics and Tests

③ Wiring Harness Check	<i>NOTE: For theory of operation, see DTC 000833.00 RACK CALIBRATION ERROR supporting information.</i> Check wiring harness for any foreign devices between ECU and injection pump.	No foreign object found: Have injection pump repaired and retest. Foreign object found: Remove object from wiring harness. Clear codes and start engine. -- -1/1

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000833.01 — Rack Position Calibration Error



Rack Position Sensor and Actuator Solenoid

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the

rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded. The rack position sensor consists of two inductive coils, the rack position coil, and rack reference coil. Each coil provides an input voltage to the ECU. The ECU processes these voltages and translates them into an actual position of the rack. For more rack position sensor information, see MEASURING RACK POSITION in Section 03, Group 140 of this manual.

DTC 000833.01 will set if:

Continued on next page

RG41183,00000D1 -19-03MAR03-1/2

- The ECU determines that the injection pump rack position is out of calibration when the ECU measures the difference between commanded rack position and actual rack position.

- On most applications, the ECU will severely derate the engine (DTC 001569.31 will also be present) by 20% per minute until the engine has been derated by 40%, but will not shut the engine down.

If DTC 000833.01 sets, the following will occur:

RG41183,00000D1 -19-03MAR03-2/2

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000833.01 — Rack Position Calibration Error

The ECU determines that the injection pump rack position is out of calibration when the ECU measures

the difference between commanded rack position and actual rack position.

RG41183,00000D2 -19-03MAR03-1/1

000833.01 Rack Position Calibration Error Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector, the 3-way pump connector, and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For theory of operation, see DTC 000833.01 RACK CALIBRATION ERROR supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all active DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

000833.01 reoccurs:
GO TO ②

000833.01 cleared and doesn't reoccur:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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② Connector Check

NOTE: For theory of operation, see DTC 000833.01 RACK CALIBRATION ERROR supporting information.

Check all connectors in the wiring harness between the ECU and injection pump for a poor connection.

No faulty connection found:
GO TO ③

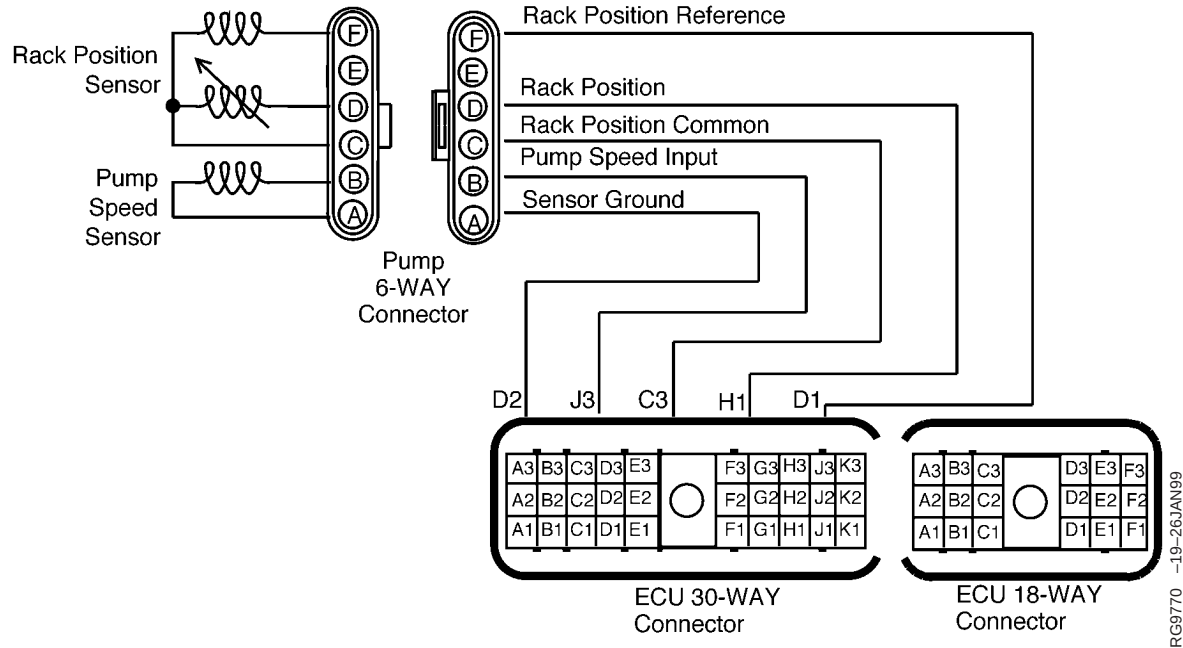
Faulty connection found:
Repair or replace faulty terminal and retest.

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③ Wiring Harness Check	NOTE: For theory of operation, see DTC 000833.01 RACK CALIBRATION ERROR supporting information. Check wiring harness for any foreign devices between ECU and injection pump.	No foreign object found: Have injection pump repaired and retest. Foreign object found: Remove object from wiring harness. Clear codes and start engine. -- 1/1

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000833.02 — Rack Position Error with Engine Off



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Position

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback

information to the ECU of the actual position of the rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded.

DTC 000833.02 will set if:

- With the ignition ON and the engine OFF, the position of the rack as measured by the rack position sensor is not at the zero fuel delivery position.

If DTC 000833.02 sets, the following will occur:

- Depending on the cause of DTC 000833.02, the engine may deliver lower power than normal or the engine may run normally.

000833.02 — Rack Position Error with Engine Off

With the ignition ON and the engine OFF, the position of the rack as measured by the rack position sensor is not at the zero fuel delivery position.

RG40854,000004A -19-08JAN01-1/1

000833.02 Rack Position Error with Engine Off Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Cold Engine Start Aborted Check

NOTE: For wiring and theory of operation information, see DTC 000833.02 RACK POSITION ERROR WITH ENGINE OFF supporting information.

In extremely cold temperatures, DTC 000833.02 could occur if an engine start is attempted and then aborted. If this may have occurred follow the steps below:

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Start engine and warm to operating temperature
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all active DTCs, then clear all DTCs
6. Read DTCs

000833.02 reoccurs:
GO TO ❷

000833.02 does not reoccur:
Problem resolved.

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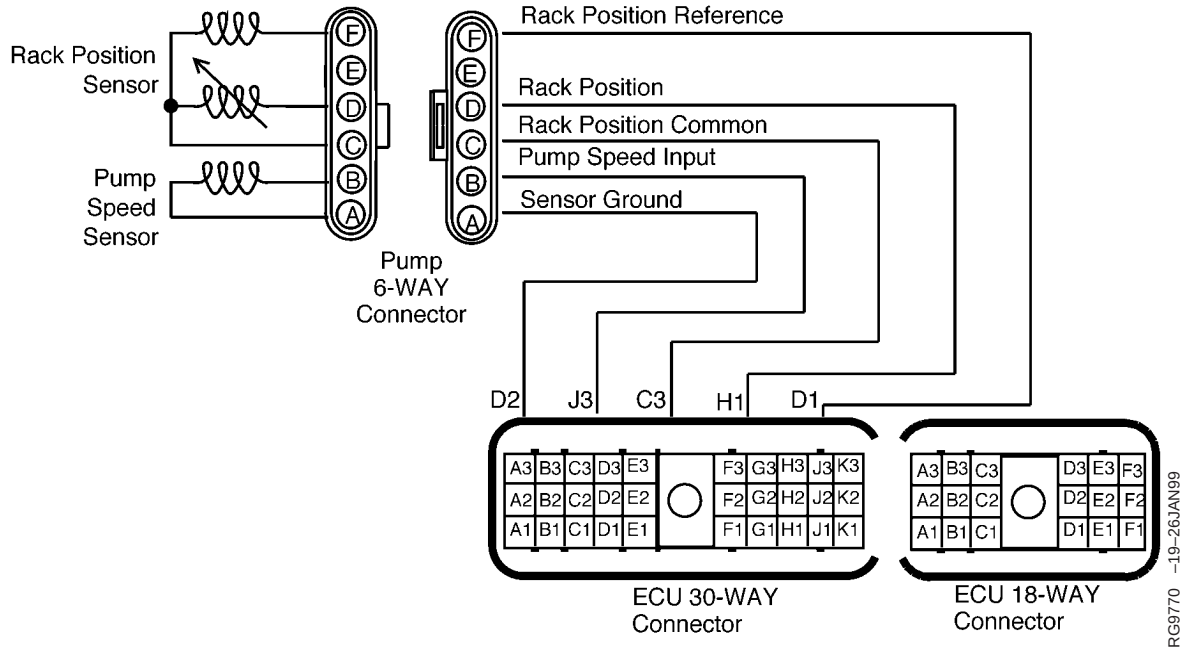
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Trouble Code Diagnostics and Tests

② Air in Injection Pump Check	<i>NOTE: For wiring and theory of operation information, see DTC 000833.02 RACK POSITION ERROR WITH ENGINE OFF supporting information.</i> DTC 000833.02 could be caused by air in the injection pump especially if fuel system has been recently opened (filter changed, line removed, etc.). Following the steps below to verify that there is no air in the pump: 1. Perform bleed procedure at injection pump. See BLEED THE FUEL SYSTEM - AT THE INJECTION PUMP in Group 150 of this manual to ensure there is no air in the injection pump. 2. Ignition ON, engine OFF 3. Read DTCs 4. Make note of all active DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	000833.02 reoccurs: GO TO ③ 000833.02 does not reoccur: Problem resolved. -- -1/1
③ Intermittent Fault Test	<i>NOTE: For wiring and theory of operation information, see DTC 000833.02 RACK POSITION ERROR WITH ENGINE OFF supporting information.</i> 1. Check for an intermittent faulty connection. Pay particularly close attention to the rack position wiring and the 6-way pump connector. See INTERMITTENT FAULT DIAGNOSTICS earlier in this Group <i>NOTE: Intermittent DTC 000833.03 and DTC 000833.04 are an indication that an intermittent connection is the cause of DTC 000833.02.</i> 2. Ignition ON, engine OFF 3. Read DTCs 4. Make note of all active DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	000833.02 reoccurs: If DTC 000833.02 repeatedly occurs and none of the above problems are found, the most likely cause is a stuck rack inside the injection pump. Have the pump repaired or replace the pump 000833.02 does not reoccur: Problem resolved. -- -1/1

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000833.03 — Rack Position Voltage High



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Position Sensor

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the

position the ECU commanded. The rack position sensor consists of two inductive coils, the rack position coil, and rack reference coil. Each coil provides an input voltage to the ECU. The ECU processes these voltages and translates them into an actual position of the rack. For more rack position sensor information, see MEASURING RACK POSITION in Section 03, Group 140 of this manual.

DTC 000833.03 will set if:

- The rack position voltage (an internal voltage in the ECU) is higher than the normal operating range.

If DTC 000833.03 sets, the following will occur:

- The ECU attempts to shut the engine off by turning off current to the actuator solenoid and to the fuel shut-off solenoid.
- Engine will die, and won't restart.

000833.03 — Rack Position Voltage High

The rack position voltage (an internal voltage in the ECU) is higher than the normal operating range.

RG40854,000004B -19-08JAN01-1/1

000833.03 Rack Position Voltage High Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see DTC 000833.03 RACK POSITION VOLTAGE HIGH supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000833.03 reoccurs: GO TO ❷ 000833.03 cleared and doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Rack Position Sensor Resistance Test	NOTE: For wiring and theory of operation information, see DTC 000833.03 RACK POSITION VOLTAGE HIGH supporting information. 1. Ignition OFF 2. Disconnect 6-way pump connector 3. Using a multimeter, measure resistance between: • Terminals C and F in the pump end of the 6-way connector • Terminals C and D in the pump end of the 6-way connector	Both measurements 14 - 26 ohms: GO TO ❸ Either measurement less than 14 or greater than 26 ohms: Open or short in rack position sensor inside injection pump. Repair/replace injection pump

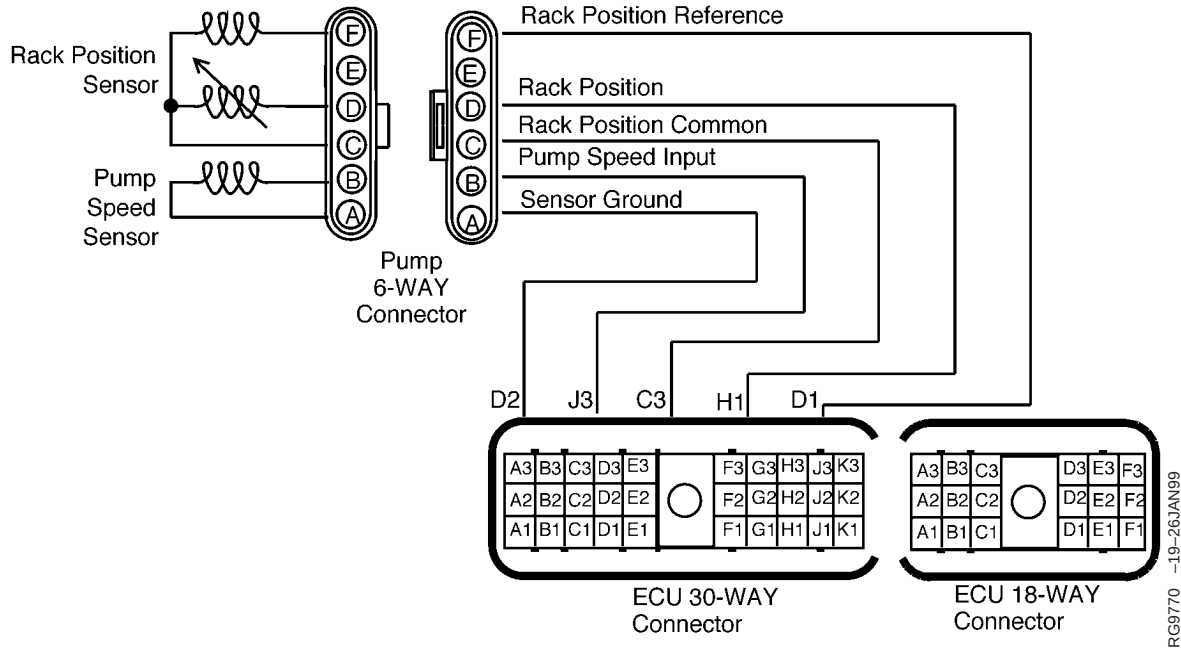
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Trouble Code Diagnostics and Tests

③ Rack Position Sensor Grounded Test	<i>NOTE: For wiring and theory of operation information, see DTC 000833.03 RACK POSITION VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Using a multimeter, measure resistance between terminal C in the pump end of the 6-way connector and: • Terminal A • Terminal B • Pump housing	All measurements greater than 2000 ohms: GO TO ④ Any measurement less than 2000 ohms: Short in rack position sensor inside injection pump. Repair/replace injection pump
④ Rack Position Circuit Grounded Test	<i>NOTE: For wiring and theory of operation information, see DTC 000833.03 RACK POSITION VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Leave 6-way pump connector disconnected 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminal H1 in the harness end of the ECU 30-way connector and a good ground 5. Using a multimeter, measure resistance between terminals D1 in the harness end of the ECU 30-way connector and a good ground	Both measurements greater than 2000 ohms: GO TO ⑤ Either measurement less than 2000 ohms: Short to ground in circuit with measurement less than 2000 ohms
⑤ Rack Position Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000833.03 RACK POSITION VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Leave 6-way pump connector and ECU 30-way connector disconnected 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between a good ground and the following: • Terminal H1 in the harness end of the ECU 30-way connector • Terminal D1 of the harness end of the ECU 30-way connector • Terminal C3 of the harness end of the ECU 30-way connector	All measurements less than 0.1 volts: GO TO ⑥ Any measurement greater than 0.1 volts: Short to voltage in circuit with measurement greater than 0.1 volts
⑥ Rack Position Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000833.03 RACK POSITION VOLTAGE HIGH supporting information.</i> 1. Ignition OFF 2. Reconnect the 6-way pump connector 3. Leave the ECU 30-way connector disconnected 4. Using a multimeter, measure resistance between terminal C3 in the harness end of the ECU 30-way connector and all other terminals in the connector (except D1 and H1)	All measurements greater than 2000 ohms: Faulty 6-way pump connector OR Faulty ECU connector OR Faulty ECU Any measurement less than 2000 ohms: Short in circuit with measurement less than 2000 ohms

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000833.04 — Rack Position Voltage Low



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Position Sensor

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the

position the ECU commanded. The rack position sensor consists of two inductive coils, the rack position coil, and rack reference coil. Each coil provides an input voltage to the ECU. The ECU processes these voltages and translates them into an actual position of the rack. For more rack position sensor information, see MEASURING RACK POSITION in Section 03, Group 140 of this manual.

DTC 000833.04 will set if:

- The rack position voltage (an internal voltage in the ECU) is lower than the normal operating range.

If DTC 000833.04 sets, the following will occur:

- The ECU attempts to shut the engine off by turning off current to the actuator solenoid and to the fuel shut-off solenoid.
- Engine will die, and won't restart.

000833.04 — Rack Position Voltage Low

The rack position voltage (an internal voltage in the ECU) is lower than the normal operating range.

RG40854,000004C -19-08JAN01-1/1

000833.04 Rack Position Voltage Low Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation, see DTC 000833.04 RACK POSITION VOLTAGE LOW supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	000833.04 reoccurs: GO TO ❷ 000833.04 cleared and doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❷ Rack Position Sensor Resistance Test	NOTE: For wiring and theory of operation, see DTC 000833.04 RACK POSITION VOLTAGE LOW supporting information. 1. Ignition OFF 2. Disconnect 6-way pump connector 3. Using a multimeter, measure resistance between: • Terminals C and F in the pump end of the 6-way connector • Terminals C and D in the pump end of the 6-way connector	Both measurements 14 - 26 ohms: GO TO ❸ Either measurement less than 14 or greater than 26 ohms: Open or short in rack position sensor inside injection pump. Repair/replace injection pump

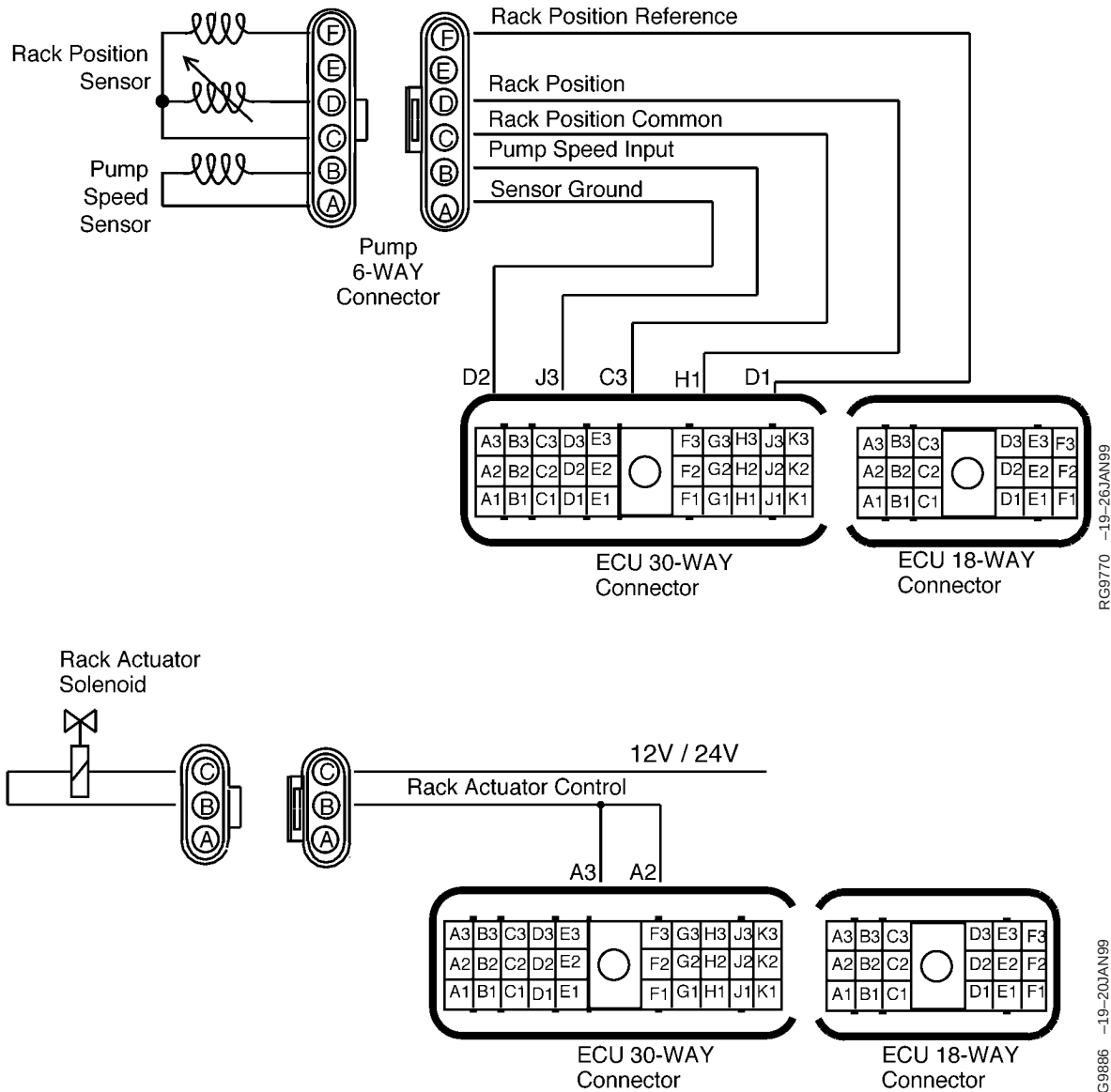
-- -1/1

Trouble Code Diagnostics and Tests

③ Rack Position Sensor Grounded Test	<i>NOTE: For wiring and theory of operation, see DTC 000833.04 RACK POSITION VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Using a multimeter, measure resistance between terminal C in the pump end of the 6-way connector and: • Terminal A • Terminal B • Pump housing	All measurements greater than 2000 ohms: GO TO ④ Any measurement less than 2000 ohms: Short in rack position sensor inside injection pump. Repair/replace injection pump -- -1/1
④ Rack Position Circuit Open Test	<i>NOTE: For wiring and theory of operation, see DTC 000833.04 RACK POSITION VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Install a secure fitting jumper wire between terminals C and F in the harness end of the 6-way pump connector 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminals C3 and D1 in the harness end of the ECU 30-way connector	5.0 ohms or less: GO TO ⑤ Greater than 5.0 ohms: Open in rack position reference circuit OR Open in rack position common circuit -- -1/1
⑤ Rack Position Circuit Open Test	<i>NOTE: For wiring and theory of operation, see DTC 000833.04 RACK POSITION VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Reposition jumper wire to terminals C and D in the harness end of the 6-way pump connector 3. Using a multimeter, measure resistance between terminals C3 and H1 in the harness end of the ECU 30-way connector	5.0 ohms or less: GO TO ⑥ Greater than 5.0 ohms: Open in rack position circuit -- -1/1
⑥ Rack Position Common Circuit Grounded Test	<i>NOTE: For wiring and theory of operation, see DTC 000833.04 RACK POSITION VOLTAGE LOW supporting information.</i> 1. Ignition OFF 2. Remove jumper wire and reconnect the 6-way pump connector 3. Leave the ECU 30-way connector disconnected 4. Using a multimeter, measure resistance between terminal C3 in the harness end of the ECU 30-way connector and a good ground	Greater than 2000 ohms: Faulty 6-way pump connector OR Faulty ECU connector OR Faulty ECU Less than 2000 ohms: Short to ground in rack position common circuit -- -1/1

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000833.07 — Rack Position Calibration Error



Rack Position Sensor and Actuator Solenoid

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the

rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded. The rack position sensor consists of two inductive coils, the rack position coil, and rack reference coil. Each coil provides an input voltage to the ECU. The ECU processes these voltages and translates them into an actual position of the rack. For more rack position sensor information, see MEASURING RACK POSITION in Section 03, Group 140 of this manual.

