PowerTech™ 8.1L Diesel Engines

Level 9 Electronic Fuel System With Denso High Pressure Common Rail

TECHNICAL MANUAL

POWERTECH™ 8.1 L Diesel Engines Level 9 Electronic Fuel System With HPCR

27SEP05 (ENGLISH)

For complete service information also see:

PowerTech™ 8.1 L Diesel Engines Base Engine	CTM86
OEM Engine Accessories	CTM67
Alternators and Starter Motors	CTM77

John Deere Power Systems

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TP6374 9/05

Introduction

Forward

This manual (CTM 255) 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 Level 9 (Tier II) Electronic Fuel System (200,000—). The following four companion manuals cover other aspects of the 8.1L engine:

- CTM68—Electronic Fuel Injection Systems
- CTM86—PowerTech® 8.1L Diesel Engines Base Engine
- CTM243—PowerTech® 8.1L Diesel Engines Mechanical Fuel Systems
- CTM134—PowerTech® 6.8L and 8.1L Diesel Engines Level 3 Electronic Fuel Systems with Bosch In-Line Pump (—199,999 engines)

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 8.1 L engines, excluding CTM68, is available in a binder by ordering CTM 450 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 up coming 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 –19–12MAY00–1/1

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INDX

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.

Section 01
General

Contents

Handle Fuel Safely—Avoid Fires

Handle fuel with care: it is highly flammable. Do not refuel while smoking or when near open flame or sparks.

Always stop engine before refueling. Fill fuel tank outdoors.

Prevent fires by keeping engine clean of accumulated trash, grease, and debris. Always clean up spilled fuel.

TS202 –UN–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 –UN–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 –UN–23AUG88

DX,RCAP –19–04JUN90–1/1

Prevent Battery Explosions

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

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

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

TS204 –UN–23AUG88

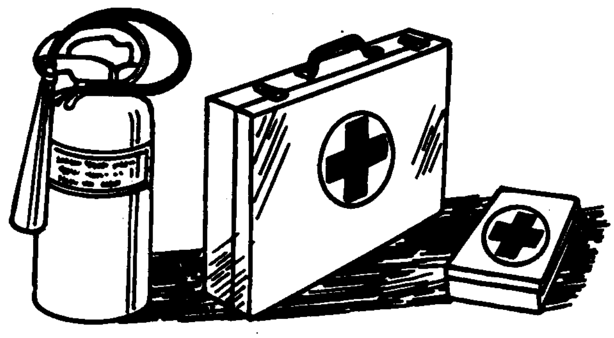
DX,SPARKS –19–03MAR93–1/1

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

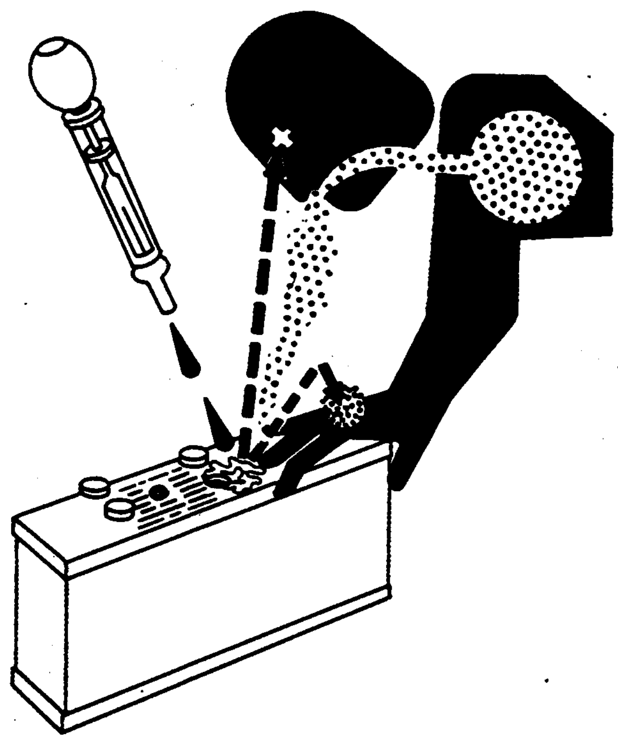
Handling Batteries Safely

TS204 –UN–23AUG88

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.



TS203 –UN–23AUG88

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.**

DPSG,OUO1004,2758 –19–11MAY00–1/1

Wait Before Opening High-Pressure Fuel System

High-pressure fluid remaining in fuel lines can cause serious injury. Only technicians familiar with this type of system should perform repairs. Before disconnecting fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system, wait a minimum of 15 minutes after engine is stopped.

TS1343 –UN–18MAR92

WL30140,0000007 –19–21JUN05–1/1

Avoid High-Pressure Fluids

High-pressure fluid remaining in fuel lines can cause serious injury. Before disconnecting fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system, wait a minimum of 15 minutes after engine is stopped..

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.

TS1343 –UN–18MAR92

DX,FLUID –19–03MAR93–1/1

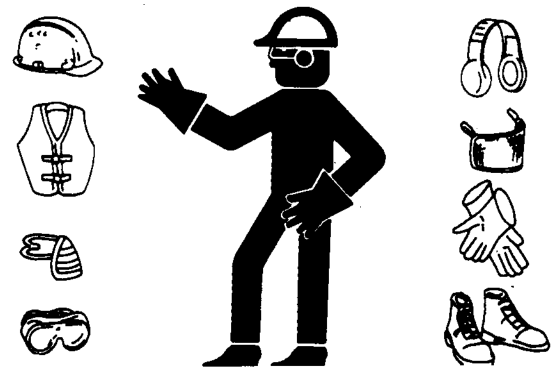
Wear Protective Clothing

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 machinery.



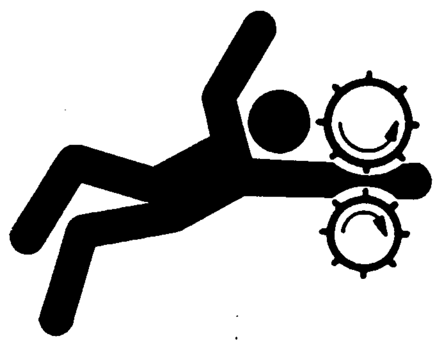
TS206 –UN–23AUG88

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.



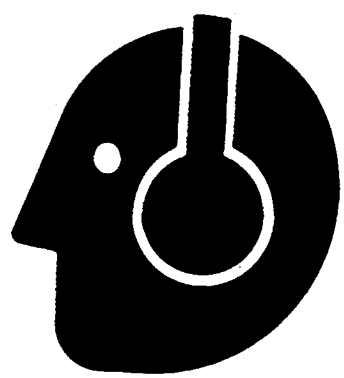
TS228 –UN–23AUG88

DX,LOOSE –19–04JUN90–1/1

Protect Against Noise

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

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



TS207 –UN–23AUG88

WL30140,0000006 –19–21JUN05–1/1

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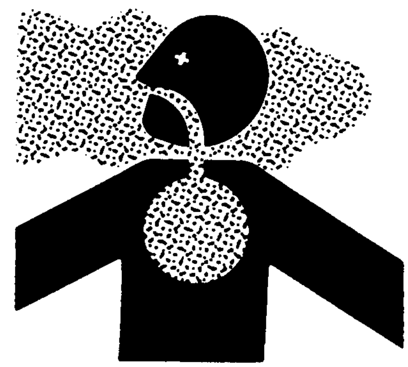
Work In Ventilated Area

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

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



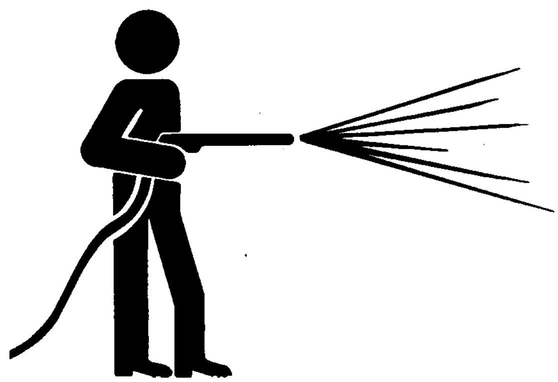
TS220 –UN–23AUG88

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 –UN–18OCT88

DX,CLEAN –19–04JUN90–1/1

Remove Paint Before Welding or Heating

Avoid toxic fumes and dust.

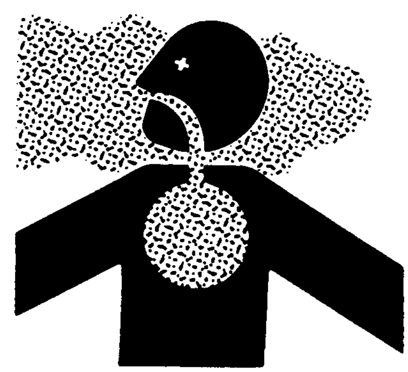
Hazardous fumes are generated when paint is heated by welding, soldering, or using a torch.

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

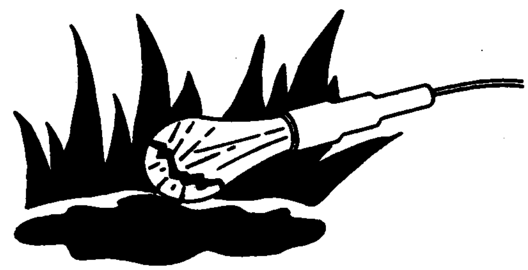
Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond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



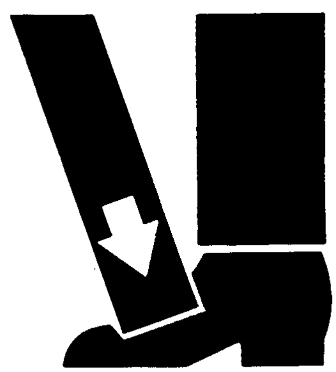
TS223 –UN–23AUG88

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.



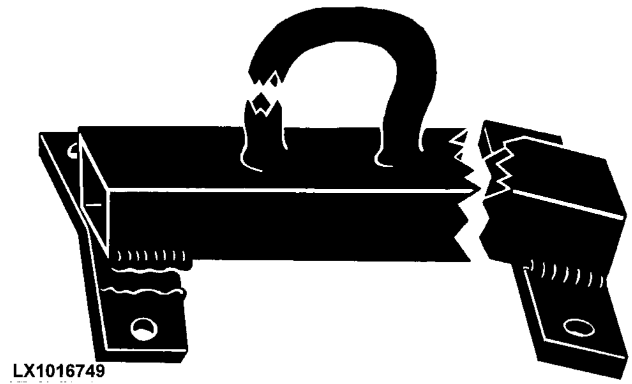
TS226 –UN–23AUG88

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.



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.

DX,SERV –19–17FEB99–1/1

Use Proper Tools

TS779 —UN—08NOV89

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

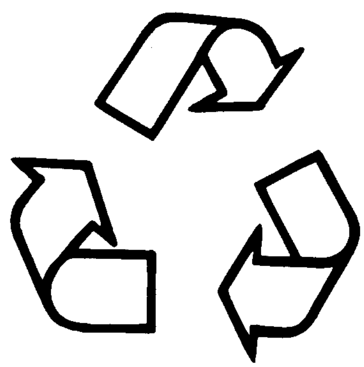
Use power tools only to loosen threaded parts and fasteners.

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.

DX,REPAIR —19—17FEB99—1/1

Dispose of Waste Properly



TS1133 —UN—26NOV90

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.

DX,DRAIN —19—03MAR93—1/1

Maintain Safety Systems

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 Model Designation

JOHN DEERE ENGINE MODEL—6081

John Deere engine model designation includes number of cylinders, displacement in liters, aspiration, user code, and application code. For example:

6081 HRW01 Engine

6	Number of cylinders
8.1	Liter designation
H	Aspiration code
RW	User code
01	Application Code

Aspiration Code

D	Naturally aspirated
T	Turbocharged, no aftercooling
A	Turbocharged and water-to-air aftercooled
H	Turbocharged and air-to-air aftercooled

User Factory Code

AT	Agritalia srl (Vittoria, Sicily, Italy)
CQ	S.L.C. Horizontina (Brazil)
DW	John Deere Davenport Works
F	OEM (Outside Equipment Manufacturers)
FF	Kernersville Deere-Hitachi (North Carolina)
FG	Goldoni S.P.A. (Modena, Italy)
FM	Marine Engines
H	John Deere Harvester Works
KV	John Deere Commercial Worksite Products (Knoxville TN)
L	John Deere Werke—Mannheim, Germany
LA	Hohn Deere Werke—Mannheim, Germany
	(eng. with Bosch VP44 Injection Pump)
LV	John Deere Commercial Products (Augusta, Georgia)
N	John Deere Des Moines Works
P	Industrias John Deere Mexico S.A. de C.V.
	(Saltillo/Monterrey, Mexico
PY	Larson & Toubro Ltd. (Pune, India)
RW	John Deere Waterloo Tractor Works
T	John Deere Dubuque Works
T8	Cameco—Deere (Thibodaux, Louisiana)
TJ	Timberjack—Deere (Sweden/Finland/Canada)
YC	John Deere Lialian Harvester Co. Limited (China)
Z	John Deere Werke Zweibrucken (Germany)

Application Code

001, etc.	See later in this Group

RG,RG34710,1021 –19–23OCT97–1/1

Engine Serial Number Plate Information

IMPORTANT: The engine serial number plate can be easily destroyed. Remove the plate or record the information elsewhere, before "hot tank" cleaning the block.

Engine Serial Number (A)

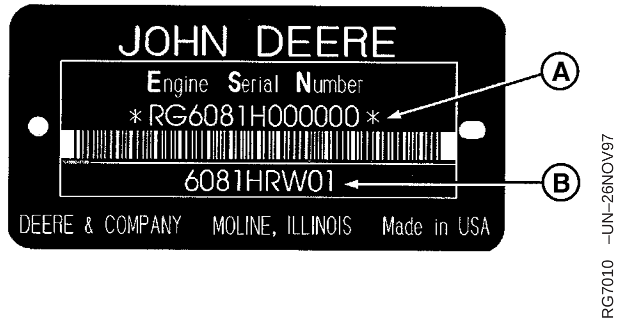
Each engine has a 13-digit John Deere engine serial number identifying the producing factory, engine model designation, and a 6-digit sequential number. The following is an example:

RG6081H000000
RG .... Factory code producing engine
6081H .... Engine model designation
000000 .... Sequential serial number
Factory Code
RG .... Waterloo Engine Works
Engine Model Designation
6801H ..... See ENGINE MODEL DESIGNATION earlier in this Group.
Sequential Number
000000 .... 6-digit sequential number

The engine serial number plate is located either on the right-hand side of engine between the oil filter base and the high pressure fuel pump (viewed from flywheel end) or on the left-hand side of the engine directly above the starter motor.

Engine Application Data (B)

The second line of information on the engine serial number plate identifies the engine/Deere machine or OEM relationship. See ENGINE APPLICATION CHART.

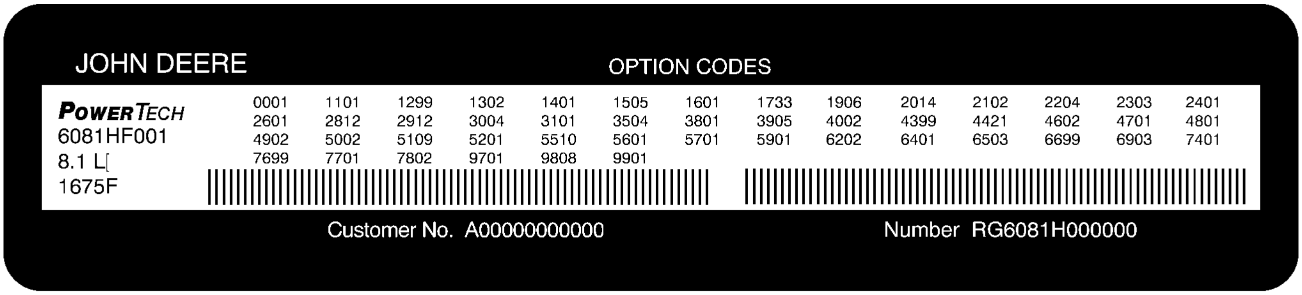


Engine Serial Number Plate

A—Engine Serial Number
B—Engine Application Data

RG41221,0000074 –19–21DEC00–1/1

Engine Option Code Label



RG7355 –UN–24MAY99

Option Code Label

In addition to the serial number plate, later OEM engines have an engine option code label affixed to the rocker arm cover. These codes indicate which of the engine options were installed on your engine at the factory.

Always provide option code information and engine base code when ordering repair parts. A listing of option codes is given in Parts Catalogs and Operator's Manuals.

NOTE: Before "hot tank" cleaning, ensure that option codes are recorded elsewhere. Record this information in the spaces provided in the Operation and Maintenance Manual.

DPSG,OUO1004,900 –19–17AUG01–1/1

Engine Application Chart

JOHN DEERE AGRICULTURAL EQUIPMENT	
Application	**Engine Model**
Tractors	
7710/7810 Tractor	6081HRW43
7820 Tractor	6081HRW41
7920 Tractor	6081HRW42
8120/8220 Tractors - FSA North America	6081HRW31
8120/8220 Tractors - FSA Region 2	6081HRW32
8120/8220 Tractors - Wheels/Tracks (Worldwide)	6081HRW23
8320 Tractor - FSA North America	6081HRW33
8320 Tractor - FSA Region 2	6081HRW34
8320 Tractor - Wheels/Tracks (Worldwide)	6081HRW25
8420 Tractor - FSA North America	6081HRW35
8420 Tractor - FSA Region 2	6081HRW36
8420 Tractor - Wheels/Tracks (Worldwide)	6081HRW27
8520 Tractor - FSA North America	6081HRW37
8520 Tractor - FSA Region 2	6081HRW38
8520 Tractor - Wheels/Tracks (Worldwide)	6081HRW28
9120 Tractor	6081HRW30
Cane Harvester	
CH3500 Sugar Cane Harvester	6081HT801
CH3500 Australian Cane Harvester	6081HT802
Combine	
9550 STS Combine	6081HH019
9560 STS Combine	6081HH019
9650 STS Combine	6081HH013
9650/9650 CTS Combine	6081HH017
9750 STS Combine	6081HH012
9760 STS Combine	6081HH025
Combine (Germany)	
9560/9560HM Combine	6081HZ008
9580/9580HM Combine	6081HZ009
9640/9640HM Combine	6081HZ009
9660/9660HM Combine	6081HZ010
9680/9680HM Combine	6081HZ011
9780/9780HM Combine	6081HZ012
9040/9040HM Combine	6081HZ017
9580/9580HM Combine	6081HZ017
9640 Combine	6081HZ017
9640 HM Combine	6081HZ017
9660/9660HM Combine	6081HZ018
9680 Combine	6081HZ019
9780 CTS Combine	6081HZ019

Continued on next page
RG,RG34710,1023 –19–02APR03–1/3

JOHN DEERE CONSTRUCTION AND FORESTRY EQUIPMENT	
Application	**Engine Model**
Loader/Grader	
644H/644J Loader	6081HDW08
724J Loader	6081HDW09
770/870 D-Series Grader	6081HDW
Sprayer (Antares)	
4920 Self-Prop. Sprayer	6081HN005
Forage Harvester (Germany)	
7200 Self Propelled Forage Harvester	6081HZ013/016
Cotton Picker	
9996 Cotton Picker	6081HN006
Crawler	
850J Crawler	6081HT006
Excavator (Japan)	
330CLC Excavator	6081HT002
370C Excavator	6081HT002
Forestry	
608B Feller Buncher - LP (Timberjack)	6081HTJ07
608L Feller Buncher - (Timberjack)	6081HTJ08
608S Feller Buncher - (Timberjack)	6081HTJ08
753G Feller Buncher - LP (John Deere)	6081HTJ08
850 Feller Buncher/Harvester (Timberjack)	6081HTJ05
950 Feller Buncher/Harvester (Timberjack)	6081HTJ09
853G/953G Feller Buncher/Harvester (John Deere)	6081HTJ05
1710/1710D Forwarder	6081HTJ02
1270D Harvester	6081HTJ03
1470D Harvester	6081HTJ04
560 Skidder (Timberjack)	6081HTJ06
748 Skidder (John Deere)	6081HTJ06
Dump Truck (Bell)	
250D/300D Articulated Dump Truck	6081HT005

Continued on next page RG,RG34710,1023 –19–02APR03–2/3

OUTSIDE EQUIPMENT MANUFACTURERS ENGINES

Application	Engine Model	Fuel System Option Code
OEM		
OEM Engine (200 HP)	6081HF070	72A1 - 72A2
OEM Engine (225 HP)	6081HF070	72B1 - 72B2
OEM Engine (250 HP)	6081HF070	72C1 - 72C2 - 72C3
OEM Engine (275 HP)	6081HF070	72D1 - 72D2
OEM Engine (300 HP)	6081HF070	72E1 - 72E2
OEM Engine (325 HP - Standard Torque)	6081HF070	72F1 - 72F2
OEM Engine (325 HP - Low Torque)	6081HF070	72G1 - 72G2
OEM Engine (350 HP - Genset)	6081HF070	722A - 722B
OEM Engine (413 HP - Genset)	6081HF070	723A - 723B
Marine		
S450 Marine OEM	6081AFM75	

RG,RG34710,1023 –19–02APR03–3/3

Lubricants and Coolant

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

RG41221,000000E –19–22SEP00–1/1

Diesel Fuel - Tier 1

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 0.50%. Sulfur content less than 0.05% is preferred.
- If diesel fuel with sulfur content greater than 0.50% 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.

RG41221,0000003 –19–17DEC02–1/1

Diesel Fuel - Tier 2

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.

Required fuel properties

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

Cetane number of 45 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 load level of 3100 grams as measured by ASTM D6078 or, maximum scar diameter of 0.45 mm as measured by ASTM D6079.

Sulfur content:

- Diesel fuel quality and fuel sulfur content must comply with all existing regulations for the area in which the engine operates.
- Sulfur content less than 0.05% (500 ppm) is preferred.
- If diesel fuel with sulfur content greater than 0.05% (500 ppm) is used, crankcase oil service intervals may be affected. (See recommendation for Diesel Engine Oil.)
- DO NOT use diesel fuel with sulfur content greater than 1.0%.

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

OUOD002,0000171 –19–17DEC02–1/1

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

Dieselscan Fuel Analysis

DIESELSCAN™ is a John Deere fuel sampling program to help you monitor the quality of your fuel source. It verifies fuel type, cleanliness, water content, suitability for cold weather operation, and if fuel is within ASTM specifications. Check with your John Deere dealer for availability of DIESELSCAN kits.

DX,FUEL6 –19–06DEC00–1/1

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 and Canada require sulfur content less than 0.05% (500 ppm).

Diesel fuel in the European Union requires sulfur content less than 0.05% (500 ppm).

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 load level of 3100 gram as measured by the ASTM D6078 or maximum scar diameter of 0.45 mm as measured by ASTM D6079.

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.

OUOD002,0000179 –19–18DEC01–1/1

Section 02
Repair and Adjustments

Contents

Fuel System - General Information

The low-pressure side of the fuel system exists in two configurations, the “single filter” (—246269) and the newer “dual filter” (246270—). The single filter design uses a 250-micron cleanable strainer and a 2-micron final filter. The dual filter design uses a 10-micron filter and a 2-micron filter. The newer dual-filter configuration is also different in the following ways:

- A diagnostic port is on the oil filter head (—246269) or fuel pump overflow valve fitting (246270—).
- Fuel return line from the injectors is routed to tank instead of a fitting on the primary filter pressure relief valve.
- Use of flexible hose.
- Check valve on fuel pump inlet.
- Check valve on primary fuel filter inlet.
- Bypass fuel from the final filter is directed to the transfer pump via a T-fitting on the primary filter.

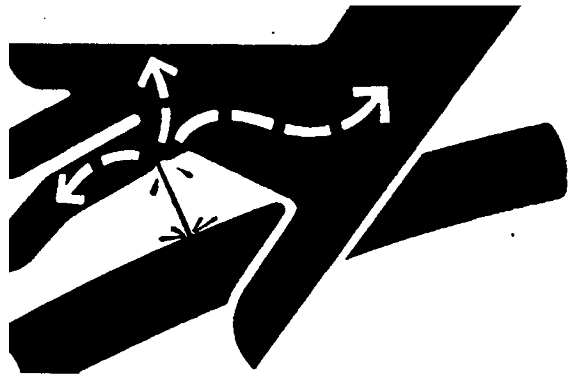
Separate procedures and illustrations are provided where necessary.

RG41165,0000036 –19–20AUG01–1/1

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.



X9811 –UN–23AUG88

High Pressure Fluids

The engine must be allowed to sit for at least 5 minutes before beginning work on the fuel system. This allows the fuel system to bleed off internal high pressure.

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. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) in Section 04, Group 150 later in this manual.

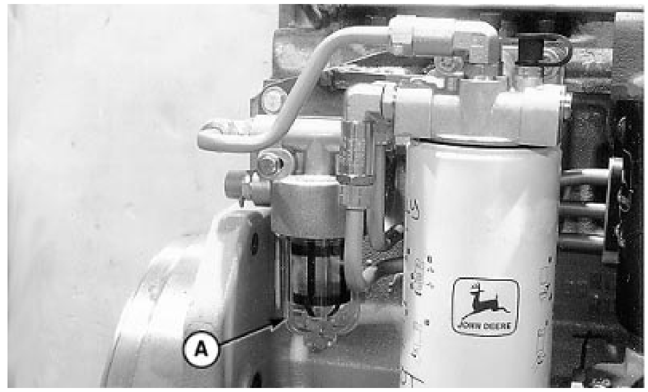
RG41165,0000037 –19–21DEC00–1/1

Clean Primary Fuel Filter (Strainer) (—246269)

NOTE: Do not clean fuel strainer and change final fuel filter at the same time. Clean fuel strainer and run engine before changing final fuel filter.

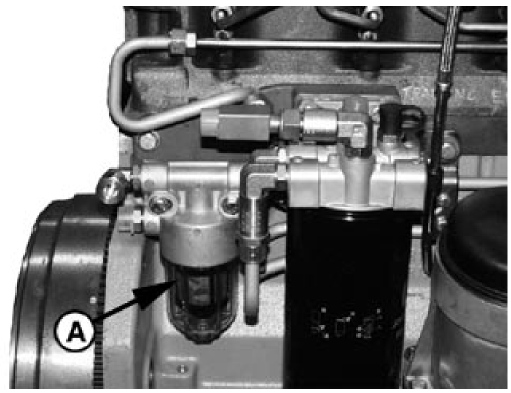
1. Close shut-off valve at bottom of fuel tank (not illustrated).
2. Thoroughly clean fuel strainer assembly and surrounding area.
3. Remove fuel strainer bowl (A) using a 1-inch socket on bottom of bowl.
4. Clean screen and replace O-ring (B) on bowl.
5. Install screen and bowl. Open shut-off valve and start engine.

A—Fuel Strainer
B—O-Ring



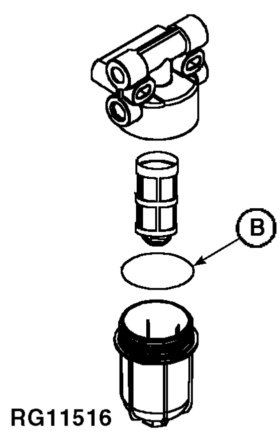
RG11078 –UN–10NOV00

Fuel Strainer



RG12245A –UN–22APR02

Fuel Strainer



RG11516 –UN–10NOV00

Fuel Strainer Parts

RG41221,000007A –19–03JAN01–1/1

Remove and Install Fuel Filter Head (—246269)

Remove Fuel Filter Head

1. Clean exterior of the final fuel filter/water separator assembly.

CAUTION: Fuel in filter may be under pressure. Open valve on bottom of water separator bowl to relieve pressure prior to removing filter.

2. Drain water and contaminants from water separator bowl into a suitable container.

3. Disconnect WIF sensor connector from bottom of filter.

4. Remove filter element using suitable filter wrench.

5. Disconnect fuel lines from inlet (A) and outlet (B) ports.

6. Disconnect fuel line fitting (C) from pressure relief valve.

7. Remove 2 capscrews (D) from filter head and remove head from mounting bracket on engine.

Install Fuel Filter Head

1. Loosely install filter head to filter mounting bracket. Do not tighten cap screws.

2. Loosely connect fuel lines to fuel filter inlet and outlet ports. Do not tighten.

3. Tighten filter head to mounting bracket on engine to specification.

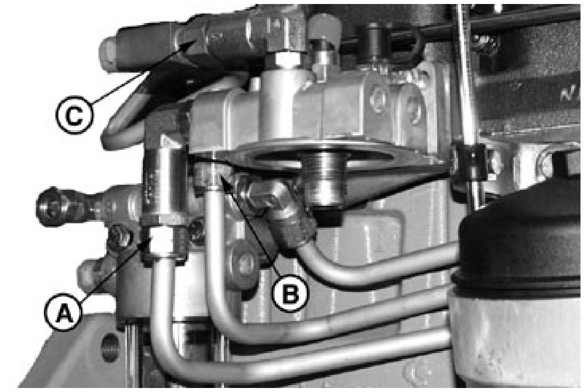
Specification

Fuel Filter Head to Mounting
Bracket Cap Screws—Torque .... 40 N•m (30 lb-ft.)

4. Tighten fuel lines on the final filter inlet and outlet ports to specification.

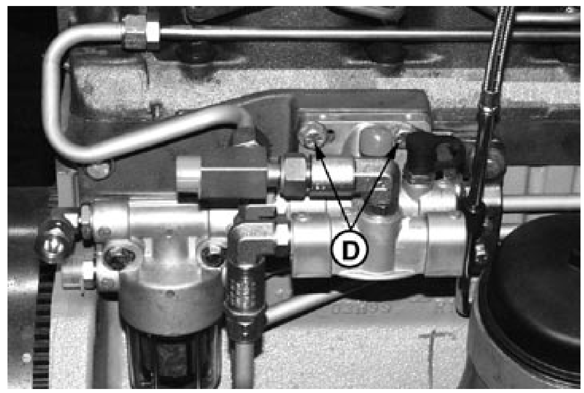
Specification

Fuel Lines—Torque .... 27 N•m (20 lb-ft.)



RG12280A –UN–22APR02

Final Fuel Filter Fuel Lines



RG12281A –UN–22APR02

Filter Head Cap Screws

A—Fuel Inlet Line
B—Fuel Outlet Line
C—Relief Valve
D—Filter Head Cap Screws

Continued on next page

5. Connect and tighten fuel line to pressure relief valve to specification.

Specification

Fuel Line - Attach to Final Fuel
Filter Relief Valve—Torque .... 27 N•m (20 lb-ft.)

6. Lubricate gasket and install filter element onto base. Tighten 3/4 turn after packing contacts base.

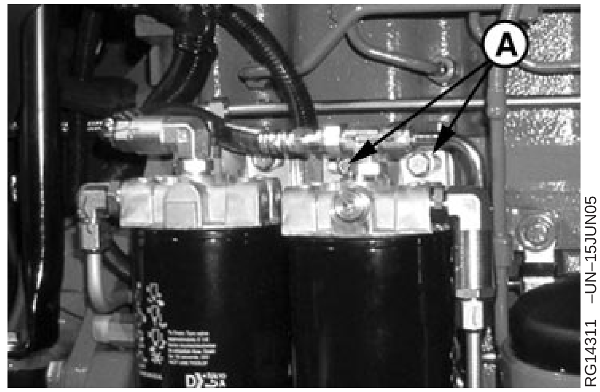
7. Make sure that drain valve is closed on the bottom of the filter element.

8. Connect WIF sensor connector.

9. Bleed the fuel system. See BLEED THE FUEL SYSTEM (—246269) in Section 04, Group 150 later in this manual.

RG41165,0000038 –19–16APR02–2/2

Remove and Install Fuel Filter Heads (246270—)



A—Filter Head Cap Screws

Remove Fuel Filter Heads

1. Clean exterior of filter assemblies.
2. Drain water and contaminants from filters into a suitable container.
3. Disconnect WIF sensor connector from bottom of filter.
4. Disconnect fuel temperature sensor connector from filter head.
5. Remove filter elements using suitable filter wrench.
6. Disconnect all fuel hoses and lines from fittings on filter heads.
7. Remove 2 capscrews (A) from each filter head and remove heads from mounting bracket on engine.

Install Fuel Filter Heads

1. Loosely install filter heads to filter mounting bracket. Do not tighten cap screws.
2. Loosely connect fuel lines and hoses to fuel filter head fittings. Do not tighten.
3. Tighten filter heads to mounting bracket on engine to specification.

Specification
Fuel Filter Head to Mounting
Bracket Cap Screws—Torque.. 40 N•m (30 lb-ft.)

4. Tighten fuel hoses and lines on filter fittings to specification.

Specification
Fuel Hoses—Torque .... 24 N•m (18 lb-ft.)

Specification
Fuel Lines—Torque.. 27 N•m (20 lb-ft.)

5. Prefill filters using prefill cups provided with filters.

Continued on next page

WL30140,0000001 –19–18APR05–1/2

6. Lubricate filter gasket and install filter element onto base. Tighten 3/4 turn after packing contacts base.

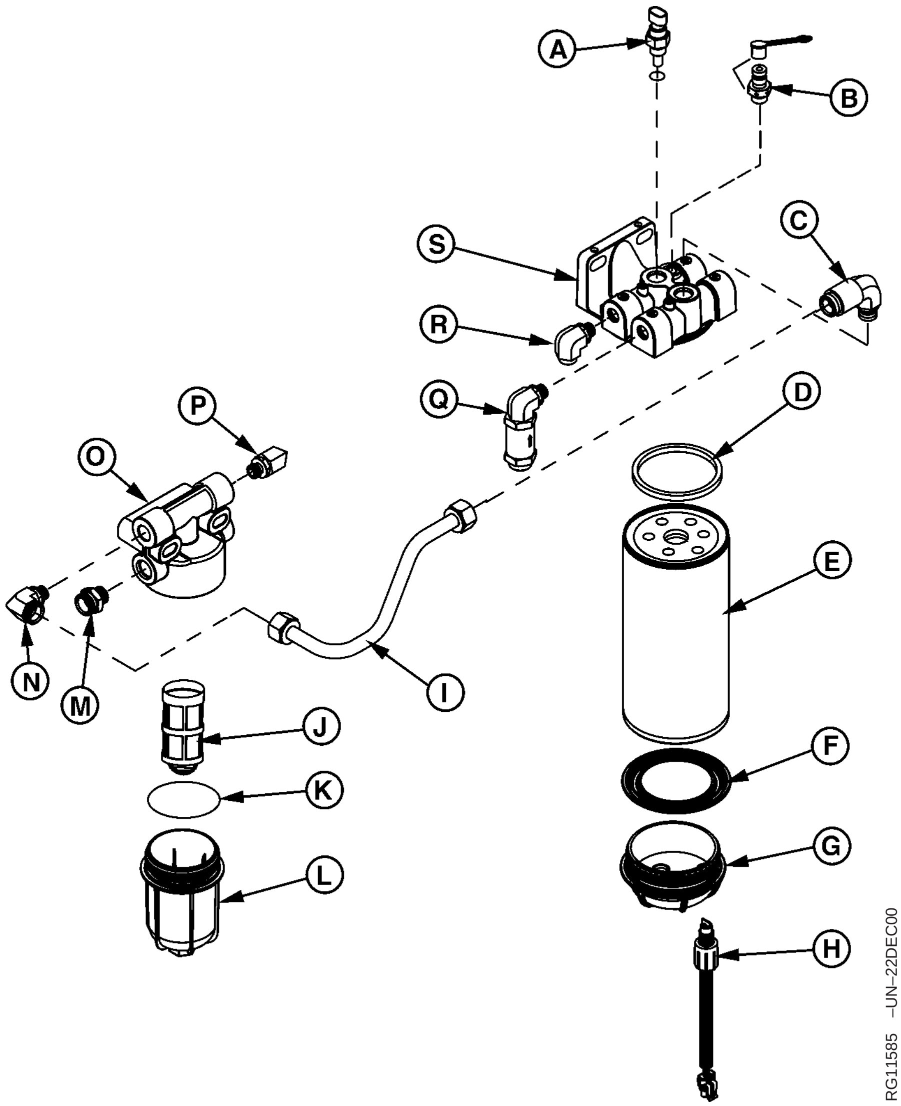
7. Make sure that the drain valves are closed on the bottom of the filter elements.

8. Connect WIF sensor connector and the water-in-fuel sensor connector.

9. Bleed the fuel system. See BLEED THE FUEL SYSTEM (246270—) in Section 04, Group 150 later in this manual.

WL30140,0000001 –19–18APR05–2/2

Fuel Filter Assemblies (—246269)



Fuel Filter Assemblies, Bypass Fuel Directed to Transfer Pump

A—Temperature Sensor
B—Diagnostic Port
C—Pressure Relief Valve
D—Gasket
E—Final Fuel Filter Element
F—O-ring
G—Water Separator Bowl
H—Water in Fuel Sensor
I—Fuel Line
J—Primary Fuel Filter
K—O-ring
L—Primary Fuel Filter Bowl
M—Fitting
N—Fitting
O—Primary Fuel Filter Header
P—Fitting
Q—Check Valve
R—Fitting
S—Final Fuel Filter Header

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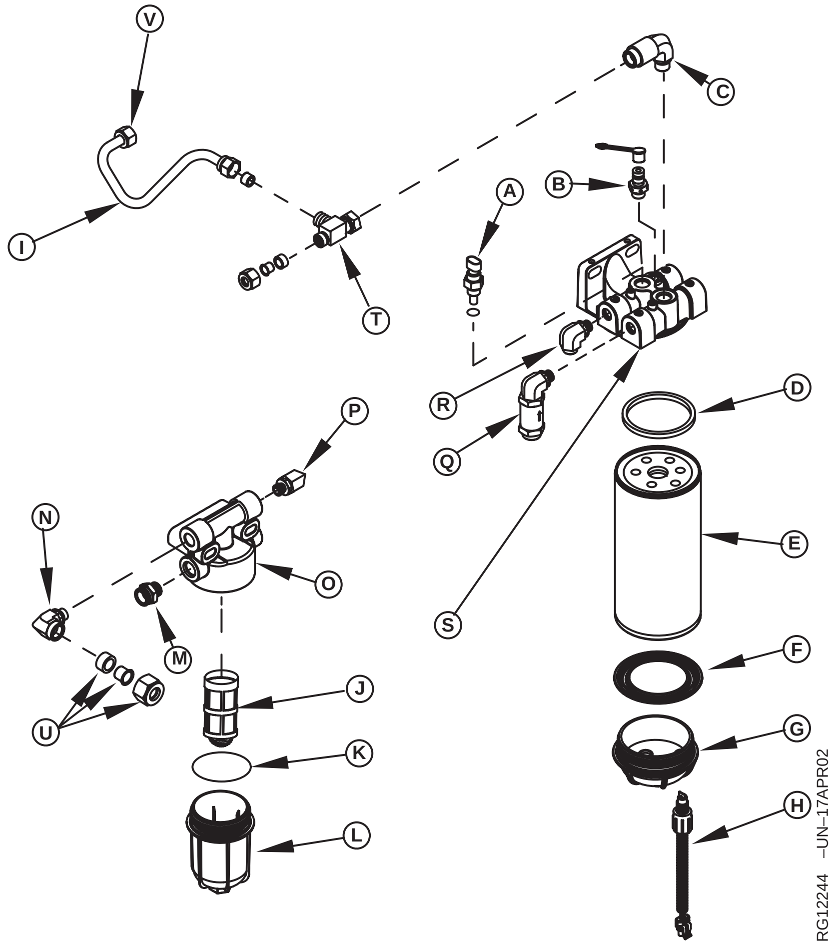
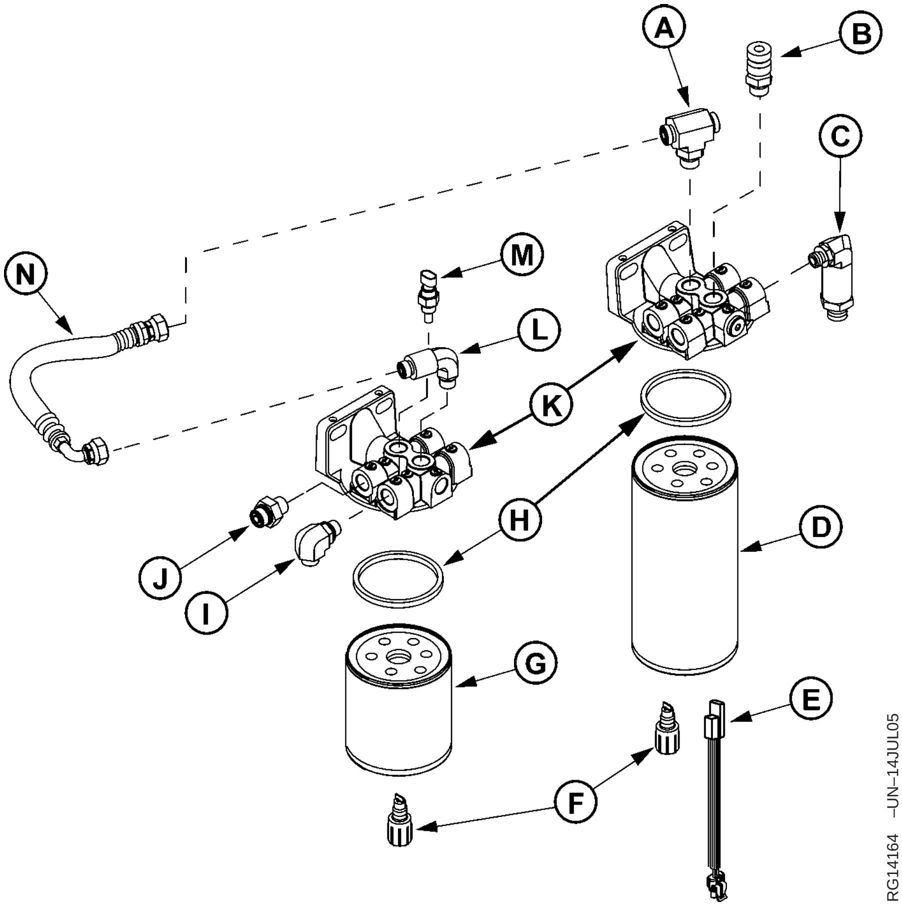


Fuel Filter Assemblies, Bypass Fuel Directed to Tank

A—Temperature Sensor
B—Diagnostic Port
C—Pressure Relief Valve
D—Gasket
E—Final Fuel Filter Element
F—O-ring
G—Water Separator Bowl
H—Water in Fuel Sensor
I—Fuel Line
J—Primary Fuel Filter
K—O-ring
L—Primary Fuel Filter Bowl
M—Fitting
N—Fitting
O—Primary Fuel Filter Header
P—Fitting
Q—Check Valve
R—Fitting
S—Final Fuel Filter Header
T—T-fitting
U—Fitting cap
V—Fitting to fuel leak-off line

RG41165,0000039 –19–21DEC00–2/2

Fuel Filter Assemblies (246270—)



A—T-Fitting
B—Diagnostic Port
C—Check Valve
D—Fuel Filter Element, 10-Micron
E—Water-in-Fuel Sensor
F—Drain Valve
G—Fuel Filter Element, 2-Micron
H—Gasket
I—Adapter
J—Fitting
K—Fuel Filter Header
L—Pressure Relief Valve
M—Temperature Sensor
N—Fuel Line, Bypass

RG41165,0000039 –19–21DEC00–1/1

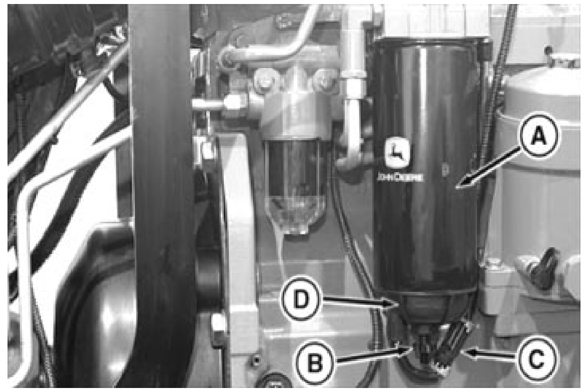
Replace Final Fuel Filter Element (—246269)

NOTE: Do not clean fuel strainer and change fuel filter at the same time. Clean fuel strainer and run engine before changing fuel filter.

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

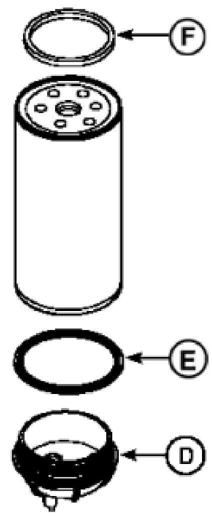
CAUTION: Fuel in filter may be under pressure. Open valve on bottom of water separator bowl to relieve pressure prior to removing filter.

2. Drain water and contaminants from water separator bowl into a suitable container by opening the drain valve (B) on bottom of filter.
3. Disconnect the WIF sensor connector (C).
4. Remove water separator bowl (D) from filter element and remove O-ring (E). Clean separator bowl and dry with compressed air.
5. Inspect bowl (D). Replace if necessary.
6. Install new O-ring (E) on separator bowl. Do not reuse old O-ring.
7. Lubricate O-ring (E) and install separator bowl onto new filter element. Tighten 1/2 turn after O-ring contacts filter.
8. Remove the old filter element (A) using a suitable filter wrench.



RG11749 –UN–10JUL01

Final Fuel Filter



RG11517A –UN–10JUL01

Final Fuel Filter Parts

A—Filter Element
B—Drain Valve
C—WIF Sensor Connector
D—Water Separator
E—O-ring
F—Packing

Continued on next page RG41221,00000C6 –19–16APR02–1/2

9. Using the filter cup (A), fill the new final filter element with fuel and drain excess fuel into suitable container.

IMPORTANT: Avoid fuel system contamination. Do not pour fuel directly into filter without filler cup. Injection pump could seize.

NOTE: Pour fuel slowly to allow fuel to flow into the element. This will eliminate the need to dump out access fuel once the element is full.

10. Remove and dispose of filler cup.

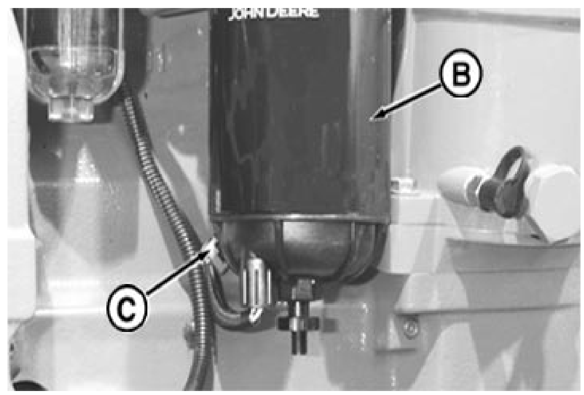
11. Lubricate packing (F) (on previous page) and install filter onto base. Tighten 3/4 turn after packing contacts base. Connect sensor.

12. Start and run engine at fast idle for 2 minutes. If engine won't start or dies, bleed the fuel system. See BLEED THE FUEL SYSTEM (—246269) in Section 04, Group 150 later in this manual. If engine will not start after bleeding the fuel system, prime the fuel system. See RESTARTING ENGINE THAT HAS RUN OUT OF FUEL (—246269) in Section 04, Group 150 later in this manual.

A—Filler Cup
B—Fuel Filter Element
C—Water Separator

RG11750 –UN–10JUL01

Filling Fuel Filter



RG11751 –UN–10JUL01

Filter Element/Water Separator

RG41221,00000C6 –19–16APR02–2/2

Replacing Fuel Filter Elements (246270—)

1. Thoroughly clean exterior of fuel filter assembly and surrounding area.

CAUTION: Fuel in filter may be under pressure. Open valve (C) on bottom of filter to relieve pressure prior to removing filter.

NOTE: Fuel/water separator is part of the fuel filter element.

2. Drain water and contaminates from fuel filters (A) and (B) into a suitable container by opening the drain valve (C) on bottom of filters.

3. Disconnect the WIF sensor connector (D).

IMPORTANT: Always replace both filters at the same time.

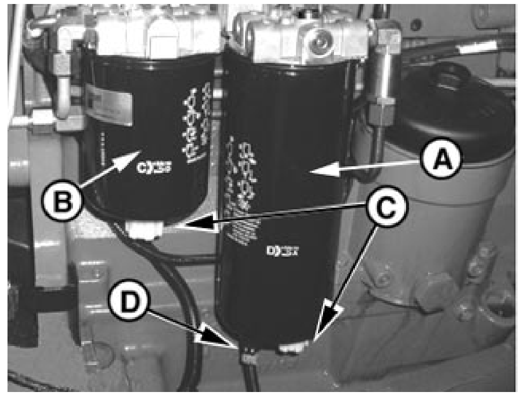
4. Remove the old filter elements (A) and (B) using a suitable filter wrench.

5. Remove WIF sensor from old primary filter. Inspect O-ring, replace as necessary and install in new primary fuel filter. Tighten to specification.

Specification

Water In Fuel (WIF) Sensor—
Torque .... 3 N•m (30 lb-in.)

A—Primary Fuel Filter
B—Secondary Fuel Filter
C—Drain Valve
D—WIF Sensor Connector

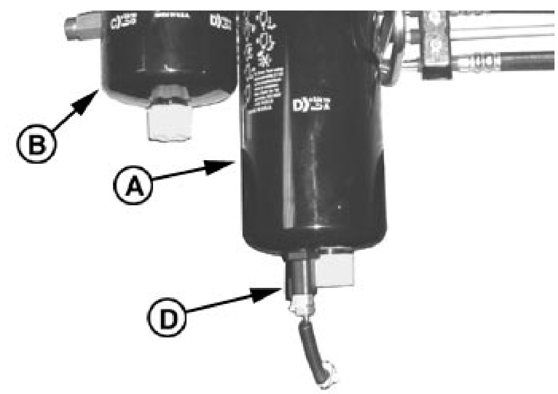


RG13299 –UN–15OCT03

Fuel Filters


RG13297 –UN–14OCT03

Removing Fuel Filter



RG13298 –UN–14OCT03

Water In Fuel (WIF) Sensor

Continued on next page RG41183,000005E –19–06OCT03–1/2

6. Using the filter cups (A) that are included with the filter element, fill the new fuel filter elements with fuel and drain excess fuel into suitable container.

NOTE: The primary and secondary fuel filter use different size filter cups. Use correct fill cup on filters to ensure fuel is properly filtered during prefill.

IMPORTANT: Avoid fuel system contamination. Do not pour fuel directly into filter without filler cup. Injection pump could seize.

NOTE: Pour fuel slowly to allow fuel to flow into the element. This will eliminate the need to dump out access fuel once the element is full.

7. Lubricate packing and install filters onto base. Tighten 1/2 turn after packing contacts base. Connect sensor.

8. Start and run engine at fast idle for 2 minutes. If engine won't start or dies, bleed the fuel system. See BBLEED THE FUEL SYSTEM (246270—). If engine will not start after bleeding the fuel system, prime the fuel system. See RESTARTING ENGINE THAT HAS RUN OUT OF FUEL (—246269).

RG11750 –UN–10JUL01

Filling Fuel Filter

A—Filler Cup
B—Fuel Filter Element

RG41183,000005E –19–06OCT03–2/2

Remove and Install High Pressure Fuel Pump Overflow Valve

Remove Overflow Valve

CAUTION: Fuel in the high pressure fuel pump is under extremely high pressure. Relieve pressure before opening pump.

1. Before removing overflow valve, turn engine OFF and let sit for at least 5 minutes. This will relieve fuel pressure from the High Pressure Fuel Pump.

IMPORTANT: If any dirt, paint chips, or debris enters the fuel system, injector failure will occur!

2. Thoroughly clean all fuel lines, fittings, and components around the overflow valve.

3. Remove fuel leak-off line(s) from overflow valve (A) (lines are shown removed).

4. Remove overflow valve.

5. Remove seal and replace with new. Do not reuse seal.

Install Overflow Valve

1. Install overflow valve with new seal. Tighten to specifications.

Specification

Overflow Valve (Single Filter Systems)—Torque.. 17 N•m (12.5 lb-ft)

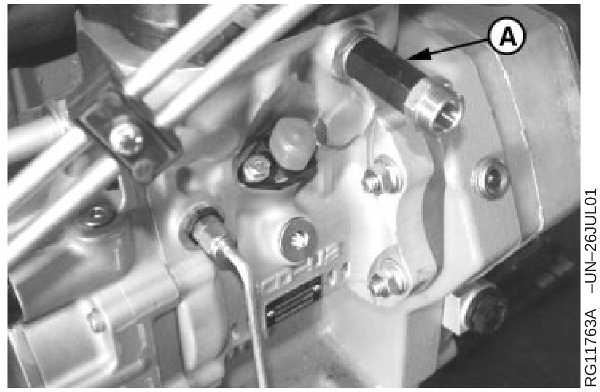
Specification

Overflow Valve (Dual Filter Systems)—Torque... 27 N•m (20 lb-ft)

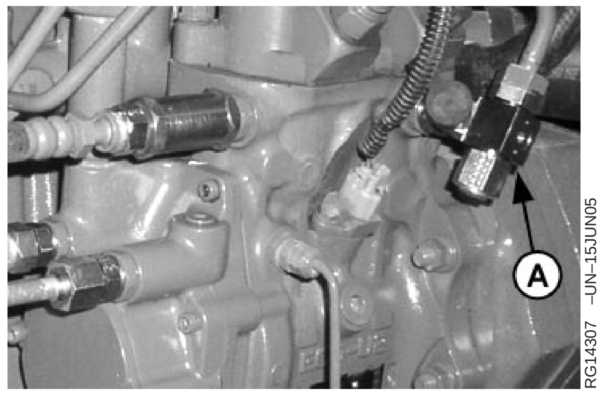
2. Install fuel leak-off line(s) to overflow valve. Tighten to specification.

Specification

Fuel Leak-off Line Fittings (Single Filter Systems)—Torque... 20 N•m (15 lb-ft)



Overflow Valve (—246269)



Overflow Valve (246270—)

A—Overflow Valve

Continued on next page

Specification

Fuel Leak-off Hose Fittings (Dual Filter Systems)—Torque.. 24 N•m (18 lb-ft)

3. Bleed the fuel system. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) in Section 04, Group 150 later in this manual.

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RG41221,0000218 –19–16APR02–2/2

Remove and Install Hand Primer

Remove Hand Primer

CAUTION: Fuel in the high pressure fuel pump is under extremely high pressure. Relieve pressure before opening pump.

1. Before removing hand primer, turn engine OFF and let sit for at least 5 minutes. This will relieve fuel pressure from the High Pressure Fuel Pump.

IMPORTANT: If any dirt, paint chips, or debris enters the fuel system, injector failure will occur!

2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the hand primer.

3. Remove hand primer assembly (A) from pump.

4. Remove washer (B), piston (C), and spring (D) from bore in pump.

5. Replace complete assembly.

6. Remove seal and replace with new. Do not reuse seal.

Install Hand Primer

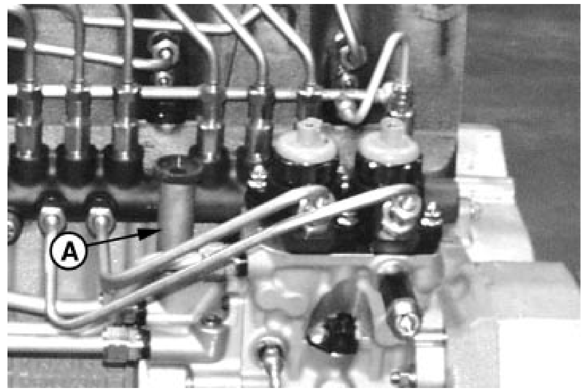
1. Install piston (C), spring (D), and then washer (B) (in this order) in the bore of the pump.

2. Install hand primer (A). Tighten to specification.

Specification

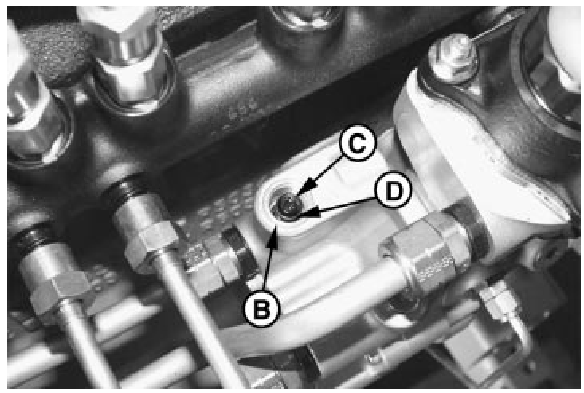
Hand Primer—Torque .... 49 N•m (36 lb-ft)

3. Bleed the fuel system. See BLEED THE FUEL SYSTEM (—246269) in Section 04, Group 150 later in this manual.



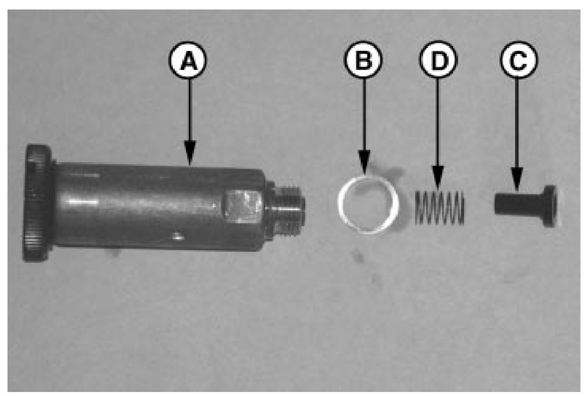
RG11764A –UN–26JUL01

Hand Primer



RG11765A –UN–26JUL01

Hand Primer Port



RG11766A –UN–26JUL01

Exploded view of Hand Primer

A—Hand Primer
B—Brass Washer
C—Piston
D—Spring

RG41221,0000219 –19–16APR02–1/1

Remove High Pressure Fuel 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. Rotate engine flywheel (in normal running direction) with JDG820 Flywheel Turning Tool until No. 1 piston is at "TDC" of its compression stroke.

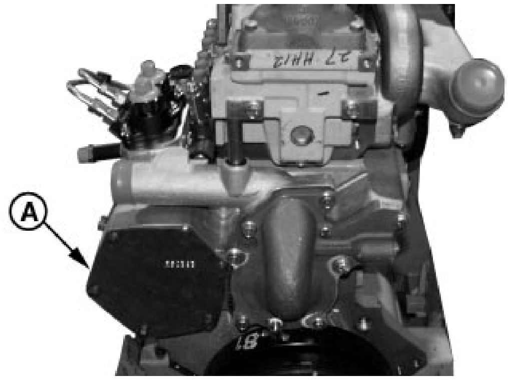
3. Remove High Pressure Fuel Pump Drive Gear Cover (A). Remove and discard all gasket material or O-ring.

4. With engine at No. 1 "TDC-Compression," install JDG886 Timing Pin (B) through hole in gear into the drive hub of the high pressure fuel pump. Thread the tool into the drive hub until the tool flange bottoms on the hub. Behind the hub is a bracket with a hole in which the end of the timing tool is now located. Since the bracket is attached to the pump body, the hub is prevented from rotating.

NOTE: If JDG886 Timing Pin cannot be threaded into the fuel pump drive hub, engine may be at No. 6 "TDC-Compression." Rotate engine one full revolution in running direction until JDE81-4 Timing Pin engages in flywheel again. Engine should then be at No. 1 "TDC-Compression." Timing pin should be in the 9 o'clock position when No. 1 "TDC-Compression".

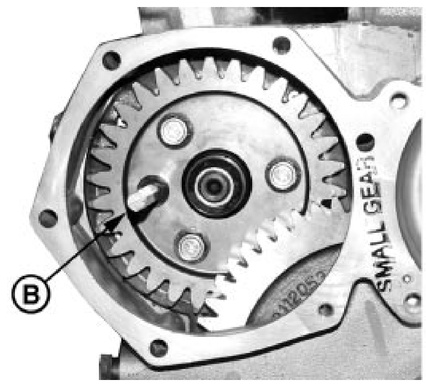
NOTE: If JDG886 Timing Pin cannot quite pass through the hole in the bracket behind the hub, loosen the drive gear capscrews and rotate the hub slightly.

IMPORTANT: Keep the JDG886 Injection Pump Timing Pin installed in the pump while the pump is out of the engine. If injection pump will be serviced at an authorized repair station, remove timing pin prior to shipping for service.



RG11634A –UN–21DEC00

High Pressure Fuel Pump Drive Gear Cover



RG11633A –UN–21DEC00

JDG886 Timing Pin

Continued on next page

WL30140,0000008 –19–21JUN05–1/4

5. Remove high pressure fuel pump leak-off line (D).

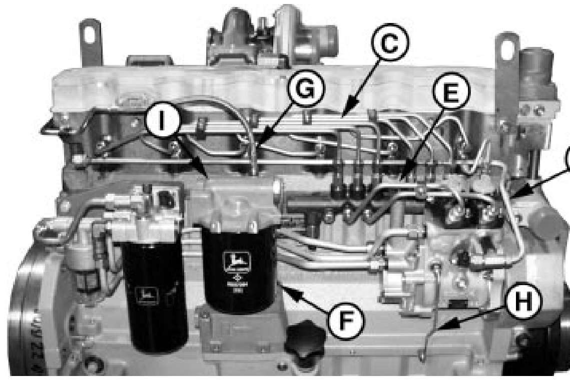
6. At common rail, remove pump-to-rail high pressure fuel lines (E).

7. If engine is equipped with a top fill oil filter, go to step 8. If engine has a bottom spin on oil filter, remove oil filter (F).

8. Remove high pressure fuel pump lube line (H).

9. If engine is equipped with a top fill oil filter, go to step 10. If engine has a bottom spin on oil filter, remove oil filter header (I) and lines to header. Plug openings.

NOTE: To prevent debris from falling into engine, plug openings after removing oil filter header lines.



RG11635A –UN–21DEC00

Fuel System

A—High Pressure Fuel Pump Drive Gear Cover
B—JDG886 Timing Pin
C—High Pressure Injection Lines
D—High Pressure Fuel Leak-off Line
E—High Pressure Fuel Lines
F—Oil Filter
G—Turbocharger Lube Line
H—High Pressure Fuel Pump Lube Line
I—Oil Filter Header

WL30140,0000008 –19–21JUN05–2/4

10. If engine is equipped with a dual fuel filter system, go to step 13. If equipped with a single filter element, loosen the fuel line clamp located behind the oil filter.

RG11631 –UN–21DEC00

Remove Fuel Filter Assembly (—246269)

Continued on next page WL30140,0000008 –19–21JUN05–3/4

11. Disconnect all fuel lines connected to high pressure fuel pump. Use JDG1463 15/16” Curved Wrench to disconnect rear-most fuel line.

IMPORTANT: Always use 2 wrenches to prevent fittings on pump from turning while loosening or tightening fuel lines. If fittings on pump turn while tightening or loosening fuel lines, pump must be replaced.

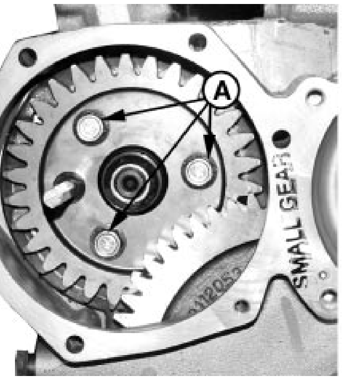
12. Remove 2 capscrews from fuel filter mounting bracket and remove fuel filter assembly.

13. Remove 3 capscrews (A) from fuel pump gear.

14. Remove 3 nuts and allen head cap screw from high pressure fuel pump.

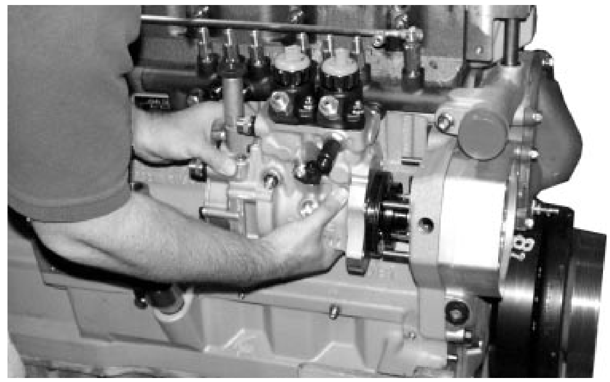
15. Carefully remove high pressure fuel pump.

A—Fuel Pump Gear Cap Screws



RG11633B –UN–21DEC00

High Pressure Fuel Pump Drive Gear Cap Screws



RG11636 –UN–21DEC00

Remove High Pressure Fuel Pump

WL30140,0000008 –19–21JUN05–4/4

Remove and Install High Pressure Common Rail

Remove High Pressure Common Rail

1. Remove high pressure fuel pump. See REMOVE HIGH PRESSURE FUEL PUMP earlier in this Group.

2. Disconnect the fuel rail pressure sensor connector.

IMPORTANT: When loosening or tightening high pressure fuel lines, use a backup wrench to ensure that flow limiters and pressure relief valve do not turn on the high pressure common rail.

3. Disconnect high pressure fuel lines from flow limiters (E) using a backup wrench.

4. Remove high pressure common rail leak-off line (C) from the pressure relief valve (A). Disconnect fitting (B) using a backup wrench on the pressure relief valve. Loosen fitting (D) enough to rotate line out of the way.

5. Remove high pressure fuel lines from the pump to the high pressure common rail if they were not completely removed with the pump.

6. Remove 2 cap screws from the rail and remove high pressure common rail.

Install High Pressure Common Rail

1. Install high pressure common rail. Tighten cap screws to specifications.

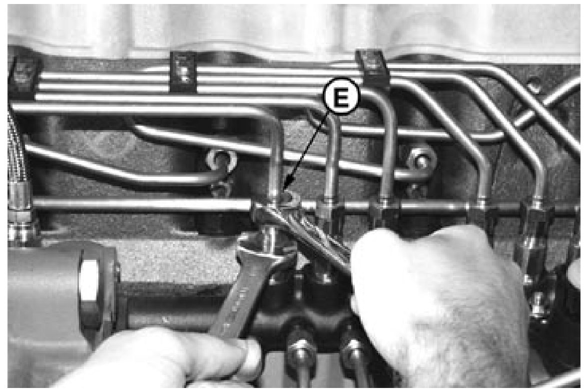
Specification

High Pressure Common Rail to
Block Cap Screws—Torque .... 61 N•m (45 lb-ft)

2. Install high pressure common rail leak-off line to pressure relief valve. Tighten fittings to specifications.

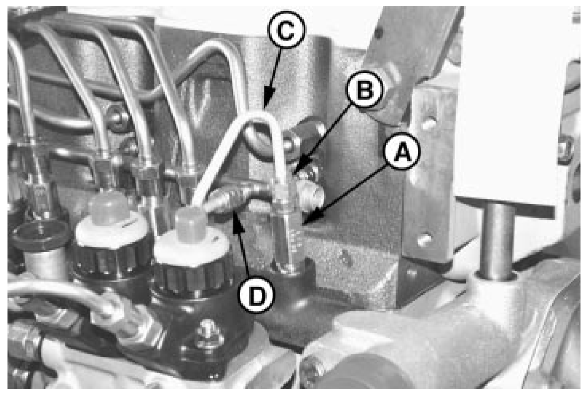
Specification

High Pressure Common Rail
Leak-off Line Fitting—Torque... 15 N•m (11 lb-ft)



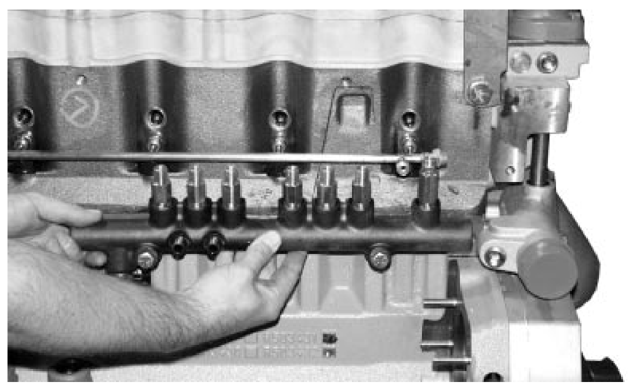
RG11759B –UN–22APR02

Flow Limiter



RG11762A –UN–26JUL01

Pressure Relief Valve



RG11637 –UN–01MAR01

Removing High Pressure Common Rail

A—Pressure Relief Valve
B—High Pressure Common Rail Leak-off Line Fitting
C—Fuel Leak-off Line
D—Fuel Leak-off Line Fitting
E—Flow Limiter Fitting

Continued on next page

RG41165,000003C –19–16APR02–1/2

3. Install high pressure injection lines to flow limiters. Use JDG1462 3/4” Flare Nut Socket to tighten fittings at fuel inlet connectors. Tighten fittings to specifications.

Specification

Fitting — High Pressure Injection
Line to Flow Limiter—Torque .... 27 N•m (20 lb-ft)

4. Install high pressure injection lines to the fuel inlets on the HPCR. Tighten fittings to specifications.

Specification

Fitting — High Pressure Injection
Line to HPCR Fuel Inlets—
Torque .... 53 N•m (39 lb-ft)

5. Connect the fuel rail pressure sensor connector.

6. Install high pressure fuel pump. See INSTALL HIGH PRESSURE FUEL PUMP, later in this Group.

RG41165,000003C –19–16APR02–2/2

Remove and Install Flow Limiters

Remove Flow Limiters

CAUTION: Fuel in the high pressure common rail is under extremely high pressure. Relieve pressure before opening rail.

1. Before removing flow limiter, turn engine OFF and let sit for at least 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail.

IMPORTANT: If any dirt, paint chips, or debris enters the fuel system, injector failure will occur!

2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the faulty flow limiter.

3. Clamp on the fuel line will need to be removed. Follow fuel line from faulty flow limiter to the electronic injector inlet connector. Place mark (A) on all fuel lines next to the clamp that needs to be removed.

4. Remove clamp that secures fuel line to faulty flow limiter.

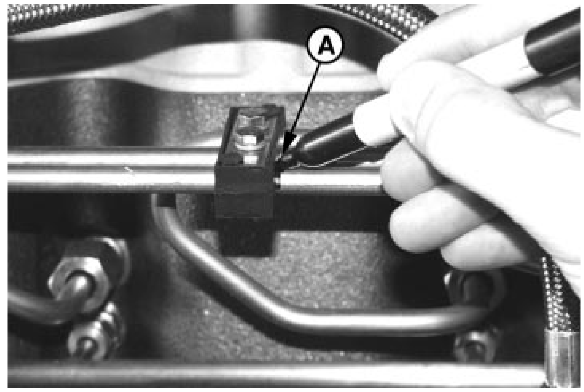
IMPORTANT: Only remove fuel line connected to the faulty flow limiter.

5. Using a backup wrench on flow limiter, loosen fuel line fitting (B) from the faulty flow limiter.

IMPORTANT: Do NOT bend or force lines out of the way.

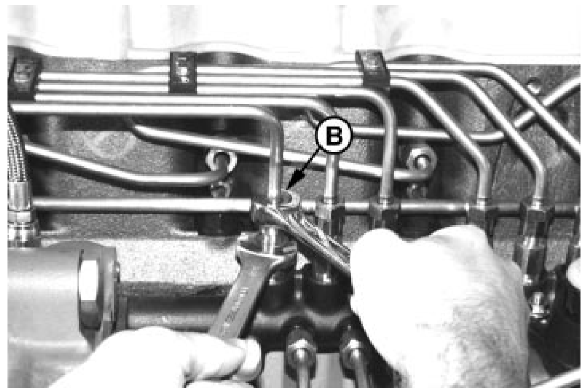
6. Loosen fuel line fitting on EI inlet connector. The line does not need to be removed.

7. Remove flow limiter keeping internal components together (C).



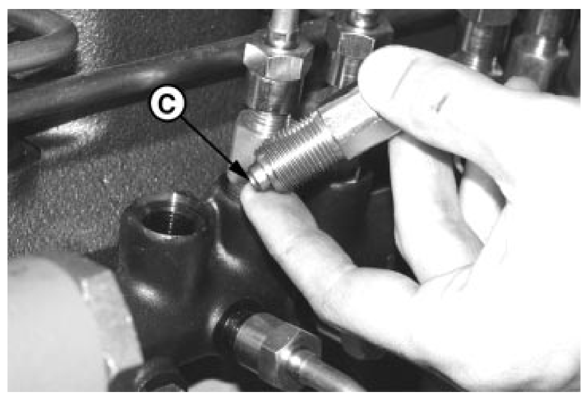
RG11758A –UN–26JUL01

Mark fuel line clamps



RG11759A –UN–26JUL01

Fuel Fitting



RG11760A –UN–26JUL01

Flow Limiter Internal Components

A—Marks on Clamp
B—Fuel Fitting
C—Internal Components

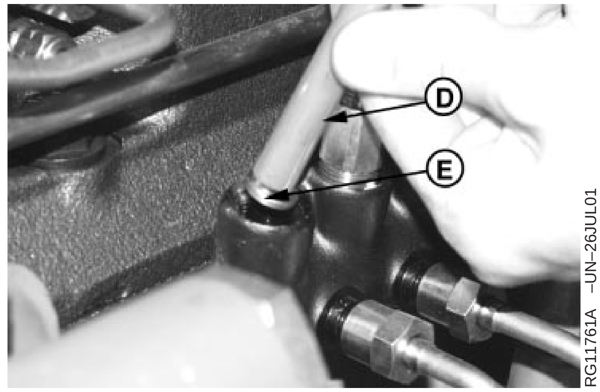
Continued on next page RG41221,0000216 –19–16APR02–1/3

8. Remove orifice plate (E) from inside flow limiter bore on high pressure common rail using a magnet (D).

IMPORTANT: Make sure magnet is clean before using.

9. Replace complete flow limiter as an assembly.

D—Magnet
E—Orifice Plate



Removing Orifice Plate

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Install Flow Limiters

1. Insert new orifice plate (A) inside bore on high pressure common rail.

2. Holding spring (C) and piston (B) inside flow limiter body (D), install new flow limiter on high pressure common rail. Tighten flow limiter to specification.

Specification
Flow Limiter—Torque .... 176 N•m (130 lb-ft)

3. Connect high pressure injection line to flow limiter using a backup wrench. Tighten to specification.

Specification
Fitting - High Pressure Injection
Line to Flow Limiter—Torque .... 27 N•m (20 lb-ft)

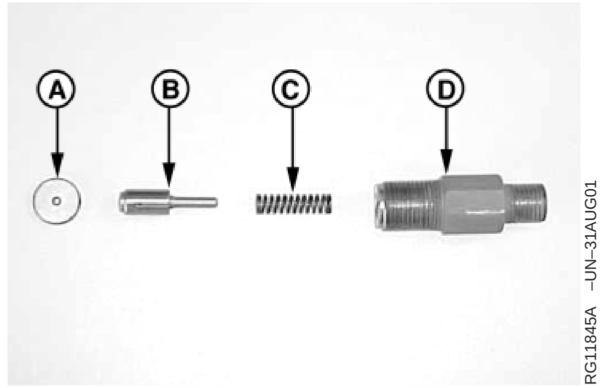
4. If other end of high pressure injection line was loosened or removed, install and tighten to specification.

Specification
Fitting - High Pressure Injection
Line to Fuel Inlet Connector—
Torque .... 53 N•m (39 lb-ft)

5. Install fuel line clamp making sure it lines up with marks from step 3 of removing flow limiter procedure. Tighten fuel line clamp cap screws to specification.

Specification
Fuel Line Clamp Cap Screws—
Torque .... 8 N•m (6 lb-ft) (71 lb-in)

6. Bleed the fuel system. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) in Section 04, Group 150 later in this manual.



Flow Limiter Exploded View

A—Orifice Plate
B—Piston
C—Spring
D—Flow Limiter Body

RG41221,0000216 –19–16APR02–3/3

Remove and Install HPCR Pressure Relief Valve

Remove Pressure Relief Valve

CAUTION: Fuel in the high pressure common rail is under extremely high pressure. Relieve pressure before opening rail.

1. Before removing pressure relief valve, turn engine OFF and let sit for at least 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail.

IMPORTANT: If any dirt, paint chips, or debris enters the fuel system, injector failure will occur! Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure relief valve.

IMPORTANT: Do NOT bend or force lines out of the way. If line does not move without force, loosen fitting (D) on fuel leak-off line.