DTC 000833.07 will set if:

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RG40854,000005E -19-18JAN01-1/2

- The ECU determines that the injection pump rack position is out of calibration when the ECU measures the difference between commanded rack position and actual rack position.

- On most applications, the ECU will severely derate the engine (DTC 001569.31 will also be present) by 20% per minute until the engine has been derated by 40%, but will not shut the engine down.

If DTC 000833.07 sets, the following will occur:

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000833.07 — Rack Position Calibration Error

The ECU determines that the injection pump rack position is out of calibration when the ECU measures the difference between commanded rack position and actual rack position.

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000833.07 Rack Position Calibration Error Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector, the 3-way pump connector, and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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1 Intermittent Fault Test

NOTE: For theory of operation, see DTC 000833.07 RACK CALIBRATION ERROR supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all active DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

000833.07 reoccurs:
GO TO 2

000833.07 cleared and doesn't reoccur:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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2 Connector Check

NOTE: For theory of operation, see DTC 000833.07 RACK CALIBRATION ERROR supporting information.

Check all connectors in the wiring harness between the ECU and injection pump for a poor connection.

No faulty connection found:
GO TO 3

Faulty connection found:
Repair or replace faulty terminal and retest.

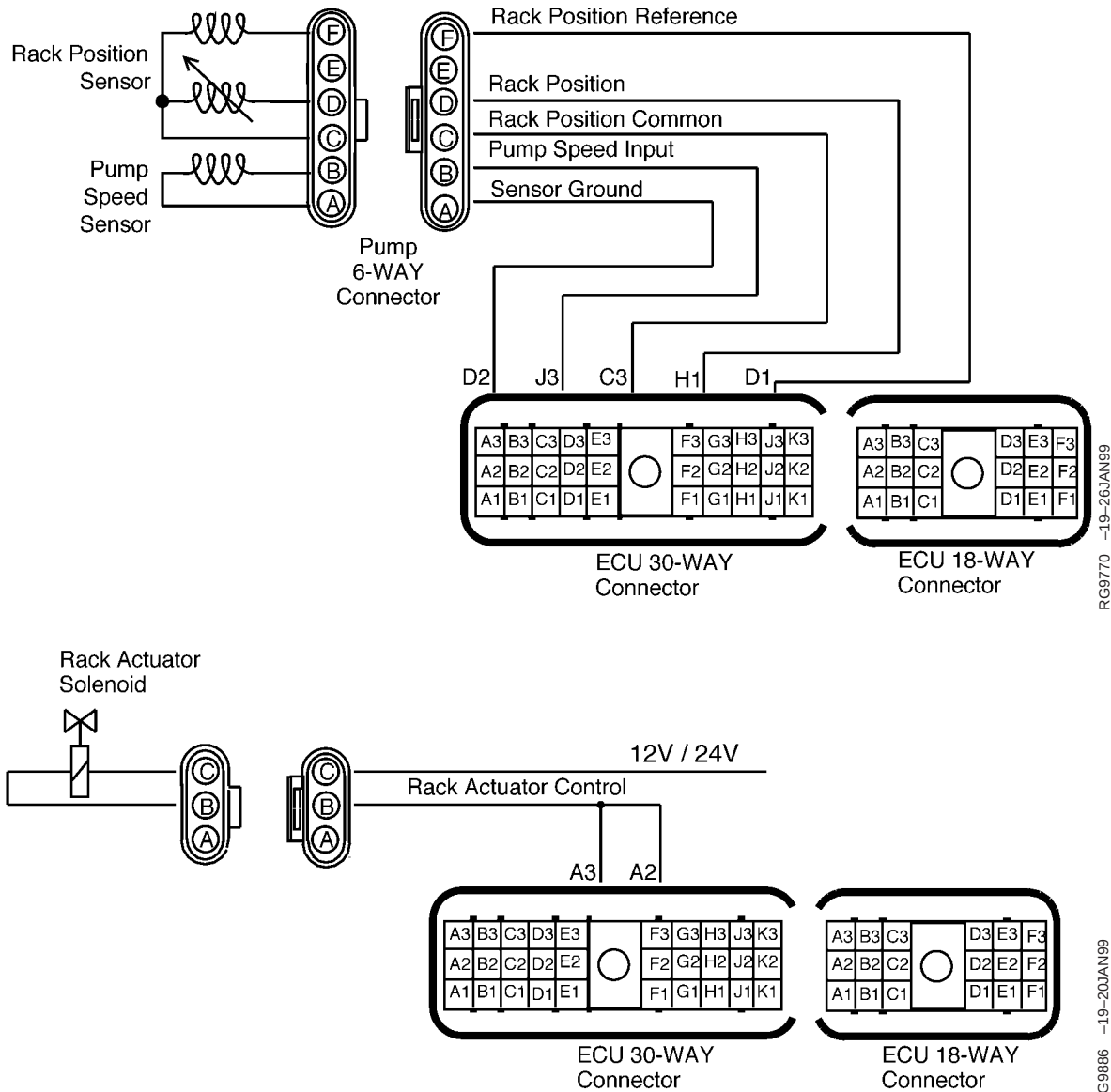
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Trouble Code Diagnostics and Tests

③ Wiring Harness Check	<i>NOTE: For theory of operation, see DTC 000833.07 RACK CALIBRATION ERROR supporting information.</i> Check wiring harness for any foreign devices between ECU and injection pump.	No foreign object found: Have injection pump repaired and retest. Foreign object found: Remove object from wiring harness. Clear codes and start engine. -- 1/1

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000833.15 — Rack Position Calibration Error



Rack Position Sensor and Actuator Solenoid

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the

rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded. The rack position sensor consists of two inductive coils, the rack position coil, and rack reference coil. Each coil provides an input voltage to the ECU. The ECU processes these voltages and translates them into an actual position of the rack. For more rack position sensor information, see MEASURING RACK POSITION in Section 03, Group 140 of this manual.

DTC 000833.15 will set if:

Continued on next page

RG41183,00000D3 -19-03MAR03-1/2

- The ECU determines that the injection pump rack position is out of calibration when the ECU measures the difference between commanded rack position and actual rack position.

- On most applications, the ECU will severely derate the engine (DTC 001569.31 will also be present) by 20% per minute until the engine has been derated by 40%, but will not shut the engine down.

If DTC 000833.15 sets, the following will occur:

RG41183,00000D3 -19-03MAR03-2/2

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000833.15 — Rack Position Calibration Error

The ECU determines that the injection pump rack position is out of calibration when the ECU measures the difference between commanded rack position and actual rack position.

RG41183,00000D4 -19-03MAR03-1/1

000833.15 Rack Position Calibration Error Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector, the 3-way pump connector, and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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1 Intermittent Fault Test

- NOTE: For theory of operation, see DTC 000833.15 RACK CALIBRATION ERROR supporting information.*
1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
 2. Ignition ON, engine OFF
 3. Start ECU communication software
 4. Read DTCs using DST or SERVICE ADVISOR™.
 5. Make note of all active DTCs, then clear all DTCs
 6. Ignition ON, engine running
 7. Read DTCs

000833.15 reoccurs:
GO TO 2

000833.15 cleared and doesn't reoccur:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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2 Connector Check

NOTE: For theory of operation, see DTC 000833.15 RACK CALIBRATION ERROR supporting information.

Check all connectors in the wiring harness between the ECU and injection pump for a poor connection.

No faulty connection found:
GO TO 3

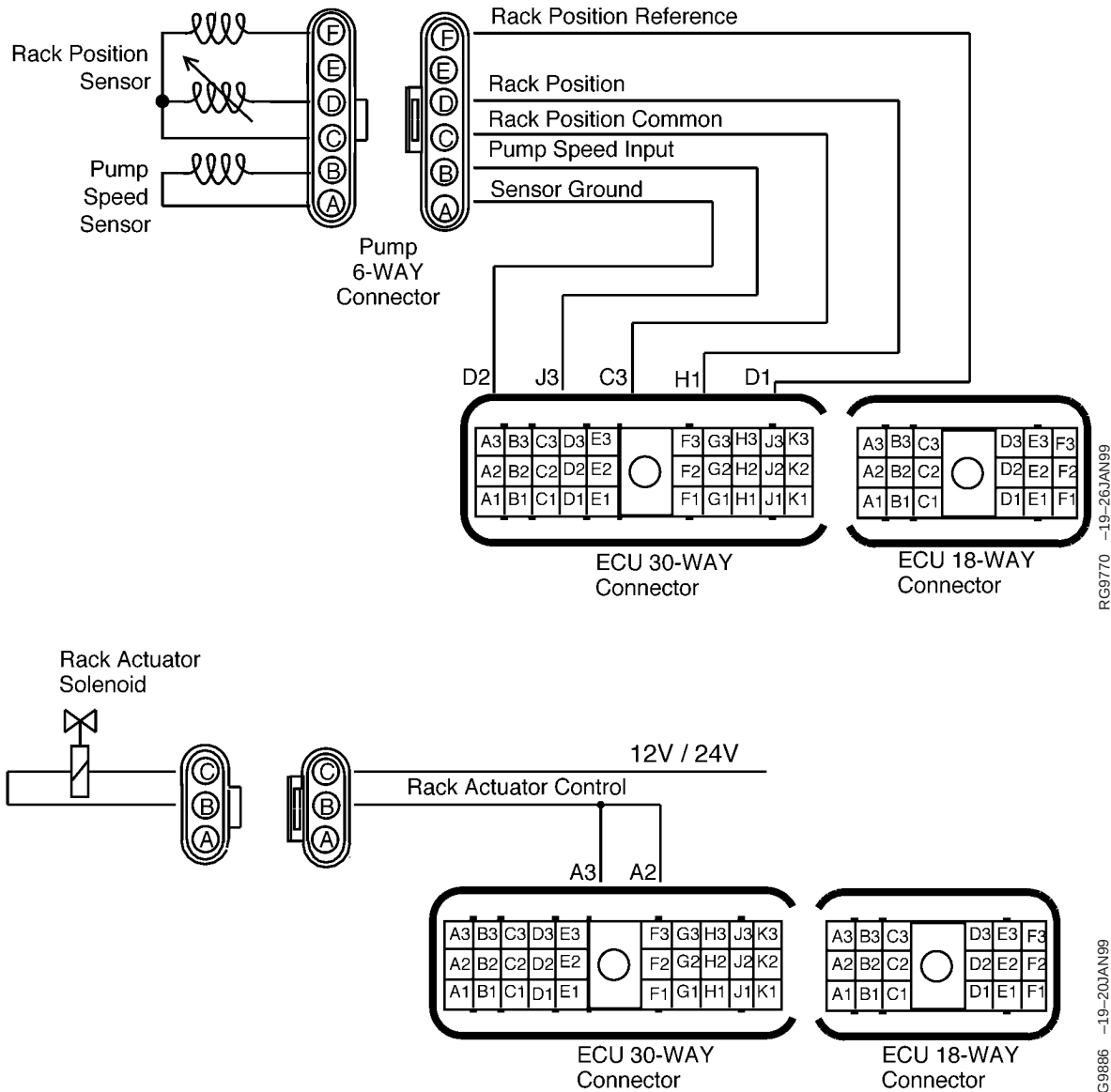
Faulty connection found:
Repair or replace faulty terminal and retest.

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③ Wiring Harness Check	NOTE: For theory of operation, see DTC 000833.15 RACK CALIBRATION ERROR supporting information. Check wiring harness for any foreign devices between ECU and injection pump.	No foreign object found: Have injection pump repaired and retest. Foreign object found: Remove object from wiring harness. Clear codes and start engine. -- -1/1

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000833.17 — Rack Position Calibration Error



Rack Position Sensor and Actuator Solenoid

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the

rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded. The rack position sensor consists of two inductive coils, the rack position coil, and rack reference coil. Each coil provides an input voltage to the ECU. The ECU processes these voltages and translates them into an actual position of the rack. For more rack position sensor information, see MEASURING RACK POSITION in Section 03, Group 140 of this manual.

DTC 000833.17 will set if:

Continued on next page

RG41183,00000D5 -19-03MAR03-1/2

- The ECU determines that the injection pump rack position is out of calibration when the ECU measures the difference between commanded rack position and actual rack position.

- On most applications, the ECU will severely derate the engine (DTC 001569.31 will also be present) by 20% per minute until the engine has been derated by 40%, but will not shut the engine down.

If DTC 000833.17 sets, the following will occur:

RG41183,00000D5 -19-03MAR03-2/2

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000833.17 — Rack Position Calibration Error

The ECU determines that the injection pump rack position is out of calibration when the ECU measures

the difference between commanded rack position and actual rack position.

RG41183,00000D6 -19-03MAR03-1/1

000833.17 Rack Position Calibration Error Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 6-way pump connector, the 3-way pump connector, and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For theory of operation, see DTC 000833.17 RACK CALIBRATION ERROR supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all active DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

000833.17 reoccurs:
GO TO ②

000833.17 cleared and doesn't reoccur:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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② Connector Check

NOTE: For theory of operation, see DTC 000833.17 RACK CALIBRATION ERROR supporting information.

Check all connectors in the wiring harness between the ECU and injection pump for a poor connection.

No faulty connection found:
GO TO ③

Faulty connection found:
Repair or replace faulty terminal and retest.

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Trouble Code Diagnostics and Tests

③ Wiring Harness Check	<i>NOTE: For theory of operation, see DTC 000833.17 RACK CALIBRATION ERROR supporting information.</i> Check wiring harness for any foreign devices between ECU and injection pump.	No foreign object found: Have injection pump repaired and retest. Foreign object found: Remove object from wiring harness. Clear codes and start engine. -- -1/1

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000834.02 — Rack Instability

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Position

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also

located inside the injection pump, provides feedback information to the ECU of the actual position of the rack. Information from the rack position sensor indicates to the ECU if the rack actually went to the position the ECU commanded.

DTC 000834.02 will set if:

- Rack position as measured by the rack position sensor is unstable.

If DTC 000834.02 sets, the following will occur:

- Depending on the cause of DTC 000834.02, the engine may feel "sluggish" or the engine may run normally.

DPSG,RG39774,68 -19-23NOV98-1/1

000834.02 — Rack Instability

Rack position as measured by the rack position sensor is unstable.

RG40854,000004D -19-08JAN01-1/1

000834.02 Rack Instability Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 3-way pump•connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Bleed the Fuel System at the Injection Pump

NOTE: For theory of operation information, see DTC 000834.02 RACK INSTABILITY supporting information

DTC 000834.02 could be caused by air in the injection pump especially if fuel system has been recently opened (filter changed, line removed, etc.). Following the steps below to verify that there is no air in the pump:

1. Perform bleed procedure at injection pump. See BLEED THE FUEL SYSTEM - AT THE INJECTION PUMP in Group 150 of this manual to ensure there is no air in the injection pump.
2. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
3. Ignition ON, engine OFF
4. Start ECU communication software
5. Read DTCs using DST or SERVICE ADVISOR™.
6. Make note of all active DTCs, then clear all DTCs
7. Ignition ON, engine running
8. Read DTCs

000834.02 reoccurs:
GO TO ❷

000834.02 does not reoccur:
Problem resolved.

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Trouble Code Diagnostics and Tests

② Intermittent Fault Test

NOTE: For theory of operation information, see DTC 000834.02 RACK INSTABILITY supporting information

1. Check for an intermittent faulty connection. Pay particularly close attention to the rack position wiring and the 6-way pump connector. See INTERMITTENT FAULT DIAGNOSTICS earlier in this Group

NOTE: Intermittent DTC 000834.03 is an indication that an intermittent connection is the cause of DTC 000834.02.

2. Ignition ON, engine OFF
3. Read DTCs
4. Make note of all active DTCs, then clear all DTCs
5. Ignition ON, engine running
6. Read DTCs

000834.02 reoccurs:

If DTC 000834.02 repeatedly occurs and none of the above problems are found, the most likely cause is a stuck rack inside the injection pump
Have the pump repaired or replace the pump

000834.02 does not reoccur:

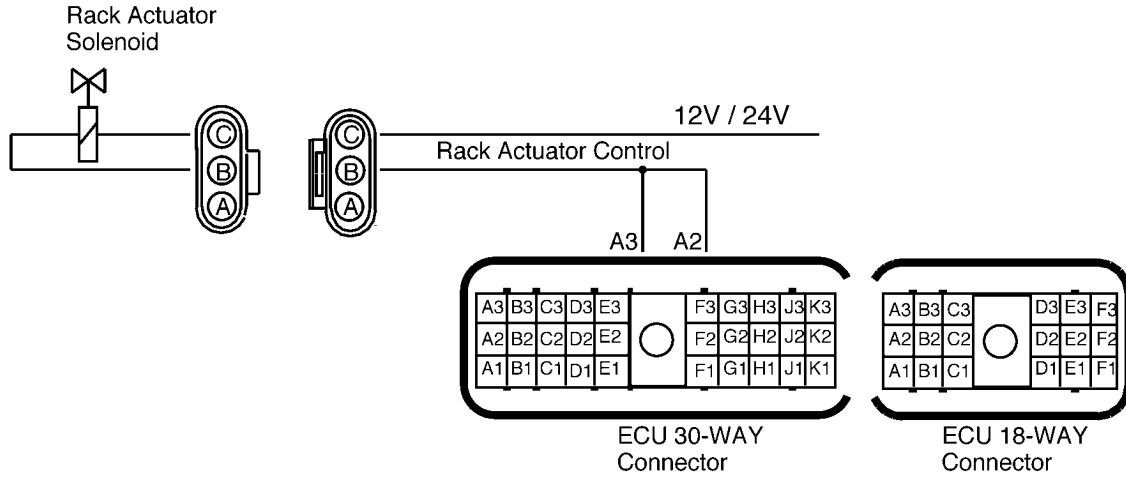
Problem resolved.

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000834.03 — Rack Actuator Control Circuit Short to Power



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Actuator

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator

solenoid by the ECU, the rack is driven toward full fuel delivery position. For more rack actuator information, see ACTUATOR SOLENOID in Section 03, Group 140 of this manual.

DTC 000834.03 will set if:

- The ECU detects a short to power in the rack actuator control circuit.

If DTC 000834.03 sets, the following will occur:

- Engine may run erratically and may shut down. Engine may restart, but will likely exhibit the same symptoms as before.

000834.03 — Rack Actuator Control Circuit Short to Power

The ECU detects a short to power in the rack actuator control circuit.