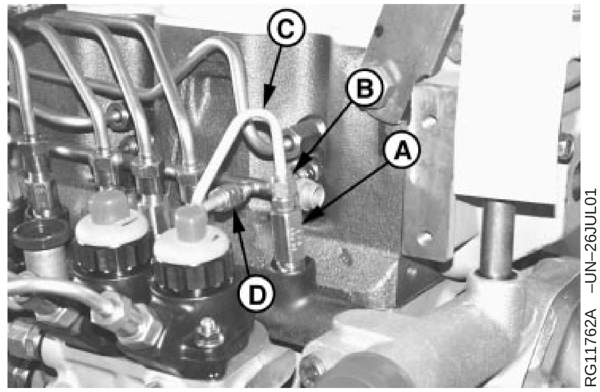
3. Disconnect fuel leak-off line fitting (B) from pressure relief valve (A) on fuel leak-off line using a backup wrench on the pressure relief valve. Move leak-off line (C) out of the way.

4. Loosen fuel line fitting (D) on fuel leak-off line. This fitting does not need to be removed.

IMPORTANT: Make sure magnet is clean before using.

5. Remove pressure relief valve. The pressure relief valve comes as an assembly. Due to the torque during installation, the crimp on the end of the assembly can come loose. When removing the pressure relief valve check to see if the entire assembly is together. If not, use a magnet to remove the loose components from the bore on the HPCR. Make sure the ball valve does not fall into the rail.

6. Remove seal and replace with new. Do not reuse seals.



Pressure Relief Valve

A—Pressure Relief Valve
B—High Pressure Common Rail Leak-off Line Fitting
C—Fuel Leak-off Line
D—Fuel Leak-off Line Fitting

Continued on next page

RG41221,0000217 –19–16APR02–1/2

Install Pressure Relief Valve

1. Install pressure relief valve on high pressure common rail. Tighten to specification.

Specification
Pressure Relief Valve—Torque .... 176 N•m (130 lb-ft)

2. Connect high pressure common rail leak-off line fitting (B) to pressure relief valve using a backup wrench. Tighten fitting to specification.

Specification
High Pressure Common Rail
Leak-off Line Fitting—Torque .... 15 N•m (11 lb-ft)

3. If other end of fuel leak-off line (D) was loosened or removed, install and tighten to specification.

Specification
Fuel Leak-off Line Fitting—
Torque .... 15 N•m (11 lb-ft)

4. Bleed the fuel system. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) in Section 04, Group 150 later in this manual.

RG41221,0000217 –19–16APR02–2/2

Install High Pressure Fuel Pump

NOTE: High pressure common rail MUST be installed before installing high pressure fuel pump. See REMOVE AND INSTALL HIGH PRESSURE COMMON RAIL earlier in this group.

NOTE: Engine must be at cylinder 1 “TDC” compression to install pump.

1. Install high pressure fuel pump onto studs. Tighten 3 nuts and cap screw to specifications.

Specification

High Pressure Fuel Pump Stud Nuts—Torque	48 N•m (35 lb-ft)
High Pressure Fuel Pump Cap Screw—Torque	48 N•m (35 lb-ft)

2. 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.

3. Install high pressure fuel pump gear. Tighten cap screws (A) to specifications.

Specification

High Pressure Fuel Pump–to–Gear Cap Screws—Torque	61 N•m (45 lb-ft)

4. Remove JDG886 Timing Pin from high pressure fuel pump.

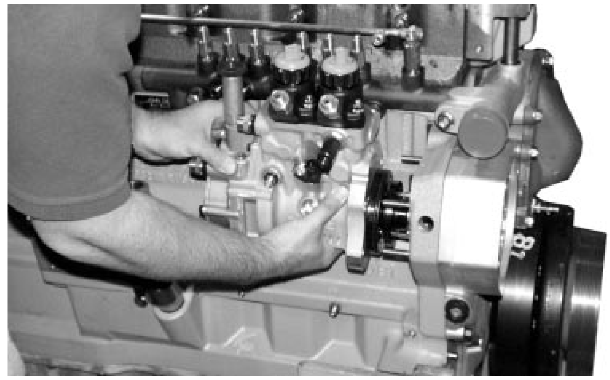
5. Install high pressure fuel pump drive gear cover using a new gasket or O-ring. Tighten cap screws to specifications.

Specification

High Pressure Fuel Pump Drive Gear Cover Cap Screws—Torque	27 N•m (20 lb-ft)

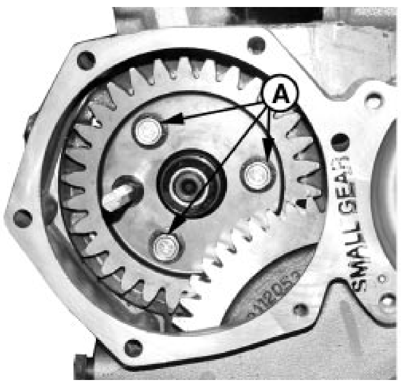
NOTE: Place injection pump drive gear with chamfered side of gear toward injection pump. Chamfer is at outer edge of bore for easier installation of gear to pump drive hub.

6. Remove JDG820 Flywheel Turning Tool and JDE84-1 Timing Pin from flywheel.



RG11636 –UN–21DEC00

Install High Pressure Fuel Pump



RG11633B –UN–21DEC00

High Pressure Fuel Pump Drive Gear Cap Screws

A—Cap Screws

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RG41165,000003D –19–16APR02–1/3

7. Install high pressure fuel pump lube line (A). Tighten to specifications.

Specification
Pump Lube Line Fitting—Torque .... 4.5 N•m (3.3 lb-ft) (40 lb-in.)

8. Install high pressure fuel pump leak-off line (B). Tighten to specifications.

Specification
Pump Leak-off Line Fitting at Fuel Pump (Single Filter Systems)—Torque .... 20 N•m (15 lb-ft)

Specification
Pump Leak-off Line Fitting at Fuel Pump (Dual Filter Systems)—Torque .... 24 N•m (18 lb-ft)

9. If removed, loosely install fuel filter assembly mounting bracket. Do not tighten cap screws.

10. If removed, loosely install fuel line clamp cap screw to engine block.

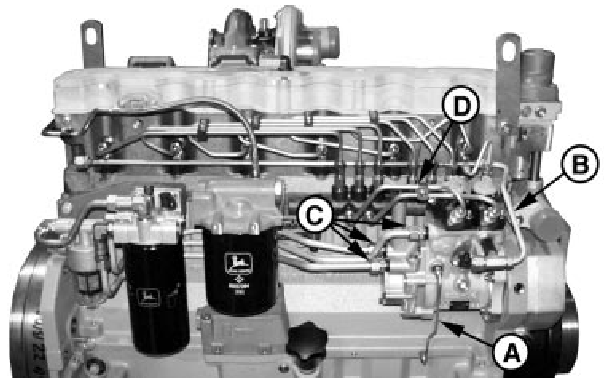
11. If engine is equipped with a single fuel filter, attach fuel lines (C) to high pressure fuel pump. Use JDG1463 15/16” Curved Wrench to tighten rear-most fuel line. Then tighten all lines to specification with torque wrench.

Specification
Fuel Lines From Fuel Filter Assembly — Attach to High Pressure Fuel Pump—Torque....................................... 27 N•m (20 lb-ft.)

If engine is equipped with dual filter system, connect the three fuel hoses from filter assembly to injection pump. Use a wrench on the line to hold orientation while tightening connection to specification.

Specification
Fuel Hoses From Fuel Filter Assembly — Attach to High Pressure Fuel Pump—Torque.. 24 N•m (18 lb-ft)

12. If engine is equipped with dual filter system, go to step 15. Otherwise, tighten fuel line clamp cap screw to specification.



RG11635B –UN–21DEC00

Fuel System Connections (Single Filter System Shown)

A—High Pressure Fuel Pump Lube Line
B—High Pressure Fuel Pump Leak-off Line
C—Fuel Lines
D—High Pressure Fuel Lines

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Continued on next page
RG41165,000003D –19–16APR02–2/3

Specification

Fuel Line Clamp Cap Screw—
Torque .... 12 N•m (9 lb-ft.)

13. Tighten fuel filter mounting bracket to engine block to specification.

Specification

Fuel Filter Mounting Bracket to
Block Cap Screws and Nut—
Torque .... 61 N•m (45 lb-ft.)

14. Install oil filter header. Tighten cap screws to specifications.

Specification

Oil Filter Header to Block Cap
Screws—Torque... 61 N•m (45 lb-ft.)

15. Install oil filter to oil filter header.

16. Install high pressure fuel lines (D) from high pressure fuel pump to high pressure common rail. Tighten fittings to specifications.

Specification

Fitting — High Pressure Fuel
Lines to High Pressure Fuel
Pump—Torque .... 27 N•m (20 lb-ft.)
Fitting — High Pressure Fuel
Lines to High Pressure Common
Rail—Torque.. 27 N•m (20 lb-ft.)

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 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. Bleed Fuel System. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) in Section 04, Group 150 later in this manual.

RG41165,000003D –19–16APR02–3/3

Remove Electronic Injectors

NOTE: The electronic injectors cannot be serviced. If any part of the component fails, the entire injector must be replaced. Also, electronic injectors cannot be tested for opening pressure because they are controlled electronically.

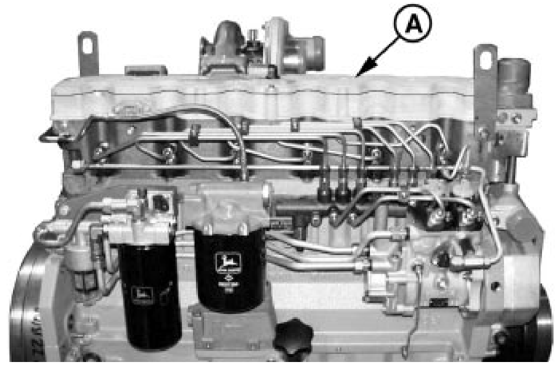
1. Disconnect electronic injector wiring harness connector from outside of the carrier.

2. Remove rocker arm cover (A) with vent tube.

3. Remove wire eyelets from electronic injector(s) that will be removed.

4. If only a few injectors are being replaced, go to step 5. If all of the EIs are being replaced, remove the carrier (B).

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



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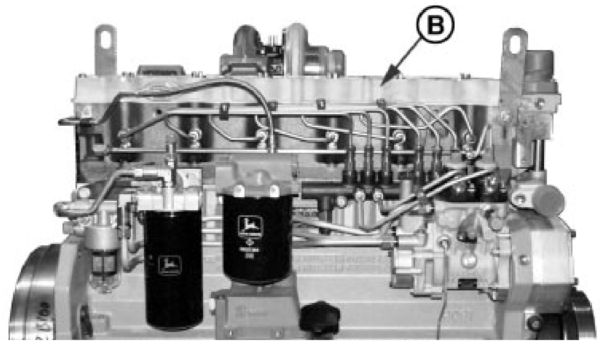
Remove Rocker Arm Cover



RG11574A –UN–20NOV00

Remove Carrier

A—Rocker Arm Cover
B—Carrier

Continued on next page RG41165,000003E –19–16APR02–1/2

5. Disconnect high pressure fuel line (A) from inlet connector on electronic injector to be removed.

6. Loosen electronic injector hold down clamp cap screw (C).

7. Use 1/2” hose grip pliers to remove the fuel inlet connector.

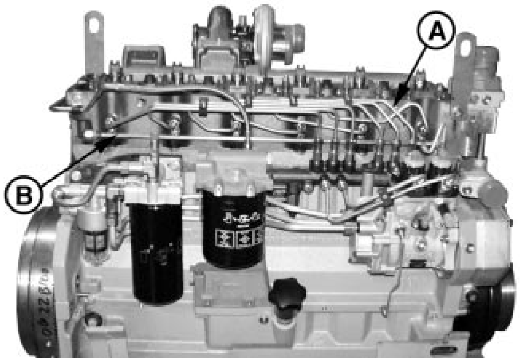
8. Use JDG1461 Fuel Leak-off Connector Socket to remove fuel leak-off connector.

IMPORTANT: Notice the orientation of the electronic injector hold down clamp. This will need to be installed in the same orientation.

9. Remove electronic injector hold down cap screw from electronic injector clamp.

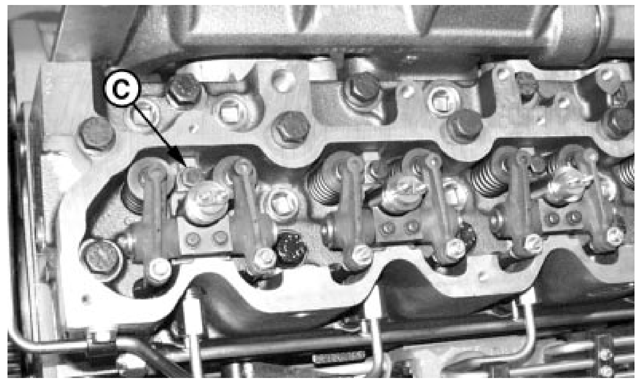
IMPORTANT: Immediately cover electronic injector bore to prevent dirt from entering the fuel system when electronic injector(s) has been removed.

10. Gripping electronic injector body by hand, remove electronic injectors.



RG11642A –UN–22DEC00

Fuel Lines



RG11641B –UN–22DEC00

Electronic Injector Hold Down Clamp Screws

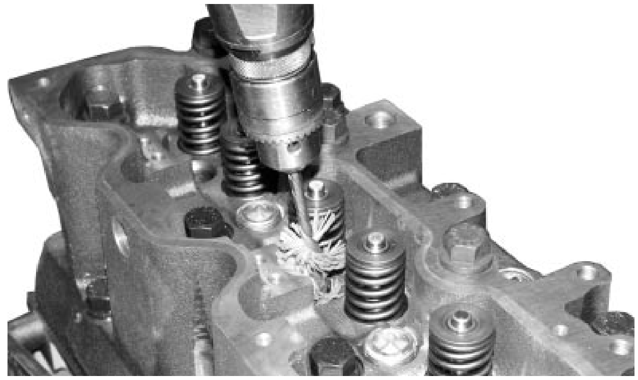
A—High Pressure Fuel Lines
B—Fuel Leak-off Line
C—Electronic Injector Hold Down Clamp Screws

RG41165,000003E –19–16APR02–2/2

Clean Electronic Injector Bore

1. Clean light deposits out of electronic injector bore using an electric drill and D17030BR Thread Cleaning brush.

2. Work brush up and down several times to clean bore.



RG11638 –UN–21DEC00

Cleaning Electronic Injector Bore

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RG41165,000003F –19–21DEC00–1/1

Clean Electronic Injector Orifice

Electronic injector orifice cannot be cleaned. If orifice is plugged, replace electronic injector.

RG41165,0000040 –19–21DEC00–1/1

Clean Electronic Injector Body

IMPORTANT: **Never use a steel brush to clean electronic injectors. Steel brush may damage electronic injectors.**

1. Clean new or used electronic injectors by washing in diesel fuel.

2. If necessary, use a brass wire brush to remove carbon deposits.

RG41165,0000041 –19–21DEC00–1/1

Inspect Electronic Injector Body

1. Inspect electronic injector body to see that it is not scratched or scored.

2. If electronic injector is scratched or scored, replace electronic injector.

RG41165,0000042 –19–21DEC00–1/1

Install Electronic Injectors

1. O-rings on the electronic injectors and fuel inlet connector must be replaced every time they are removed. If re-installing a used injector or inlet connector, replace o-ring. Additionally, install a new sealing washer on the injector tip. Use AMOGELL (or similar) petroleum grease to hold the sealing washer in place and to protect the o-rings from damage during installation.

IMPORTANT: Take care to not get oil or grease into the high pressure fuel passages or sealing surfaces.

IMPORTANT: When installing the Electronic Injector (EI), do not twist the top of the EI. This will cause the EI calibration to change.

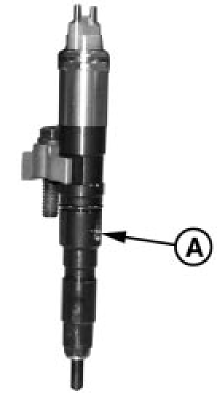
2. Slide the forked legs of the electronic injector clamp around the flat part of the electronic injector. Orient the conical bore (A) in the side of the electronic injector away from the clamp as shown.

3. Carefully insert the electronic injector and clamp assembly into the electronic injector bore (as illustrated).The EI position marks on the solenoid top needs to face toward the fuel inlet connector bore on the side of the cylinder head.

4. Position JDG1460A-4 Injector installation tool over the injector terminals to prevent them from damage during installation. Using the heel of a hand, carefully force the injector into the bore until it “pops” into place. Remove the installation tool and set aside.

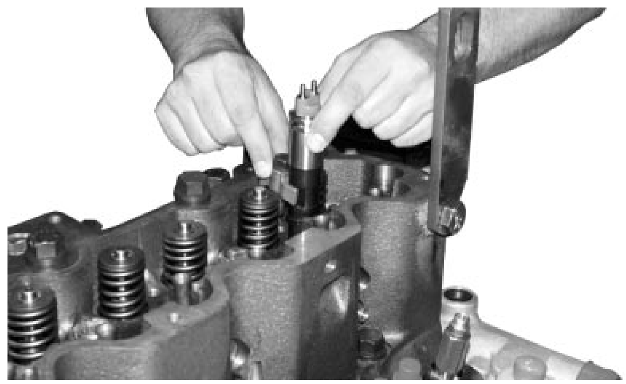
5. Thread JDG1460A-2 Alignment Tool (C) into cylinder head and EI finger tight to align the EI in position.

6. Torque EI clamp capscrew to 5 N•M (3 lb-in) to hold EI in correct position. Remove JDG1460A-2 Alignment Tool.



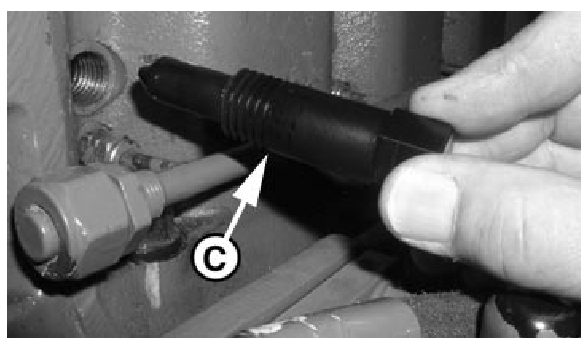
RG11643A –UN–22DEC00

Electronic Injector with Hold Down Clamp



RG11644 –UN–22DEC00

Install Electronic Injector



RG13704 –UN–08SEP04

EI Alignment

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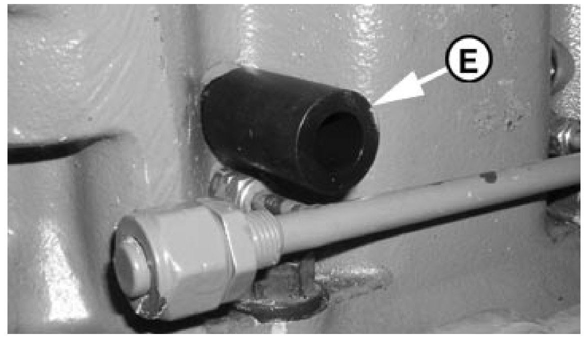
7. Insert JDG1460A-1 Inlet Connector Installation Tool (E) into the cylinder head until it seats tightly against cylinder head.

IMPORTANT: If re-using the fuel inlet connector, inspect the high pressure sealing surfaces for nicks, scratches, or a deformed seat. If damaged in any way or if there is a question, replace the connector.

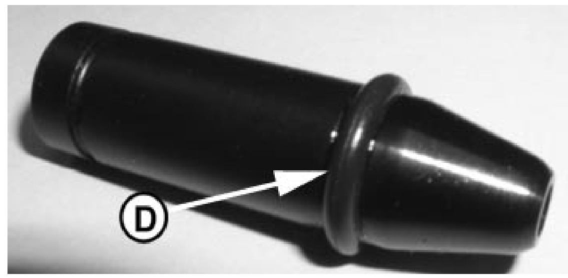
8. Install a new o-ring packing (D) in the groove on the fuel inlet connector.

9. Lubricate the o-ring with AMOJELL or equivalent petroleum grease to ease assembly and protect the o-ring from damage. Install fuel inlet connector into bore of JDG1460A-1 Installation Tool (as illustrated).



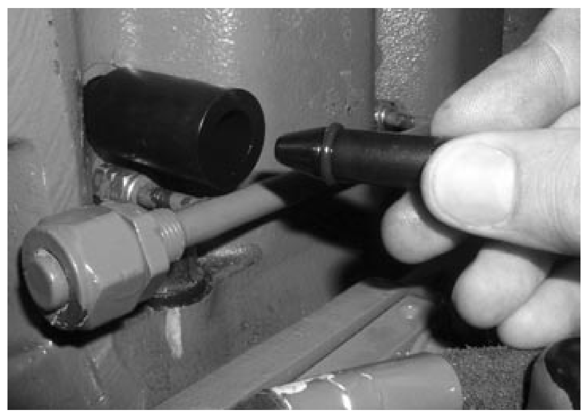
RG13706 –UN–08SEP04

Installation Tool



RG13705 –UN–08SEP04

Inlet Connector O-Ring



RG13708 –UN–08SEP04

Inlet Connector Installation

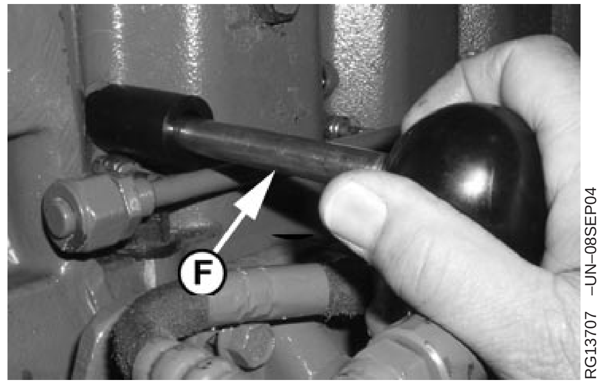
Continued on next page RG41165,0000043 –19–16APR02–2/5

10. Using JDG1460A-3 ram rod pusher tool (F), seat the fuel inlet connector in to the EI. There will be some resistance as the connector is forced into the EI. The connector should “pop” into place when it seats in postion.

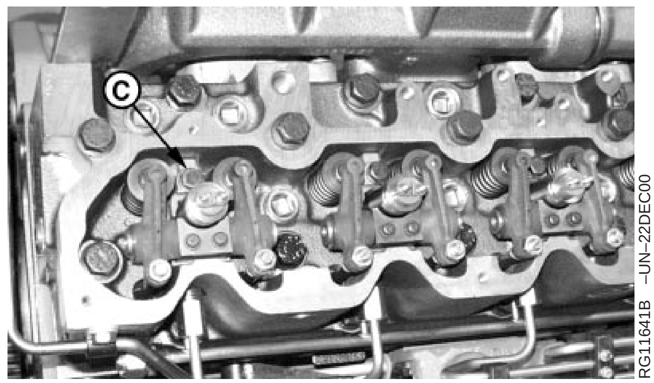
11. Remove JDG1460A-1 Fuel Inlet Connector Installation tool.

12. Use JDG1461 Fuel Leak-off Connector Socket to install fuel leak-off connectors.

A—Fuel Leak-off Lines
B—High Pressure Fuel Lines
C—Electronic Injector Hold Down Clamp Screw



Inlet Connector Pusher Tool



Electronic Injector Hold Down Clamp Screw

Continued on next page RG41165,0000043 –19–16APR02–3/5

13. Install fuel leak-off lines (A). Tighten fittings to specifications.

Specification

Fuel Leak-off Line Fittings—
Torque .... 15 N•m (11 lb-ft)

14. Install high pressure fuel lines (B). Use JDG1462 3/4” Flare Nut Socket to install high pressure fuel lines to fuel inlet connectors. Tighten fittings to specifications.

Specification

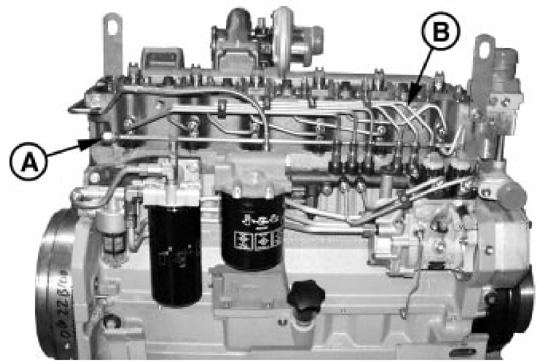
High Pressure Fuel Line to Fuel
Inlet Connector Fittings—Torque .... 53 N•m (39 lb-ft)

IMPORTANT: Make sure hold down clamps are in correct orientation.

15. Tighten electronic injector hold down clamp cap screws (C) and TORQUE TURN to specifications.

Specification

Electronic Injector Clamp Cap
Screws—Torque Turn .... 10 N•m + 90 degrees (7 lb-ft + 90 degrees)



RG11642B –UN–22DEC00

Fuel Lines

Continued on next page RG41165,0000043 –19–16APR02–4/5

16. If carrier was removed, install carrier. Tighten cap screws in order shown to specifications.

Specification

Carrier-to-Cylinder Head Cap Screws—Torque .... 8 N•m (6 lb-ft)

IMPORTANT: Do NOT use red or blue LOCTITE® on solenoid studs. Bonding strength is too high for small studs, making future removal impossible without twisting off stud.

17. Apply LOCTITE® 680 Retaining Compound (PM37485) to injector studs.

18. Install solenoid wire retaining nuts to injector studs and tighten to specifications.

Specification

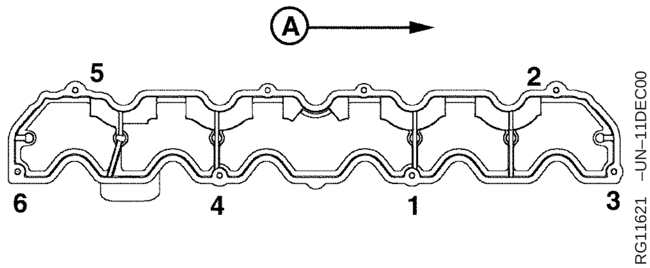
Solenoid Wire Retaining Nuts—Torque .... 1.9 N•m (1.4 lb-ft) (17 lb-in.)

19. Install rocker arm cover with vent tube. Tighten capscrews in order shown to specifications.

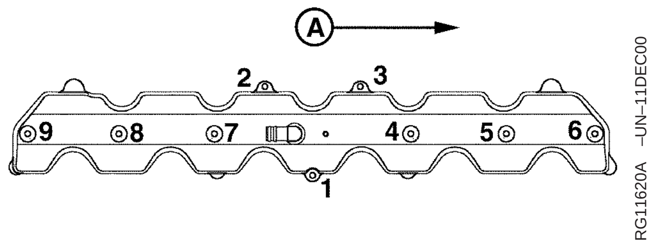
Specification

Rocker Arm Cover Capscrews—Torque .... 8 N•m (6 lb-ft)

20. Connect electronic injector wiring harness connector to carrier.



Order to Tighten Carrier Cap Screws



Order to Tighten Rocker Arm Cover Cap Screws

A—Front of Engine

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RG41165,0000043 –19–16APR02–5/5

Engine Control Unit (ECU)


RG11822 –UN–20AUG01

Engine Control Unit (ECU)

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

IMPORTANT: 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. Also disconnect module connector at injector pump.**
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 Section 04, Groups 150 and 160 as required.

IMPORTANT: DO NOT OPEN ENGINE CONTROL UNIT.

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

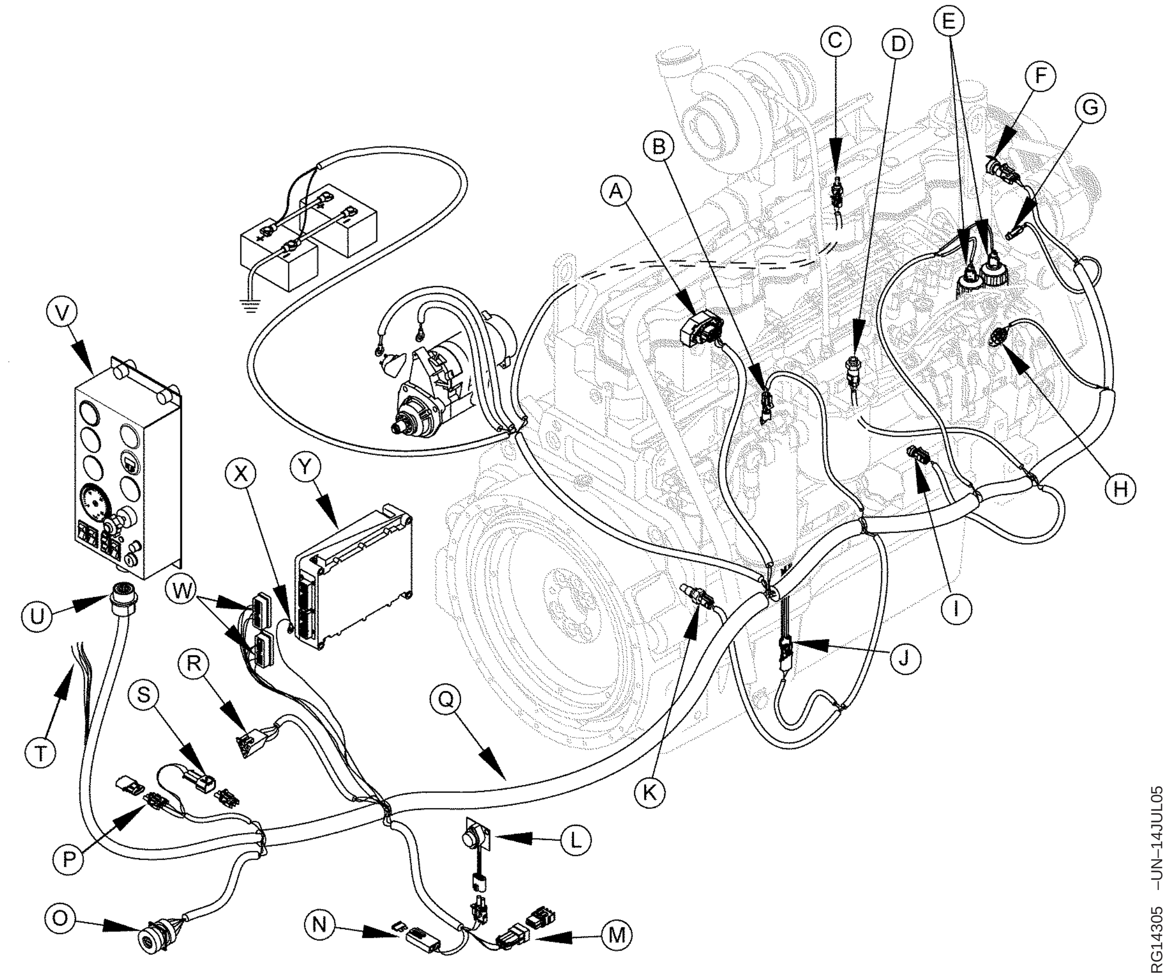
The ECU is not repairable. If it is found to be defective, replace it as a unit.

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

The wiring connector for the ECU is repairable. See REPAIR (PULL TYPE) METRI-PACK™ CONNECTORS later in this Group.

RG41183,0000034 –19–26MAR02–1/1

Electronic Engine Control System and Sensors



A—Electronic Injector (EI) Wiring Harness Connector
B—Fuel Temperature Sensor
C—Manifold Air Temperature Sensor (MAT)
D—Fuel Rail Pressure Sensor
E—Pump Control Valves (PCVs)
F—Engine Coolant Temperature Sensor (ECT)
G—Alternator Ignition Connector
H—Pump Position Sensor
I—Oil Pressure Sensor
J—Water In Fuel (WIF) Sensor Harness
K—Crankshaft Position Sensor
L—Transient Voltage Protection (TVP) Module
M—Performance Program Connector
N—Main System Fuse (10A)
O—CAN Diagnostic Connector
P—Secondary Analog Throttle Connector
Q—Engine Wiring Harness
R—SAE 1939 CAN Connector
S—Remote On/Off Connector
T—Unterminated Wires
U—Instrument Panel Connector
V—Optional Instrument Panel
W—ECU Connectors
X—System Ground
Y—Engine Control Unit

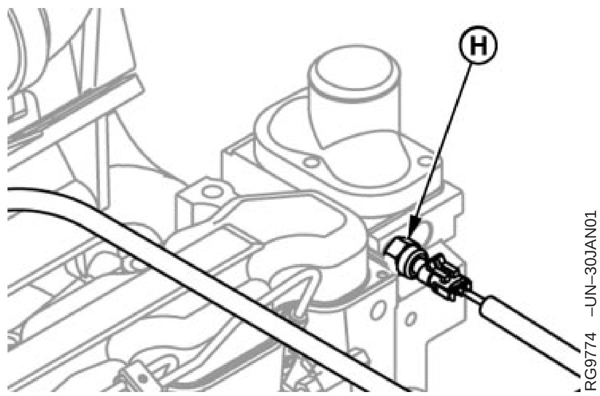
RG41183,0000091 –19–06DEC00–1/1

Fuel Pump Sensors

The Pump Position Sensor and the Pump Control Valves are not serviceable. If the sensor or one of the valves fail, the entire high pressure fuel pump must be replaced. See REMOVE HIGH PRESSURE FUEL PUMP in Section 02, Group 090 later in this manual.

RG41183,0000014 –19–20AUG01–1/1

Replace Coolant Temperature Sensor



Coolant Temperature Sensor in Thermostat Housing

1. Disconnect coolant temperature sensor (H) wiring connector and remove sensor.

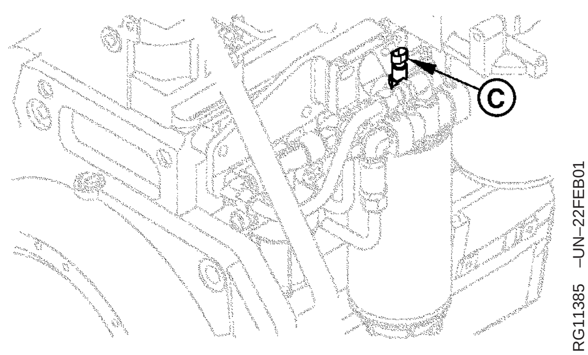
2. Coat sensor O-ring with JDT405 High Temperature Grease and install sensor in thermostat housing.Tighten to specifications.

Specification	
Coolant Temperature Sensor (In Thermostat Cover)—Torque	10 N•m (7 lb-ft)

3. Install sensor wiring connector.

RG41183,0000092 –19–06DEC00–1/1

Replace Fuel Temperature Sensor



Fuel Temperature Sensor

NOTE: On dual filter systems, the temperature sensor is located above the secondary (smaller) filter.

1. Disconnect fuel temperature sensor (C) wiring connector and remove sensor.

2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.

3. Reconnect sensor wiring connection.

Specification	
Fuel Temperature Sensor—Torque	10 N•m (7 lb-ft)

RG41183,0000093 –19–06DEC00–1/1

Replace Crankshaft Position Sensor

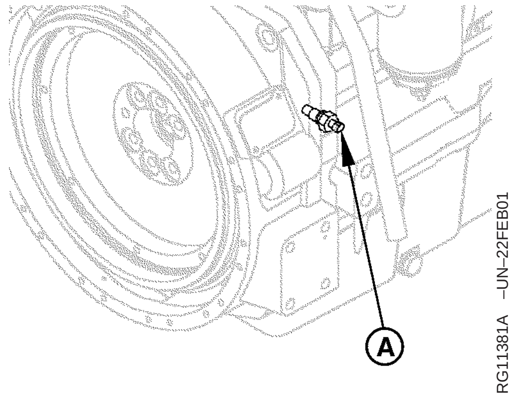
1. Disconnect crankshaft position sensor (A) wiring connector and remove sensor.

2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.

3. Reconnect sensor wiring connection.

Specification

Crankshaft Position Sensor—
Torque .... 14 N•m (10 lb-ft)



Crankshaft (“Crank”) Position Sensor

RG41183,0000017 –19–10JAN01–1/1

Replace Manifold Air Temperature (MAT) Sensor

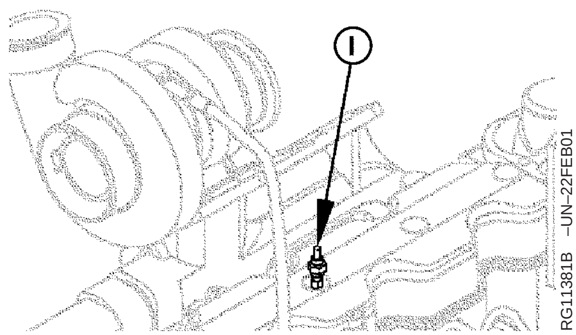
1. Disconnect manifold air temperature sensor (I) wiring connector and remove sensor.

2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.

3. Reconnect sensor wiring connection.

Specification

Manifold Air Temperature (MAT)
Sensor—Torque .... 10 N•m (7 lb-ft)



Manifold Air Temperature (MAT) Sensor

RG41183,0000018 –19–10JAN01–1/1

Replace Water in Fuel (WIF) Sensor

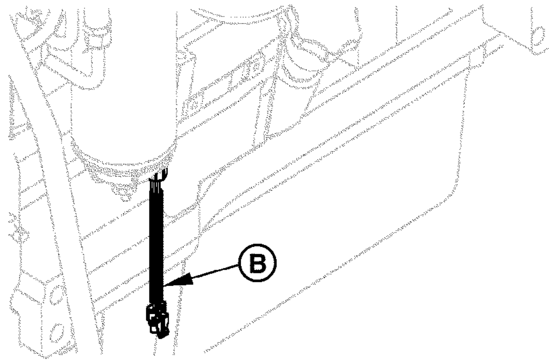
1. Disconnect water in fuel sensor (B) wiring connection and remove sensor.

2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.

Specification

WIF Sensor—Torque.. 3 N•m (30 lb-in)

3. Reconnect sensor wiring connection.



Water in Fuel Sensor

RG41183,0000019 –19–11JAN01–1/1

Remove and Install Oil Pressure Sensor

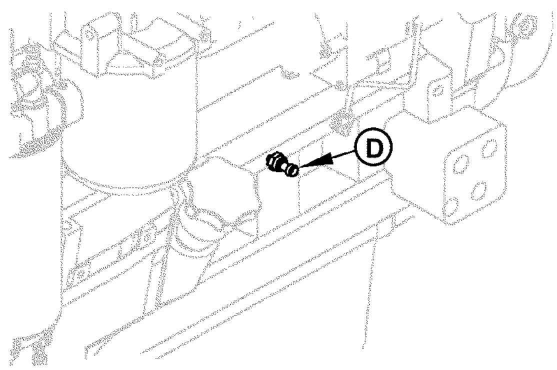
1. Disconnect oil pressure sensor (D) wiring connection and remove sensor.

2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.

Specification

Oil Pressure Sensor—Torque .... 9 N•m (7 lb-ft)

3. Reconnect oil pressure sensor wiring connection.



Oil Pressure Sensor

RG41183,0000028 –19–06FEB01–1/1

Remove and Install Fuel Rail Pressure Sensor

CAUTION: Fuel in the high pressure common rail is under extremely high pressure. Relieve pressure before opening rail.

1. Before removing fuel rail pressure sensor, turn engine OFF and let sit for 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail.

IMPORTANT: If any dirt, paint chips, or debris enters the fuel system, injector failure will occur!

2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the fuel rail pressure sensor.

3. Disconnect fuel rail pressure sensor wiring connection and remove sensor (E). Do not reuse sensor once it has been removed from the rail.

IMPORTANT: Do not get any grease on tip of sensor.

4. Coat new sensor threads with JDT405 High Temperature Grease.

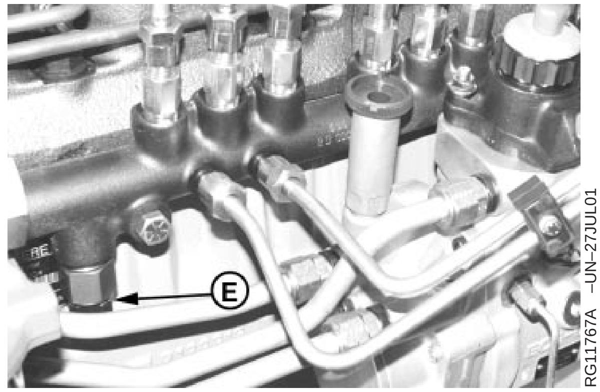
5. Verify that sensor is clean from all debris and install new sensor. Tighten to specification.

Specification

Fuel Rail Pressure Sensor—
Torque .... 98 N•m (72 lb-ft)

6. Reconnect sensor wiring connection.

7. Bleed the fuel system. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) in Section 04, Group 150 later in this manual.



Fuel Rail Pressure Sensor

RG41221,000021A –19–31AUG01–1/1

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

Use Electrical Insulating Compound

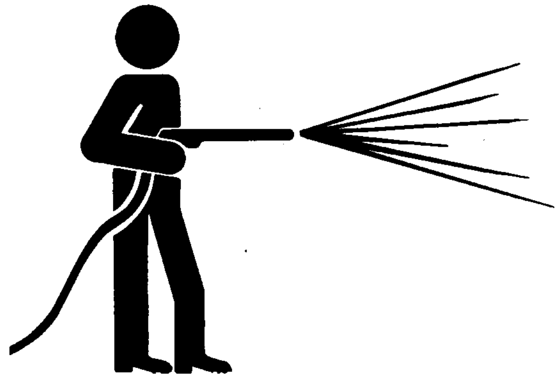
Apply AT66865 Compound directly to the terminals between the wire seal and connector body. This provides a moisture barrier, especially in wet and humid conditions.

RG,RG34710,1335 –19–23OCT97–1/1

Using High-Pressure Washer

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

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.



T6642EJ –UN–18OCT88

Using High-Pressure Washer

RG,RG34710,1329 –19–23OCT97–1/1

Repair WEATHERPACK™ Connector

TS0128 –UN–23AUG88

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 Tool[1] 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 Pliers[2], 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 Pliers[2], strip 6 mm (1/4 in.) insulation from end of wire.

WEATHERPACK is a trademark of Packard Electric

[1] Included in JT07195B Electrical Repair Kit

[2]Included in JDG155 Electrical Repair Tool Kit

Continued on next page 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*

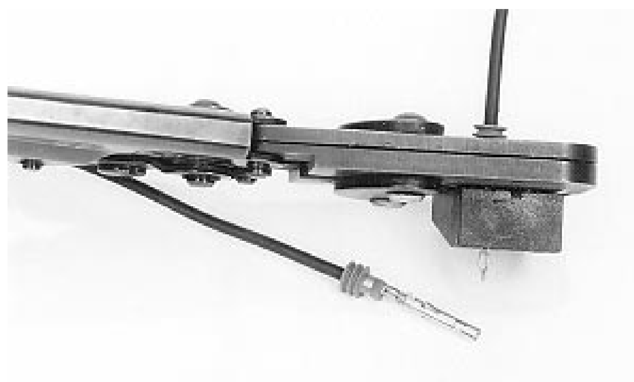
TS0136 –UN–23AUG88

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*



TS1623 –UN–02NOV94

WEATHER PACK is a trademark of Packard Electric

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AG,OUOD008,296 –19–06MAR02–3/4

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.

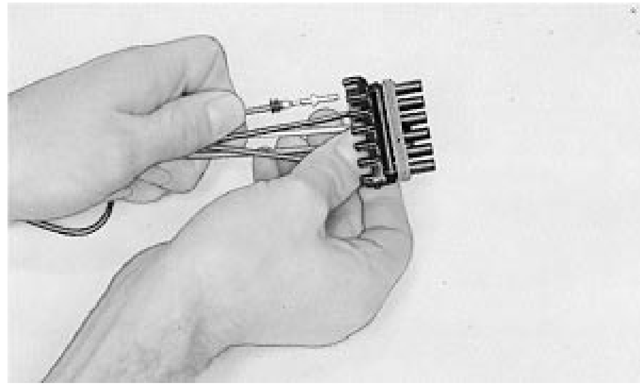
Correct terminal installation for sleeve (A) and pin (B) is illustrated.

10. Gently pull on wire to insure that the terminal is locked in position.

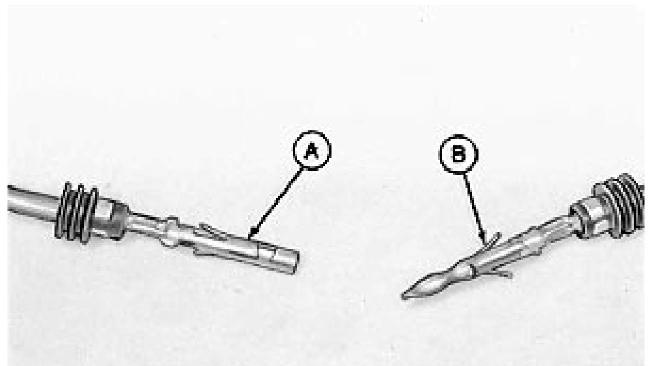
11. Repair or transfer remaining wires.

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

02
110
12

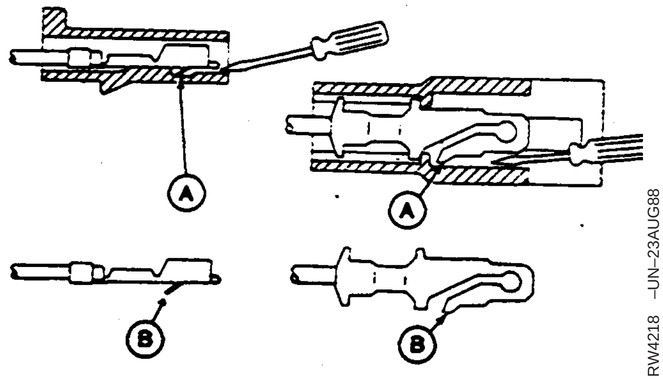
Remove Blade Terminals from Connector Body

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 Tool[1] 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 its original position before installing into a connector.



A—Locking Tang
B—Original Position

[1]*Included in JT07195B Electrical Repair Kit*

AG,OUOD008,297 –19–06MAR02–1/1

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.

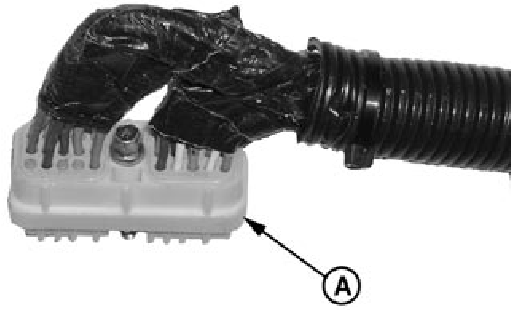
NOTE: Extraction tool must be used from the back of the connector.

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.

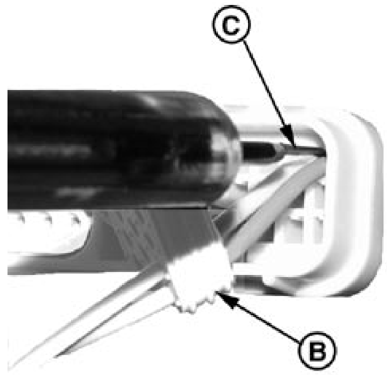
6. With extraction tool inserted into the connector, gently rotate tool clockwise and counter-clockwise (no more than 1/8 turn each direction) to depress the terminal locking tang (D).

7. Remove extraction tool from back of connector.

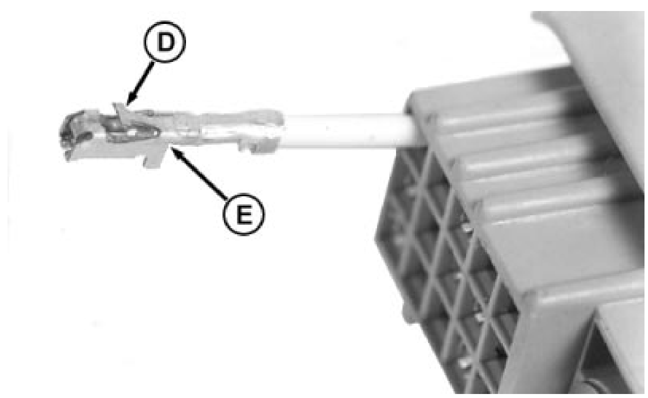
8. Push wire until terminal has extracted from the front of the connector. If terminal does not extract, repeat steps 4-6.



RG12231A –UN–13MAR02



RG12232A –UN–13MAR02



RW16935A –UN–05AUG98

A—Connector
B—Connector Seal
C—JDG777 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*

Continued on next page

AG,OUOD008,298 –19–06MAR02–1/2

9. Using JDG145 Universal Electrical Pliers[1], 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 Pliers[1], 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.

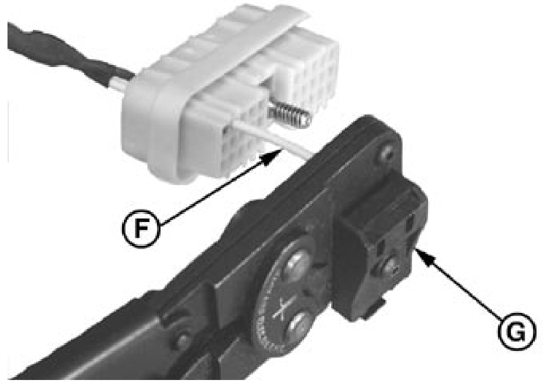
13. Make sure terminal locking tang (D) on new terminal is in outward position. Pull wire back into connector cavity until terminal locks.

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

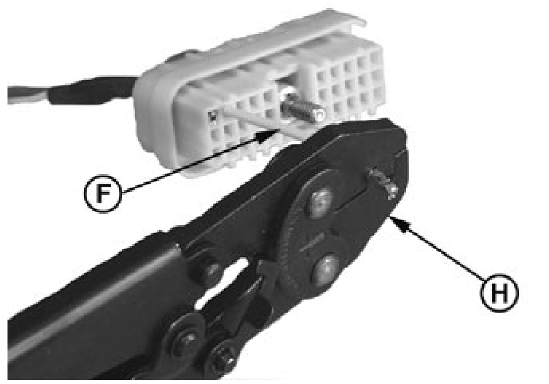
14. Push on the wire to make sure terminal is locked into the connector.

15. Slide the connector seal back into the connector. Make sure seal is in its original position.

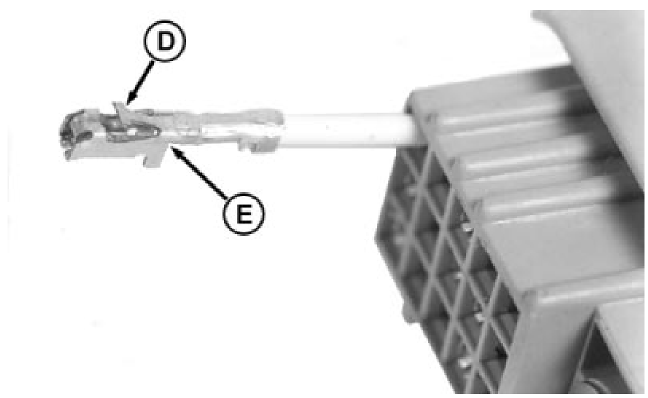
16. Retape the wires and add the required tie bands to the harness.



RG12234A –UN–13MAR02



RG12233A –UN–13MAR02



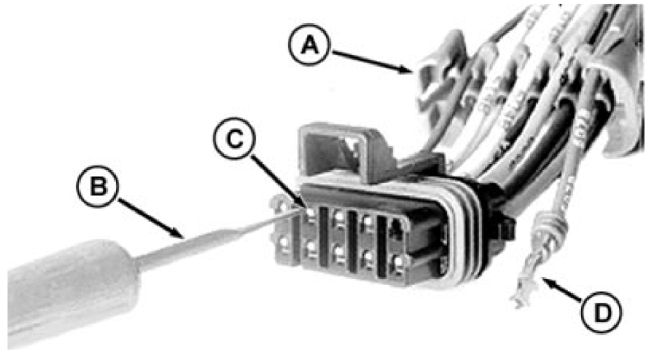
RW16935A –UN–05AUG98

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

[1] *Included in JDG155 Electrical Repair Tool Kit*

AG,OUOD008,298 –19–06MAR02–2/2

Repair *(Push Type)* METRI-PACK™ Connectors



RW77137 –UN–08DEC98

TS0136 –UN–23AUG88

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 Tool[1] (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 Pliers[2], cut off wire directly behind the terminal.
7. Using JDG145 Universal Electrical Pliers[2] 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

[1]Included in JT07195B Electrical Repair Kit

[2]Included 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

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.

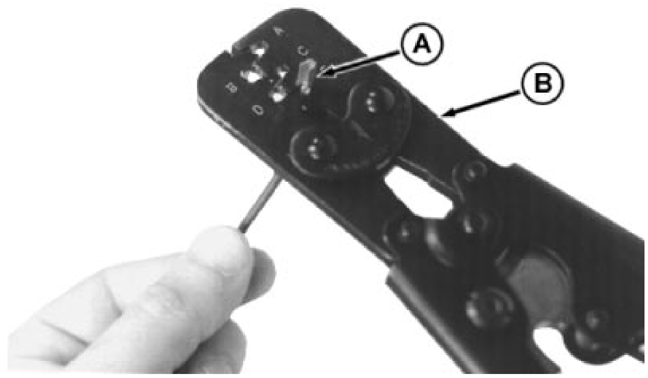
13. Push terminal into the correct connector cavity until terminal locks.

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

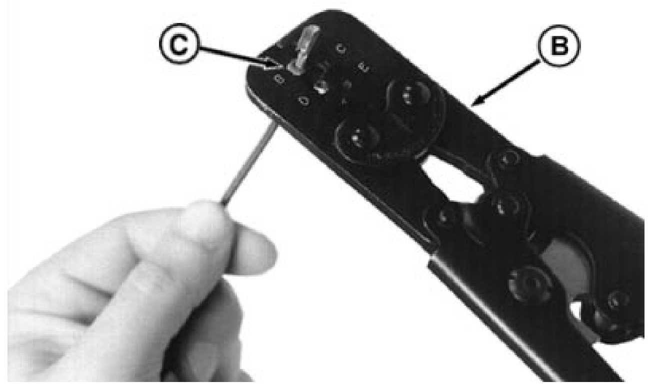
15. Place the secondary lock back on the connector.

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

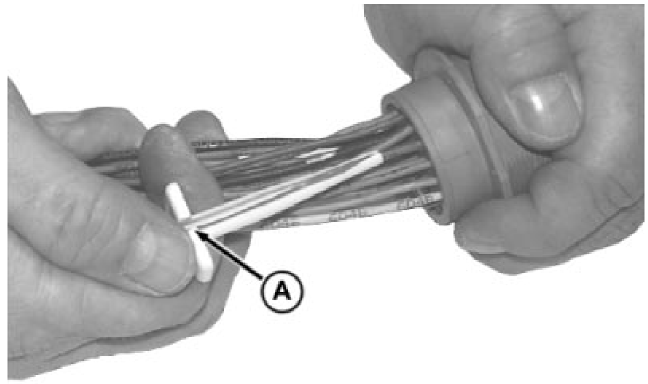


RW77138A –UN–15MAR02

RW77140A –UN–15MAR02

AG,OUOD008,299 –19–06MAR02–3/3

Repair DEUTSCH™ Connectors



A—Handle

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 Wire[1]
   - JDG362 Extractor Tool - 16—18 Gauge Wire[1]
   - JDG363 Extractor Tool - 20 Gauge Wire[2]
   - JDG785 Extractor Tool - 6-8 Gauge Wire[3]

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 Pliers[4] cut off wire directly behind the terminal.

9. Using JDG145 Universal Electrical Pliers[4], strip 6 mm (1/4 in.) insulation from end of wire.

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

[2]Included in JDG359 DEUTSCH Electrical Repair Kit

[3]Included in JT07195B Electrical Repair Tool Kit

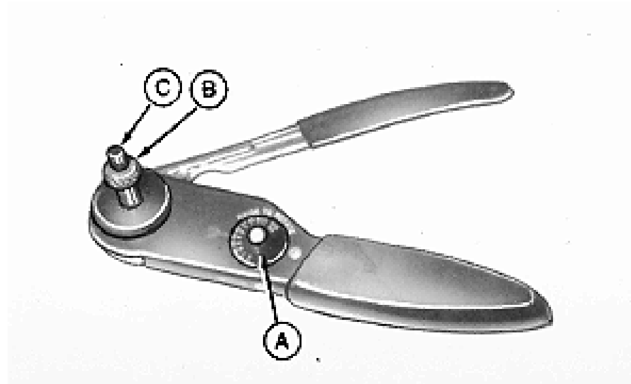
[4]Included in JDG155 Electrical Repair Tool Kit

Continued on next page

AG,OUOD008,304 –19–26MAR02–1/4

10. Adjust selector (A) on JDG360 Crimping Tool[1] for correct wire size .

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



TS117 –UN–23AUG88

A—Selector
B—Lock Nut
C—Adjusting Screw

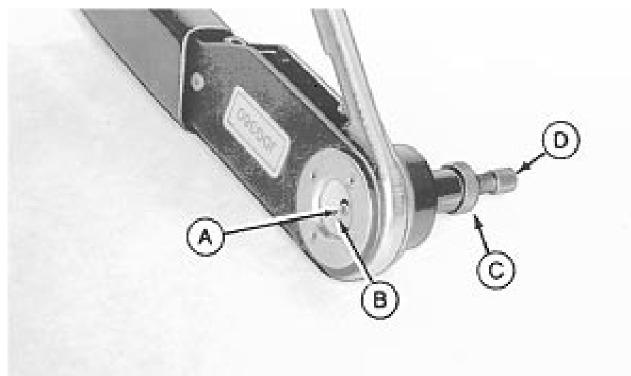
[1] *Included in JDG359 Electrical Repair Kit*

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).



TS0134 –UN–23AUG88

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

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.

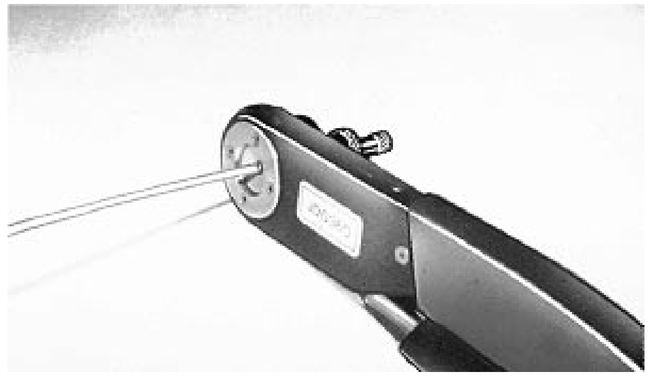
17. Push terminal straight into correct connector cavity until positive stop is felt.

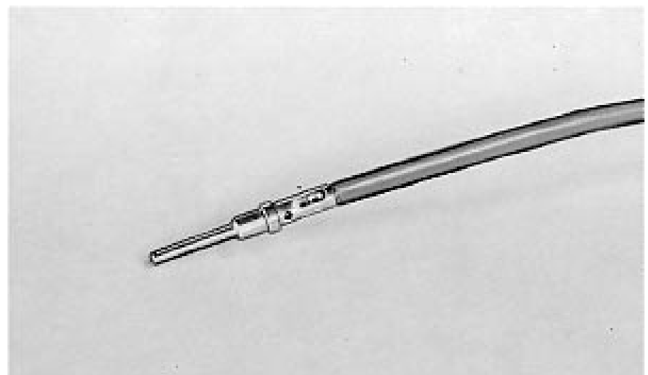
IMPORTANT: Install terminal in correct connector cavity using correct size grommet.

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.

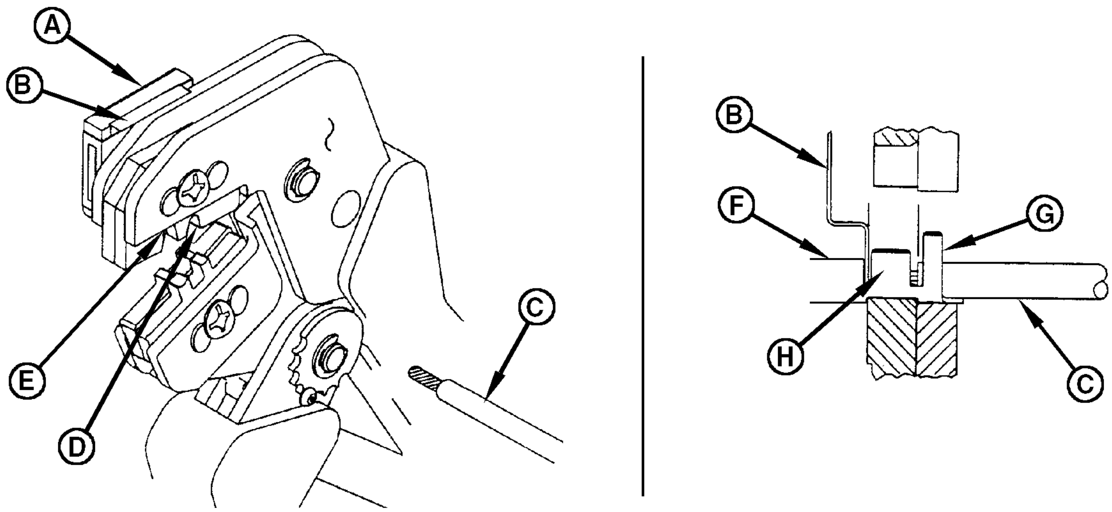

TS118 –UN–23AUG88


TS0135 –UN–23AUG88


RW77141 –UN–07DEC98

AG,OUOD008,304 –19–26MAR02–4/4

Repair AMP Connector



Using AMP Crimping Tool

A—Locator Assembly
B—Locator
C—Wire
D—Crimping Slot
E—Crimping Slot
F—Terminal
G—Insulation Barrel
H—Wire Barrel

1. Disconnect AMP connector. Remove the tie bands and tape.

2. Identify wire color/number to the connector cavity. Make sure the each wire goes back into the correct cavity location.

3. Press JDG1369 Terminal Extraction Tool into face of connector and remove wire and terminal from back of connector.

NOTE: Verify wire stripping length and crimp height before using AMP crimping tool. See instructions provided with tool.

4. Strip new wire to length indicated in tool instructions. Do not nick or cut wire strands.

5. Hold JDG708 AMP Crimping Tool so that the back (wire side) is facing you. Squeeze tool handles together and allow them to open fully.

NOTE: See instructions provided with tool to determine which crimping slot (D or E) to use.

6. Holding the terminal (F) by the mating end, insert the insulation barrel (G) first, through the front of the tool and into the appropriate crimp slot (D or E).

IMPORTANT: Make sure that both sides of the insulation barrel (G) are started evenly into the crimping section. Do NOT attempt to crimp an improperly positioned terminal.

7. Position the terminal so that the open “U” of the wire and insulation barrels (H and G) face the top of the tool. Place the terminal up into the nest so that the movable locator (B) drops into the slot in the terminal as shown. Butt the front end of the wire barrel (H) against the movable locator.

8. Hold the terminal (F) in position and squeeze the tool handles together until ratchet engages sufficiently to hold the terminal in position. DO NOT deform insulation barrel or wire barrel.

9. Insert stripped wire (C) into terminal insulation and wire barrels until it is butted against the wire stop.

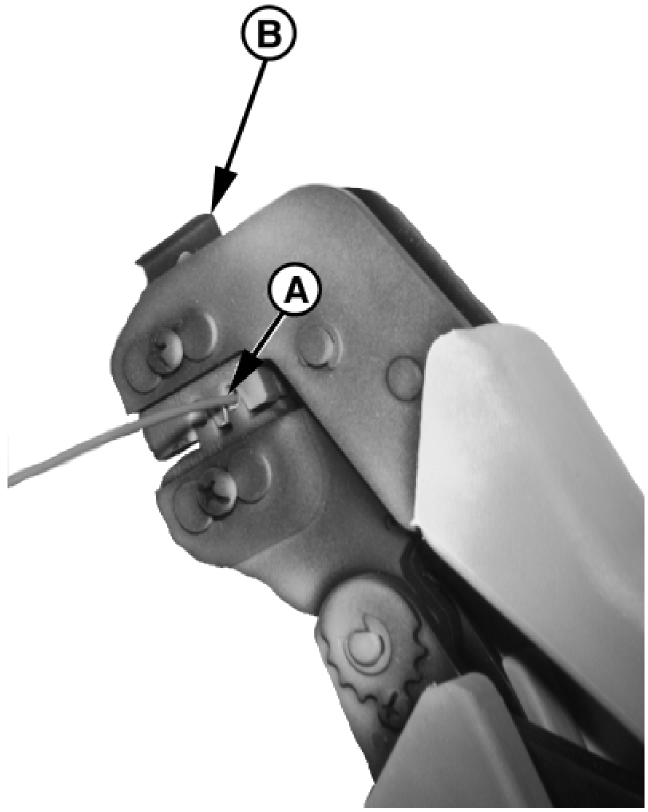
Continued on next page DPSG,OUO1004,2867 –19–06MAR02–1/2

10. Hold the wire and terminal (A) in place. Squeeze tool handles together until ratchet releases. Allow tool handles to open and remove crimped terminal.

NOTE: The crimped terminal may stick in the crimping area. It can be easily removed by pushing downward on the top of the locator (B).

11. Install wire in correct connector cavity.

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

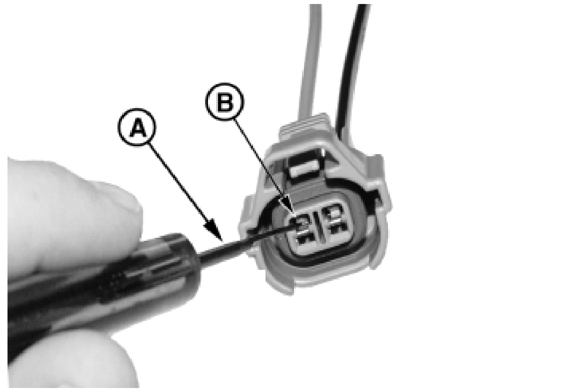


T112335E –UN–15MAR02

A—Wire and Terminal
B—Locator

DPSG,OUO1004,2867 –19–06MAR02–2/2

Repair SUMITOMO™ Connectors



RG11676 –UN–05FEB01

1. Disconnect the SUMITOMO™ connector. Remove the tie bands and tape.

2. Identify wire color/number location with the connector cavity. Make sure each wire goes back to the correct cavity location.

3. Insert JDG777 Terminal Extraction Tool[1] (A) into connector body socket pushing the terminal locking tab upward (B).

TS0136 –UN–23AUG88

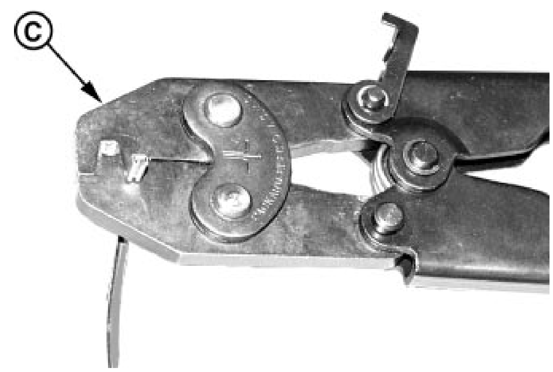
4. Gently pull wire from the back of the connector. Then remove the extraction tool.

5. Remove old contact from wire using JDG145 Universal Electrical Pliers[2].

6. Using JDG145 Universal Electrical Pliers[2], strip 6 mm (1/4 in.) insulation from end of wire.

7. Select the correct 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.

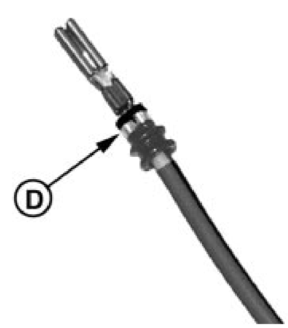
IMPORTANT: The seal must fit snug over the cable insulation, without a gap between the cable seal and the insulation.



RG11678 –UN–05FEB01

8. Crimp contact on cable seal (D) using JDG707 Crimping Tool (C).

A—Terminal Extraction Tool
B—Connector Locking Tang
C—Terminal Crimping Tool
D—Crimped Cable Seal



RG11680 –UN–05FEB01

[1] *Included in JT07195B Electrical Repair Tool Kit.*

[2] *Included in JDG155 Electrical Repair Tool Kit.*

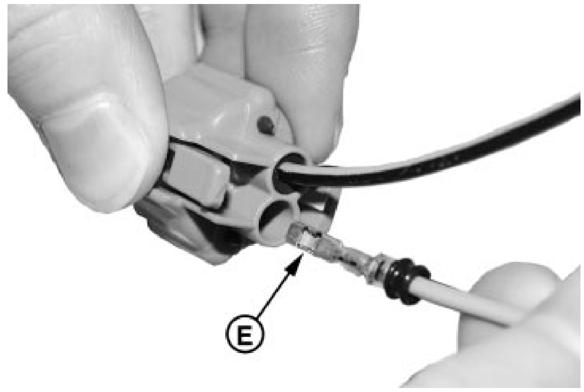
Continued on next page

9. Make sure the terminal is positioned correctly (E) for the locking tang inside the connector.

10. Push terminal into correct connector cavity until terminal locks.

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

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



E—Terminal Orientation

RG41183,0000015 –19–06MAR02–2/2

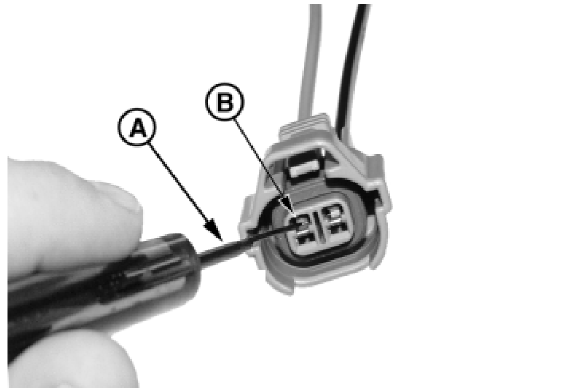
Repair YAZAKI™ Connectors

1. Disconnect the YAZAKI™ connector. Remove the tie bands and tape.
2. Identify wire color/number location with the connector cavity. Make sure each wire goes back to the correct cavity location.
3. Insert JDG777 Terminal Extraction Tool[1] (A) into connector body socket pushing the terminal locking tab upward (B).
4. Gently pull wire from the back of the connector. Then remove the extraction tool.
5. Remove old contact from wire using JDG145 Universal Electrical Pliers[2].
6. Using JDG145 Universal Electrical Pliers[2], strip 6 mm (1/4 in.) insulation from end of wire.
7. Select the correct 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.

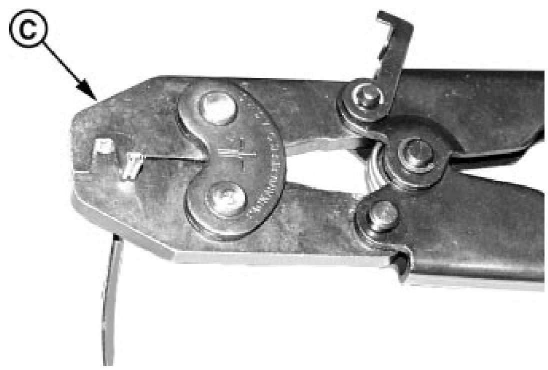
8. Crimp contact on cable seal (D) using JDG707 Crimping Tool (C).

A—Terminal Extraction Tool
B—Connector Locking Tang
C—Terminal Crimping Tool
D—Crimped Cable Seal



RG11676 –UN–05FEB01


TS0136 –UN–23AUG88



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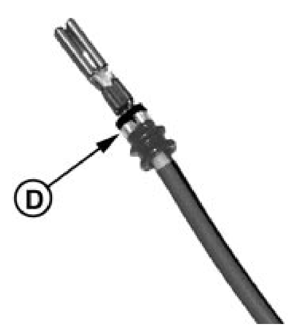

RG11680 –UN–05FEB01

[1]*Included in JT07195B Electrical Repair Tool Kit.*

[2]*Included in JDG155 Electrical Repair Tool Kit.*

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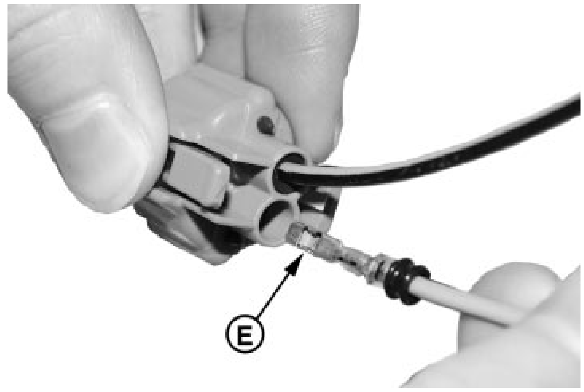
RG41221,000032A –19–06MAR02–1/2

9. Make sure the terminal is positioned correctly (E) for the locking tang inside the connector.

10. Push terminal into correct connector cavity until terminal locks.

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

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



E—Terminal Orientation

RG41221,000032A –19–06MAR02–2/2

Section 03
Theory Of Operation

Contents

About This Group

In this group, fuel system theory of operation information is described in the following categories:

- Fuel System Operation
- Primary Fuel Filter Operation
- Fuel Transfer Pump Operation
- Final Fuel Filter Operation
- High Pressure Fuel Pump Operation
- High Pressure Common Rail (HPCR)
- Electronic Injector (EI) Operation
  - EI - No Injection
  - EI - Begin Injection
  - EI - Ending Injection

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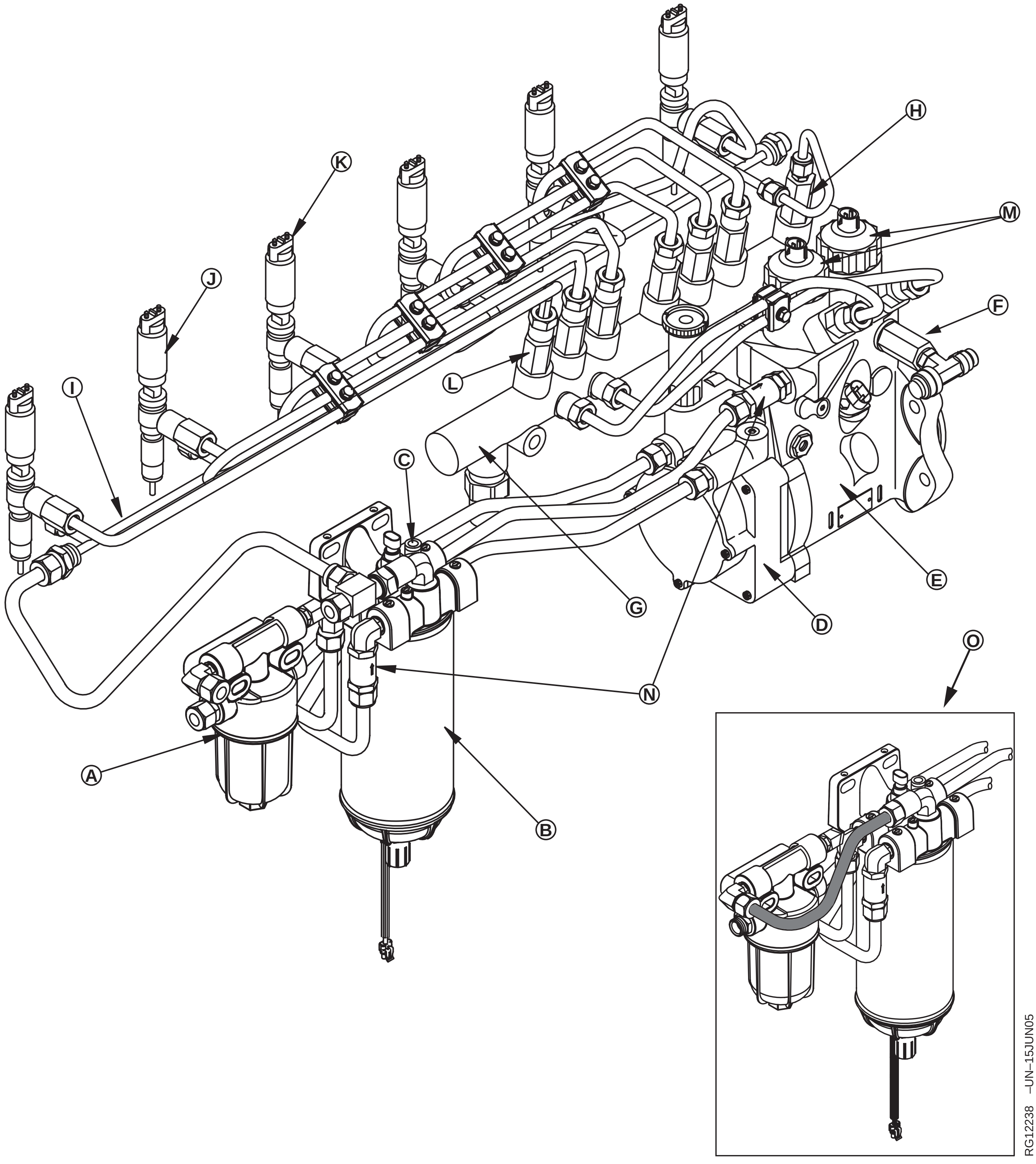
Fuel System Operation



Fuel System, Single Filter Type (—246269)

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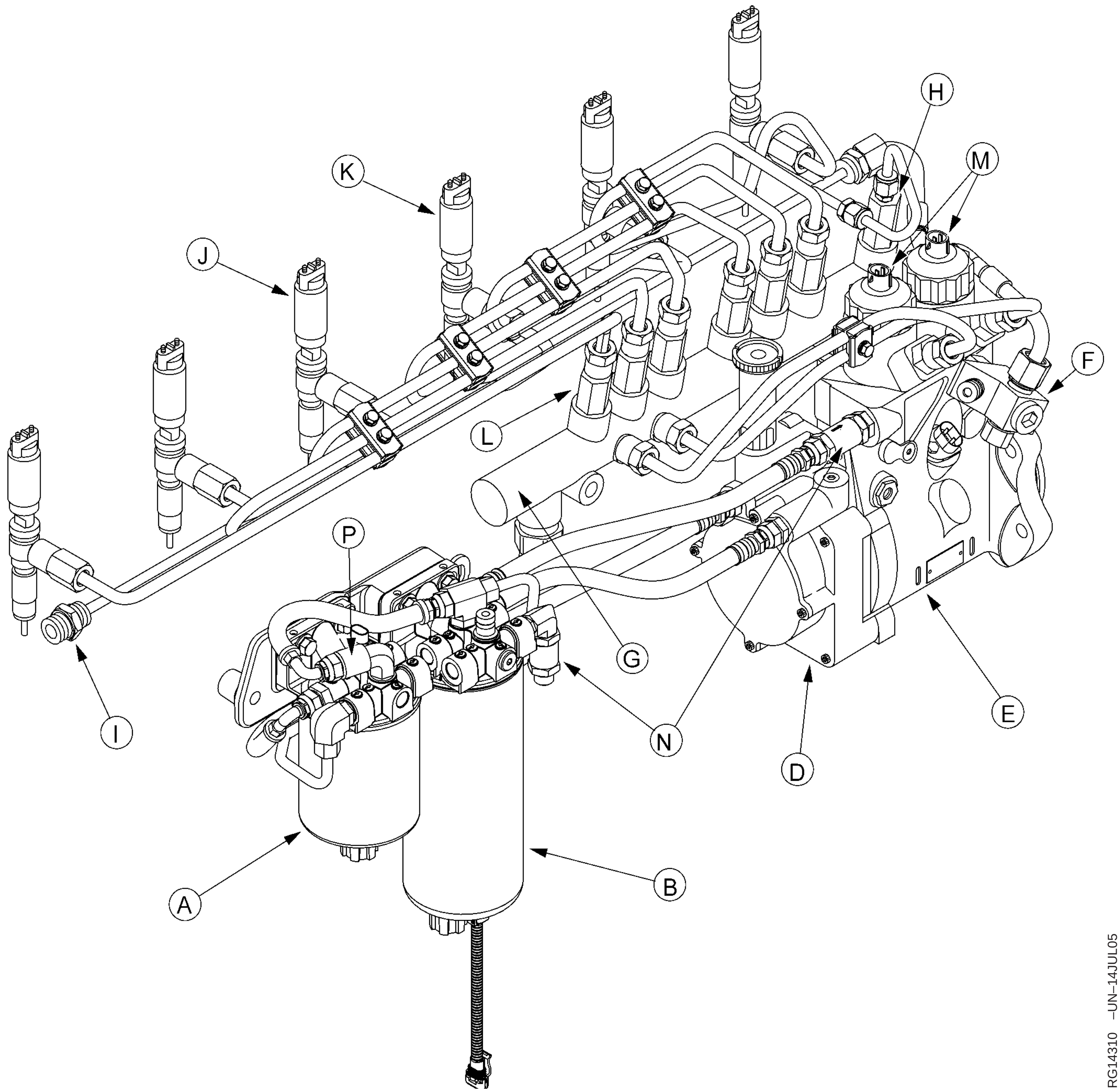


Fuel System, Dual Filter Type (246270—)

A—Primary Filter (250-Micron Fuel Strainer or 10-Micron Filter)
B—Final Filter
C—Diagnostic Port
D—Fuel Transfer Pump
E—High Pressure Fuel Pump
F—Overflow Valve
G—High Pressure Common Rail (HPCR)
H—Pressure Relief Valve
I—Fuel Return Line
J—Electronic Injector (EI)
K—Two-Way Valve (TWV)
L—Flow Limiter
M—Pump Control Valves (PCVs)
N—Check Valves
O—Filter Return Configuration - Some Applications
P—Pressure Relief Valve

Fuel System Operation

Fuel is drawn from the vented fuel tank and through the primary fuel filter (A) by the fuel transfer pump (D). On single-filter systems, the primary filter is actually a 250-micron cleanable strainer. On dual filter systems, the primary filter is a 10-micron replaceable element. From the fuel transfer pump, the fuel travels back to the filter assembly and into the 2-micron final filter (B). In some equipment, there is a fuel cooler between the transfer pump and the final filter. There is a quick-disconnect diagnostic port (C) at the final filter (—246269) or fuel pump (246270—) which can be used to attach a pressure gauge or bleed air out of the system. A pressure relief valve (P) on the final filter allows fuel to bypass the final filter if the filter becomes plugged. Bypass fuel is directed back to the tank to prevent both filter rupture and unfiltered fuel from entering the high pressure fuel system. On some equipment (O), the bypass fuel is directed back to the fuel transfer pump. Check valves (N) are used to prevent fuel from draining out of the fuel filter and the high pressure fuel pump when the engine is not running.

The fuel exits the final filter and flows to the high pressure fuel pump (E). The high pressure fuel pump raises the pressure of the fuel to the required pressure for injection. Pump control valves (PCVs) (M) control when fuel enters the pump. These valves are controlled by the ECU. When there is no current from the ECU, fuel is allowed to fill the pump. When the necessary volume of fuel is in the pumping chamber to maintain the correct fuel pressure in the high pressure common rail (HPCR) (G), the ECU will shut the valves. The pump then raises the pressure of the fuel. When the fuel pressure in the pump exceeds the pump's delivery valve opening pressure, the high pressure fuel is allowed into the (HPCR) which evenly distributes fuel to all of the Electronic Injectors (EIs) (J).

The HPCR uses flow limiters (L) to maintain a constant pressure to the EIs. The ECU sends a signal to the two-way valve (K) to control the volume of fuel, the timing of delivery, and the rate of delivery for each EI. Excess fuel from the nozzles travels through the fuel rail return line.

A pressure relief valve (H) will allow excess fuel in the HPCR to flow into the low-pressure fuel rail return line (I). An overflow valve (F) on the high pressure fuel pump will also release excess fuel into the fuel rail return line and back to the tank.

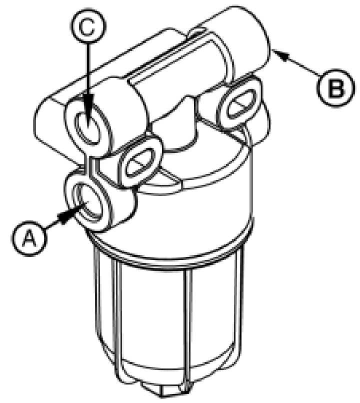
RG41221,000000B –19–28AUG01–1/1

Primary Fuel Filter (Strainer) Operation (—246269)

On single-filter systems, the primary filter has a 250-micron cleanable screen. The primary filter is on the suction side of the transfer pump. Fuel is routed from the vented fuel tank directly to the primary filter inlet (A). The primary filter screens out particles greater than 250 microns in size out of the fuel. After exiting out the primary filter outlet (B), the fuel travels to the fuel transfer pump.

On some equipment, the extra outlet (C) is connected to the final filter to route bypass fuel back to the transfer pump.

The primary filter (strainer) must be emptied and cleaned on a regular basis.



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Primary Fuel Filter (Strainer), 250-Micron

A—Primary Filter Inlet
B—Primary Filter Outlet
C—Extra Filter Outlet

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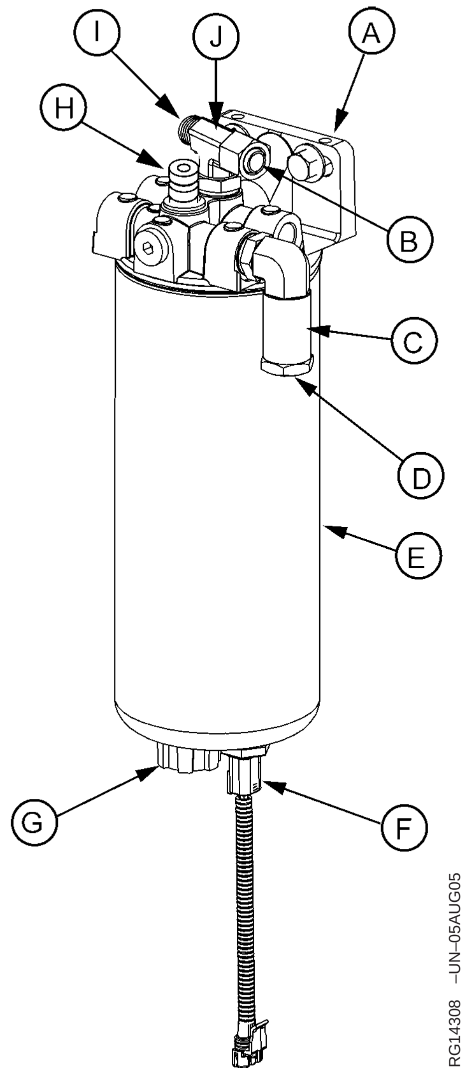
Primary Fuel Filter Operation (246270—)



Primary Fuel Filter (246270—)

On dual filter systems, the primary filter has a 10-micron replaceable element with built-in water separator and port for attaching the Water-In-Fuel sensor harness (F). The primary filter is on the suction side of the transfer pump. Fuel is routed from the vented fuel tank directly to the primary filter inlet (D). On the inlet piping is a quick-connect port (H) that can be used for filling the filter. The primary filter removes particles greater than 10 microns in size from the fuel. Fuel exits the primary filter through a T-fitting (I) and then travels to the fuel transfer pump (The other side of the T-fitting is used by a plugged final filter to route overflow fuel back to the transfer pump).

Water and contaminants settle to the bottom of the water separator bowl. Open the valve (G) in bottom of the bowl to drain these contaminants from the system.

The Water in Fuel (WIF) sensor is used to detect water-contaminated fuel. For more information on the WIF sensor, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 later in this manual.

The primary filter should be replaced when the final filter is replaced.

A—Filter Head
B—Inlet from Transfer Pump
C—Check Valve
D—Inlet from Tank
E—Element, 10-Micron
F—Water In Fuel (WIF) Sensor Harness
G—Drain Valve
H—Quick-Connect Port
I—Inlet from Relief Valve on Final Filter
J—T-Fitting

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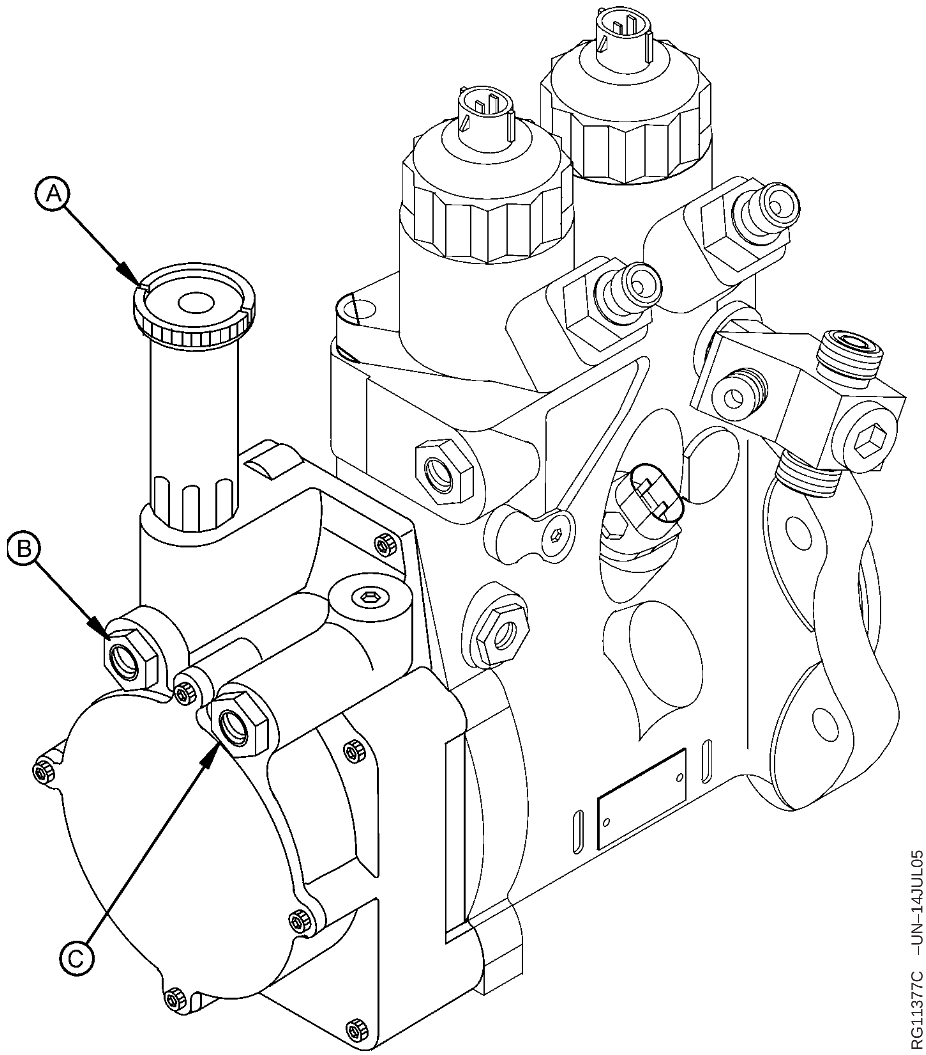
Fuel Transfer Pump Operation



Electronic Fuel Transfer Pump Operation

A—Hand Primer **B—Fuel Transfer Pump Inlet** **C—Fuel Transfer Pump Outlet**

The fuel transfer pump is mounted on the high pressure fuel pump and is driven by the high pressure fuel pump camshaft. The transfer pump draws fuel from the fuel tank, through the primary filter, and into the transfer pump inlet (B). Fuel is then pressurized, exits the transfer pump at outlet (C), and travels to the final filter. On its way to the final filter, the fuel may be routed through a customer-supplied cooler. The hand primer (A) is provided for bleeding air from the fuel system.

The transfer pump and the high pressure fuel pump are supplied as an assembled unit. The entire unit must be replaced if a failure occurs.

RG41221,000001B –19–28AUG01–1/1

Final Fuel Filter Operation (—246269)

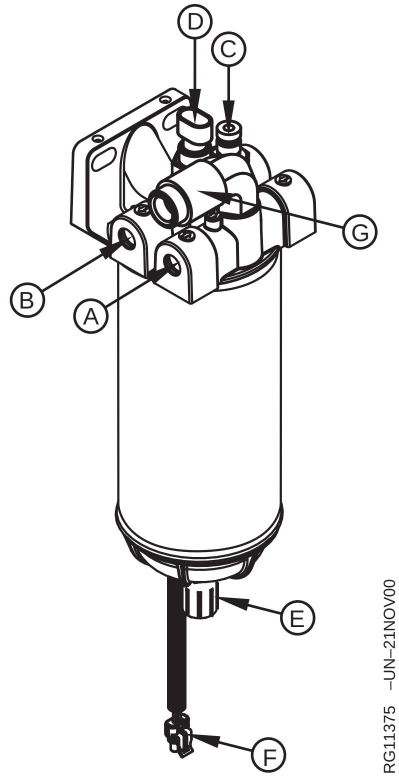
CAUTION: Fuel in filter may be under pressure. Open valve on bottom of filter to relieve pressure prior to removing filter.

The final filter is a 2-micron filter. Fuel enters the final filter at the fuel inlet (A), flows through the filter element, and exits through the outlet (B) to the high pressure fuel pump. The diagnostic port (C) is a quick-disconnect fitting to allow connection of a pressure gauge for testing the low-pressure-supply side of the fuel system. Also, air and excess fuel can be expelled through the diagnostic port for bleeding purposes. If the filter becomes clogged, pressure will increase inside the filter until the pressure relief valve (G) opens. Any fuel passing through this valve flows back to the fuel tank (on some engines, bypass fuel is routed back to the transfer pump). If too much fuel bypasses the filter, not enough fuel will reach the high pressure fuel pump, causing pressure to drop inside the high pressure common rail. This will cause diagnostic trouble codes (DTCs).

The fuel temperature sensor (D) measures the temperature of the fuel. This helps the ECU calculate fuel density for injection purposes. For more information on the fuel temperature sensor, see MEASURING TEMPERATURE in Section 03, Group 140 later in this manual.

Water and contaminants settle to the bottom of the water separator bowl. Open valve (E) to drain these contaminants from the system.

The Water in Fuel (WIF) sensor inside the water separator bowl is used to detect water-contaminated fuel. For more information on the WIF sensor, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 later in this manual.



Final Fuel Filter (—246269)

A—Fuel Inlet
B—Fuel Outlet
C—Diagnostic Port
D—Fuel Temperature Sensor
E—Drain Valve
F—Water In Fuel (WIF) Sensor Harness
G—Pressure Relief Valve

RG41221,000001C –19–26MAR02–1/1

Final Fuel Filter Operation (246270—)

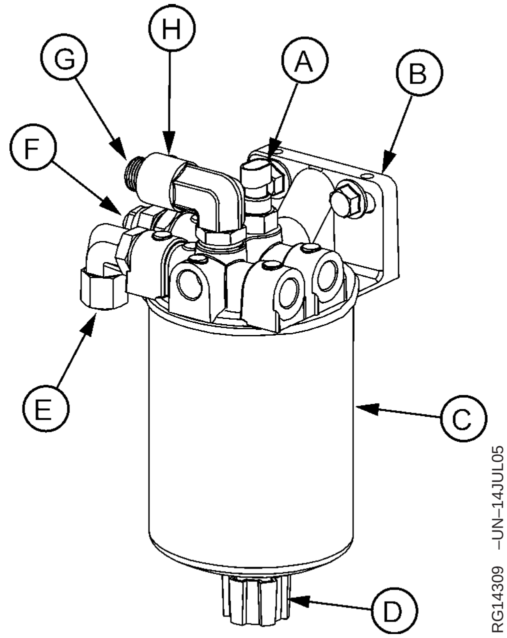
CAUTION: Fuel in filter may be under pressure. Open valve on bottom of filter to relieve pressure prior to removing filter.

The final filter is a 2-micron filter. Fuel enters the final filter at the fuel inlet (E), flows through the filter element, and exits through the outlet (F) to the high pressure fuel pump. If the filter becomes clogged, pressure will increase inside the filter until the pressure relief valve (H) opens. Any fuel passing through this valve flows back to the transfer pump via the T-fitting on the primary filter. If too much fuel bypasses the filter, not enough fuel will reach the high pressure fuel pump, causing pressure to drop inside the high pressure common rail. This will cause diagnostic trouble codes (DTCs).

The fuel temperature sensor (A) provides a signal to the ECU which uses the data to calculate fuel density for injection purposes, increase idle speed when fuel is cold, and derate engine if fuel temperature is too high. For more information on the fuel temperature sensor, see MEASURING TEMPERATURE in Section 03, Group 140 later in this manual.

Water and contaminants may be drained by opening valve (D) in the bottom of the filter.

The final filter and the primary filter should be replaced at the same time.

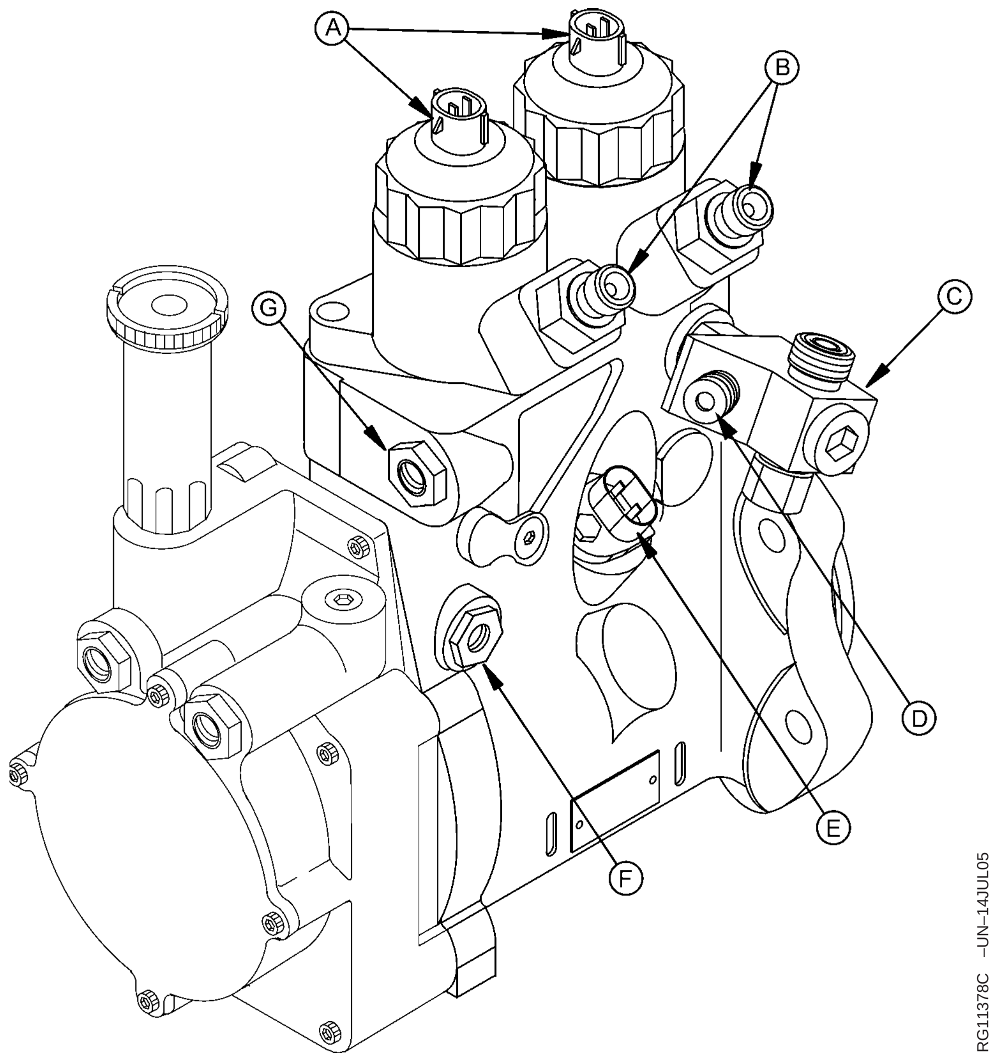


Final Fuel Filter (246270—)

A—Fuel Temperature Sensor
B—Filter Head
C—Element, 2-Micron
D—Drain Valve
E—Inlet from Transfer Pump
F—Outlet to Injection Pump
G—Bypass Outlet to Primary Filter
H—Pressure Relief Valve

RG41221,000001C –19–26MAR02–1/1

High Pressure Fuel Pump Operation



High Pressure Fuel Pump (246270— Type Shown)

A—Pump Control Valves (PCVs)
B—Delivery Valves with Fuel Outlets
C—Overflow Valve (supplied separate of pump)
D—Diagnostic Port (246270—)
E—Pump Position Sensor
F—Oil Lube Inlet
G—Fuel Inlet

The 6081 high pressure common rail engine uses the Denso ECD-U2 high pressure fuel pump. The main components of the ECD-U2 pump are the driveshaft, two 3-lobed cams, timing wheel, two pumping plungers, pump control valves (PVCs), delivery valves (B), and the pump position sensor (E). The diagnostic port (D) is a quick-disconnect fitting to allow connection of a pressure gauge for testing the low-pressure-supply side of the fuel system.

Continued on next page

RG41221,000001D –19–26MAR02–1/2

NOTE: The pump supplied with the single-filter system (—246269) has a different overflow valve and does not have a diagnostic port. On engines prior to 246270, the diagnostic port is located on the fuel filter head.

Filtered fuel from the primary filter fills the high pressure fuel pump at the fuel inlet (G). Both cam lobes and the timing wheel are attached to the driveshaft. As the driveshaft rotates, both cam lobes operate their respective plungers to increase the pressure of the fuel. The timing wheel is used to keep the high pressure fuel pump and the engine timing in sync with each other. The timing wheel is comprised of 6 equally spaced notches with 1 additional notch. The ECU uses the pump position sensor (D) to detect each notch on the gear as it rotates past the sensor. The ECU uses an additional notch to determine when cylinder #1 is approaching Top-Dead-Center (TDC). For more information on the Pump Position Sensor, see MEASURING ENGINE SPEED in Section 03, Group 140 later in this manual.

The PCVs (A) receive an electronic signal from the ECU to regulate the discharge volume of fuel to the High Pressure Common Rail (HPCR).

As the plunger is in the downward stroke, the PCV is open allowing fuel to enter the pumping chamber. The PCV remains open as the plunger starts the upward stroke. As long as the PCV is open, there is no pressure developing. The pump position sensor tells the ECU when to shut the PCV to start pressurizing the fuel based on the timing of the engine. The ECU sends a signal to the PCV that closes the valve and starts to build pressure. Once the pressure rises to delivery pressure, a delivery valve opens allowing fuel to exit at the fuel outlets (B). The ECU uses the timing of the PCV opening and closing to regulate the fuel pressure in the High Pressure Common Rail (HPCR). Once the plunger reaches the maximum height on the cam lobe, delivery is over. The plunger starts the downward stroke and the pressure decreases, closing the delivery valve. The ECU removes the current to the PCV opening the valve and allowing more fuel to flow into the pumping chamber. This cycle repeats itself for each lobe on the cam.

NOTE: If the pump position sensor harness connections are reversed, the engine will not start or run.

For more information on the Pump Control Valves, see PUMP CONTROL VALVES (PCVs) in Section 03, Group 140 later in this manual.

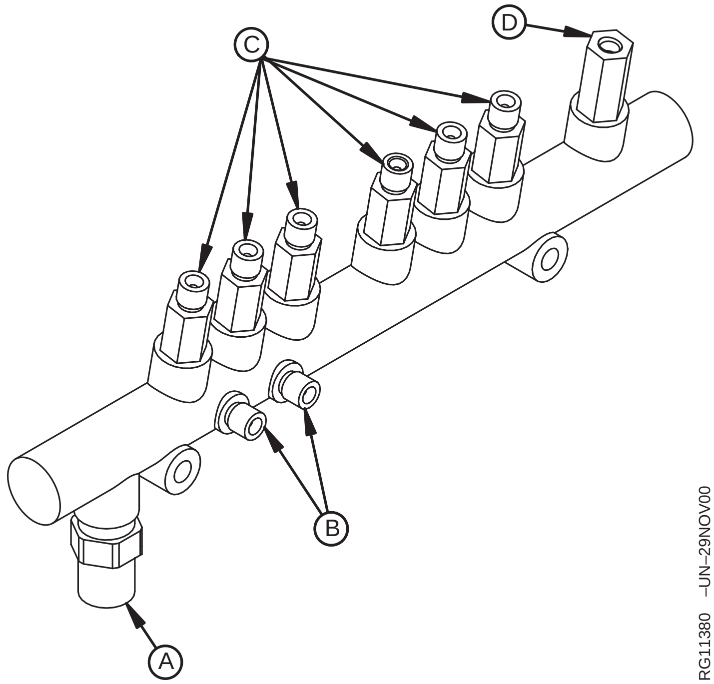
Each of the pumping chambers supply fuel for 3 of the cylinders. This means that the pumping plungers are always opposite each other. If the harness connections are reversed, the pump will be closing the PCVs when there is not enough fuel in the chamber to raise the pressure to open the delivery valve. The engine will not start or run under this condition.

Excess fuel inside the pump flows out the overflow valve (C) and is routed back to the tank.

The transfer pump and the high pressure fuel pump come as an assembled unit. The entire pump must be replaced if a failure occurs.

RG41221,000001D –19–26MAR02–2/2

High Pressure Common Rail (HPCR) Operation



High Pressure Common Rail

A—Fuel Rail Pressure Sensor **B—Fuel Inlets** **C—Flow Limiter** **D—Pressure Relief Valve**

High pressure fuel is delivered to the high pressure common rail (HPCR) at the fuel inlets (B) from the high pressure fuel pump. The HPCR distributes high pressure fuel to the Electronic Injectors (EIs). The fuel rail pressure sensor, flow limiter, and pressure relief valve work together to regulate fuel distribution. The fuel rail pressure sensor (A) detects the fuel pressure inside the rail. The engine control unit (ECU) uses this sensor to monitor the fuel pressure to determine the timing of the pump control valves on the high pressure fuel pump. For more information on the fuel rail pressure sensor, see MEASURING PRESSURE in Section 03, Group 140 later in this manual.

The flow limiters (C) use a piston and ball valve to reduce pressure pulsations. This ensures a steady pressure in the fuel lines to the electronic injectors (EIs). The flow limiters are also used to limit the maximum fuel flow to the EIs to prevent engine damage due to a failed EI or a high pressure leak by shutting off fuel to that particular EI. This is done by moving the ball valve until it seats closing the valve.

If a fuel pressure of 200 MPa (2000 bar) (29,000 psi) is generated within the HPCR, the pressure relief valve (D) will release the excess pressure and drain fuel back to the tank.

RG41221,000001E –19–26MAR02–1/1

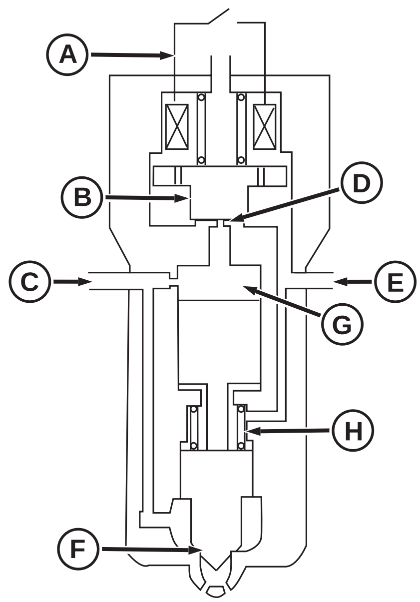
Electronic Injector (EI) Operation

The electronic injectors (EIs) are located inside the engine's cylinder head and are electronically controlled by the ECU. The amount of fuel delivered to the cylinder is in direct proportion with the length of time current is supplied to the two-way electromagnetic valve (TWV) on each EI.

RG41221,000001F –19–29SEP00–1/4

EI - No Injection

Fuel from the HPCR enters the EI at the fuel inlet (C). When no current is supplied to the TWV (A), the valve spring (H) and the hydraulic pressure of the fuel in the control chamber (G) cause the hydraulic piston to push the needle down and close the nozzle. This holds the high pressure fuel from the common rail inside the nozzle until injection.



RG11556A –UN–16FEB01

No/Ending Injection

A—Two-Way Valve (TWV)
B—Solenoid Valve
C—Fuel Inlet
D—Orifice Seat
E—Fuel Leak-off
F—Nozzle
G—Control Chamber
H—Valve Spring

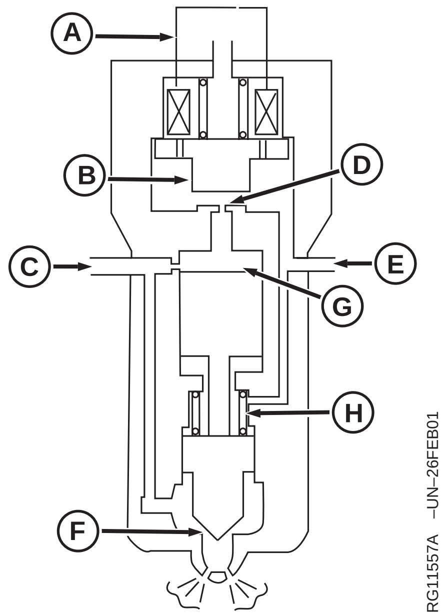
Continued on next page

RG41221,000001F –19–29SEP00–2/4

EI - Begin Injection

Injection begins when current is supplied from the ECU to the TWV (A). The electromagnetic force pulls the solenoid valve (B) up, causing the orifice seat (D) to open. The fuel in the control chamber (G) flows out of the injector to the fuel leak-off (E) line. Fuel is then routed back to the fuel tank. As the fuel exits the injector, the force is removed from the hydraulic piston allowing fuel through the nozzle (F) to start the injection process.

A—Two-Way Valve (TWV)
B—Solenoid Valve
C—Fuel Inlet
D—Orifice Seat
E—Fuel Leak-off
F—Nozzle
G—Control Chamber
H—Valve Spring



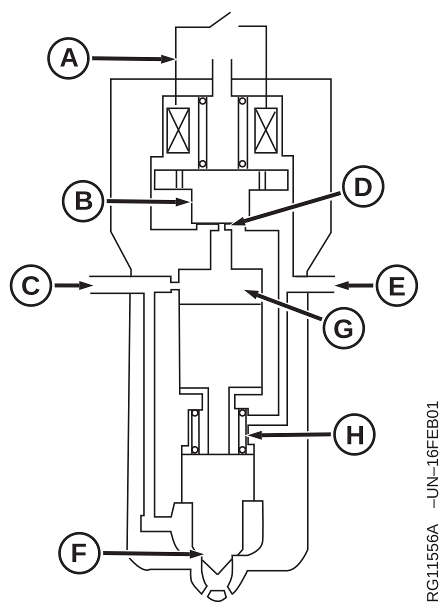
Begin Injection

RG41221,000001F –19–29SEP00–3/4

EI - Ending Injection

Injection ends when the current is removed from the TWV (A). The solenoid valve (B) closes causing fuel to fill the control chamber (G). The valve spring and the hydraulic force from the fuel in the control chamber cause the hydraulic piston to push the needle down and close the nozzle. At this time the injection is complete.

A—Two-Way Valve (TWV)
B—Solenoid Valve
C—Fuel Inlet
D—Orifice Seat
E—Fuel Leak-off
F—Nozzle
G—Control Chamber
H—Valve Spring



No/Ending Injection

RG41221,000001F –19–29SEP00–4/4

About This Group

In this group, the electrical control system is described in the following categories:

- Electronic Control System Terminology
- Electronic Control System Operation
- Electronic Control System Overview
- Monitoring Engine Parameters
- Measuring Temperature
  - ECT (Engine Coolant Temperature) Sensor
  - Fuel Temperature Sensor
  - MAT Manifold Air Temperature Sensor
- Measuring Pressure
  - Fuel Rail Pressure Sensor
  - Oil Pressure Sensor
  - Manifold Pressure Sensor
- Measuring Engine Speed
  - Crankshaft Position Sensor
  - Pump Position Sensor
- Water In Fuel (WIF) Sensor
- Throttle Descriptions
  - Combination Throttle
  - Analog Throttle
  - CAN Throttle
  - Excavator Throttle
  - Multi-state (Digital) Throttles
  - Pulse-Width-Modulated (PWM) Throttle
  - Digital Throttle Adjustments
  - Marine Throttles
- Pump Control Valves (PCVs)
- Electronic Injector (EI) Wiring Harness Connector
- Engine Control Unit (ECU)
- Controlled Area Network (CAN)
- Low-Idle Warmup
- Intake Air Heater Operation
- Cruise Control Operation
- Engine Derate and Shutdown
- Torque Curves
- Governor Droop Modes
- Engine Control Unit (ECU) Self-Diagnosis

RG41221,0000002 –19–16APR02–1/1

Electronic Control System Terminology

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.
Boost	Pressurized air in the intake manifold.
CAN	Controller Area Network. The network on vehicles that allows communication between controllers.
Digital	A signal which consists of only two voltage levels — usually 0 volts and +5 volts.
DST	Diagnostic Scan Tool. This is a diagnostic software that is used to read engine parameters, check DTCs, and run special tests. The DST consists of an Windows or NT compatible computer and a hardware kit available from John Deere Distribution Service Center (DSC): JDIS121 - ECU Communication Hardware Kit. The software is available to download from your John Deere home page.
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.
ECT	Engine Coolant Temperature (sensor). Measure the temperature of the engine coolant. For further ECT sensor information, see MEASURING TEMPERATURE later in this Group.
ECU	Engine Control Unit. Computer that controls the fuel, air, ignition, and other systems on the engine and vehicle.
EI	Electronic Injector. The EI is an electronic injector that is controller by the ECU. The ECU controls the start of injection and the amount of fuel injected by energizing and de-energizing the two-way valve on the injectors. For more information on EIs, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual for details.
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).
HPCR	High Pressure Common Rail is used to distribute the high pressure fuel to each individual EI. For more information on the HPCR, see HIGH PRESSURE COMMON RAIL (HPCR) OPERATION in Section 03, Group 130 earlier in this manual.
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. For further MAT sensor information, see MEASURING TEMPERATURE later in this Group.
PCV	Pump Control Valve is used to regulate the amount of fuel that the high pressure fuel pump supplies the HPCR. For further Pump Control Valve information, see PUMP CONTROL VALVES (PCVs) later in this Group.
PROM	Programmable Read-Only Memory. A computer chip in the ECU that contains calibration information and various engine and application-specific settings for governor, throttle, special options, etc.
PWM	Pulse Width Modulation. A digital electronic signal that 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.

Continued on next page

RG41221,0000017 –19–28SEP00–1/2

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 for details.)
TWV	Two-Way Valve. The TWV is energized to raise the outer valve allowing fuel to be injected into the cylinder. or more information on the TWV, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.
WIF	Water In Fuel (sensor). The WIF sensor sends a signal to the ECU when water is detected in the fuel. For further WIF sensor information, see WATER IN FUEL (WIF) SENSOR later in this Group.

RG41221,0000017 –19–28SEP00–2/2

Electronic Control System Operation

Engine Starting Mode

When the key is turned to the “ON” position, a switched power voltage is sent to the Engine Control Unit (ECU). This energizes the ECU and allows it 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.

As soon as the ECU receives an input from the crankshaft position sensor verifying that the engine is cranking, the ECU will determine using the pump position sensor input when cylinder number 1 is coming to top-dead-center at the end of the compression stroke. It will then start injecting fuel when the next cylinder in the firing order (cylinder number 5) is at the correct position before top-dead-center at the end of its compression stroke.

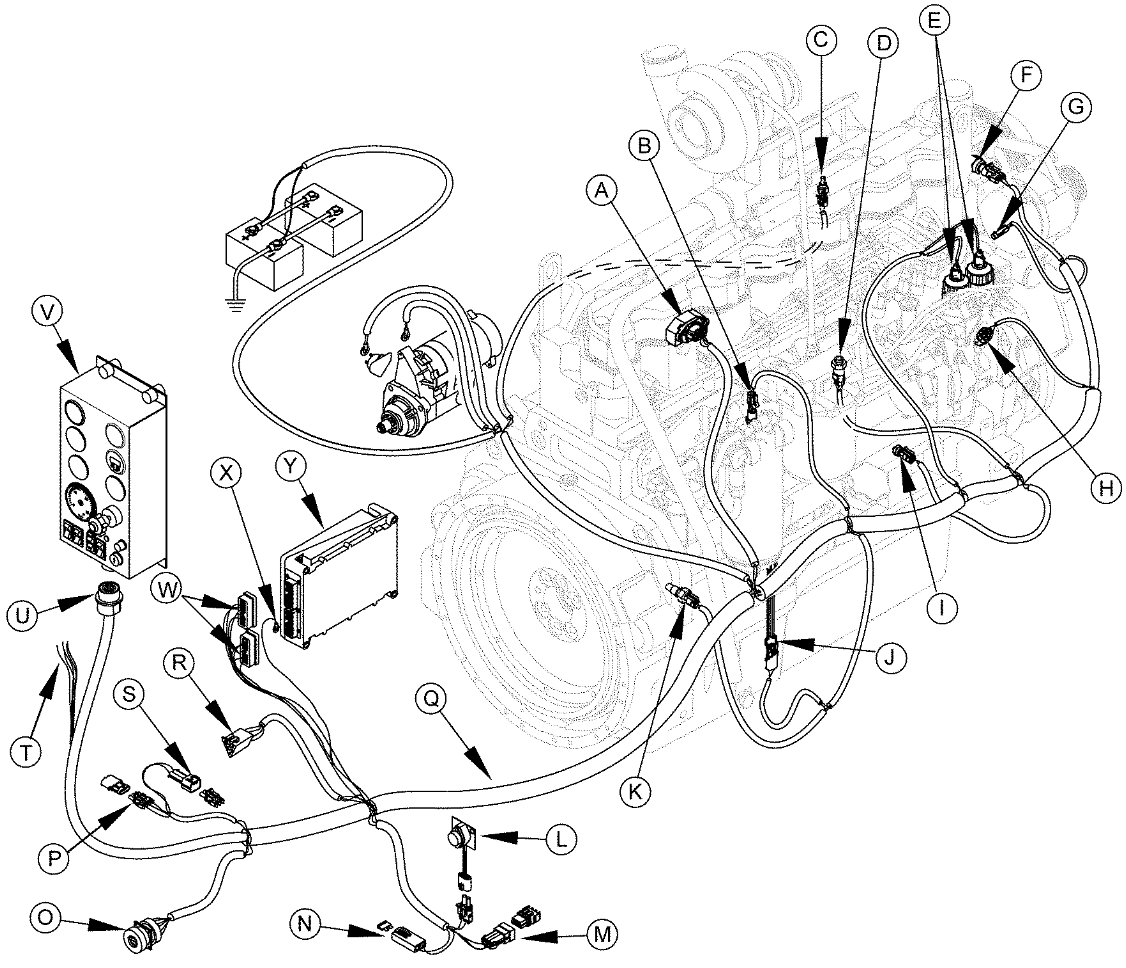
To provide cold temperature enrichment, the amount of fuel injected is based on the temperature measured by the Engine Coolant Temperature (ECT) sensor. At this point, the engine will start and the ECU will go into the running mode.

Engine Running Mode

In the running mode, both the pump and crankshaft position sensors allow the ECU to precisely determine piston position in relation to top-dead-center. The ECU use this information to inform each individual EI of the injection timing and rate. The ECU controls fuel delivery by energizing and de-energizing the two-way valve (TWV). When the TWV is energized, the EI needle opens and injection begins. When the correct amount of fuel has been injected, the TWV de-energizes causing the valve needle to close and fuel injection to stop.

RG41221,0000071 –19–16APR02–1/1

Electronic Control System Overview



RG14305 –UN–14JUL05

A—Electronic Injector (EI) Wiring Harness Connector
B—Fuel Temperature Sensor
C—Manifold Air Temperature Sensor (MAT)
D—Fuel Rail Pressure Sensor
E—Pump Control Valves (PCVs)
F—Engine Coolant Temperature Sensor (ECT)
G—Alternator Ignition Connector
H—Pump Position Sensor
I—Oil Pressure Sensor
J—Water In Fuel (WIF) Sensor Harness
K—Crankshaft Position Sensor
L—Transient Voltage Protection (TVP) Module
M—Performance Program Connector
N—Main System Fuse (10A)
O—CAN Diagnostic Connector
P—Secondary Analog Throttle Connector
Q—Engine Wiring Harness
R—SAE 1939 CAN Connector
S—Remote On/Off Connector
T—Unterminated Wires
U—Instrument Panel Connector
V—Optional Instrument Panel
W—ECU Connectors
X—System Ground
Y—Engine Control Unit

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

The electronic control system serves as an engine governor by controlling the Electronic Injectors (EIs) so that fuel is delivered according to a given set engine conditions, precise amounts, and at a precise time in relation to piston position. In order to achieve this, the control system performs the following functions:

- Constantly monitor engine operating conditions
- Precisely determines piston position
- Deliver optimum amount of fuel for a given set of operating conditions

Continued on next page RG41221,0000010 –19–16APR02–1/2

- Deliver fuel at optimum piston position
- Provide multiple control modes
- Perform self-diagnosis

RG41221,0000010 –19–16APR02–2/2

Monitoring Engine Parameters

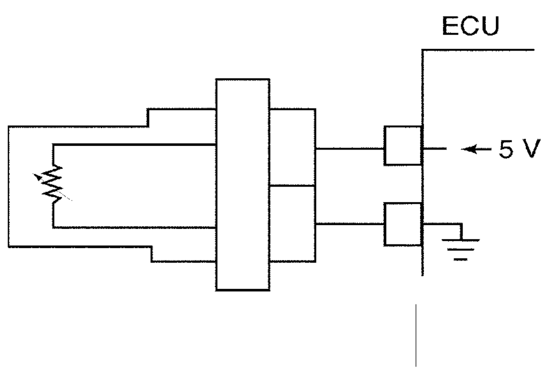
In order for the electronic control system to deliver fuel according to a given set of operating conditions and, on some applications to provide engine protection, the following engine parameters are monitored by the ECU:

- Engine Coolant Temperature (ECT)
- Fuel Temperature
- Manifold Air Temperature (MAT)
- Fuel Rail Pressure
- Oil Pressure
- Manifold Air Pressure (MAP) (optional)
- Air Filter Differential Pressure (optional)
- Crankshaft Position
- Pump Position
- Water in Fuel (WIF)

RG41221,0000018 –19–28SEP00–1/1

Measuring Temperature

The Engine Coolant Temperature (ECT), the Fuel Temperature, and the Manifold Air Temperature (MAT) sensors are thermistors (temperature sensitive variable resistors). Resistance inside the sensor changes as temperature changes. The supply voltage to the sensor from the ECU will be pulled down according to how much current passes through the sensor to the ground side of the sensor circuit. The ECU monitors this voltage and responds with the appropriate control signals according to its programming.



RG11819 –UN–17AUG01

Temperature Sensor Schematic

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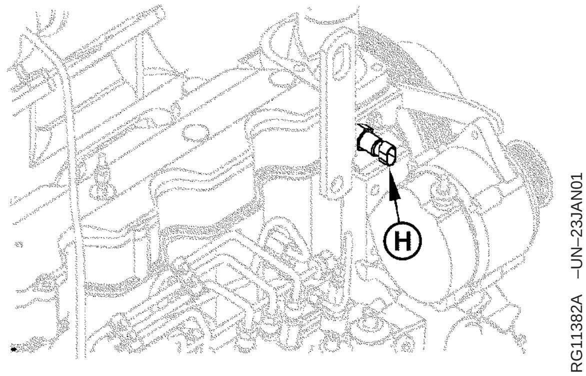
RG41221,0000019 –19–28AUG01–1/4

ECT (Engine Coolant Temperature) Sensor

The ECT sensor (H) is located in the thermostat housing. The ECU monitors engine coolant temperature for:

- Engine protection purposes. An over-temperature signal will derate the engine. For more information on engine protection and derate programs, see ENGINE DERATE AND SHUTDOWN PROTECTION later in this Group.
- Starting fuel quantity determination — The ECU will adjust the amount of fuel delivered during start-up based on the initial ECT readings.
- Idle speed determination — In order to speed engine warm-up, the ECU will increase idle speed after start-up if a low coolant temperature is measured.

In the event of a failed sensor or an over-temperature condition, the ECU will store an applicable diagnostic trouble code.



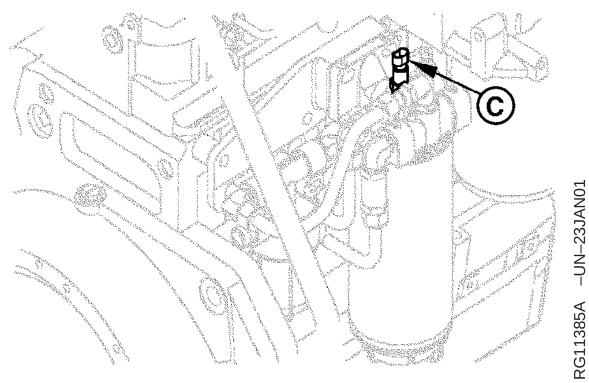
ECT Sensor in Thermostat Housing

RG41221,0000019 –19–28AUG01–2/4

Fuel Temperature Sensor

The fuel temperature sensor (C) is located in the head of the final fuel filter. The ECU uses this sensor input to calculate fuel density and adjust fuel delivery accordingly. In the event of a failed sensor or an over-temperature condition, the ECU will store an applicable diagnostic trouble code.

On some applications, an over-temperature signal will derate the engine. For more information on engine protection and derate programs, see ENGINE DERATE AND SHUTDOWN PROTECTION later in this Group.



Fuel Temperature Sensor

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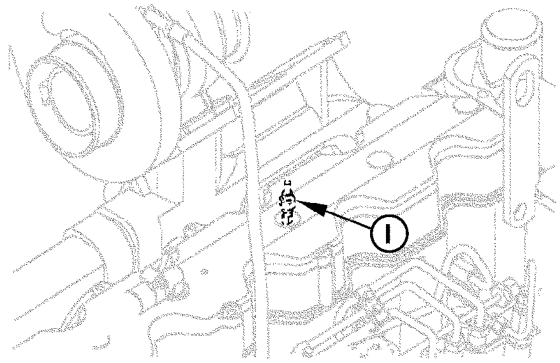
RG41221,0000019 –19–28AUG01–3/4

MAT (Manifold Air Temperature) Sensor

The MAT sensor (I) is installed either onto the top or underside the intake manifold. The MAT sensor measures intake air temperature to help the ECU calculate correct fueling. The ECU also monitors manifold air temperature for engine protection purposes. An over-temperature signal will derate the engine. For more information on engine protection and derate programs, see ENGINE DERATE AND SHUTDOWN PROTECTION later in this Group.



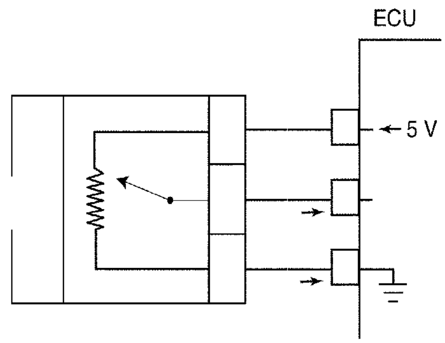
RG11383A –UN–23JAN01

MAT Sensor

RG41221,0000019 –19–28AUG01–4/4

Measuring Pressure

The pressure sensors are 3-wire variable resistors. A supply voltage is applied to the sensor by the ECU which is used by the sensor circuitry to return a voltage signal back to the ECU that will vary according to the pressure at the sensor. This voltage is monitored by the ECU which responds with the appropriate control signals according to its programming.



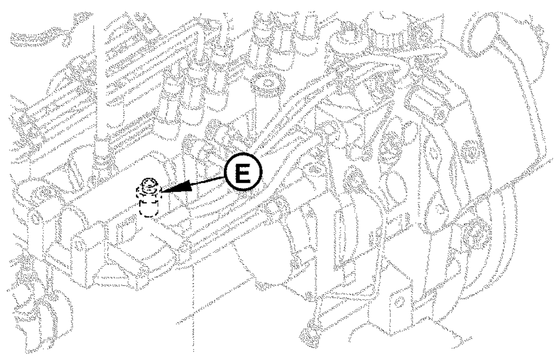
RG12827 –UN–30JAN03

Pressure Sensor Schematic

RG41221,0000020 –19–03APR03–1/4

Fuel Rail Pressure Sensor

The fuel rail pressure sensor (E) is located on the HPCR. The ECU uses this sensor to monitor fuel pressure inside the rail. Using the sensor signal, the ECU adjusts the timing of the pump control valves on the high pressure fuel pump to deliver more or less fuel to the HPCR. The ECU uses this signal input to determine if fuel rail pressure is adequate, out of range (OOR), dropping too fast, or not developing at all, or if the sensor has failed. On OEM engines, a failed sensor condition will derate the engine to a default fuel rail pressure.



RG11391A –UN–23JAN01

Fuel Rail Pressure Sensor

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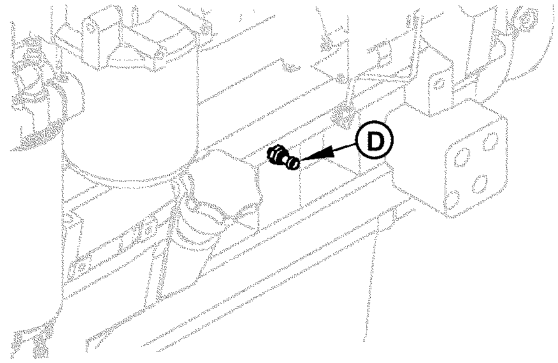
RG41221,0000020 –19–03APR03–2/4

Oil Pressure Sensor

The oil pressure sensor (D) is located in the main engine galley of the block. The ECU monitors oil pressure for engine protection purposes. The ECU determines whether oil pressure is moderately low or extremely low. On most engines, a low oil pressure condition will derate the engine. For more information on engine protection and derate programs, see ENGINE DERATE AND SHUTDOWN PROTECTION later in this Group.



Oil Pressure Sensor

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9

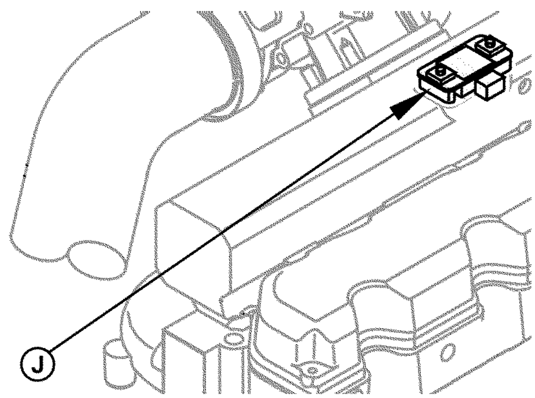
RG41221,0000020 –19–03APR03–3/4

MAP (Manifold Air Pressure) Sensor

The optional MAP sensor (J) supplies the ECU with a direct measurement of turbo boost and is used by the ECU to help calculate the amount of airflow into the engine. The MAP sensor, if used, is located on the intake manifold.

Air Filter Differential Pressure Switch

The optional air filter differential pressure (or “air filter restriction”) switch is either a normally open or normally closed switch, depending on application. The switch either opens or closes if the difference in pressure between normal atmospheric and the clean side of the filter becomes too high, indicating that the engine air filter is restricted. The switch, if used, is typically located where the clean-side ducting is clamped to the air filter. Additional diagnostic information can be found in the application’s test and diagnostic manual.



MAP Sensor

RG41221,0000020 –19–03APR03–4/4

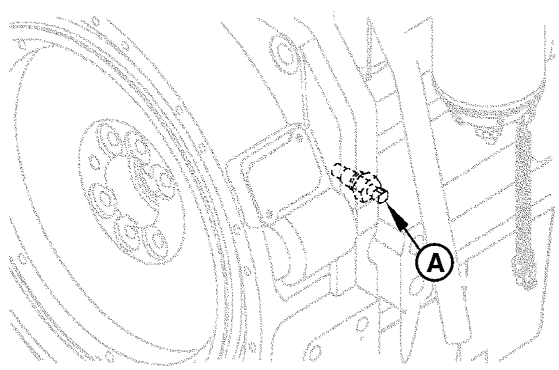
Measuring Engine Speed

Both the crankshaft position sensor and the pump position sensor operate by detecting changes in voltage induced by their corresponding gear/timing wheel. The gear teeth on the gear/timing wheel induce a voltage in the sensor. When a notch (one or more missing teeth) passes under the sensor, the pattern of the signal changes. By monitoring these changes in signal, the ECU calculates engine speed and the cylinder that is ready for injection. The ECU monitors both of these sensors to verify that they are in time with each other.

RG41221,0000021 –19–13DEC01–1/3

Crankshaft Position Sensor

The crankshaft position sensor (A) is located on the rear of the engine. It is an inductive type pickup sensor that detects teeth on the oil pump drive gear. The ECU uses the crankshaft position input to determine engine speed and precise piston position in relation to the firing order. The oil pump drive gear is comprised of 72 evenly spaced teeth with 2 teeth ground off. The ground teeth help the ECU determine when cylinder #1 is at Top-Dead-Center (TDC).



Crankshaft Position Sensor

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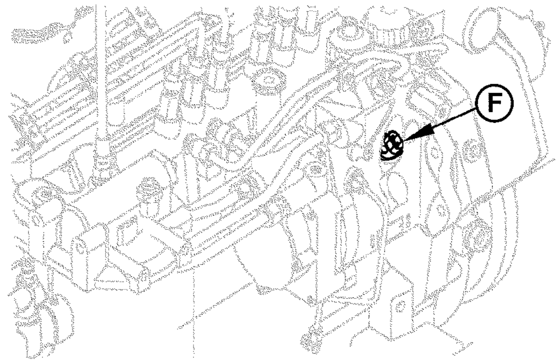
RG41221,0000021 –19–13DEC01–2/3

Pump Position Sensor

The pump position sensor (F) is located on the side of the high pressure fuel pump. It is an inductive-type pickup sensor that detects notches on the timing wheel of the high pressure fuel pump camshaft. The ECU uses this sensor to determine engine speed and when each cylinder is at TDC at the end of the compression stroke. The ECU needs this information to deliver the correct amount of fuel to the correct EI at the correct time. The ECU monitors the voltage that is created by the pump position sensor when the notches of the timing wheel pass. The timing gear has 6 evenly spaced notches with one additional notch offset to tell the ECU that cylinder #1 is approaching Top-Dead-Center.



Pump Position Sensor

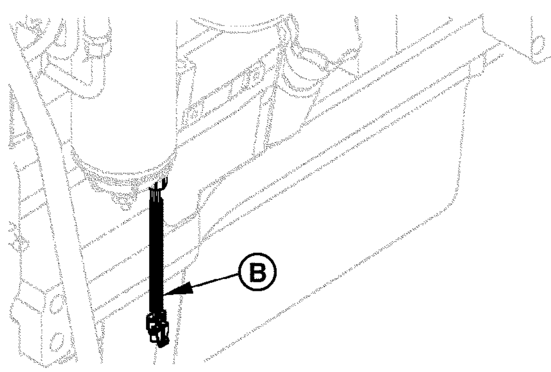
Tachometer Output

The ECU's tachometer output can be used with tachometers that use a 5-volt square-wave input signal. When this feature is enabled, the tachometer output signal is turned on. The customer can select from 0.5, 27, 30, or 60 pulses per revolution.

RG41221,0000021 –19–13DEC01–3/3

Water In Fuel (WIF) Sensor

The WIF sensor (B) is located inside the water separating bowl of the final fuel filter (—246269) or the primary fuel filter (246270—). When water is detected in the fuel, a signal is sent to the ECU. The WIF sensor uses the resistance of fuel and water in the fuel system along with the principle that water is a better conductor than fuel. If water is present, the voltage in the input circuit will be lower. The ECU monitors this for engine protection purposes. For more information on engine protection and derate programs, see ENGINE DERATE AND SHUTDOWN PROTECTION later in this Group.



Water in Fuel Sensor (WIF) Harness

RG41221,0000022 –19–28AUG01–1/1

Throttle Descriptions

The 8.1 L engine has the option of operating with a pulse-width-modulated (PWM) throttle signal, an analog throttle position sensor output signal, a digital (multi-state switch) throttle, or a CAN throttle. If multiple throttles are used on an application, a “combination throttle” is enabled as an option in the ECU.

Combination Throttle

If the Combination Throttle option is enabled, one Master throttle must be selected. One or two additional throttles, identified as 2nd input and 3rd input, can also be enabled.

When Combination Throttle is disabled, the ECU uses inputs from all enabled throttles to set the engine speed. The fastest throttle setting of the enabled throttles will control engine speed.

Any throttle type (Digital, Primary Analog or Secondary Analog) can be designated as the Master throttle.

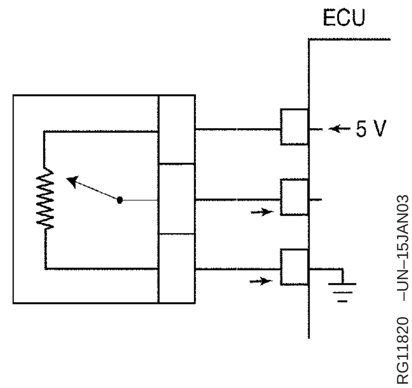
Each type of throttle can be selected only one time in the Combination Throttle selections. For example, if the Primary Analog throttle is selected as the Master throttle, the 2nd input and 3rd input cannot be the Primary Analog throttle. If Combination Throttles is enabled for Master and 2nd input, and the 3rd input is not enabled, the 3rd input throttle will function independently of the Combination Throttles. If all three throttles are enabled in Combination Throttles, all three throttles will work in combination.

Throttles are usually accelerator type throttles. An accelerator type throttle will increase engine speed as throttle input increases. The Master throttle is always an accelerator type throttle.

While not common, decelerator throttles can be useful in applications where a throttle is needed to decrease engine speed. A decelerator type throttle will decrease engine speed as throttle input increases. The decelerator function is not compatible with the tri-state throttle.

Continued on next page RG41221,0000029 –19–16APR02–1/8

Analog Throttle



Position Sensor

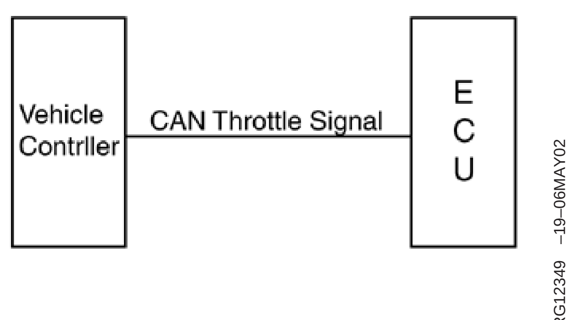
An analog throttle uses a variable resistor (potentiometer) sensor to measure the position of the throttle. The reference (5-volt) voltage that is sent to the sensor by the ECU will drop across the resistor. Because sensor resistance changes as the throttle position changes, the return voltage to the ECU will vary according to the throttle position. The return voltage is monitored by the ECU which responds by sending out the appropriate control signals according to its programming.

An analog throttle can be one of two types: a hand throttle with 2.25-turns between fast and low idle, and/or a foot throttle.

The analog throttle input voltage normally varies between 1.0 volts and 4.0 depending on throttle position. Analog throttle voltage at low idle is approximately 1.0 volt and 4.0 volts at high idle. When the self-calibration option is used, the voltage range will be automatically expanded to match the throttle signal voltage input range. With Self-Calibration enabled, the maximum voltage range is 0.25 volts up to 4.75 volts.

RG41221,0000029 –19–16APR02–2/8

CAN Throttle



CAN Throttle Schematic

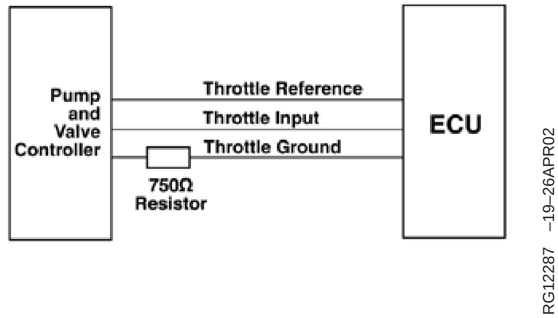
CAN (Controlled Area Network) throttle is information of the desired throttle position that is sent to the ECU by another controller over the CAN bus.

Continued on next page

RG41221,0000029 –19–16APR02–3/8

Excavator Throttle

The Excavator uses an analog throttle to measure throttle position. This throttle is connected to the Pump and Valve controller, which sends throttle input information to the ECU through a dedicated wire. Since the ECU and Pump and Valve controller do not share a common ground, a throttle voltage reference wire and a throttle ground wire accompany the throttle input wire. The ECU uses the differences in controller grounds to determine the throttle request by the Pump and Valve controller.



Excavator Throttle

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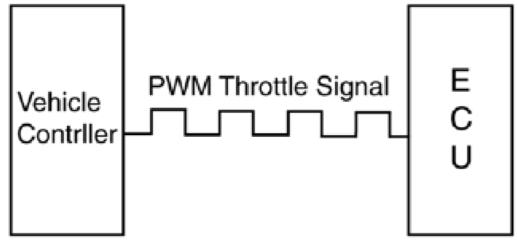
Pulse-Width-Modulated (PWM) Throttle

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 to indicate the desired throttle opening.



PWM Throttle Schematic

Multi-State (Digital) Throttles

Digital throttles use switches to send speed control commands to the ECU. They allow you to preset one high and one low operating speed and switch between them without the use of potentiometers or mechanical adjustments. This feature is available only on ECUs that are not equipped with cruise control.

If an analog (foot or hand) throttle is also desired, up to two throttle potentiometers can be added that would operate between the preset high and low operating speeds. For the analog throttle to work, the multi-state throttle must be set in the minimum throttle position.

There are three types of multi-state throttles: Dual-state, Tri-state, and Ramp. These throttles are wired the same but have a different switch to control the engine speed. For information on each of these throttles, see Dual-State Throttle, Tri-State Throttle, or Ramp Throttle below.

For instructions on operating the multi-state throttle switches and their associated switches (bump enable and speed increase/decrease), see your John Deere Engine Operation and Maintenance Manual.

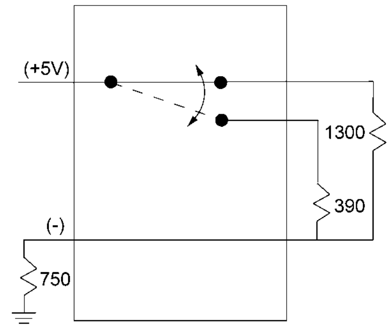
Continued on next page

RG41221,0000029 –19–16APR02–5/8

Dual-State Throttle

The digital dual-state (or “2-state”) throttle has two available positions, minimum throttle and fast idle. Minimum throttle speed can be adjusted in the ECU according to the needs of the application, but the fast idle (no-load) speed is factory-preset.

The switch uses two different resistors to change the voltage returned to the ECU. The ECU converts the voltage to a specific engine speed using an internal conversion table. When the switch is in the minimum throttle position, current is routed through a 390-ohm resistor. Fast idle position uses a 1300-ohm resistor.



RG14302 –UN–14JUL05

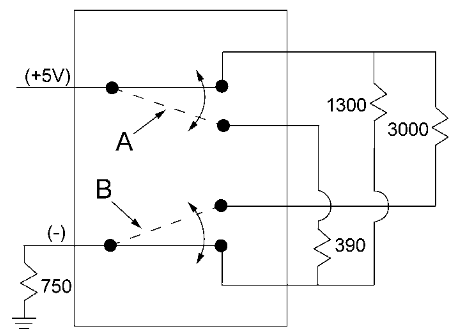
RG41221,0000029 –19–16APR02–6/8

Tri-State Throttle

The digital tri-state (or “3-state”) throttle works similar to the dual-state throttle. This throttle uses a switch with three positions: minimum throttle (turtle), maximum throttle (“ADJ”), and fast idle (rabbit). In the minimum throttle position, engine RPM defaults to a speed that has been set in the ECU according to the needs of the application. The fast idle (no-load) speed is factory-preset. In the maximum (ADJ) throttle position, engine speed can be bumped up or down within a range programmed into the ECU.

To bump engine speed, the tri-state throttle must be in the ADJ position and the “Bump Enable” switch must be in the “enable up” or “enable down” position while the “Idle Select” switch is held in the increase (+) or the decrease (—) position.

The switch uses three different resistors to change the voltage returned to the ECU. The ECU converts the voltage to a specific engine speed using an internal conversion table. When the switch is in the minimum throttle position, current is routed through a 390-ohm resistor. The maximum throttle (ADJ) position uses a 1300-ohm resistor and the fast idle position uses a 3000-ohm resistor.



RG14303 –UN–14JUL05

A—Minimum Throttle (adjustable in ECU) Circuit
B—Fast Idle Circuit
Neither A or B—Maximum Throttle (adjustable by operator) Circuit

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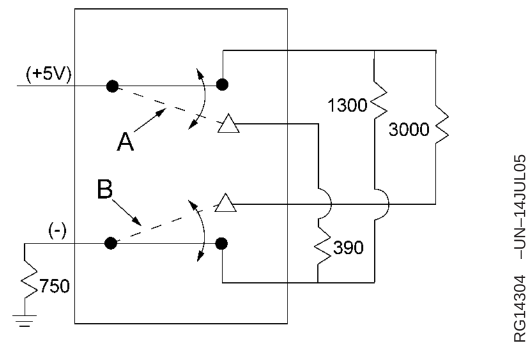
RG41221,0000029 –19–16APR02–7/8

Ramp Throttle

The digital ramp throttle operates between minimum throttle and fast idle and uses a 3-position “Ramp Idle”switch. If the switch is held in the “Increase Throttle” (rabbit) position, the engine speed will ramp up in small increments. If the switch is held in the “Decrease Throttle” (turtle) position, the engine speed will ramp down. As long as this switch is held in a momentary position, the engine continues to ramp up or down until the maximum high or low throttle speed setting is reached. When released, the switch returns to the center “hold throttle” position.

The rate at which the engine speed changes when the switch is held is adjusted in the ECU according to the need of the application. The amount of speed change when the switch is “bumped” is also adjusted in the ECU. The switch uses the same value resistors and is wired essentially the same as the tri-state throttle described above. The only difference is that the Ramp Idle” switch has two momentary positions. Also, the Ramp Idle switch operates alone and does not require an enable or bump switch.



A—“Decrease” Throttle Circuit
B—“Increase” Throttle Circuit
Neither A or B—Hold Throttle Circuit

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Digital Throttle Adjustments

Throttle Out-of-Range Recovery

Throttle Out-of-Range Recovery (all except ramp throttle) determines how the ECU will respond when an invalid throttle signal is again valid (returns to acceptable range). When a throttle signal is invalid (outside the acceptable range), the ECU will send a fault code and set that throttle to 0%. Typically this occurs when analog throttle endpoints are misadjusted, but can also be caused by faulty wiring.

- **Resume Recovery:** When the throttle signal becomes valid, throttle control will immediately resume. Note: This selection may result in sudden engine speed changes.
- **Idle Recovery:** When the throttle signal becomes valid, the throttle must be returned to the 0% throttle position to reactivate the throttle.
- **Idle Lock:** When the throttle signal becomes valid, the key switch must be turned off for 30 seconds to reactivate the throttle.

Because the Ramp throttle resets itself to minimum throttle for any out-of-range condition, selecting a different "Throttle Out-of-Range Recovery" will have no effect on the ramp throttle.

Minimum Throttle Offset

Minimum throttle offset is used to adjust engine low idle speed. The minimum throttle offset increases the minimum throttle setting for all enabled throttles. Engine idle speed adjustments can also be made with the bump switch, if installed.

Maximum Throttle Offset (Tri-State Throttle Only)

Maximum throttle offset is used to adjust maximum engine speed. The Maximum throttle offset decreases the maximum throttle setting for all enabled throttles. With the tri-state throttle, maximum engine speed adjustments can be made with the bump switch.

Continued on next page

WL30140,0000004 –19–06JUN05–1/2

Throttle Rate

Throttle rate is how quickly the ECU changes the engine fuel rate in response to a throttle increase signal. Throttle Rate applies to all active throttles except ramp throttle. Throttle rate has no impact on the deceleration. The ECU is shipped with the Maximum rate selected. Four rates are available: Maximum, Fast, Medium, and Slow.

NOTE: If Ramp Throttle is enabled, the Throttle Rate feature is disabled for all throttles.

Ramp Rate (Ramp Throttle Only)

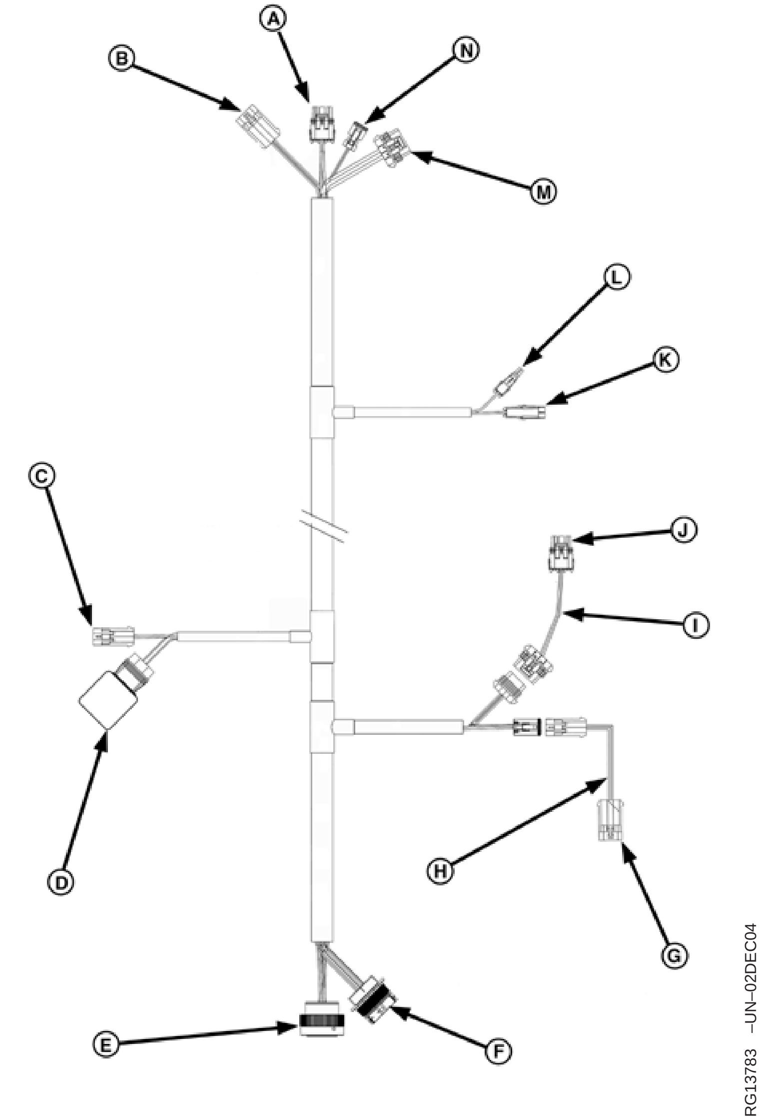
The ramp rate selection sets the rate of change for engine speed increases or decreases. There are four ramp rate options available:

- **3-Second Exponential:** Engine speed will start to increase/decrease at a slow rate and will accelerate/decelerate at an increasingly faster rate the longer the switch is held. The engine will go from 0% to 100% throttle in 3 to 5 seconds.
- **5-Second Linear:** Engine speed will increase/decrease at a constant rate. With this setting the engine throttle setting will go from 0% to 100% throttle in 5 seconds.
- **7-Second Linear:** Engine speed will increase/decrease at a constant rate. With this setting the engine throttle setting will go from 0% to 100% throttle in 7 seconds.
- **9-Second Linear:** Engine speed will increase/decrease at a constant rate. With this setting the engine throttle setting will go from 0% to 100% throttle in 9 seconds.

Ramp Step (Ramp Throttle Only)

Ramp steps or "bumps" are minor increases or decreases in the engine speed setting. When the ramp throttle switch is momentarily held in the "Increase Throttle" or "Decrease Throttle" position, the engine speed will increase/decrease a selected percentage of the throttle range. The actual engine RPM speed change for each setting will vary. Four ramp step rates are available: 0.4% of throttle range, 0.8% of throttle range, 1.6% of throttle range, and 2.8% of throttle range.

Marine Throttles



A—Wheelhouse Throttle Input
B—Wheelhouse Station Select Input
C—External Shutdown Connection
D—Starter Cutout Relay
E—23-Pin Connector
F—21-Pin Connector
G—Auliliary Station Select Input
H—Auxiliary Station Select Adapter
I—Auxiliary Throttle Adapter
J—Auliliary Throttle Input
K—Engine Sync. Output
L—Engine Sync Input
M—Battery (+), Ground (-), Switched Power and Start (to inst. pnl.)
N—CAN Connection (to inst. pnl.)

The 8.1L marine engine has two dual throttle options: 1. Dual throttles with transfer control and 2. Engine synchronization control. To operate, either option requires a variation of the marine transition harness (shown above). Which variation depends on feature configuration(s). Both options cannot operate simultaneously. Operation of each option is described on the next page.