RG40854,000004E -19-08JAN01-1/1

000834.03 Rack Actuator Control Circuit Short To Power Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 3-way pump connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	<i>NOTE: For wiring and theory of operation, see DTC 000834.03 RACK ACTUATOR CONTROL CIRCUIT SHORT TO POWER supporting information.</i> 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON 7. Read DTCs	000834.03 reoccurs: GO TO ❷ 000834.03 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Rack Actuator Solenoid Resistance Test	<i>NOTE: For wiring and theory of operation, see DTC 000834.03 RACK ACTUATOR CONTROL CIRCUIT SHORT TO POWER supporting information.</i> 1. Ignition OFF 2. Disconnect 3-way pump connector 3. Using a multimeter, measure resistance between terminals B and C in the pump end of the 3-way pump connector	Between 0.5 - 1.5 ohms: GO TO ❸ Less than 0.5 or greater than 1.5 ohms: Faulty rack actuator inside injection pump. Have pump repaired or replace pump

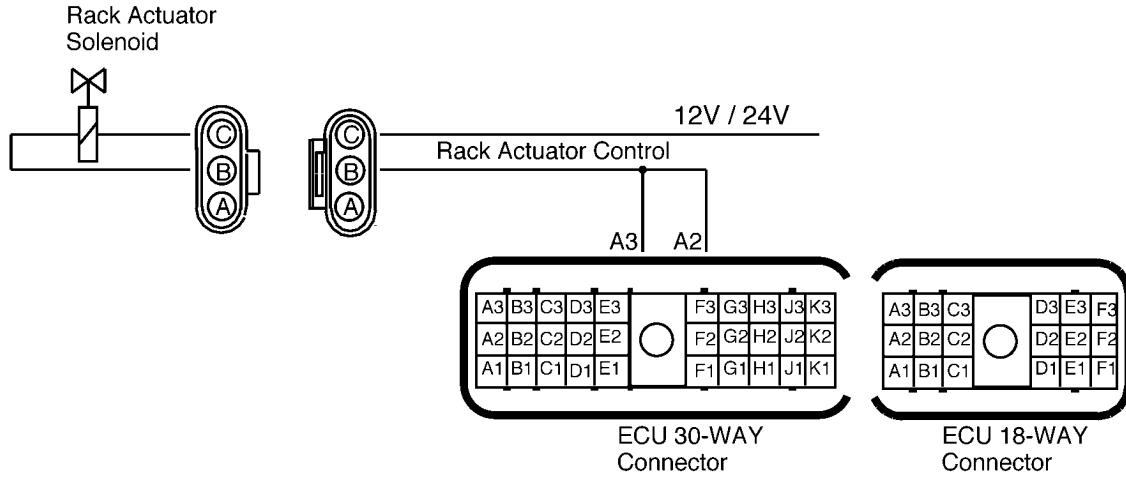
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Trouble Code Diagnostics and Tests

③ Rack Actuator Solenoid Grounded Test	<i>NOTE: For wiring and theory of operation, see DTC 000834.03 RACK ACTUATOR CONTROL CIRCUIT SHORT TO POWER supporting information.</i> 1. Ignition OFF 2. 3-way pump connector still•disconnected 3. Using a multimeter, measure resistance between terminal B in the pump end of the 3-way pump connector and pump housing	Greater than 2000 ohms: GO TO ④ 2000 ohms or less: Faulty rack actuator inside injection pump. Have pump repaired or replace pump -- -1/1
④ Rack Actuator Control Circuit Shorted Test	<i>NOTE: For wiring and theory of operation, see DTC 000834.03 RACK ACTUATOR CONTROL CIRCUIT SHORT TO POWER supporting information.</i> 1. Ignition OFF 2. 3-way pump connector still disconnected 3. Also disconnect the ECU 30-way and 18-way (if equipped) connectors 4. Using a multimeter, measure resistance between terminal A2 in the harness end of the ECU 30-way connector and: • All other terminals in the ECU 30-way and 18-way (if equipped) connectors (except A3) • A good ground	All measurements greater than 2000 ohms: GO TO ⑤ Any measurement less than 2000 ohms: Short in rack actuator control circuit -- -1/1
⑤ Rack Actuator Control Circuit Shorted Test	<i>NOTE: For wiring and theory of operation, see DTC 000834.03 RACK ACTUATOR CONTROL CIRCUIT SHORT TO POWER supporting information.</i> 1. Ignition OFF 2. 3-way pump, ECU 30-way and 18-way (if equipped) connectors still disconnected 3. Using a multimeter, measure resistance between terminal A3 in the harness end of the ECU 30-way connector and: • All other terminals in the ECU 30-way and 18-way (if equipped) connectors (except A2) • A good ground	All measurements greater than 2000 ohms: Faulty 3-way pump connector OR Faulty ECU 30-way connector OR Faulty ECU Any measurement less than 2000 ohms: Short in rack actuator control circuit -- -1/1

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000834.05 — Rack Actuator Control Circuit Open



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Actuator

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator

solenoid by the ECU, the rack is driven toward full fuel delivery position. For more rack actuator information, see ACTUATOR SOLENOID in Section 03, Group 140 of this manual.

DTC 000834.05 will set if:

- The ECU detects an open in the rack actuator control circuit.

If DTC 000834.05 sets, the following will occur:

- With an open in the rack actuator control circuit, the engine will die, and will not restart.

000834.05 — Rack Actuator Control Circuit Open

The ECU detects an open in the rack actuator control circuit.

RG40854,000004F -19-08JAN01-1/1

000834.05 Rack Actuator Control Circuit Open Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 3-way pump connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see DTC 000834.05 RACK ACTUATOR CONTROL CIRCUIT OPEN supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON 7. Read DTCs	000834.05 reoccurs: GO TO ❷ 000834.05 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Rack Actuator Solenoid Resistance Test	NOTE: For wiring and theory of operation information, see DTC 000834.05 RACK ACTUATOR CONTROL CIRCUIT OPEN supporting information. 1. Ignition OFF 2. Disconnect 3-way pump connector 3. Using a multimeter, measure resistance between terminals B and C in the pump end of the 3-way pump connector	Between 0.5 - 1.5 ohms: GO TO ❸ Less than 0.5 or greater than 1.5 ohms: Faulty rack actuator inside injection pump. Have pump repaired or replace pump

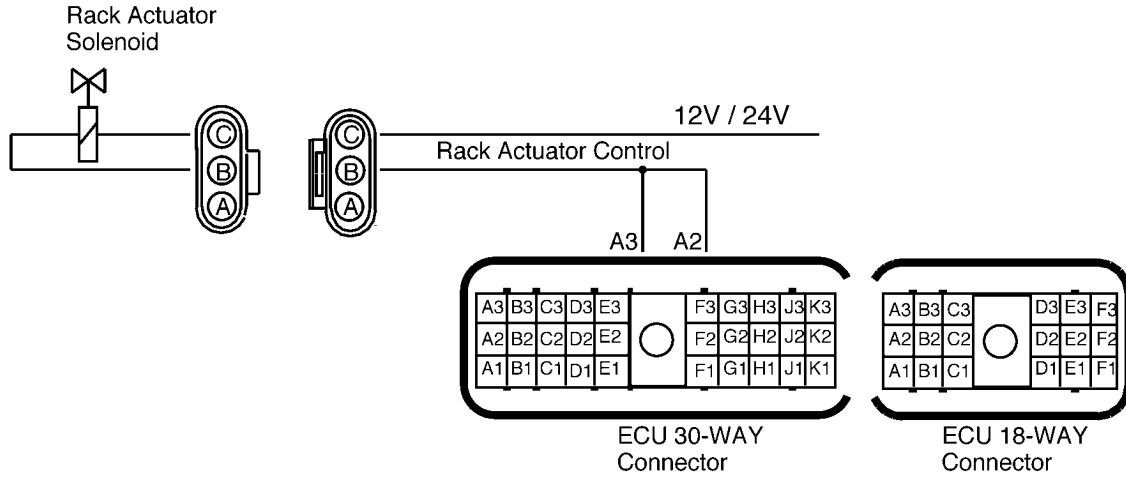
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Trouble Code Diagnostics and Tests

③ Rack Actuator Control Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.05 RACK ACTUATOR CONTROL CIRCUIT OPEN supporting information.</i> 1. Ignition OFF 2. 3-way pump connector still disconnected 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminal A2 in the harness end of the ECU 30-way connector and terminal B in the harness end of the 3-way pump connector	5.0 ohms or less: GO TO ④ Greater than 5.0 ohms: Open in rack actuator control circuit -- -1/1
④ Rack Actuator Control Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.05 RACK ACTUATOR CONTROL CIRCUIT OPEN supporting information.</i> 1. Ignition OFF 2. 3-way pump and ECU 30-way connectors still disconnected 3. Using a multimeter, measure resistance between terminals A2 and A3 in the harness end of the ECU 30-way connector	5.0 ohms or less: Faulty 3-way pump connector OR Faulty ECU 30-way connector OR Faulty ECU Greater than 5.0 ohms: Open in rack actuator control circuit -- -1/1

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000834.06 — Rack Actuator Control Circuit Short to Ground



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Actuator

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. For more rack actuator

information, see ACTUATOR SOLENOID in Section 03, Group 140 of this manual.

DTC 000834.06 will set if:

- The ECU detects a short to ground in the rack actuator control circuit.

If DTC 000834.06 sets, the following will occur:

- The ECU attempts to shut the engine off by turning off current to the actuator solenoid and to the fuel shut-off solenoid.
- Engine may run erratically and may shut down. Engine should restart, but will likely exhibit the same symptoms as before.

000834.06 — Rack Actuator Control Circuit Short To Ground

The ECU detects a short to ground in the rack actuator control circuit.

RG40854,0000050 -19-08JAN01-1/1

000834.06 Rack Actuator Control Circuit Short To Ground Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 3-way pump connector and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.06 RACK ACTUATOR CONTROL CIRCUIT SHORT TO GROUND supporting information.</i> 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Start the ECU communication software 3. Ignition ON, engine OFF 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON 7. Read DTCs	000834.06 reoccurs: GO TO ❷ 000834.06 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Rack Actuator Solenoid Resistance Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.06 RACK ACTUATOR CONTROL CIRCUIT SHORT TO GROUND supporting information.</i> 1. Ignition OFF 2. Disconnect 3-way pump connector 3. Using a multimeter, measure resistance between terminals B and C in the pump end of the 3-way pump connector	Between 0.5 - 1.5 ohms: GO TO ❸ Less than 0.5 or greater than 1.5 ohms: Faulty rack actuator inside injection pump. Have pump repaired or replace pump

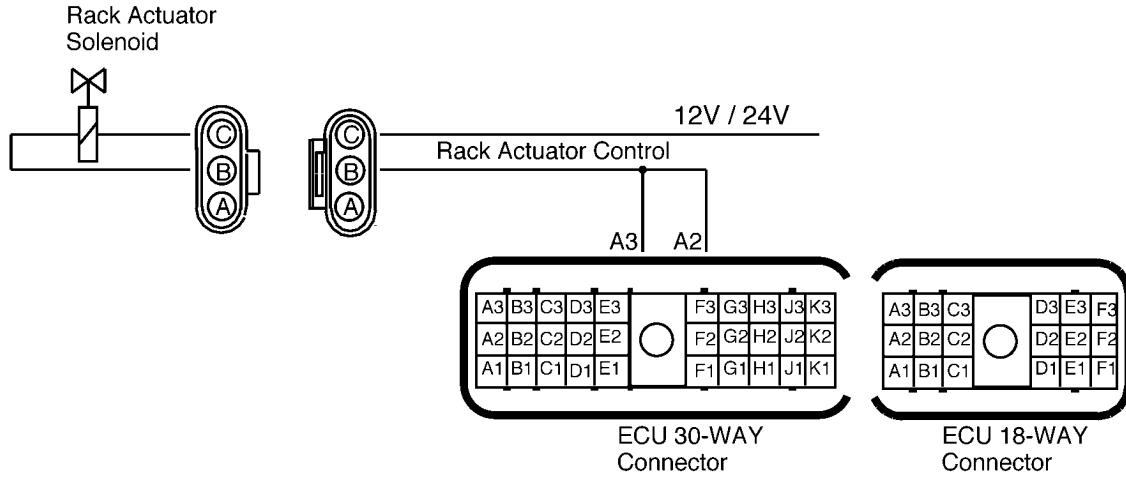
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Trouble Code Diagnostics and Tests

③ Rack Actuator Solenoid Grounded Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.06 RACK ACTUATOR CONTROL CIRCUIT SHORT TO GROUND supporting information.</i> 1. Ignition OFF 2. 3-way pump connector still•disconnected 3. Using a multimeter, measure resistance between terminal B in the pump end of the 3-way pump connector and pump housing	Greater than 2000 ohms: GO TO ④ 2000 ohms or less: Faulty rack actuator inside injection pump. Have pump repaired or replace pump -- -1/1
④ Rack Actuator Control Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.06 RACK ACTUATOR CONTROL CIRCUIT SHORT TO GROUND supporting information.</i> 1. Ignition OFF 2. 3-way pump connector still disconnected 3. Also disconnect the ECU 30-way and 18-way (if equipped) connectors 4. Using a multimeter, measure resistance between terminal A2 in the harness end of the ECU 30-way connector and: • All other terminals in the ECU 30-way and 18-way (if equipped) connectors (except A3) • A good ground	All measurements greater than 2000 ohms: GO TO ⑤ Any measurement less than 2000 ohms: Short in rack actuator control circuit -- -1/1
⑤ Rack Actuator Control Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.06 RACK ACTUATOR CONTROL CIRCUIT SHORT TO GROUND supporting information.</i> 1. Ignition OFF 2. 3-way pump, ECU 30-way and 18-way (if equipped) connectors still disconnected 3. Using a multimeter, measure resistance between terminal A3 in the harness end of the ECU 30-way connector and: • All other terminals in the ECU 30-way and 18-way (if equipped) connectors (except A2) • A good ground	All measurements greater than 2000 ohms: Faulty 3-way pump connector OR Faulty ECU 30-way connector OR Faulty ECU Any measurement less than 2000 ohms: Short in rack actuator control circuit -- -1/1

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000834.07 — Rack Position Error



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Rack Position

- The ECU controls the quantity of fuel delivered by the injection pump by energizing the rack actuator solenoid (located inside the injection pump) to achieve a specific position of the rack. The rack is spring loaded to the zero fuel delivery position. As increasing current is supplied to the actuator solenoid by the ECU, the rack is driven toward full fuel delivery position. The rack position sensor, also located inside the injection pump, provides feedback information to the ECU of the actual position of the rack. Information from the rack position sensor

indicates to the ECU if the rack actually went to the position the ECU commanded. For more rack actuator information, see ACTUATOR SOLENOID in Section 03, Group 140 of this manual.

DTC 000834.07 will set if:

- The position of the rack as measured by the rack position sensor is not the position that the ECU commanded.

If DTC 000834.07 sets, the following will occur:

- The ECU attempts to shut the engine off by turning off current to the actuator solenoid and to the fuel shut-off solenoid.
- Engine may run erratically or may shut down. Engine should restart, but will likely exhibit the same symptoms as before.

DPSG, RG39774, 52 -19-23NOV98-1/1

000834.07 — Rack Position Error

The position of the rack as measured by the rack position sensor is not the position that the ECU commanded.

RG40854,0000051 -19-08JAN01-1/1

000834.07 Rack Position Error Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 3-way and 6-way pump connectors and the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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① Active/Stored DTC Check	NOTE: For wiring and theory of operation information, see DTC 000834.07 RACK POSITION ERROR supporting information 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Read active DTCs and stored DTCs using DST or SERVICE ADVISOR™. IMPORTANT: If DTC 000833.03 or 4 (on some applications, DTC 000733.03 or 000733.04) are stored or active, DO NOT continue with this procedure. • For DTC 000733.03 or DTC 000833.03, see DTC 000833.03 RACK POSITION VOLTAGE HIGH earlier in this Group. • For DTC 000733.04 or DTC 000833.04, see DTC 000833.04 RACK POSITION VOLTAGE LOW earlier in this Group.	Only stored or active 000834.07: GO TO ④ Stored or active 000834.07 AND 000190.00 or 16: GO TO ② Stored or active DTCs OTHER than 000834.07 See appropriate procedure, diagnose and repair cause of DTC

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② Rack Actuator Grounded Test	NOTE: For wiring and theory of operation information, see DTC 000834.07 RACK POSITION ERROR supporting information 1. Ignition OFF 2. Disconnect pump 3-way connector 3. Using a multimeter, measure resistance between terminal B in the pump end of the 3-way pump connector and pump housing	Greater than 5.0 ohms: GO TO ③ 5.0 ohms or less: Faulty rack actuator inside injection pump. Have pump repaired or replace pump.

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Trouble Code Diagnostics and Tests

③ Rack Actuator Control Circuit Grounded Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.07 RACK POSITION ERROR supporting information</i> 1. Ignition OFF 2. Disconnect pump 3-way connector 3. Using a multimeter, measure resistance between terminal B in the harness end of the 3-way pump connector and a good ground	Greater than 5.0 ohms: Faulty ECU 5.0 ohms or less: Short to ground in rack actuator control circuit -- -1/1
④ Engine Start Check	<i>NOTE: For wiring and theory of operation information, see DTC 000834.07 RACK POSITION ERROR supporting information</i> 1. Ignition ON, engine OFF 2. Read active DTCs and stored DTCs. 3. Make note of all active and stored DTCs, then clear all DTCs 4. With ignition ON, attempt to start engine 5. Read active DTCs and stored DTCs.	Engine doesn't start and 000834.07 occurred during cranking: GO TO ⑥ Engine starts and runs normally: GO TO ⑤ -- -1/1
⑤ Engine Operation Check	<i>NOTE: For wiring and theory of operation information, see DTC 000834.07 RACK POSITION ERROR supporting information</i> Operate engine at varying speeds and loads while reading active DTCs and stored DTCs.	Stored or active 000834.07 ONLY: Faulty injection pump OR Faulty ECU Stored or active DTCs other than codes 000834.07: See appropriate procedure, diagnose and repair cause of DTC -- -1/1
⑥ Rack Actuator Resistance Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.07 RACK POSITION ERROR supporting information</i> 1. Ignition OFF 2. Disconnect pump 3-way connector 3. Using a multimeter, measure resistance between terminals B and C in the pump end of the 3-way pump connector	Between 0.5 and 1.5 ohms: GO TO ⑦ Less than 0.5 ohms or greater than 1.5 ohms: Faulty rack actuator inside injection pump. Have pump repaired or replace pump -- -1/1

Trouble Code Diagnostics and Tests

7 Rack Actuator Control Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.07 RACK POSITION ERROR supporting information</i> 1. Ignition OFF 2. 3-way pump connector still disconnected 3. Disconnect the ECU 30-way connector 4. Using a multimeter, measure resistance between terminal A2 in the harness end of the ECU 30-way connector and terminal B in the harness end of the 3-way pump connector	5.0 ohms or less: GO TO 8 Greater than 5.0 ohms: Open in rack actuator control circuit -- -1/1
8 Rack Actuator Control Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.07 RACK POSITION ERROR supporting information</i> 1. Ignition OFF 2. 3-way pump connector still disconnected 3. ECU 30-way connector still disconnected 4. Using a multimeter, measure resistance between terminals A2 and A3 in the harness end of the ECU 30-way connector	5.0 ohms or less: GO TO 9 Greater than 5.0 ohms: Open in rack actuator control circuit -- -1/1
9 Rack Actuator Power Test	<i>NOTE: For wiring and theory of operation information, see DTC 000834.07 RACK POSITION ERROR supporting information</i> 1. Ignition OFF 2. Pump 3-way connector still disconnected 3. Reconnect ECU 30-way connector 4. Ignition ON, engine OFF 5. Using a multimeter, measure voltage between terminal C in the harness end of pump 3-way connector and a good ground	Battery voltage: GO TO 10 Less than battery voltage: Open in rack actuator power circuit -- -1/1

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10 Rack Actuator Solenoid Test

IMPORTANT: During the following test, be careful to keep the jumper leads isolated so that battery voltage is not shorted to ground. Also, if the rack actuator is functioning correctly, about 20 amps of current will be conducted during this check and a spark will occur when the circuit is broken. This condition should not be continued beyond a few seconds, as overheating of the actuator solenoid will occur.

NOTE: For wiring and theory of operation information, see DTC 000834.07 RACK POSITION ERROR supporting information

1. Ignition OFF
2. Pump 3-way connector still disconnected
3. Locate the diagnostic voltage connector
4. Ignition ON
5. Using a multimeter, measure voltage between terminals C (+) and D (-) in the diagnostic voltage connector
6. Connect a jumper wire between terminal B in the pump end of the pump 3-way connector **and** a good ground
7. Connect a second jumper wire between terminal C in the pump end of the pump 3-way connector **and** battery voltage
8. While the above connection is made, measure voltage between terminals C (+) and D (-) in the diagnostic voltage connector

Voltage changed from about 0.5 volt first measurement to 4.0 volts or greater second:

Faulty 3-way pump connector

OR

Faulty ECU connector

OR

Faulty ECU

Voltage DID NOT change from about 0.5 volt first measurement to 4.0 volts or greater second:

Faulty injection pump.
Have pump repaired or replace pump

000898.09 — Vehicle Speed Invalid

The ECU does not receive the engine speed message over CAN or it is not valid.

CAN (Controller Area Network) Engine Speed Message

- The CAN (Controller Area Network) transmits the vehicle's desired engine speed to the ECU from another controller.

DTC 000898.09 will set if:

- The ECU does not receive the engine speed message over CAN or it is not valid.

If DTC 000898.09 sets, the following will occur:

- The ECU will default engine speed to low idle.

If DTC 000898.09 sets:

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
- With ignition ON and engine OFF, start the ECU communication software
- Read active DTCs and stored DTCs using DST or SERVICE ADVISOR™. If DTC 000639.00, 000639.02 or 000639.13 also, occur, see DTC 000639.13 CAN ERROR later in this Group.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.