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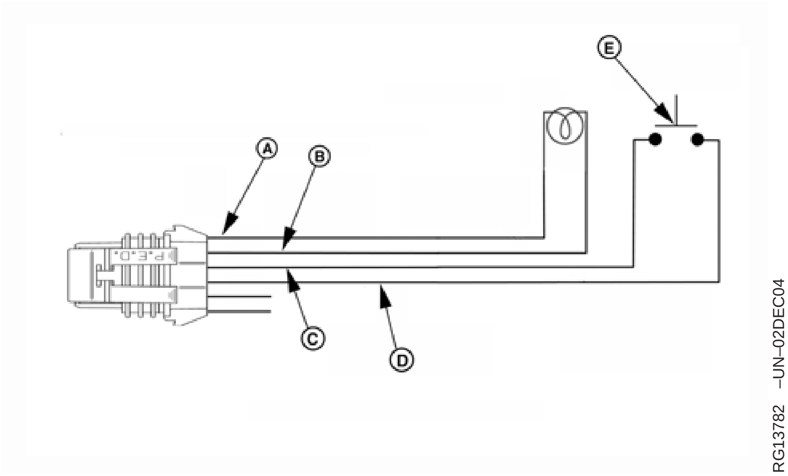
DB92450,0000020 –19–13OCT04–1/3



A.—12 or 24V (+)
B.—Bulb Ground
C—Station Select Input
D—System Voltage (Switched)
E—Push Button Switch

Dual-Throttle Transfer Control

This feature allows throttle control from one of two locations, the wheelhouse or a secondary (auxiliary) station. When the ECU is initialized at key ON, throttle control defaults to the station selected via the trim options during the last ECU programming.

To change throttle control location during engine operation, the station select pushbutton switch at the requesting throttle is held engaged. The indicator lamp will briefly flash, indicating the circuit integrity is good. The pushbutton is held engaged until the station indicator lamp is solid, indicating that throttle control transfer has been successful.

For transfer of throttle control to be successful, the position of the requested throttle must be within 2% of the active throttle position. For example, if the ECU is sampling a throttle command of 55% at the active throttle, then the ECU must receive a throttle command between 53% and 57% at the requesting throttle. If the requesting throttle is not within 2% (approximately 33 rpm) of the active throttle, the lamp flashes on and off. If the station select pushbutton switch is held engaged and the operator moves the requesting throttle to within 2%, transfer will occur. The lamp will go from flashing to solid and the switch at the requesting throttle can be released.

If the requesting throttle position is outside normal operating range (that is, out of normal signal range: 0-0.5 volts low and 4.5-5.0 volts high), its lamp momentarily lights, then shuts off and remains off. If the switch contacts of both throttles are simultaneously closed, the ECU selects the “highest priority location”, which has been designated during ECU programming, via trim options.

At key ON, a test of the lamps at that throttle station will occur. If any lamp does not briefly come on, replace the bulb. The lamp test will occur only if the key has been OFF for at least 30 seconds.

Normal throttle operating voltage is from 0.5 to 4.5 volts, and is usually set by adjusting the throttle mechanical stops.

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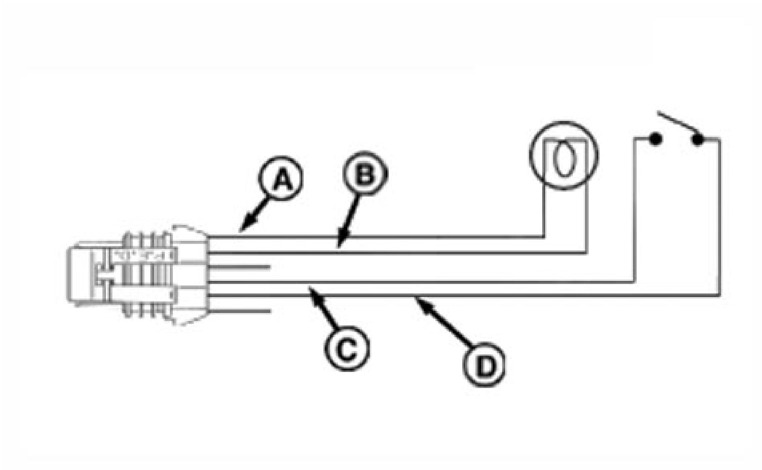


A—12 or 24V (+) Input **B—Bulb Ground** **C—System Voltage (Switched)** **D—Sync Enable**

Engine Synchronization Control

The Engine Sync feature is selected during ECU programming. This feature allows the synchronous operation of two engines through a two-throttle, lead-follow system: one ECU is programmed as the Lead and the other as the Follower. When the system is successfully engaged, the follower ECU runs off the lead ECU's signal. On engines that also have the dual throttle option described above, auxiliary throttle location input is automatically deselected when engine synchronization is in operation.

In order to enable this system, the following three criteria must be met and sustained for at least two seconds: 1. both engines must be running at greater than or equal to 975 rpm; 2. the engines must be running to within 100 rpm or less of each other; and, 3. individual throttle commands of each ECU must be within 5% of each other's value. When the synchronous throttle switch is turned on with the initial criteria met, the throttle station lamp comes on. If at least one of the three criteria is not met, the throttle station lamp flashes on and off until the failing condition has been corrected.

When engine synchronization is successful, the ECU will have automatically disabled the tachometer of the follower engine and will have set each engine to isochronous governor operation. When an engine is above or below engine rpm demand, its governor sends a signal back to the engine's ECU and the ECU makes the appropriate adjustment.

During large demands for acceleration or deceleration, it is normal for the synchronization system to shut down. Synchronous operation may at any time be reenabled as long as the initial criteria are met.

At key ON, a test of the lamps at the throttle station will occur. If any lamp does not briefly come on, replace the bulb. The lamp test will occur only if the key has been OFF for at least 30 seconds.

Normal throttle operating voltage is from 0.5 to 4.5 volts, and is usually set by adjusting the throttle mechanical stops.

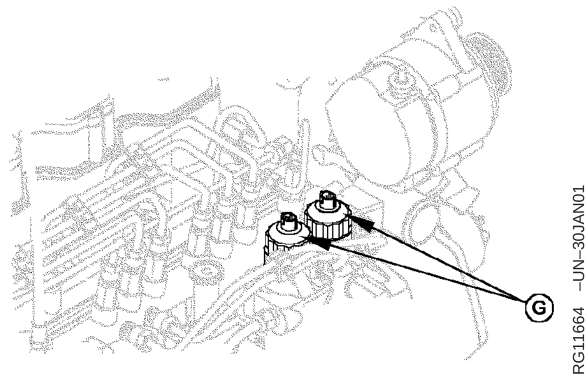
DB92450,0000020 –19–13OCT04–3/3

Pump Control Valves (PCVs)

The Pump Control Valves (G) are located on the high pressure fuel pump. The ECU sends an electronic signal to the PCVs to regulate the delivery of fuel to the High Pressure Common Rail (HPCR). The pressure in the rail is dependent on the timing of the current to the PCVs.

When the PCVs are not energized, the valves are open allowing fuel to enter the pumping chamber. When the PCV is energized, the valve closes allowing fuel pressure to increase in the pumping chamber. Once the desired pressure is reached, the delivery valves open and fuel is transferred to the high pressure fuel pump.

Each of the pumping chambers supply fuel for 3 of the cylinders. This means that the pumping plungers are always opposite each other. If the harness connections are reversed, the pump will be closing the PCVs when there is not enough fuel in the chamber to raise the pressure to open the delivery valve. The engine will not start or run under this condition.

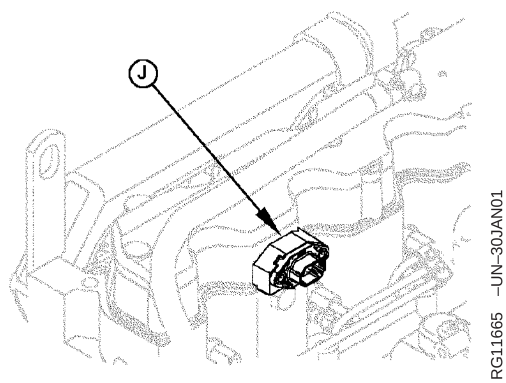


Pump Control Valves (PCVs)

RG41221,00000F0 –19–16APR02–1/1

Electronic Injector (EI) Wiring Harness Connector

The EI wiring harness connector (J) is located on the cylinder head carrier. This connector provides voltage and a ground from the ECU to the EI wiring harness internal to the cylinder head carrier.



Electronic Injector (EI) Wiring Harness Connector

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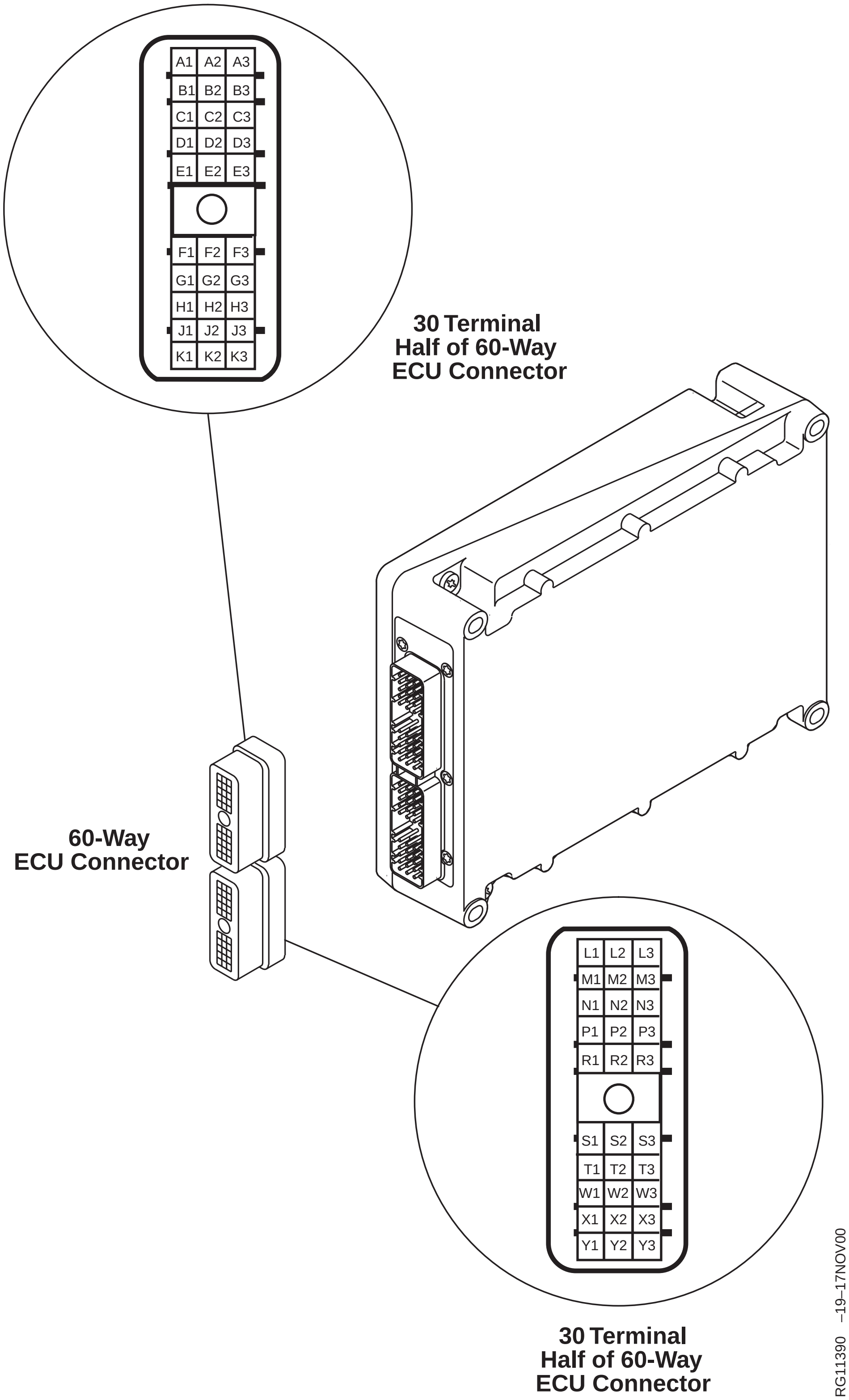
Engine Control Unit (ECU)



John Deere Level 9 ECU

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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:

- Convert the electrical signals from the various sensors into digital signals
- Make decisions of optimum fuel quantity and fuel injection timing based on information from various sensors
- Limit maximum fuel for operation on multiple power curves
- Provide all-speed governing
- Provide self-diagnosis on the control system
- Store trouble codes in memory

The ECU connects to the wiring harness through two 30-way ECU connectors. Each connectors is marked by terminal numbers.

The ECU is comprised 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 communicates its desired fuel quantity and timing to the high pressure fuel pump and EIs and it 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.

RG41221,0000023 –19–09OCT00–2/2

Controlled Area Network (CAN)

The CAN buss is a high-speed open interconnect network for electronic systems on on-highway and off-road vehicles and stationary equipment. It allows electronic systems to communicate with each other through a standard architecture of electronic signals over shielded twisted-pair wires. Engines can communicate with throttles, transmissions and brakes. Vehicles can communicate with trailers. Agricultural and construction equipment can communicate with implements and accessories. Stationary equipment can communicate with controllers or other networked equipment. Information on the network can be displayed to the operator on a virtual terminal (instrument panel) or relayed to another location via telemetry. Up to 30 Electronic Control Units or modules can be connected together through a single CAN network segment. A CAN connection (SAE J1939) is provided in two different locations on the engine wiring harness. A round Deutsch 9-pin connector is provided primarily for service/diagnostic purposes. A Deutsch 3-pin wedge connector, intended for customer computer interface, has also been provided.

Just about any type of information can be communicated over the CAN Bus. Depending on the application, information like throttle position, application requested derates and or engine protection, displaying engine information on vehicle displays, ect., is transferred between vehicle controllers.

CAN also allows diagnostic software like the Diagnostic Scan Tool (DST) and SERVICE ADVISOR™ to communicate with our engine controller. All of the information viewed through the software is transferred from the controller via the CAN Bus.

SERVICE ADVISOR is a trademark of Deere & Company

RG41221,0000248 –19–16AUG01–1/1

Pilot Injection

Pilot injection is a small amount of fuel that is injected just prior to normal injection. The benefits of pilot injection are reduced combustion noise, improved cold starting, and reduced white smoke. Pilot injection is turned on by the ECU when coolant temperature is below 70°C (158°F). Pilot injection will turn off 10 minutes after engine start or when coolant temperature exceeds 70°C.

Also, if engine speed drops below 700 rpm when low idle speed is 800 rpm, pilot injection is turned on. This helps prevent detonation that can occur at very low speeds.

WL30140,0000018 –19–04AUG05–1/1

Low-Idle Warmup

Low-idle warm-up increases engine speed when fuel and/or air temperatures are cold. The low idle warm up feature is disabled when an alternate low speed governor gain (Governor Gains feature) is selected. If low idle warm-up is enabled and the fuel temperature is below 0C (32F), the minimum throttle is increased by 200 rpm for three minutes.

WL30140,0000005 –19–06JUN05–1/1

Intake Air Heater Operation

The Intake Air Heater function is not included on all engines. 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 calculates the ECT, determines if the temperature is below the set point, turns on the “Air Heater Indicator” light on the dash (if equipped), 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 “Air Heater Indicator” light and de-energize the air heater relay. If the operator turns the ignition from “ON” to “START” at this time, the engine will crank and start.

If the operator turns the key from “START” to “ON” without waiting for the “Air Heater Indicator” light to turn off, the ECU will de-energize the air heater relay and a key-off/key-on cycle is required before preheating is allowed again.

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

NOTE: CAN wait-to-start enables the CAN bus messages for shutdown and for wait-to-start. It may be used in place of the wait-to-start lamp in order to notify the operator that air heaters have been energized. Disabling this feature disables both the wait-to-start broadcast and the shutdown broadcast.

DPSG,RG34710,8 –19–03DEC98–1/1

Charge Air Cooling Operation

Charge air is air that is compressed by the turbocharger. Air compressed in a turbocharger heats up. When directed through a heat exchanger, the charge air is cooled and becomes denser so more air can be packed into the engine. This allows for increased power. The cooler air also maintains engine durability by reducing combustion temperatures and firing pressures.

An air-to-air charge air cooled (CAC) engine provides improved performance and fuel economy, reduced emissions, and lower heat rejection to the coolant compared with naturally aspirated, turbocharged without cooling, or water-to-air charge air cooled engines.

The charge air cooling options provided by John Deere are an integral part of the engine's cooling system and are engineered to match the unique requirements of each engine type. Charge air components are subject to heat and high pressures, so if hoses, clamps, etc. ever require replacement, only use parts that meet the system's specifications for these conditions.

If a problem with the charge air cooling system is suspected, check for restrictions, loose clamps, failing, kinked, improperly routed hose, etc. A small interruption of airflow can significantly affect engine performance. Also check for blocked cooling fins and make sure that the engine's thermostat is operating properly. For further information, refer to the Operator's and Maintenance manuals supplied with the equipment.

WL30140,000000A –19–22JUN05–1/1

Cruise Control Operation

Engine ECU's are available with and without the Cruise Control function. The Cruise Control is an off-road type that maintains a constant engine RPM under varying load conditions. It is not an automotive type cruise control (which maintains a constant road speed). Cruise control is not compatible with external derate, harness selectable governor, or 3-state throttle.

Cruise Control typically uses two toggle switches, a switch on the brake, a switch on the clutch, and sometimes a Cancel/Resume pushbutton switch. One toggle switch is an On/Off switch for the cruise control system. The other toggle switch is a two-position momentary contact switch with the familiar "rabbit" and "turtle" icons. With the Cruise Control On, the cruise speed is "Set" when the "rabbit" position is first pushed. Holding or bumping the switch in the "rabbit" position will accelerate ("Accel") engine RPM. To temporarily disengage the Cruise Control, press the brake or clutch pedal. To "Resume" the set speed, briefly press the "turtle" position. If the "turtle" position is "bumped" or held while the Cruise Control is engaged, the engine will decelerate ("Decel") a small amount or until the button is released.

The optional Cancel/Resume momentary pushbutton switch is used to disengage the cruise control instead of having to use the brake or clutch. It is a convenience for operators of applications like tractors and sprayers for turning around at the end of rows in a field. It allows the operator 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 800 RPM and presses the Cancel/Resume button again to resume cruise speed.

- **On/Off:** Turns cruise control power on or off.
- **Set/Accel:** Engages cruise control and Sets engine speed upon first contact after turning cruise control on. When cruise control is on and engaged, increases the set speed.
- **Resume/Decel:** Resumes engine speed after disengaging (braking or clutching). When cruise control is on and engaged, decreases the set speed.
- **Disengage:** Switch input from vehicle brake system or clutch pedal to temporarily turn off cruise control.
- **Cancel/Resume:** Upon first contact, disengages cruise control without having to use the brake or clutch to do so. Second contact Resumes the Set speed.

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

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Engine Derate and Shutdown Protection

The Engine Control Unit (ECU) will derate the amount of fuel that is delivered to the engine or shut the engine down when sensor inputs exceed normal operating ranges. A Diagnostic Trouble Code (DTC) always accompanies a fuel derate. See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for derate specifications per application.

There are three ECU engine protection options:

- **No Protection** — Engine ECU's with "No Protection" do not derate or shut down the engine if a fault occurs. The the standard fault lamp will illuminate when a "Warning" fault is detected by the ECU, and the standard stop-engine lamp will illuminate when a "Shutdown" fault is detected. The engine operator is responsible for reducing engine speed and power when a "Warning" fault exists and for shutting down the engine when a "Shutdown" fault exists.
- **Engine Derate Protection WITHOUT Shutdown** — In addition to illuminating the standard fault indicating lights, the ECU will derate the engine when a certain (depending on application) Warning faults are detected. It is the responsibility of the operator to decide if it is necessary to shut down the engine.
- **Engine Derate Protection with Shutdown** — In addition to illuminating the standard fault indicating lights, the ECU will derate the engine when certain (depending on application) warning and shutdown faults are detected. If a DTC that requires shutdown is set, the ECU will severely derate the engine and shut down the engine either immediately or in 30 seconds, depending on the shutdown timer setting in the ECU. If the fault has a 30-second shutdown delay, and the problem is corrected within the 30 second delay period, the power will increase at a particular rate until full power is reached.

NOTE: *CAN wait-to-start enables the CAN bus messages for shutdown and for wait-to-start. Disabling this feature disables both the wait-to-start broadcast and the shutdown broadcast.*

Shutdown Override

NOTE: *Holding the shutdown override switch continuously "ON" will not reset the 30 second timer.*

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.

Similarly, if the key switch is turned off the engine Shutdown feature will be reset, but when restarted only 30 seconds of running is allowed until the engine will again shut down unless the "Shutdown" fault condition has been cleared.

External Derate

Wiring is provided on the engine harness for additional switches that control engine derate. These additional external switches can provide an additional level of engine control. The external switch type and derate rate are selectable:

- **External Derate Enable:** When enabled and the external derate circuit is activated, the external derate feature will derate the engine at the selected external derate rate.
- **External Derate Input:** Either a normally open switch or normally closed switch is used for the external derate input.
- **External Derate Rate:** Three external derate rates are available: 20% derate over 10 minutes, 20% derate over 1 minute, and 50% derate over 1 minute. Each provides a linear derate of engine power over the time selected. Derates are based on the 100% torque curve value, so operation below the derated power level is still possible.

Continued on next page

NOTE: External Derate is not compatible with cruise control.

External Shutdown

Wiring is provided on the engine harness for additional engine shutdown switches. Either a normally open switch or normally closed switch can be used for the external shutdown input. When enabled and the external shutdown circuit is activated, the ECU will shut down the engine. Features include:

- **External Shutdown Timer:** The external shutdown timer can be set for either immediate shut down or a 30-second delayed shut down. If the shutdown switch returns to normal before the end of the 30-second delay, the engine will resume normal running
- **Override External Shutdown at Engine Start:** Some external shutdowns must be overridden when starting the engine. When enabled, the ECU will disable external shutdowns during engine startup.
- **Override External Shutdown Time:** Once the engine switches to "Run" mode (reaches low idle), the ECU will continue to disengage external shutdown for the time that has been selected. Three override times are available: 5 seconds, 30 seconds, and 1 minute.

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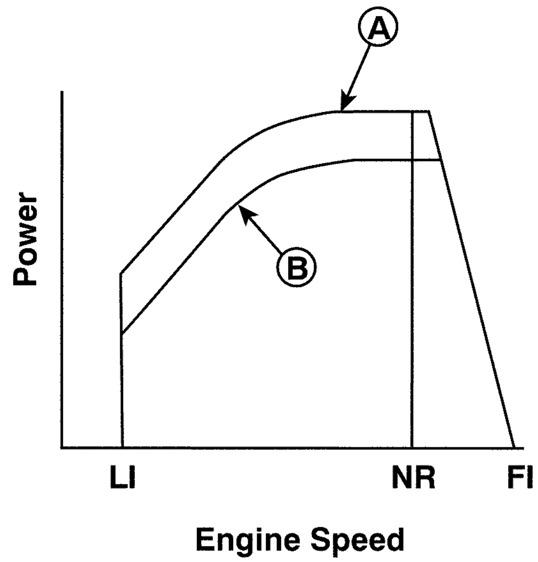
Torque Curves

The ECU has the ability to limit the maximum fuel quantity through the high-pressure fuel pump such that up to four different torque curves (also called “power curves”) can be individually selected while the engine is running. The selection of different 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, transmissions, etc. under certain operating conditions.

For example, a machine can choose torque curves using a simple switching arrangement. An on/off toggle switch and resistor can be used to switch between torque curve 1 (maximum power) and any of the other torque 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 APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for torque curve selection specifications.



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

Torque Curves

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DPSG,RG40854,460 –19–14OCT99–1/1

Governor Droop Modes

Either “Single Governor” or “Harness Selectable Governor” is enabled in the ECU.

Single Governor (“all-speed governing”) of the engine speed is based on the analog throttle input.

Harness Selectable Governor means that a jumper wire in the engine harness is used to choose one of the “RPM of Droop” settings (RPM of Droop is the difference in RPM between engine breakaway and fast idle speed). Droop allows a drop in RPM with an increase in load or an increase in RPM with a decrease in load.

RPM of Droop can be set to one of the following:

- 0 rpm of droop (isochronous)
- 75 rpm of droop
- 100 rpm of droop
- 125 rpm of droop
- 150 rpm of droop

With droop is set at 0 RPM (isochronous), 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 can be determined by engine speed, load, and application. See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for governor droop mode specifications.

DPSG,RG40854,461 –19–14OCT99–1/1

Engine Control Unit (ECU) Self-Diagnosis

The Engine Control Unit (ECU) has the ability to detect problems within itself and also within the electronic control system, such as 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.

Indicator Lamps

All applications are required to have all three indicator lamps listed below. The lamps are illuminated via a hard-wire connection to the ECU or SAE J1939 communication from the ECU. Applications using the engine protection shut-down feature must use a hard-wired "STOP" indicator lamp. When the condition causing the DTC is no longer present, the DTC will change from active to stored and the lamp will turn off.

- **Malfunction Indicator Lamp:** The MIL is also referred to as the Check Engine Light (CEL). It illuminates to indicate an active emission related trouble code. The problem should be corrected as soon as possible. Examples of conditions that cause the MIL to illuminate include a disconnected fuel injector or ignition coil.
- **Warning Indicator Lamp:** The amber warning indicator lamp illuminates to indicate a problem with the engine. Depending on the specific DTC, the condition may lead to engine failure if not corrected, and the ECU may take actions to minimize engine damage. The problem should be corrected as soon as possible. Examples of conditions that will cause the warning indicator lamp to illuminate include an open circuit in the foot pedal, moderately low oil pressure, and moderately high throttle charge temperature.
- **"STOP" Indicator Lamp:** The red "STOP" indicator lamp illuminates to indicate imminent engine failure. The ECU will take action to minimize engine damage. If the "STOP" indicator illuminates, the engine should be stopped as soon as it is safe to do so. Examples of conditions that will cause the "STOP" indicator to illuminate include severely high engine coolant temperature and severely low oil pressure.

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Section 04
Diagnostics

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About This Group

This section of the manual contains necessary information for observable diagnostics and fuel-related test procedures. Use this information in conjunction with the 8.1 L Diesel Engines Base Engine Manual (CTM 86). 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:

NOTE: Follow the diagnostic procedure of an active or stored DTC before pursuing any observable diagnostic procedure.

NOTE: To diagnose observable symptoms on engines with a mechanical fuel system, see 8.1 L Diesel Engines Mechanical Fuel Systems Manual (CTM 243).

- (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 Fuel System Malfunctions:
  - F1 - Fuel supply system check
  - F2 - Excessive fuel consumption
  - F3 - Fuel in oil
- (D) Diagnosing Diagnostic Software Malfunctions:
  - D1 - ECU Does Not Communicate With DST or SERVICE ADVISOR™
  - D2 - Diagnostic Gauge Does Not Communicate With ECU
- (A) Intake Air Heater Check

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 first. Symptoms arranged in both formats refer to testing procedures in the second part of this section. The second part of this section manual contains the following testing procedures:

- Fuel System Testing Procedures:
  - Check Fuel Supply Quality
  - Test for Air in Fuel
  - Check Fuel Supply Pressure
  - Check for Restricted Fuel Return Line
  - Bleed the Fuel System
  - Restarting Engine That Has Run Out Of Fuel
  - Check and Adjust High Pressure Fuel Pump Static Timing
- Electrical Concepts
- Using a Digital Multimeter
- Electrical Circuit Malfunctions
- Troubleshooting Circuit Malfunctions

DPSG,RG40854,512 –19–06MAR00–1/1

E1 - Engine Cranks/Won’t Start/Very Hard to Start (—246269)

DPSG,RG40854,513 –19–16APR02–1/1

E1 - Engine Cranks/Won’t Start Diagnostic Procedure

IMPORTANT: This procedure applies to engines with John Deere Engine Control Units (ECUs). This procedure should be used if engine cranking speed is OK but engine will not start or only starts after prolonged cranking.

If engine will not crank, see diagnostic procedure E6 ENGINE WILL NOT CRANK later in this group.

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❶ **E1 - Preliminary Checks**	Before using this diagnostic procedure: 1. Find out how engine ran before it would not start. Use that information to determine possible diagnosis. For example, if engine smoked excessively, refer to the Engine Emits Excessive Black (or White) Exhaust Smoke before proceeding to the steps below. 2. Check for loose fittings in the fuel system. 3. Check that fuel filters are full. 4. Check that fuel filters are not plugged. 5. Check for blocked fuel line from tank to primary filter. 6. Check for air leak on suction side of fuel system (between tank and transfer pump inlet). 7. Check for air in fuel. See TEST FOR AIR IN FUEL later in this Group. 8. Check for intake and exhaust restrictions. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86). 9. Ensure that fuel quality and quantity are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. 10. Ensure that engine cranking speed is OK. See CHECK ENGINE CRANKING SPEED in Group 150 of 8.1 L Diesel Engine Base Engine Manual (CTM 86). 11. Ensure that oil viscosity is correct. See DIESEL ENGINE OIL in Group 02 of 8.1L Diesel Engine Base Engine Manual (CTM 86). 12. If application has an air heater, verify air heater operation in cold temperatures. See A1 - INTAKE AIR HEATER CHECK later in this group.	**No problems found:** GO TO ❷ **Problem found:** Repair and retest. If loose fitting(s) were found, bleed fuel system prior to retest. See BLEED THE FUEL SYSTEM (—246269).

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❷ **Active DTC Test**	1. Use the diagnostic gauge OR 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 Section 04, Group 160 earlier in this manual. 2. Ignition ON, engine OFF. 3. Start the ECU diagnostic software, if applicable. 4. Crank engine for 15 seconds. 5. Read DTCs while cranking engine.	**No active DTCs present:** GO TO ❸ **Active DTC(s) present:** Diagnose active DTCs first. If any of the DTCs have a SPN of 636 or 637, go to those first. **Can't communicate with ECU:** See D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ DIAGNOSTIC PROCEDURE later in this Group.

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❸ **PCV Check**	Verify that the PCVs are wired correctly. If the two PCV connectors are reversed, the engine will crank, but won't start. At least one of the connectors should be labeled. PCV #1 is located closest to the front of the engine.	**Connections correct:** GO TO ❹ **Connections reversed:** Reverse connections and retest.

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❹ **Pump Position Indicator Test**	1. Start cranking engine. 2. Using the diagnostic software, observe pump position status and pump position sensor input noise indicator. See DATA PARAMETER DESCRIPTION in Section 04, Group 160 earlier in this manual for an explanation of the Pump Position parameters.	**No pump position noise and pump position status reached 15:** GO TO ❺ **Pump position noise and pump position status does not reach 15:** Inspect vehicle for possible failures that can cause either of these conditions: Bad electrical connections, damaged sensor, damaged high pressure fuel pump camshaft, or EMI from improperly installed radio equipment, or other electronic devices. Repair and retest.

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❺ **Crank Position Indicator Test**	1. Start cranking engine. 2. Using the diagnostic software, observe crank position input noise indicator, and crank position status. See DATA PARAMETER DESCRIPTION in Section 04, Group 160 earlier in this manual for an explanation of the Pump Position parameters.	**No crank position noise and crank position status reached 15:** GO TO ❻ **Crank position noise and crank position status does not reach 15:** Inspect vehicle for possible failures that can cause either of these conditions: Bad electrical connections, damaged sensor, damaged crankshaft timing ring, or EMI from improperly installed radio equipment, or other electronic devices. Repair and retest. – – –1/1

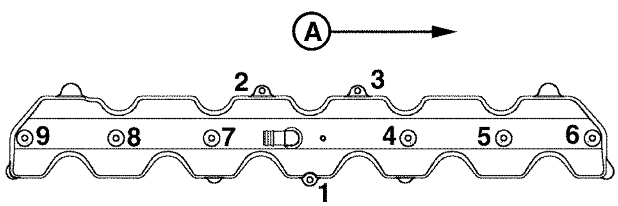
❻ **Fuel Hand Primer Test**	1. Ignition OFF. 2. Operate hand primer pump, located on the fuel transfer pump, until moderate resistance is felt. 3. Try to start engine.	**Engine starts:** GO TO ❽ **Engine does not start:** GO TO ❼ – – –1/1

❼ **Pilot Injection Test**	1. Ignition ON, engine OFF. 2. Read engine coolant temperature If engine coolant temperature is below 70°C (158°F), Pilot Injection should be ON. 3. Ignition ON, engine cranking 4. Read pilot injection	**Pilot Injection reads ON or N/A:** GO TO ❽ **Pilot Injection reads OFF:** Pilot Injection should be ON if the engine coolant temperature is below 70°C (158°F). If Pilot Injection is OFF under this condition, test the engine coolant temperature sensor and replace if needed. Retest pilot injection. – – –1/1

❽ **Fuel Supply System Check**	Check the fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.	**Fuel supply system OK:** GO TO ❾ **Fuel supply system problem found:** Repair fuel supply system problem and retest. – – –1/1

❾ **Intake and Exhaust Restrictions Test**	Check for intake and exhaust restrictions. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).	**All components operating correctly:** GO TO ❿ **Restriction are found:** Repair faulty component and retest. – – –1/1

❿ **Compression Test**	Perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 earlier in this manual.	**All cylinders scored within 10% of each other:** GO TO ⓫ **One or more cylinders scored 10% or more lower than other cylinders:** GO TO ⓬ – – –1/1

11 EI Cap Screw and EI Harness and Connector Test	1. Ignition OFF. 2. Remove rocker arm cover. *NOTE: Rocker arm cover gasket is reusable if no visible damages is detected. Do NOT store cover on gasket surface.* 3. Check EI rocker arms, valve rocker arms, and camshaft operation. 4. Check that the hold down clamp cap screws on all EIs are tightened and torque turned to specification. See INSTALL ELECTRONIC INJECTORS in Section 02, Group 90 earlier in this manual. **Specification** EI Hold Down Clamps—Torque Turn .... 10 N•m + 90 degrees (7 lb-ft + 90 degrees) 5. Inspect EI harness and EI harness connector looking for dirty, damaged, or poorly positioned terminals. 6. When diagnostics are completed, reassemble the rocker arm cover and tighten to specifications. **Specification** Rocker Arm Cover Capscrews—Torque... 8 N•m (6 lb-ft)  RG11620A –UN–11DEC00 *Order to Tighten Rocker Arm Cover Capscrews*	**All components operating correctly:** GO TO 12 **Faulty component found:** Repair faulty component and retest.

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12 Valve Clearance Check	Check valve lash. See CHECK VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**Valve clearance on all valves within specification:** GO TO 13 **Valve clearance on one or more valves out of specification:** Adjust valve clearance. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).

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⓭ **Valve Lift Check**	Check valve lift. See CHECK VALVE LIFT SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**Lift on valves within specification:** GO TO ⓮ **Valve lift on one or more valves is out of specification:** Reset clearance to specification after measuring lift. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86). – – –1/1

⓮ **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 ring 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 reconditioned	**Problem found in pistons, rings, and/or liners or valve guides:** Repair problem as necessary. – – –1/1

E1--Engine Cranks/Wont'Start/Very Hard to Start (246270--)

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E1 - Engine Cranks/Won't Start/Very Hard to Start Diagnostic Procedure

IMPORTANT: This procedure applies to engines with John Deere Engine Control Units (ECUs). This procedure should be used if engine cranking speed is OK but engine will not start or only starts after prolonged cranking.

If engine will not crank, see diagnostic procedure E6 ENGINE WILL NOT CRANK later in this group.

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❶ **E1 - Preliminary Checks**	Before using this diagnostic procedure: 1. Find out how engine ran before it would not start. Use that information to determine possible diagnosis. For example, if engine smoked excessively, refer to the Engine Emits Excessive Black (or White) Exhaust Smoke before proceeding to the steps below. 2. Check for loose fittings in the fuel system. 3. Check that fuel filters are full. 4. Check that fuel filters are not plugged. 5. Check for blocked fuel line from tank to primary filter. 6. Check for air leak on suction side of fuel system (between tank and transfer pump inlet). 7. Check for air in fuel. See TEST FOR AIR IN FUEL later in this Group. 8. Check for intake and exhaust restrictions. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86). 9. Ensure that fuel quality and quantity are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. 10. Ensure that engine cranking speed is OK. See CHECK ENGINE CRANKING SPEED in Group 150 of 8.1 L Diesel Engine Base Engine Manual (CTM 86). 11. Ensure that oil viscosity is correct. See DIESEL ENGINE OIL in Group 02 of 8.1L Diesel Engine Base Engine Manual (CTM 86). 12. If application has an air heater, verify air heater operation in cold temperatures. See A1 - INTAKE AIR HEATER CHECK later in this group.	**No problems found:** GO TO ❷ **Problem found:** Repair and retest. If loose fitting(s) were found, bleed fuel system prior to retest. See BLEED THE FUEL SYSTEM (246270—).

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❷ **Active DTC Test**	1. Check for active fault codes using either the diagnostic gauge on instrument panel, 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 Section 04, Group 160 later in this manual. Record codes. 2. Check for stored codes and record. 3. Clear all codes. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON. 6. Check again for active fault codes.	**No active DTCs present:** GO TO ❸ **Active DTC(s) present:** Diagnose active DTCs. If any of the DTCs have an SPN of 636 or 637, attend to those first. **Can't communicate with ECU:** See D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ DIAGNOSTIC PROCEDURE later in this Group.

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❸ **Pump Control Valve Visual Inspection of Connectors and Wiring**	Verify that the PCVs are wired correctly. If the two PCV connectors are reversed, the engine will crank, but won't start. At least one of the connectors should be labeled. PCV #1 is located closest to the front of the engine.	**Connections correct:** GO TO ❹ **Connections reversed:** Swap connections and retest.

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❹ **Pressure-Test Low-Pressure Fuel System**	1. Ignition OFF. 2. Attach pressure gauge to diagnostic port on fuel pump. 3. Operate hand primer pump until pressure builds to at least 20 psi.	**Pressure develops:** Bleed fuel system and try to start engine. If engine does not start, GO TO ❿ **Pressure dissapates quickly or does not develop:** GO TO ❺

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❺ **Pump Overflow Valve Test**	1. Ignition OFF. 2. Remove fuel line from overflow valve outlet. 3. Install a cap on the overflow valve outlet. 4. Operate hand primer pump.	**Pressure develops:** Replace overflow valve, bleed fuel system, and start engine. If engine does not start, GO TO ❿ **Pressure does not develop:** Test hand primer. GO TO ❻

– – –1/1

❻ **Fuel Hand Primer Test**	1. Ignition OFF. 2. Reinstall fuel line to overflow valve. 3. Remove the inlet and outlet fuel lines from the fuel transfer pump. 4. Attach a hose to the open ports on the transfer pump. 5. Put other end of hoses into a container of clean fuel. 6. Operate hand primer pump until fuel circulates through transfer pump into and out of container. 7. Remove the hose from the outlet port and cap the port (other hose still attached to pump with end in fuel container). 8. Operate hand primer pump until pressure builds to at least 20 psi.	**Pressure develops:** Primer pump OK. GO TO ❼ **Pressure does not develop or pump will not circulate fuel:** Replace hand primer pump, bleed fuel system, and start engine. If engine does not start, GO TO ❿ – – –1/1

❼ **High Pressure Pump Check Valve Test**	1. Ignition OFF. 2. Reinstall fuel lines to transfer pump. 3. Operate hand primer pump. 4. Loosen fuel line from check valve on high pressure pump pump inlet while monitoring the pressure gauge.	**Pressure on gauge drops:** Replace or clean check valve, then bleed fuel system and start engine. If engine does not start,GO TO ❿ **Pressure on gauge holds steady:** Check valve OK. GO TO ❽ – – –1/1

❽ **Filter Relief Valve Test**	1. Ignition OFF. 2. Remove fuel line from filter relief valve (located on final filter). 3. Cap the fuel line. 4. Operate hand primer pump while observing pressure gauge.	**Valve holds a minimum of 25 psi:** Relief valve OK. GO TO ❾ **Valve allows fuel to pass below 25 psi:** Replace valve. Bleed fuel system and start engine. If engine does not start, GO TO ❿ – – –1/1

9 **Filter Inlet Check Valve Test**	1. Ignition OFF. 2. Remove fuel line from inlet check valve (located on the larger filter). 3. Manually operate the valve by pushing it open and closed. Make sure it operates easily and smoothly.	**Valve OK:** Low-pressure fuel system OK. Bleed fuel system and try to start engine. If engine does not start, GO TO 10 **Valve stuck or contaminated:** Replace valve. Bleed fuel system and start engine. If engine does not start, GO TO 10 – – –1/1

10 **Cranking Fuel Rail Pressure Test**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine cranking. 2. Using the ECU diagnostic software, read fuel rail pressure - actual.	**Consistently below 20 MPa (200 bar) (2900 psi):** GO TO 11 **Consistently above 20 MPa (200 bar) (2900 psi):** No fuel system problem is apparent. GO TO 12 – – –1/1

11 Common Rail Pressure Relief Valve Test	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* **CAUTION: 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.** 1. Before removing fuel line from pressure relief valve, turn engine OFF and let sit for at least 5 minutes. This will relieve fuel pressure from the high pressure common rail. 2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure relief valve. 3. Disconnect fuel return line fitting from the pressure relief valve. Do NOT remove the pressure relief valve. 4. Plug the return line. 5. Run a clear line from a suitable container for diesel fuel to the pressure relief valve. 6. Ignition ON, engine cranking. 7. Check fuel flow at pressure relief valve.	**No fuel present:** Relief valve OK. Leaking fuel injectors or faulty fuel pump. **Fuel flow is present:** Faulty pressure relief valve. Replace pressure relief valve and retest. See REMOVE AND INSTALL HPCR PRESSURE RELIEF VALVE in Section 02, Group 090 earlier in this manual. – – –1/1

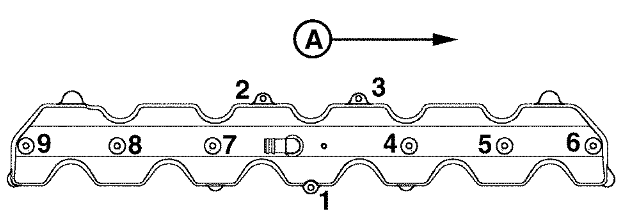
12 Pilot Injection Test	*NOTE: Pilot injection is not used by all engines.* 1. Ignition ON, engine OFF. 2. Read engine coolant temperature. 3. Ignition ON, engine cranking. 4. Read pilot injection.	**Pilot Injection reads ON or N/A:** GO TO 13 **Pilot Injection reads OFF:** Pilot injection should be ON if the engine coolant temperature is below 70°C (158°F). If pilot injection is OFF under this condition, test the engine coolant temperature sensor and replace if needed. Retest pilot injection. – – –1/1

13 **Compression Test**	Perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 later in this manual.	**All cylinders scored within 10% of each other:** GO TO 17 **One or more cylinders scored 10% or more lower than other cylinders:** GO TO 14 – – –1/1

14 **Valve Clearance Check**	Check valve lash. See CHECK VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**Valve clearance on all valves within specification:** GO TO 15 **Valve clearance on one or more valves out of specification:** Adjust valve clearance. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86). – – –1/1

15 **Valve Lift Check**	Check valve lift. See CHECK VALVE LIFT SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**Lift on valves within specification:** GO TO 16 **Valve lift on one or more valves is out of specification:** Reset clearance to specification after measuring lift. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86). – – –1/1

16 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 ring 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 reconditioned	**Problem found in pistons, rings, and/or liners or valve guides:** Repair problem as necessary. **No problem found:** GO TO 17 – – –1/1

17 EI Capscrew Torque and Harness Connector Check	1. Ignition OFF. 2. Remove rocker arm cover. *NOTE: Rocker arm cover gasket is reusable if no visible damages is detected. Do NOT store cover on gasket surface.* 3. Check EI rocker arms, valve rocker arms, and camshaft operation. 4. Check that the hold down clamp cap screws on all EIs are tightened and torque turned to specification. See INSTALL ELECTRONIC INJECTORS in Section 02, Group 90 earlier in this manual. **Specification** EI Hold Down Clamps—Torque Turn .... 10 N•m + 90 degrees (7 lb-ft + 90 degrees) 5. Inspect EI harness and EI harness connector for contamination, damage, or poor positioning. Check wiring for damage. 6. When diagnostics are completed, reassemble the rocker arm cover and tighten to specifications. **Specification** Rocker Arm Cover Capscrews—Torque.. 8 N•m (6 lb-ft)  RG11620A –UN–11DEC00 *Order to Tighten Rocker Arm Cover Capscrews*	**All components operating correctly:** GO TO 18 **Faulty component found:** Repair faulty component and retest. – – –1/1

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150
14

18 **Pump Position Indicator Test**	1. Start cranking engine. 2. Using the diagnostic software, observe pump position status and pump position sensor input noise indicator. See DATA PARAMETER DESCRIPTION in Section 04, Group 160 later in this manual for an explanation of the Pump Position parameters.	**No pump position noise and pump position status reached 15:** GO TO 19 **Pump position noise and pump position status does not reach 15:** Inspect vehicle for possible failures that can cause either of these conditions: Bad electrical connections, damaged sensor, damaged high pressure fuel pump camshaft, or EMI from improperly installed radio equipment, or other electronic devices. Repair and retest. – – –1/1

19 **Crankshaft Position Indicator Test**	1. Start cranking engine. 2. Using the diagnostic software, observe crankshaft position input noise indicator, and crankshaft position status. See DATA PARAMETER DESCRIPTION in Section 04, Group 160 later in this manual for an explanation of the Pump Position parameters.	**No crankshaft position noise and crankshaft position status reached 15:** Inconclusive results. **Crankshaft position noise and crankshaft position status does not reach 15:** Inspect vehicle for possible failures that can cause either of these conditions: Bad electrical connections, damaged sensor, damaged crankshaft timing ring, or EMI from improperly installed radio equipment, or other electronic devices. Repair and retest. – – –1/1

E2 - Engine Misfires/Runs Irregularly

RG41221,00000BF –19–26MAR02–1/1

E2 - Engine Misfires/Runs Irregularly Diagnostic Procedure

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❶ **E2 - Preliminary Check**	Before using this diagnostic procedure, make the following checks that could cause or be mistaken as miss/rough running: 1. Check for intake manifold air leaks. 2. Check for engine mechanical problems. 3. Check for transmission problems. 4. Check for engine accessories such as A/C cycling on and off. 5. Check for electromagnetic interference (EMI) from improperly installed radios, ect.	**No problems found:** GO TO ❷ **Problem found:** Repair and retest

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❷ **Active DTC Test**	1. Check for active fault codes using either the diagnostic gauge on instrument panel, 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 Section 04, Group 160 later in this manual. Record codes. 2. Check for stored codes and record. 3. Clear all codes. 4. Start engine and run until warm, then shut off engine. 5. Check again for active fault codes.	**No active DTCs:** GO TO ❸ **Active DTC(s) present:** Diagnose active DTCs first. If any of the DTCs have an SPN of 636 or 637, diagnose those first. Repair and retest.

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❸ **Engine Performance Test**	1. Ignition ON, engine idling. 2. Observe engine performance.	**Not running rough:** GO TO ❹ **Running rough:** GO TO ❻

– – –1/1

❹ **Recreate Conditions**	Operate engine under conditions where the miss/rough running complaint occurs.	**Running rough:** GO TO ❺ **Not running rough:** No problem found. Verify complaint and try to reproduce conditions of miss/rough running complaint. – – –1/1

❺ **Active DTC Test**	1. Ignition ON, engine idling. 2. Check for active fault codes using either the diagnostic gauge on instrument panel, 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 Section 04, Group 160 later in this manual. Record codes.	**No active DTCs:** GO TO ❻ **Active DTCs present:** Diagnose DTCs. If any of the DTCs have a SPN 636 or 637, diagnose those first.

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❻ **Head Gasket Failure Check**	Check for head gasket joint failures. See CHECK FOR HEAD GASKET FAILURES in Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).	**No sign of head gasket failure:** GO TO ❼ **Signs of head gasket failure found:** Replace head gasket and retest. – – –1/1

❼ **Compression and Misfire Test**	1. Using the DST or Service ADVISOR, perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 later in this manual. 2. Make note of the results. 3. Using the DST or Service ADVISOR, perform the Misfire Test. For instructions, see ENGINE TEST INSTRUCTIONS - MISFIRE TEST in Section 04, Group 160 later in this manual. 4. Make note of the results.	**All cylinders scored within 10% of each other on both tests:** GO TO ❽ **One or more cylinders scored 10% or more lower than the rest of the cylinders on the Compression Test and DIFFERENT cylinder(s) scored 10% or more lower on the Misfire Test:** GO TO ❾ **One or more cylinders scored 10% or more lower than the rest of the cylinders on the Compression Test and SAME cylinder(s) scored 10% or more lower on the Misfire Test:** Determine cause of low compression on the low scoring cylinders. **All cylinders scored within 10% of each other on the Compression Test and one or more cylinders scored 10% or more lower than other cylinders on the Misfire Test:**Inspect the EI(s) of the cylinder(s) that tested low on the Misfire Test. – – –1/1

❽ **Fuel Supply System Test**	Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.	**No fuel supply system problems:** GO TO ❿ **Fuel supply system problem found:** Repair and retest. – – –1/1

❾ **Inconclusive Test Results**	These types of results indicate either the Misfire Test or Compression Test could not operate correctly.	Further engine diagnostics should be performed to determine if the engine misfire is caused by a faulty EI or by a compression problem.

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❿ **Valve Clearance Check**	Check valve lash. See CHECK VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**Valve clearance on all valves within specification:** GO TO ⓫ **Valve clearance on one or more valves out of specification:** Adjust valve clearance. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).

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⓫ **Valve Lift Check**	Check valve lift. See CHECK VALVE LIFT SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**Lift on valves within specification:** GO TO ⓬ **Valve lift on one or more valves is out of specification:** Reset clearance to specification after measuring lift. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).

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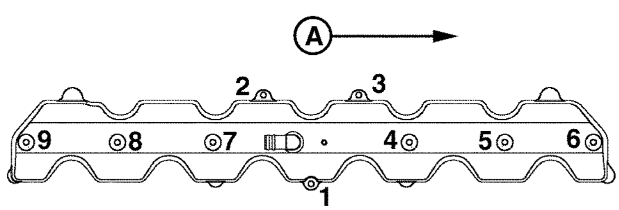
⓬ **Pistons, Rings, Cylinder Liners Check**	At this point, the most likely cause of the low engine compression pressure is one of the following failures in the pistons, rings, and/or cylinder liners or in the valve guides. Check the most likely items as needed. • Oil control ring worn or broken • Scored 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 reconditioned	**Problem found in pistons, rings, and/or liners or valve guides:** Repair problem as necessary. **Problem not found in pistons, rings, and/or liners or valve guides:**GO TO ⓭ – – –1/1

⓭ **EI Cap Screw and Harness Test**	1. Innition OFF *NOTE: Rocker arm cover gasket is reusable if no visible damage is detected. Do NOT store cover on gasket surface.* 2. Remove Rocker arm cover. 3. Check EI rocker arms and valve rocker arm operation. *NOTE: Verify that hold-down clamps are positioned correctly.* 4. Check that the hold-down clamp cap screws on all EIs are tightened and torque turned to specification. See INSTALL ELECTRONIC INJECTORS in Section 02, Group 090, earlier in this manual. 5. Inspect EI harness connector for damage. 6. When diagnostics are completed, reassemble the rocker arm cover and tighten to specifications. **Specification** Rocker Arm Cover Capscrews—Torque.. 8 N•m (6 lb-ft)  RG11620A –UN–11DEC00 *Order to Tighten Rocker Arm Cover Capscrews*	**All components operating correctly:**GO TO ⓮ – – –1/1

⓮ **Verification Check**	1. Make sure there are no engine mechanical problems. 2. Make sure there is not something excessively drawing engine power.	**If engine power less than expected:** See E3 - ENGINE DOES NOT DEVELOP FULL POWER on the following page. – – –1/1

E3 - Engine Does Not Develop Full Power

RG41221,00000C3 –19–26MAR02–1/1

E3 - Engine Does Not Develop Full Power Diagnostic Procedure

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❶ **E3 - Preliminary Check**	Before using this diagnostic procedure, make the following checks that could cause or be mistaken as low power: 1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. 2. Check for plugged air and fuel filters. 3. Check for transmission problems. 4. Check for engine mechanical problems. 5. Check for excessive load on the engine. 6. Check for unbalanced ballast.	**No problems found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Active DTC Test**	1. Check for active fault codes using either the diagnostic gauge on instrument panel, 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 Section 04, Group 160 later in this manual. Record codes. 2. Check for stored codes and record. 3. Clear all codes. 4. Start engine and recreate conditions in which problem occured. Stop engine. 5. Check again for active fault codes.	**No active DTCs:** GO TO ❸ **Active DTC(s) present:** Diagnose active DTCs first.

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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 DIAGNOSTIC PROCEDURE later in this Group. **Heavy black or gray exhaust smoke:** See E5 - ENGINE EMITS EXCESSIVE BLACK OR GRAY EXHAUST SMOKE DIAGNOSTIC PROCEDURE later in this Group. – – –1/1

❹ **Torque Curve Check**	*NOTE: This check is not required for applications that either do not select multiple torque curves or use torque curve selection over the Controller Area Network (CAN). For these applications, GO TO ❺* The ECU has the ability to operate on multiple torque curves selected by certain operating conditions. See TORQUE CURVES in Section 03, Group 140 earlier in this manual. 1. Recreate the conditions of the low power complaint. 2. Read the torque curve number. 3. Compare the torque curve parameter to the appropriate torque curve chart. See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.	**Torque curve number displayed is correct for the operating conditions of the low power complaint:** GO TO ❺ **Torque curve number displayed is NOT correct for the operating conditions of the low power complaint:** Refer to machine manual to determine components that could prevent the correct torque curve from being selected. OR Investigate torque curve selection problems including checking for open, short, and grounded circuits in the torque curve selection wiring. – – –1/1

❺ **Governor Droop Mode Check**	*NOTE: This check is not required for applications that either do not select different droop modes or use droop mode selection over the Controller Area Network (CAN). For these applications, GO TO ❻* The ECU has the ability to operate in several different droop modes selected by certain operating conditions. See GOVERNOR DROOP MODES in Section 03, Group 140 earlier in this manual. 1. Operate engine and attempt to recreate the low power condition. 2. Read the desired speed governor curve and the maximum speed governor curve. 3. Compare governor selection to the appropriate governor mode chart. See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.	**Governor Droop mode is correct:** GO TO ❻ **Governor Droop mode is incorrect:** Refer to machine manual to determine components that could prevent the correct governor droop from being selected. OR Investigate droop mode selection problems including checking for open, short, and grounded circuits in the droop mode selection wiring. – – –1/1

❻ **Compression and Misfire Test**	1. Using the DST or Service ADVISOR, perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 later in this manual. 2. Make note of the results. 3. Using the DST or Service ADVISOR, perform the Misfire Test. For instructions, see ENGINE TEST INSTRUCTIONS - MISFIRE TEST in Section 04, Group 160 later in this manual. 4. Make note of the results.	**All cylinders scored within 10% of each other on both tests:** GO TO ❼ **One or more cylinders scored 10% or more lower than the rest of the cylinders on the Compression Test and DIFFERENT cylinder(s) scored 10% or more lower on the Misfire Test:** These types of results indicate either the Misfire Test or Compression Test could not operate correctly. Further engine diagnostics should be performed to determine if the engine misfire is caused by a faulty EI or a compression problem. **One or more cylinders scored 10% or more lower than the rest of the cylinders on the Compression Test and SAME cylinder(s) scored 10% or more lower on the Misfire Test:** Determine cause of low compression on the low scoring cylinders. GO TO ⓫ **All cylinders scored within 10% of each other on the Compression Test and one or more cylinders scored 10% or more lower than other cylinders on the Misfire Test:** Replace the EI(s) of the cylinder(s) that tested low on the Misfire Test. – – –1/1

❼ **Throttle Test**	1. Operate engine at full load rated speed. 2. At these operating conditions, read throttle position data parameter.	**97% or above:** GO TO ❽ **Below 97%:** Refer to your machine manual and perform the throttle calibration procedure, then retest. – – –1/1

❽ **Turbocharger Boost Pressure Check**	Check Turbo Boost pressure. See MEASURE INTAKE MANIFOLD PRESSURE (TURBO BOOST) in Group 150 of 8.1 L Diesel Engine Base Engine Manual (CTM 86).	**Intake manifold pressure in range or above compared to boost specifications:** See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group. **Intake manifold pressure below range compared to boost specifications:** GO TO ❾ – – –1/1

❾ **Turbocharger Failure Check**	Check the following that could cause reduced boost pressure: • Restricted air cleaner • Intake air leak • Exhaust air leak • Restriction in exhaust • Faulty turbocharger. See TURBOCHARGER INSPECTION in Group 080 in 8.1L Diesel Engine Base Engine Manual (CTM 86).	**None of the problems found:** GO TO ❿ **Above problem found:** Repair problem and retest. – – –1/1

❿ **Fuel Supply System Test**	Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.	**No fuel supply system problems:** GO TO ⓫ **Fuel supply system problem found:** Repair and retest. – – –1/1

⓫ **Valve Clearance Check**	Check valve lash. See CHECK VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**Valve clearance on all valves within specification:** GO TO ⓬ **Valve clearance on one or more valves out of specification:** Adjust valve clearance. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86). – – –1/1

⓬ **Valve Lift Check**	Check valve lift. See CHECK VALVE LIFT SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**Lift on valves within specification:** GO TO ⓭ **Valve lift on one or more valves is out of specification:** Rest clearance to specification after measuring lift. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86). – – –1/1

⓭ **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 ring 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 reconditioned	**Problem found in pistons, rings, and/or liners or valve guides:** Repair problem as necessary. – – –1/1

E4 - Engine Emits Excessive White Exhaust Smoke

RG41221,00000C0 –19–26MAR02–1/1

E4 - Engine Emits Excessive White Exhaust Smoke Diagnostic Procedure

This procedure should be used if:
The engine emits excessive white exhaust smoke. This type of smoke causes a burning sensation to the eyes. If engine emits a less heavy, bluish exhaust smoke, see L1 - EXCESSIVE OIL CONSUMPTION diagnostic procedure in Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86)

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❶ E4 - Preliminary Check	Before using this diagnostic procedure: 1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. 2. Ensure engine coolant temperature is not extremely low.	**No problems found:** GO TO ❷ **Problem found:** Repair and retest – – –1/1

❷ Head Gasket Test	Check for failed head gasket. See CHECK FOR HEAD GASKET FAILURES in Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).	**No signs of head gasket failure.** GO TO ❸ **Signs of head gasket failure are found:** See HEAD GASKET INSPECTION AND REPAIR SEQUENCE SERIAL NUMBER (200,000—) in Group 021 of 8.1 L Diesel Engines Base Engine Manual (CTM 86). – – –1/1

❸ Compression Test	Perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 later in this manual.	**All cylinders scored within 10% of each other:** GO TO ❹ **One or more cylinders scored 10% or more lower than other cylinders:** Determine cause of low compression on the low scoring cylinders. GO TO ❺ – – –1/1

❹ **Fuel Pressure Check**	Check fuel pressure. See CHECK FUEL SUPPLY PRESSURE later in this Group.	**Fuel pressure within specification:** GO TO ❺ **Fuel pressure below specification:** See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group. – – –1/1

❺ **Valve Clearance Check**	Check valve lash. See CHECK VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**Valve clearance on all valves within specification:** GO TO ❻ **Valve clearance on one or more valves out of specification:** Adjust valve clearance. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86). – – –1/1

❻ **Valve Lift Check**	Check valve lift. See CHECK VALVE LIFT SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**Lift on valves within specification:** GO TO ❼ **Valve lift on one or more valves is out of specification:** Rest clearance to specification after measuring lift. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86). – – –1/1

❼ **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 ring 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 reconditioned	**Problem found in pistons, rings, and/or liners or valve guides:** Repair problem as necessary. – – –1/1

E5 - Engine Emits Excessive Black or Gray Exhaust Smoke

RG41221,00000C1 –19–26MAR02–1/1

E5 - Engine Emits Excessive Black or Gray Exhaust Smoke Diagnostic Procedure

This procedure should be used if the engine emits excessive black or gray smoke. If engine emits a less heavy, bluish exhaust smoke, see L1 - EXCESSIVE OIL CONSUMPTION diagnostic procedure in Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).

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❶ **E5 - Preliminary Check**	Before using this diagnostic procedure: 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 ❷ **Problem found:** Repair and retest

– – –1/1

❷ **Intake and Exhaust Restriction and Air Leak Test**	Check for intake and exhaust restrictions and air leaks. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS AND TEST FOR INTAKE AIR LEAKS AND CHECK FOR EXHAUST AIR LEAKS (TURBOCHARGED ENGINES) in Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86)	**No restrictions or leaks found:** GO TO ❸ **Restrictions or leaks found:** Repair or replace components as necessary.

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❸ **Turbocharger Failure Test**	Check for turbocharger failure. See TURBOCHARGER INSPECTION in Group 080 in 8.1L Diesel Engine Base Engine Manual (CTM 86).	**No turbocharger failure found:** GO TO ❹ **Turbocharger failure found:** Follow appropriate repair procedure in Group 080 of 8.1 L Diesel Engine Base Engine Manual (CTM 86). – – –1/1

❹ **Valve Clearance Check**	Check valve lash. See CHECK VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).	**All valve clearances within specification:** GO TO ❺ **Valve clearance on one or more valves out of specification:** Adjust valve clearance. See ADJUST VALVE CLEARANCE SERIAL NUMBER (200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86). – – –1/1

❺ **Pump Position Timing Check**	Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING later in this Group.	**Timing is OK:** Ensure there are no engine mechanical problems. If no other problems are found, continue diagnosing by going to diagnostic chart E3 - ENGINE DOES NOT DEVELOP FULL POWER DIAGNOSTIC PROCEDURE earlier in this Group. **Timing out of sync:** Adjust timing and retest. – – –1/1

E6 - Engine Will Not Crank

Symptom	Problem	Solution
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.
	Start circuit defective	Check wiring, fuses, and relays.
	Engine is seized	Check by rotating engine by hand.

DPSG,RG40854,668 –19–25MAY00–1/1

E7 - Engine Idles Poorly

Symptom	Problem	Solution
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. See AIR INTAKE AND EXHAUST SYSTEM REPAIR SPECIFICATIONS in Section 6, Group 200 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
	Electronic control system problem or basic engine problem	See E2 - ENGINE MISFIRE/RUNS IRREGULARLY DIAGNOSTIC PROCEDURE earlier in this Group.

DPSG,RG40854,669 –19–25MAY00–1/1

E8 - Abnormal Engine Noise

Symptom	Problem	Solution
Abnormal Engine Noise	Worn main or connecting rod bearings	Determine bearing clearance. See CYLINDER BLOCK, LINERS, PISTONS, AND RODS REPAIR SPECIFICATIONS in Group 200 or CRANKSHAFT , MAIN BEARINGS, AND FLYWHEEL REPAIR SPECIFICATIONS in Group 200 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
	Excessive crankshaft end play	Check crankshaft end play. See CHECK CRANKSHAFT END PLAY in Group 040 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
	Loose main bearing caps	Check bearing clearance. Replace bearings and bearing cap screws as required. See CRANKSHAFT , MAIN BEARINGS, AND FLYWHEEL REPAIR SPECIFICATIONS in Group 200 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
	Worn connecting rod bushings and piston pins	Inspect piston pins and bushings. See INSPECT PISTON PINS AND BUSHINGS in Group 030 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
	Scored pistons	Inspect pistons. See PRELIMINARY LINER, PISTON, AND ROD CHECKS in Group 030 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).

Continued on next page

DPSG,RG40854,670 –19–26MAR02–1/2

Symptom	Problem	Solution
	Worn timing gears or excess back lash	Check timing gear back lash. See CHECK CAMSHAFT ENDPLAY AND MEASURE GEAR BACKLASH in Group 050 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
	Excessive valve clearance	Check and adjust valve clearance. See CHECK VALVE CLEARANCE (SERIAL NUMBER 200,000—) and ADJUST VALVE CLEARANCE (SERIAL NUMBER 200,000—) in Group 021 of the 8.1L Diesel Engine Base Engine Manual (CTM 86).
	Worn camshaft	Inspect camshaft. See VISUALLY INSPECT CAMSHAFT in Group 050 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
	Worn rocker arm shaft(s)	Inspect rocker arm shafts. See INSPECT ROCKER ARM SHAFT ASSEMBLY (SERIAL NUMBER 200,000—) in Group 021 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
	Insufficient engine lubrication	See L2 - ENGINE OIL PRESSURE LOW in Group 150 of 8.1 L Diesel Engines Base Engine Manual (CTM 86).
	Turbocharger noise	See TURBOCHARGER INSPECTION in Group 080 in 8.1L Diesel Engine Base Engine Manual (CTM 86).

DPSG,RG40854,670 –19–26MAR02–2/2

F1 - Fuel Supply System Check

DPSG,RG40854,521 –19–26MAR02–1/1

F1 - Fuel Supply System Check Diagnostic Procedure

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❶ **F1 - Preliminary Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Before using this diagnostic procedure: 1. If fuel system has been recently opened (filter changed, line removed etc.) perform fuel system bleed procedure. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) later in this Group and retest. 2. Check for ruptured fuel lines. 3. Check for restricted vent in fuel tank. 4. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest

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❷ **Active DTC Test**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Check for active fault codes using either the diagnostic gauge on instrument panel, 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 Section 04, Group 160 later in this manual. Record codes. 2. Check for stored codes and record. 3. Clear all codes. 4. Start engine and recreate conditions in which problem occured. Stop engine. 5. Check again for active fault codes.	**No active DTCs present:** GO TO ❸ **Active DTC(s) present:** Diagnose active DTCs first. If any of the DTCs have a 636 or 637, go to those first. **Can’t communicate with ECU:** See D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ DIAGNOSTIC PROCEDURE later in this Group.

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❸ **Engine Start Test**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Ignition ON, engine cranking.	**Engine Starts:** GO TO ⓭ **Engine cranks but won't start:** GO TO ❹ – – –1/1

❹ **Pump Control Valve Visual Inspection of Connectors and Wiring**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Verify that the PCVs are wired correctly. If the two PCV connectors are reversed, the engine will crank but won't start. At least one of the connectors should be labeled. PCV #1 is located closest to the front of the engine. If unsure if connectors are reversed, swap them and try to start engine. If engine does not start, return PCV connectors to original positions.	**Connections correct:** GO TO ❺ **Connections reversed:** Swap connections and retest. – – –1/1

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❺ **Air in Fuel Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Check for air in the fuel. See TEST FOR AIR IN FUEL later in this Group.	**No air found in fuel system:** GO TO ❻ **Air found in fuel system:** Bleed the fuel system. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) later in this Group. – – –1/1

❻ **Cranking Fuel Rail Pressure Test**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine cranking. 2. Using the ECU diagnostic software, read fuel rail pressure - actual.	**Consistently below 20 MPa (200 bar) (2900 psi):** GO TO ❼ **Consistently above 20 MPa (200 bar) (2900 psi):** No fuel supply problem is apparent. See E1-ENGINE CRANKS/WON'T START DIAGNOSTIC PROCEDURE earlier in this Group. – – –1/1

❼ **Fuel Pressure at Final Fuel Filter Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Connect proper pressure gauge from Universal Pressure Kit JT05412 to diagnostic port on either final filter base (—246269) or injection pump (246270—) as applicable. 3. Ignition ON, engine cranking. 4. Using gauge, read pressure.	**Consistently below 100 kPa (1 bar) (15 psi):** GO TO ❽ **Consistently between 100-140 kPa (1-1.4 bar) (15-20 psi):** GO TO ⓫ – – –1/1

❽ **Final Fuel Filter Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Replace the final fuel filter element and recheck fuel pressure at the rail and the final fuel filter. See REPLACE FINAL FUEL FILTER ELEMENT in Group 90 earlier in this manual.	**Fuel pressure still below spec:** GO TO ❾ **Fuel pressure in spec:** Problem fixed. – – –1/1

❾ **Fuel Line Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Check for a partially restricted fuel line between the following: • Fuel tank and primary fuel filter. • Primary fuel filter and transfer pump inlet. • Transfer pump outlet and final fuel filter inlet.	**No restrictions found:** GO TO ❿ **Restriction(s) found:** Repair fuel line and retest. – – –1/1

❿ **Final Fuel Filter Check Valve Test**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Disconnect fuel line from check valve at the final fuel filter inlet using a backup wrench to avoid turning the fitting on the filter. 3. Remove check valve from the fitting at the filter using a backup wrench to avoid turning the fitting on the filter. 4. Pour clean diesel fuel into the outlet side (final filter side) of the check valve and look for leaks in valve. 5. Reconnect fuel lines and check valve and tighten to specification: **Specification** Check Valve—Torque .... 27 N•m (20 lb-ft.) Fuel Line to Check Valve—Torque .... 27 N•m (20 lb-ft.)	**No fuel flows through check valve:** Faulty fuel transfer pump. Replace fuel pump and retest. **Fuel flow through check valve present:** Faulty check valve. Replace check valve and bleed the fuel system. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) later in this Group. Retest. – – –1/1

11 Fuel Line Check	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Check for a partially restricted fuel line between the final fuel filter outlet and the high pressure fuel pump inlet	**No restrictions found:** GO TO 12 **Restriction(s) found:** Repair fuel line and retest. – – –1/1
12 Transfer Pump Check Valve Test	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Disconnect fuel line from check valve at the transfer pump inlet using a backup wrench to avoid turning the fitting on the pump. 3. Remove check valve using a backup wrench to avoid turning the fitting on the pump. 4. Reconnect fuel line to the inlet side of the check valve. 5. Run a clear line from a suitable container for diesel fuel to the pump side of check valve. 6. Crank engine watching for fuel flow through check valve. 7. Reconnect fuel lines and check valve and tighten to specification: **Specification** Check Valve—Torque .... 27 N•m (20 lb-ft.) Fuel Line to Check Valve—Torque .... 27 N•m (20 lb-ft.)	**No fuel flows through check valve:** Faulty check valve. Replace check valve and bleed the fuel system. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) later in this Group. Retest. **Fuel flow through check valve present:** Faulty high pressure fuel pump. Replace and retest. – – –1/1
13 Fuel Rail Pressure Test	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running at low idle. 2. Using the ECU diagnostic software, read fuel rail pressure - actual with engine at low idle.	**Rail pressure consistently below 40 MPa (400 bar) (5800 psi):** GO TO 14 **Rail pressure consistently at or above 40 MPa (400 bar) (5800 psi):** No fuel supply problem found. – – –1/1
14 Fuel Pressure at Final Fuel Filter Check	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Connect proper pressure gauge from Universal Pressure Kit JT05412 to diagnostic port on either final filter base (—246269) or injection pump (246270—) as applicable. 3. Ignition ON, engine running at low idle. 4. Using gauge, read pressure.	**Consistently below 200 kPa (2 bar) (30 psi):** GO TO 17 **Consistently between 200-240 kPa (2-2.4 bar) (30-35 psi):** GO TO 15 – – –1/1

15 HPCR Pressure Relief Valve Test	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* **CAUTION: 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.** 1.Before removing fuel line from pressure relief valve, turn engine OFF and let sit for at least 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail. 2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure relief valve. 3. Disconnect fuel return line fitting at the fuel leak-off line from the pressure relief valve. Do NOT remove the pressure relief valve. 4. Run a clear line from a suitable container for diesel fuel to the pressure relief valve. 5. Ignition ON, engine running. 6. Check fuel flow at pressure relief valve.	**Minimal or no fuel present:** GO TO 16 **Fuel flow is present:** Faulty pressure relief valve. Replace pressure relief and retest. See REMOVE AND INSTALL HPCR PRESSURE RELIEF VALVE in Section 02, Group 090 earlier in this manual. – – –1/1

16 Overflow Valve Check	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Disconnect fitting from fuel return line at the fuel leak-off on high pressure fuel pump. **CAUTION: Fuel is under pressure and hot. Make sure hose is securely in suitable container.** 3.Run a clear line from a suitable container for diesel fuel to the overflow valve 4. Ignition ON, engine running at low idle. 5. Check fuel flow at overflow valve.	**Fuel flow is present:** Faulty high pressure fuel pump OR Faulty ECU **No fuel is present:** Faulty overflow valve. Replace overflow valve and retest. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP OVERFLOW VALVE in Section 02, Group 090 earlier in this manual. – – –1/1

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17 **Final Fuel Filter Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Replace the final fuel filter element and recheck fuel pressure at the rail and the final fuel filter. See REPLACE FINAL FUEL FILTER ELEMENT (—246269) in Group 90 earlier in this manual.	**Fuel pressure in spec:** Problem fixed. **Fuel pressure still below spec:** Faulty high pressure fuel pump OR Faulty ECU – – –1/1

F2 - Excessive Fuel Consumption

Symptom	Problem	Solution
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.

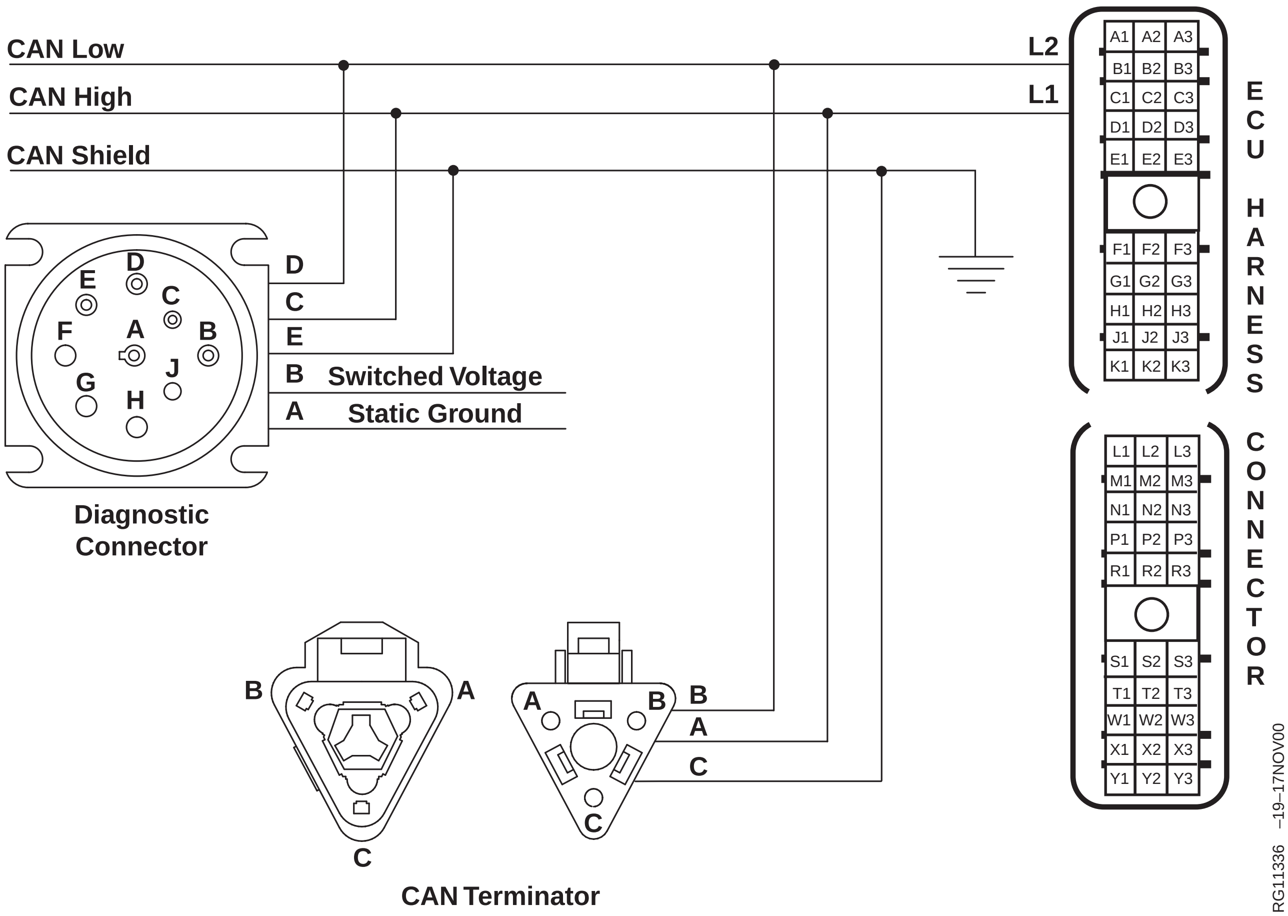
DPSG,RG40854,666 –19–25MAY00–1/1

F3 - Fuel in Oil

Symptom	Problem	Solution
Fuel in Oil	Faulty high pressure fuel pump front seal	Replace front seal.