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RG40854,0000003 -19-19FEB01-1/1

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000970.00 — Auxiliary Engine Shutdown Switch Active

The ECU receives an engine shutdown input voltage that is within the necessary voltage range to shut the engine down. On some applications, the ECU receives an engine shutdown request from another controller over CAN.

Engine Shutdown Signal

- The external shutdown signal is an input to the ECU that will because of certain operating conditions, cause the ECU to shut the engine down. On some applications, an engine shutdown request is sent over CAN(Controller Area Network) to the ECU from another controller.

DTC 000970.00 will set if:

- The ECU receives an engine shutdown input voltage that is within the necessary voltage range to shut the engine down. On some applications, the ECU receives an engine shutdown request from another controller over CAN.

If DTC 000970.00 sets, the following will occur:

- The engine will shutdown.

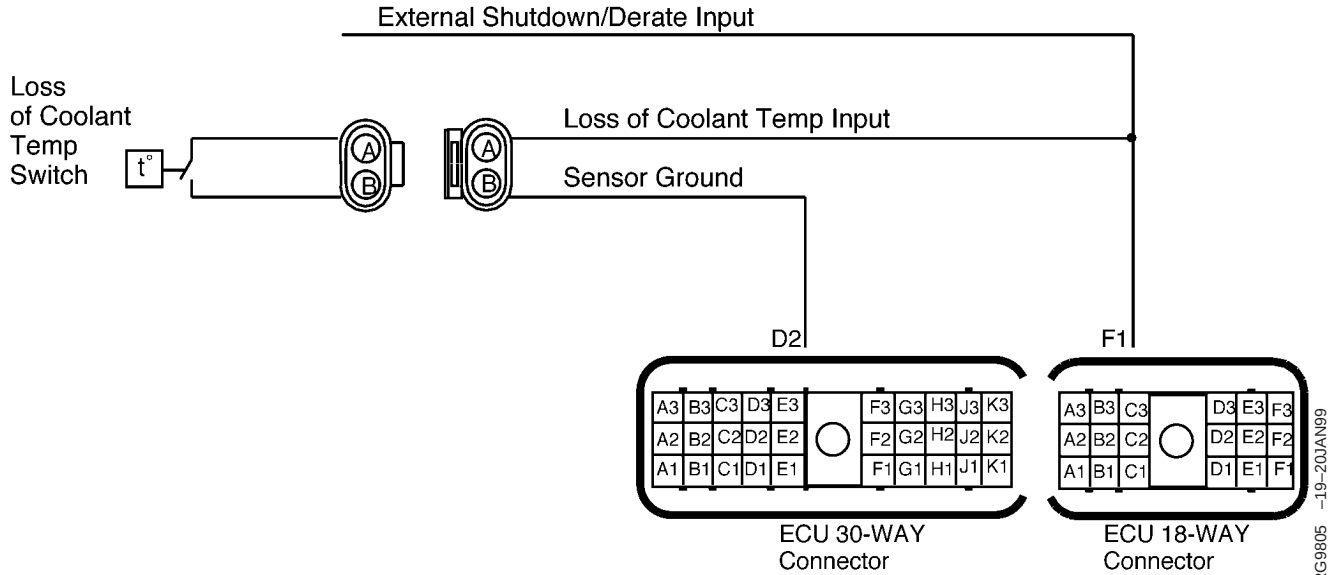
If DTC 000970.00 sets:

- Check for other stored or active fault codes on the ECU and, if equipped, other controllers on the machine that indicate the reason for the engine shutdown.

RG41183,00000D7 -19-03MAR03-1/1

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000970.11 — Engine Shutdown Signal Invalid



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Engine Shutdown Signal

- The shutdown signal is an input to the ECU that will because of certain operating conditions, cause the ECU to shut the engine down.

DTC 000970.11 will set if:

- The ECU receives an engine shutdown input voltage which is either out of range high or out of range low.

000970.11 — Engine Shutdown Signal Invalid

The ECU receives an engine shutdown input voltage which is either out of range high or out of range low.

RG40854,0000052 -19-08JAN01-1/1

000970.11 Engine Shutdown Signal Invalid Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 30-way and 18-way (if equipped) ECU connector(s) looking for dirty, damaged, or poorly positioned terminals.

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① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 000970.11 ENGINE SHUTDOWN SIGNAL INVALID supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start the ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

000970.11 reoccurs:
GO TO ②

000970.11 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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Trouble Code Diagnostics and Tests

② Engine Shutdown Signal Circuit Open Test	<i>NOTE: For wiring and theory of operation information, see DTC 000970.11 ENGINE SHUTDOWN SIGNAL INVALID supporting information.</i> 1. Ignition OFF 2. Disconnect ECU 30-way and 18-way (if equipped) connectors 3. Obtain wiring information for this application and determine the source of the engine shutdown signal 4. Disconnect the connector that outputs the shutdown signal 5. Using a multimeter, measure resistance between the shutdown signal terminal in the harness end of the ECU 30-way connector and originating shutdown signal terminal	5.0 ohms or less: GO TO ③ Greater than 5.0 ohms: Open in engine shutdown signal circuit -- -1/1
③ Engine Shutdown Signal Circuit Shorted Test	<i>NOTE: For wiring and theory of operation information, see DTC 000970.11 ENGINE SHUTDOWN SIGNAL INVALID supporting information.</i> 1. Ignition OFF 2. Using a multimeter, measure resistance between shutdown signal input terminal in the harness end of the ECU 30-way connector and: • All other terminals in the ECU connector • A good ground 3. Using a multimeter, measure resistance between originating shutdown signal input terminal in the vehicle connector and: • All other terminals in the vehicle connector • A good ground	All measurements greater than 5.0 ohms: Faulty ECU OR Faulty engine shutdown signal source Any measurement less than 5.0 ohms: Engine shutdown signal circuit shorted to another circuit in the wiring harness or to ground -- -1/1

000970.31 — Auxiliary Engine Shutdown Switch Active

The ECU receives an engine shutdown input voltage that is within the necessary voltage range to shut the engine down. On some applications, the ECU receives an engine shutdown request from another controller over CAN.

Engine Shutdown Signal

- The external shutdown signal is an input to the ECU that will because of certain operating conditions, cause the ECU to shut the engine down. On some applications, an engine shutdown request is sent over CAN(Controller Area Network) to the ECU from another controller.

DTC 000970.31 will set if:

- The ECU receives an engine shutdown input voltage that is within the necessary voltage range to shut the engine down. On some applications, the ECU receives an engine shutdown request from another controller over CAN.

If DTC 000970.31 sets, the following will occur:

- The engine will shutdown.

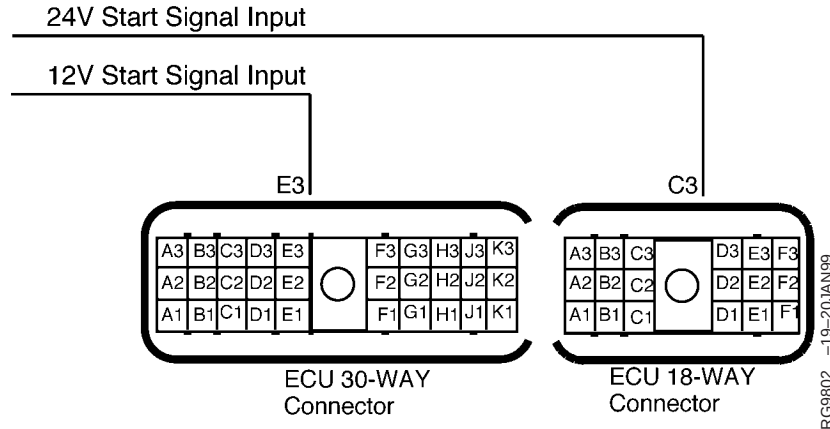
If DTC 000970.31 sets:

- Check for other stored or active fault codes on the ECU and, if equipped, other controllers on the machine that indicate the reason for the engine shutdown.

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DPSG,RG39774,67 -19-23NOV98-1/1

001041.02 — Start Signal Missing



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Start Signal

- The start signal is an input to the ECU that is typically connected to the starter relay circuit such that battery voltage is present when the ignition is in the START position. This input is used to allow the

ECU to position the injection pump rack in the starting fuel position slightly ahead of the time that an engine speed input is detected.

DTC 001041.02 will set if:

- The ECU has detected an engine speed greater than low idle without having detected a voltage at the start signal input terminal.

If DTC 001041.02 sets, the following will occur:

- Under normal conditions, the engine should start and run normally.
- Under adverse starting conditions, slightly longer cranking times may occur.

DPSG, RG39774, 58 -19-23NOV98-1/1

001041.02 — Start Signal Missing

The ECU has detected an engine speed greater than low idle without having detected a voltage at the start signal input terminal.

RG40854,0000053 -19-08JAN01-1/1

001041.02 Start Signal Missing Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 30-way and 18-way (if equipped) ECU connector(s) looking for dirty, damaged, or poorly positioned terminals.

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1 Start Signal Voltage Test



CAUTION: Instruction is given to crank the engine. Although the engine will not start because of the disconnected ECU, be aware that the engine will be cranking and use appropriate safeguards.

NOTE: For wiring and theory of operation information, see DTC 001041.02 START SIGNAL MISSING supporting information

1. Ignition OFF
2. Disconnect the 30-way and 18-way (if equipped) ECU connector(s)
3. Turn ignition to START position while monitoring voltage from the start signal terminal (+) in the harness end of the ECU connector **and** a good ground (-)

Greater than 3.0 volts:
GO TO 2

3.0 volts or less:
Open in start signal circuit
OR
Short to ground in start signal circuit

-- -1/1

Trouble Code Diagnostics and Tests

② Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 001041.02 START SIGNAL MISSING supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition OFF
3. Reconnect the 30-way and 18-way (if equipped) ECU connector(s)
4. Ignition ON, engine OFF
5. Start ECU communication software
6. Read DTCs using DST or SERVICE ADVISOR™.
7. Make note of all DTCs, then clear all DTCs
8. Ignition ON, engine OFF
9. Read DTCs

001041.02 cleared and doesn't reoccur:
GO TO ③

001041.02 reoccurs:
Faulty speed sensor wiring causing a false speed signal to the ECU while the engine is stopped
OR
Faulty ECU

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③ Intermittent DTC 001041.02 Checks

NOTE: For wiring and theory of operation information, see DTC 001041.02 START SIGNAL MISSING supporting information

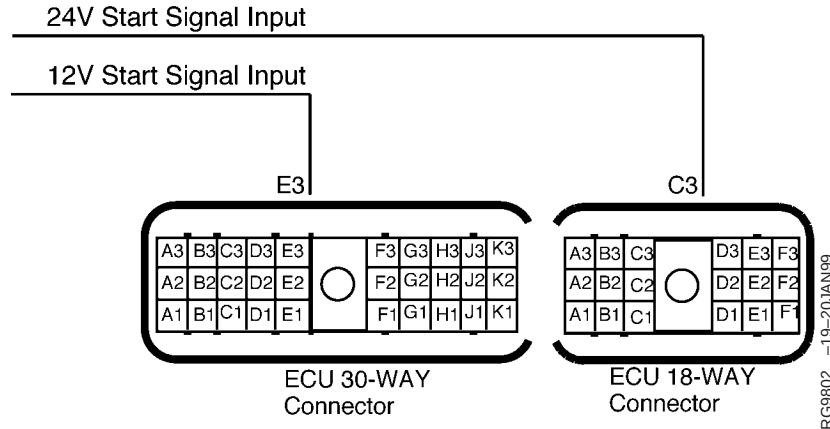
An intermittent DTC 001041.02 can be caused by:

- Rapidly cycling the ignition switch from ON to OFF back to ON without the engine dying
- Faulty ignition switch
- Intermittent faulty start signal circuit
- Intermittent faulty ECU power supply
- Intermittent faulty ECU ground circuit

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001041.03 — Start Signal Always Active



NOTE: Wiring diagram shows OEM engine applications. For wiring information on non-OEM engines, refer to machine manual.

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

Start Signal

- The start signal is an input to the ECU that is typically connected to the starter relay circuit such that battery voltage is present when the ignition is in the START position. This input is used to allow the ECU to position the injection pump rack in the

starting fuel position slightly ahead of the time that an engine speed input is detected.

DTC 001041.03 will set if:

- The ECU detects a low idle or greater engine speed and is still detecting a voltage at the start signal input terminal.

If DTC 001041.03 sets, the following will occur:

- The engine should start and run normally.
- Depending on the cause of the fault, it is possible that the starter is engaged even though the key is not in the START position. If this is the case, starter damage may occur.

DPSG, RG39774, 63 -19-23NOV98-1/1

001041.03 — Start Signal Always Active

The ECU detects a low idle or greater engine speed and is still detecting a voltage at the start signal input terminal.

RG40854,0000054 -19-08JAN01-1/1

001041.03 Start Signal Always Active Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the 30-way and 18-way (if equipped) ECU connector(s) looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test	<i>NOTE: For wiring and theory of operation information, see DTC 001041.03 START SIGNAL ALWAYS ACTIVE supporting information</i> 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	001041.03 reoccurs: GO TO ❷ 001041.03 cleared and doesn't reoccur: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Start Signal Voltage Test	<i>NOTE: For wiring and theory of operation information, see DTC 001041.03 START SIGNAL ALWAYS ACTIVE supporting information</i> 1. Ignition OFF 2. Disconnect the 30-way and 18-way (if equipped) ECU connector(s) 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage from the start signal terminal (+) in the harness end of the ECU connector and a good ground (-)	Less than 1.0 volts: GO TO ❸ 1.0 volts or greater: Short to power in start signal circuit

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Trouble Code Diagnostics and Tests

③ Start Signal Shorted Test

NOTE: For wiring and theory of operation information, see DTC 001041.03 START SIGNAL ALWAYS ACTIVE supporting information

- 1. Ignition OFF
- 2. Using a multimeter, measure resistance between start signal input terminal in the harness end of the ECU connector **and** all other terminals in the 30-way and 18-way (if equipped) ECU connectors

All measurements greater than 5.0 ohms:
Faulty ECU

Any measurement less than 5.0 ohms:
Short to power in start signal circuit

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001069.09 — Tire Size Invalid

The ECU does not receive tire size information or it is invalid.

CAN (Controller Area Network) Tire Size

- CAN (Controller Area Network) tire size is sent to the ECU by another controller over CAN about desired throttle position.

DTC 001069.09 will set if:

- The ECU does not receive tire size information or it is invalid.

If DTC 001069.09 sets, the following will occur:

- The ECU will assume the largest tire size.
- The ECU will limit engine speed to 1950 rpm when vehicle is in top gear.

If DTC 001069.09 sets:

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
- With ignition ON, engine OFF, start ECU communication software.
- Read DTCs using DST or SERVICE ADVISOR™. If DTC 000639.00, 000639.02 or 000639.13 also, occur, see DTC 000639.13 CAN ERROR later in this Group.
- Check to see if any other controllers on the machine have any active or stored DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.

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RG40854,0000004 -19-19FEB01-1/1

001069.31 — Tire Size Error

The ECU finds the tire size information to be incorrect from the value of the tire size programmed into the ECU.

CAN (Controller Area Network) Tire Size

- CAN (Controller Area Network) tire size is sent to the ECU by another controller over CAN about desired throttle position.

DTC 001069.31 will set if:

- The ECU finds the tire size information to be incorrect from the value of the tire size programmed into the ECU.

If DTC 001069.31 sets, the following will occur:

- The ECU will assume the largest tire size.
- The ECU will limit engine speed to 1950 rpm when vehicle is in top gear.

If DTC 001069.31 sets:

- Reprogram tire size by using the tire size calibration program on the vehicle.

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RG40854,0000005 -19-22JUN01-1/1

001082.09 — Engine Coolant Load Increase Invalid

The ECU does not receive the engine coolant load increase message or it is invalid.

CAN (Controller Area Network) Engine Coolant Load Increase Message

- The ECU receives a message over CAN (Controller Area Network) that the vehicle is going to be putting more load on the engine coolant system. The ECU reacts by increasing the fan speed. On some applications, the vehicle will send this message to the ECU if the PTO is active.

DTC 001082.09 will set if:

- The ECU does not receive the engine coolant load increase message or it is invalid.

If DTC 001082.09 sets, the following will occur:

- The ECU will run the fan at the non-PTO operation fan speed.

If DTC 001082.09 sets:

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
- With ignition ON, engine OFF, start ECU communication software.
- Read DTCs using DST or SERVICE ADVISOR™. If DTC 000639.00, 000639.02 or 000639.13 also, occur, see DTC 000639.13 CAN ERROR later in this Group.
- Check to see if any other controllers on the machine have any active or stored DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.

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RG40854,0000006 -19-19FEB01-1/1

001109.14 — Engine Shutdown

The ECU senses an oil pressure below the shutdown value set point in the ECU. The ECU senses a coolant temperature of 115°C (239 °F). The loss of coolant temperature switch contacts close causing the ECU to sense continuity to ground through the external shutdown/derate input terminal.

Engine Shutdown

- This code informs the operator that a low oil pressure, high coolant temperature, or low coolant level shutdown threshold has occurred, and if the ECU is programmed with engine protection with shutdown, the ECU is going to shut the engine down.

DTC 001109.14 will set if:

- The ECU senses an oil pressure below the shutdown value set point in the ECU (DTC 000100.18 will also be present).
- The ECU senses a coolant temperature of 115°C (239 °F) (DTC 000110.00 will also be present).

NOTE: Temperature value shown applies to OEM engine applications. Other applications may

have the same or a similar temperature value. Refer to machine manual for high coolant temperature value.

- The loss of coolant temperature switch contacts close causing the ECU to sense continuity to ground through the external shutdown/derate input terminal (DTC 000111.01 will also be present).

If DTC 001109.14 sets, the following will occur:

- ECUs that have engine protection with shutdown:
 - The ECU will shut the engine down.
- ECUs that have engine protection without shutdown:
 - Will derate the engine (DTC 001569.31 will also be present), but will not shut the engine down.
- ECUs that have no engine protection:
 - There will be no derate and the ECU will not shut the engine down.

If DTC 001109.14 sets:

- Check for other stored or active fault codes that indicate the reason for the engine shutdown.

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RG41183,00000D9 -19-03MAR03-1/1

001110.31 — Engine Shutdown

The ECU senses an oil pressure below the shutdown value set point in the ECU. The ECU senses a coolant temperature of 115°C (239 °F). The loss of coolant temperature switch contacts close causing the ECU to sense continuity to ground through the external shutdown/derate input terminal.

Engine Shutdown

- This code informs the operator that a low oil pressure, high coolant temperature, or low coolant level shutdown threshold has occurred, and if the ECU is programmed with engine protection with shutdown, the ECU is going to shut the engine down.

DTC 001110.31 will set if:

- The ECU senses an oil pressure below the shutdown value set point in the ECU (DTC 000100.18 will also be present).
- The ECU senses a coolant temperature of 115°C (239 °F) (DTC 000110.00 will also be present).

NOTE: Temperature value shown applies to OEM engine applications. Other applications may

have the same or a similar temperature value. Refer to machine manual for high coolant temperature value.

- The loss of coolant temperature switch contacts close causing the ECU to sense continuity to ground through the external shutdown/derate input terminal (DTC 000111.01 will also be present).

If DTC 001110.31 sets, the following will occur:

- ECUs that have engine protection with shutdown:
 - The ECU will shut the engine down.
- ECUs that have engine protection without shutdown:
 - Will derate the engine (DTC 001569.31 will also be present), but will not shut the engine down.
- ECUs that have no engine protection:
 - There will be no derate and the ECU will not shut the engine down.

If DTC 001110.31 sets:

- Check for other stored or active fault codes that indicate the reason for the engine shutdown.

RG41183,00000DA -19-03MAR03-1/1

001568.02 — Torque Curve Selection Invalid

The ECU either does not receive torque curve selection information over CAN, or the information received is not valid.

NOTE: *On some applications DTC 001569.09 may be displayed for Torque Curve Selection Invalid. If this occurs, use the information below.*

CAN (Controller Area Network) Torque Curve Selection

- The ECU has the ability operate the engine on multiple different torque curves. Individual curves can be selected based on information sent to the ECU over CAN (Controller Area Network) by another controller.

DTC 001568.02 will set if:

- The ECU either does not receive torque curve selection information over CAN, or the information received is not valid.

If DTC 001568.02 sets, the following will occur:

- The ECU will select a default torque curve to continue running.
- Depending on application, the selected default torque curve may be a lower power curve.

If DTC 001568.02 sets:

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
- With ignition ON, engine OFF, start ECU communication software.
- Read DTCs using DST or SERVICE ADVISOR™. If DTC 000639.00, 000639.02 or 000639.13 also, occur, see DTC 000639.13 CAN ERROR later in this Group.
- Check to see if any other controllers on the machine have any active or stored DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.

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DPSG, RG39774, 27 -19-12JAN99-1/1

001568.09 — Torque Curve Selection Invalid

The ECU either does not receive torque curve selection information over CAN, or the information received is not valid.

NOTE: *On some applications DTC 001569.09 may be displayed for Torque Curve Selection Invalid. If this occurs, use the information below.*

CAN (Controller Area Network) Torque Curve Selection

- The ECU has the ability operate the engine on multiple different torque curves. Individual curves can be selected based on information sent to the ECU over CAN (Controller Area Network) by another controller.

DTC 001568.09 will set if:

- The ECU either does not receive torque curve selection information over CAN, or the information received is not valid.