DPSG,RG40854,667 –19–25MAY00–1/1

D1 - ECU Does Not Communicate with DST or SERVICE ADVISOR



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. For more information on CAN, see CONTROLLED AREA NETWORK (CAN) in Section 03, Group 130 earlier in this manual.

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D1 - ECU Does Not Communicate with DST or SERVICE ADVISOR™

RG41221,00000C4 –19–02APR03–1/1

D1 - ECU Does Not Communicate With DST or SERVICE ADVISOR™ Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.* Inspect the connector pins on the ECU and the connectors at both ends of the diagnostic harness for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair connection and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.* 1. Use the diagnostic gauge OR 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 Section 04, Group 160 later in this manual. 2. Make sure all communication cables are properly connected. 3. Ignition ON, engine OFF. 4. Start the ECU diagnostic software, if applicable.	**Can't communicate with ECU:** GO TO ❸ **Communicates with ECU:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS later in this Group.

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❸ **Sensor Supply 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 one of the following: • Fuel temperature sensor • MAT sensor • ECT sensor For sensor location, see ELECTRONIC CONTROL SYSTEM OVERVIEW in Section 03, Group 140 earlier in this manual. 3. Ignition ON. 4. Using a multimeter, measure the voltage between both terminals of the sensor wiring connector.	**4.5 volts or above:** GO TO ❺ **Below 4.5 volts:** GO TO ❹

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❹ **ECU Power Supply Test**	*NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Ignition ON 4. Using a multimeter, measure the voltage between a good chassis ground and terminal E3 in the harness end of the ECU connector.	**10.0 volts or above:** Faulty ECU power wiring OR Faulty ECU. **Below 10.0 volts:** Faulty ECU power fuse OR Key-on signal wire shorted to ground OR Faulty ignition switch OR Faulty key-on power fuse.

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❺ **Parallel Data Module (PDM) Power Light Test**	*NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.* 1. Ignition ON 2. Note power light on the PDM.	**Power light is Green:** GO TO ❽ **Power light is Red or OFF:** GO TO ❻

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❻ **Open in Diagnostic Harness Ground Wire Test**	*NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.* 1. Ignition OFF. 2. Disconnect the diagnostic cable from the diagnostic connector on main harness. 3. Using a multimeter, measure voltage between the ground terminal and the power terminal (terminals A and B) in the diagnostic connector on the main harness.	**Substantially less than battery voltage:** GO TO ❼ **At or near battery voltage:** Faulty diagnostic cable between diagnostic connector and PDM OR Faulty Parallel Data Module (PDM)

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❼ **Harness Power and Ground Wire Test**	*NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.* 1. Ignition OFF. 2. Disconnect the diagnostic cable from the diagnostic connector on main harness. 3. Probe terminal A in diagnostic connector with test light connected to battery voltage.	**Light ON:** Faulty diagnostic connector OR Open or short to ground in diagnostic connector switched power wire. **Light OFF:** Faulty diagnostic connector OR Open in diagnostic connector ground wire.

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❽ **Open in Harness Circuit Test**	*NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors and diagnostic cable from the diagnostic connector. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure resistance on the harness end of both connectors between: • Terminal D in the diagnostic connector and terminal L2 in the ECU connector. • Terminal C in the diagnostic connector and terminal L1 in the ECU connector.	**All measurements 5 ohms or less:** GO TO ❾ **One or more measurements greater than 5 ohms:** Open in harness circuit OR Connector terminals in wrong position.

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❾ **CAN Resistance Check**	*NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.* 1. Ignition OFF. 2. ECU and diagnostic connectors 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 ❿ **Less than 45 ohms or greater than 75 ohms:** Faulty or missing CAN terminator connector(s). OR Open or short in CAN wiring harness

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❿ **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 both 30-way ECU connectors. 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 volts:** Faulty ECU/Cab Harness connection 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 volts or greater than 3.5 volts:** CAN wiring shorted to ground or voltage OR Faulty ECU.

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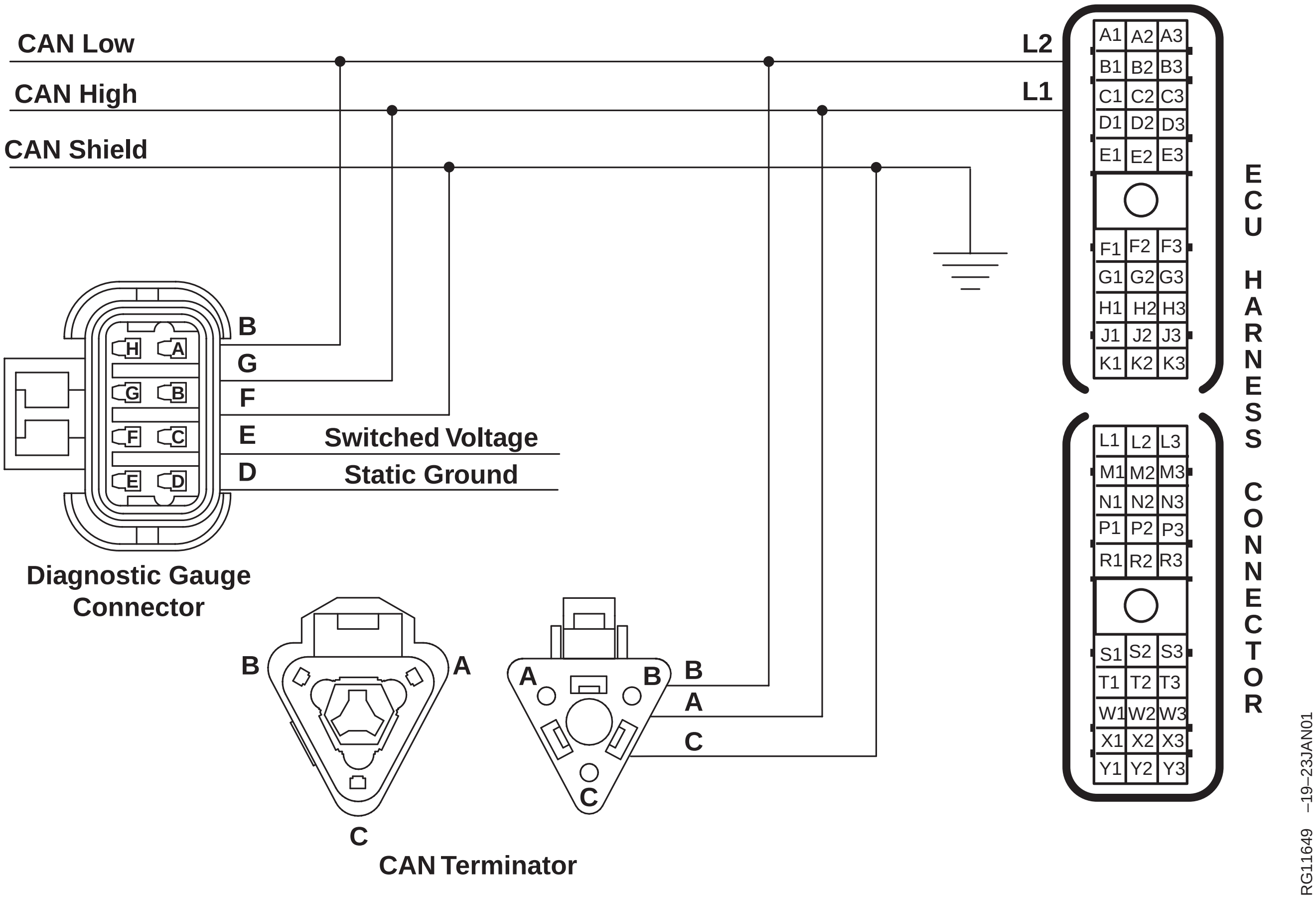
D2 - Diagnostic Gauge Does Not Communicate With ECU



NOTE: *For more information on CAN, see CONTROLLED AREA NETWORK (CAN) in Section 03, Group 140 earlier in this manual.*

Internal Diagnostic Gauge Errors

- The D2 - Diagnostic Gauge Does Not Communicate With ECU 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

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D2 - Diagnostic Gauge Does Not Communicate With ECU

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D2 - Diagnostic Gauge Does Not Communicate With ECU Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* Before using this diagnostic procedure, Without disconnecting, visually inspect the ECU connectors, diagnostic gauge connector, and the CAN terminator connector looking for dirty damaged, or poorly positioned terminals.	**No problem found:** GO TO ❷ **Problem found:** Repair connection and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF. 2. Ignition ON 3. Look for error message on diagnostic gauge.	**Error or no power found in diagnostic gauge:** GO TO ❸ **No error found and power present in diagnostic gauge:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Sensor Voltage Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF. 2. Disconnect any of the following: • Fuel temperature sensor • MAT sensor • ECT 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 ❺ **Below 4.5 V:** GO TO ❹ – – –1/1

❹ **Power Supply Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF. 2. Disconnect both 30 way ECU connectors. 3. Ignition ON 4. Using a multimeter, measure the voltage between a good ground and terminal E3 in the harness end of the ECU connector.	**10.0 V or above:** Faulty ECU power wiring OR Faulty ECU **Below 10.0 V:** Faulty ECU power fuse OR Key-on signal wire open or short to ground OR Faulty ignition switch OR Faulty key-on power fuse – – –1/1

❺ **Diagnostic Gauge Power Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition ON 2. View diagnostic gauge	**Gauge has power:** GO TO ❽ **Gauge does not have power:** GO TO ❻ – – –1/1

❻ **Open in Diagnostic Gauge Connector Ground Wire Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF. 2. Disconnect the diagnostic gauge from the diagnostic connector. 3. Ignition ON 4. Using a multimeter, measure voltage between the switched voltage terminal and the ground terminal (terminals D and E) of the harness end of the diagnostic gauge connector.	**Substantially less than battery voltage:** GO TO ❼. **At or near battery voltage:** Faulty diagnostic connector OR Faulty diagnostic cable OR Faulty Parallel Port Data Module (PDM) – – –1/1

❼ **Open in Diagnostic Gauge Connector Power Wire Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 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

❽ **Open in Harness Circuit Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors and the diagnostic gauge from the diagnostic connector. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure resistance on the harness end of both connectors between: • Terminal B in the diagnostic gauge connector and terminal L2 in the ECU connector. • Terminal G in the diagnostic gauge connector and terminal L1 in the ECU connector.	**All measurements 5 ohms or less:** GO TO ❾ **One or more measurements greater than 5 ohms:** Open in harness circuit OR Connector terminals in wrong position – – –1/1

❾ **CAN Resistance Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF. 2. Both 30-way ECU and diagnostic gauge connectors 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 ❿ **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

10 CAN High and Low Voltage Test	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF. 2. Reconnect both 30-way ECU connectors. 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 connection OR Faulty diagnostic gauge connection OR Faulty diagnostic software/computer configuration OR Faulty ECU **Either measurement less than 1.5 V or greater than 3.5 V:** CAN wiring shorted to ground or power OR Faulty ECU – – –1/1

A1 - Intake Air Heater Check

Intake Air Heater Option

The optional intake air heater is located between the intake pipe and intake manifold. Its function is to heat the intake air during cold starting conditions. Its operation time is dependent on the fuel temperature for most applications (some applications use manifold air temperature).

At key On, the ECU checks the temperature sensor input to determine if the air heater needs to come on. If the ECU reads a temperature input at or below the values shown in the tables below, the ECU sends battery voltage out of pin J3 to the air heater relay and the air heater turns ON. The ECU will illuminate the air heater indicator light. After the specified heater On time, the ECU stops sending battery voltage, the solenoid deactivates, and the air heater turns OFF. The ECU will turn the air heater indicator light OFF.

To take full advantage of the intake air heater, the operator should wait until the light goes out before starting the engine. A key-off/key-on cycle is required to restart the air heater.

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A1 - Intake Air Heater Check

NOTE: The air heater indicator light is the same light that trouble codes are displayed on. The air heater will run for 5 additional seconds after the light turns OFF.

Intake Air Heater Operation - Loaders	
Fuel Temperature	**Light ON Time**
-5°C (23°F)	10 seconds
-10°C (14°F)	15 seconds
-15°C (5°F)	20 seconds
-20°C (-4°F) and below	30 seconds

Intake Air Heater Operation - Marine	
Manifold Air Temperature	**Light ON Time**
5°C (41°F)	5 seconds
0°C (32°F)	10 seconds
-5°C (23°F)	20 seconds
-10°C (14°F) and below	30 seconds

Intake Air Heater Operation - OEM	
Fuel Temperature	**Light ON Time**
-1°C (30.2°F)	5 seconds
-5°C (23°F)	10 seconds
-10°C (14°F)	15 seconds
-15°C (5°F)	20 seconds
-20°C (-4°F) and below	25 seconds

Intake Air Heater Operation - Tractors	
Fuel Temperature	**Light ON Time**
-1°C (30.2°F)	5 seconds
-2°C (28.4°F)	10 seconds
-3°C (26.6°F)	15 seconds
-4°C (24.8°F)	20 seconds
-5°C (23°F) and below	25 seconds

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A1 - Intake Air Heater Check Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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: For wiring and theory of operation, see A1 - INTAKE AIR HEATER CHECK supporting information* Without disconnecting, visually inspect the ECU connector, air heater relay connector, and air heater connector for contamination, damage, or poor positioning. Check wiring for damage. Make sure the indicator light is working.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Active DTC Test**	*NOTE: For wiring and theory of operation, see A1 - INTAKE AIR HEATER CHECK supporting information.* 1. Check for active fault codes using either the diagnostic gauge on instrument panel, 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 Section 04, Group 160 later in this manual. Record codes. 2. Ignition ON, engine OFF. 3. Read DTCs.	**No active DTC(s) present:** GO TO ❸ **Active DTC(s) present:** Go to appropriate diagnostic procedure.

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❸ **Engine Coolant Temperature Check**	*NOTE: For wiring and theory of operation, see A1 - INTAKE AIR HEATER CHECK supporting information.* 1. Key ON, engine OFF. 2. See the fuel temperature parameter. On Marine applications, see the manifold air temperature parameter. 3. Compare the temperature to the corresponding temperature specification table. See A1 - INTAKE AIR HEATER CHECK earlier in this Group.	**Temperature is below the specification to turn the air heater ON:** GO TO ❹ **Temperature is above the specification to turn the air heater ON:** No air heater-related problem found.

– – –1/1

❹ **Voltage at Air Heater Check**	*NOTE: For wiring and theory of operation information, see A1 - INTAKE AIR HEATER CHECK supporting information* 1. Key OFF. 2. Using a multimeter, measure the voltage between the air heater power stud and a good chassis ground while turning key ON (engine OFF). *NOTE: Voltage must be read as key is turned ON.*	**At or near battery voltage:** GO TO ❺ **No voltage detected:** GO TO ❻

– – –1/1

❺ **Air Heater Check**	*NOTE: For wiring and theory of operation information, see A1 - INTAKE AIR HEATER CHECK supporting information.* 1. Key OFF. 2. Using a multimeter, measure the temperature of air heater housing with temperature probes. 3. Key ON, engine OFF. 4. Continue to monitor temperature of air heater housing.	**Temperature increases:** No air heater related problem found. **Temperature does not increase** Faulty air heater.

– – –1/1

❻ **Air Heater Relay Check**	*NOTE: For wiring and theory of operation information, see A1 - INTAKE AIR HEATER CHECK supporting information.* 1. Key OFF. 2. Listen for air heater relay to click while turning key ON (engine OFF).	**Relay clicks:** Faulty power wire to relay OR Faulty wire between relay and heater OR Faulty air heater relay. **Relay does not click:** Faulty air heater enable wire OR Faulty relay ground OR Faulty relay. – – –1/1

Check Fuel Supply Quality

The quality of diesel fuel affects engine performance. Check operators manual for correct fuel specifications.

Poor quality or contaminated fuel will make engine hard to start, misfire, run rough, or produce low power.

If poor quality or contaminated fuel is suspected, perform the following:

1. Empty and clean filter(s) and/or water separator bowl.
2. Fill filters with clean filtered fuel of the proper grade and reinstall.
3. Disconnect tank fuel line from inlet side of primary fuel filter or water separator bowl, depending on filter configuration.
4. Obtain a clean hose and connect one end to the inlet port and submerge the other end in a container of good quality, clean fuel meeting engine specifications.
5. Operate engine under load and observe performance.

If performance improves, fuel is contaminated or not of the proper grade. Check fuel source.

RG41221,000002C –19–22APR02–1/1

Test for Air in Fuel

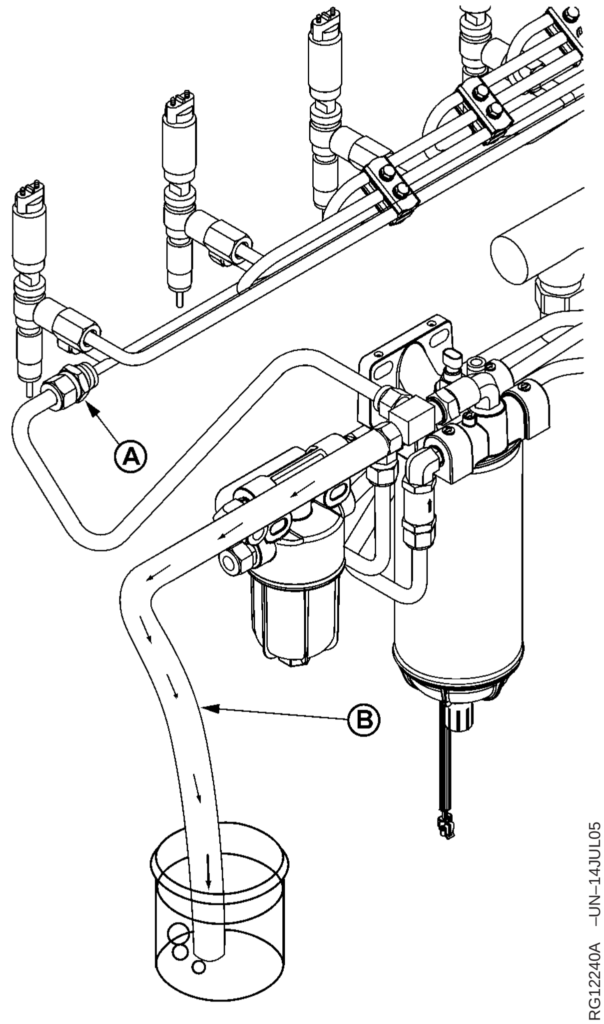
NOTE: If engine cranks but won't start, see BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) later in this Group.

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.

If the fuel system has been opened for repair, it must be bled to remove any air that might have entered the system.

1. Single-filter systems: Empty and clean primary filter (strainer) bowl, drain contaminants from final filter. Dual filter systems: Drain contaminants from the fuel filters.
2. Single-filter systems: Fill bowl with filtered fuel and reinstall bowl.
3. Disconnect fuel line from inlet side of primary fuel filter.
4. Connect hose to inlet port (B) of primary fuel filter or to the fuel injecting leak-off connection (A), depending on fuel system configuration.
5. Submerge hose in a container of good quality, clean fuel meeting engine specifications.
6. Start engine. Run engine for 1 minute at 1500 rpm. Stop engine.
7. Do steps 1 and 2 again.
8. Start engine and operate under load, observing engine performance.
9. Reduce engine speed to idle and shut down engine.

Perform any necessary repairs, bleed the fuel system, and repeat test. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) later in this Group.



Air in Fuel Check (—246269 shown)

A—On dual-filter systems and some single-filter applications, the return-to-tank line connects here.
B—Hose shown connected to the typical single-filter return-to-tank connection.

Check Fuel Supply Pressure

IMPORTANT: Before disconnecting and fuel lines, completely clean any debris from around the fitting. DO NOT allow debris to enter fuel line.

1. Connect proper pressure gauge from Universal Pressure Kit JT05412 to diagnostic port on either final filter base (—246269) or injection pump (246270—) as applicable.

2. Start engine and run at low idle. Fuel transfer pump should maintain minimum output pressure shown in specification.

Specification

Fuel Transfer Pump Pressure—
Pressure.. 200-240 kPa (2.0-2.4 bar) (29-35 psi)

3. If pressure is below the minimum specified and no restriction in fuel lines are visible, empty and clean the primary fuel filter and replace final filter and recheck.

   If pressure is still low, connect the primary filter inlet line to a temporary fuel tank and recheck pressure. If pressure increases to specification, check the fuel supply line, primary filter, the fuel tank, and the fuel tank vent for any possible restrictions.

4. If pressure does not increase, replace high pressure fuel pump and retest.

RG41221,000002F –19–22APR02–1/1

Check for Restricted Fuel Return Line

This check will help determine if the fuel return line is restricted.

1. Disconnect fuel-to-tank return line (Dual filter systems and some single-filter systems: at injector fuel leak-off line. Most single-filter systems: at overflow valve on final filter).

2. Remove fuel tank cap.

3. Apply compressed air into the fuel return line while listening at the fuel tank filler neck. Air bubbling into the fuel tank should be audible.

CAUTION: Maximum air pressure should be 100 kPa (1 bar) (14.5 psi) when performing this test.

4. If bubbling is not audible, check fuel return line for restrictions.

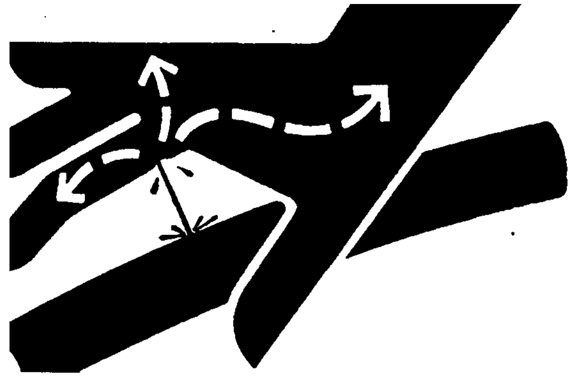
5. Reconnect fuel lines.

RG41221,0000030 –19–22APR02–1/1

Bleed the Fuel System (—246269)

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.

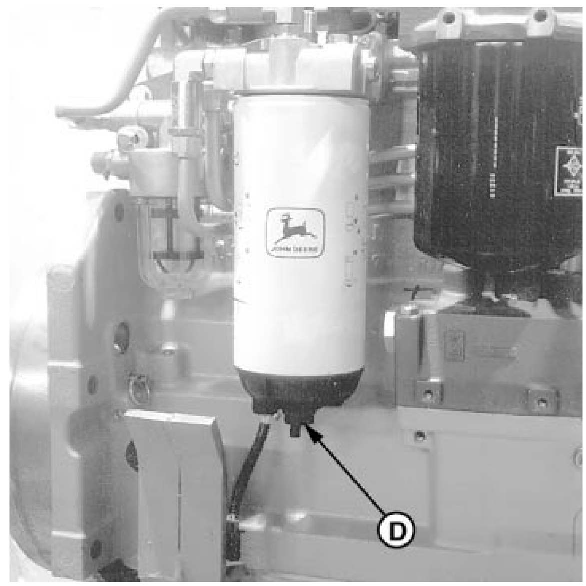
If ANY fluid is injected into the skin, a doctor familiar with this type of injury must surgically remove it within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



X9811 –UN–23AUG88

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

1. Drain water and contaminants from water separator bowl by opening the drain valve (D).



RG11519B –UN–14DEC00

Drain Valve on Final Filter

D—Drain Valve

Continued on next page RG41221,0000031 –19–22APR02–1/3

2. Connect JT03472 coupler and hose to diagnostic port (A). If JT03472 coupler is not available, loosen the diagnostic port to allow air and fuel to escape. Bleed fuel into suitable container.

3. Unlock and operate hand primer (B) until a steady flow of fuel (without bubbles) flows out of hose. This could take 270 - 330 strokes until steady fuel flow is free of bubbles.

4. Continue to pump hand primer while disconnecting JT03472 coupler from diagnostic port, or while tightening diagnostic port to specification below.

Specification

Diagnostic Port—Torque .... 14 N•m (10 lb-ft)

5. Start engine and run at 1200-1500 RPM for 3-5 minutes.

6. If engine fails to start, loosen high pressure fuel line fittings (C). Pump hand primer (B) until steady flow of fuel escapes the fuel pump. Tighten fuel lines to specification below and lock hand primer. This could take an addition 90 - 120 strokes until steady fuel flow is free of bubbles.

Specification

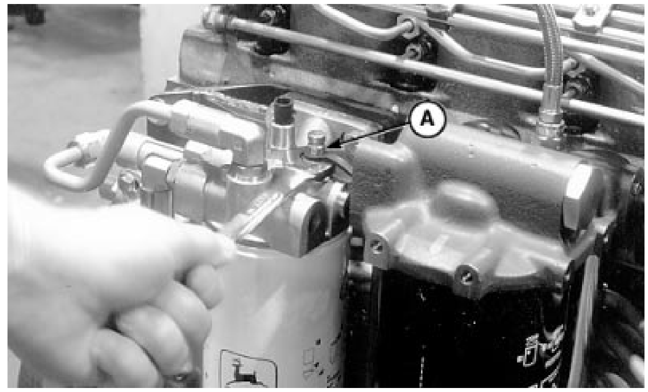
High Pressure Fuel Lines—
Torque .... 27 N•m (20 lb-ft)

7. Crank engine up to 15 seconds. If engine does not start, wait 15 seconds and then crank for an additional 15 seconds. If engine starts, run at 1200-1500 RPM for 3-5 minutes.

8. If engine fails to start, loosen fuel line fitting on HPCR flow limiter #6. Place rag around fitting to absorb fuel. Pump hand primer (B) until steady flow of fuel escapes the flow limiter. Tighten fuel lines to specification below and lock hand primer (pull up, then push down and lock).

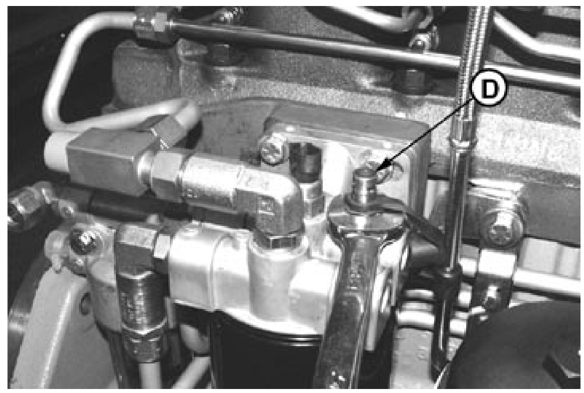
Specification

High Pressure Fuel Lines—
Torque .... 27 N•m (20 lb-ft)



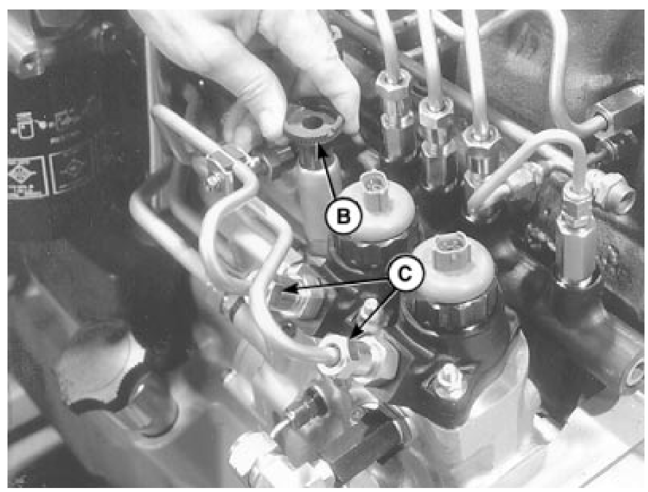
RG11081 –UN–10NOV00

Diagnostic Port



RG12279A –UN–22APR02

Diagnostic Port



RG11518 –UN–11DEC00

Hand Primer

A—Diagnostic Port
B—Hand Primer
C—High Pressure Fuel Line Fittings

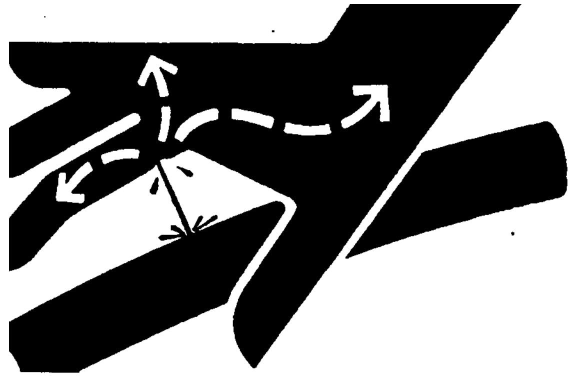
Continued on next page

RG41221,0000031 –19–22APR02–2/3

9. Crank engine up to 15 seconds. If engine does not start, wait 15 seconds and then crank for an additional 15 seconds. If engine starts, run at 1200-1500 RPM for 3-5 minutes.

RG41221,0000031 –19–22APR02–3/3

Restarting Engine That Has Run Out Of Fuel (—246269)


X9811 –UN–23AUG88

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.

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.

If the engine will not start after the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system. See BLEED THE FUEL SYSTEM (—246269) earlier in this Group.

In case the engine has run out of fuel, the fuel system must be primed by the following method:

1. Fill fuel tank

Continued on next page RG41221,0000001 –19–22APR02–1/3

2. Loosen transfer pump low pressure outlet line (A) (outside lower line of fuel pump). Unlock and operate hand primer (B) until a steady flow of fuel (without bubbles) flows out of the outlet of the transfer pump. This can 90-105 strokes. Tighten outlet line to specification below:

Specification

Low Pressure Outlet Line—
Torque .... 27 N•m (20 lb-ft)

3. Connect JT03472 coupler and hose to diagnostic port (D). If JT03472 coupler is not available, loosen the diagnostic port to allow air and fuel to escape. Bleed fuel into suitable container.

4. Unlock and operate hand primer (B) until a steady flow of fuel (without bubbles) flows out of hose. This could take another 170-230 strokes until steady fuel flow is free of bubbles. Disconnect coupler or tighten diagnostic port to specification below.

Specification

Diagnostic Port—Torque .... 14 N•m (10 lb-ft)

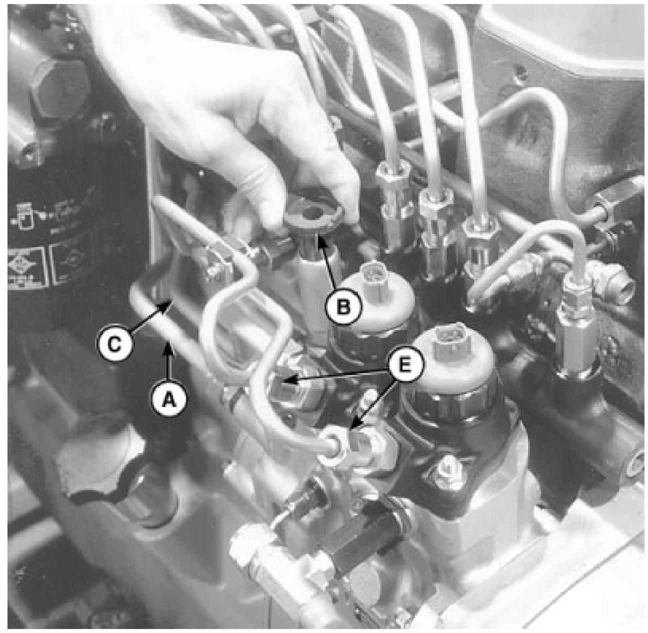
5. Loosen both high pressure fuel lines (E) from fuel pump. Pump hand primer (B) until steady flow of fuel escapes both of the outlets on the fuel pump. This could take another 90-120 strokes until steady fuel flow is free of bubbles. Tighten fuel lines to specification below and lock hand primer (pull up, then push down and lock).

Specification

High Pressure Fuel Lines—
Torque .... 27 N•m (20 lb-ft)

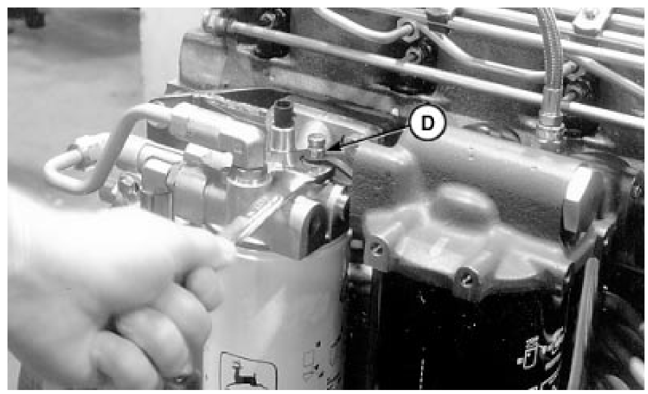
6. Crank engine up to 15 seconds. If engine does not start, wait 15 seconds and then crank for an additional 15 seconds. If engine starts, run at 1200-1500 RPM for 3-5 minutes.

7. If engine fails to start, loosen fuel line fitting on HPCR flow limiter #6. Place rag around fitting to absorb fuel. Pump hand primer (B) until steady flow of fuel escapes the flow limiter. Tighten fuel lines to specification below and lock hand primer (pull up, then push down and lock).



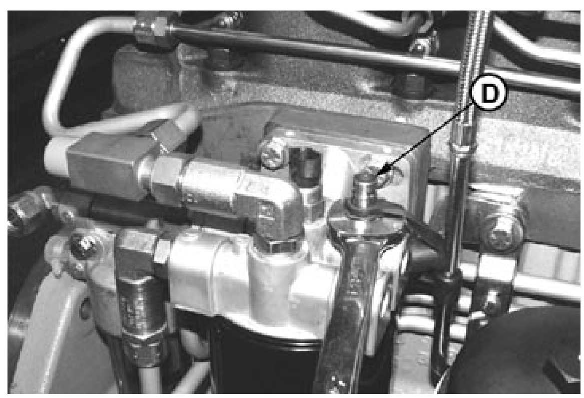
RG11600 –UN–11DEC00

Hand Primer and Fuel Lines



RG11599 –UN–11DEC00

Diagnostic Port



RG12279A –UN–22APR02

Diagnostic Port

A—Low Pressure Outlet Line
B—Hand Primer
C—Low Pressure Inlet Line
D—Diagnostic Port
E—High Pressure Fuel Lines

Continued on next page

RG41221,0000001 –19–22APR02–2/3

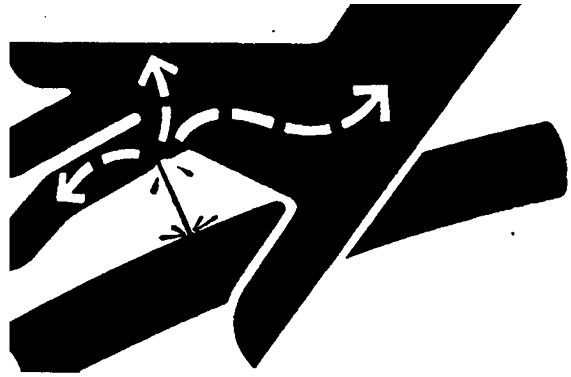
Specification

High Pressure Fuel Line—Torque.................................. 27 N•m (20 lb-ft)

8. Crank engine up to 15 seconds. If engine does not start, wait 15 seconds and then crank for an additional 15 seconds. If engine starts, run at 1200-1500 RPM for 3-5 minutes.

RG41221,0000001 –19–22APR02–3/3

Bleed the Fuel System (246270—)


X9811 –UN–23AUG88

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.

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.

When fuel filters are being removed or replaced they must be prefilled. See REPLACE FUEL FILTER (246270--).

In case the engine has run out of fuel, see RESTARTING ENGINE THAT HAS RUN OUT OF FUEL (246270--).

Continued on next page RG41183,0000056 –19–16SEP03–1/4

IMPORTANT: Bleeding the fuel system is easier when using an electric priming pump. See ELECTRIC FUEL PRIMING PUMP or BLEED THE FUEL SYSTEM USING ELECTRIC PRIMING PUMP (246270—)

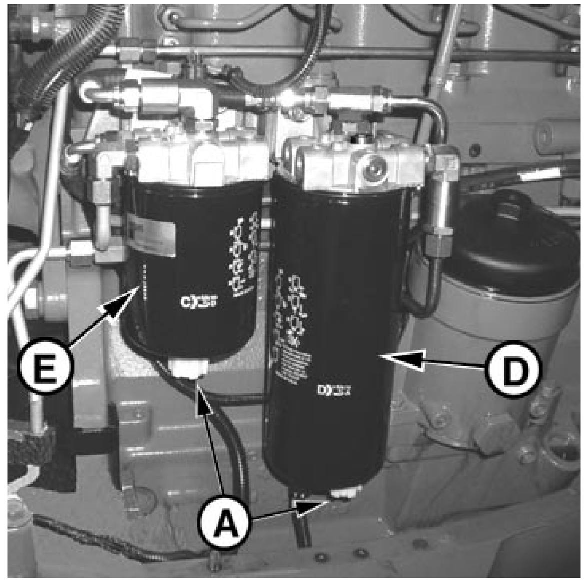
IMPORTANT: When draining water from fuel filters the drain valve must be unthreaded completely and valve drops down approximately 12 mm (0.5 in.) to properly drain water from filter.

1. Drain water and contaminates from filter by opening the drain valve (A) on the primary (D) and secondary (E) filters.

04
150
68

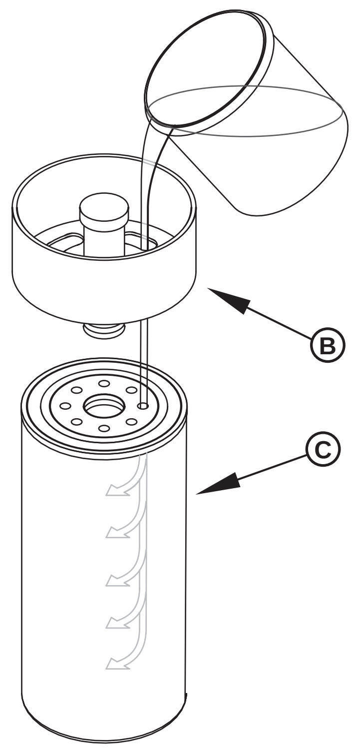
2. Prefill fuel filters (C) using prefill cup (B) and install filters.

A—Drain Valve
B—Prefill Cup
C—Fuel Filter
D—Primary Fuel Filter
E—Secondary Fuel Filter



RG13269 –UN–04NOV03

Drain Valve on Fuel Filters



RG13296 –UN–22JUN05

Prefilling Fuel Filter

Continued on next page RG41183,0000056 –19–16SEP03–2/4

3. Loosen the fuel outlet (A) of the transfer pump. Unlock and operate hand primer (B) until a steady flow of fuel without bubbles flows out of connection. This could take 270 - 330 strokes until steady fuel flow is free of air bubbles. Then retighten fuel hose.

Specification
Fuel Outlet Hose—Torque .... 24 N•m (18 lb-ft)

4. Loosen the high-pressure fuel supply line (C) and operate the hand pump until a steady flow of fuel without bubbles flows out. Tighten the high-pressure fuel supply line to specification.

Specification
High Pressure Fuel Supply Line—
Torque .... 24 N•m (18 lb-ft)

5. Loosen the other high-pressure fuel supply line (D) and operate the hand pump until a steady flow of fuel without bubbles flows out. Tighten the high-pressure fuel supply line to specification.

Specification
High Pressure Fuel Line—Torque.................................. 24 N•m (18 lb-ft)

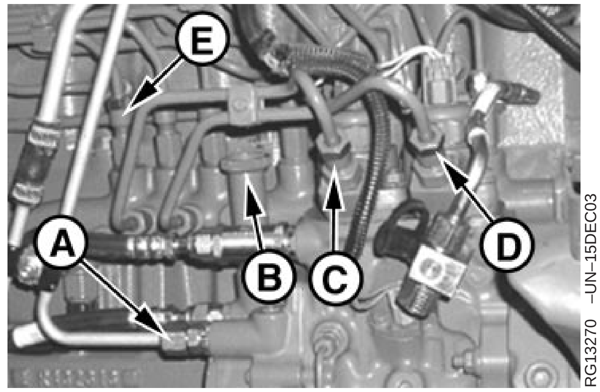
6. Loosen fuel line fitting on fuel rail flow limiter #6 (E). Place rag around fitting to absorb fuel. Pump hand primer (B) until steady flow of fuel escapes the flow limiter. Tighten fuel line to specification.

Specification
Pressure Relief Valve—Torque...................................... 24 N•m (18 lb-ft)

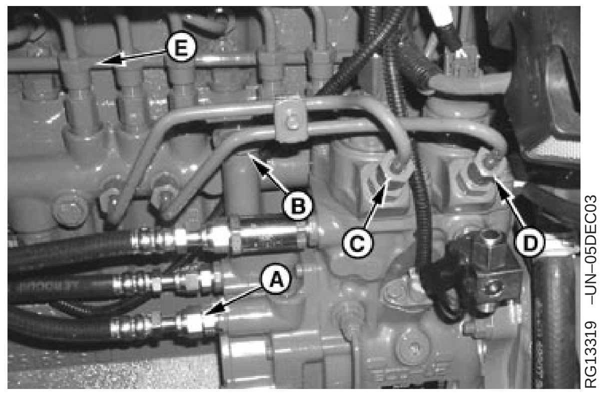
7. Pump hand primer approximately 30 more times. Lock hand primer (B) (pull up, then push down and lock).

8. Crank engine up to 15 seconds. If engine does not start, wait 15 seconds and then crank for an additional 15 seconds. If engine starts, run at 1200-1500 RPM for 3-5 minutes.

9. If engine fails to start, loosen fuel line fitting on HPCR flow limiter #6. Place rag around fitting to absorb fuel. Pump hand primer (B) until steady flow of fuel escapes the flow limiter. Tighten fuel lines to specification below and lock hand primer (pull up, then push down and lock).



Model with Fuel Cooler



Model without Fuel Cooler

A—Fuel Transfer Pump Outlet Hose
B—Hand Primer
C—High Pressure Fuel Supply Line
D—High Pressure Fuel Supply Line
E—Fuel Line Fitting on Fuel Rail Flow Limiter #6

Continued on next page RG41183,0000056 –19–16SEP03–3/4

Specification

High Pressure Fuel Lines—
Torque .... 24 N•m (18 lb-ft)

RG41183,0000056 –19–16SEP03–4/4

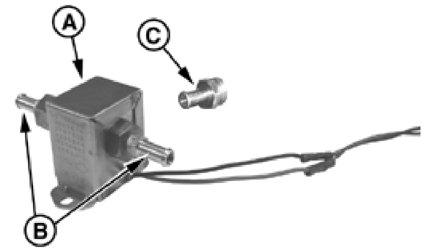
Electric Fuel Priming Pump

Electric Priming Pump Kit

There are three special parts necessary to bleed the fuel system using an electric pump:

- AH130127 Electric Pump
- R134954 Hose Barb Fitting (2)
- RE193349 Barb Fitting for 3/8-inch hose (M14 x 1.5-6 o-ring)

These parts can be ordered from John Deere or they can be assembled from parts you may have on hand. The electric pump should be power rated for 12V or 24V and be approved for pumping diesel fuel. Barb fittings need to fit onto the intake and output ports on the pump, and a barb fitting needs to fit onto the filter head port.



RG13372 –UN–25NOV03

Electric Fuel Priming Pump

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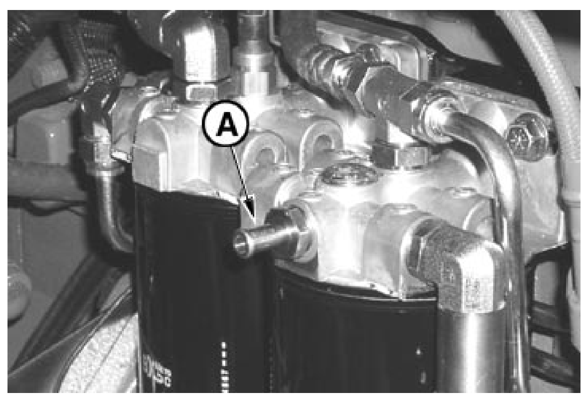
RG41183,0000071 –19–26NOV03–1/2

Pump Set-Up

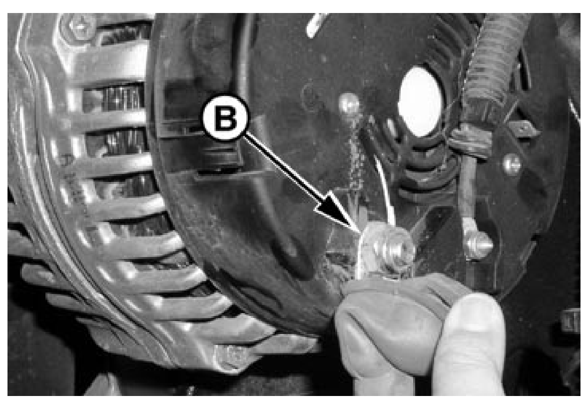
1. Remove plug and install RE193349 fitting (A) into filter header.
2. Connect output hose of priming pump to fitting (A) in filter header.
3. Install input hose into container of fuel. Place fuel container higher than fuel pump for better priming results.
4. Connect power wire to positive terminal on alternator with switch off and find a clean ground point for ground connection.

A—RE193349 Barb Fitting
B—Positive Terminal



RG13320 –UN–04NOV03

Fitting at Filter Header

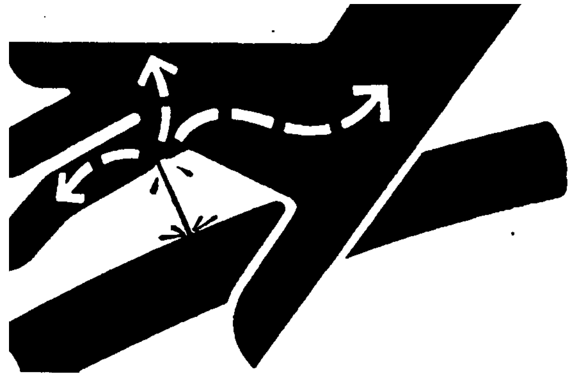


RG13376 –UN–26NOV03

Alternator

RG41183,0000071 –19–26NOV03–2/2

Bleed the Fuel System Using Electric Priming Pump (246270—)


X9811 –UN–23AUG88

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.

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.

When fuel filters are being removed or replaced they must be prefilled. See REPLACE FUEL FILTER (246270--).

In case the engine has run out of fuel, see RESTARTING ENGINE THAT HAS RUN OUT OF FUEL (246270--).

Continued on next page

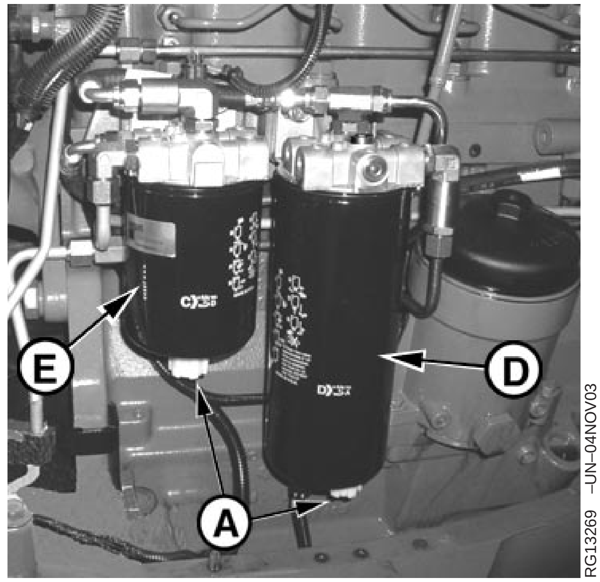
RG41183,0000056 –19–16SEP03–1/4

IMPORTANT: When draining water from fuel filters the drain valve must be unthreaded completely and valve drops down approximately 12 mm (0.5 in.) to properly drain water from filter.

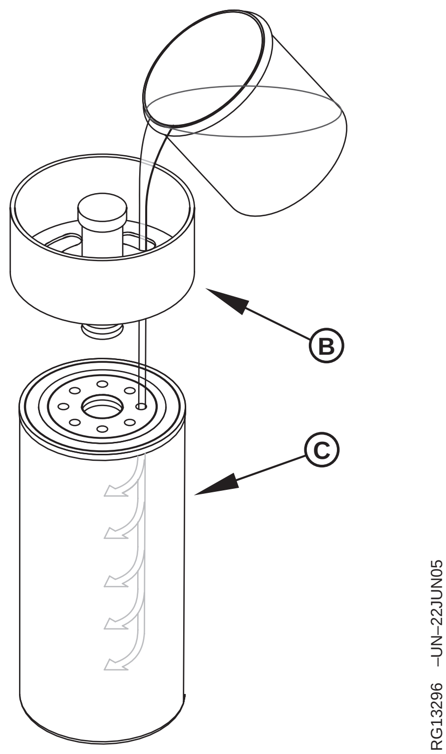
1. Drain water and contaminates from filter by opening the drain valve (A) on the primary (D) and secondary (E) filters.

2. Prefill fuel filters (C) using prefill cup (B) and install filters.

A—Drain Valve
B—Prefill Cup
C—Fuel Filter
D—Primary Fuel Filter
E—Secondary Fuel Filter



Drain Valve on Fuel Filters



Prefilling Fuel Filter

Continued on next page RG41183,0000056 –19–16SEP03–2/4

3. Set up and prime the electric priming pump as described on the previous page.Turn on the electric priming pump and loosen the fuel outlet hose (A) of the transfer pump until a steady flow of fuel without bubbles flows out of connection. Then retighten hose.

Specification

Fuel Outlet Hose—Torque .... 24 N•m (18 lb-ft)

4. Loosen the high-pressure fuel supply line (C) and operate the pump. Unlock and operate the hand primer to assist.

5. When a steady flow of fuel without bubbles flows out, tighten the high-pressure fuel supply line to specification.

Specification

High Pressure Fuel Supply Line—
Torque .... 24 N•m (18 lb-ft)

6. Loosen the other high-pressure fuel supply line (D) and operate the pump. Operate the hand primer to assist.

7. When a steady flow of fuel without bubbles flows out, tighten the high-pressure fuel supply line to specification. Lock the hand primer.

Specification

High Pressure Fuel Supply Line—
Torque .... 24 N•m (18 lb-ft)

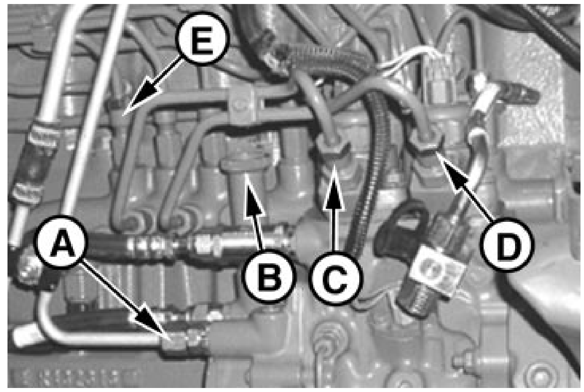
8. Loosen fuel line fitting on fuel rail flow limiter #6 (E). Place rag around fitting to absorb fuel. Operate the electric pump until steady flow of fuel escapes the flow limiter. Tighten fuel line to specification.

Specification

Pressure Relief Valve—Torque...................................... 24 N•m (18 lb-ft)

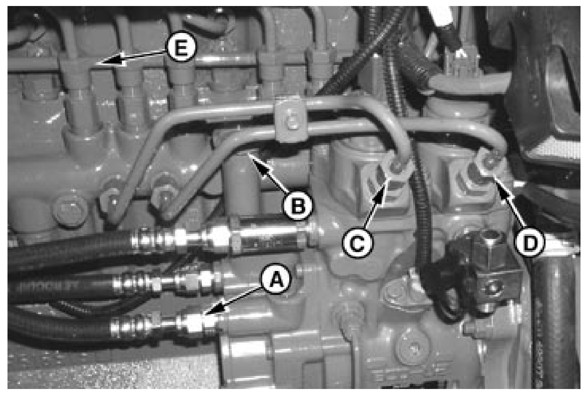
9. Operate the electric pump for approximately 10 seconds.

10. Remove electric pump. Remove the hose fitting that was installed onto the filter head and install the plug back into the filter head.



RG13270 –UN–15DEC03

Model with Fuel Cooler



RG13319 –UN–05DEC03

Model without Fuel Cooler

A—Fuel Transfer Pump Outlet Hose
B—Hand Primer
C—High Pressure Fuel Supply Line
D—High Pressure Fuel Supply Line
E—Fuel Line Fitting on Fuel Rail Flow Limiter #6

Continued on next page

11. Crank engine up to 15 seconds. If engine does not start, wait 15 seconds and then crank for an additional 15 seconds. If engine starts, run at 1200-1500 RPM for 3-5 minutes.

12. If engine fails to start, loosen fuel line fitting on HPCR flow limiter #6. Place rag around fitting to absorb fuel. Pump hand primer (B) until steady flow of fuel escapes the flow limiter. Tighten fuel lines to specification below and lock hand primer.

Specification

High Pressure Fuel Lines—
Torque .... 24 N•m (18 lb-ft)

RG41183,0000056 –19–16SEP03–4/4

Restarting Engine That Has Run Out of Fuel (246270—)

When the engine has been run out of fuel, the system must be primed.

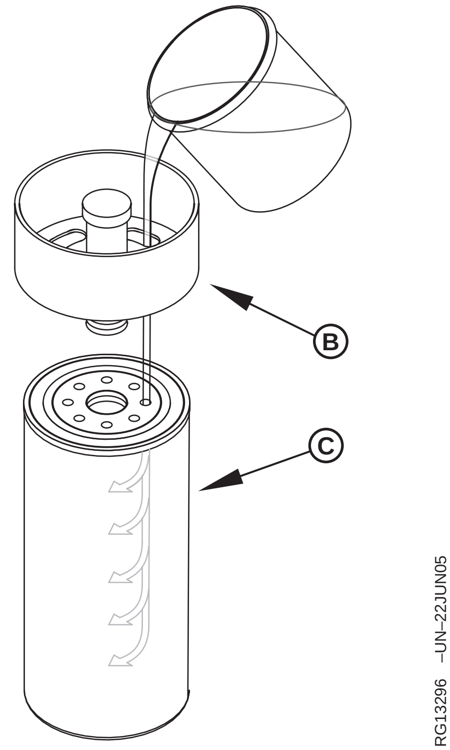
1. Fill fuel tank.

IMPORTANT: The prefill cup must be used when filling the fuel filters to insure that the fuel is being filtered. If prefill cups are not available the filters are not to be removed and proceed to bleeding the fuel system procedure.

2. Remove fuel filters and connect prefill cup to filter and fill filters with fuel.

3. Bleed air from system. See BLEED THE FUEL SYSTEM (246270—).

B—Prefill Cup
C—Fuel Filter



Prefilling Fuel Filter

RG41183,000005D –19–03OCT03–1/1

Check and Adjust High Pressure Fuel Pump Static Timing

1. Remove plug from engine block.

2. Install and rotate engine flywheel using JDG820 Flywheel Turning Tool (A) (in normal running direction) until No. 1 piston is at “TDC” of its compression stroke. At this point, JDE81-4 Timing Pin (B) should enter hole in flywheel.

3. Remove the high pressure fuel pump drive gear cover.

4. Try to thread JDG886 High Pressure Fuel Pump Timing Pin (C) into drive hub until it bottoms out. If timing pin bottoms out the timing is set.

NOTE: If JDG886 Timing Pin does not enter high pressure fuel pump, engine may be at No. 6 “TDC-Compression.” Rotate engine no more than once until JDE81-4 Timing Pin engages in flywheel again. Engine should then be at No. 1 “TDC-Compression.” Timing pin should be in the 9 o’clock position.

5. If timing pin cannot thread in the drive hub, loosen drive gear-to-pump hub cap screws and rotate hub until pin threads into hub.

6. Tighten drive gear-to-pump hub cap screws:

Specification

Fuel Pump Drive Gear-to-Pump Hub Cap Screws—Torque .... 61 N•m (45 lb-ft)

7. Remove JDG886 Timing Pin from pump hub.

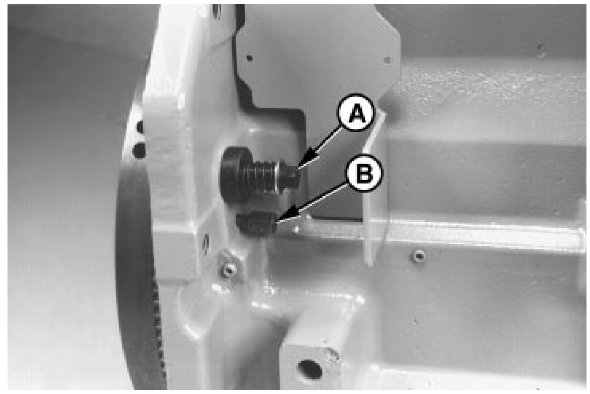
8. Install drive gear cover. Tighten cap screws to specification.

Specification

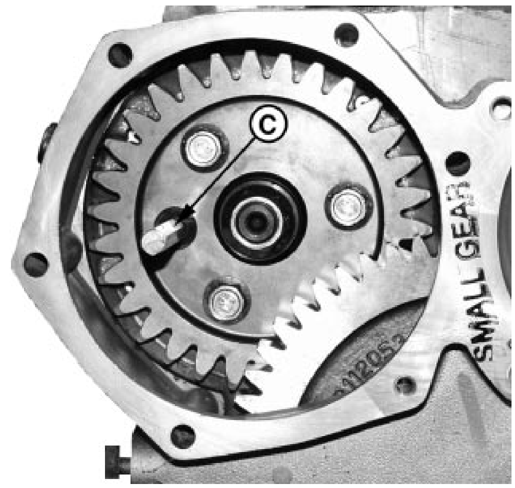
Fuel Pump Drive Gear Cover—Torque .... 27 N•m (20 lb-ft)

9. Remove JDE81-4 Timing Pin and JDG820 Flywheel Turning Tool from flywheel.

10. Insert plug back into engine block.



Flywheel Tool and Timing Pin



Pump Gear Timing Pin

A—Flywheel Timing Tool
B—Timing Pin
C—High Pressure Fuel Pump Timing Pin

Electrical Concepts

Tests referred to in the diagnostic procedures include taking measurements of voltage and resistance and checking for open circuits and short circuits. An understanding of the following concepts is required:

- Voltage (volts)
- Current (amps)
- Resistance (ohms)
- Open Circuit
- Short Circuit

RG,RG34710,1553 –19–30SEP97–1/1

Using a Digital Multimeter

RG11126 –UN–19JUN00

Digital Multimeter

A digital multimeter (JT07306 or equivalent with an analog display) is often required to make 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.

IMPORTANT: When using the "Ohms" function on a multimeter, there must be no voltage present in the circuit. Exposing the "Ohms" function to voltage will damage the multimeter or blow the multimeter fuse.

RG,RG34710,1554 –19–30SEP97–1/1

Electrical Circuit Malfunctions

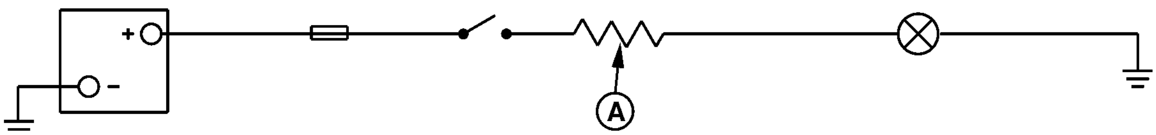
Circuit Malfunctions

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



Example Circuit

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.

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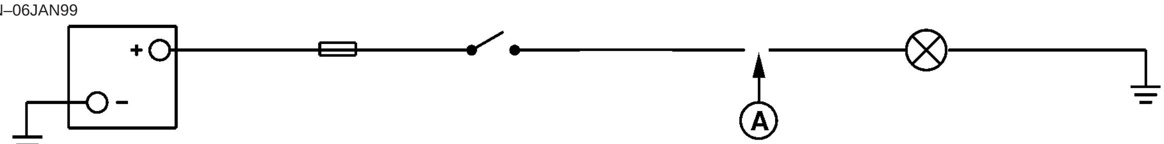
RG9892 –UN–06JAN99



Example Circuit

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.

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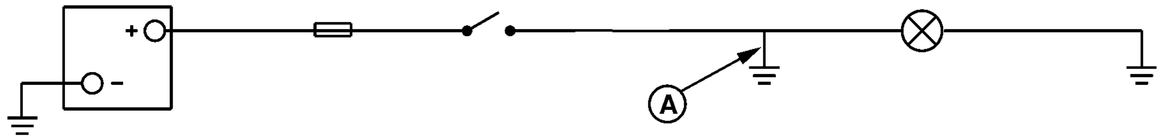
RG9893 –UN–06JAN99

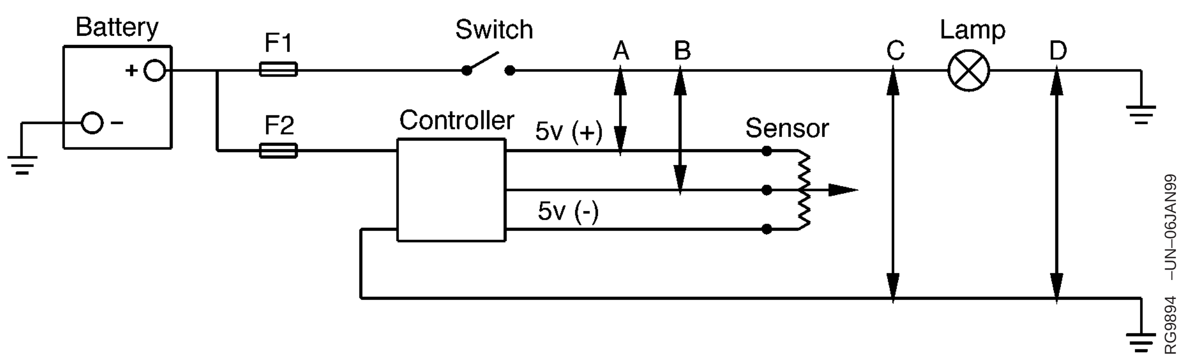


Example Circuit

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. Also sometimes called a "short to ground."

DPSG,RG40854,37 –19–15DEC98–4/6



Different Types of Circuit Shorts

4. **Wire-to-Wire 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:
   - Example A: Voltage wire shorted to another voltage wire (wires of equal or unequal voltage).
   - Example B: Voltage wire shorted to a sensor signal wire (wires of unequal voltage).
   - Example C: 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).

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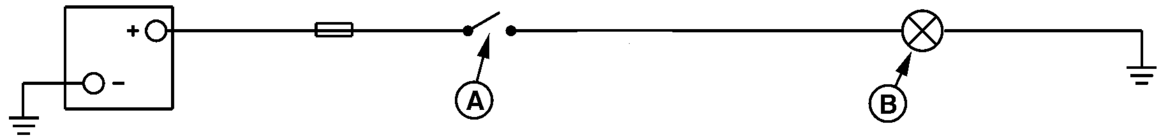
DPSG,RG40854,37 –19–15DEC98–5/6

RG9895 –UN–06JAN99



Example Circuit

A—Controlling Switch **B—Load**

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.

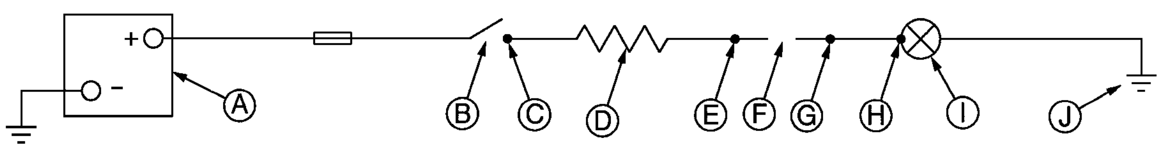
Example: A component may not operate before disconnecting an electrical connection, but it operates after reconnecting the connector.

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 reestablished good continuity through the connector.

DPSG,RG40854,37 –19–15DEC98–6/6

Troubleshooting Circuit Malfunctions

RG9896 –UN–06JAN99



Example Circuit

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

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).

Open Circuit:

An "Open" circuit (for example: broken wire, terminals disconnected, open protective device or open switch), results in no component operation because the circuit is incomplete.

Do the following to isolate the location of a "High Resistance" or "Open" circuit:

1. With the controlling switch (B) closed (on) and the load (I) connected into the circuit, check for 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.

NOTE: The example shows high resistance (D) between (C) and (E) and the open circuit (F) between (E) and (G).

2. Repair the circuit as required.

3. Perform an operational check-out on the component after completing the repair.

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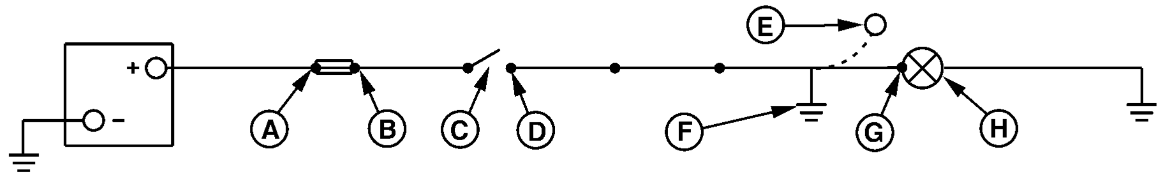
RG9897 –UN–06JAN99



Example Circuit

A—Fuse Terminal "A"
B—Fuse Terminal "B"
C—Switch
D—Switch Terminal
E—Wire Terminal
F—Location of Ground
G—Component Terminal
H—Load (Lamp)

Grounded Circuit:

IMPORTANT: When using the "Ohms" function on a multimeter, there must be no voltage present in the circuit. Exposing the "Ohms" function to voltage will damage the multimeter or blow the multimeter fuse.

A "Grounded" circuit occurs when a power wire contacts a ground, such as the machine frame, chassis, pump housing, another ground wire, etc. A low resistance to ground (or "partial" ground,) can result in a reduction (a light dims, for instance) in operation. Or a direct short to ground (near zero ohms resistance) can result in an open fuse or circuit breaker, resulting in a complete failure of a component's operation.

Do the following to isolate the location of the fault in a "grounded" circuit:

NOTE: The following presumes that the fuse is blown in the circuit shown above.

NOTE: The most useful test results are obtained when any resistive loads, such as lights, heating elements, and sensors are temporarily removed or disconnected from the circuit.

NOTE: Also see the steps to isolate a Short Circuit on the next page.

1. Disconnect power source from circuit being tested.

2. Switch (C) must be open (off). Check resistance to ground at (B) or (C).

   - If there is low resistance to ground, there is a grounded circuit between (B) and (C). Repair the circuit.
   - If there is high resistance to ground, go to the next step.

3. Disconnect the load (H) at component terminal (G).

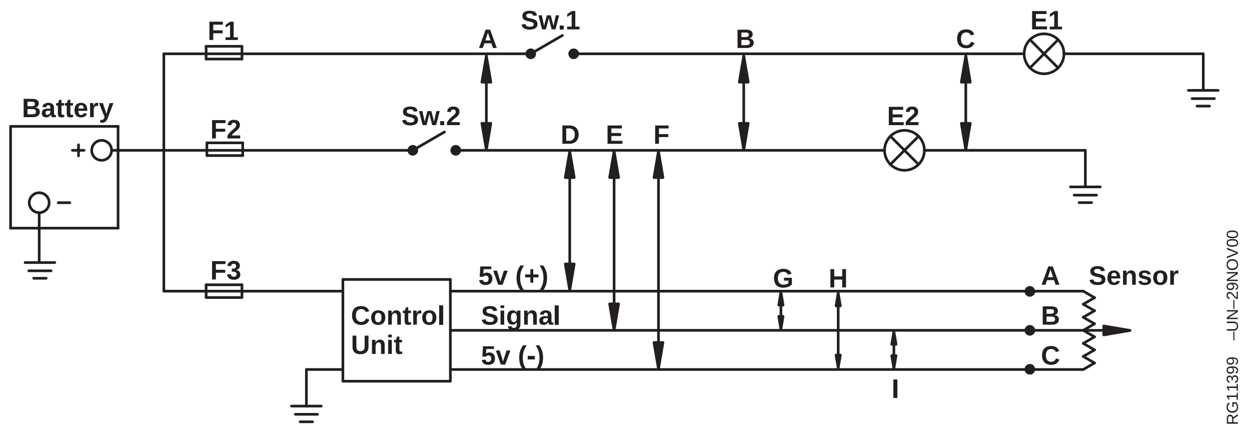
4. With the switch (C) open (off), check resistance to ground between (D) and (G).

   - If there is low resistance, there is a grounded circuit between (D) and (G). Repair the circuit.

NOTE: The example is grounded at (F), between (D) and (G).

- Perform an operational check-out on the component after completing the repair.

Continued on next page DPSG,RG40854,38 –19–15DEC98–2/4



Wire-to-Wire Short Circuit:

Wiring harnesses can become shorted by one of the following ways shown above.

- 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.
- 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).
- Battery wire from fuse (F1) is shorted at (C) to a ground wire.
  Result: Fuse (F1) opens after closing switch (Sw. 1)
- Battery wire from switch (Sw. 2) is shorted at (D) to a regulated voltage wire.
  Result: The sensor signal voltage is distorted.[1]
- Battery wire from switch (Sw. 2) is shorted at (E) to the sensor signal voltage wire.
  Result: The sensor signal is distorted.[1]
- 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.[2]
- Controller regulated voltage wire is shorted at (G) to the sensor signal voltage wire.
  Result: The sensor signal is distorted.
- Controller regulated voltage wire is shorted at (H) to the sensor ground wire.
  Result: The sensor signal is distorted.[2]
- Sensor voltage wire is shorted at (I) to the sensor ground wire.
  Result: The sensor signal is distorted.[2]

Do the following to isolate a Short in a wiring harness.

[1]The sensor signal voltage goes out of range and a fault code may set. The controller may shut down or provide limited operation for its function.

[2]The 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.

Continued on next page

DPSG,RG40854,38 –19–15DEC98–3/4

IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit. This will ensure that terminal damage does not occur.

NOTE: A connector pigtail can be easily made using a spare connector with wires attached that are a few inches long.

NOTE: The following procedure assumes that the component itself is not at fault.

1. Review the machine electrical schematic to identify the circuit of the inoperable component.
2. Disconnect the harness connectors at each end of the circuit to isolate the affected wires.
3. Make sure there is no voltage at the harness connector.
   At the connector, check resistance between any two terminals. The meter should show no continuity (i.e., there should be high resistance) between the two terminals. Repeat the check across another combination of two terminals until all terminals in the affected connector have been checked.
4. 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.
5. If no problem found, check for a short to another group of circuits within the harness or to an adjacent wire harness:
   Connectors are still disconnected as above. Turn the key switch on and set meter to 12V scale. Connect one meter lead to a good frame ground. With the other meter lead, touch each of the terminals in the suspected connector one at a time. If there is a voltage reading, the circuit is shorted to another voltage wire. Repair the circuit as follows:
   a. Wires not in a loom: Wrap individual wires with electrical tape or replace the damaged wire and band as required.
   b. Wires in a loom: If hot spots exist in shorted area of the harness, replace the harness. If hot sports 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.

6. Perform an operational check-out on the component after completing the repair.

DPSG,RG40854,38 –19–15DEC98–4/4

About This Group

This group of the manual contains necessary information to diagnose the electronic control system. Use this information in conjunction with 8.1 L Diesel Engines Base Engine Manual (CTM 86)

See 8.1 L Diesel Engines Base Engine Manual (CTM 86) for:

- Removal of base engine components
- Base engine repair procedures
- Base engine disassembly
- Base engine inspection
- Base engine assembly

Parts such as sensors, actuators, connectors, and wiring harnesses are serviceable and available.

To help diagnose electronic control system problems, Section 06, Group 210 ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM contains useful information, such as system wiring schematic and ECU terminal identification.

IMPORTANT: Not under any circumstances, should the Engine Control Unit (ECU) be opened.

NOTE: Instruction are given throughout the diagnostic charts to make resistance and voltage measurements in the ECU/Cab connector and the ECU/Engine connector. 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.

The Diagnostic section is divided into the following headings:

- Connecting to Diagnostic Scan Tool (DST) or SERVICE ADVISOR™
- Parameters Shown on Diagnostic Gauge
- Viewing Active DTCs on Diagnostic Gauge
- Viewing Stored DTCs on Diagnostic Gauge
- Clearing Stored DTCs on Diagnostic Gauge
- Parameters Shown on Diagnostic Tools
- Engine Test Instructions - Cylinder Misfire Test
- Engine Test Instructions - Compression Test
- Engine Test Instructions - Cylinder Cutout Test
- Engine Test Instructions - Tractor Torque Curve Change Test
- Diagnostic Trouble Codes
- Listing of Diagnostic Trouble Codes (DTCs) on ECU
  - – Ascending SPN/FMI Order
  - – Ascending 2-Digit/3-Digit Codes
- Diagnostic Procedure Overview
- Intermittent Fault Diagnostics
- Listing of Throttle Codes
- All DTC Diagnostics in Ascending SPN/FMI Order

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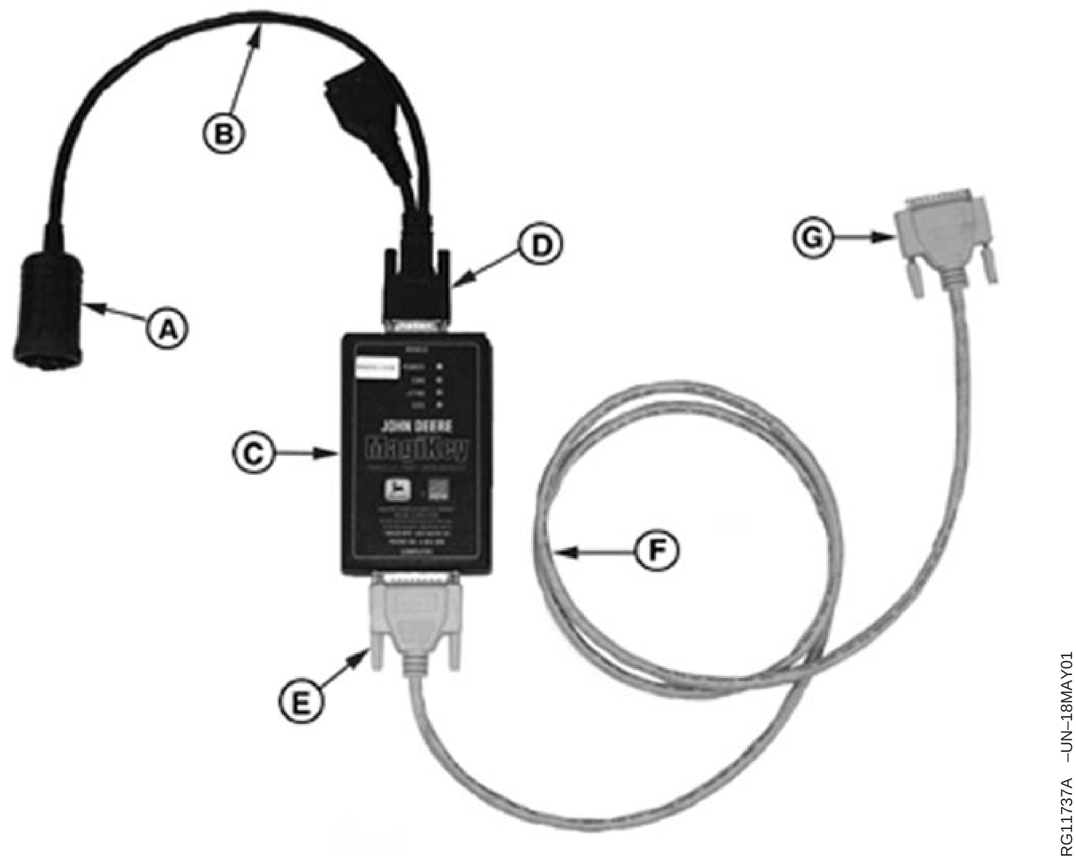
Connecting to Diagnostic Scan Tool (DST) or SERVICE ADVISOR™



Connecting to the DST or SERVICE ADVISOR™

A—CAN Diagnostic Connector
B—John Deere Controller Cable
C—26-Pin Connector
D—MagiKey CAN Adapter
E—25-Pin Connector
F—PC Cable
G—Connector to Computer (PC) that has Diagnostic Software

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. The location of the diagnostic connector may vary depending on application. On OEM the connector is located near the ECU on the engine wiring harness.

1. Locate CAN diagnostic connector on engine and remove dust cap.
2. Connect the CAN diagnostic connector (A) to the CAN diagnostic connector on the engine harness.
3. Connect the other end of the John Deere Controller Cable (B) to the MagiKey CAN adapter (D) (also known as a Parallel Data Module or PDM).
4. Connect the PC cable (F) to the MagiKey CAN adapter.
5. Connect the PC cable to a computer equipped with the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™.
6. Key ON, engine off or running, verify that power light on MagiKey adapter is illuminated green.

Continued on next page

RG41221,000020A –19–12JUN01–1/2

7. Start the diagnostic software and select the appropriate application.
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 Section 04, Group 150 earlier in this manual.
10. If power to the MagiKey adapter is lost during cranking the engine for the Compression Test, use the Power Adapter. The Power Adapter connects between the MagiKey adapter and the 26 pin connector.
11. When finished, replace the dust cap on the CAN diagnostic connector.

RG12277 –UN–22APR02

Power Adapter

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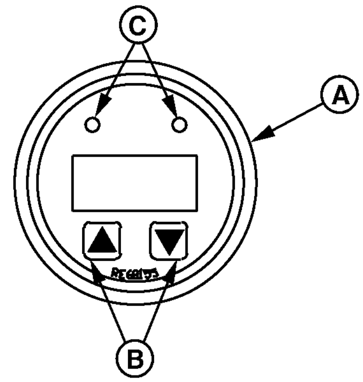
RG41221,000020A –19–12JUN01–2/2

Viewing Active DTCs on Diagnostic Gauge (Earlier Model)

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 “SrvcCodes” sub-menu by ***simultaneously*** pressing the right and the left touch switch.
3. Scroll through the “Srvc 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 “SrvcCodes” sub menu, ***simultaneously*** press the right and left touch switch



A—Diagnostic Gauge
B—Touch Switches
C—Lights

DPSG,OUOD007,2842 –19–15NOV00–1/1

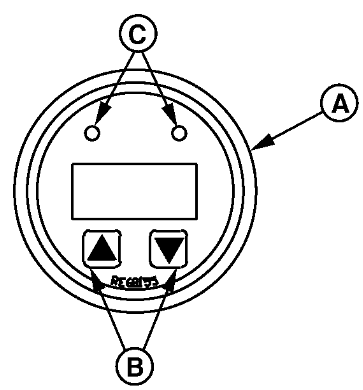
Viewing Stored DTCs on Diagnostic Gauge (Earlier Model)

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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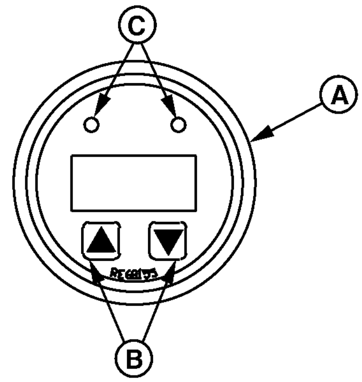
Clearing Stored DTCs on Diagnostic Gauge (Earlier Model)



A—Diagnostic Gauge
B—Touch Switches
C—Lights

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 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 are now cleared. In order to exit "DM2Codes" sub menu, ***simultaneously*** press the right and left touch switch

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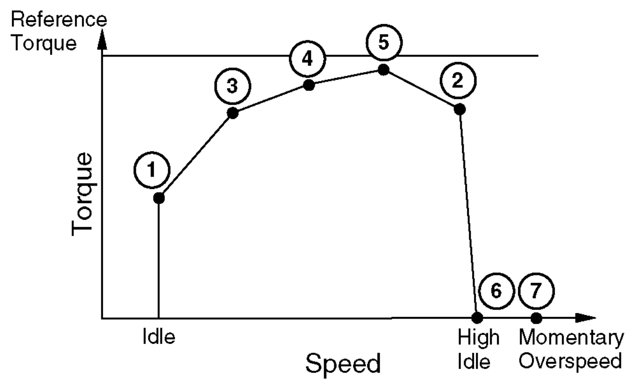
Engine Configuration Parameters on Diagnostic Gauge (Earlier Model)



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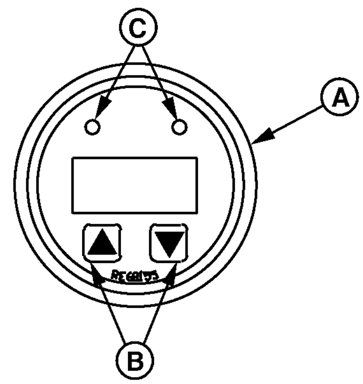
Accessing Engine Configuration Data Parameters:

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



RG10031 –UN–28OCT99

A—Diagnostic Gauge
B—Touch Switches
C—Lights

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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.

DPSG,OUOD007,2840 –19–21OCT99–2/2

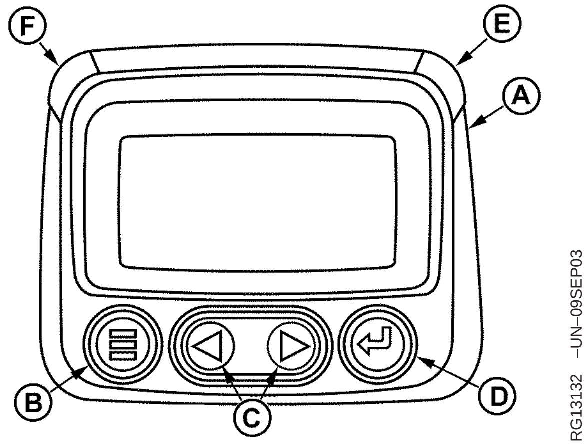
Viewing Active DTCs on Diagnostic Gauge (Later Model)

NOTE: For more detailed information on the diagnostic gauge, see the PowerView Installation and Operation Manual or your John Deere Engine Operation and Maintenance Manual.

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

For description of trouble codes, see chart in Troubleshooting Section.

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



Diagnostic Gauge

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

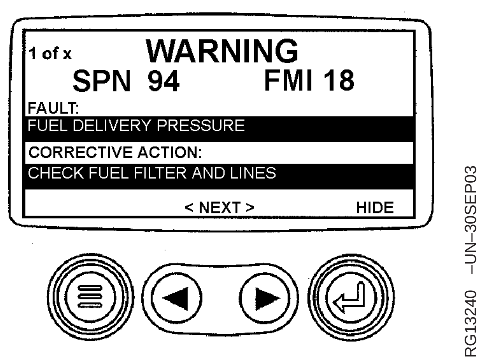
OURGP11,00000AD –19–03SEP03–1/4

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

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

   The number of active codes present is shown in the top left of the display.

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



Active Trouble Code Display

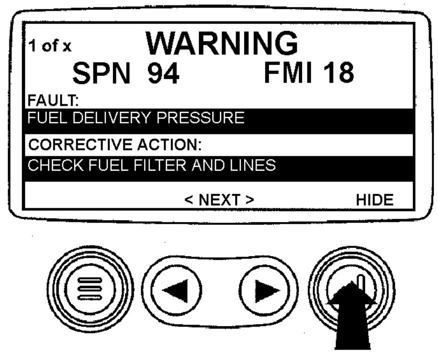
A—Menu key
B—Enter key

Continued on next page

OURGP11,00000AD –19–03SEP03–2/4

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

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



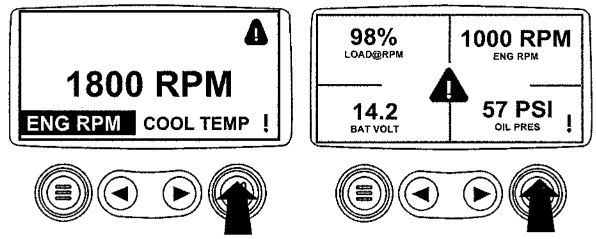
RG13242 –UN–30SEP03

Hide Trouble Codes

OURGP11,00000AD –19–03SEP03–3/4

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

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



RG13176 –UN–26SEP03

Active Trouble Code Icon

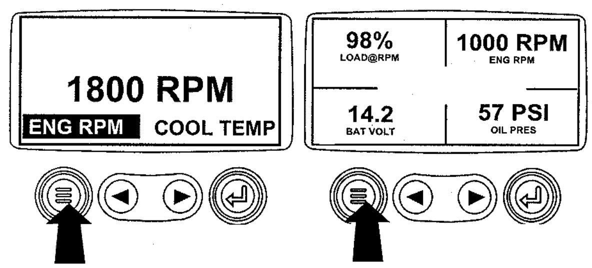
OURGP11,00000AD –19–03SEP03–4/4

Viewing Stored DTCs on Diagnostic Gauge (Later Models)

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of trouble codes, see chart later in this Group.

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



RG13159 –UN–26SEP03

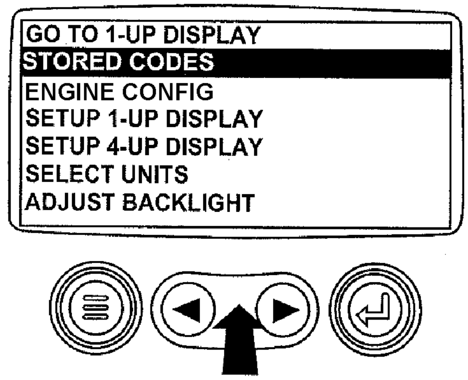
Menu Key

Continued on next page

OURGP11,00000AC –19–03SEP03–1/4

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

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



RG13168 –UN–02OCT03

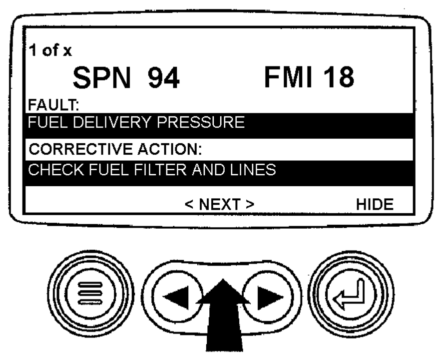
Selecting the Stored Codes Display

OURGP11,00000AC –19–03SEP03–2/4

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

   The number of active codes present is shown in the top left of the display.

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

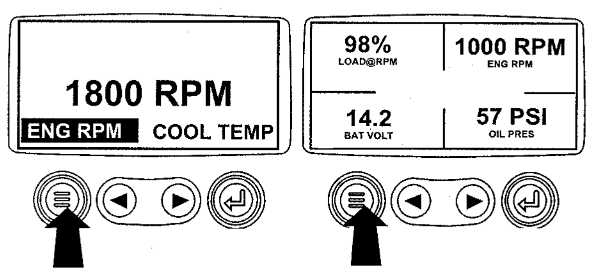


RG13245 –UN–02OCT03

Use Arrow Keys To Scroll

OURGP11,00000AC –19–03SEP03–3/4

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



RG13159 –UN–26SEP03

Exit Main Menu

OURGP11,00000AC –19–03SEP03–4/4

Clearing Stored DTCs on Diagnostic Gauge (Later Models)

NOTE: For more detailed information on the diagnostic gauge, see the PowerView Installation and Operation Manual or your John Deere Engine Operation and Maintenance Manual.

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

For description of trouble codes, see chart in Troubleshooting Section.

1. Turn power to diagnostic gauge off.

2. When ready to immediately to do step 3., turn power to diagnostic gauge on. Screen backlight comes on.

3. As soon as screen backlight comes on, simultaneously press and hold menu and enter keys. A menu appears on the screen with the following options: “Clear Fault Codes” and “Restore All Defaults”.

NOTE: Because there is only a split-second moment when this step can successfully be performed, it might have to be done more than once before success is achieved.

4. Press arrow key to highlight “Clear Fault Codes”.

5. Press enter key. Screen displays that stored fault codes have been cleared.

6. Prior to restarting the engine or other such operation, turn power to the diagnostic gauge off, then turn it back on again.

DB92450,0000023 –19–20OCT04–1/1

Data Parameters on Diagnostic Tools

Following is a list of the ECU data parameters that can be read on the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™. The DST consists of a Windows ('95 or '98 or 2000) or NT compatible computer and JDIS121 - ECU Communication Hardware Kit available from John Deere. Included in the list below is a brief description of each parameter, the range of possible readings, and each parameter's unit of measurement. Depending on application, not all parameters may be available.

Parameter	Units	Description
Analog Throttle A Input Voltage	volts	The return voltage to ECU from analog throttle A position sensor (potentiometer) ECU.
Analog Throttle B Input Voltage	volts	The return voltage to ECU from analog throttle B position sensor (potentiometer) to ECU.
Analog Throttle C Input Voltage	volts	The return voltage to ECU from analog throttle C position sensor (potentiometer) to ECU.
Battery Voltage, Switched	volts	Voltage at IGN terminal.
Battery Voltage, Unwitched	volts	Voltage at the battery.
Brake Hydraulic Temperature	°C	Temperature of brake fluid.
Brake Pressure Sensor Input Voltage	volts	The return voltage to ECU from brake pressure sensor.
Commanded Power	kW	ECU calculates horsepower based on engine fueling.
Commanded Torque	Nm	ECU calculates torque based on engine fueling.
Crankshaft Position Improper Pattern Indicator	%	A "0" reading means that there is NO improper pattern. Between 0—100, the crank pattern becomes progressively more improper. When 100 is reached, a trouble code is set.
Crankshaft Position Input Noise Indicator	%	A "0" reading means that there is NO noise. Between 0—100, crank noise becomes progressively worse. When 100 is reached, a trouble code is set.
Crankshaft Position Sensor	rpm	The speed of the crank shaft.
Crankshaft Position Status	1-15	When status is 15, the ECU is receiving ALL of the signal. When the status is below 15, it means that the ECU is not receiving all of the signal.
Cruise Accelerate Switch	N/A[a]	The cruise accelerate function has been activated. This should increase the speed at which cruise is set.
Cruise Brake Switch	N/A[a]	The cruise brake function has been activated. This will cancel the cruise when the brake is applied until operator resumes operation.
Cruise Clutch Switch	N/A[a]	The cruise clutch function has been activated. This will cancel the cruise when the clutch is applied until operator resumes operation.
Cruise Coast Switch	N/A[a]	The cruise coast function has been activated. This should decrease the speed at which cruise is set.
Cruise Control Active	N/A[a]	Confirms that cruise is ON/OFF depending on the operators command.
Cruise Control State	N/A[a]	Confirms that the function chosen by the operator is activated: hold, accelerate, coast, resume, set, throttle override.
Cruise Control On/Off Switch	N/A[a]	The operator has turn the cruise ON/OFF.

[a]N/A = Not Applicable

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Parameter	Units	Description
Cruise Resume Switch	N/A[a]	The cruise resume function has been activated. This will reset the cruise to the speed at which cruise was at prior to using the brake or clutch.
Cruise Set Switch	N/A[a]	The cruise set function has been activated. This should lock the current engine speed in when switch is activated.
Desired Speed Governor Curve	Curve #	The mode selected is dependent on the application. See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.
ECU Boot Block Part Number	Part #	Part number for the Engine Control Unit (ECU) boot block.
ECU Configuration File Part Number	Part #	Part number for the configuration file in the ECU.
ECU EOL Data Part Number	Part #	Part number for the data programmed into the ECU at the end of the assembly line. EOL = End of Line
ECU Part Number	Part #	Part number for the Engine Control Unit (ECU) hardware.
ECU Serial Number	Serial #	Serial number for the Engine Control Unit (ECU).
ECU Software Assembly Part Number	Part #	Part number for the Engine Control Unit (ECU) software assembly.
ECU Software Part Number	Part #	Part number for the Engine Control Unit (ECU) operating software.
Engine Coolant Temperature	°C	Engine coolant temperature value. *NOTE: If there is an active fault for the ECT circuit, the ECT value displayed will be the “limp-home” value.*
Engine Coolant Temperature Input Voltage	volts	Return voltage to the ECU from the engine coolant temperature sensor.
Engine Hourmeter	hours	Total hours (to the tenth) the ECU has run on an engine.
Engine Load at Current Speed	%	Percentage of load on the engine at a given speed.
Engine Model Number	Model #	The model number for the engine.
Engine Oil Pressure	kPa	Engine oil pressure value
Engine Oil Pressure Input Voltage	volts	Return voltage to the ECU from the engine oil pressure sensor.
Engine Oil Temperature	°C	Engine oil temperature value.
Engine Serial Number	Serial #	Serial number for the engine.
Engine Speed	rpm	The speed the crankshaft position sensor detects the engine to be turning.
Fuel Mode	Mode #	This code explains the operation mode of the engine.
Fuel Rail Pressure - Actual (Absolute)	MPa	On the high pressure common rail fuel system applications, the ECU monitors fuel pressure in the actual state.
Fuel Rail Pressure - Desired (Absolute)	MPa	On the high pressure common rail fuel system applications, the ECU monitors fuel pressure in the desired state. This is the pressure the ECU is commanding the pump to provide.
Fuel Rail Pressure Input Voltage	volts	Return voltage to ECU from fuel rail sensor.
Fuel Rail Pressure Sensor Supply Voltage	volts	Output voltage from ECU to the fuel rail pressure sensor.
Fuel System Part Number	Part #	The part number for the fuel system used on the engine.

[a]N/A = Not Applicable

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Parameter	Units	Description
Fuel System Serial Number	Serial #	The serial number for the fuel system used on the engine.
Fuel Temperature	°C	Fuel temperature value. *NOTE: If there is an active fault for the fuel temperature circuit, the fuel temperature value displayed will be the "limp-home" value.*
Fuel Temperature Input Voltage	volts	Return voltage to ECU from the fuel temperature sensor.
Fuel Usage Rate	L/h	Total amount of fuel the ECU has commanded the EIs to deliver during the total hours shown by the Engine Hour Meter parameter.
Inject Start Time	microsec	If value of zero appears, one or more of the injectors are not firing.
Injector Supply Voltage	volts	Injector supply voltage problem. Injector currents out of specification.
Injector Wiring Voltage	volts	Injector drive circuit voltage. There is a short in an injector wire.
Manifold Absolute Pressure	kPa	Manifold Air Pressure value (boost pressure). *NOTE: If there is an active fault for the MAP circuit, the MAP value displayed will be the “limp-home” value.*
Manifold Absolute Pressure Input Voltage	volts	Return voltage to ECU from the manifold absolute pressure sensor.
Manifold Air Temperature	°C	Manifold Air Temperature value. *NOTE: If there is an active fault for the MAP circuit, the MAP value displayed will be the “limp-home” value.*
Manifold Air Temperature Input Voltage	volts	Return voltage to ECU from the anifold Air temperature sensor.
Maximum Speed Governor Curve	Curve #	The mode selected is dependent on the application. See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.
Option Assembly Part Number	Part #	Part number that describes all of the options on the entire vehicle. This includes the Performance Option Part Number and the Vehicle Option Part Number.
Performance Option Part Number	Part #	These are the engine performance specific options relate to power and torque.
Pilot Injection	On/Off	Aids engine starting. Displays ON when pilot injection is on, OFF when pilot injection is off.
Pump Drive Angle	deg	The angle of the pump drive. If value is 94 degrees the pump is operating wide open.
Pump Position Sensor Improper Pattern Indicator	%	A "0" reading means that there is NO improper pattern. Between 0—100, the pump position pattern becomes progressively more improper. When 100 is reached, a trouble code is thrown.
Pump Position Sensor Input Noise Indicator	%	A "0" reading means that there is NO noise. Between 0—100, pump position noise becomes progressively worse. When 100 is reached, a trouble code is thrown.
Pump Position Sensor Speed	rpm	The speed of the pump camshaft.
Pump Position Sensor Status	1-15	When status is 15, the ECU is receiving ALL of the signal. When the status is below 15, it means that the ECU is not receiving all of the signal.
Pump Solenoid Voltage	volts	Fuel pump solenoid input and output voltages.
Sensor Supply 1 Voltage	volts	Output voltage from ECU to group 1 devices (see ECU wiring diagram for the particular application).
Sensor Supply 2 Voltage	volts	Output voltage from ECU to group 2 devices (see ECU wiring diagram for the particular application).
Throttle #1 Position	%	Percent of the throttle being used.
Throttle #2 Position	%	Percent of the throttle being used.

Continued on next page RG,RG34710,1560 –19–08APR03–3/4

Parameter	Units	Description
Throttle Supply Voltage	volts	Output voltage from the ECU to the throttle.
Throttle Type	Throttle #	Level 9 Electronic Fuel Systems operate with several types of throttles. Throttle Type displays the type being used on this application.
Torque Curve Number	Curve #	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. Definition of the possible torque curves is found in Group 198 Specifications.
Total Fuel Consumption	Liters	Monitors-measures total amount of fuel consumed.
Vehicle Speed	mph	Calculated from vehicle speed radar frequency input.
Vehicle Option Part Number	Part #	These are the vehicle-specific options for the engine like fuel derates, shutdowns, sensor thresholds, ect.
Vehicle Serial Number	Serial #	The serial number of the vehicle in which this engine is located.
Water in Fuel	State	Whether or not water has been detected in the separator bowl.
Water in Fuel Input Voltage	volts	Return voltage to ECU from the water-in-fuel sensor.

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Engine Test Instructions—Cylinder Misfire Test

For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™.

The Cylinder Misfire Test is used to compare the output of each cylinder relative to each of the other cylinders. The test will help identify problems such as an engine misfire or irregularly running engine. During the test, the Engine Control Unit (ECU) will disable a cylinder, then accelerate the engine with a fixed amount of fuel and measure the time taken to accelerate the engine from one speed to the next with that cylinder disabled. The ECU will then repeat the procedure for the remaining cylinders.

The Cylinder Misfire Test cannot determine if an engine is delivering low power. The test results are only a guide to help determine if there is a problem in a cylinder. The results alone should not be used as a conclusive reason for replacing the injection pump or nozzles. Other information such as the results of a Compression Test, Cylinder Cutout Test, and other engine diagnostic procedures should be used to accurately determine the source of an engine problem.

Before executing the Cylinder Misfire Test

- Warm engine to normal operating temperature.
- Repair the cause of any Diagnostic Trouble Codes.

NOTE: The ECU will not allow the test to run if there are any active DTCs.

- Remove any load to engine that may change during the test. For example, turn air conditioner off.

Performing the Cylinder Misfire Test

1. Engine idling - 0% throttle

2. Select Cylinder Misfire Test on the DST or SERVICE ADVISOR™.

3. Follow instruction given by the diagnostic software. The software will instruct that the throttle lever be moved from low idle position to wide open throttle position, then back to low idle position 6 times.

NOTE: On most Marine applications, either throttle may be used to run this test. However, on some early applications, only analog throttle (B) can run this test. In this situation the connectors for analog throttle (A) and analog throttle (B) need to be switched to allow operation from analog throttle (A). After test is completed, be sure to switch back connectors.

NOTE: For OEM genset applications that use a tri-state throttle, use the low idle position and the center switch position to run this test.

NOTE: For OEM genset applications that use an analog throttle, slowly adjust throttle in higher rpm direction until engine speeds increases. When speed increases, turn back to low idle position. If throttle is adjusted too fast, test may not function correctly.

The diagnostic software will inform test operator if test was not successful. If test was successfully completed, results will be displayed on screen.

Results shown will represent each cylinders' performance as a percentage in relation to the average of all cylinders. If any cylinder is above or below the average by more than 10%, that indicates the cylinder is contributing too much (above average) or not contributing enough (below average).

NOTE: Run the test be run at least 3 times to ensure repeatable, accurate results.

To help determine cause of problem in cylinder(s) above or below average, do the Compression Test.

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Engine Test Instructions—Compression Test

For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.

The Compression Test is used to compare the compression of each cylinder to the average compression of all cylinders. The test will help determine if a cylinder has low compression compared to all other cylinders. During the test, the Engine Control Unit (ECU) will disable the engine from starting (by not activating the high pressure solenoid valve in the injection pump), then measure the time it takes the piston of each cylinder to accelerate through and past TDC. A piston that accelerated faster than the rest would indicate that cylinder has lower compression than the other cylinders.

The Compression Test cannot determine the true compression pressure of any cylinder, it can only compare each cylinder to the average. The test results are only a guide to help determine if a cylinder has lower compression. The results alone should not be used as a conclusive reason for performing any major engine work. Other information such as the results of the Cylinder Misfire Test, Cylinder Cutout Test, and other engine diagnostic procedures should be used to accurately determine the source of an engine problem.

Before executing the Compression Test

- Warm engine to normal operating temperature
- Repair the cause of any Diagnostic Trouble Codes (DTCs)

NOTE: *The ECU will not allow the test to run if there are any active DTCs.*

- Ensure that the battery and starter are in good working condition

Performing the Compression Test

1. Key ON, engine OFF.

2. Select Compression Test on the DST or SERVICE ADVISOR™.

3. Follow instruction given by the diagnostic software. The software will instruct that the engine be cranked for up to 15 seconds. Typically, it should take less than 5 seconds. The DST or SERVICE ADVISOR™. should be observed carefully for instructions during the test.

   The diagnostic software will inform the test operator if the test was not successfully completed. If the test was successfully completed, the results will be displayed on the screen.

   Results shown will represent each cylinders' compression as a percentage in relation to the average of all cylinders. If any cylinder is more than 10% below the rest, that indicates the cylinder's compression is lower than the rest.

NOTE: *Run the test be run at least 3 times to ensure repeatable, accurate results.*

   Further engine diagnostics should be performed to determine the cause of low compression.

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Engine Test Instructions— Cylinder Cutout Test

For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.

The Cylinder Cutout Test is used to aid in identifying a cylinder that is having a problem or to help in diagnosing mechanical or intermittent problems. During the test, the Engine Control Unit (ECU) will disable the cylinder(s) that the technician selects. This test can be performed while operating the vehicle under the conditions that the problem occurs.

The Cylinder Cutout Test can not determine if an engine is developing low power. The test is only a guide to help determine if there is a problem in a cylinder. The results alone should not be used as a conclusive reason for replacing the injection pump or nozzles. Other information such as the results of a Compression Test and other engine diagnostic procedures should be used to accurately determine the source of the engine problem.

Before executing the Cylinder Cutout Test

- Warm engine to normal operating temperature
- Repair the cause of any Diagnostic Trouble Codes (DTCs)

NOTE: The ECU will not allow the test to run if there are any active DTCs.

- Ensure that the battery and starter are in good working condition

Performing the Cylinder Cutout Test

1. Engine idling or under the conditions that the problem occurred.

2. Select Cylinder Cutout Test on the DST or SERVICE ADVISOR™.

3. Follow instructions given by the DST or SERVICE ADVISOR™.

4. Select the cylinder to be cut out.

5. Observe engine operation and the parameters on the DST or SERVICE ADVISOR™. These parameters include: engine load at current speed, engine speed, and manifold air temperature.

6. Use this data and observations to help in the diagnosis of the problem.

NOTE: Run the test be run at least 3 times to ensure repeatable, accurate results.

DPSG,RG40854,358 –19–16APR02–1/1

Engine Test Instructions— Tractor Torque Curve Change Test

Torque curve adjustment may be necessary for tractors while operating on a dynamometer. This test allows the user to select the highest torque curve available on the tractor in order to simulate the max power. Torque curve adjustment can only be accomplished with 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.

Performing the Torque Curve Dynamometer Adjustment

1. Ignition ON, engine off.
2. Select Tractor Torque Curve Change Test on the DST or SERVICE ADVISOR™.
3. Select the option that corresponds to the desired operation.

    1. Normal operation
    2. Dynamometer setup

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RG41221,000011B –19–07APR03–1/1

Diagnostic Trouble Codes (DTCs)

There are several different methods of displaying both stored and active DTCs.

SPN/FMI CODES

Service tools such as the DST, SERVICE ADVISOR™, and the Diagnostic Gauge display active and stored DTCs. When using DST or SERVICE ADVISOR™ the codes will be displayed as a two part code in a 000000.00 format. For example, SPN 110 FMI 3 will be displayed as 000110.03.

The first part, called the Suspect Parameter Number (SPN), 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, the Failure Mode Identifier (FMI), contains 2 digits. The FMI identifies the type of failure that has occurred. For example, FMI 3 indicates an above-normal value. Combining SPN 110 with FMI 3 translates to "engine coolant temperature input voltage high".

ON-BOARD DISPLAY CODES

Some John Deere applications that have an on-board display will show DTCs as a 2-digit or a 3-digit code. To translate 2-digit or 3-digit codes into SPN/FMI code for diagnosing, see LIST OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU - Ascending 2-Digit/3-Digit Codes later in this Group.

WARNING LAMP, STOP LAMP, AND AUDIBLE ALARM

On most applications there is an amber "Warning" lamp and a red "Stop" lamp that come on when a code becomes active. When a code is active, one of the lamps will blink, indicating that the ECU has detected a fault and engine performance may be affected.

The "Stop" lamp indicates a serious malfunction. The engine may be incurring damage. The operator should stop the engine immediately. The diagnostic display will show the alarm information. A "Stop" condition cannot be acknowledged and will continue until the condition is resolved. The audible alarm will accompany a "Stop" condition.

The "Warning" (or "Service Alert") lamp indicates the engine is operable but has a problem that requires operator action. The machine may be damaged or experience a significant performance reduction if it is not serviced, repaired, or operated in a different manner, or a potentially hazardous condition exists of which the operator need to be aware.

On applications with a diagnostic display, the operator may acknowledge the alarm and the display will return to its pre-alarm screen, but the light will continue to blink until the condition is resolved. The audible alarm will sound five times in event of a "Warning" condition. An acknowledged alarm may be reissued at intervals per ECU programming.

These lamps come on for 3 seconds at power-on as a lamp test.

CLEARING STORED DTCs

Stored DTCs can be cleared through the OEM instrument panel using the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™.

DPSG,RG40854,467 –19–16APR02–1/1

List of Diagnostic Trouble Codes (DTCs) on ECU

List of SPN/FMI Codes

SPN	FMI	2-Dig/3-Dig	Description
000028	03		Throttle Voltage High
	04		Throttle Voltage Low
000029	03		Throttle Voltage High
	04		Throttle Voltage Low
	14		Throttle Voltage Out of Range
000084	09	197	Vehicle Speed Invalid or Missing
000091	03	13	Throttle Voltage High
	04	14	Throttle Voltage Low
	08	15	PWM Throttle Abnormal Pulse Width
	09	27	Throttle Invalid
	14		Throttle Voltage Out of Range
000094	03	50/127	Fuel Rail Pressure Input Voltage High
	04	51/129	Fuel Rail Pressure Input Voltage Low
	10	71/171	Fuel Rail Pressure Loss Detected
	17	72/172	Fuel Rail Pressure Not Developed
000097	00		Water in Fuel Continuously Detected
	03	76/176	Water in Fuel Signal Voltage High
	04	76/176	Water in Fuel Signal Voltage Low
	16	75/175	Water in Fuel Detected
	31		Water in Fuel Detected
000100	01	65	Engine Oil Pressure Extremely Low
	03		Engine Oil Pressure Input Voltage High
	04		Engine Oil Pressure Input Voltage Low
	16		Engine Oil Pressure Above Normal at 0 RPM
	18	64	Engine Oil Pressure Moderately Low
000102	03		Manifold Air Pressure Input Voltage High
	04		Manifold Air Pressure Input Voltage Low
000105	03	23	Manifold Air Temperature Input Voltage High
	04	24	Manifold Air Temperature Input Voltage Low
	16	66	Manifold Air Temperature Moderately High
000107	00		Air Filter Differential Pressure
000110	00	63	Engine Coolant Temperature Extremely High
	03	25	Engine Coolant Temperature Input Voltage High
	04	26	Engine Coolant Temperature Input Voltage Low
	15		Engine Coolant Temperature High Least Severe
	16	62	Engine Coolant Temperature Moderately High
	31		Engine Coolant Temperature High
000111	01	61	Engine Coolant Level Low
000158	17	84	ECU Power Down Error
000160	02	88	Wheel Speed Input Noise
000171	03		Ambient Air Temperature Voltage OOR high
	04		Ambient Air Temperature Voltage OOR low
000174	00		Fuel Temperature High Most Severe
	03	37	Fuel Temperature Input Voltage High
	04	38	Fuel Temperature Input Voltage Low
	16	80/81	Fuel Temperature High Moderately Severe
000189	00		Engine Speed Derate
000190	00		Engine Overspeed Extreme
	01		Engine Overload Moderate

Continued on next page RG,RG34710,1563 –19–07APR03–1/6

	16		Engine Overspeed Moderate
	18		Engine Overload Severe
000237	02		Vehicle Identification Number Invalid
	13		Vehicle Identification Option Code Invalid
	31		Vehicle Model Number Invalid
000523	09		Gear Selection Invalid
000596	31		Cruise Control On/Off Circuit Fault
000611	03	98	Electronic Injector Wiring Shorted to Power Source
	04	99	Electronic Injector Wiring Shorted to Ground
000620	03	21	Sensor Supply 1 Voltage High
	04	22	Sensor Supply 1 Voltage Low
000627	01	97	Electronic Injector Supply Voltage Problem
000629	13	28	ECU Error
000636	02	44/144	Pump Position Sensor Input Noise
	08	43/143	Pump Position Sensor Input Missing
	10	44/144	Pump Position Sensor Input Pattern Error
000637	02	42/142	Crankshaft Position Input Noise
	07	45/145	ECU/Pump Timing Moderately Out of Sync
	08	41/141	Crankshaft Position Input Missing
	10	42/142	Crankshaft Position Input Pattern Error
000639	13	55	CAN Bus Error
000640	31	52	Engine Shutdown Vehicle Request
000644	02		External Speed Command Input Erratic
000651	05	31/131	Cylinder #1 Electronic Injector Circuit Open
	06	91	Cylinder #1 Electronic Injector Circuit Shorted
	07	10/110	Cylinder #1 Electronic Injector Mechanical Failure
000652	05	32/132	Cylinder #2 Electronic Injector Circuit Open
	06	92	Cylinder #2 Electronic Injector Circuit Shorted
	07	20/120	Cylinder #2 Electronic Injector Mechanical Failure
000653	05	33/133	Cylinder #3 Electronic Injector Circuit Open
	06	93	Cylinder #3 Electronic Injector Circuit Shorted
	07	30/130	Cylinder #3 Electronic Injector Mechanical Failure
000654	05	34/134	Cylinder #4 Electronic Injector Circuit Open
	06	94	Cylinder #4 Electronic Injector Circuit Shorted
	07	40/140	Cylinder #4 Electronic Injector Mechanical Failure
000655	05	35/135	Cylinder #5 Electronic Injector Circuit Open
	06	95	Cylinder #5 Electronic Injector Circuit Shorted
	07	69/150	Cylinder #5 Electronic Injector Mechanical Failure
000656	05	36/136	Cylinder #6 Electronic Injector Circuit Open
	06	96	Cylinder #6 Electronic Injector Circuit Shorted
	07	60/160	Cylinder #6 Electronic Injector Mechanical Failure
000898	09		Vehicle Speed Invalid/Missing
000970	31	83	Engine Shutdown Switch Activated - Auxiliary Request
000971	31		External Fuel Derate Switch Active
001069	09	96	Tire Size Invalid
	31	89	Tire Size Error
001079	03		Sensor Supply 2 Voltage High
	04		Sensor Supply 2 Voltage Low
001080	03	73/173	Fuel Rail Pressure Sensor Supply Voltage High
	04	74/174	Fuel Rail Pressure Sensor Supply Voltage Low
001109	31		Engine Protection Shutdown Warning
001110	03		Engine Protection Shutdown
	31	67	Engine Protection Shutdown
001347	03		Pump Control Valve Current High
	05	77/177	Pump Control Valve #1 Error

Continued on next page

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	07	78/178	Fuel Rail Pressure Control Error
	10	88	Pump Control Valve #1 Fuel Flow Not Detected
001348	05	79/179	Pump Control Valve #2 Error
	10	89	Pump Control Valve #2 Fuel Flow Not Detected
001568	02	29	Torque Curve Selection Invalid
	09		Torque Curve Selection Missing
001569	31	68	Fuel Derate
001638	00		Hydraulic Oil Temperature Above Normal - Most Severe
	03		Hydraulic Oil Temperature Sensor Voltage above normal
	04		Hydraulic Oil Temperature Sensor Voltage below normal
	16		Hydraulic Oil Temperature Above Normal - Moderately Severe
001639	01	56	Fan Speed Signal Missing
	16	58	Fan Speed Higher Than Expected
	18	57	Fan Speed Lower Than Expected
002005	09		ACU Signal Missing
002049	09		CAB Signal Missing
002071	09		CCU Signal Missing
002580	03		Hydraulic Brake Pressure Sensor Voltage Above Normal
	04		Hydraulic Brake Pressure Sensor Voltage Below Normal

Continued on next page RG,RG34710,1563 –19–07APR03–3/6

2-Digit/3-Digit and SPN/FMI Codes Cross-Reference List

2-Dig/3-Dig	SPN	FMI	Description
10	000651	07	Cylinder #1 Electronic Injector Mechanical Failure
13	000091	03	Throttle Voltage High
14	000091	04	Throttle Voltage Low
15	000091	08	PWM Throttle Abnormal Pulse Width
20	000652	07	Cylinder #2 Electronic Injector Mechanical Failure
21	000620	03	Sensor Supply 1 Voltage High
22	000620	04	Sensor Supply 1 Voltage Low
23	000105	03	Manifold Air Temperature Input Voltage High
24	000105	04	Manifold Air Temperature Input Voltage Low
25	000110	03	Engine Coolant Temperature Input Voltage High
26	000110	04	Engine Coolant Temperature Input Voltage Low
27	000091	09	Throttle Invalid
28	000629	13	ECU Error
29	001568	02	Torque Curve Selection Invalid
30	000653	07	Cylinder #3 Electronic Injector Mechanical Failure
31	000651	05	Cylinder #1 Electronic Injector Circuit Open
32	000652	05	Cylinder #2 Electronic Injector Circuit Open
33	000653	05	Cylinder #3 Electronic Injector Circuit Open
34	000654	05	Cylinder #4 Electronic Injector Circuit Open
35	000655	05	Cylinder #5 Electronic Injector Circuit Open
36	000656	06	Cylinder #6 Electronic Injector Circuit Open
37	000174	03	Fuel Temperature Input Voltage High
38	000174	04	Fuel Temperature Input Voltage Low
40	000654	07	Cylinder #4 Electronic Injector Mechanical Failure
41	000637	08	Crankshaft Position Input Missing
42	000637	02	Crankshaft Position Input Noise
42	000637	10	Crankshaft Position Input Pattern Error
43	000636	08	Pump Position Sensor Input Missing
44	000636	02	Pump Position Sensor Input Noise
44	000636	10	Pump Position Sensor Input Pattern Error
45	000637	07	ECU/Pump Timing Moderately Out of Sync
49	000640	11	Engine Shutdown Vehicle Requested Invalid
50	000094	03	Fuel Rail Pressure Input Voltage High
51	000094	04	Fuel Rail Pressure Input Voltage Low
52	000640	31	Engine Shutdown Vehicle Request
55	000639	13	CAN Bus Error
56	001639	01	Fan Speed Signal Missing
57	001639	18	Fan Speed Lower Than Expected
58	001639	16	Fan Speed Higher Than Expected
59	001639	02	Fan Speed Signal Erratic
60	000656	07	Cylinder #6 Electronic Injector Mechanical Failure
61	000111	01	Engine Coolant Level Low
62	000110	16	Engine Coolant Temperature Moderately High
63	000110	00	Engine Coolant Temperature Extremely High
64	000100	18	Engine Oil Pressure Moderately Low
65	000100	01	Engine Oil Pressure Extremely Low
66	000105	16	Manifold Air Temperature Moderately High
67	001110	31	Engine Protection Shutdown
68	001569	31	Fuel Derate
69	000655	07	Cylinder #5 Electronic Injector Mechanical Failure

Continued on next page

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71	000094	10	Fuel Rail Pressure Loss Detected
72	000094	17	Fuel Rail Pressure Not Developed
73	001080	03	Fuel Rail Pressure Supply Voltage High
74	001080	04	Fuel Rail Pressure Supply Voltage Low
75	000097	16	Water in Fuel Detected
76	000097	03	Water in Fuel Signal Voltage High
76	000097	04	Water in Fuel Signal Voltage Low
77	001347	05	Pump Control Valve #1 Error
78	001347	07	Fuel Rail Pressure Control Error
79	001348	05	Pump Control Valve #2 Error
80	000174	16	Fuel Temperature High Moderately Severe
81	000174	16	Fuel Temperature High Moderately Severe
83	000970	31	Engine Shutdown - Auxiliary Request
84	000158	17	ECU Power Down Error
88	000160	02	Wheel Speed Input Noise
88	001347	10	PCV #1 Fuel Flow Not Detected
89	001069	31	Tire Size Error
	001348	05	PCV #2 Circuit open, shorted to ground, or overloaded
89	001348	10	PCV #2 Fuel Flow Not Detected
90	000094	13	Fuel Rail Pressure Higher Than Expected
91	000651	06	Cylinder #1 Electronic Injector Circuit Shorted
92	000652	06	Cylinder #2 Electronic Injector Circuit Shorted
93	000653	06	Cylinder #3 Electronic Injector Circuit Shorted
94	000654	06	Cylinder #4 Electronic Injector Circuit Shorted
95	000655	06	Cylinder #5 Electronic Injector Circuit Shorted
96	000656	06	Cylinder #6 Electronic Injector Circuit Shorted
96	001069	09	Tire Size Invalid
97	000627	01	Electronic Injector Supply Voltage Problem
98	000611	03	Electronic Injector Wiring Shorted to Power Source
99	000611	04	Electronic Injector Wiring Shorted to Ground
110	000651	07	Cylinder #1 Electronic Injector Mechanical Failure
120	000652	07	Cylinder #2 Electronic Injector Mechanical Failure
127	000094	03	Fuel Rail Pressure Input Voltage High
129	000094	04	Fuel Rail Pressure Input Voltage Low
130	000653	07	Cylinder #3 Electronic Injector Mechanical Failure
131	000651	05	Cylinder #1 Electronic Injector Circuit Open
132	000652	05	Cylinder #2 Electronic Injector Circuit Open
133	000653	05	Cylinder #3 Electronic Injector Circuit Open
134	000654	05	Cylinder #4 Electronic Injector Circuit Open
135	000655	05	Cylinder #5 Electronic Injector Circuit Open
136	000656	05	Cylinder #6 Electronic Injector Circuit Open
140	000654	07	Cylinder #4 Electronic Injector Mechanical Failure
141	000637	08	Crankshaft Position Input Missing
142	000637	02	Crankshaft Position Input Noise
142	000637	10	Crankshaft Position Input Pattern Error
143	000636	08	Pump Position Sensor Input Missing
144	000636	02	Pump Position Sensor Input Noise
144	000636	10	Pump Position Sensor Input Pattern Error
145	000637	07	ECU/Pump Timing Moderately Out of Sync
150	000655	07	Cylinder #5 Electronic Injector Mechanical Failure
160	000656	07	Cylinder #6 Electronic Injector Mechanical Failure
171	000094	10	Fuel Rail Pressure Loss Detected
172	000094	17	Fuel Rail Pressure Not Developed
173	001080	03	Fuel Rail Pressure Sensor Supply Voltage High
174	001080	04	Fuel Rail Pressure Sensor Supply Voltage Low

Continued on next page

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175	000097	16	Water in Fuel Detected
176	000097	03	Water in Fuel Signal Voltage High
176	000097	04	Water in Fuel Signal Voltage Low
177	001347	05	Pump Control Valve #1 Error
178	001347	07	Fuel Rail Pressure Control Error
179	001348	05	Pump Control Valve #2 Error
197	000084	09	Vehicle Speed Invalid or Missing

RG,RG34710,1563 –19–07APR03–6/6

Diagnostic Procedure Overview

Diagnosis of the electronic control system should be performed according to the following procedure:

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly.

2. Read and record DTC(s).

3. Go to the diagnostic chart that corresponds to the DTC(s) present.

NOTE: If more than one DTC is present, go to the chart corresponding to the lowest number DTC and diagnose that problem to correction unless directed to do otherwise.

4. If no DTC(s) are present, go to the appropriate “observable” diagnostic procedure in Group 150.

5. After any repairs are made, recheck to make sure all DTCs have been eliminated.

NOTE: After using the DST or SERVICE ADVISOR™, always replace the dust cover on the diagnostic connector.

IMPORTANT: Care should be used during diagnostic procedures to avoid damaging the terminals of connectors, sensors, and actuators. Probes should not be poked into or around the terminals or damage will result. Probes should only be touched against the terminals to make measurements. Use JT07328 Connector Adapter Test Kit to make measurements in connectors, sensors, and actuators. These adapters will ensure that terminal damage does not occur.

RG,RG34710,1564 –19–14SEP01–1/1

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.

IMPORTANT: The ECU is the component LEAST likely to fail.

Suggestions for diagnosing intermittent faults:

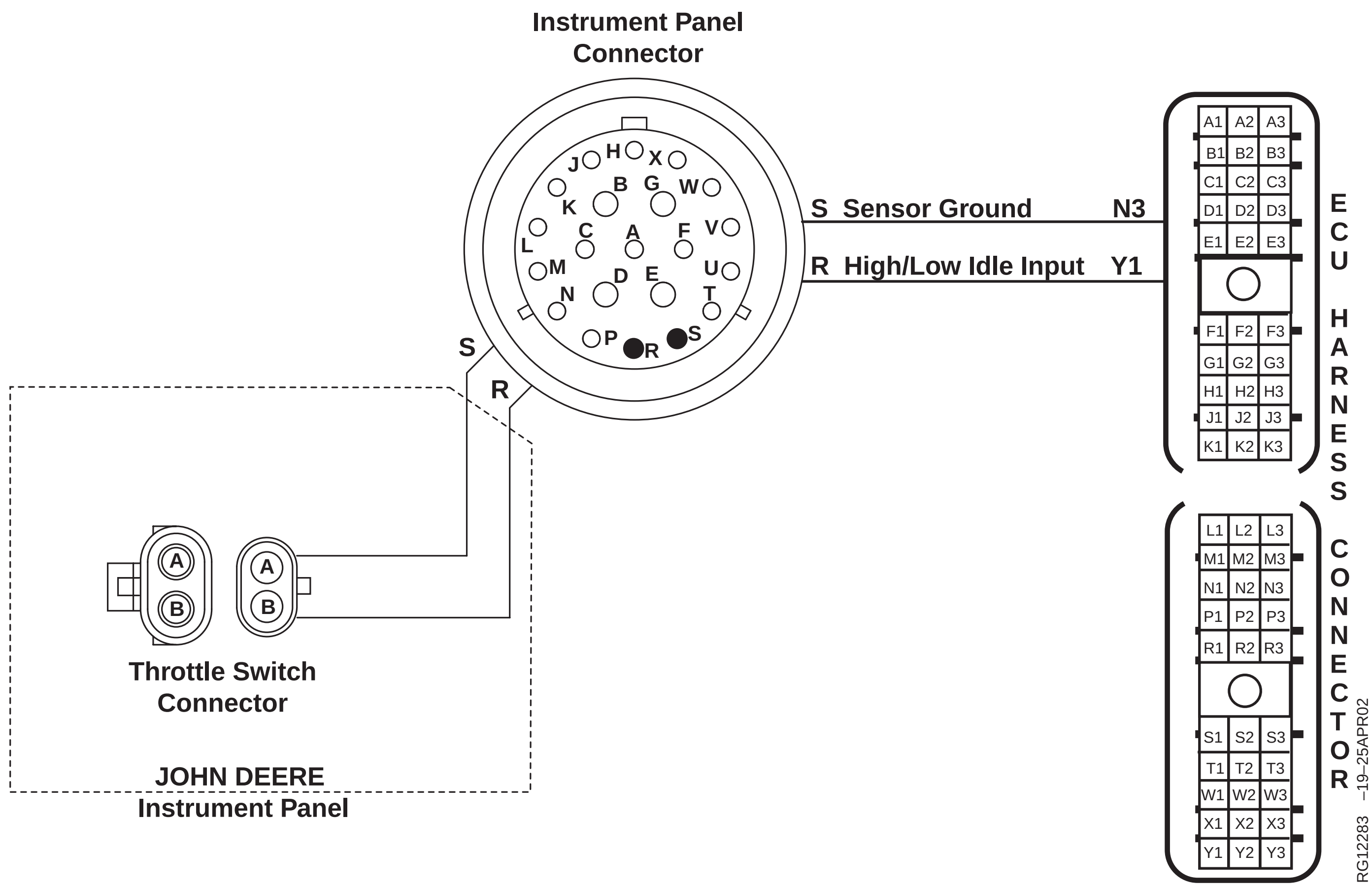
- If the diagnostic troubleshooting chart indicates that the problem is intermittent, try to reproduce the operating conditions that were present when the DTC set. The Diagnostic Scan Tool (DST) or SERVICE ADVISOR™ can be used to help locate intermittent problems, as it includes a function called Recording. The Recording function permits the recording of data parameter values during a diagnostic session. If a DTC sets during a certain diagnostic session, the parameters can be played back and observed to see what each parameter's value was when the DTC occurred.
- If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the DST or SERVICE ADVISOR™ to see if the fault resets.
- 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.
- Faulty Ground feedback problems.

RG,RG34710,1565 –19–30SEP97–1/1

T1 - Multi-state Throttle Input High



Multi-state Throttle Switch

The multi-state throttle features require no mechanical or analog (potentiometer) throttle to operate the engine. They allow you to preset one high and one low operating speed, and switch between them electrically without the use of potentiometers or mechanical adjustments. This adjustability feature is available only on ECUs that are not equipped with cruise control.

If an analog (foot or hand) throttle is also desired, up to two throttle potentiometers can be added that would operate between the preset high and low operating speeds. The multi-state throttle must be set in the minimum throttle position for the analog throttle to work. 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 control

There are three types of multi-state throttles: Dual-state, Tri-state, and Ramp. These throttles are wired the same but have a different switch to control the engine speed. For information on each of these throttles, see THROTTLE DESCRIPTIONS in Section 03, Group 140 earlier in this manual.

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.

If this code sets, the following will occur:

Continued on next page

DPSG,RG40854,298 –19–27MAR02–1/2

- 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 allow only idle engine speed.

DPSG,RG40854,298 –19–27MAR02–2/2

T1 - Multi-state Throttle Input High

RG41221,000007C –19–16APR02–1/1

T1 - Multi-State Throttle Input High Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T1 - MULTI-STATE THROTTLE INPUT HIGHsupporting information.* Without disconnecting, visually inspect the ECU connectors, the multi-state throttle connector, and any connectors between them for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information.* 1. Use the diagnostic gauge OR 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. Make note of any DTCs, then clear all DTCs. 4. Move the multi-state switch through all the positions. 5. Read DTCs.	**000091.03 reoccurs:** GO TO ❸ **000091.03 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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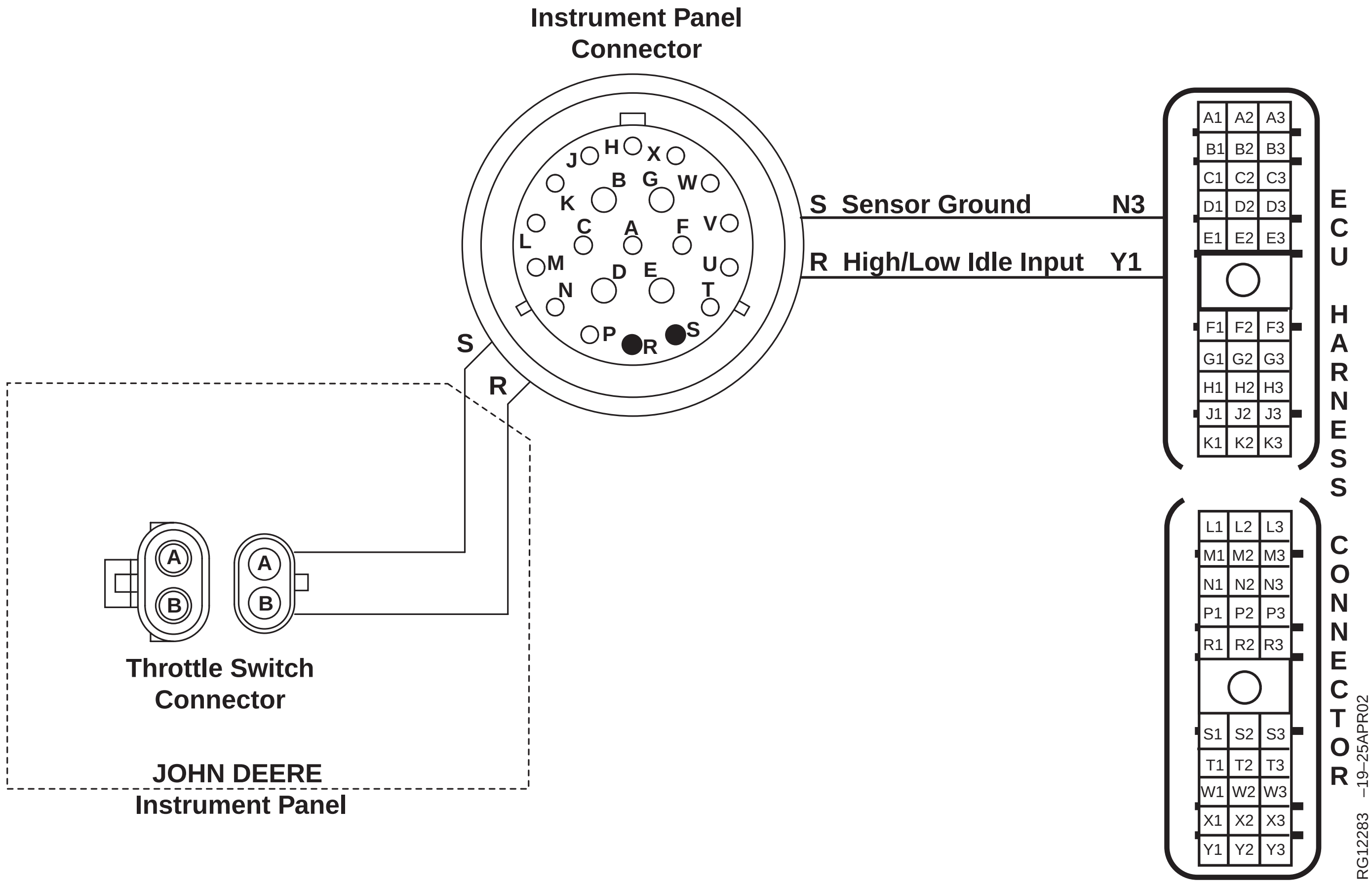
– – –1/1

❸ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information.* 1. Ignition OFF. 2. Disconnect multi-state throttle switch at two wire connector behind instrument panel. 3. Install a jumper wire between both terminals of the switch harness connector. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine OFF. 6. Using the ECU diagnostic software, read DTCs	**000091.03 reoccurs:** GO TO ❹ **000091.04 occurs:** Faulty multi-state throttle switch connector OR Faulty multi-state throttle switch – – –1/1

❹ **Throttle Position Return (Ground) Circuit Open Test**	*NOTE: For wiring and theory of operation, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information.* 1. Ignition OFF. 2. Remove jumper wire. 3. Ignition ON, engine OFF. 4. Using a multimeter, measure voltage between multi-state switch 5 V input terminal (terminal B) and a good chassis ground.	**4.0 - 6.0 volts:** Open in multi-state switch ground circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 volts:** Open in multi-state switch 5 V input circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

T2 - Multi-state Throttle Input Low



Multi-state Throttle Switch

The multi-state throttle is used when a few fixed engine speeds are desired. Multi-state throttle is comprised 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. There are three types of multi-state throttles: Dual-state, Tri-state, and Ramp. All of these throttles are wired the same. The only difference is the actual switch that is used to control the engine speed. For information on each of these throttles, see THROTTLE DESCRIPTIONS in Section 03, Group 140 earlier in this manual.

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.

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 allow only idle engine speed.

DPSG,RG40854,299 –19–27MAR02–1/1

T2 - Multi-state Throttle Input Low

RG41221,000007D –19–27MAR02–1/1

T2 - Multi-State Throttle Input Low Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information.* Without disconnecting, visually inspect the ECU connectors, the multi-state throttle connector, and any connector between them for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

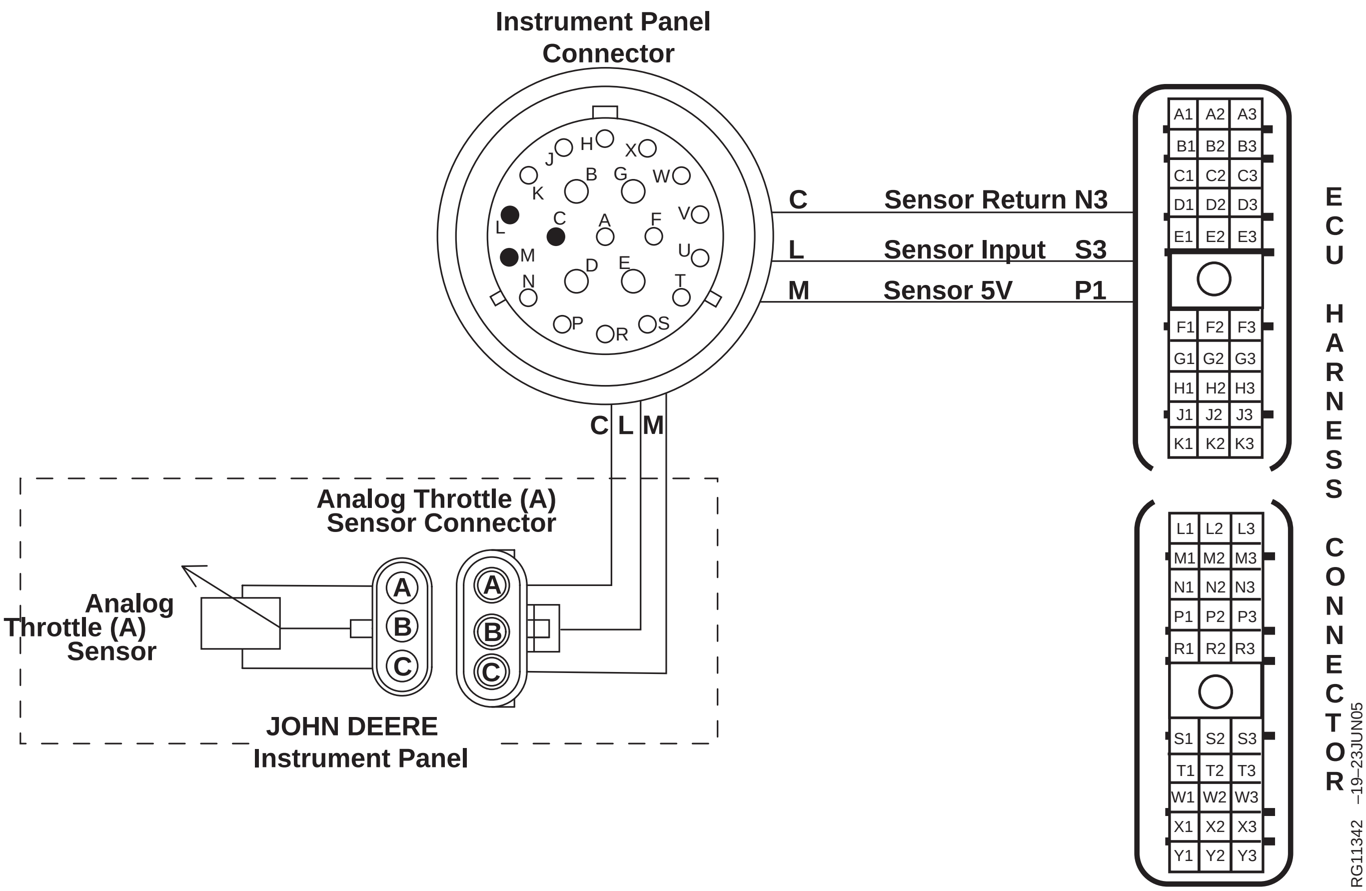
– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine OFF. 6. Move the multi-state switch through all the positions. 7. Read DTCs.	**000091.04 reoccurs:** GO TO ❸ **000091.04 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

– – –1/1

❸ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information.* 1. Ignition OFF. 2. Disconnect multi-state throttle switch at two wire connector behind instrument panel. 3. Make note of any DTCs, then clear all DTCs. 4. Ignition ON, engine OFF. 5. Using the ECU diagnostic software, read DTCs	**000091.04 reoccurs:** Short to ground in multi-state input circuit OR Open in multi-state input circuit OR Faulty ECU **000091.03 occurs:** Faulty multi-state throttle switch connector OR Faulty multi-state throttle switch. – – –1/1

T3 - Analog Throttle (A) Input High



NOTE: Wiring diagram shows OEM engine applications. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

This code will set if:

- The analog throttle (A) input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for the throttle lever to achieve.
  – For OEM applications, the high analog throttle (A) input voltage specification is 4.7 volts.
  – For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for the high analog throttle (A) input voltage specification.

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, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will allow only idle engine speed.

DPSG,RG40854,77 –19–16APR02–1/1

T3 - Analog Throttle (A) Input High

RG41221,000007E –19–16APR02–1/1

T3 - Analog Throttle (A) Input High Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* Perform a preliminary inspection ECU connectors, the analog throttle (A) sensor connector, and any connectors between them for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Analog Throttle (A) in the idle position. 5. Read the analog throttle (A) input voltage on DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the high analog throttle (A) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**4.7 volts or greater:** GO TO ❹ **Below 4.7 volts:** GO TO ❸

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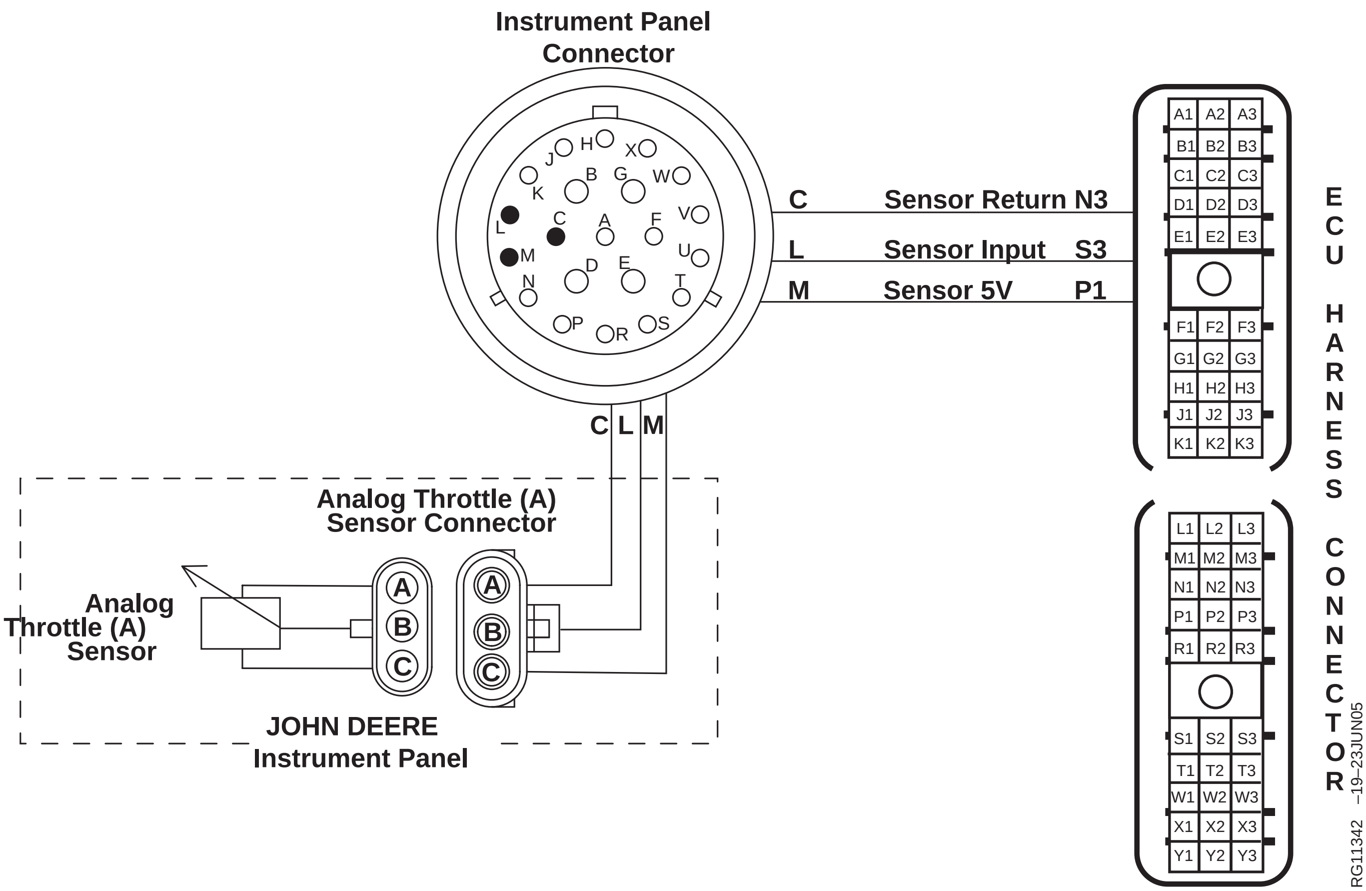
❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* 1. Slowly operate analog throttle (A) through its full travel. 2. Using the ECU diagnostic software, read the analog throttle (A) input voltage *NOTE: For OEM applications, the high analog throttle (A) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**Goes above 4.7 volts:** Faulty analog throttle (A) sensor connector OR Open in analog throttle (A) sensor ground circuit OR Faulty analog throttle (A) sensor OR Idle stop on throttle adjusted too low **Never goes above 4.7 volts:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group – – –1/1

❹ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* 1. Ignition OFF. 2. Disconnect analog throttle (A) sensor connector. 3. Ignition ON, Engine OFF 4. Using the ECU diagnostic software, read the analog throttle (A) input voltage *NOTE: For OEM applications, the low analog throttle (A) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**0.3 volts or less:** GO TO ❺ **Above 0.3 volts:** Short to voltage in analog throttle (A) input circuit OR Faulty ECU – – –1/1

❺ **Throttle Position Return (Ground) Circuit Open Test**	*NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* 1. Ignition OFF. 2. Analog throttle (A) sensor connector disconnected. 3. Using a test light connected to battery (+), probe the return terminal (terminal A) in the analog throttle (A) sensor connector on the wiring harness.	**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



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NOTE: *Wiring diagram shows OEM engine applications. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

This code will set if:

- The analog throttle (A) input voltage drops below the sensor's low voltage specification. The voltage is lower than what is physically possible for the throttle lever to achieve.
  - For OEM applications, the low analog throttle (A) input voltage specification is 0.3 volts.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for the low analog throttle (A) input voltage specification.

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, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will allow only idle engine speed.

DPSG,RG40854,170 –19–16APR02–1/1

T4 - Analog Throttle (A) Input Low

RG41221,000007F –19–16APR02–1/1

T4 - Analog Throttle (A) Input Low Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* Visually inspect ECU connectors, the analog throttle (A) sensor connector, and any connector between them for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Throttle (A) in the idle position. 5. Read the analog throttle (A) input voltage on DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the low analog throttle (A) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**0.3 volts or less:** GO TO ❹ **Above 0.3 volts:** GO TO ❸

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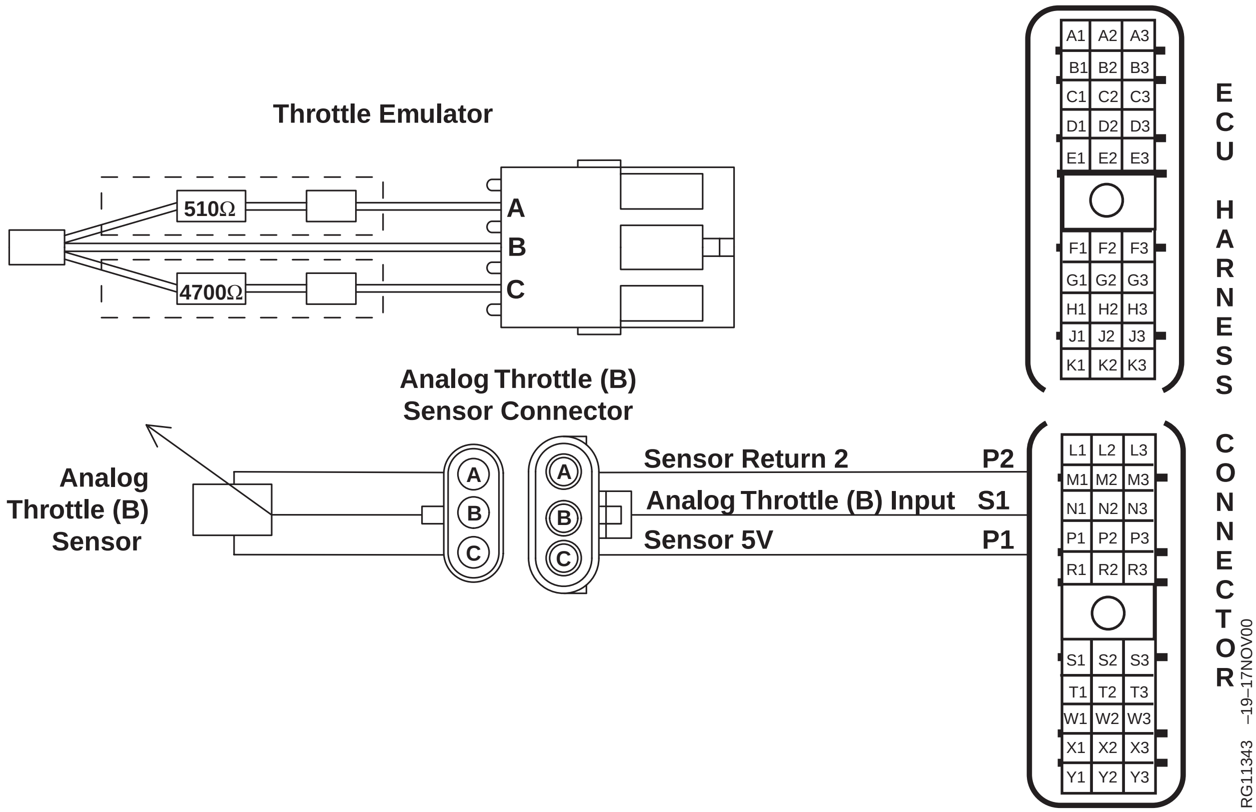
– – –1/1

❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* 1. Slowly operate analog throttle (A) through its full travel. 2. Using the ECU diagnostic software, read the analog throttle (A) input voltage *NOTE: For OEM applications, the low analog throttle (A) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**Goes below 0.3 volts:** Faulty analog throttle (A) sensor connector OR Open in analog throttle (A) sensor ground circuit OR Fast idle stop on throttle adjusted too high OR Faulty analog throttle (A) sensor **Never goes above 0.3 volts:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group – – –1/1

❹ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* 1. Ignition OFF. 2. Disconnect analog throttle (A) sensor connector. 3. Install a jumper wire between the 5 V Supply terminal and the input terminal (terminals B and C) in the analog throttle (A) sensor connector on the engine harness. 4. Ignition ON, engine OFF. 5. Using the ECU diagnostic software, read the analog throttle (A) input voltage *NOTE: For OEM applications, the high analog throttle (A) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**Below 4.7 volts:** GO TO ❺ **4.7 volts or greater:** Faulty analog throttle (A) sensor connector OR Faulty analog throttle (A) sensor – – –1/1

❺ **Throttle Position 5V Supply Test**	*NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* 1. Ignition OFF. 2. Remove jumper wire. 3. Ignition ON, engine OFF. 4. Using a multimeter, measure the voltage between the analog throttle (A) return terminal and the 5 V Supply terminal (terminals A and C) in the analog throttle (A) sensor connector on the engine harness.	**4.0-6.0 volts:** 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 volts:** 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

T5 - Analog Throttle (B) Input High



NOTE: Wiring diagram shows OEM engine applications. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

This code will set if:

- The analog throttle (B) input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for the throttle lever to achieve.
  – For OEM applications, the high analog throttle (B) input voltage specification is 4.7 volts.
  – For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for the high analog throttle (B) input voltage specification.

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, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will allow only idle engine speed.

DPSG,RG40854,296 –19–16APR02–1/1

T5 - Analog Throttle (B) Input High

RG41221,0000080 –19–16APR02–1/1

T5 - Analog Throttle (B) Input High Diagnostic Procedure

– – –1/1

❶ Visual Inspection of Connectors and Wiring	**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.** *NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* Perform a preliminary inspection ECU connectors and the analog throttle (B) sensor connector for contamination, damage, looseness, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ Intermittent Fault Test	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Analog Throttle (B) in the idle position. 5. Read the analog throttle (B) input voltage on DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**4.7 volts or greater:** GO TO ❹ **Below 4.7 volts:** GO TO ❸

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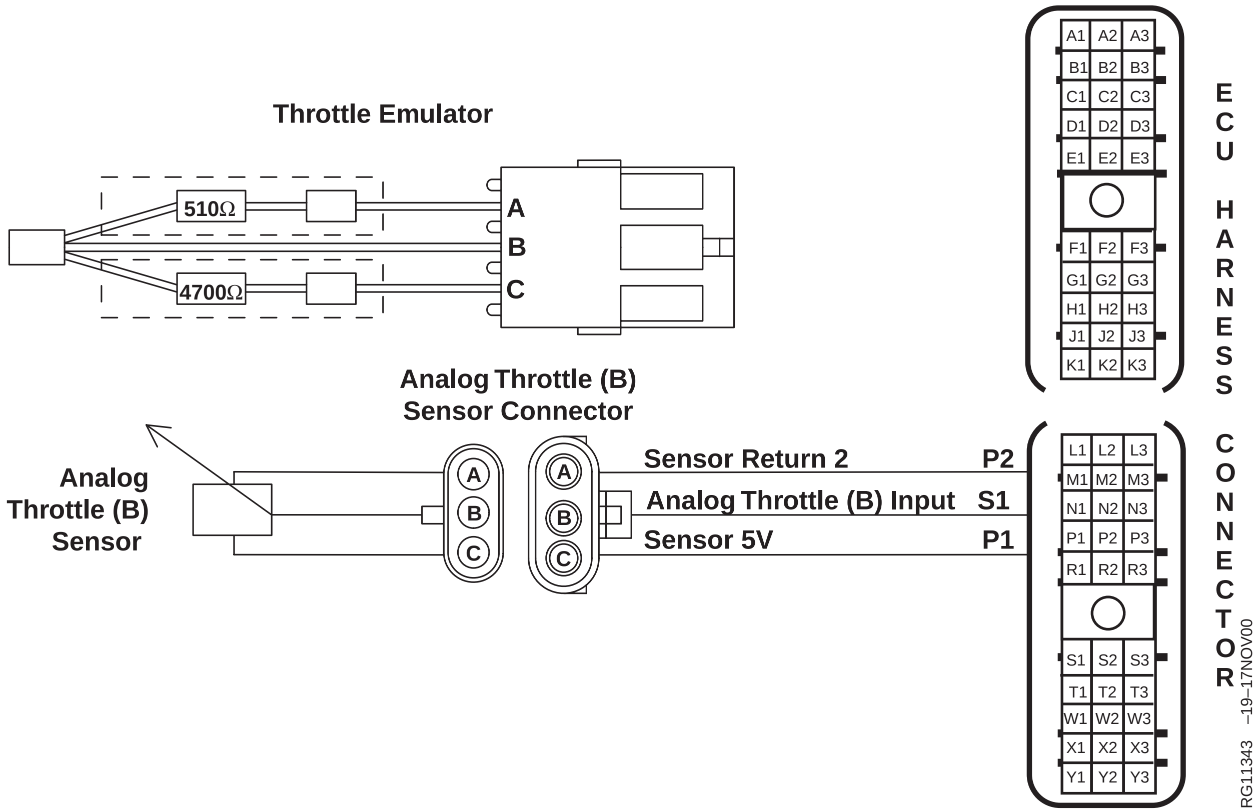
❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* 1. Slowly operate analog throttle (B) through its full travel. 2. Using the ECU diagnostic software, read the analog throttle (B) input voltage *NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**Goes above 4.7 volts:** Faulty analog throttle (B) sensor connector OR Open in analog throttle (B) sensor ground circuit OR Idle stop on throttle adjusted too low OR Faulty analog throttle (B) sensor **Never goes above 4.7 volts:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❹. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group – – –1/1

❹ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* 1. Ignition OFF. 2. Disconnect analog throttle (B) sensor connector. 3. Ignition ON, Engine OFF 4. Using the ECU diagnostic software, read the analog throttle (B) input voltage *NOTE: For OEM applications, the low analog throttle (B) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**0.3 volts or less:** GO TO ❺ **Above 0.3 volts:** Short to voltage in analog throttle (B) input circuit OR Faulty ECU – – –1/1

❺ **Throttle Position Return (Ground) Circuit Open Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* 1. Ignition OFF. 2. Analog throttle (B) sensor connector disconnected. 3. Using a test light connected to battery (+), probe the return terminal (terminal A) in the analog throttle (B) sensor connector on the engine harness.	**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

T6 - Analog Throttle (B) Input Low



NOTE: Wiring diagram shows OEM engine applications. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

This code will set if:

- The analog throttle (B) input voltage drops below the sensor's low voltage specification. The voltage is lower than what is physically possible for the throttle lever to achieve.
  – For OEM applications, the low analog throttle (B) input voltage specification is 0.3 volts.
  – For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for the low analog throttle (B) input voltage specification.