If DTC 001568.09 sets, the following will occur:

- The ECU will select a default torque curve to continue running.
- Depending on application, the selected default torque curve may be a lower power curve.

If DTC 001568.09 sets:

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
- With ignition ON, engine OFF, start ECU communication software.
- Read DTCs using DST or SERVICE ADVISOR™. If DTC 000639.00, 000639.02 or 000639.13 also, occur, see DTC 000639.13 CAN ERROR later in this Group.
- Check to see if any other controllers on the machine have any active or stored DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.

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RG41221,00000F3 -19-27JAN03-1/1

001569.31 — Fuel Derate

The ECU senses a coolant temperature of 108°C (226 °F). The ECU senses an oil pressure below the warning value set point in the ECU. The ECU senses a manifold air temperature above the warning value set point in the ECU. On air-to-air aftercooled (H engines) OEM applications, the ECU senses high charge air temperature.

Fuel Derate

- The fuel derate fault code is information to the operator that the ECU has detected a condition such as low oil pressure, high coolant temperature, low coolant level, high manifold or charge air temperature, and is derating the engine by limiting the maximum amount of fuel available to the engine.

DTC 001569.31 will set if:

- The ECU senses a coolant temperature of 108°C (226 °F) (DTC 000110.16 will also be present).

NOTE: Temperature value shown applies to OEM engine applications. Other applications may have the same or a similar temperature value.

Refer to machine manual for high coolant temperature value.

- The ECU senses an oil pressure below the warning value set point in the ECU (DTC 000100.18 will also be present).
- The ECU senses a manifold air temperature above the warning value set point in the ECU (DTC 000105.16 will also be present). In most applications, the maximum value set point is 88°C (190°F).
- On air-to-air aftercooled (H engines) OEM applications, the ECU senses high charge air temperature (no other related DTC will be present).

If DTC 001569.31 sets, the following will occur:

- The ECU will limit the amount of fuel available to the engine in an attempt to protect the engine.

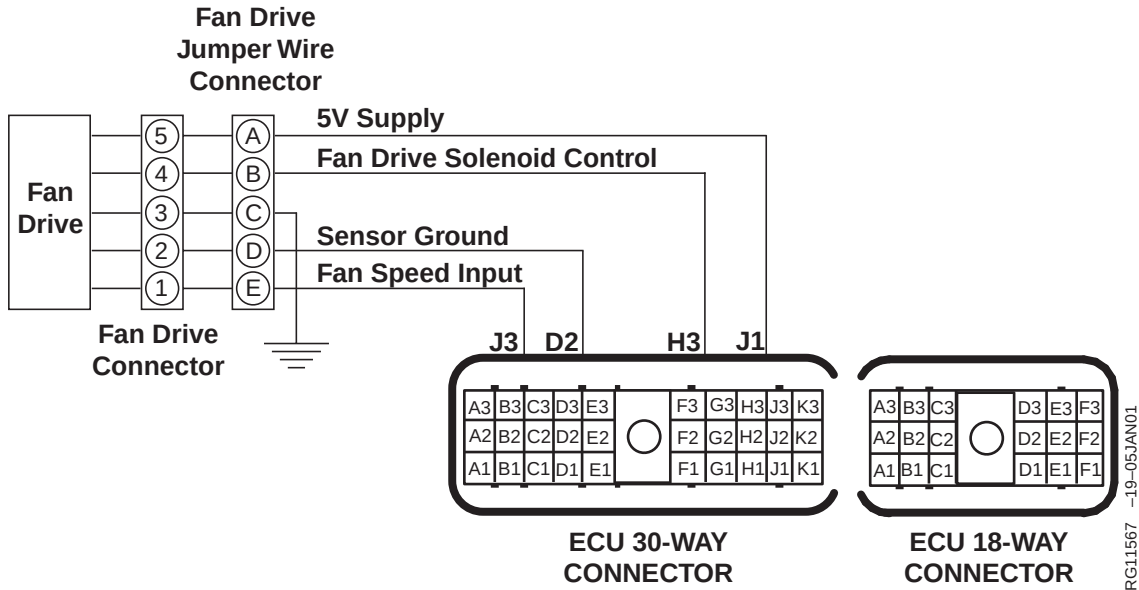
If DTC 001569.31 sets:

- Check for other stored or active fault codes that indicate the reason for the fuel derate.

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,341

DPSG, RG39774, 22 -19-17DEC98-1/1

001639.01 — Fan Speed Input Missing



Fan Speed Drive

The ECU monitors various parameters such as engine coolant temperature, oil temperature, air temperature, and other components on the engine. When these become excessive, the ECU commands the fan drive to run at a higher speed. The ECU sends a PWM signal through the fan drive solenoid control wire to energize the fan drive solenoid. This controls fan speed. The ECU monitors fan speed through a hall effect sensor in the fan drive. This allows the ECU to

determine if there is any significant difference between desired and actual fan speed.

DTC 001639.01 will set if:

- The ECU detects that fan speed input is missing.

If DTC 001639.01 sets, the following will occur:

- The ECU commands the fan to run at the highest possible speed

RG40854,0000021 -19-05JAN01-1/1

001639.01 — Fan Speed Input Missing

The ECU detects that fan speed input is missing.

RG40854,0000002 -19-13FEB01-1/1

001639.01 Fan Speed Input Missing Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

-- -1/1

① Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Ignition ON, engine OFF
3. Start ECU communication software
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

001639.01 reoccurs:
GO TO ②

001639.01 cleared and doesn't reoccur:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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343

② 5 Volt Supply Check	<i>NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information</i> 1. Ignition OFF  CAUTION: Do NOT continue this procedure until engine is OFF and fan is no longer running. Hand injury can occur. 2. Disconnect fan drive connector 3. Connect a multimeter between terminal 5 and terminal 2 of the fan drive connector. 4. Ignition ON 5. Using the multimeter, measure voltage between terminals.	4.0 volts or greater: GO TO ④ Less than 4.0 volts: GO TO ③ -- -1/1
③ Sensor Ground Check	<i>NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information</i> 1. Ignition OFF  CAUTION: Do NOT continue this procedure until engine is OFF and fan is no longer running. 2. Fan drive connector still disconnected. 3. Probe terminal 2 of the fan drive connector with a test light connected to battery voltage.	Light ON: Open in 5V supply wire OR Short to ground in 5V supply wire OR Faulty ECU connector OR Faulty ECU Light OFF: Open in sensor ground OR Faulty ECU connector OR Faulty ECU -- -1/1

Trouble Code Diagnostics and Tests

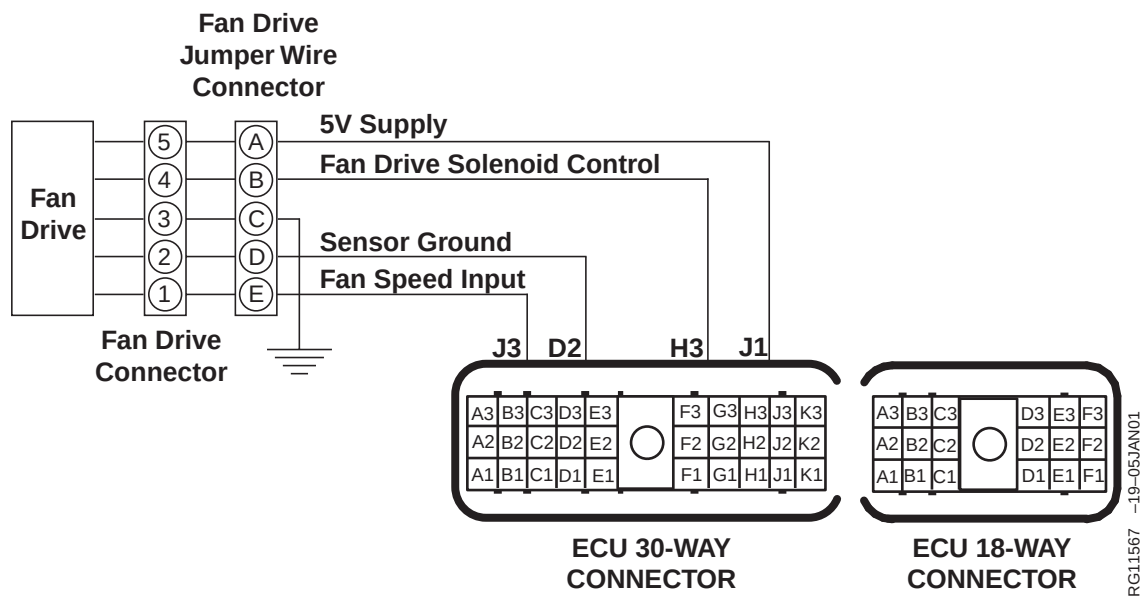
④ Fan Input Wire Check	<i>NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information</i> 1. Ignition OFF  CAUTION: Do NOT continue this procedure until engine is OFF and fan is no longer running. Hand injury can occur. 2. Disconnect ECU 30-way and 18-way connectors 3. Fan drive connector still disconnected. 4. Install a jumper wire between terminal 1 and terminal 2 of the fan drive connector. 5. Using a multimeter, measure resistance between terminal J3 and terminal D2 of the ECU 30-way connector.	Less than 5.0 ohms: GO TO ⑤ 5.0 ohms or greater: Open in fan speed input wire OR Short to ground in fan speed input wire OR Faulty fan drive jumper wire connector OR Faulty ECU connector OR Faulty ECU
⑤ Observe Fan Performance	<i>NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information</i> 1. Ignition OFF.  CAUTION: Do NOT continue this procedure until engine is OFF and fan is no longer running. Hand injury can occur. 2. Connect fan drive connector. 3. Ignition ON, engine running.  CAUTION: Do NOT continue this procedure until engine is OFF and fan is no longer running. Hand injury can occur. 4. Monitor fan to determine if it is operational. <i>NOTE: Fan operation only occurs when commanded by the ECU.</i>	Fan runs: Faulty fan drive connector OR Faulty fan speed sensor Fan will not run: Faulty fan drive connector OR Faulty fan drive

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001639.02 — Fan Speed Input Noise



Fan Speed Drive

The ECU monitors various parameters such as engine coolant temperature, oil temperature, air temperature, and other components on the engine. When these become excessive, the ECU commands the fan drive to run at a higher speed. The ECU sends a PWM signal through the fan drive solenoid control wire to energize the fan drive solenoid. This controls fan speed. The ECU monitors fan speed through a hall effect sensor in the fan drive. This allows the ECU to

determine if there is any significant difference between desired and actual fan speed.

DTC 001639.02 will set if:

- The ECU detects noise on the fan speed input.

If DTC 001639.02 sets, the following will occur:

- The ECU commands the fan to run at the highest possible speed

001639.02 — Fan Speed Input Noise

The ECU detects noise on the fan speed input.

RG40854,0000009 -19-20FEB01-1/1

001639.02 Fan Speed Input Noise Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

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❶ Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 001639.02 FAN SPEED INPUT NOISE supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Warm engine
3. Ignition ON, engine OFF
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

001639.02 reoccurs:
GO TO ❷

001639.02 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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② Fan Speed Input
Noise Check

NOTE: For wiring and theory of operation information, see DTC 001639.02 FAN SPEED INPUT NOISE supporting information.

DTC 001639.02 is mostly likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections any where on the machine. Things to check:

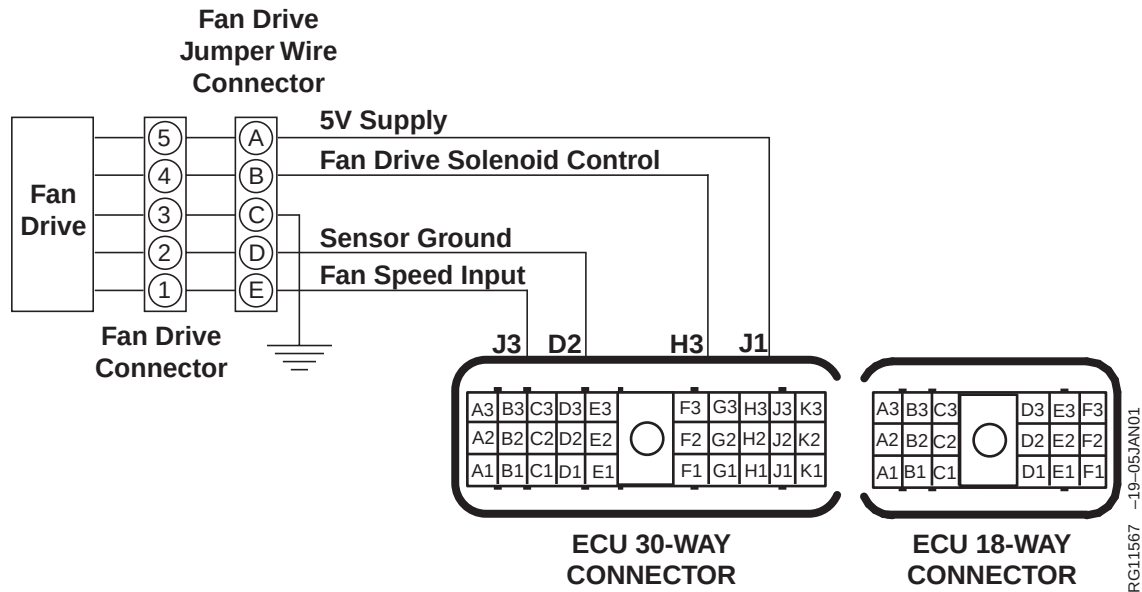
- All harness connectors
- Alternator connections
- Chassis ground connections, battery ground connection
- Corrosion, dirt, or paint can cause intermittent and "noisy" connections
- Check the wiring harness for intermittent open and short circuits, particularly the fan speed sensor wiring

Other possible causes of DTC 001639.02:

- Electromagnetic interference (EMI) from an incorrectly installed 2-way radio
- Interference from some radar source

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160
,349

001639.16 — Fan Speed Higher Than Expected



Fan Speed Drive

The ECU monitors various parameters such as engine coolant temperature, oil temperature, air temperature, and other components on the engine. When these become excessive, the ECU commands the fan drive to run at a higher speed. The ECU sends a PWM signal through the fan drive solenoid control wire to energize the fan drive solenoid. This controls fan speed. The ECU monitors fan speed through a hall effect sensor in the fan drive. This allows the ECU to

determine if there is any significant difference between desired and actual fan speed.

DTC 001639.16 will set if:

- The ECU detects a higher fan than expected fan speed.

If DTC 001639.16 sets, the following will occur:

- There is no change to engine performance.

RG40854,000000A -19-20FEB01-1/1

001639.16 — Fan Speed Higher Than Expected

The ECU detects a higher fan than expected fan speed.

RG40854,000000B -19-20FEB01-1/1

001639.16 Fan Speed Higher Than Expected Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

-- -1/1

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❶ Intermittent Fault Test	NOTE: For wiring and theory of operation information, see DTC 001639.16 FAN SPEED HIGHER THAN EXPECTED supporting information. 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Warm engine 3. Ignition ON, engine OFF 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	001639.16 reoccurs: GO TO ❷ 001639.16 cleared: Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❷ Fan Speed Solenoid Control Wire Check	NOTE: For wiring and theory of operation information, see DTC 001639.16 FAN SPEED HIGHER THAN EXPECTED supporting information. 1. Ignition OFF  CAUTION: Do NOT continue this procedure until engine is OFF and fan is no longer running. Hand injury can occur. 2. Disconnect the ECU 30-way and 18-way connectors 3. Disconnect the fan drive connector 4. Using a multimeter, measure resistance between terminal H3 on the ECU 30-way connector and all terminals on the ECU 30-way and 18-way connectors	All measurements greater than 2000 ohms: GO TO ❸ Any measurement less than 2000 ohms: Faulty fan drive solenoid control wire

-- -1/1

Trouble Code Diagnostics and Tests

③ Fan Drive Check

NOTE: For wiring and theory of operation information, see DTC 001639.16 FAN SPEED HIGHER THAN EXPECTED supporting information.

At this point, the most likely cause of DTC 001639.16 is a failure in the fan drive or fan drive solenoid. Before checking these, check for connection problems first. For more fan drive diagnostics, refer to application manual.

Problem found:
Repair and retest

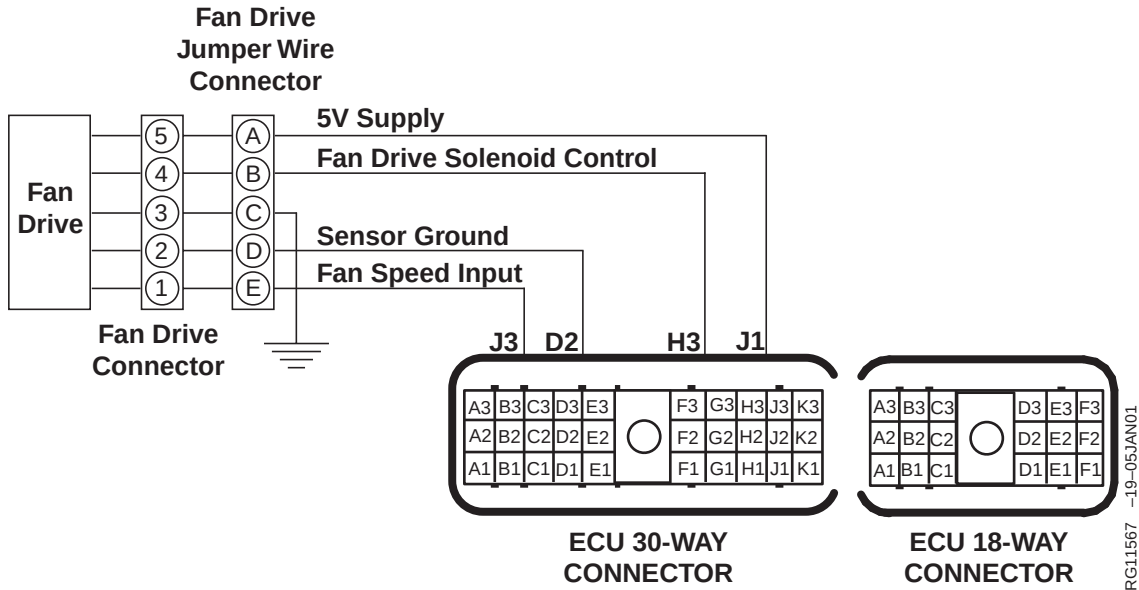
No problem found:
Replace ECU and retest.

-- -1/1

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,352

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,353

001639.18 — Fan Speed Lower Than Expected



Fan Speed Drive

The ECU monitors various parameters such as engine coolant temperature, oil temperature, air temperature, and other components on the engine. When these become excessive, the ECU commands the fan drive to run at a higher speed. The ECU sends a PWM signal through the fan drive solenoid control wire to energize the fan drive solenoid. This controls fan speed. The ECU monitors fan speed through a hall effect sensor in the fan drive. This allows the ECU to

determine if there is any significant difference between desired and actual fan speed.

DTC 001639.18 will set if:

- The ECU detects a lower than expected fan speed.

If DTC 001639.18 sets, the following will occur:

- There is no change to engine performance.

RG40854,000000C -19-20FEB01-1/1

001639.18 — Fan Speed Lower Than Expected

The ECU detects a lower than expected fan speed.

RG40854,000000D -19-20FEB01-1/1

001639.18 Fan Speed Lower Than Expected Diagnostic Procedure

NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU 30-way connector looking for dirty, damaged, or poorly positioned terminals.

-- -1/1

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❶ Intermittent Fault Test

NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.
2. Warm engine
3. Ignition ON, engine OFF
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Make note of all DTCs, then clear all DTCs
6. Ignition ON, engine running
7. Read DTCs

001639.18 reoccurs:
GO TO ❷

001639.18 cleared:
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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-- -1/1

❷ Fan Belt Check

NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.

1. Ignition ON, engine running



CAUTION: Keep hands away from fan drive at all times. Hand injury can occur.

2. Monitor fan operation and observe fan belt.

NOTE: Fan operation only takes place when commanded by the ECU.

Fan belt appears normal:
GO TO ❸

Fan belt slips or is broken:
Determine cause for belt slipping or for broken belt. Repair and retest.

-- -1/1

Trouble Code Diagnostics and Tests

③ Short in Fan Speed Solenoid Control Wire Check	<i>NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.</i> 1. Ignition OFF  CAUTION: Do NOT continue this procedure until engine is OFF and fan is no longer running. Hand injury can occur. 2. Keep fan drive connector disconnected and disconnect ECU 30-way connector 3. Using a multimeter, measure resistance between ECU terminal H3 in the harness end of the ECU 30-way connector and: • All other terminals in the ECU 30-way and 18-way (if equipped) connectors • A good ground	All measurements greater than 2000 ohms: GO TO ④ Any measurement less than 2000 ohms: Short in fan speed solenoid wire -- -1/1
④ Open in Fan Speed Solenoid Control Wire Check	<i>NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.</i> 1. Ignition OFF 2. Disconnect the ECU 30-way and 18-way connectors 3. Disconnect the fan drive connector 4. Install a jumper wire between terminal 5 and terminal 4 of the fan drive connector. 5. Using a multimeter, measure resistance between terminal J1 and terminal H3 on the ECU 30-way connector.	5 ohms or less: GO TO ⑤ Greater than 5 ohms: Open in fan drive solenoid control wire OR Faulty fan drive jumper wire connector OR Faulty ECU connector OR Faulty ECU -- -1/1
⑤ Fan Drive Check	<i>NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.</i> At this point, the most likely cause of DTC 001639.18 is a failure in the fan drive or fan drive solenoid. Before checking these, check for connection problems first. For more fan drive diagnostics, refer to application manual.	Problem found: Repair and retest No problem found: Replace ECU and retest. -- -1/1

002000.09 — Vehicle ID Missing

The ECU does not receive the Vehicle ID from the vehicle controllers over the CAN bus.