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, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will allow only idle engine speed.

DPSG,RG40854,297 –19–16APR02–1/1

T6 - Analog Throttle (B) Input Low

RG41221,0000081 –19–16APR02–1/1

T6 - Analog Throttle (B) Input Low Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* Visually inspect ECU connectors and the analog throttle (B) sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Analog Throttle (B) in the idle position. 5. Read the analog throttle (B) input voltage on DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the low analog throttle (B) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**0.3 volts or less:** GO TO ❹ **Above 0.3 volts:** GO TO ❸

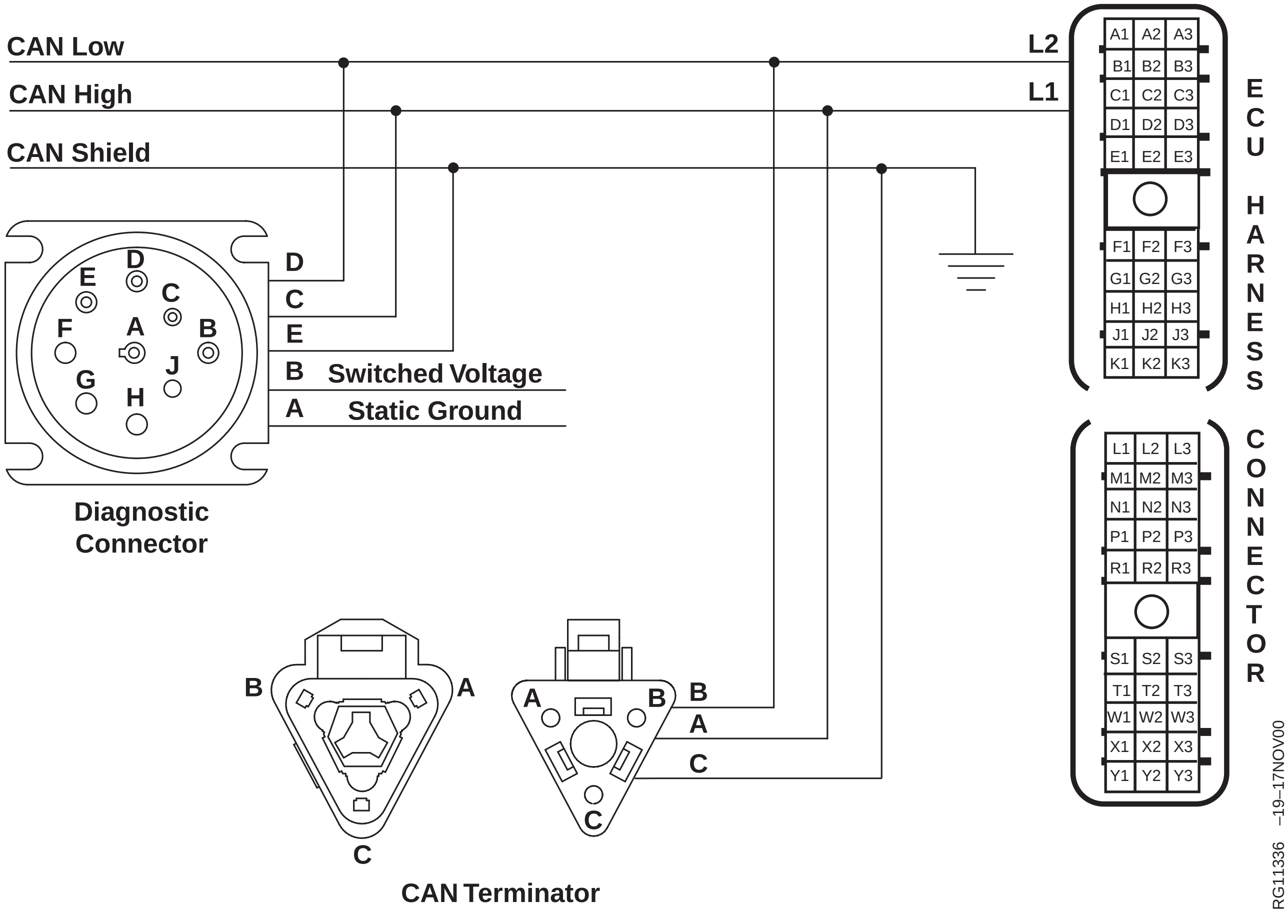
– – –1/1

❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* 1. Slowly operate analog throttle (B) through its full travel. 2. Using the ECU diagnostic software, read the analog throttle (B) input voltage *NOTE: For OEM applications, the low analog throttle (B) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**Goes below 0.3 volts:** Faulty analog throttle (B) sensor connector OR Open in analog throttle (B) sensor ground circuit OR Faulty analog throttle (B) sensor **Never goes above 0.3 volts:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❹. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group – – –1/1

❹ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* 1. Ignition OFF. 2. Disconnect analog throttle (B) sensor connector. 3. Install a jumper wire between the 5 V Supply terminal and the input terminal (terminals B and C) in the analog throttle (B) sensor connector on the engine harness. 4. Ignition ON, engine OFF. 5. Using the ECU diagnostic software, read the analog throttle (B) input voltage *NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**Below 4.7 volts:** GO TO ❺ **4.7 volts or greater:** Faulty analog throttle (B) sensor connector OR Faulty analog throttle (B) sensor – – –1/1

❺ **Throttle Position 5 V Supply Test**	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* 1. Ignition OFF. 2. Remove jumper wire. 3. Ignition ON, engine OFF. 4. Using a multimeter, measure the voltage between the analog throttle (B) return terminal and the 5 V supply terminal (terminals A and C) in the analog throttle (B) sensor connector on the engine harness.	**4.0-6.0 volts:** Open in analog throttle (B) input circuit OR Short to ground in analog throttle (B) input circuit OR Faulty ECU connector OR Faulty ECU **Below 4.0 volts:** Open in analog throttle (B) 5 V Supply circuit OR Short to ground in analog throttle (B) 5 V Supply circuit OR Faulty ECU connector OR Faulty ECU – – –1/1

T7 - CAN Throttle Invalid



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.

This code will set if:

- The ECU either does not receive throttle information over CAN, or the information received is not valid.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the CAN throttle, and will use the input values from another throttle.
- If the CAN throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default “limp-home” throttle value that will allow only idle engine speed.

DPSG,RG40854,209 –19–27MAR02–1/1

T7 - CAN Throttle Invalid

RG41221,0000082 –19–17APR02–1/1

T7 - Can Throttle Invalid Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.* Visually inspect ECU connectors for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000091.09 reoccurs:** GO TO ❸ **000091.09 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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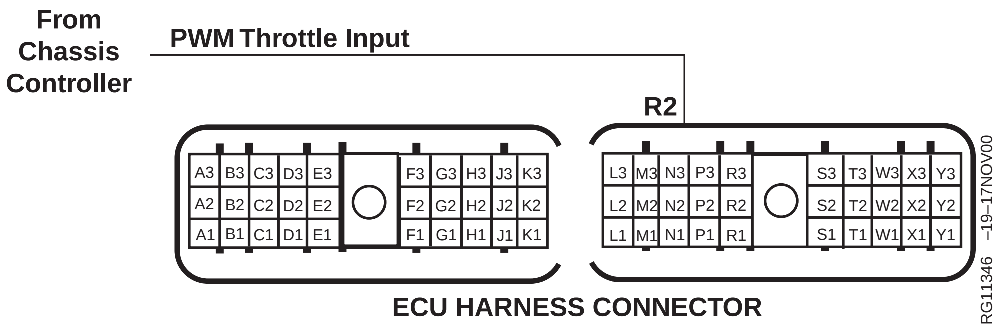
❸ **Application Related DTCs Test**	*NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.* If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs.	**No CAN related DTCs found on other controllers:** GO TO ❹ **Found CAN related DTCs found on other controllers:** Refer to diagnostic procedure for that controller. – – –1/1

❹ **Resistance Between CAN High and Low Test**	*NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.* 1. Ignition OFF. 2. Using a multimeter, measure resistance between terminals C and D in the harness end of the diagnostic connector.	**Between 45-75 ohms:** GO TO ❺ **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

❺ **CAN Wiring Shorted to Ground or Voltage Test**	*NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.* 1. Ignition OFF. 2. 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 and 3.5 volts:** Faulty ECU connector OR Other connector in the CAN system OR Faulty ECU. **Either measurement less than 1.5 or greater than 3.5 volts:** CAN wiring shorted to ground or voltage OR Another controller in the CAN system is faulty OR Faulty ECU – – –1/1

T8 - PWM Throttle Input High



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 allow only idle engine speed.

DPSG,RG40854,294 –19–27MAR02–1/1

T8 - PWM Throttle Input High

RG41221,0000083 –19–03JAN01–1/1

T8 - PWM Throttle Input High Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T8 - PWM THROTTLE INPUT HIGH supporting information.* Visually inspect ECU connectors and the throttle sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T8 - PWM THROTTLE INPUT HIGH supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of all DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000091.03 reoccurs:** GO TO ❸ **000091.03 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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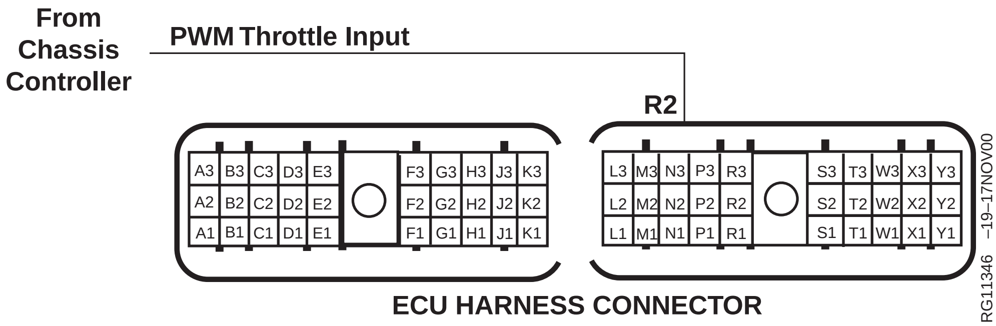
❸ **Applications Related to DTCs Test**	*NOTE: For wiring and theory of operation, see T8 - PWM THROTTLE INPUT HIGH supporting information.* If PWM throttle signal originates from another controller, check that controller for related DTCs.	**Controller reports no throttle related DTCs:** GO TO ❹ **Controller does report throttle related DTC:** Refer to diagnostic procedures for controller AND Repair cause of throttle related DTC AND Retest. – – –1/1

❹ **Open in PWM Signal Wire Test**	*NOTE: For wiring and theory of operation, see T8 - PWM THROTTLE INPUT HIGH supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 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 R2 of the ECU connector and the originating PWM throttle signal terminal.	**5 ohms or less:** GO TO ❺ **Greater than 5 ohms:** Open in PWM throttle signal wire. – – –1/1

❺ **Short in PWM Circuit Test**	*NOTE: For wiring and theory of operation, see T8 - PWM THROTTLE INPUT HIGH supporting information.* 1. Ignition OFF. 2. ECU connectors and the other signal source controller still disconnected. 3. Using a multimeter, measure resistance between terminal R2 in the harness end of the ECU connector and: • All other terminals in that connector • A good chassis ground	**All measurements greater than 2k ohms:** GO TO ❻ **Any measurement less than 2k ohms:** Short in PWM circuit. – – –1/1

❻ **PWM Throttle Source Controller Connector Test**	*NOTE: For wiring and theory of operation, see T8 - PWM THROTTLE INPUT HIGH supporting information.* 1. Ignition OFF. 2. ECU connectors still disconnected. 3. Reconnect PWM signal source connector. 4. Ignition ON 5. Using a multimeter, measure voltage while operating the throttle between: • Terminal R2 in the harness end of the ECU connector and a good chassis ground.	**Between 0.5 and 4.8 volts:** Faulty PWM signal source controller OR Wrong ECU for the vehicle OR Faulty ECU connector OR Faulty ECU **Less than 0.5 or greater than 4.8 volts:** Faulty PWM throttle signal source controller connector OR Faulty PWM throttle signal source controller – – –1/1

T9 - PWM Throttle Input Low



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 allow only idle engine speed.

DPSG,RG40854,295 –19–27MAR02–1/1

T9 - PWM Throttle Input Low

RG41221,0000084 –19–17APR02–1/1

T9 - PWM Throttle Input Low Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T9 - PWM THROTTLE INPUT LOW supporting information.* Visually inspect ECU connectors and the throttle sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T9 - PWM THROTTLE INPUT LOW supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000091.04 reoccurs:** GO TO ❸ **000091.04 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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– – –1/1

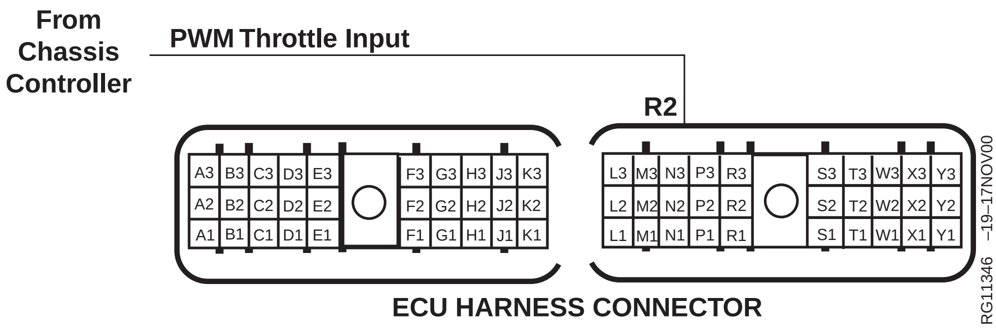
❸ **Application Related DTCs Test**	*NOTE: For wiring and theory of operation, see T9 - PWM THROTTLE INPUT LOW supporting information.* If PWM throttle signal originates from another controller, check that controller for related DTCs.	**Controller reports no throttle related DTCs:** GO TO ❹ **Controller does report a throttle related DTC:** Refer to diagnostic procedures for controller AND Repair cause of throttle related DTC AND Retest. – – –1/1

❹ **Open in PWM Signal Wire Test**	*NOTE: For wiring and theory of operation, see T9 - PWM THROTTLE INPUT LOW supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 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 R2 of the ECU connector and the originating PWM throttle signal terminal.	**5 ohms or less:** GO TO ❺ **Greater than 5 ohms:** Open in PWM throttle signal wire. – – –1/1

❺ **Short in PWM Circuit Test**	*NOTE: For wiring and theory of operation, see T9 - PWM THROTTLE INPUT LOW supporting information.* 1. Ignition OFF. 2. ECU connectors and the other signal source controller still disconnected. 3. Using a multimeter measure resistance between terminal R2 in the harness end of the ECU connector and: • All other terminals in that connector. • A good chassis ground.	**All measurements greater than 2k ohms:** GO TO ❻ **Any measurement less than 2k ohms:** Short in PWM circuit. – – –1/1

❻ **PWM Throttle Source Controller Connector Test**	*NOTE: For wiring and theory of operation, see T9 - PWM THROTTLE INPUT LOW supporting information.* 1. Ignition OFF. 2. ECU connectors still disconnected. 3. Reconnect PWM signal source connector. 4. Ignition ON 5. Using a multimeter, measure voltage while operating the throttle, between: • Terminal R2 in the harness end of the ECU connector and a good chassis ground.	**Between 0.5 and 4.8 volts:** Faulty PWM signal source controller OR Wrong ECU for the vehicle OR Faulty ECU connector OR Faulty ECU **Less than 0.5 or greater than 4.8 volts:** Faulty PWM throttle signal source controller connector OR Faulty PWM throttle signal source controller. – – –1/1

T10 - PWM Throttle Abnormal Pulse Width



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 ECU senses that the frequency of the PWM signal is not within range.

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 allow only idle engine speed.

DPSG,RG40854,171 –19–27MAR02–1/1

T10 - PWM Throttle Abnormal Pulse Width

RG41221,0000085 –19–17APR02–1/1

T10 - PWM Throttle Abnormal Pulse Width Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information.* Visually inspect ECU connectors and the throttle sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **No Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000091.08 reoccurs:** GO TO ❸ **000091.08 doesn’t reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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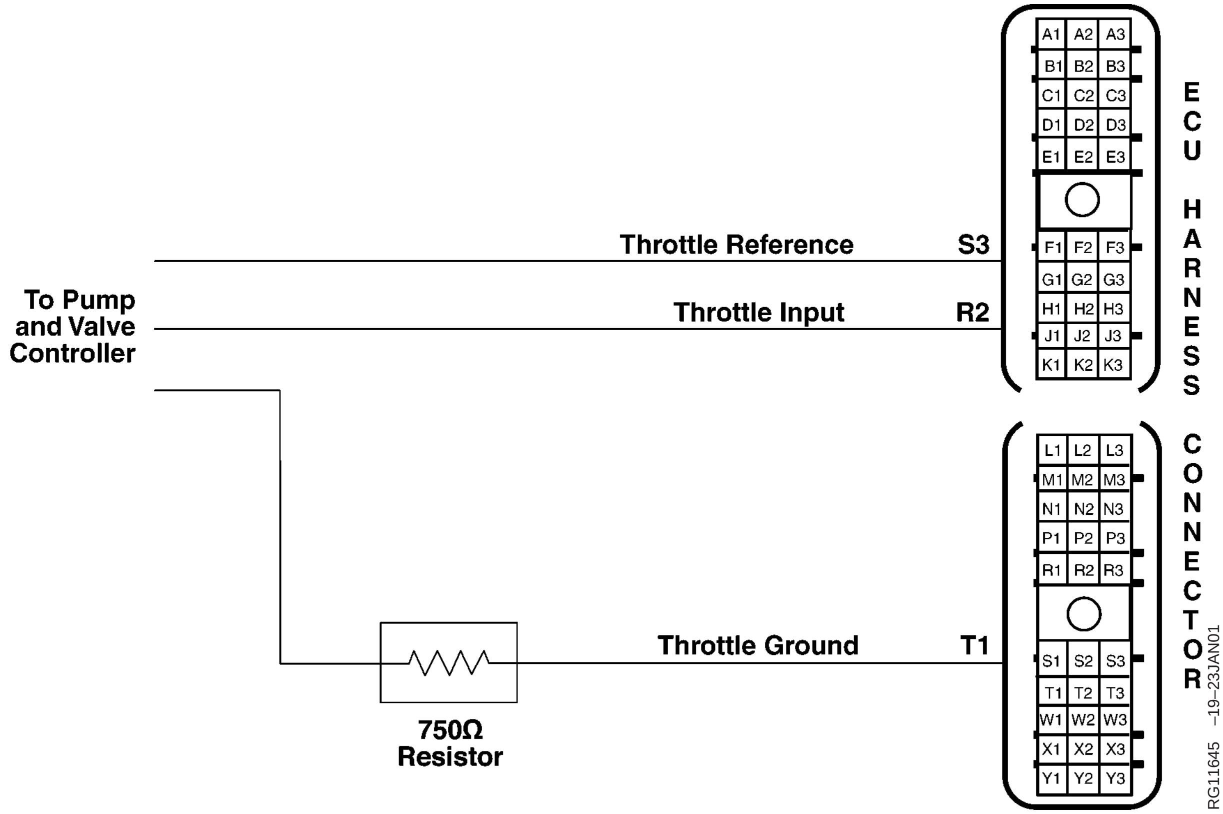
❸ **Applications Related DTCs Test**	*NOTE: For wiring and theory of operation, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information.* If PWM throttle signal originates from another controller, check that controller for related DTCs.	**Controller reports no throttle related DTCs:** GO TO ❹ **Controller does report a throttle related DTC:** Refer to diagnostic procedures for controller AND Repair cause of throttle related DTC AND Retest – – –1/1

❹ **Open in PWM Throttle Signal Wire Test**	*NOTE: For wiring and theory of operation, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 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 R2 of the ECU connector and the originating PWM throttle signal terminal.	**5 ohms or less:** GO TO ❺ **Greater than 5 ohms:** Open in PWM throttle signal wire. – – –1/1

❺ **Short in PWM Circuit Test**	*NOTE: For wiring and theory of operation, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information.* 1. Ignition OFF. 2. ECU connectors and the other signal source controller still disconnected. 3. Using a multimeter measure resistance between terminal R2 in the harness end of the ECU connector and: • All other terminals in that connector. • A good chassis ground.	**All measurements greater than 2k ohms:** GO TO ❻ **Any measurement less than 2k ohms:** Short in PWM circuit. – – –1/1

❻ **PWM Throttle Source Controller Connector Test**	*NOTE: For wiring and theory of operation, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information.* 1. Ignition OFF. 2. ECU connectors still disconnected. 3. Reconnect PWM signal source connector. 4. Ignition ON 5. Using a multimeter, measure voltage while operating the throttle, between: • Terminal R2 in the harness end of the ECU connector and a good chassis ground.	**Between 0.5 and 4.8 volts:** Faulty PWM signal source controller OR Wrong ECU for the vehicle OR Faulty ECU connector OR Faulty ECU **Less than 0.5 or greater than 4.8 volts:** Faulty PWM throttle signal source controller connector Faulty PWM throttle signal source controller – – –1/1

T11 - Excavator Throttle Reference Voltage High



NOTE: For more Excavator throttle wiring information, refer to machine manual.

Excavator Throttle

- The Excavator uses an analog throttle to measure throttle position. This throttle is connected to the Pump and Valve controller, which sends throttle input information to the ECU through a dedicated wire. Since the ECU and Pump and Valve controller do not share a common ground, a throttle voltage reference wire and a throttle ground wire accompany the throttle input wire. The ECU calculates the differences in controller grounds in order to determine the throttle request by the Pump and Valve controller.

This code will set if:

- The excavator throttle reference voltage to the ECU exceeds 4.2 volts.

If this code sets, the following will occur:

- The ECU will default excavator reference throttle voltage to 3.7 volts.

RG41221,00000C8 –19–27MAR02–1/1

T11 - Excavator Throttle Reference Voltage High

RG41221,00000C9 –19–17APR02–1/1

T11 - Excavator Throttle Reference Voltage High Diagnostic Procedure

NOTE: This procedure is only used to diagnose the Excavator Throttles.

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information.* Visually inspect both 30-way ECU connectors, the throttle sensor connector, an any connector between for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. *NOTE: If DTCs 000029.03 or 000029.04 are active, follow those DTCs first.* 5. Read DTCs: • Ignition ON, engine OFF. • Ignition ON, engine running.	**000028.03 reoccurs when engine is off and running:** GO TO ❸ **000028.03 reoccurs only when engine is running:** GO TO ❹ **000028.03 doesn’t reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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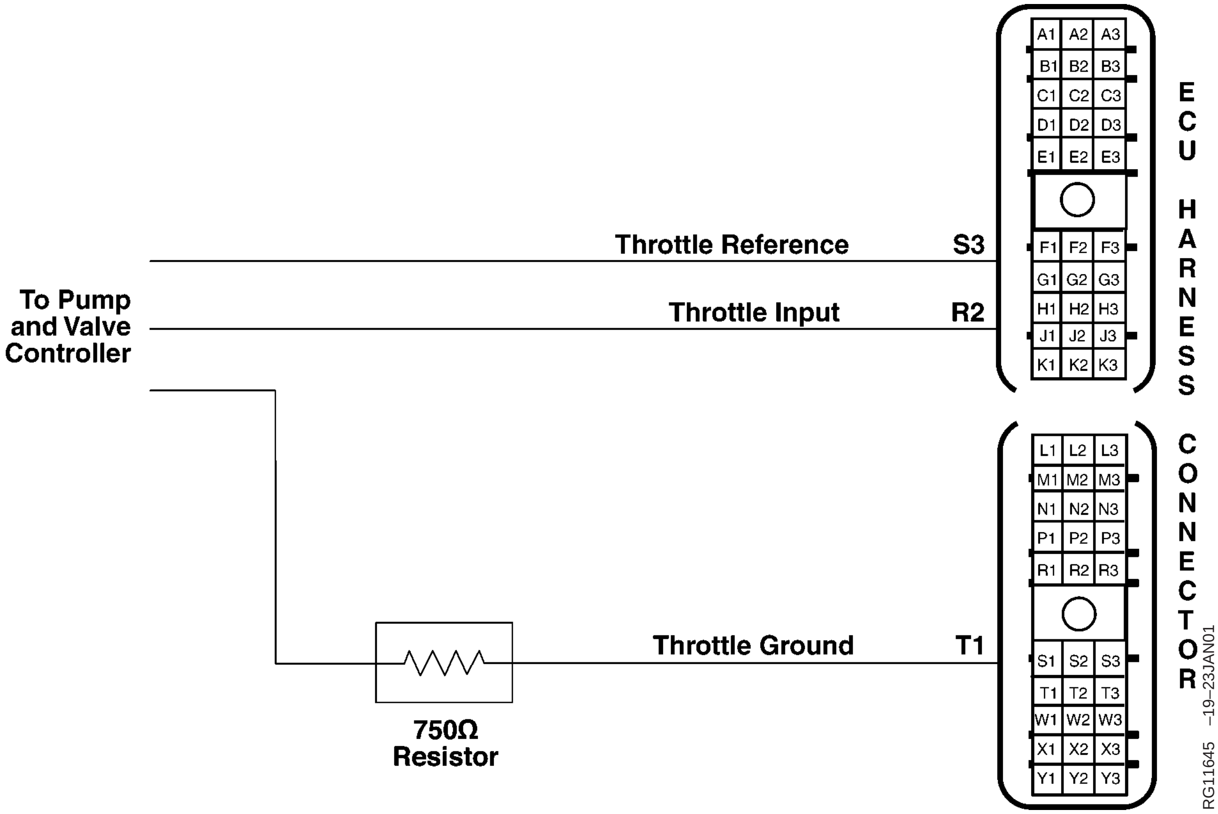
❸ **Throttle Reference Wire Test**	*NOTE: For wiring and theory of operation, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure voltage between terminal S3 in the harness end of the 30-way ECU connector and the ground stud of the Pump and Valve controller.	**3.9 volts or less:** GO TO ❹ **Greater than 3.9 volts:** Short to power in throttle reference wire OR Faulty Pump and Valve controller connector OR Faulty Pump and Valve controller – – –1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information.* There is a difference between grounds of the ECU and Pump and Valve controller. Check for loose ground connections at each controller.	– – –1/1

T12 - Excavator Throttle Reference Voltage Low



NOTE: For more Excavator throttle wiring information, refer to machine manual.

Excavator Throttle

- The Excavator uses an analog throttle to measure throttle position. This throttle is connected to the Pump and Valve controller, which sends throttle input information to the ECU through a dedicated wire. Because the ECU and Pump and Valve controller do not share a common ground, a throttle voltage reference wire and a throttle ground wire accompany the throttle input wire. The ECU calculates the differences in controller grounds in order to determine the throttle request by the Pump and Valve controller.

This code will set if:

- The excavator throttle reference voltage to the ECU goes below 2.7 volts.

If this code sets, the following will occur:

- The ECU will default excavator reference throttle voltage to 3.7 volts.

RG41221,00000CA –19–27MAR02–1/1

T12 - Excavator Throttle Reference Voltage Low

RG41221,00000CB –19–17APR02–1/1

T12 - Excavator Throttle Reference Voltage Low Diagnostic Procedure

NOTE: This procedure is only used to diagnose the Excavator Throttles.

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information.* Visually inspect both 30-way ECU connectors, the throttle sensor connector, an any connector between for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. *NOTE: If DTCs 000029.03 or 000029.04 are active, follow those DTCs first.* 5. Read DTCs: • Ignition ON, engine OFF. • Ignition ON, engine running.	**000028.04 reoccurs when engine is off and running:** GO TO ❸ **000028.04 reoccurs only when engine is running:** GO TO ❹ **000028.04 doesn’t reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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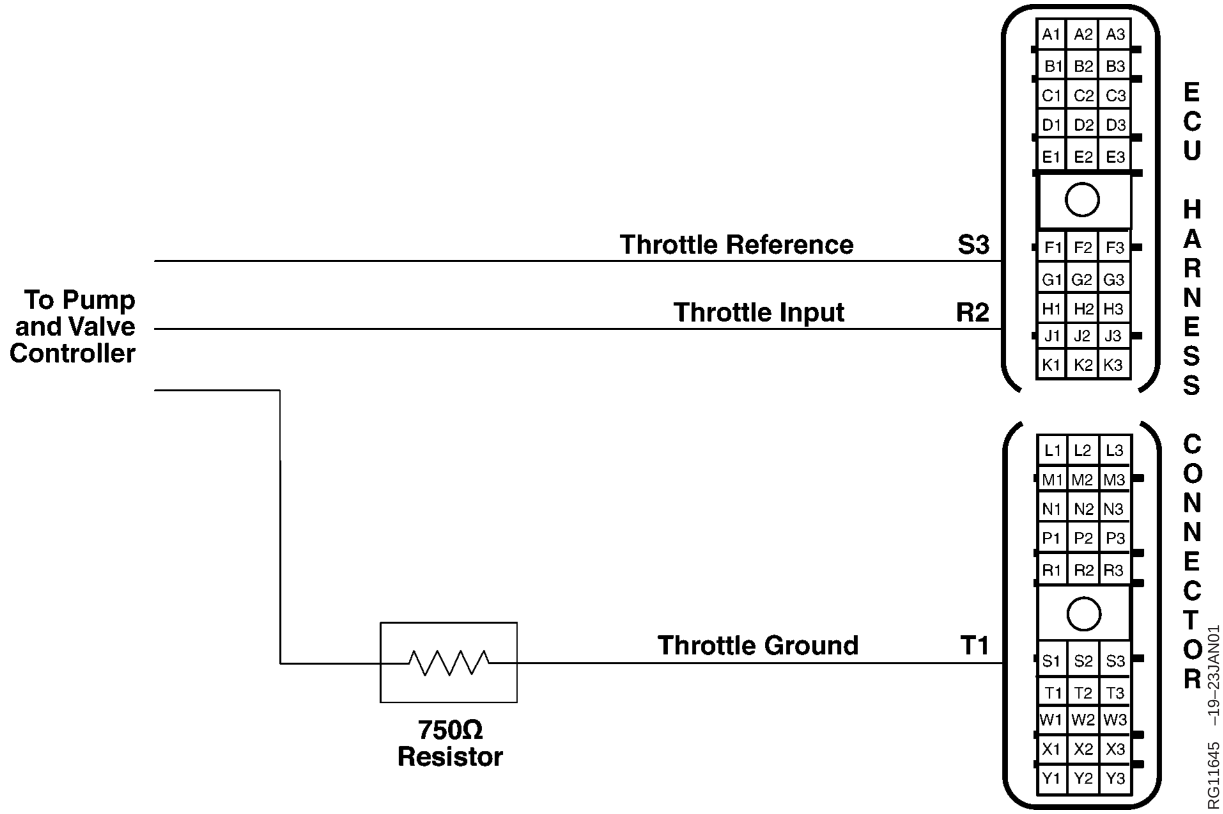
❸ **Throttle Reference Wire Test**	*NOTE: For wiring and theory of operation, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure voltage between terminal S3 in the harness end of the ECU connector and the ground stud of the Pump and Valve controller.	**3.5 volts or greater:** GO TO ❹ **Less than 3.5 volts:** Open in throttle reference wire OR Faulty Pump and Valve controller connector OR Faulty Pump and Valve controller – – –1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information.* There is a difference between the grounds of the ECU and Pump and Valve controller. Check for loose ground connections at each controller.	– – –1/1

T13 - Excavator Throttle Ground Voltage High



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NOTE: For more Excavator throttle wiring information, refer to machine manual.

Excavator Throttle

- The Excavator uses an analog throttle to measure throttle position. This throttle is connected to the Pump and Valve controller, which sends throttle input information to the ECU through a dedicated wire. Because the ECU and Pump and Valve controller do not share a common ground, a throttle voltage reference wire and a throttle ground wire accompany the throttle input wire. The ECU calculates the differences in controller grounds in order to determine the throttle request by the Pump and Valve controller.

This code will set if:

- The excavator throttle ground voltage to the ECU exceeds 3.0 volts.

If this code sets, the following will occur:

- The ECU will default excavator throttle ground voltage to 0 volts.

RG41221,00000CC –19–27MAR02–1/1

T13 - Excavator Throttle Ground Voltage High

RG41221,00000CD –19–17APR02–1/1

T13 - Excavator Throttle Ground Voltage High Diagnostic Procedure

NOTE: This procedure is only used to diagnose the Excavator Throttles.

– – –1/1

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* Visually inspect both 30-way ECU connectors, the throttle sensor connector, an any connector between for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Read DTCs: • Ignition ON, engine OFF. • Ignition ON, engine running.	**000029.03 reoccurs when engine is off and running:** GO TO ❸ **000029.03 reoccurs only when engine is running:** GO TO ❹ **000029.03 doesn’t reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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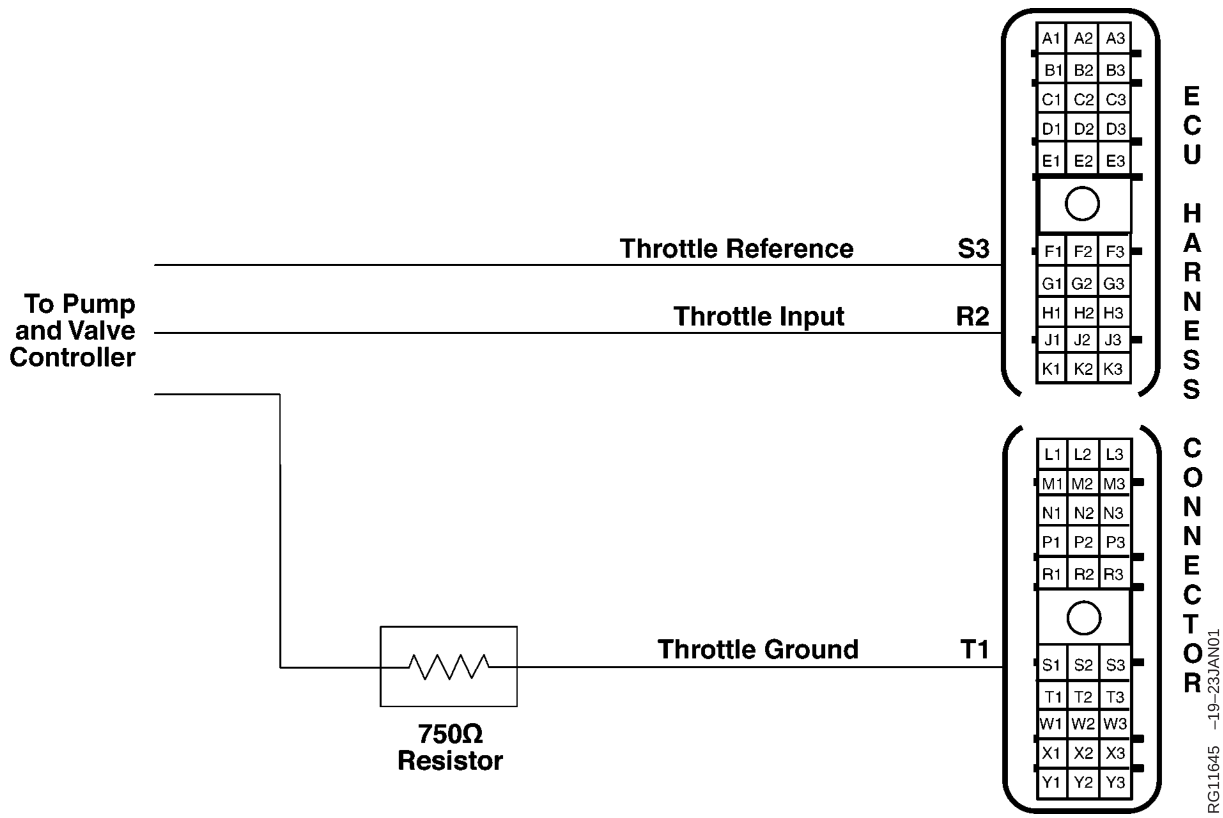
❸ **Throttle Ground Wire Test**	*NOTE: For wiring and theory of operation, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Disconnect Pump and Valve controller connector. 4. Using a multimeter, measure resistance between terminal T1 in the harness end of the 30-way ECU connector and the corresponding return terminal of the Pump and Valve controller connector.	**770 ohms or less:** GO TO ❹ **Greater than 770 ohms:** Short to power in throttle ground wire between ECU and 750 ohm resistor OR Open in throttle ground wire OR Faulty 750 ohm resistor OR Faulty ECU connector OR Faulty ECU – – –1/1

❹ **Pump and Valve Controller Test**	*NOTE: For wiring and theory of operation, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Both 30-way ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal T1 in the harness end of the 30-way ECU connector and the ground stud of the Pump and Valve controller.	**770 ohms or less:** GO TO ❺ **Greater than 770 ohms:** Faulty Pump and Valve controller connector OR Faulty Pump and Valve controller – – –1/1

❺ **Ground Test**	*NOTE: For wiring and theory of operation, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* There is a difference between grounds of the ECU and Pump and Valve controller. Check for loose ground connection at each controller.	– – –1/1

T14 - Excavator Throttle Ground Voltage Low



NOTE: For more Excavator throttle wiring information, refer to machine manual.

Excavator Throttle

- The Excavator uses an analog throttle to measure throttle position. This throttle is connected to the Pump and Valve controller, which sends throttle input information to the ECU through a dedicated wire. Because the ECU and Pump and Valve controller do not share a common ground, a throttle voltage reference wire and a throttle ground wire accompany the throttle input wire. The ECU calculates the differences in controller grounds in order to determine the throttle request by the Pump and Valve controller.

This code will set if:

- The excavator throttle ground voltage to the ECU goes below 2.0 volts.

If this code sets, the following will occur:

- The ECU will default excavator throttle ground voltage to 0 volts.

RG41221,00000CE –19–27MAR02–1/1

T14 - Excavator Throttle Ground Voltage Low

RG41221,00000D0 –19–17APR02–1/1

T14 - Excavator Throttle Ground Voltage Low Diagnostic Procedure

NOTE: This procedure is only used to diagnose the Excavator Throttles.

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information.* Visually inspect both 30-way ECU connectors, the throttle sensor connector, an any connector between for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Read DTCs: • Ignition ON, engine OFF. • Ignition ON, engine running.	**000029.04 reoccurs when engine is off and running:** GO TO ❸ **000029.04 reoccurs only when engine is running:** GO TO ❹ **000029.04 doesn’t reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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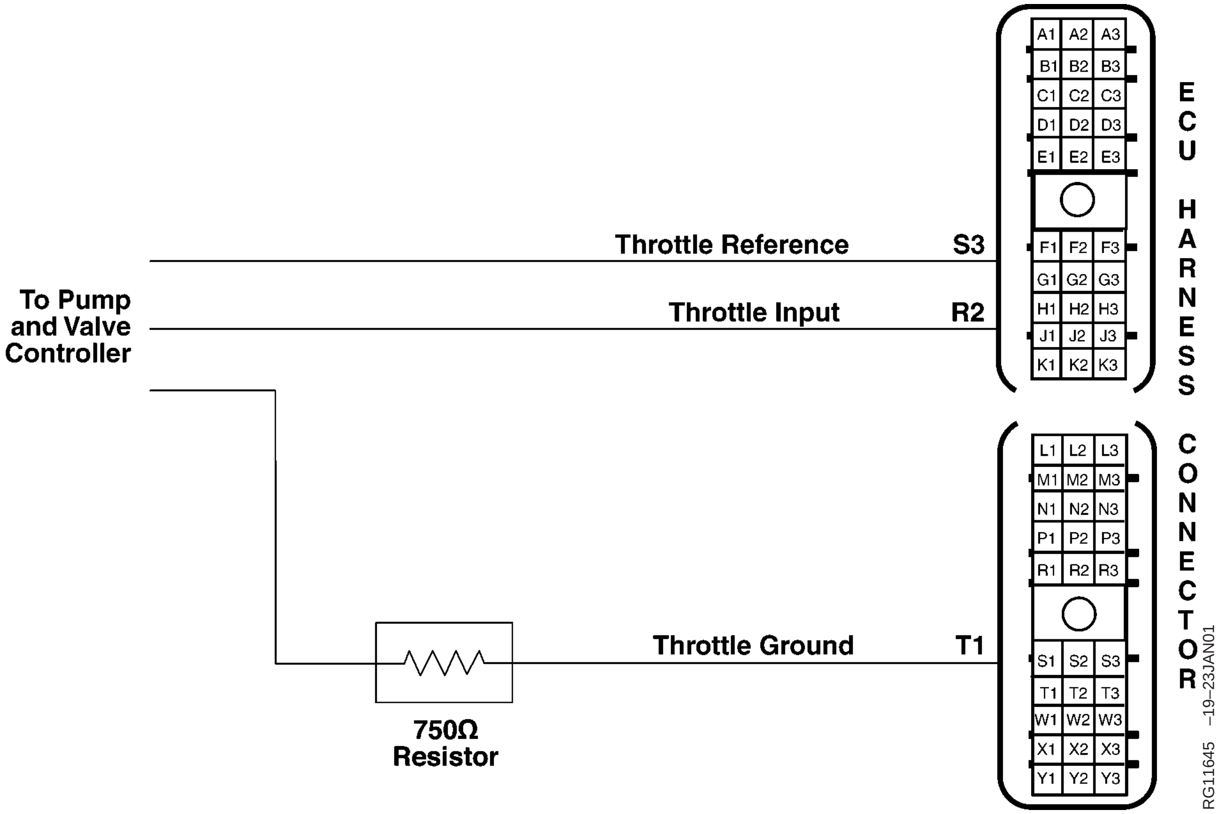
❸ **Throttle Ground Test**	*NOTE: For wiring and theory of operation, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure resistance between terminal T1 in the harness end of the 30-way ECU connector and the corresponding return terminal of the Pump and Valve controller connector.	**730 ohms or greater:** GO TO ❹ **Less than 730 ohms:** Short to ground in throttle ground wire between ECU and resistor OR Faulty ECU connector OR Faulty ECU – – –1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information.* There is a difference between grounds of the ECU and Pump and Valve controller. Check for loose ground connection at each controller.	– – –1/1

T15 - Excavator Throttle Input Voltage High



NOTE: *For more Excavator throttle wiring information, refer to machine manual.*

Excavator Throttle

- The Excavator uses an analog throttle to measure throttle position. This throttle is connected to the Pump and Valve controller, which sends throttle input information to the ECU through a dedicated wire. Because the ECU and Pump and Valve controller do not share a common ground, a throttle voltage reference wire and a throttle ground wire accompany the throttle input wire. The ECU calculates the differences in controller grounds in order to determine the throttle request by the Pump and Valve controller.

This code will set if:

- The excavator throttle input voltage to the ECU exceeds 4.9 volts.

If this code sets, the following will occur:

- The ECU will use a default “limp-home” throttle value that will allow only idle engine speed.

RG41221,00000CF –19–27MAR02–1/1

T15 - Excavator Throttle Input Voltage High

RG41221,00000D1 –19–17APR02–1/1

T15 - Excavator Throttle Input Voltage High Diagnostic Procedure

NOTE: This procedure is only used to diagnose the Excavator Throttle.

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH supporting information.* Visually inspect both 30-way ECU connectors, the throttle sensor connector, an any connector between for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

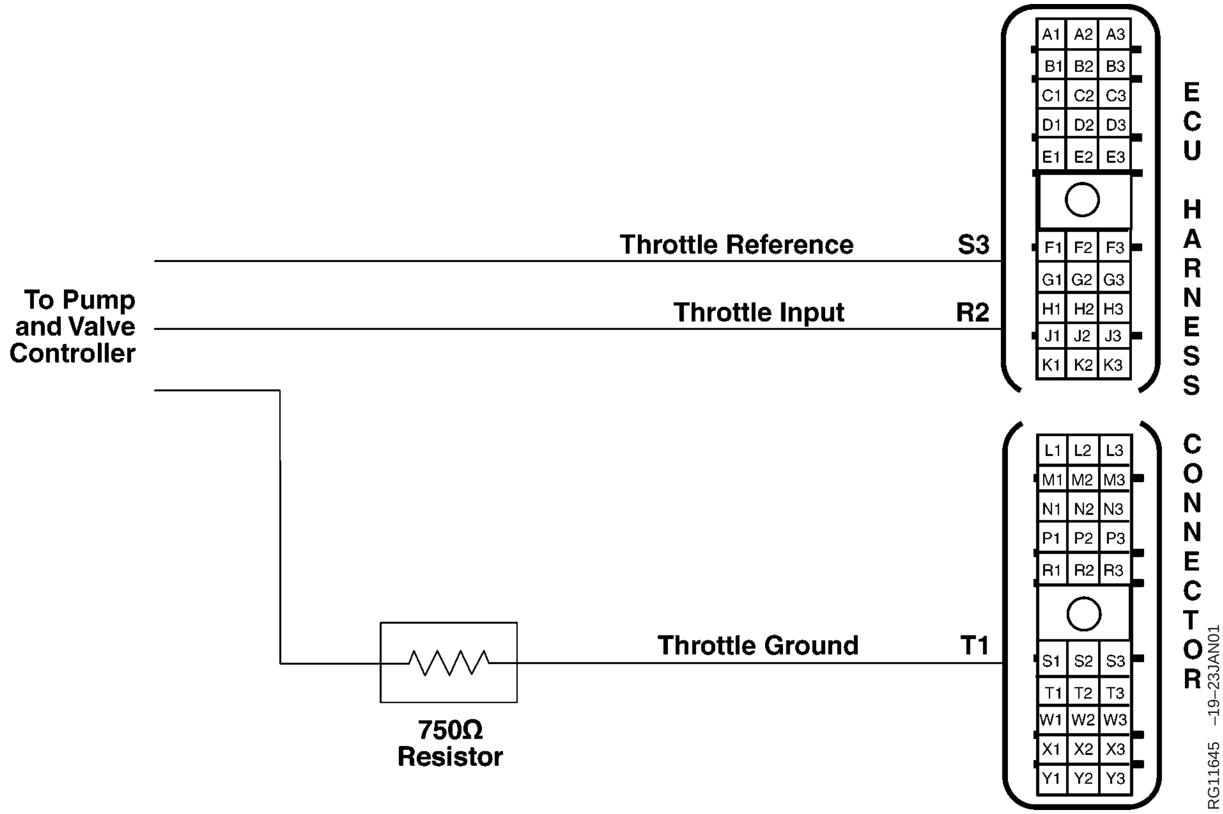
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH supporting information.* 1. Use the diagnostic gauge OR connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF. 3. Start the ECU diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. *NOTE: If DTCs 000029.03 or 000029.04 are active, follow those DTCs first.* 5. Read DTCs: • Ignition ON, engine OFF. • Ignition ON, engine running.	**000091.03 reoccurs when engine is off and running:** GO TO ❸ **000091.03 reoccurs only when engine is running:** GO TO ❹ **000091.03 doesn’t reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

– – –1/1

❸ **Throttle Signal Wire Test**	*NOTE: For wiring and theory of operation, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure voltage between terminal R2 in the harness end of the 30-way ECU connector and the ground pin of the Pump and Valve controller.	**4.0 volts or less:** GO TO ❹ **Greater than 4.0 volts:** Short to power in throttle signal wire OR Faulty Pump and Valve controller connector OR Faulty Pump and Valve controller – – –1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH supporting information.* There is a difference between grounds of the ECU and Pump and Valve controller. Check for loose ground connection at each controller.	– – –1/1

T16 - Excavator Throttle Input Voltage Low



04
160
90

NOTE: For more Excavator throttle wiring information, refer to machine manual.

Excavator Throttle

- The Excavator uses an analog throttle to measure throttle position. This throttle is connected to the Pump and Valve controller, which sends throttle input information to the ECU through a dedicated wire. Since the ECU and Pump and Valve controller do not share a common ground, a throttle voltage reference wire and a throttle ground wire accompany the throttle input wire. The ECU calculates the differences in controller grounds in order to determine the throttle request by the Pump and Valve controller.

This code will set if:

- The excavator throttle input voltage to the ECU goes below 0.1 volts.

If this code sets, the following will occur:

- The ECU will use a default “limp-home” throttle value that will allow only idle engine speed.

RG41221,00000D2 –19–27MAR02–1/1

T16 - Excavator Throttle Input Voltage Low

RG41221,00000D3 –19–17APR02–1/1

T16 - Excavator Throttle Input Voltage Low Diagnostic Procedure

NOTE: This procedure is only used to diagnose the Excavator Throttle.

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information.* Visually inspect both 30-way ECU connectors, the throttle sensor connector, an any connector between for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. *NOTE: If DTCs 000029.03 or 000029.04 are active, follow those DTCs first.* 5. Read DTCs: • Ignition ON, engine OFF. • Ignition ON, engine running.	**000091.04 reoccurs when engine is off and running:** GO TO ❸ **000091.04 reoccurs only when engine is running:** GO TO ❹ **000091.04 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Throttle Signal Wire Test**	*NOTE: For wiring and theory of operation, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure voltage between terminal R2 in the harness end of the 30-way ECU connector and the ground pin of the Pump and Valve controller.	**1.0 volts or greater:** GO TO ❹ **Less than 1.0 volts:** Open in throttle signal wire OR Faulty Pump and Valve controller connector OR Faulty Pump and Valve controller – – –1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information.* There is a difference between grounds of the ECU and MCX controller. Check for loose ground connection at each controller.	– – –1/1

T22 - Analog Throttle (A) Input Voltage Out of Range

Analog Throttle Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on the throttle position. Analog throttle voltage at low idle will be approximately 1.0 volts and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltage range may change per application.

This code will set if:

- The ECU detects a high or low out of range analog throttle (A) input voltage.

If this code sets, the following will occur:

- For engines with only one throttle, the ECU will ignore the analog throttle input and run the engine at low idle.
- For engines with multiple throttles, the ECU will ignore the faulty throttle's input and run entirely off the other throttle.

If this code sets:

- Check for other throttle DTCs and diagnose those first.
- Return throttle to 0% throttle position.
- Some applications require key OFF/restart cycle to clear the code.

RG41221,000032E –19–27MAR02–1/1

T23 - Multi-state Throttle Input Voltage Out of Range

Multi-state Throttle Switch

- Multi-state throttle is comprised of an idle switch that allows engine speed to be set to high or low idle. On some applications, there is a bump up and 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 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 ECU detects a high or low out of range multi-state throttle input voltage.

If this code sets, the following will occur:

- The engine will not run if this code is active.

If this code sets:

- Check to see if DTC 000091.03 or 4 is active and diagnose those first.
- Return throttle to 0% throttle position.

RG41221,000032D –19–27MAR02–1/1

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 earlier in this group.

Application	Diagnostic Procedure
Excavator	T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH
OEM	T5 - ANALOG THROTTLE (B) INPUT HIGH

RG41221,00000BB –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 earlier in this group.

Application	Diagnostic Procedure
Excavator	T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW
OEM	T6 - ANALOG THROTTLE (B) INPUT LOW

RG41221,00000BC –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 earlier in this group.

Application	Diagnostic Procedure
Excavator	T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH
Marine OEM, S450	
OEM	T3 - ANALOG THROTTLE (A) INPUT HIGH
Skidder	T1 - MULTI-STATE THROTTLE INPUT HIGH
7010 Tractor	T5 - ANALOG THROTTLE (B) INPUT HIGH

RG41221,00000BD –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 earlier in this group.

Application	Diagnostic Procedure
Excavator	T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW
Grader, 770/820/870/920 (Decelerator)	
OEM	T4 - ANALOG THROTTLE (A) INPUT LOW
Cane Harvester, 3500 Skidder	T2 - MULTI-STATE THROTTLE INPUT LOW
7010 Tractor	T6 - ANALOG THROTTLE (B) INPUT LOW
Marine OEM, S450	

RG41221,00000BE –19–22JAN03–1/1

000029.14 — Throttle Voltage Out of Range

Throttle voltage is out of 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 earlier in this group.

Application	Diagnostic Procedure
Skidder	T23 - MULTI-STATE THROTTLE INPUT VOLTAGE OUT OF RANGE

RG41221,00000C2 –19–22JAN03–1/1

000084.09 — Vehicle Speed Invalid or Missing

The vehicle speed is calculated by the RCU (Reverser Control Unit) by using tire size and transmission speed.

Vehicle Speed

- The vehicle speed is calculated by the RCU (Reverser Control Unit) by using tire size and transmission speed. Once the vehicle speed has been calculated, the RCU transmits the information to the ECU over the CAN bus.

DTC 000084.09 will set if:

- The ECU does not receive vehicle speed information or it is invalid.

If DTC 000084.09 sets, the following will occur:

- The ECU disables the transport boost curve to hold vehicle speeds below 25 kph (15.5 mph).
- Reduced power at higher speeds.
- DTC 000639.13 or 001069.09 may also be present. If either of these are present, diagnose them first.

If DTC 000084.09 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 later in this Group. If DTC 001069.09 also occurs, see DTC 001069.09 TIRE SIZE INVALID later 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.

RG41221,0000049 –19–17SEP02–1/1

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 earlier in this group.

Application	Diagnostic Procedure
Articulated Dump Truck	T9 - PWM THROTTLE INPUT LOW
Excavator	T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW
OEM	T2 - MULTI-STATE THROTTLE INPUT LOW
Feller Buncher, 608 Grader, 770/820/870/920 Loader Skidder 7010 Tractor	T4 - ANALOG THROTTLE (A) INPUT LOW
9120 Tractor	T9 - PWM THROTTLE INPUT LOW

RG41221,00000BF –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 earlier in this group.

Application	Diagnostic Procedure
Articulated Dump Truck	T9 - PWM THROTTLE INPUT LOW
Excavator	T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW
OEM	T2 - MULTI-STATE THROTTLE INPUT LOW
Feller Buncher, 608 Grader, 770/820/870/920 Loader Skidder 7010 Tractor	T4 - ANALOG THROTTLE (A) INPUT LOW
9120 Tractor	T9 - PWM THROTTLE INPUT LOW

RG41221,00000C0 –19–22JAN03–1/1

000091.08 — PWM Throttle Abnormal Pulse Width

ECU senses that 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 earlier in this group.

Application	Diagnostic Procedure
Articulated Dump Truck	T10 - PWM THROTTLE ABNORMAL PULSE WIDTH
9120 Tractor	T10 - PWM THROTTLE ABNORMAL PULSE WIDTH

RG41221,00000C3 –19–22JAN03–1/1

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 earlier in this group.

Application	Diagnostic Procedure
Combine	T7 - CAN THROTTLE INVALID
Self Propelled Forage Harvester	T7 - CAN THROTTLE INVALID
4920 Sprayer	T7 - CAN THROTTLE INVALID
8020 Tractor	T7 - CAN THROTTLE INVALID

RG41221,00000C1 –19–22JAN03–1/1

000091.14 — Throttle Voltage Out of Range

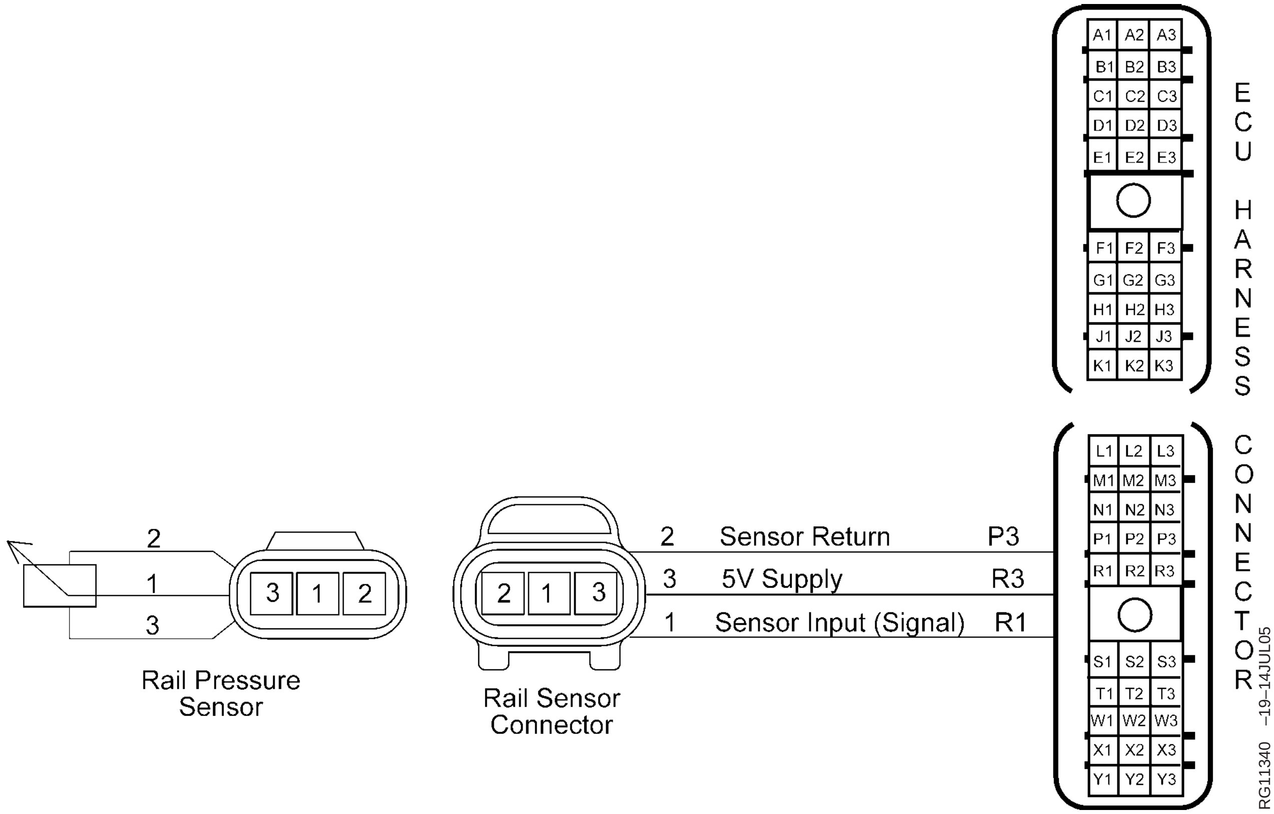
Throttle voltage is above or below the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure earlier in this group.

Application	Diagnostic Procedure
Feller Buncher, 608	T22 - ANALOG THROTTLE (A) INPUT VOLTAGE OUT OF RANGE
Skidder	T22 - ANALOG THROTTLE (A) INPUT VOLTAGE OUT OF RANGE

RG41221,00000C5 –19–22JAN03–1/1

000094.03 — Fuel Rail Pressure Input Voltage High



04
160
,104

NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Fuel Rail Pressure Sensor

- The fuel rail pressure sensor uses a pressure transducer to measure the fuel pressure within the rail. The rail pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

DTC 000094.03 will set if:

- Input voltage in the sensor circuit rises to a level that is outside its normal operating range. The voltage corresponds to a pressure that is higher than what is physically possible for rail pressure.

If DTC 000094.03 sets, the following will occur:

- The ECU will command the high pressure fuel pump to a default pressure of 160 mPa (1600 bar) (26,206 psi). Depending on the condition, the high pressure fuel pump will either pump more or less fuel.

NOTE: If this code is accompanied by 001080.04 Fuel Rail Pressure Sensor Supply Voltage Low, troubleshoot that code first, then retest.

DPSG,RG40854,301 –19–17APR02–1/1

000094.03 — Fuel Rail Pressure Input Voltage High

Input voltage in the sensor circuit rises to a level that is outside its normal operating range. Two things will cause this to happen: An open 5V supply circuit or an open input (signal) circuit.

RG41221,0000086 –19–17APR02–1/1

000094.03 Fuel Rail Pressure Input Voltage High Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000094.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH supporting information.* Without disconnecting connectors, visually inspect ECU connectors and the rail pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see DTC 000094.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000094.03 reoccurs:** GO TO ❸ **000094.03 doesn’t reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

– – –1/1

❸ **Sensor Test**	*NOTE: For wiring and theory of operation, see DTC 000094.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect the pressure sensor. 3. Using a multimeter, check resistance between the sensor's supply pin and the sensor's signal pin.	**2K to 3K ohms:** Sensor OK. GO TO ❹ **More than 3K ohms:** Replace sensor and retest. – – –1/1

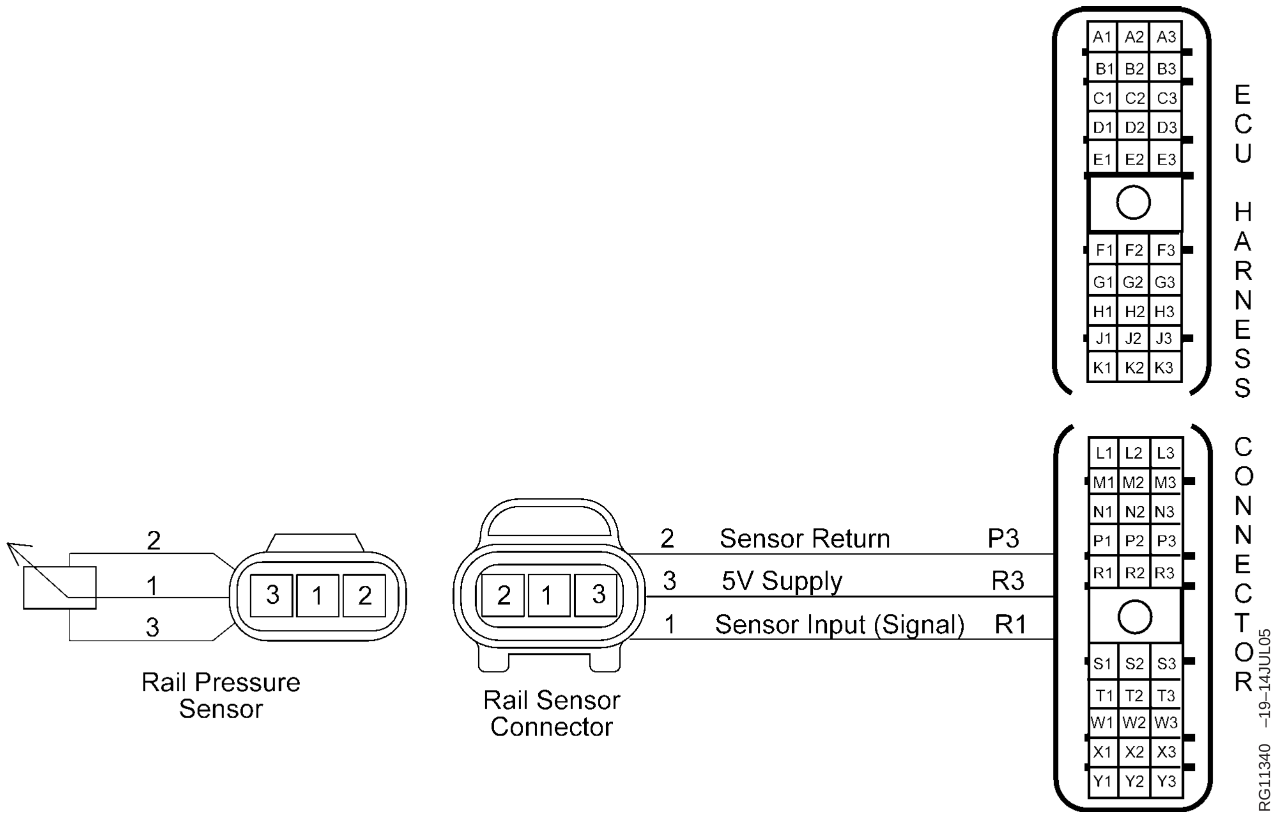
❹ **"Supply Circuit Open?" Test**	*NOTE: For wiring and theory of operation, see DTC 000094.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Pressure sensor still disconnected. 2. Ignition ON, engine OFF. 3. Using a multimeter, check supply voltage at the sensor connector.	**4.5-5.5V:** Supply circuit OK. Check input circuit. GO TO ❻ **Below 4.5-5.5V:** Open or high resistance in supply circuit. GO TO ❺ – – –1/1

❺ **"Supply Wiring Open?" Test**	*NOTE: For wiring and theory of operation, see DTC 000094.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the 30-pin connector at the ECU. Check for a bent pin or damaged connector terminal. 4. Using a multimeter, check continuity of the supply circuit.	**Less than 2 ohms:** Supply wiring OK. Test ECU. GO TO ❼ **Greater than 2 ohms:** Open or high resistance in the supply wiring or connectors. Repair and retest. – – –1/1

❻ **"Input (Signal) Circuit Open?" Test**	*NOTE: For wiring and theory of operation, see DTC 000094.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the 30-pin connector at the ECU. Inspect connector and ECU pins. 4. Using a multimeter, check continuity of the input circuit.	**Less than 2 ohms:** Input wiring OK. Remove and test ECU. GO TO ❼ **More than 2 ohms:** Open or high resistance in the input wiring or connectors. Repair and retest. – – –1/1

❼ **ECU Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between: • ECU pins R3-P3 • ECU pins R1-P3	**Both tests between 100K to 250K ohms:** ECU OK. Reinstall and retest. **Either test below 100K ohms or above 250K ohms:** Faulty ECU. Replace and retest. – – –1/1

000094.04 — Fuel Rail Pressure Input Voltage Low



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Fuel Rail Pressure Sensor

- The fuel rail pressure sensor uses a pressure transducer to measure the fuel pressure within the rail. The rail pressure intake voltage varies as fuel pressure varies. As the pressure decreases, the input voltage to the ECU decreases. For further fuel rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

DTC 000094.04 will set if:

- Input voltage in the sensor circuit drops to a level that is outside its normal operating range. The voltage corresponds to a pressure that is lower than what is physically possible for rail pressure.

If DTC 000094.04 sets, the following will occur:

- The ECU will command the high pressure fuel pump to a default pressure of 160 MPa (1600 bar) (26,206 psi). Depending on the condition, the high pressure fuel pump will either pump more or less fuel.

NOTE: If this code is accompanied by 001080.03 Fuel Rail Pressure Sensor Supply Voltage High, troubleshoot that code first, then retest.

DPSG,RG40854,302 –19–17APR02–1/1

000094.04 — Fuel Rail Pressure Input Voltage Low

Input voltage in the sensor circuit drops to a level that is outside its normal operating range. Three things will cause this to happen: An open return circuit, the input (signal) circuit shorted to ground, or the 5V supply circuit shorted to ground.

RG41221,0000087 –19–17APR02–1/1

000094.04 Fuel Rail Pressure Input Voltage Low Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.* Visually inspect ECU connectors and the sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000094.04 reoccurs:** GO TO ❸ **000094.04 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Sensor Test**	*NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect the pressure sensor. 3. Using a multimeter, check resistance between: • the sensor's supply terminal and a good chassis ground Is resistance less than 100K ohms? • the sensor's signal terminal and a good chassis ground Is resistance less than 100K ohms? • the sensor's return terminal and the sensor's supply terminal Is resistance more than 15K ohms?	**If No to all:** Sensor OK. GO TO ❹ **If Yes to any:** Replace sensor and retest. – – –1/1

❹ **"Return (Ground) Circuit Open?" Test**	*NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Using a multimeter, check resistance between the sensor's return terminal in the harness connector and a good chassis ground.	**Less than 2 ohms:** Return circuit OK. Check supply circuit. GO TO ❻ **More than 2 ohms:** Open or high resistance in return circuit or faulty ECU. GO TO ❺ – – –1/1

❺ **"Return (Ground) Wiring Open?" Test**	*NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Remove the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Using a multimeter, check resistance between the sensor return terminal in the harness connector and the ECU connector.	**Less than 2 ohms:** Return circuit wiring OK. Remove and test ECU. GO TO ❿. **More than 2 ohms:** Open or high resistance in connector or ground wiring. Repair and retest. – – –1/1

❻ **“Supply Circuit Grounded?” Test**	*NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Using a multimeter, check resistance between the supply terminal in the sensor harness connector and a good chassis ground.	**Resistance greater than 100K ohms:** Supply circuit OK. Check input circuit. GO TO ❽ **Resistance less than 100K ohms:** Low resistance to ground in supply circuit. GO TO ❼ – – –1/1

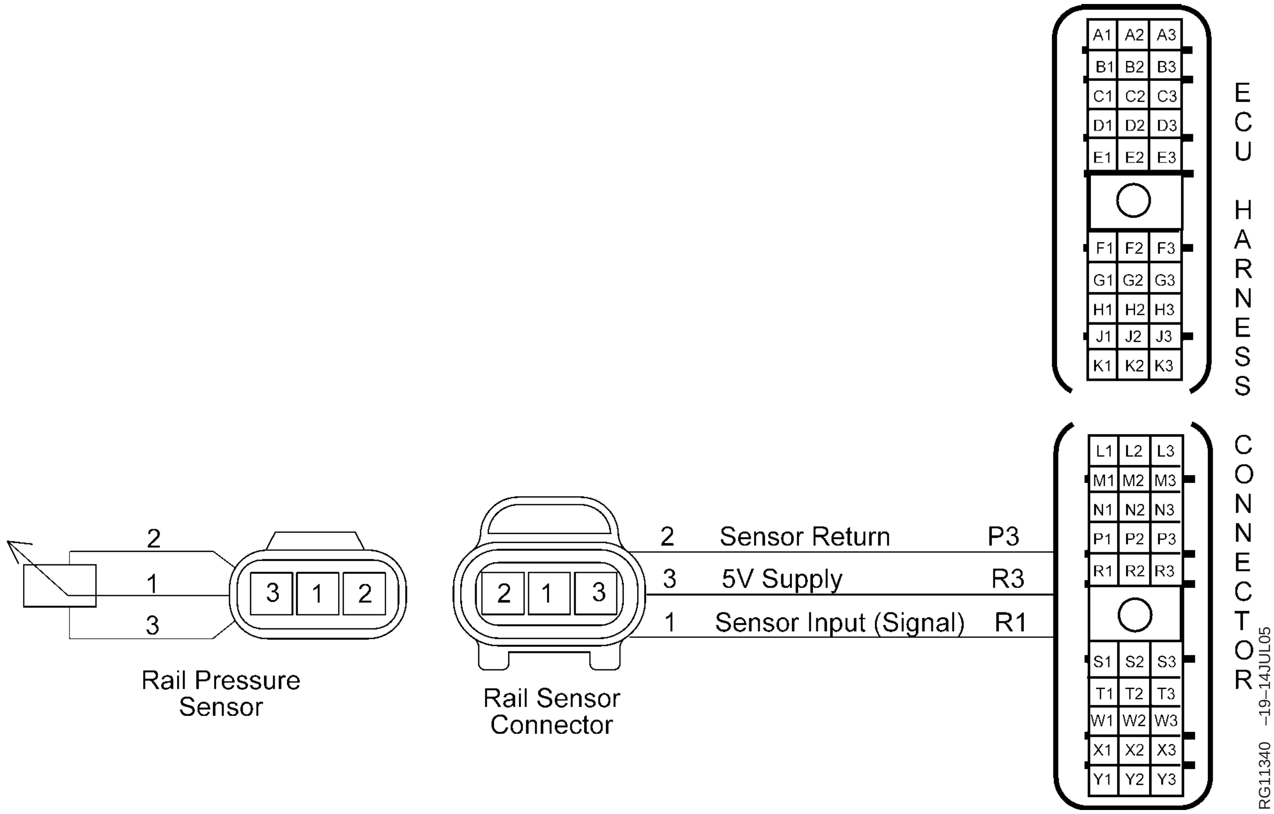
❼ **“Supply Wiring Grounded?” Test**	*NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Remove the circuit’s 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Using a multimeter, check resistance between the sensor supply terminal in the sensor harness connector and a good chassis ground.	**Resistance less than 50K ohms:** Low resistance to ground in supply wiring or bad connector. Repair and retest. **Resistance greater than 50K ohms:** Supply circuit wiring and connectors OK. Remove and test ECU. GO TO ❿. – – –1/1

❽ **“Input (Signal) Circuit Grounded?” Test**	*NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Using a multimeter, check resistance between the input terminal in the sensor harness connector and a good chassis ground.	**Resistance less than 1M ohms:** Low resistance to ground in input circuit. GO TO ❾. **Resistance greater than 1M ohms:** Input circuit OK. Remove and test ECU. GO TO ❿ – – –1/1

❾ **“Input (Signal) Wiring Grounded?” Test**	*NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Remove the circuit’s 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Using a multimeter, check resistance between the input terminal in the sensor harness connector and a good chassis ground.	**Resistance less than 1M ohms:** Low resistance to ground in input wiring or bad connector. Repair and retest. **Resistance greater than 1M ohms:** Input wiring and connectors OK. Remove and test ECU. GO TO ❿. – – –1/1

⓾ **ECU Test**	*NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between: • ECU pins P3-C2 • ECU pins R3-P3 • ECU pins R1-P3	**If any one of the following are true:** **P3-C2 greater than 2 ohms** **R3-C2 less than 100K ohms** **R1-C2 less than 25K ohms** Faulty ECU. Replace and retest. Otherwise, reinstall ECU and retest. – – –1/1

000094.10 — Fuel Rail Pressure Loss Detected



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Fuel Rail Pressure Sensor

- The fuel rail pressure sensor uses a pressure transducer to measure the fuel pressure within the rail. The rail pressure intake voltage varies as rail pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

DTC 000094.10 will set if:

- The ECU detects a sudden decrease of 150 MPa (1500 bar) (21755 psi)/second in fuel rail pressure while the engine is not injecting or pumping. This usually occurs when the engine is shifted from high idle or a heavy load to low idle.

If DTC 000094.10 sets, the following will occur:

- Engine may not start due to lack of pressure.
- Engine may start and run normal when no load is applied to engine.

DPSG,RG40854,869 –19–18AUG00–1/1

000094.10 — Fuel Rail Pressure Loss Detected

The ECU detects a sudden decrease in fuel rail pressure while the engine is not injecting or pumping.