Security Violation

- When the ignition switch is first turned on, all of the controllers on the machine communicate with each other to make sure that all controllers are correct for the particular machine.

DTC 002000.09 will set if:

- The ECU does not receive the Vehicle ID from the vehicle controllers over the CAN bus.

If DTC 002000.09 sets, the following will occur:

- The ECU will allow the engine to start, but will only allow engine to run in lowest torque curve.

If DTC 002000.09 sets:

- Using the DST or SERVICE ADVISOR™, monitor DTCs on the active code display parameter. If DTC 000639.13 also occurs, see DTC 000639.13 CAN BUS ERROR DIAGNOSTIC PROCEDURE earlier in this Group.
- Check to see if any other controllers on the machine have any active or stored CAN or vehicle related DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN or vehicle related DTCs are found, replace ECU and retest.

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RG41183,00000DB -19-03MAR03-1/1

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,357

002000.13 — Security Violation

The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

Security Violation

- When the ignition switch is first turned on, all of the controllers on the machine communicate with each other to make sure that all controllers are correct for the particular machine.

DTC 002000.13 will set if:

- The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

If DTC 002000.13 sets, the following will occur:

- The ECU will allow the engine to start, but will only allow low idle engine speed.

If DTC 002000.13 sets:

- If one of the controllers on the machine has just been replaced, make sure the correct controller was installed.
- If all controllers on the machine are the correct part numbers, check to see if any controllers have active or stored CAN related DTCs. If they do, go to the appropriate diagnostic procedure.

DPSG, RG39774, 16 –19–17DEC98–1/1

Section 05

Tools and Other Materials

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Engine Diagnostics and Testing Procedure Tools	05-180-1

05

Fuel System Repair and Adjustment - Essential Tools

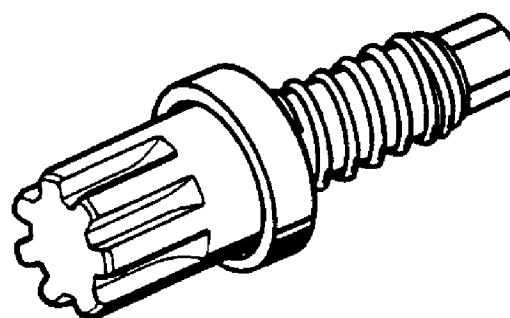
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

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RG40854.0000010 -19-22FEB01-1/12

Flywheel Turning Tool JDG820

Used to rotate flywheel on engine to check damper radial runout and time engine. JDE81-1 may be used also if JDG820 is not available.



JDG820

RG7056

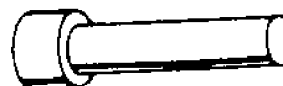
RG7056 -UN-05DEC97

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RG40854.0000010 -19-22FEB01-2/12

Timing Pin JDE81-4

Lock engine at TDC when timing valve train, adjusting valve clearance, and installing fuel injection pump. Use with JDG820 and JDE81-1 Flywheel Turning Tools.



JDE81-4

RG5068

RG5068 -UN-05DEC97

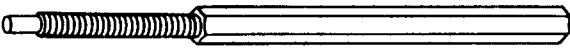
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RG40854.0000010 -19-22FEB01-3/12

RG7212 -UN-23NOV97

Injection Pump Timing Pin. JDG886

Used to set Bosch and Nippondenso fuel injection pump timing prior to removal of pump.



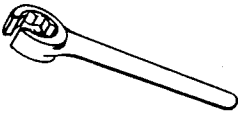
JDG886

RG40854,0000010 -19-22FEB01-4/12

RG5290 -UN-15OCT92

Serrated Wrench. JDE90

Use to hold injection pump fuel outlet fittings on Bosch "P" pump from turning when loosening and tightening fuel pipe connections.



JDE90

RG40854,0000010 -19-22FEB01-5/12

RG5288 -UN-23AUG88

Crowsfoot Wrench. JDF22

Used to loosen and tighten fuel pipes at injection nozzles and at injection pump.



JDF22

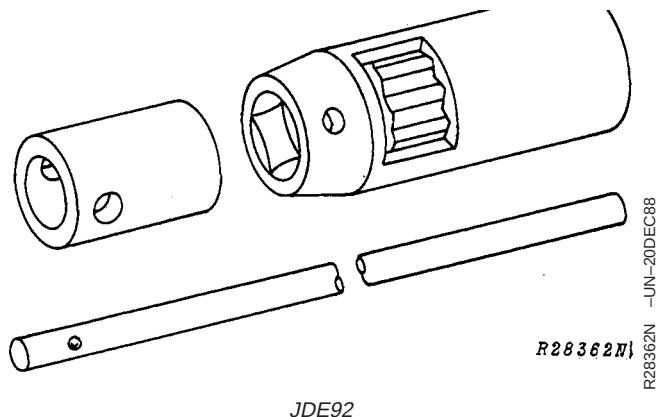
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RG40854,0000010 -19-22FEB01-6/12

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2

Nozzle Socket JDE92

Used to remove and install 21 mm injection nozzles.

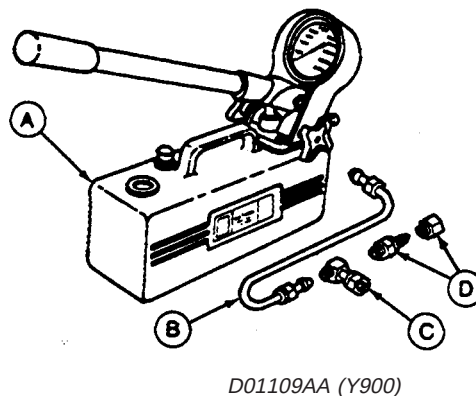


–UN–20DEC88
R28362N

RG40854,0000010 –19–22FEB01–7/12

Fuel Injection Nozzle Tester and Attaching
Hardware D01109AA (Y900)

Used to test operational performance and opening pressure of nozzles. Shown are D01109AA (Y900) Fuel Injection Nozzle Tester (A), Y900-2A Fuel Injection Line Assembly (B)¹, Y900-21 Adapter Nut (C)², and Y900-7 and Y900-15 Straight Adapters (D).¹



–UN–14DEC88
RG4954

¹Included in D01110AA (Y910A) Adapter Set.

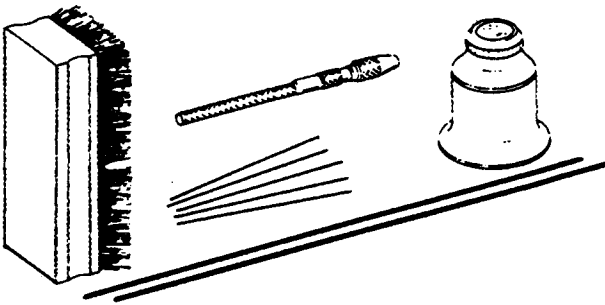
²May be used instead of Y900-7 and Y900-15.

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RG40854,0000010 –19–22FEB01–8/12

Nozzle Cleaning Kit JDF13 (JDE105)

Used to clean injection nozzles.



JDF13 (JDE105)

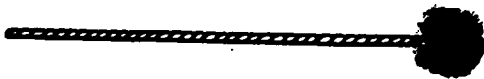
RG4953 -UN-14DEC88

RG40854,0000010 -19-22FEB01-9/12

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4

Nozzle Thread Cleaning Brush. D17030BR

Used to clean nozzle threads in cylinder head.



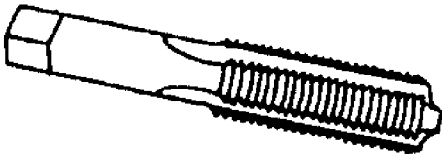
D17030BR

RG5099 -UN-23AUG88

RG40854,0000010 -19-22FEB01-10/12

Tap JDF5

Used to restore nozzle threads in cylinder head.



JDF5

RG5100

RG5100 -UN-05DEC97

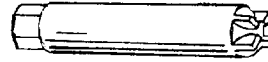
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RG40854,0000010 -19-22FEB01-11/12

RG5289 -UN-07NOV97

Nozzle Seat Reamer JDG609

Used to clean carbon from nozzle seats in cylinder head.



JDG609

RG5289

RG40854,0000010 -19-22FEB01-12/12

Fuel System Repair and Adjustment - Service Equipment and Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

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RG40854,0000011 -19-22FEB01-1/2

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5

Adapter TORX® T45

Injection pump drive gear-to-hub cap screws.

TORX is a registered trademark of Camcar/Textron.

RG40854,0000011 -19-22FEB01-2/2

Fuel System Repair and Adjustment - Other Material

Number	Name	Use
TY9375 (U.S.) TY9480 (Canadian) 592 (LOCTITE®)	Pipe Sealant	Apply to rectangular fuel filter bleed plug and drain plug.
T43512 (U.S.) TY9473 (Canadian) 242 (LOCTITE®)	Thread Lock and Sealer (Medium Strength)	Apply to injection pump timing hole plug. Apply to threads of leak-off connectors on engines with nylon leak-off lines.
AR54749 (U.S.)	Soap Lubricant	Injection pump mounting flange O-ring.
PT569 (U.S.)	NEVER-SEEZ® Compound	Injection nozzle gland nut threads and barrel.

LOCTITE is a registered trademark of Loctite Corp.
NEVER-SEEZ is a registered trademark of Emhart Chemical Group.

RG40854,0000012 -19-22FEB01-1/1

Control System Repair and Adjustment - Essential Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

SERVICEGARD is a trademark of Deere & Company

RG40854,0000013 -19-22FEB01-1/8

Starter Wrench JDE80

Remove and install starter motor.



JDE80

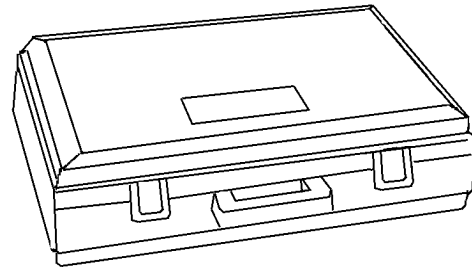
RW17441 -UN-16NOV89

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RG40854,0000013 -19-22FEB01-2/8

Technician's Electrical Repair kit JT07195A

Remove and install wires into connectors.



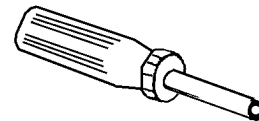
JT07195A

RW25558 -UN-29AUG96

RG40854,0000013 -19-22FEB01-3/8

WEATHER PACK™ Extractor Tool JDG364¹

Remove wires from connectors.



JDG364

WEATHER PACK is a trademark of Packard Electric

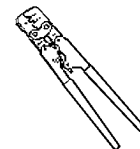
¹Included in JT07195A Electrical Repair Kit

RW25539 -UN-28AUG96

RG40854,0000013 -19-22FEB01-4/8

WEATHER PACK™ Crimping Tool JDG783¹

Crimp contacts to wires.



JDG783

WEATHER PACK is a trademark of Packard Electric

¹Included in JT07195A Electrical Repair Kit

RW25542 -UN-20AUG96

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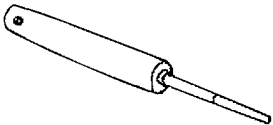
RG40854,0000013 -19-22FEB01-5/8

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RW25541 -UN-20AUG96

WEATHER PACK™ Extractor (Narrow) JDG777¹

Remove terminals from connectors.



JDG777

WEATHER PACK is a trademark of Packard Electric

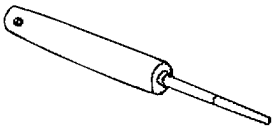
¹Included in JT07195A Electrical Repair Kit

RG40854,0000013 -19-22FEB01-6/8

RW25541 -UN-20AUG96

WEATHER PACK™ Extractor (Wide) JDG776¹

Remove terminals from connectors.



JDG776

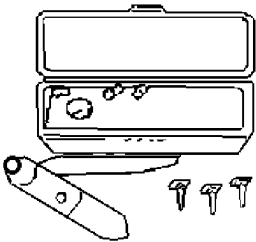
WEATHER PACK is a trademark of Packard Electric

¹Included in JT07195A Electrical Repair Kit

RG40854,0000013 -19-22FEB01-7/8

DEUTSCH™ Electrical Repair Tool Kit. JDG359

Repair DEUTSCH™ electrical connector bodies.



JDG359

RW25540 -UN-06SEP96

DEUTSCH is a trademark of Deutsch Co.

RG40854,0000013 -19-22FEB01-8/8

Control System Repair and Adjustment -
Other Material

Number	Name	Use
JDT405 (U.S.)	High Temperature Grease	Sensor O-rings.
AT66865 (U.S.)	Lubricant	Insulate electrical connectors.

RG40854,0000014 -19-22FEB01-1/1

Engine Diagnostics and Testing Procedure Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

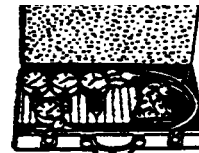
SERVICEGARD is a trademark of Deere & Company

RG40854.0000015 -19-22FEB01-1/11

Universal Pressure Test Kit JT05470 (formerly D15027NU or FKM10002)

Used for testing engine oil pressure, intake manifold pressure (turbo boost), and fuel supply pump pressure.

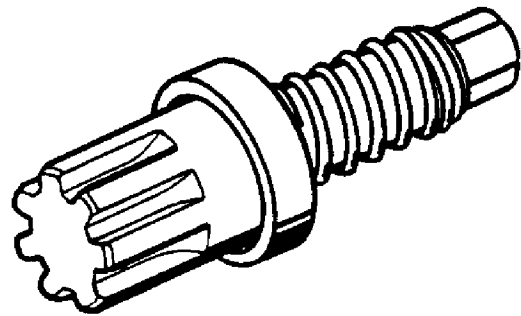
RG5162 -UN-23AUG88



RG40854.0000015 -19-22FEB01-2/11

Flywheel Turning Tool JDG820

Used to rotate engine flywheel to lock engine at "TDC" to check fuel injection pump timing. Use with JDE81-4 Timing Pin.



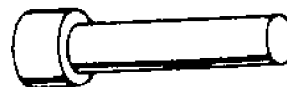
RG7056

RG40854.0000015 -19-22FEB01-3/11

Timing Pin JDE81-4

Used to lock engine at "TDC". Use with JDG820 Flywheel Turning Tool.

RG5068 -UN-05DEC97



RG5068

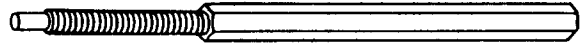
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RG40854.0000015 -19-22FEB01-4/11

RG7212 -UN-23NOV97

Injection Pump Timing Pin. JDG886

Used to lock in-line fuel injection pump timing prior to removal and during installation of pump. Used to check injection pump static timing.



RG40854,0000015 -19-22FEB01-5/11

Break-Out-Box (BOB) JT07349

Test voltage, resistance, or current flow through wiring harness by using JT07306 Digital Multimeter.



RG9990 -UN-22JAN99

RG40854,0000015 -19-22FEB01-6/11

Digital Multimeter JT07306

Test electrical components for voltage, resistance, or current flow. It is especially good for measuring low voltage or high resistance circuits.



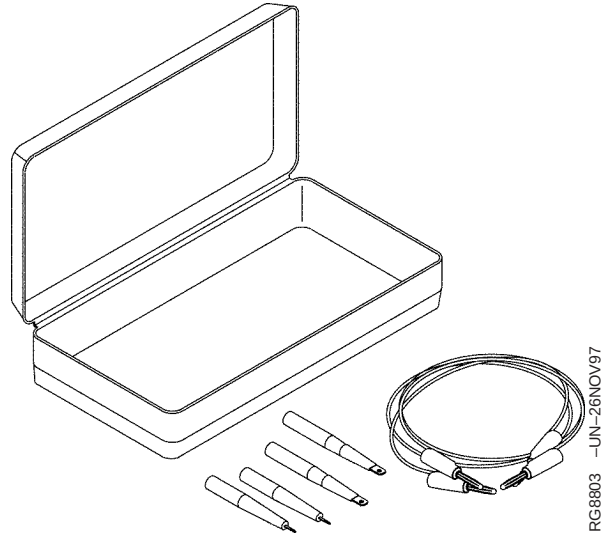
RG11126 -UN-19JUN00

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RG40854,0000015 -19-22FEB01-7/11

Connector Adaptor Test Kit JT07328

Used with JT07306 Digital Multimeter to make voltage and resistance measurements in control system wiring harness connectors. Can also be used to test terminals for proper fit.



RG40854,0000015 -19-22FEB01-8/11

Electronic Governor Tester JT05829

Used to display 2-digit Diagnostic Trouble Codes for applications that don't have on-board display.



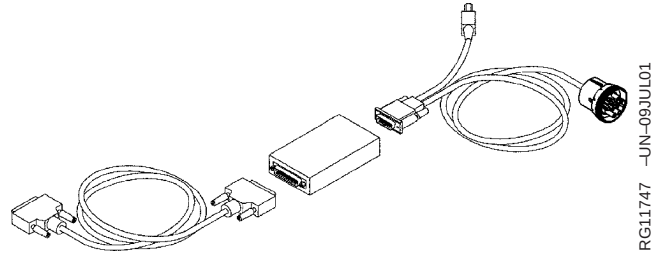
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ECU Communication Hardware Kit JDIS121

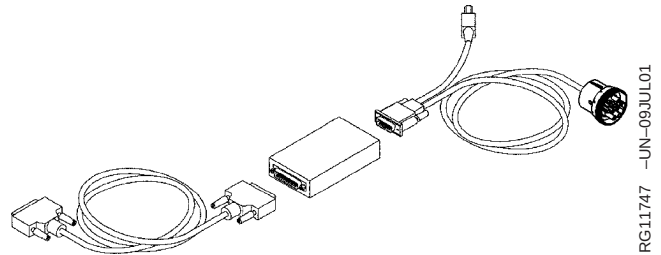
Used with ECU Communication Software Kit. Together, the kits enable a Windows ('95, '98, 2000, ME, and XP) or NT compatible computer to read information from the Engine Control Unit (ECU). The computer must be at least a 486/66 with 8 MB of RAM and an IEEE 1284 compliant parallel port. This kit allows communication with all John Deere applications that use one of the following diagnostic connectors: black 9-pin Deutsch diagnostic connector, gray 9-pin Deutsch diagnostic connector (early 8000 series tractors), or the flat 6-pin Weatherpack diagnostic connector (Lucas controllers). Not all of the components in this kit are shown to the right.



RG40854,0000015 -19-22FEB01-10/11

ECU Communication Hardware Kit DS10023

Used with ECU Communication Software Kit. Together, the kits enable a Windows ('95, '98, 2000, ME, and XP) or NT compatible computer to read information from the Engine Control Unit (ECU). The computer must be at least a 486/66 with 8 MB of RAM and an IEEE 1284 compliant parallel port. This kit allows communication with all John Deere applications that use the black 9-pin Deutsch diagnostic connector. All of the components in this kit are shown to the right.



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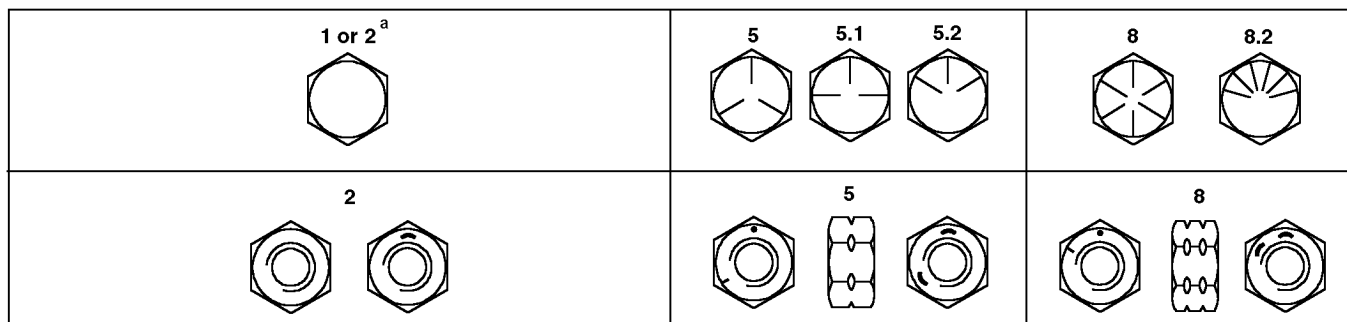
Section 06

Specifications

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.	06-210-15

Unified Inch Bolt and Cap Screw Torque Values



Top, SAE Grade and Head Markings; Bottom, SAE Grade and Nut Markings

Size	Grade 1 (No Mark)		Grade 2 ^a (No Mark)		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
	Lubricated ^b N•m(lb-ft)	Dry ^c N•m(lb-ft)	Lubricated ^b N•m(lb-ft)	Dry ^c N•m(lb-ft)	Lubricated ^b N•m(lb-ft)	Dry ^c N•m(lb-ft)	Lubricated ^b N•m(lb-ft)	Dry ^c N•m(lb-ft)
1/4	3.8 (2.8)	4.7 (3.5)	6 (4.4)	7.5 (5.5)	9.5 (7)	12 (9)	13.5 (10)	17 (12.5)
5/16	7.7 (5.7)	9.8 (7.2)	12 (9)	15.5 (11.5)	19.5 (14.5)	25 (18.5)	28 (20.5)	35 (26)
3/8	13.5 (10)	17.5 (13)	22 (16)	27.5 (20)	35 (26)	44 (32.5)	49 (36)	63 (46)
7/16	22 (16)	28 (20.5)	35 (26)	44 (32.5)	56 (41)	70 (52)	80 (59)	100 (74)
1/2	34 (25)	42 (31)	53 (39)	67 (49)	85 (63)	110 (80)	120 (88)	155 (115)
9/16	48 (35.5)	60 (45)	76 (56)	95 (70)	125 (92)	155 (115)	175 (130)	220 (165)
5/8	67 (49)	85 (63)	105 (77)	135 (100)	170 (125)	215 (160)	240 (175)	305 (225)
3/4	120 (88)	150 (110)	190 (140)	240 (175)	300 (220)	380 (280)	425 (315)	540 (400)
7/8	190 (140)	240 (175)	190 (140)	240 (175)	490 (360)	615 (455)	690 (510)	870 (640)
1	285 (210)	360 (265)	285 (210)	360 (265)	730 (540)	920 (680)	1030 (760)	1300 (960)
1-1/8	400 (300)	510 (375)	400 (300)	510 (375)	910 (670)	1150 (850)	1450 (1075)	1850 (1350)
1-1/4	570 (420)	725 (535)	570 (420)	725 (535)	1280 (945)	1630 (1200)	2050 (1500)	2600 (1920)
1-3/8	750 (550)	950 (700)	750 (550)	950 (700)	1700 (1250)	2140 (1580)	2700 (2000)	3400 (2500)
1-1/2	990 (730)	1250 (930)	990 (730)	1250 (930)	2250 (1650)	2850 (2100)	3600 (2650)	4550 (3350)

^a Grade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

^b "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

^c "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

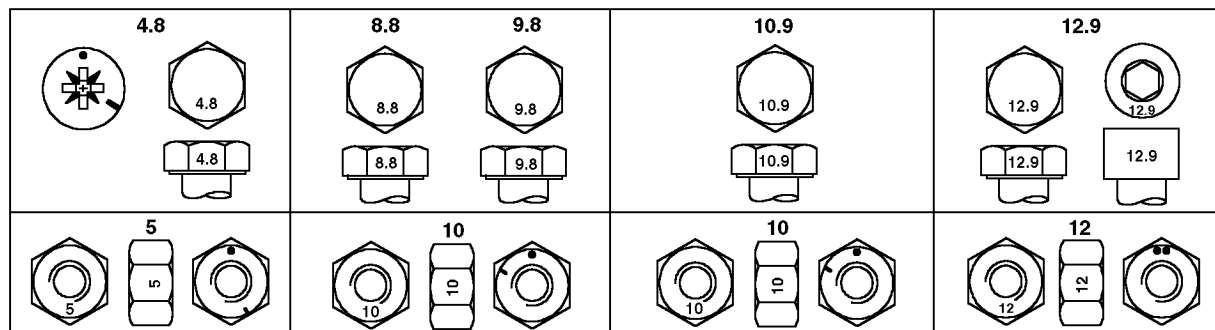
Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

TORQ1A -UN-27SEP99

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Metric Bolt and Cap Screw Torque Values



Top, Property Class and Head Markings; Bottom, Property Class and Nut Markings

	Class 4.8		Class 8.8 or 9.8		Class 10.9		Class 12.9	
Size	Lubricated ^a N•m(lb-ft)	Dry ^b N•m(lb-ft)	Lubricated ^a N•m(lb-ft)	Dry ^b N•m(lb-ft)	Lubricated ^a N•m(lb-ft)	Dry ^b N•m(lb-ft)	Lubricated ^a N•m(lb-ft)	Dry ^b N•m(lb-ft)
M6	4.7 (3.5)	6 (4.4)	9 (6.6)	11.5 (8.5)	13 (9.5)	16.5 (12.2)	15.5 (11.5)	19.5 (14.5)
M8	11.5 (8.5)	14.5 (10.7)	22 (16)	28 (20.5)	32 (23.5)	40 (29.5)	37 (27.5)	47 (35)
M10	23 (17)	29 (21)	43 (32)	55 (40)	63 (46)	80 (59)	75 (55)	95 (70)
M12	40 (29.5)	50 (37)	75 (55)	95 (70)	110 (80)	140 (105)	130 (95)	165 (120)
M14	63 (46)	80 (59)	120 (88)	150 (110)	175 (130)	220 (165)	205 (150)	260 (190)
M16	100 (74)	125 (92)	190 (140)	240 (175)	275 (200)	350 (255)	320 (235)	400 (300)
M18	135 (100)	170 (125)	265 (195)	330 (245)	375 (275)	475 (350)	440 (325)	560 (410)
M20	190 (140)	245 (180)	375 (275)	475 (350)	530 (390)	675 (500)	625 (460)	790 (580)
M22	265 (195)	330 (245)	510 (375)	650 (480)	725 (535)	920 (680)	850 (625)	1080 (800)
M24	330 (245)	425 (315)	650 (480)	820 (600)	920 (680)	1150 (850)	1080 (800)	1350 (1000)
M27	490 (360)	625 (460)	950 (700)	1200 (885)	1350 (1000)	1700 (1250)	1580 (1160)	2000 (1475)
M30	660 (490)	850 (625)	1290 (950)	1630 (1200)	1850 (1350)	2300 (1700)	2140 (1580)	2700 (2000)
M33	900 (665)	1150 (850)	1750 (1300)	2200 (1625)	2500 (1850)	3150 (2325)	2900 (2150)	3700 (2730)
M36	1150 (850)	1450 (1075)	2250 (1650)	2850 (2100)	3200 (2350)	4050 (3000)	3750 (2770)	4750 (3500)

^a "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

^b "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

TORQ2 -UN-07SEP99

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Electronic Fuel System Repair Specifications

Item	Measurement	Specification
Injection Pump	Type	Bosch P3000 In-Line with Std. or Electronic Governor
	Type	Bosch P7100 In-Line with Std. or Electronic Governor
Engine	Operating Speeds	OEM Engines (See Group 001 CTM86) Vehicle Engines (See Machine Technical Manual)
Injection Pump	Timing	No. 1 Engine Cylinder at TDC Compression Stroke
Fuel Filter Base-to-Block Mounting Cap Screws	Torque	35 N•m (25 lb-ft)
Fuel Pipe Connections at Filter Base	Maximum Torque	17 N•m (12 lb-ft) (150 lb-in.) maximum
Fuel Filter Base-to-Oil Filter Base Cap Screws	Torque	61 N•m (45 lb-ft)
Supply Pump Mounting Stud Nuts	Torque	5—7 N•m (4—5 lb-ft) (45—60 lb-in.)
Fuel Supply Pump Inlet and Outlet Lines	Torque	10 N•m (7 lb-ft)
Fuel Supply Pump Elbow Lock Nuts	Torque	35 N•m (26 lb-ft)
Fuel Supply Pump Inlet and Outlet Lines	Torque	10 N•m (7 lb-ft)
Aneroid Activator Special Screw	Torque	14 N•m (10 lb-ft)
Fuel Injection Pump Overflow Valve	Opening Pressure	130—180 kPa (1.3—1.8 bar) (19—26 psi)
Fuel Shut-off Solenoid Mounting Cap Screw	Torque	23 N•m (17 lb-ft)
Fuel Shut-off Solenoid Mounting Hex Nut	Torque	7 N•m (5 lb-ft)

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RG41183,000001E -19-02NOV00-1/3

Repair Specifications

Item	Measurement	Specification
Injection Pump-to-Cylinder Block Stud Nuts	Torque	47 N•m (35 lb-ft)
Injection Pump Drive Gear-to-Pump Hub Cap Screw	Torque	61 N•m (45 lb-ft)
Injection Pump Drive Gear Cover Cap Screws	Torque	27 N•m (20 lb-ft)
Fuel Delivery Line Connectors @ Delivery Valves and Nozzles	Torque	27 N•m (20 lb-ft)
Fuel Leak-Off Lines-to-Injection Pump Connectors	Torque	13 N•m (10 lb-ft)
Fuel Supply Pump Lines-to-Injection Pump	Torque	10 N•m (7 lb-ft)
Fuel Inlet Line-to-Injection Pump	Torque	10 N•m (7 lb-ft)
Injection Pump Lube Line	Torque	4.5 N•m (3 lb-ft) (36 lb-in.)
Injection Pump Housing Oil Fill Plug	Torque	25 N•m (18 lb-ft)
Injection Pump Governor Housing Oil Fill Plug	Torque	40 N•m (30 lb-ft)
Injection Pump Drive Gear Cover Cap Screws	Torque	27 N•m (20 lb-ft)
Fuel Inlet Line-to-Injection Pump	Torque	10 N•m (7 lb-ft)
Fuel Injection Nozzle	Type	21 mm with 7 mm tip
Fuel Injection Nozzle ¹	Tip Hole Sizes	7 hole x 0.208—0.255 mm ID x 148° Spray Angle
New Injection Nozzle (All Tip Sizes)	Opening Pressure	29 000 kPa (290 bar) (4200 psi) minimum
Used Injection Nozzle (All Tip Sizes)	Opening Pressure	26 200 kPa (262 bar) (3800 psi) minimum

¹ Nozzle tips available in various ID hole sizes: 0.208, 0.220, 0.236, 0.240, 0.244 and 0.255 mm.

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RG41183,000001E -19-02NOV00-2/3

Repair Specifications

Item	Measurement	Specification
Fuel Injection Nozzle Retaining Nut	Torque	60—80 N•m (44—59 lb-ft)
Fuel Injection Nozzle Gland Nut-to-Cylinder Head	Torque	88 N•m (65 lb-ft)
Fuel Injection Nozzle Leak-Off Connectors-to-Injectors (Metal Leak-Off Lines)	Torque	7.5 N•m (5.5 lb-ft) (66 lb-in.)
Fuel Injection Nozzle Leak-Off Connectors-to-Injectors (Nylon Leak-Off Lines)	Torque	15 N•M (11 lb-ft) (133 lb in.)
Fuel Leak-Off Lines-to-Connectors	Torque	11 N•m (8 lb-ft) (97 lb-in.)
Fuel Leak-Off Line-to-Injection Pump	Torque	13 N•m (10 lb-ft) (115 lb-in.)
Fuel Leak-Off Line End Plug	Torque	16 N•m (12 lb-ft) (142 lb-in.)
Fuel Injection Line Nuts at Delivery Valves	Torque	27 N•m (20 lb-ft)

RG41183,000001E -19-02NOV00-3/3

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Electronic Engine Control Repair Specifications

Item	Measurement	Specification
Coolant Temperature Sensor	Torque	14 N•m (10 lb-ft)
Fuel Shut-off Solenoid (on Injection Pump)	Torque	50 N•m (37 lb-ft)

RG41183,000001F -19-02NOV00-1/1

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Fuel System Diagnostic Specifications

Fuel Injection Nozzle Delivery Lines

Specification

FUEL INJECTION NOZZLE
DELIVERY LINES—Torque 27 N•m (20 lb-ft)

Overflow Valve on Injection Pump

Specification

OVERFLOW VALVE ON
INJECTION PUMP—Torque 30 N•m (22 lb-ft)

Fuel Shut-off Solenoid

PULL AND HOLD COIL RESISTANCE SPECIFICATIONS

Solenoid Voltage	Pull Coil Resistance (Ohms)	Hold Coil Resistance (Ohms)
12-Volt System	0.195-0.239 ^a	10.035-12.265
24-Volt System	0.735-0.899 ^a	37.215-45.485

^aSubtract multimeter test lead resistance.

RG40854,0000016 -19-22FEB01-1/1

Torque Curve Selection

NOTE: 7710 (40K), 7810 (40K), and 9100 Tractors have only one torque curve.

NOTE: 850C Crawlers only have one torque curve.

John Deere Applications

Torque Curve Selection for 7710 and 7810 Series Tractors

Torque Curve on DST or SERVICE ADVISOR™	Conditions
0	Default
1	Normal operations under 30 km/h (18.6 mi/hr)
2	Boost at greater than 30 km/hr (18.6 mi/hr)

Torque Curve Selection for 8000 Wheel and Track Tractors

Torque Curve on DST or SERVICE ADVISOR™	Conditions	Voltage Value Between Fuel Limit Select and Sensor Ground	Voltage Value Between Torque Curve Select and Sensor Ground
0	None of the condition below	Greater than 4.25 volts	Greater than 4.25 volts
1	Field cruise activated	Less than 1.5 volts	Greater than 4.25 volts
2	Any reverse speed	Between 3.5 and 4.0 volts	Greater than 4.25 volts
3	6FWD	Greater than 4.25 volts	Less than 1.5 volts
4	5FWD	Less than 1.5 volts	Less than 1.5 volts
5	1—4FWD	3.5—4.0 volts	Less than 1.5 volts

Torque Curve Selection for 8010 Wheel and Track Tractors

Torque Curve on DST or SERVICE ADVISOR™	Conditions
1	None of the conditions below
2	Field cruise activated
3	Any reverse speed
4	6FWD
5	5FWD
6	1—4FWD

Torque Curve Selection for 9976 Cotton Picker

Torque Curve on DST or SERVICE ADVISOR™	Conditions	Voltage Value Between Torque Curve Select and Sensor Ground
0	Normal Operation	Less than 1.5 volts
1	Auger boost ON	Greater than 4.25 volts

Torque Curve Selection for 9510, 9610, and 2268 Series Combines

Torque Curve on DST or SERVICE ADVISOR™	Conditions	Voltage Value Between Torque Curve Select and Sensor Ground
0	Normal Operation	Greater than 4.25 Volts
1	Auger boost ON	3.5—4.0 Volts
2	Derate for high MAT	Less than 1.5 Volts

SERVICE ADVISOR is a trademark of Deere & Company

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DPSG,RG40854,65 -19-15JAN99-1/4

Torque Curve Selection for 9550 and 9650 Series Combines

Torque Curve on DST or SERVICE ADVISOR™	Conditions
0	Default - No CAN bus
1	Normal operation
2	Auger boost ON

Torque Curve Selection for Peanut Combine

Torque Curve on DST or SERVICE ADVISOR™	Conditions	Voltage Value Between Torque Curve Select and Sensor Ground
0	Normal Operation	Greater than 4.25 Volts
1	Derate	Less than 1.5 Volts

Torque Curve Selection for Early 700 Series Motor Graders

Torque Curve on DST or SERVICE ADVISOR™	Conditions
1	770C - Gears 1—8 770CH - Gears 1—2
2	770CH - Gear 3
3	770CH - Gears 4—8
4	772CH - (HFWD OFF) Gears 1—2
5	772CH - (HFWD OFF) Gear 3
6	772CH - (HFWD OFF) Gears 4—8
7	772CH - (HFWD ON) Gears 1—2
8	772CH - (HFWD ON) Gear 3
9	772CH - (HFWD ON) Gears 4—8

Torque Curve Selection for Later 700 Series Motor Graders

Torque Curve on DST or SERVICE ADVISOR™	Conditions
1	770C - Gears 1—8 AND 770CH - Gears 1—2
2	770CH - Gear 3
3	770CH - Gears 4—5
4	772CH - (HFWD OFF) Gears 1—2
5	772CH - (HFWD OFF) Gear 3
6	772CH - (HFWD OFF) Gears 4—5
7	772CH - (HFWD ON) Gears 1—2
8	772CH - (HFWD ON) Gear 3
9	772CH - (HFWD ON) Gears 4—5
10	770CH - Gears 6—8
11	772CH (HFWD OFF) Gears 6—8 AND 772CH (HFWD ON) Gears 6—8

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Diagnostic Specifications

Torque Curve Selection for Early 600 Series Motor Graders

Torque Curve on DST or SERVICE ADVISOR™	Conditions
1	670C - Gears 1—8 670CH - Gears 1—2
2	670CH - Gear 3
3	670CH - Gears 4—8
4	672CH - (HFWD OFF) Gears 1—2
5	672CH - (HFWD OFF) Gear 3
6	672CH - (HFWD OFF) Gears 4—8
7	672CH - (HFWD ON) Gears 1—2
8	672CH - (HFWD ON) Gear 3
9	672CH - (HFWD ON) Gears 4—8

Torque Curve Selection for Later 600 Series Motor Graders

Torque Curve on DST or SERVICE ADVISOR™	Conditions
1	670C - Gears 1—8 AND 670CH - Gears 1—2
2	670CH - Gear 3
3	670CH - Gears 4—5
4	672CH - (HFWD OFF) Gears 1—2
5	672CH - (HFWD OFF) Gear 3
6	672CH - (HFWD OFF) Gears 4—5
7	672CH - (HFWD ON) Gears 1—2
8	672CH - (HFWD ON) Gear 3
9	672CH - (HFWD ON) Gears 4—5
10	670CH - Gears 6—8
11	672CH (HFWD OFF) Gears 6—8 AND 672CH (HFWD ON) Gears 6—8

Torque Curve Selection for 644 and LX 150 Loaders

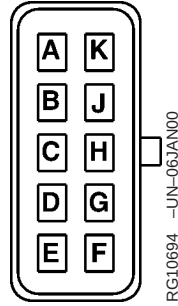
Torque Curve on DST or SERVICE ADVISOR™	Conditions
0	Default
1	Base Machine - 644H & LX150
2	644MH - Gear 1
3	644MH - Gears 2—4

Torque Curve Selection for Trucks

Torque Curve on DST or SERVICE ADVISOR™	Conditions
0	Default
1	Gears 1, 2, reverse
2	Gears, 3—5
3	Gear 6, neutral

OEM and Marine Applications

Torque Curve Selection for OEM Applications		
Torque Curve on DST or SERVICE ADVISOR™	Conditions	Voltage Value Between Torque Curve Select and Sensor Ground
0	High Power 224kW (300hp)	Greater than 4.25 volts
1	Medium Power 204kW (273hp)	3.0—4.0 volts
2	Low Power 187kW (250hp)	1.25—2.5 volts
3	High Power with 80% derate used for high MAT	Less than 0.9 volts



Connector

Performance Program

Torque Curve Selection for Marine Applications		
Torque Curve on DST or SERVICE ADVISOR™	Rated Speed	Jumper wire on Program Performance Connector:
0	High Power (2400 rpm rated)	No jumper wires installed
1	Medium High Power (2300 rpm rated)	Jumper wire installed between terminals C and H only
2	Medium Low Power (2200 rpm rated)	Jumper wire installed between terminals B and J.
3	Low Power (2100 rpm rated)	Jumper wire installed between terminals A and K only

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06
210
5

Governor Droop Mode Selection

John Deere Applications

Desired Speed Governor Selection for 8000 Series Wheel and Track Tractors

Mode on DST or SERVICE ADVISOR™	Conditions:
0	Normal droop
1	Transmission Calibration activated
2	Field Cruise active
3	Normal droop with baler gains
4	Normal droop with torque curve 3
5	Normal droop with torque curve 4
6	Normal droop with torque curve 5
12	Normal droop with baler with torque curve 3
13	Normal droop with baler with torque curve 4
14	Normal droop with baler with torque curve 5

Max. Speed Governor Selection 8000 Series Wheel and Tracks Tractors

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop

Desired Speed Governor Selection for 7710 and 7810 Series Tractors

Mode on DST or SERVICE ADVISOR™	Conditions:
0	Normal droop
2	Field Cruise ON
3	Normal droop with baler gains ON

Max. Speed Governor Selection for 7710 and 7810 Series Tractors

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop
11	Field Cruise ON
12	Baler Gain ON

Desired Speed Governor Selection for 9100 Series Tractors

Mode on DST or SERVICE ADVISOR™	Conditions:
0	Normal droop
2	Field Cruise ON

Max. Speed Governor Selection for 9100 Series Tractors

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop
11	Field Cruise ON

Desired Speed Governor Selection for 9550/9650 Series Combines

Mode on DST or SERVICE ADVISOR™	Conditions:
0	Normal droop
2	Auger operation ON

Max. Speed Governor Selection for 9550/9650 Series Combines

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop

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Desired Speed Governor Selection for Peanut Combines

Mode on DST or SERVICE ADVISOR™	Conditions:
0	Normal droop
2	Fast idle increase

Max. Speed Governor Selection for Peanut Combines

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop

Desired Speed Governor Selection for 2268 Combines

Mode on DST or SERVICE ADVISOR™	Conditions:
0	Normal droop
2	Power boost ON

Max. Speed Governor Selection for 2268 Combines

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop
10	Power boost ON

Desired Speed Governor Selection for 644 Loader/LX150 Loader

Mode on DST or SERVICE ADVISOR™	Conditions:
0	Normal droop

Max. Speed Governor Selection for 644 Loader/LX150 Loader

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop

Desired Speed Governor Selection for 850C Crawler

Mode on DST or SERVICE ADVISOR™	Conditions:
0	Normal droop

Max. Speed Governor Selection for 850C Crawler

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop

Desired Speed Governor Selection for 700 Series Graders

Mode on DST or SERVICE ADVISOR™	Conditions:
0	770CH: gears 6—8; 772CH with HFWD OFF: gears 6—8; 772CH with HFWD ON: gear 7
1	770C and 770CH: gears 1—3
2	770C: gears 4-8; 770CH: gears 4—5
3	772CH: gears 1—3
4	772CH: gears 4—5 and all other gears

Max. Speed Governor Selection for 700 Series Graders

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop
10	770CH: gears 6-8; 772CH: gears 6-8

Desired Speed Governor Selection for 600 Series Graders

Mode on DST or SERVICE ADVISOR™	Conditions:
0	670CH: gears 6—8; 672CH with HFWD OFF: gears 6—8; 672CH with HFWD ON: gear 7
1	670CH: gears: 1—2; 672CH: gears 1—2
2	672CH: reverse 3
3	670C/CH gear 3; 672CH gear 3;
4	670C/CH: Reverse 3; 670C: 4—8; 670CH: 4—5; 672CH 4—5; all other reverse gears

Max. Speed Governor Selection for 600 Series Graders

Mode on DST or SERVICE ADVISOR™	Conditions:
9	All other gears
10	670CH: gears 6—8; 672CH: gears 6—8

Desired Speed Governor Selection for Bell Truck

Mode on DST or SERVICE ADVISOR™	Conditions:
0	Normal droop

Max. Speed Governor Selection for Bell Truck

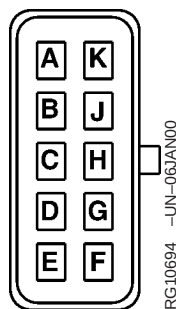
Mode on DST or SERVICE ADVISOR™	Conditions:
9	Gear 1, 2, reverse
10	Gear 3, 4, and 5
11	Gear 6 and neutral

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DPSG,RG40854,66 -19-15JAN99-3/6

OEM and Marine Applications**Desired Speed Governor Selection for OEM Applications**

Mode on DST or SERVICE ADVISOR™	Conditions:
0	Torque Curve 0
1	Torque Curve 1
2	Torque Curve 2
3	Torque Curve 3
4	Isochronous



Connector

Performance Program

Max. Speed Governor Selection for OEM Applications

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Torque Curve 0
10	Torque Curve 1
11	Torque Curve 2
12	Torque Curve 3
13	Isochronous

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Continued on next page

DPSG,RG40854,66 -19-15JAN99-4/6

Desired Speed Governor Selection for Marine Applications		
Mode on DST or SERVICE ADVISOR™	Conditions:	Jumper Wire Used:
0	High power (2400 rpm rated speed) normal droop	No jumper wire installed
1	Medium high power (2300 rpm rated speed) normal droop	No jumper wire installed
2	Medium low power (2200 rpm rated speed) normal droop	No jumper wire installed
3	Low power (2100 rpm rated speed) normal droop	No jumper wire installed
4	High power (2400 rpm rated speed) isochronous	Jumper wire installed between pins E and F on the performance program connector.
5	Medium high power (2300 rpm rated speed) isochronous	Jumper wire installed between pins E and F on the performance program connector.
6	Medium low power (2200 rpm rated speed) isochronous	Jumper wire installed between pins E and F on the performance program connector.
7	Low power (2100 rpm rated speed) isochronous	Jumper wire installed between pins E and F on the performance program connector.
11	High power (2400 rpm rated speed) with Alternate Low Speed Governor	Jumper wire installed between pins B and A on the throttle bump connector
12	Medium high power (2300 rpm rated speed) with Alternate Low Speed Governor	Jumper wire installed between pins B and A on the throttle bump connector

Diagnostic Specifications

13	Medium low power (2300 rpm rated speed) with Alternate Low Speed Governor	Jumper wire installed between pins B and A on the throttle bump connector
14	Low power (2100 rpm rated speed) with Alternate Low Speed Governor	Jumper wire installed between pins B and A on the throttle bump connector

Max. Speed Governor Selection for Marine Applications

Mode on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop

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DPSG,RG40854,66 –19–15JAN99–6/6

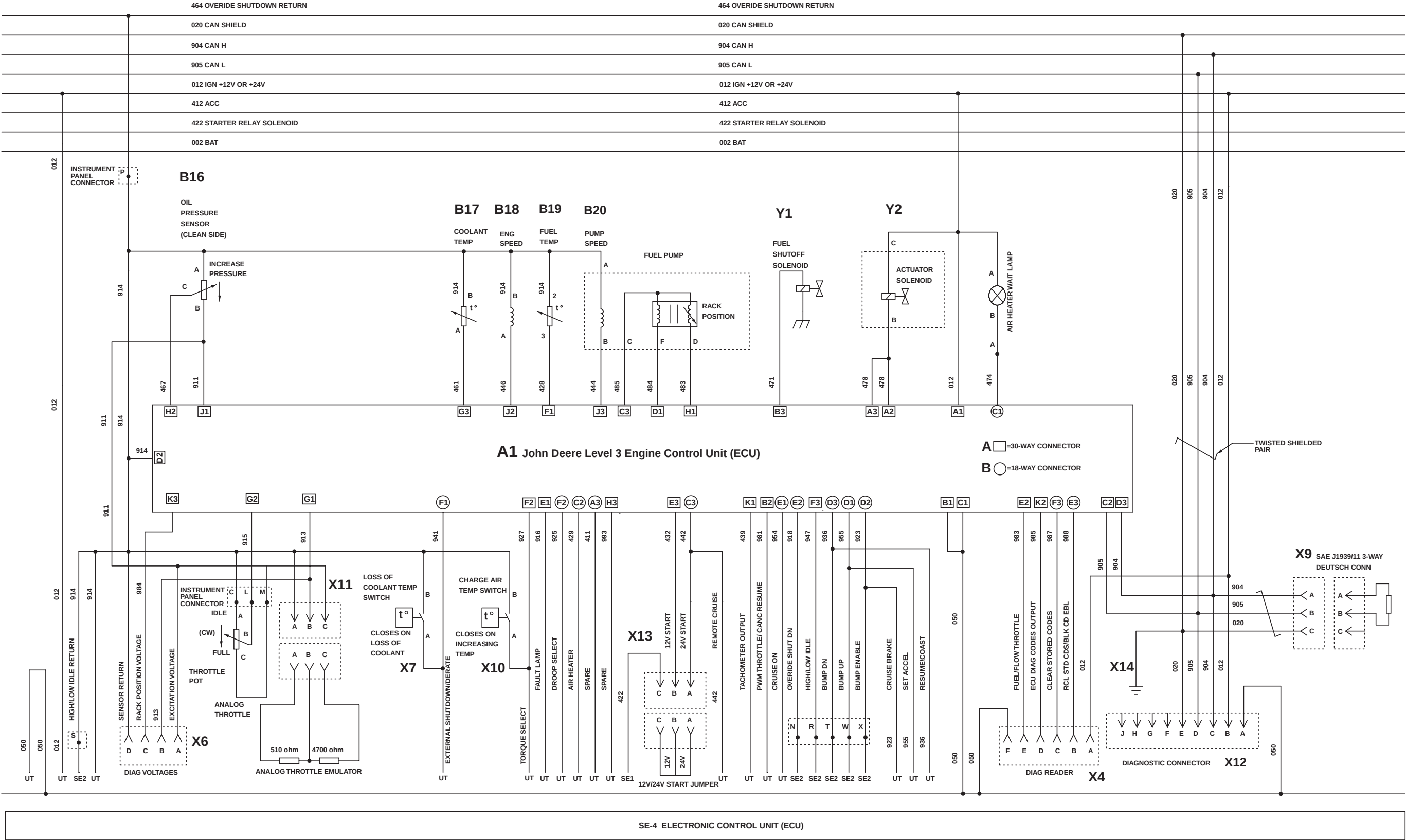
Input Voltage to ECU for Applications with Analog Throttle at Full Throttle

Full Throttle Input Voltage Value for Applications with Analog Throttle	
Application	Full Throttle Input Voltage Value
6650 Self-Propelled Forage Harvester	4.5—4.75 Volts
OEM (6081 A,H,T Engines)	4.0—4.75 Volts

DPSG,RG40854,67 –19–15JAN99–1/1

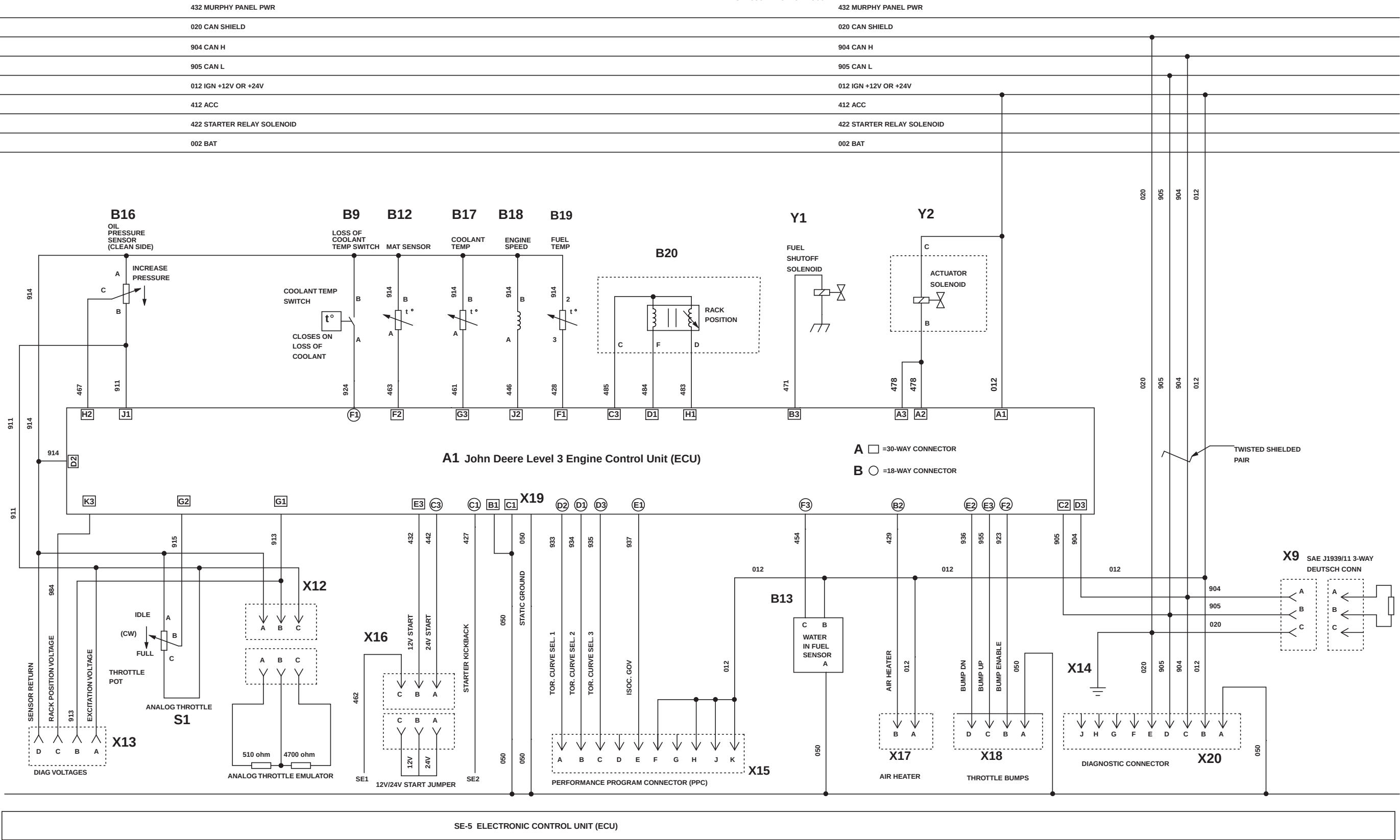
6.8 L and 8.1 L OEM Application Electronic Control System Wiring Diagram

RG11357 -19-22JAN01

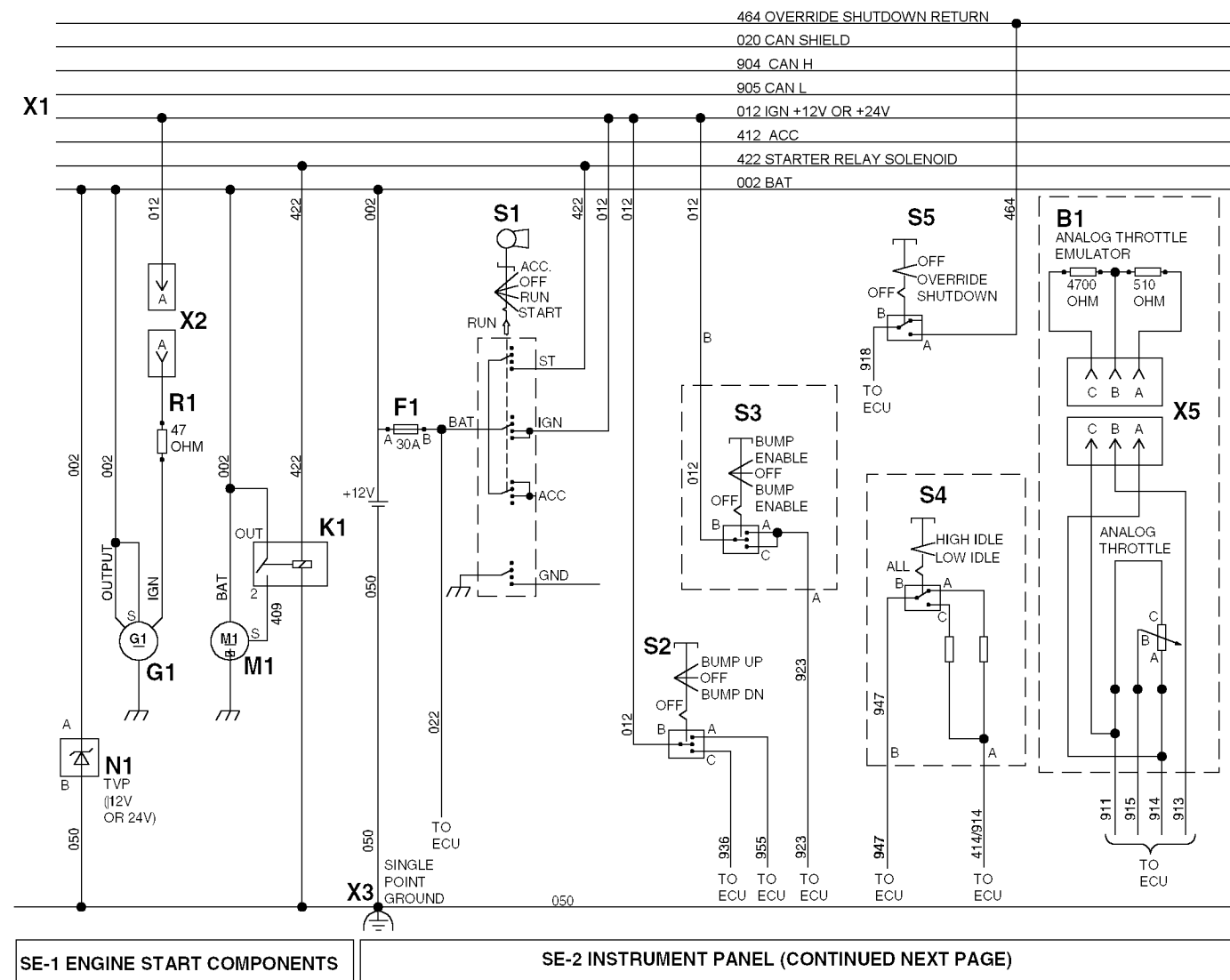


8.1L Marine Application Electronic Control System Wiring Diagram

RG11356 -19-18DEC00



6.8 L & 8.1 L OEM Application Instrument Panel/Engine Start Components Electrical Wiring Diagram



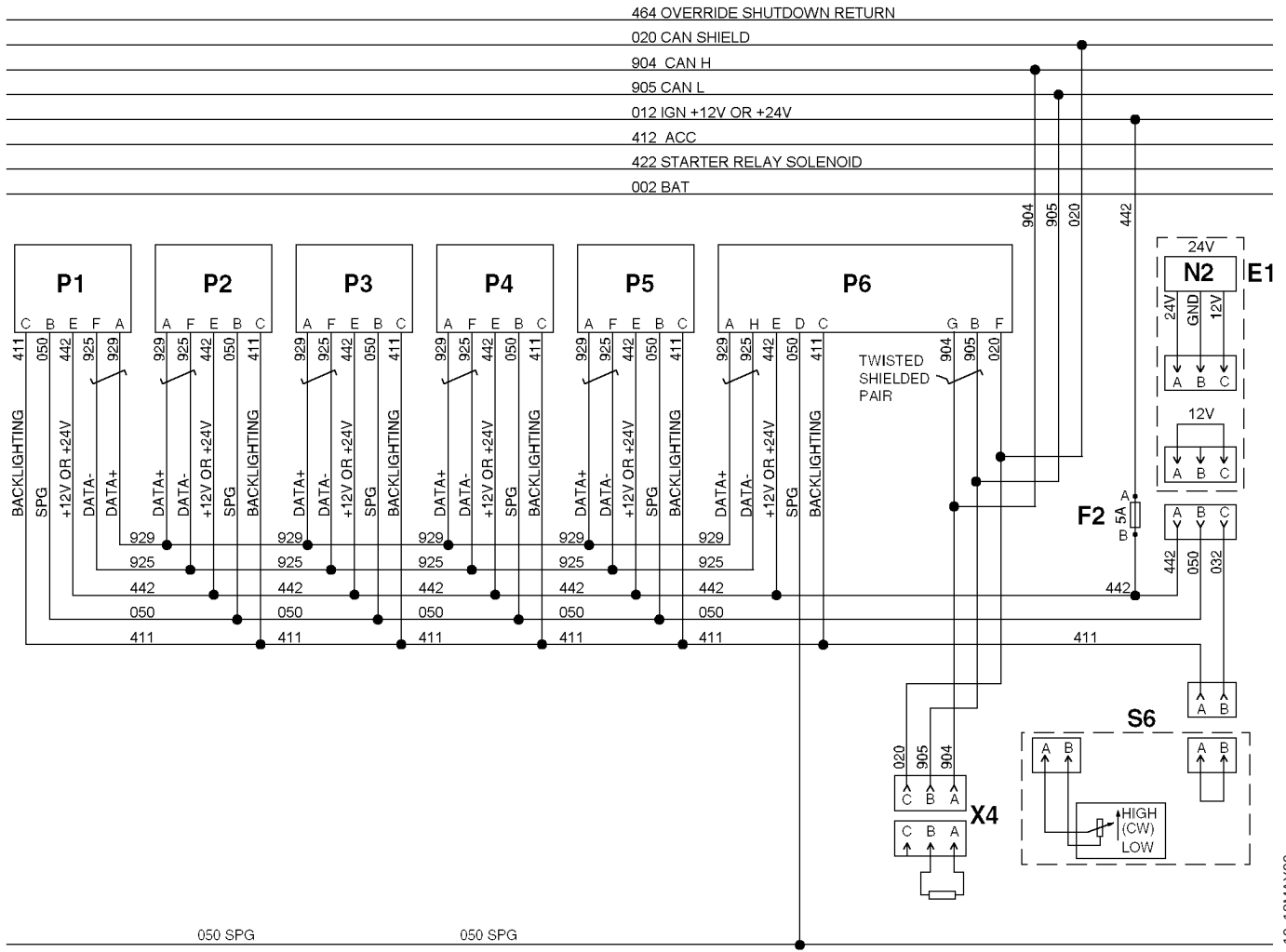
B1—Analog Throttle or Emulator
 E1—Back Light Regulator (24V) or Plug (12V)
 F1—Fuse (30 Amp)
 F2—Fuse (5 amp)
 G1—Alternator
 K1—Starter Relay
 M1—Starter Motor
 N1—Transient Voltage Protector

N2—Voltage Regulator (for 24V Operation)
 P1—Optional Gauge
 P2—Optional Gauge
 P3—Oil Pressure Gauge
 P4—Coolant Temperature Gauge
 P5—Tachometer Display
 P6—Hourmeter/Diagnostic Meter

R1—Resistor
 S1—Ignition Key Switch
 S2—Speed Select Switch (Momentary)
 S3—Bump Enable Switch (Momentary)
 S4—High-Low Speed Switch
 S5—Override Shutdown Switch (Momentary)
 S6—Dimmer Control or Jumper Plug

X1—Vehicle Harness Connector
 X2—Alternator Harness Connector
 X3—Single Point Ground
 X4—CAN Terminator
 X5—Analog Throttle Connector

6.8 L & 8.1 L OEM Application Instrument Panel/Engine Start Components Electrical Wiring Diagram - Continued



SE-2 INSTRUMENT PANEL (CONTINUED)

B1—Analog Throttle or Emulator
E1—Back Light Regulator (24V) or Plug (12V)
F1—Fuse (30 Amp)
F2—Fuse (5 amp)
G1—Alternator
K1—Starter Relay
M1—Starter Motor
N1—Transient Voltage Protector

N2—Voltage Regulator (for 24V Operation)
P1—Optional Gauge
P2—Optional Gauge
P3—Oil Pressure Gauge
P4—Coolant Temperature Gauge
P5—Tachometer Display
P6—Hourmeter/Diagnostic Meter

R1—Resistor
S1—Ignition Key Switch
S2—Speed Select Switch (Momentary)
S3—Bump Enable Switch (Momentary)
S4—High-Low Speed Switch
S5—Override Shutdown Switch (Momentary)
S6—Dimmer Control or Jumper Plug

X1—Vehicle Harness Connector
X2—Alternator Harness Connector
X3—Single Point Ground
X4—CAN Terminator
X5—Analog Throttle Connector

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RG-10040 -19-18MAY99

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