RG41221,0000088 –19–03APR03–1/1

DTC 000094.10 Fuel Rail Pressure Loss Detected Diagnostic Procedure

NOTE: If DTC 000094.10 is accompanied with 000094.03, 000094.04, 001347.05, and/or 001348.05, follow that diagnostic procedure first.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000094.10 FUEL RAIL PRESSURE LOSS DETECTED supporting information.* Visually inspect ECU connectors and the fuel rail pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Tampering Check**	*NOTE: For wiring and theory of operation, see DTC 000094.13 FUEL RAIL PRESSURE HIGHER THAN EXPECTED supporting information.* Recently adjustments or components have been added to the fuel system to supply addition power.	**No tampering has occurred:** GO TO ❸ **Tampering has occurred:** Remove added components or change adjustment to normal state AND Call your DTAC representative

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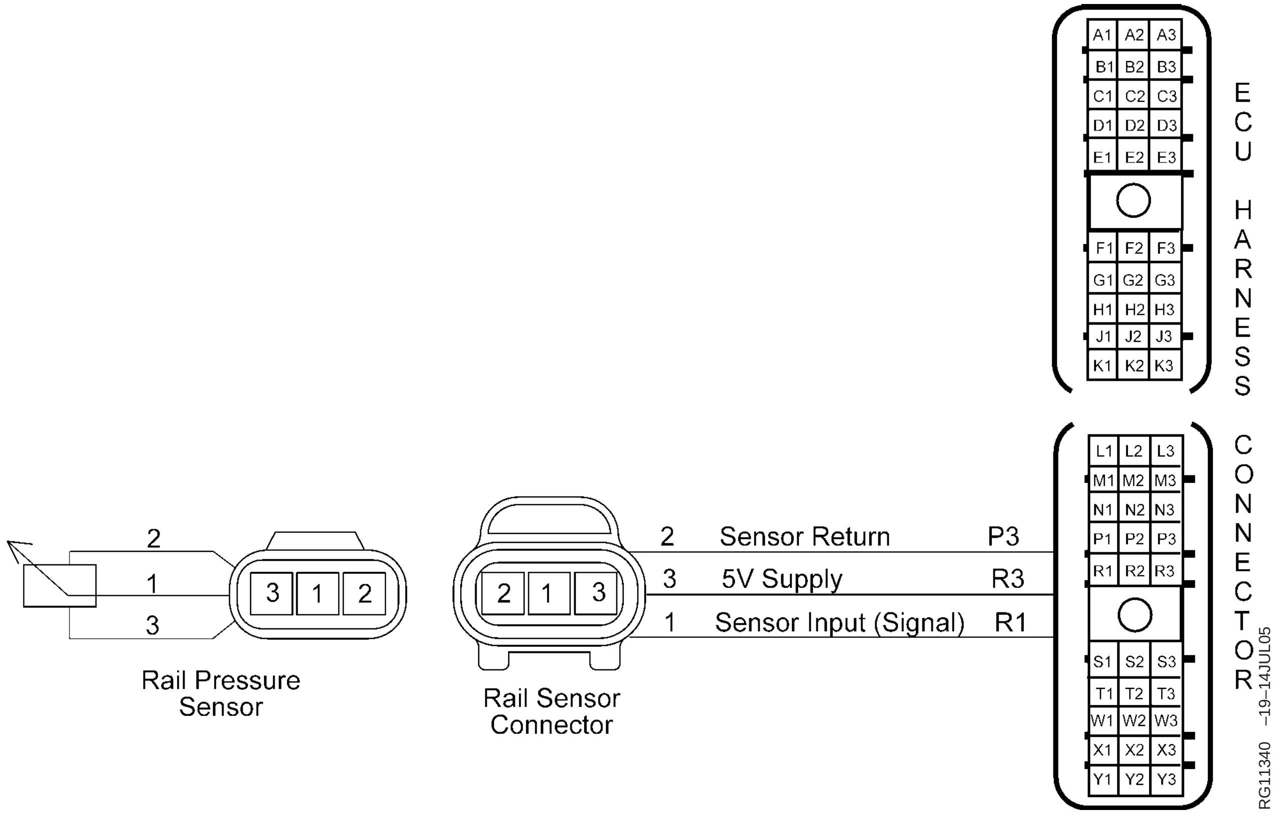
❸ **Fuel Lines/Fittings Leakage Test**	*NOTE: For wiring and theory of operation, see DTC 000094.10 FUEL RAIL PRESSURE LOSS DETECTED supporting information.* 1. Ignition ON, engine running. 2. Inspect all fuel lines and fittings for leakage.	**No fuel leak(s) present:** GO TO ❹ **Fuel leak(s) present:** Tighten loose fitting to proper specification and retest. – – –1/1

❹ **HPCR Pressure Relief Valve Test**	*NOTE: For wiring and theory of operation, see DTC 000094.10 FUEL RAIL PRESSURE LOSS DETECTED supporting information.* **CAUTION: 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.** 1.Before removing pressure relief valve, turn engine OFF and let sit for 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail. 2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure relief valve. 3. Disconnect fuel return line fitting from the pressure relief valve. Do NOT remove the pressure relief valve. 4. Plug the fuel return fitting. 5. Run a clear line from a suitable container for diesel fuel to the pressure relief valve. 6. Ignition ON, engine running. 7. Check fuel flow at flow limiter valve.	**Minimal or no fuel present:** GO TO ❺ **Fuel flow is present:** Faulty pressure relief valve. Replace pressure relief valve and retest. See REMOVE AND INSTALL HPCR PRESSURE RELIEF VALVE in Group 090 earlier in this manual. – – –1/1

❺ **Faulty Electronic Injector Test**	*NOTE: For wiring and theory of operation, see DTC 000094.10 FUEL RAIL PRESSURE LOSS DETECTED supporting information.* 1. Ignition ON, engine running. 2. Using the diagnostic software, perform the Cylinder Cutout Test. For instruction, see ENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST earlier in this Group.	**All cylinders react with slight misfire:** Faulty ECU **One cylinder does not show a misfire:** Faulty EI – – –1/1

000094.17 — Fuel Rail Pressure Not Developed



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Fuel Rail Pressure Sensor

- The fuel rail pressure sensor uses a pressure transducer to measure the rail pressure within the fuel rail. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

DTC 000094.17 will set if:

- The ECU does not detect 10 MPa (100 Bar) (1450 psi) of fuel rail pressure after cranking the engine for approximately 3 seconds.

If DTC 000094.17 sets, the following will occur:

- Engine will not start without adequate fuel rail pressure.

DPSG,RG40854,870 –19–17APR02–1/1

000094.17 — Fuel Rail Pressure Not Developed

The ECU does not detect specified fuel rail pressure after cranking the engine for approximately 3 seconds.

RG41221,0000089 –19–17APR02–1/1

000094.17 Fuel Rail Pressure Not Developed Diagnostic Procedure

NOTE: If DTC 000094.17 is accompanied with, DTC 001347.05, and/or DTC 001348.05, follow that diagnostic procedure first.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.* Without disconnecting, visually inspect the ECU connectors and the fuel rail pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Preliminary Check**	*NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.* Before using this diagnostic procedure, check the following: 1. If fuel system has been recently opened (filter changed, line removed etc.) perform fuel system bleed procedure. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—)in Section 05, Group 150 later in this manual and retest. 2. Ensure that there is an adequate amount of fuel in the fuel tank. 3. Check that fuel filters are full. 4. Check that fuel filters are not plugged. 5. Check for blocked fuel line from tank to primary filter.	**No problem found:** GO TO ❸ **Problem found:** Repair and retest.

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❸ **Fuel Lines/Fitting Leakage Test**	*NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.* 1. Ignition ON, engine cranking 2. Inspect all fuel lines and fittings for leakage.	**No fuel leak(s) present:** GO TO ❹ **Fuel leak(s) present:** Tighten loose fitting to proper specification and retest. – – –1/1

❹ **Check Pump Control Valve Connections**	*NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.* Verify that the PCVs are wired correctly. If the two PCV connectors are reversed, the engine will crank, but won't start. At least one of the connectors should be labeled. PCV #1 is located closest to the front of the engine. If unsure if the connectors are reversed, swap them and try top start the engine. If engine does not start, return PCV connector to original positions.	**Connections are correct:** GO TO ❺ **Connections reversed:** Reverse connections and retest. – – –1/1

❺ **Final Fuel Filter Pressure Test**	*NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.* 1. Ignition OFF. 2. Connect proper pressure gauge from Universal Pressure Kit JT05412 to diagnostic port on final filter base (—246269) or injection pump (246270—) as applicable. 3. Ignition ON, engine cranking. 4. Using gauge, read pressure.	**Pressure between 100-140 kPa (1-1.4 bar) (15-20 psi):** GO TO ⓬ **Pressure below 100 kPa (1 bar) (15 psi):** GO TO ❻ – – –1/1

❻ **Restricted Fuel Line Test**	*NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.* **CAUTION: Fuel in lines may be under high pressure. Use extreme caution while opening fuel lines. Let engine sit for several minutes after cranking or running engine prior to opening fuel lines.** Check fuel lines between the fuel tank and the high pressure fuel pump for restrictions.	**No restrictions found:** GO TO ❼. **Restrictions found:** Clean fuel lines and retest. – – –1/1

❼ **Pressure-Test Low-Pressure Fuel System**	1. Ignition OFF. 2. Attach pressure gauge to diagnostic port on fuel pump. 3. Operate hand primer pump until pressure builds to at least 20 psi.	**Pressure develops:** GO TO ⓬ **Pressure dissapates quickly or does not develop:** GO TO❽

– – –1/1

❽ **Fuel Hand Primer Test**	1. Ignition OFF. 2. Remove fuel line from hand primer pump. 3. Remove hand primer pump. 4. Disassemble and examine hand primer pump for contaminants and missing or damaged parts. Replace if necessary. 5. Re-assemble and install hand primer pump. 6. Attach pressure gauge to diagnostic port on fuel pump.. 7. Operate hand primer pump until pressure builds to at least 20 psi.	**Pressure develops:** Bleed fuel system and retest. **Pressure dissapates quickly or does not develop:** GO TO❾ **Contaminants found in valve:** Replace valve and check fuel quality. See CHECK FUEL SUPPLY QUALITY later in this Group.

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❾ **Inspect Check Valves**	1. Ignition OFF. 2. Remove fuel line from check valve on pump inlet and check valve on filter. 3. Remove check valves and examine valves for contaminants. 4. Clean valves or replace any damaged valves. 5. Install check valves. 6. Install fuel lines. 7. Operate hand primer pump until pressure builds to at least 20 psi.	**Contaminants found in valve(s):** Replace valve(s) and check fuel quality. See CHECK FUEL SUPPLY QUALITY later in this Group. **Pressure develops:** Bleed fuel system and retest. **Pressure dissapates quickly or does not develop:** GO TO❿.

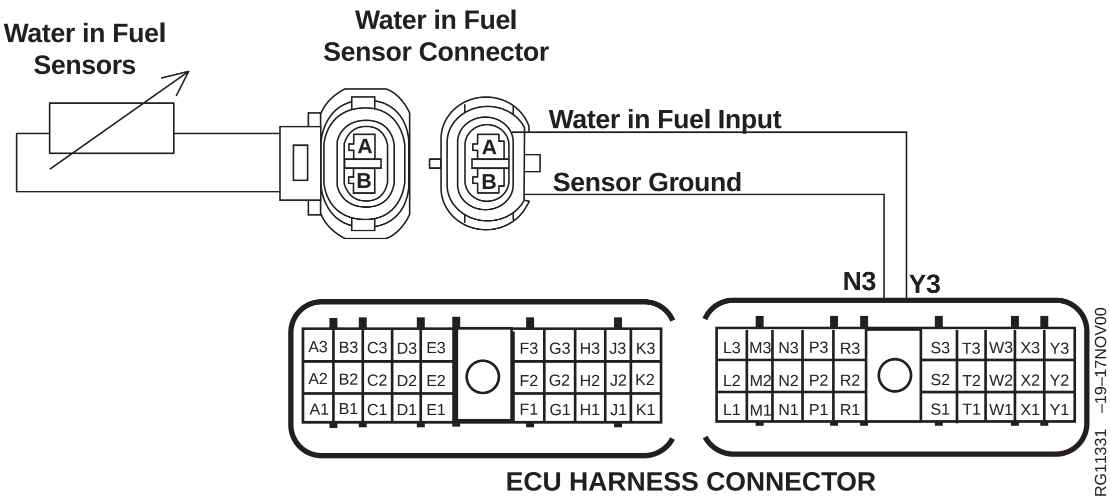
– – –1/1

10 Pump Overflow Valve test	1. Ignition OFF. 2. Remove fuel line(s) from overflow valve. 3. Cover valve with a cloth. 4. Attach gage to diagnostic port on fuel pump. 5. Operate hand primer pump and observe when fuel leaks from valve.	**Valve allows fuel to pass below 25 psi:** Replace valve. Bleed fuel system and retest. **Valve does not leak, pressure does not build or hold 25 psi:** GO TO 11. – – –1/1

11 Filter Relief Valve test	1. Ignition OFF. 2. Remove fuel line from filter relief valve. 3. Attach gage to diagnostic port on fuel pump. 4. Place one end of a hose on relief valve and other end in a container. 5. Operate hand primer pump and observe if fuel leaks from valve.	**Valve holds a minimum of 25 psi:** Faulty fuel pump. Replace and retest. **Valve allows fuel to pass below 25 psi:** Replace valve. Bleed fuel system and retest. – – –1/1

12 HPCR Pressure Relief Valve Test	*NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.* **CAUTION: 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.** 1.Before removing pressure relief valve, turn engine OFF and let sit for 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail. 2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure relief valve. 3. Disconnect fuel return line fitting at the fuel leak-off line from the pressure relief valve. Do NOT remove the pressure relief valve. 4. Run a clear line from a suitable container for diesel fuel to the pressure relief valve 5. Ignition ON, engine running. 6. Check fuel flow at pressure relief valve.	**Minimal or no fuel present:** Faulty high pressure fuel pump. Replace and retest. **Fuel flow present:** Faulty pressure relief valve. Replace pressure relief valve and retest. See REMOVE AND INSTALL HPCR PRESSURE RELIEF VALVE in Group 090 earlier in this manual. – – –1/1

000097.00 — Water in Fuel Continuously Detected



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Water in Fuel (WIF) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system on the principle that water is a better conductor of electricity than is fuel. When water is present in the fuel filter sediment bowl, resistance to ground in the WIF circuit is decreased, resulting in a voltage drop in the input (supply) circuit. For further WIF sensor information, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140.

DTC 000097.00 will set if:

- The WIF limit is above a predetermined quantity for an extended period of time.

If DTC 000097.00 sets, the following will occur:

- Engine protection is enabled. See ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  – With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  – With Derate Feature: On some early OEM applications, the engine derates 40% per minute until the engine is running at 40% of full power. Other OEM applications, the engine derates 20% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

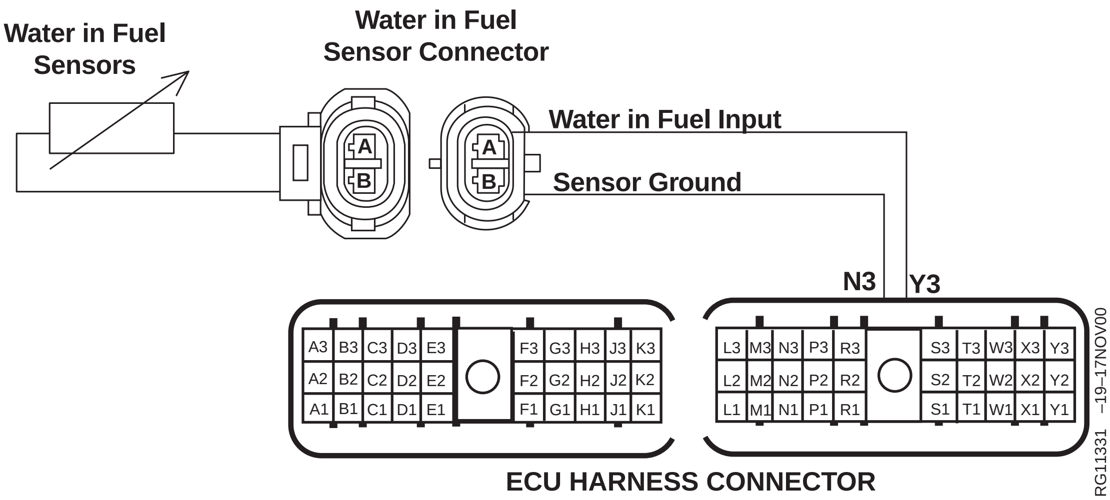
RG41221,00000D9 –19–17APR02–1/1

000097.00 — Water in Fuel Continuously Detected

The procedure for 000097.00 is identical to 000097.31.
GO TO 000097.31 — Water in Fuel Detected Diagnostic Procedure

RG41221,00000DA –19–17APR02–1/1

000097.03 — Water in Fuel Input Voltage High



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Water in Fuel (WIF) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system on the principle that water is a better conductor of electricity than is fuel. When water is present in the fuel filter sediment bowl, resistance to ground in the WIF circuit is decreased, resulting in a voltage drop in the input (supply) circuit. For further WIF sensor information, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140.

DTC 000097.03 will set if:

- The WIF input voltage exceeds the sensor's high voltage specification. The voltage corresponds to an amount of water in fuel that is not possible.

If DTC 000097.03 sets, the following will occur:

- ECU's WIF engine protection feature disabled.

DPSG,RG40854,306 –19–17APR02–1/1

000097.03 — Water in Fuel Input Voltage High

The input voltage in the sensor circuit rises to a level that is outside the normal operating range. Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open input or open ground circuit. Less probable is a short from the 5V input wire to a higher voltage source.

RG41221,000008A –19–17APR02–1/1

000097.03 Water In Fuel Signal Voltage High Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL INPUT VOLTAGE HIGH supporting information.* Without disconnecting, visually inspect the ECU connectors and the WIF sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL INPUT VOLTAGE HIGH supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000097.03 reoccurs:** GO TO ❸ **000097.03 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **"Sensor Open?" Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect the WIF sensor. 3. Using a multimeter, check resistance between the sensor terminals.	**Less than 250K ohms:** Sensor OK.GO TO ❹ **More than 250K ohms:** Replace sensor and retest. – – –1/1

❹ **Input Circuit "OK or Not OK" Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL INPUT VOLTAGE HIGH supporting information.* 1. Sensor still disconnected. 2. Ignition ON, engine OFF. 3. Using a multimeter, check voltage between the input terminal of the sensor connector and a good chassis ground.	**4.5V - 5.5V:** Input circuit OK. Check ground circuit. GO TO ❼ **Below 4.5V:** Open or high resistance in input circuit. GO TO ❻ **Significantly above 5.5V:** Input circuit shorted to a power source. GO TO ❺ – – –1/1

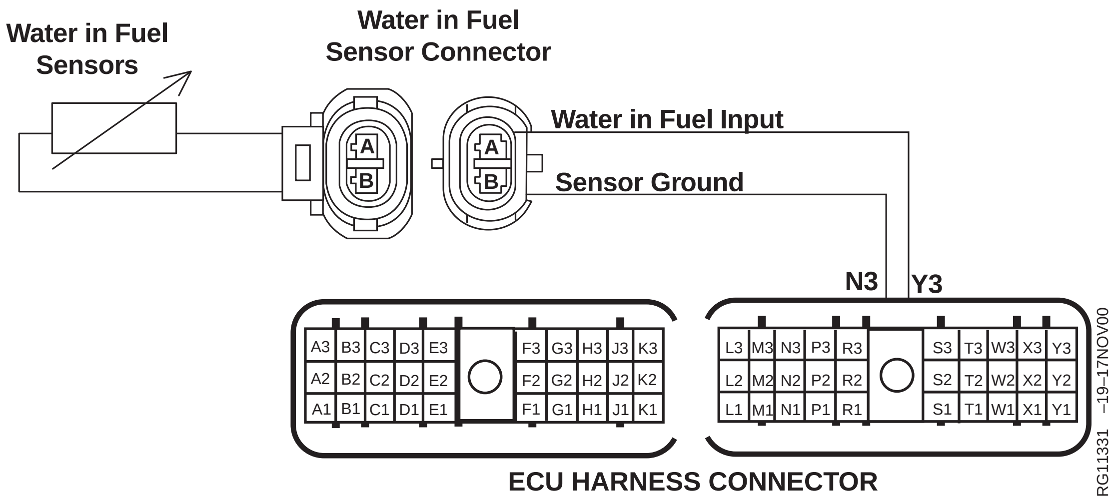
❺ **Input Wiring "Shorted to Voltage Source?" Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL INPUT VOLTAGE HIGH supporting information.* 1. Ignition ON 2. Sensor still disconnected. 3. Disconnect the 30-pin connectors at the ECU. Inspect connectors and ECU pins. 4. Using a multimeter, check voltage of the input circuit in the harness.	**Any voltage:** Input wiring shorted to voltage source. Repair and retest. **Zero volts:** Remove and test ECU. GO TO ❽ – – –1/1

❻ **Input Circuit "Harness Wiring Open?" Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the 30-pin connector at the ECU. Inspect connector and ECU pins. 4. Using a multimeter, check continuity of the input circuit in the harness.	**2 ohms or less:** Input wiring OK. Remove and test ECU. GO TO ❽ **More than 2 ohms:** Open or high resistance in the input wiring. Repair and retest. – – –1/1

❼ **Ground Circuit "Harness Wiring Open?" Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the 30-pin connector at the ECU. Inspect connector and ECU pins. 4. Using a multimeter, check continuity of the ground circuit in the harness.	**2 ohms or less:** Ground wiring OK. Remove and test ECU. GO TO ❽ **More than 2 ohms:** Open or high resistance in ground wiring. Repair and retest. – – –1/1

❽ **ECU Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL INPUT VOLTAGE HIGH supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the Y3 and the N3 pin in the ECU.	**9K to 14K ohms:** ECU OK. Reinstall and retest. **Below 9K or above 14K ohms:** Faulty ECU. Replace and retest. – – –1/1

000097.04 — Water in Fuel Input Voltage Low



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Water in Fuel (WIF) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system on the principle that water is a better conductor of electricity than is fuel. When water is present in the fuel filter sediment bowl, resistance to ground in the WIF circuit is decreased, resulting in a voltage drop in the input (supply) circuit. For further WIF sensor information, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140.

DTC 000097.04 will set if:

- The WIF input voltage drops below the sensor's low voltage specification. The voltage corresponds to an amount of water in fuel that is not possible.

If DTC 000097.04 sets, the following will occur:

- ECU's WIF engine protection feature disabled.

DPSG,RG40854,307 –19–17APR02–1/1

000097.04 — Water in Fuel Input Voltage Low

Input voltage in the sensor circuit drops to a level that is outside its normal operating range. Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault is low resistance to ground (grounded input circuit).

RG41221,000008B –19–17APR02–1/1

000097.04 Water In Fuel Signal Voltage Low Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL INPUT VOLTAGE LOW supporting information.* Without disconnecting, visually inspect the ECU connectors and the WIF sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL INPUT VOLTAGE LOW supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000097.04 reoccurs:** GO TO ❸ **000097.04 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **"Sensor Shorted?" Test**	*NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect the WIF sensor. 3. Using a multimeter, check resistance between the sensor terminals.	**More than 200K ohms:** Sensor not shorted. GO TO ❹ **Less than 200K ohms:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

❹ **"Sensor Grounded?" Test**	*NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Sensor disconnected. 3. Using a multimeter, check resistance between each sensor terminal and a good chassis ground.	**Resistance less than 200K ohms:** Low resistance to ground. Replace sensor and retest. **Resistance greater than 200K ohms:** Sensor not grounded. Check wiring. GO TO ❺ – – –1/1

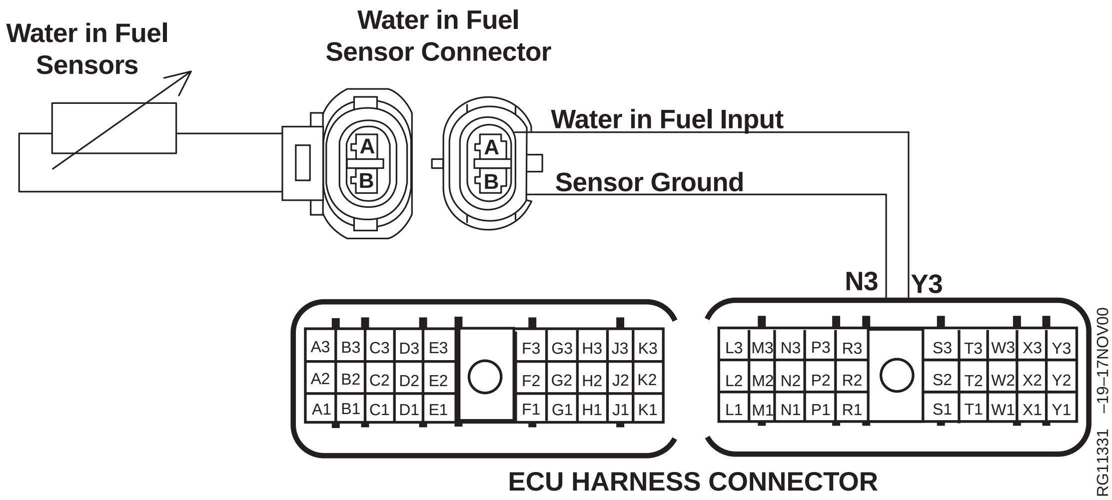
04
160
,132

❺ **"Input Circuit Grounded?" Test**	*NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Using a multimeter, check resistance between the sensor connector input terminal and a good chassis ground.	**Resistance less than 5K ohms:** Low resistance to ground in input circuit. GO TO ❻ **Resistance greater than 5K ohms:** Input wiring OK. Remove and test ECU. GO TO ❼ – – –1/1

❻ **Input Circuit "Harness Wiring Grounded?" Test**	*NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the 30-pin connector at the ECU. Inspect connector and ECU pins. 4. Using a multimeter, check resistance between the input terminal in the sensor harness connector and a good chassis ground.	**Resistance less than 1M ohms:** Low resistance to ground in input wiring. Repair and retest. **Resistance greater than 1M ohms:** Input wiring OK. Remove and test ECU. GO TO ❼ – – –1/1

❼ **ECU Test**	*NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL INPUT VOLTAGE LOW supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between pins Y3 and N3 in the ECU.	**9K to 14K ohms:** ECU OK. Reinstall and retest. **Below 9K or above 14K ohms:** Faulty ECU. Replace and retest. – – –1/1

000097.16 — Water in Fuel Detected



NOTE: *Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*

Water in Fuel (WIF) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system on the principle that water is a better conductor of electricity than is fuel. When water is present in the fuel filter sediment bowl, resistance to ground in the WIF circuit is decreased, resulting in a voltage drop in the input (supply) circuit. For further WIF sensor information, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140.

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:

- Engine protection is enabled. See ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  – With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

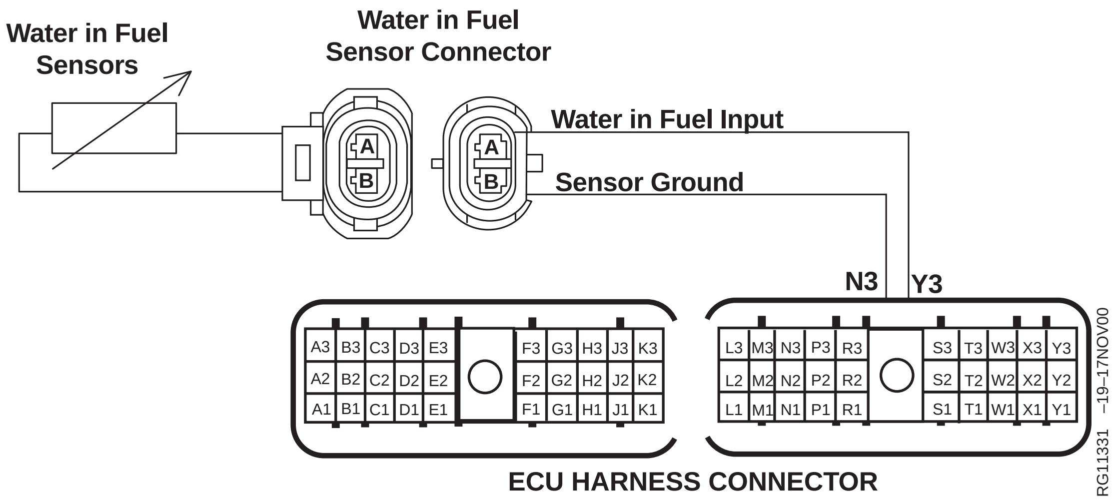
DPSG,RG40854,308 –19–17APR02–1/1

000097.16 — Water in Fuel Detected

The procedure for 000097.16 is identical to 000097.31.
GO TO 000097.31 — Water in Fuel Detected
Diagnostic Procedure

RG41221,000008C –19–17APR02–1/1

000097.31 — Water in Fuel Detected



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Water in Fuel (WIF) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system on the principle that water is a better conductor of electricity than is fuel. When water is present in the fuel filter sediment bowl, resistance to ground in the WIF circuit is decreased, resulting in a voltage drop in the input (supply) circuit. For further WIF sensor information, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140.

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:

- With Derate Feature: On some early OEM applications, the engine derates 40% per minute until the engine is running at 40% of full power. Other OEM applications, the engine derates 20% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.
- On engine without engine protection, a warning light will flash.
- With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.

RG41221,00000F2 –19–18APR02–1/1

000097.31 — Water in Fuel Detected

The WIF is above a predetermined quantity at any given time.

RG41221,00000F4 –19–18APR02–1/1

000097.31 Water In Fuel Detected Diagnostic Procedure

– – –1/1

❶ **Water in Fuel Checks**	*NOTE: For wiring and theory of operation, 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 • Moisture buildup over time	**Cause of DTC found:** Repair problem, drain sediment bowl, and retest **No cause of DTC located:** Check for sensor or wiring problem. GO TO ❷

– – –1/1

❷ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000097.31 WATER IN FUEL DETECTED supporting information.* Without disconnecting, visually inspect the ECU connectors and the WIF sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❸ **Problem found:** Repair and retest.

– – –1/1

❸ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see DTC 000097.31 WATER IN FUEL DETECTED supporting information.* 1. Use the diagnostic gauge OR 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000097.31 reoccurs:** GO TO ❹ **000097.31 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❹. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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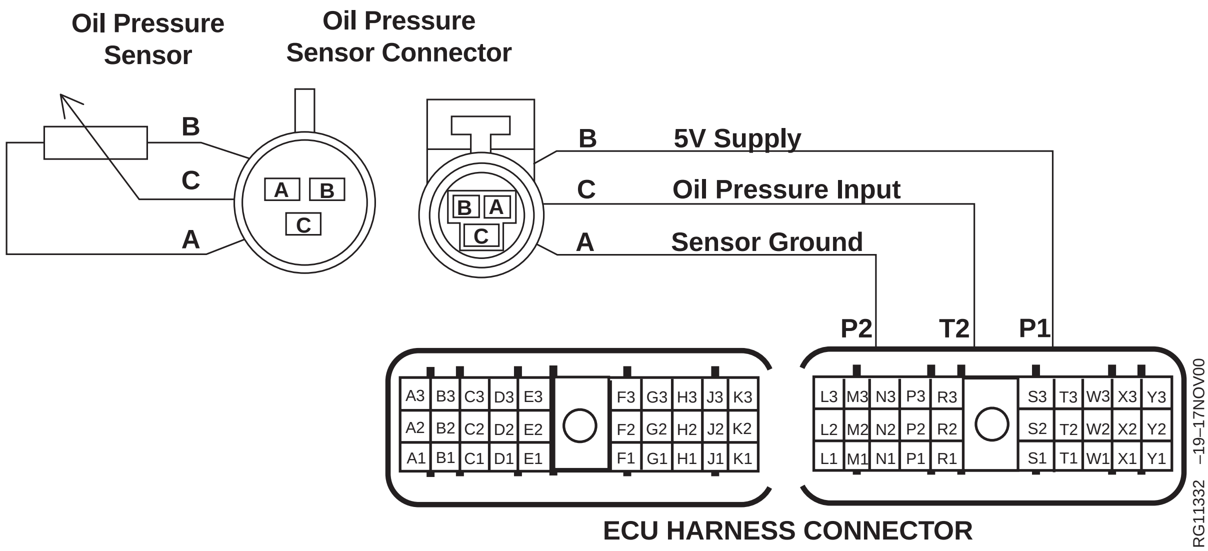
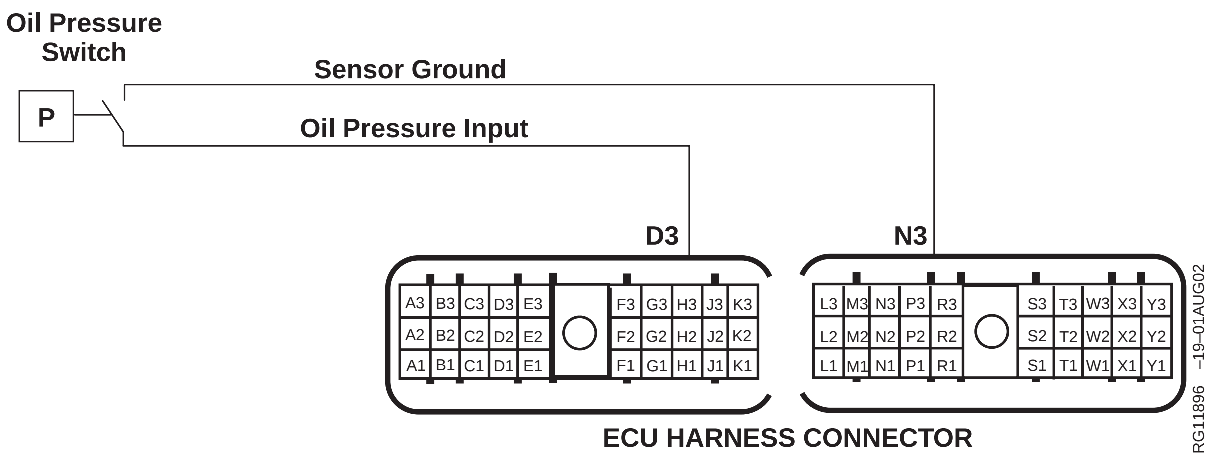
❹ **WIF Sensor Check**	*NOTE: For wiring and theory of operation, see DTC 000097.31 WATER IN FUEL DETECTED supporting information.* 1. Ignition OFF. 2. Disconnect the WIF sensor. 3. Using a multimeter, measure resistance between: • both sensor terminals. • both terminals and a good chassis ground.	**More than 200K ohms:** Sensor OK. If code returns and there is no water in the sediment bowl, verify that WIF input circuit is not grounded. See procedures for 000097.04. **Significantly less than 200K ohms:** Excessively low resistance in the sensor. Replace and retest.

– – –1/1

000100.01 — Engine Oil Pressure Extremely Low





NOTE: *Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*

Oil Pressure Sensor or Switch

- The oil pressure sensor is a pressure transducer connected to the main oil gallery or oil cooler. 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 PRESSURE in Section 03, Group 140.
- 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 pressure threshold the switch will open. When the engine is not running, the switch is open. For further oil pressure switch information, see MEASURING PRESSURE in Section 03, Group 140.

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.

Continued on next page

DPSG,RG40854,310 –19–18APR02–1/2

- 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:

- Engine protection is enabled. See ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  – With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  – With Derate Feature: On OEM applications, the engine derates 40% per minute until the engine is running at 40% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

DPSG,RG40854,310 –19–18APR02–2/2

000100.01 — Engine Oil Pressure Extremely Low

The ECU senses an oil pressure below the shutdown value set point in the ECU.

RG41221,000008D –19–18APR02–1/1

000100.01 Engine Oil Pressure Extremely Low Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information.* Without disconnecting, visually inspect the ECU connectors and the oil pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Oil Pressure Test**	*NOTE: For wiring and theory of operation, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information.* Under the conditions where DTC 000100.01 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).	**Oil pressure below specification:** See L2 - ENGINE OIL PRESSURE LOW diagnostic procedure in Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86). **Oil pressure within specification:** Verify that oil pressure sensor 5V supply, input, and return circuits are OK. See procedures for 000100.03 and 000100.04.

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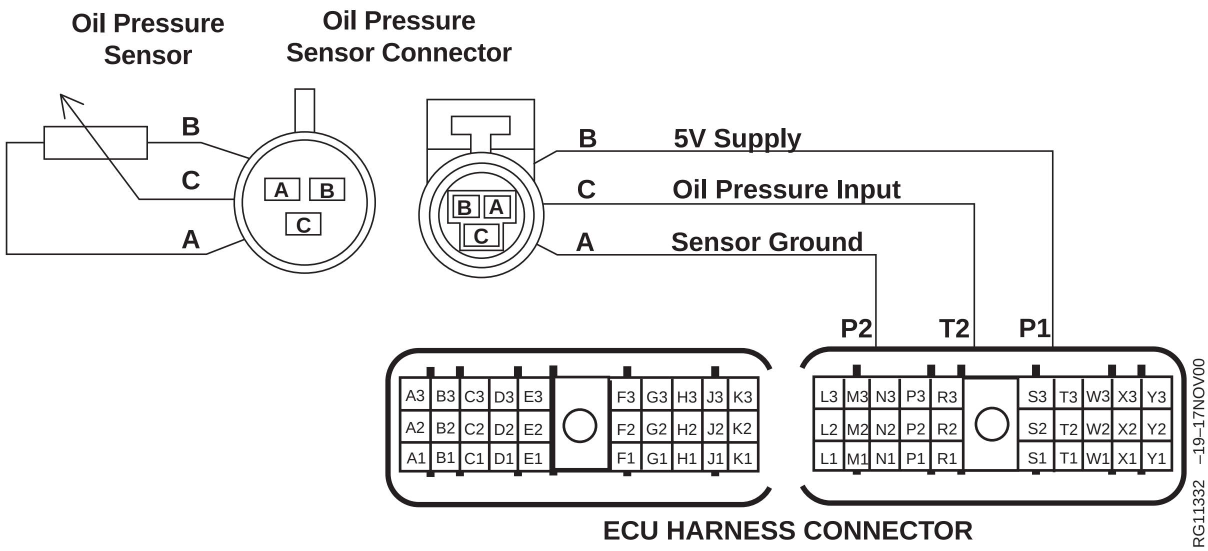
000100.03 — Engine Oil Pressure Input Voltage High



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil gallery or oil cooler. 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 PRESSURE in Section 03, Group 140.
- On some applications an oil pressure switch is used instead of a sensor. The following procedure applies only to systems that use a sensor.

DTC 000100.03 will set if:

- The input voltage exceeds the circuit's high voltage specification. The 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 uses a default oil pressure of 500 kPa (5.0 bar) (72.5 psi).
- ECU's low oil pressure engine protection feature disabled.

DPSG,RG40854,311 –19–18APR02–1/1

000100.03 — Engine Oil Pressure Input Voltage High

Input voltage in the sensor circuit rises to a level that is outside its normal operating range. This can be caused by an open ground circuit or the input or supply circuit shorted to a voltage source.

NOTE: If a Sensor Supply Voltage High DTC occurs, troubleshoot that fault first.

RG41221,000008E –19–18APR02–1/1

000100.03 Engine Oil Pressure Input Voltage High Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* Without disconnecting, visually inspect the ECU connectors and the oil pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000100.03 reoccurs:** GO TO ❸ **000100.03 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Is it a Sensor or a Switch?**	*NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* Determine whether an oil pressure sensor (3-wire) or an oil pressure switch (2-wire) is being used.	**Oil pressure sensor being used:** GO TO ❹ **Oil pressure switch being used:** **The following**

– – –1/1

❹ **"Ground Circuit Open?" Test**	*NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect oil pressure sensor connector. 3. Using a multimeter, check resistance between terminal A in the sensor connector and a good chassis ground.	**Near zero ohms:** Ground circuit OK. GO TO ❺ **Significantly above zero ohms:** Open in ground circuit. Repair and retest.

– – –1/1

❺ **"Input Circuit Shorted to a Power Source?" Test**	*NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition ON. 2. Using a multimeter, check voltage between terminal C in the sensor connector and a good chassis ground.	**Less than 4.5 Volts:** Input circuit OK. Check supply circuit. GO TO ❼ **More than 4.5 Volts:** Short to power source in input circuit. GO TO ❻. – – –1/1

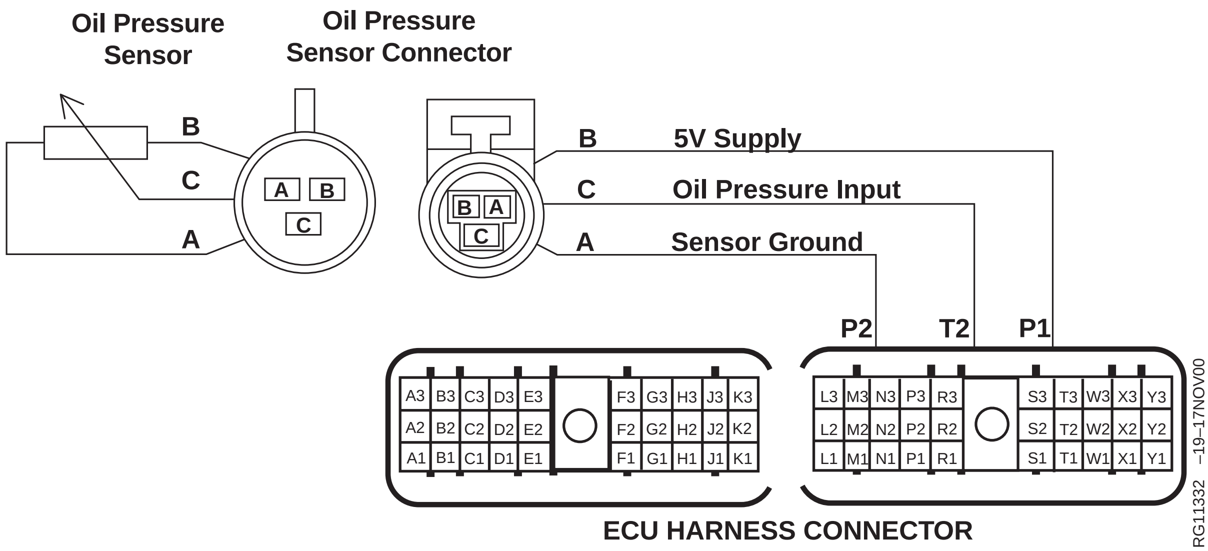
❻ **"Input Wiring Shorted to a Power Source?" Test**	*NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect the connectors from the ECU. 3. Using a multimeter, measure resistance between terminal T2 in the ECU connector and all other terminals in the ECU connectors.	**2000 ohms or more:** Input wiring OK. Check ECU. GO TO ❾ **less than 2000 ohms:** Input wiring shorted to circuit measuring low resistance. Repair and retest. – – –1/1

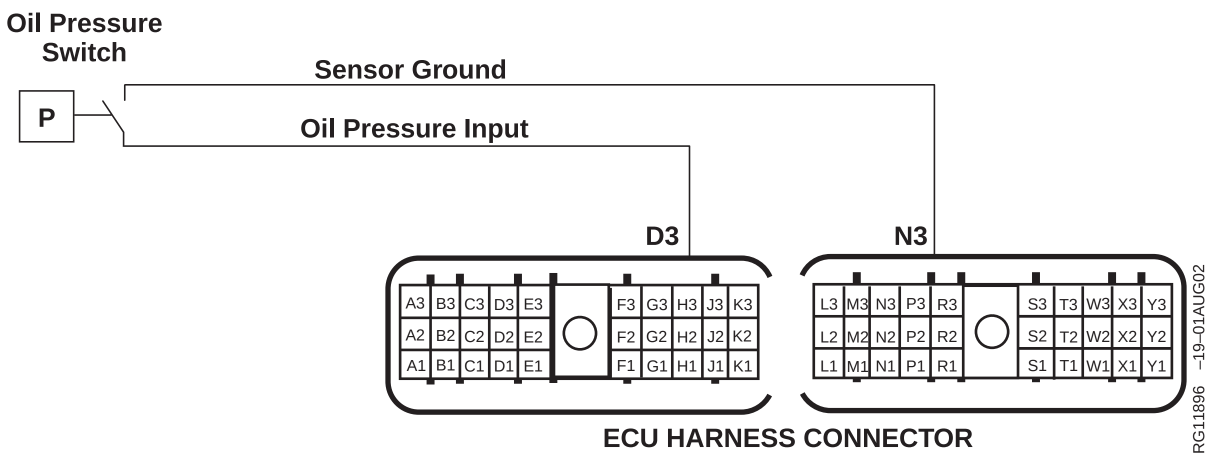
❼ **"Supply Circuit Shorted to a Power Source?" Test**	*NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition ON. 2. Using a multimeter, check voltage between terminal B in the sensor connector and a good chassis ground.	**4.5-5.5 Volts:** Supply circuit OK. **Replace sensor** and retest. **More than 5.5 Volts:** Supply circuit shorted to higher power source. GO TO ❽. – – –1/1

❽ **"Supply Wiring Shorted to a Power Source?" Test**	*NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect the connectors from the ECU. 3. Using a multimeter, measure resistance between terminal P1 in the ECU connector and all other terminals in the ECU connectors.	**2000 ohms or more:** Supply wiring OK. Check ECU. GO TO ❾ **less than 2000 ohms:** Supply wiring shorted to circuit measuring low resistance. Repair and retest. – – –1/1

❾ **Check ECU**	1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, check that resistances between the following ECU pins fall within the range of values shown. • P1 and P2: 50K-90K ohms • P2 and T2: 130K-200K ohms	**All measured resistance values within range:** ECU OK. Reinstall ECU and retest. **Any resistance measurement out of range:** Replace ECU and retest. – – –1/1

000100.04 — Engine Oil Pressure Input Voltage Low





NOTE: Wiring schematic shows OEM engine. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil gallery or oil cooler. 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 PRESSURE in Section 03, Group 140.
- On some applications an oil pressure switch is used instead of a sensor. The following procedure applies only to systems that use a sensor.

DTC 000100.04 will set if:

- For engines with an oil pressure sensor, the oil pressure input voltage drops below the sensor's low voltage specification. The voltage corresponds to a pressure that is lower than what is physically possible for oil pressure.

If DTC 000100.04 sets, the following will occur:

- For engines with an oil pressure sensor:

Continued on next page

DPSG,RG40854,312 –19–18APR02–1/2

- ECU uses a default oil pressure of 500 kPa (5.0 bar) (72.5 psi).
- ECU’s low oil pressure engine protection feature disabled.

- For engines with an oil pressure switch, the vehicle will display a warning fault light.

DPSG,RG40854,312 –19–18APR02–2/2

000100.04 — Engine Oil Pressure Input Voltage Low

Input voltage in the sensor circuit drops to a level that is outside its normal operating range. This can be caused by a grounded input, open input, grounded supply, or open supply circuit.

NOTE: If a Sensor Supply Voltage Low DTC occurs, troubleshoot that fault first.

RG41221,000008F –19–18APR02–1/1

000100.04 Oil Pressure Input Voltage Low Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* Without disconnecting, visually inspect the ECU connectors and the oil pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest. – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000100.04 reoccurs:** GO TO ❸ **000100.04 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Is it a Sensor or a Switch?**	*NOTE: For wiring and theory of operation, 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 ❹ **Oil pressure switch being used:** **The following**

– – –1/1

❹ **"Sensor Problem or Wiring Problem?" Test**	*NOTE: For wiring and theory of operation, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect oil pressure sensor connector. 3. In the connector, install a jumper wire between the supply and input terminals (terminals B and C). 4. Ignition ON, engine OFF. 5. Read DTCs.	**000100.03 (input voltage high) occurs:** Input and supply circuits OK. Replace sensor and retest. **000100.03 (input voltage high) does NOT occur:** Sensor OK. Faulty input or supply circuit. GO TO ❺

– – –1/1

❺ **Supply Circuit Test I**	*NOTE: For wiring and theory of operation, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Remove jumper wire. 3. Ignition ON. 4. Using a multimeter, measure voltage between terminal B in the sensor connector and a good chassis ground.	**4.5-5.5 Volts:** Supply circuit OK. Check input circuit. GO TO ❽ **Less than 4.5 Volts:** Open or short to ground in oil pressure sensor 5V supply circuit. GO TO ❻. – – –1/1

❻ **Supply Circuit Test II**	*NOTE: For wiring and theory of operation, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect the connectors from the ECU. 3. Using a multimeter, measure resistance between terminal B in the sensor connector and a good chassis ground.	**20K ohms or more:** Supply circuit not grounded. Check for open circuit. GO TO ❼ **less than 20K ohms:** Low resistance to ground in supply circuit. Repair and retest. – – –1/1

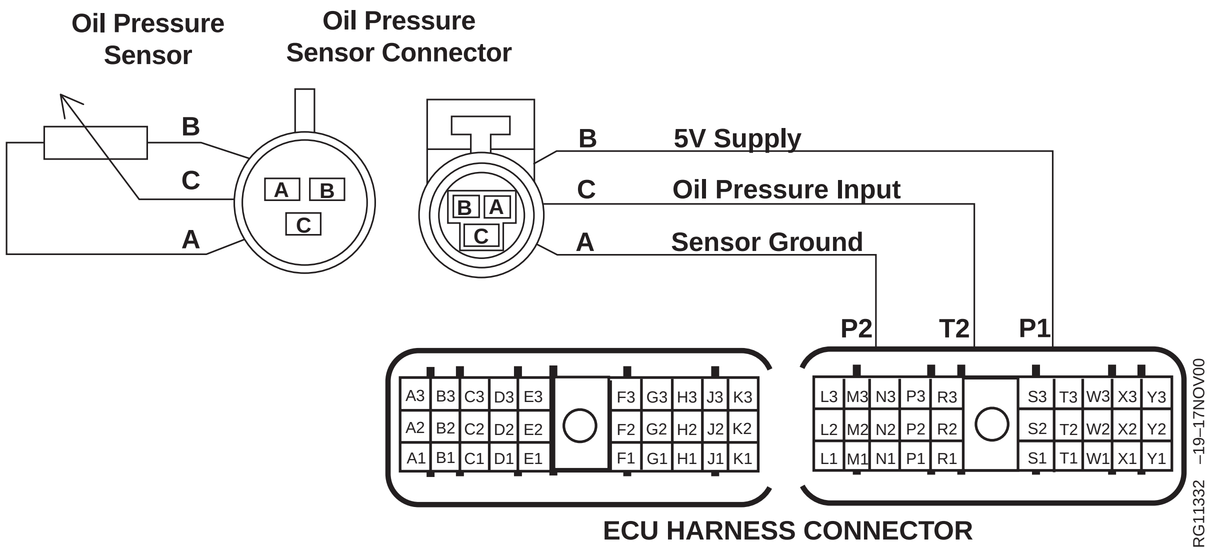
❼ **Supply Wiring Test**	1. Ignition OFF. 2. Using a multimeter, measure resistance between terminal P1 in the ECU connector and all other terminals in the ECU connectors.	**2000 ohms or more:** Supply circuit not open. Check ECU. GO TO ❿ **any measurement less than 2000 ohms:** Low resistance between supply circuit and the circuit that measured low. Repair and retest. – – –1/1

❽ **Input Circuit Test**	*NOTE: For wiring and theory of operation, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Using a multimeter, measure resistance between terminal C in the sensor connector and a good chassis ground.	**2000 ohms or more:** Input circuit not grounded. Check for open circuit. GO TO ❾ **less than 2000 ohms:** Low resistance to ground in input circuit. Repair and retest. – – –1/1

❾ **Input Wiring Test**	1. Ignition OFF. 2. Disconnect the connectors from the ECU. 3. Using a multimeter, measure resistance between terminal T2 in the ECU connector and all other terminals in the ECU connectors.	**2000 ohms or more:** Input circuit not open. Check ECU. GO TO ❿ **any measurement less than 2000 ohms:** Low resistance between input circuit and the circuit that measured low. Repair and retest. – – –1/1

❿ **ECU Test**	1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, check that resistances between the following ECU pins fall within the range of values shown. • P1 and P2: 50K-90K ohms • P2 and T2: 130K-200K ohms	**All measured resistance values within range:** ECU OK. Reinstall ECU and retest. **Any resistance measurement out of range:** Replace ECU and retest. – – –1/1

000100.16 — Engine Oil Pressure Above Normal



NOTE: This code is used on the D-Series Grader and 850J Loader.

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil gallery or oil cooler. 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 PRESSURE in Section 03, Group 140.

DTC 000100.16 will set if:

- The ECU receives an oil pressure signal above that expected for 0 RPM.

If DTC 000100.16 sets, the following will occur:

-

DPSG,RG40854,313 –19–28MAR02–1/1

000100.16 — Engine Oil Pressure Above Normal

The ECU senses an oil pressure input voltage higher than expected at 0 RPM.

WL30140,0000023 –19–16AUG05–1/1

000100.16 Engine Oil Pressure Above Normal Diagnostic Procedure

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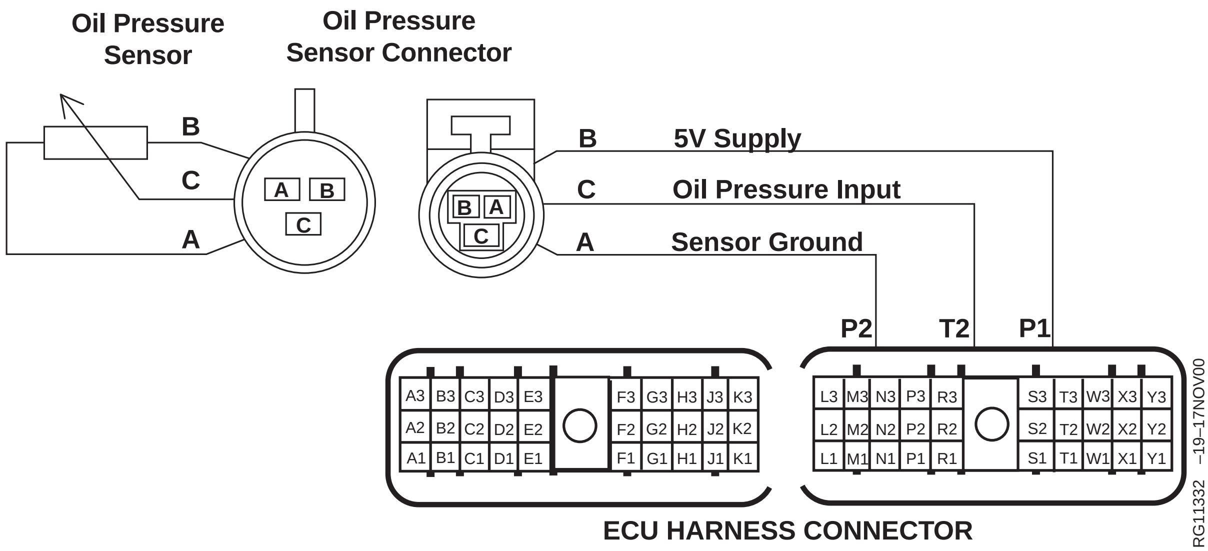
❶ **Visually Inspect Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see supporting information above.* Without disconnecting, visually inspect the ECU connectors and the oil pressure sensor connector for contamination, damage, improper seating, or poor alignment with mating connector. Check wiring for obvious damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest. – – –1/1

❷ **Check Wiring and Sensor**	*NOTE: For wiring and theory of operation, see supporting information above.*	Likely cause of this fault is bad sensor, wiring, or connectors. Troubleshoot and repair. See procedures for 000100.03 Engine Oil Pressure Input Voltage High. – – –1/1

000100.18 — Engine Oil Pressure Moderately Low



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NOTE: *Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil gallery or oil cooler. 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 PRESSURE in Section 03, Group 140.

DTC 000100.18 will set if:

- 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.

If DTC 000100.18 sets, the following will occur:

- Engine protection is enabled. See ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  – With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

DPSG,RG40854,313 –19–28MAR02–1/1

000100.18 — Engine Oil Pressure Moderately Low

The ECU senses an oil pressure below the warning value set point in the ECU.

RG41221,0000090 –19–18APR02–1/1

000100.18 Engine Oil Pressure Moderately Low Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation, see DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information.* Without disconnecting, visually inspect the ECU connectors and the oil pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Oil Pressure Test**	*NOTE: For wiring and theory of operation, see DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information.* Under the conditions where DTC 000100.18 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).	**Oil pressure below specification:** See L2 - ENGINE OIL PRESSURE LOW diagnostic procedure in Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86). **Oil pressure within specification:** Verify that oil pressure sensor 5V supply, input, and return circuits are OK. If oil pressure sensor circuits are OK, replace oil pressure sensor and retest.

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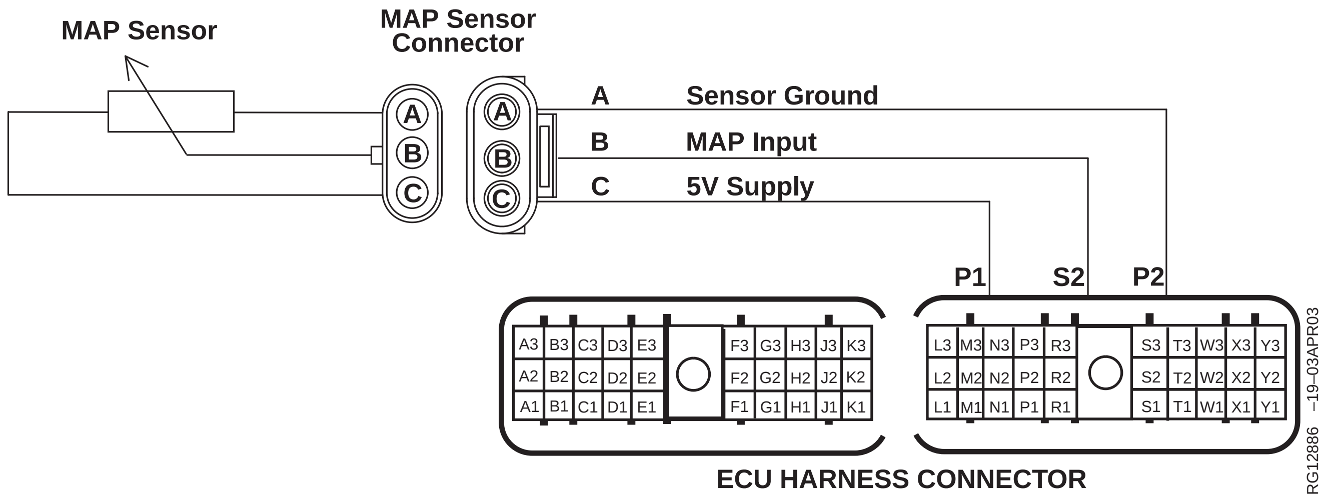
000102.03 — Manifold Air Pressure Input Voltage High



Manifold Air Pressure (MAP) Sensor

- The Manifold Absolute Pressure (MAP) sensor is a pressure transducer located in the intake manifold. The ECU uses the MAP sensor to measure air pressure in the intake manifold. The MAP signal varies as intake manifold pressure varies. High pressures result in higher voltages, lower pressures result in lower voltages. For further MAP sensor information, see MEASURING PRESSURE in Group 100 earlier in this manual.

DTC 000102.03 will set if:

- The manifold air pressure input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a pressure that is higher than what is physically possible for manifold air pressure.
  - For OEM applications, the high manifold air pressure input voltage specification is 4.9 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for the high manifold air temperature input voltage specification.

If DTC 000102.03 sets, the following will occur:

- The ECU will use a default “limp-home” MAP value of 200 kPa (29 psi) (2.0 bar).

RG41221,0000107 –19–02APR03–1/1

000102.03 — Manifold Air Pressure Input Voltage High

Input voltage in the sensor circuit rises to a level that is outside its normal operating range. This can be caused by an open ground circuit or the input or supply circuit shorted to a voltage source.

NOTE: If a Sensor Supply Voltage High DTC occurs, troubleshoot that fault first.

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RG41221,0000108 –19–02APR03–1/1

000102.03 Manifold Air Pressure Input Voltage High Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information.* Without disconnecting, visually inspect the ECU connectors and the manifold air pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Use the diagnostic gauge OR 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000102.03 reoccurs:** GO TO ❸ **000102.03 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **"Ground Circuit Open?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect pressure sensor connector. 3. Using a multimeter, check resistance between terminal A in the sensor connector and a good chassis ground.	**Near zero ohms:** Ground circuit OK. GO TO ❹ **Significantly above zero ohms:** Open in ground circuit. Repair and retest.

– – –1/1

❹ **"Input Circuit Shorted to a Power Source?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition ON. 2. Using a multimeter, check voltage between terminal C in the sensor connector and a good chassis ground.	**Less than 4.9 Volts:** Input circuit OK. Check supply circuit. GO TO ❻ **More than 4.9 Volts:** Short to power source in input circuit. GO TO ❺.

– – –1/1

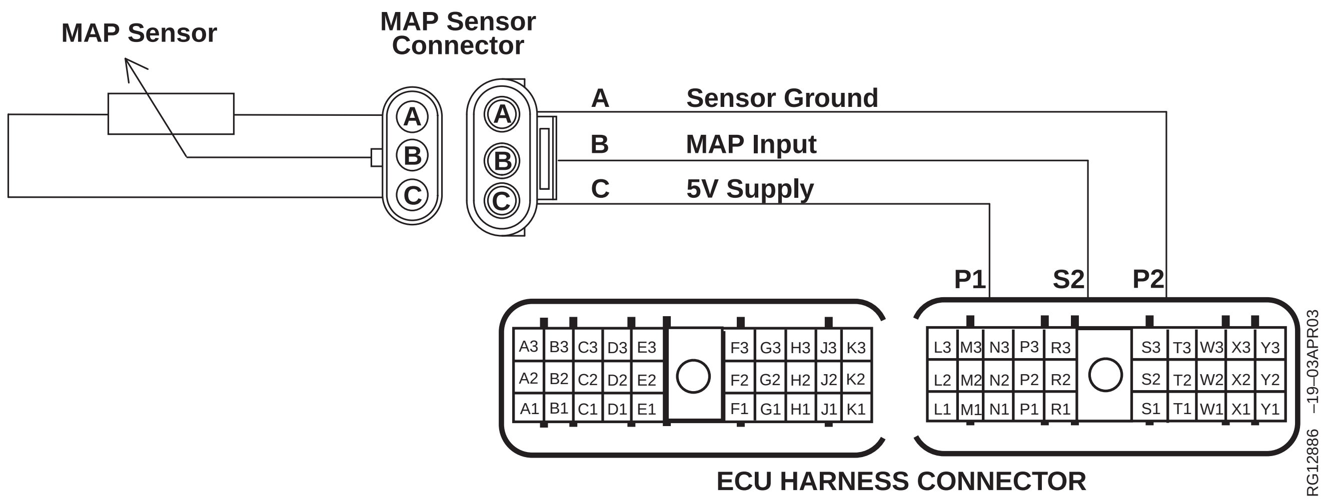
❺ **“Input Wiring Shorted to a Power Source?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect the connectors from the ECU. 3. Using a multimeter, measure resistance between terminal S2 in the ECU connector and all other terminals in the ECU connectors.	**2000 ohms or more:** Input wiring OK. Check ECU. GO TO ❽ **less than 2000 ohms:** Input wiring shorted to circuit measuring low resistance. Repair and retest. – – –1/1

❻ **“Supply Circuit Shorted to a Power Source?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition ON. 2. Using a multimeter, check voltage between terminal B in the sensor connector and a good chassis ground.	**4.5-5.5 Volts:** Supply circuit OK. **Replace sensor** and retest. **More than 5.5 Volts:** Supply circuit shorted to higher power source. GO TO ❼. – – –1/1

❼ **“Supply Wiring Shorted to a Power Source?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect the connectors from the ECU. 3. Using a multimeter, measure resistance between terminal P1 in the ECU connector and all other terminals in the ECU connectors.	**2000 ohms or more:** Supply wiring OK. Check ECU. GO TO ❽ **less than 2000 ohms:** Supply wiring shorted to circuit measuring low resistance. Repair and retest. – – –1/1

❽ **Check ECU**	1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, check that resistances between the following ECU pins fall within the range of values shown. • P1 and P2: 50K-90K ohms • P2 and S2: 130K-200K ohms	**All measured resistance values within range:** ECU OK. Reinstall ECU and retest. **Any resistance measurement out of range:** Replace ECU and retest. – – –1/1

000102.04 — Manifold Air Pressure Input Voltage Low



Manifold Air Pressure (MAP) Sensor

- The Manifold Absolute Pressure (MAP) sensor is a pressure transducer located in the intake manifold. The ECU uses the MAP sensor to measure air pressure in the intake manifold. The MAP signal varies as intake manifold pressure varies. High pressures result in higher voltages, lower pressures result in lower voltages. For further MAP sensor information, see MEASURING PRESSURE in Group 100 earlier in this manual.

DTC 000102.04 will set if:

- The manifold air pressure input voltage exceeds the sensor's low voltage specification. The voltage corresponds to a pressure that is lower than what is physically possible for manifold air pressure.
  – For OEM applications, the low manifold air pressure input voltage specification is 0.3 volts.
  – For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for the high manifold air temperature input voltage specification.

If DTC 000102.04 sets, the following will occur:

- The ECU will use a default "limp-home" MAP value of 200 kPa (29 psi) (2.0 bar).

RG41221,0000109 –19–03APR03–1/1

000102.04 — Manifold Air Pressure Input Voltage Low

Input voltage in the sensor circuit drops to a level that is outside its normal operating range. This can be caused by a grounded input, open input, grounded supply, or open supply circuit.

NOTE: If a Sensor Supply Voltage Low DTC occurs, troubleshoot that fault first.

RG41221,000010A –19–03APR03–1/1

000102.04 Manifold Air Pressure Input Voltage Low Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* Without disconnecting, visually inspect the ECU connectors and the manifold air pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Use the diagnostic gauge OR 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. Make note of any DTCs, then clear all DTCs. 4. Ignition ON, engine running at low idle. 5. Read DTCs.	**000102.04 reoccurs:** GO TO ❸ **000102.04 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **"Sensor Problem or Wiring Problem?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect pressure sensor connector. 3. In the connector, install a jumper wire between the supply and input terminals (terminals B and C). 4. Ignition ON, engine OFF. 5. Read DTCs.	**000102.03 (input voltage high) occurs:** Input and supply circuits OK. Replace sensor and retest. **000102.03 (input voltage high) does NOT occur:** Sensor OK. Faulty input or supply circuit. GO TO ❹

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❹ **"5V Supply Circuit OK/Not OK" Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Remove jumper wire. 3. Ignition ON. 4. Using a multimeter, measure voltage between terminal B in the sensor connector and a good chassis ground.	**4.5-5.5 Volts:** Supply circuit OK. Check input circuit. GO TO ❼ **Less than 4.5 Volts:** Open or short to ground in pressure sensor 5V supply circuit. GO TO ❺.

– – –1/1

❺ **Supply Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect the connectors from the ECU. 3. Using a multimeter, measure resistance between terminal B in the sensor connector and a good chassis ground.	**20K ohms or more:** Supply circuit not grounded. Check for open circuit. GO TO ❻ **less than 20K ohms:** Low resistance to ground in supply circuit. Repair and retest. – – –1/1

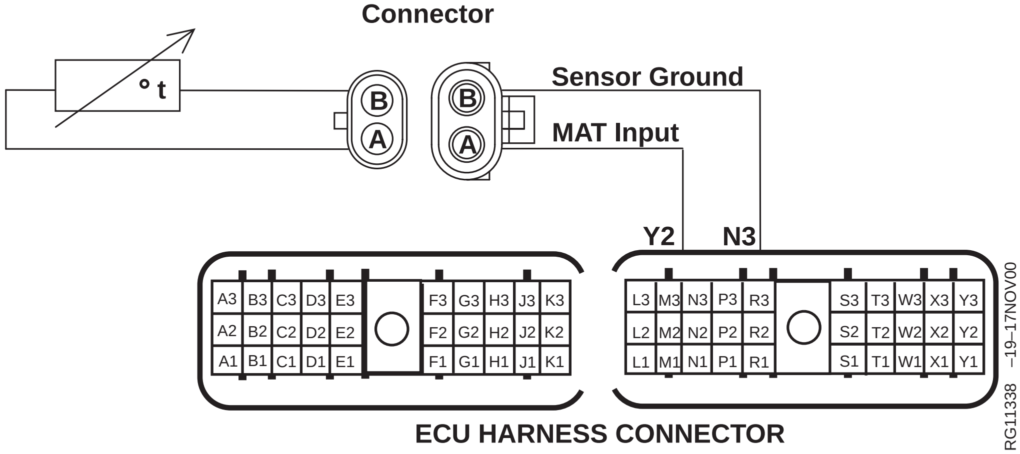
❻ **Supply Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Using a multimeter, measure resistance between terminal P1 in the ECU connector and all other terminals in the ECU connectors.	**2000 ohms or more:** Supply circuit not open. Check ECU. GO TO ❾ **any measurement less than 2000 ohms:** Low resistance between supply circuit and the circuit that measured low. Repair and retest. – – –1/1

❼ **Input Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Using a multimeter, measure resistance between terminal C in the sensor connector and a good chassis ground.	**2000 ohms or more:** Input circuit not grounded. Check for open circuit. GO TO ❽ **less than 2000 ohms:** Low resistance to ground in input circuit. Repair and retest. – – –1/1

❽ **Input Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Using a multimeter, measure resistance between terminal S2 in the ECU connector and all other terminals in the ECU connectors.	**2000 ohms or more:** Input circuit not open. Check ECU. GO TO ❾ **any measurement less than 2000 ohms:** Low resistance between input circuit and the circuit that measured low. Repair and retest. – – –1/1

❾ **ECU Test**	1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, check that resistances between the following ECU pins fall within the range of values shown. • P1 and P2: 50K-90K ohms • P2 and S2: 130K-200K ohms	**All measured resistance values within range:** ECU OK. Reinstall ECU and retest. **Any resistance measurement out of range:** Replace ECU and retest. – – –1/1

000105.03 — Manifold Air Temperature Input Voltage High



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Manifold Air Temperature (MAT) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. 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.

DTC 000105.03 will set if:

- The input voltage in the sensor circuit rises to a level that is outside the normal operating range. The voltage corresponds to a temperature that is lower than what is physically possible for manifold air temperature.

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,RG40854,172 –19–02APR03–1/1

000105.03 — Manifold Air Temperature Input Voltage High

The input voltage in the sensor circuit rises to a level that is outside the normal operating range. Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open input or open ground circuit. Less probable is a short from the 5V input wire to a higher voltage source.

RG41221,0000091 –19–18APR02–1/1

000105.03 Manifold Air Temperature Input Voltage High Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* Without disconnecting connectors, visually inspect the ECU connectors and the temperature sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Use the diagnostic gage on the instrument panel OR connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000105.03 reoccurs:** GO TO ❸ **000105.03 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **“Sensor Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor terminals.	**Less than 100K ohms:** Sensor not open. GO TO ❹ **More than 100K ohms:** Excessively high resistance in the sensor. Replace and retest. – – –1/1

❹ **Input Circuit “Open or Short?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition ON. 2. Temperature sensor still disconnected. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground.	**Above 5.5V:** Sensor 5V input wire shorted to a higher voltage source. GO TO ❺ **4.5-5.5V:** Input OK. Check ground circuit. GO TO ❼ **Less than 4.5V:** Open or high resistance in input wiring. GO TO ❻ – – –1/1

❺ **“Harness Shorted to Higher Voltage?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect 30-pin connectors from ECU. 3. Ignition ON. 4. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground	**Above 5.5V:** Harness or connected wiring shorted to a higher voltage source. Repair and retest. **0V:** Harness wiring OK. Remove and test ECU. GO TO ❾ – – –1/1

❻ **“Harness Input Wiring Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect the circuit’s 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Sensor still disconnected. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor’s input wiring in the harness.	**Near zero ohms:** Input wiring OK. Remove and test ECU. GO TO ❾ **Significantly above zero ohms:** Open or high resistance in input wiring. Repair and retest. – – –1/1

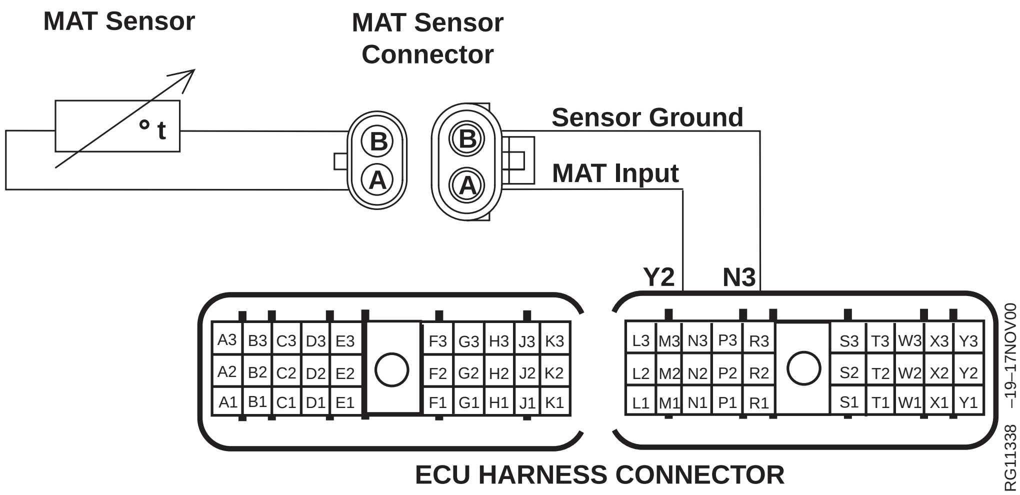
❼ **“Ground Circuit Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Use a multimeter and JT07328 Connector Adapter Test Kit to check resistance from the return terminal in the sensor connector to a good chassis ground.	**Near zero ohms:** Ground circuit OK. Reconnect and retest. **Significantly above zero ohms:** Open or high resistance in ground circuit. GO TO ❽ – – –1/1

❽ **“Harness Ground Wiring Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the circuit’s 30-pin connector from the ECU. Inspect connector and ECU pins. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor’s ground wiring in the harness.	**Near zero ohms:** Wiring OK. Remove and test ECU. GO TO ❿ **Significantly above zero ohms:** Open or high resistance in ground wiring. Repair and retest. – – –1/1

❾ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit’s input and ground pins the ECU.	**1.5K to 3.5K ohms:** ECU OK. Reinstall and retest. **Below 1.5K or above 3.5K ohms:** Faulty ECU. Replace and retest. – – –1/1

⓾ **ECU Ground Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. ECU removed. 2. Using a multimeter and JT07328 Connector Adapter Test Kit, measure resistance between the sensor circuit's ground pin and pin C3 or C2 the ECU.	**Near zero ohms:** ECU OK. Reconnect and retest. **2 ohms or more:** Faulty ECU. Replace and retest. – – –1/1

000105.04 — Manifold Air Temperature Input Voltage Low



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Manifold Air Temperature (MAT) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. 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.

DTC 000105.04 will set if:

- The input voltage in the sensor circuit falls to a level that is outside the normal operating range. The voltage corresponds to a temperature that is higher than what is physically possible for manifold air temperature.

If DTC 000105.04 sets, the following will occur:

- The ECU will use a MAT default "limp-home" MAT value of 50°C (122°F).
- ECU's high manifold air temperature engine protection feature disabled.

DPSG,RG40854,173 –19–02APR03–1/1

000105.04 — Manifold Air Temperature Input Voltage Low

Input voltage in the sensor circuit drops to a level that is outside its normal operating range. Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault is low resistance to ground (grounded input circuit).

RG41221,0000092 –19–18APR02–1/1

000105.04 Manifold Air Temperature Input Voltage Low Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* Without disconnecting connectors, visually inspect the ECU connectors and the temperature sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000105.04 occurs:** GO TO ❸ **000105.04 does not occur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured.GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **"Sensor Shorted?" 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 the sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor pins.	**More than 100 ohms:** Sensor not shorted. GO TO ❹ **Less than 100 ohms:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

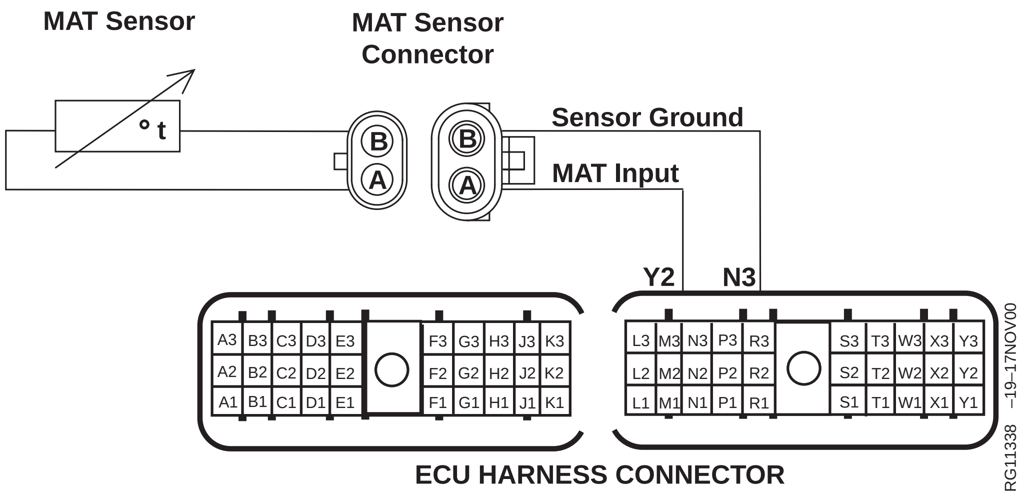
❹ **"Sensor Grounded?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between each sensor pin and a good chassis ground.	**Both pins 1M ohms or more:** Sensor OK. Check wiring. GO TO ❺ **Any one pin less than 1M ohms:** Low resistance to ground. Replace sensor and retest. – – –1/1

❺ **"Grounded Input Circuit?" 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. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground.	**1000 ohms or more:** Input circuit OK. Reconnect and retest. **Less than 1000 ohms:** GO TO ❻ – – –1/1

❻ **"Harness Input Wiring 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 the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 3. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground.	**1M ohms or greater:** Input wiring OK. Remove and test ECU. GO TO ❼ **Less than 1M ohms:** Input wire shorted to ground. Repair and retest. – – –1/1

❼ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input and ground pins in the ECU.	**1.5K to 3.5K ohms:** ECU OK. Reinstall and retest. **Below 1.5K or above 3.5K ohms:** Faulty ECU. Replace and retest. – – –1/1

000105.16 — Manifold Air Temperature Moderately High



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Manifold Air Temperature (MAT) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. 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.

DTC 000105.16 will set if:

- The ECU senses a manifold air temperature on OEM applications above 88°C (190°F). For manifold air temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

If DTC 000105.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  - With derate feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

DPSG,RG40854,174 –19–18APR02–1/1

000105.16 — Manifold Air Temperature Moderately High

The ECU senses a manifold air temperature above specifications.

RG41221,0000093 –19–18APR02–1/1

000105.16 Manifold Air Temperature Moderately High Diagnostic Procedure

– – –1/1

❶ **Connector Check**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.* Without disconnecting, visually inspect the ECU connectors and the MAT sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000105.16 occurs:** GO TO ❸ **000105.16 does not occur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured.GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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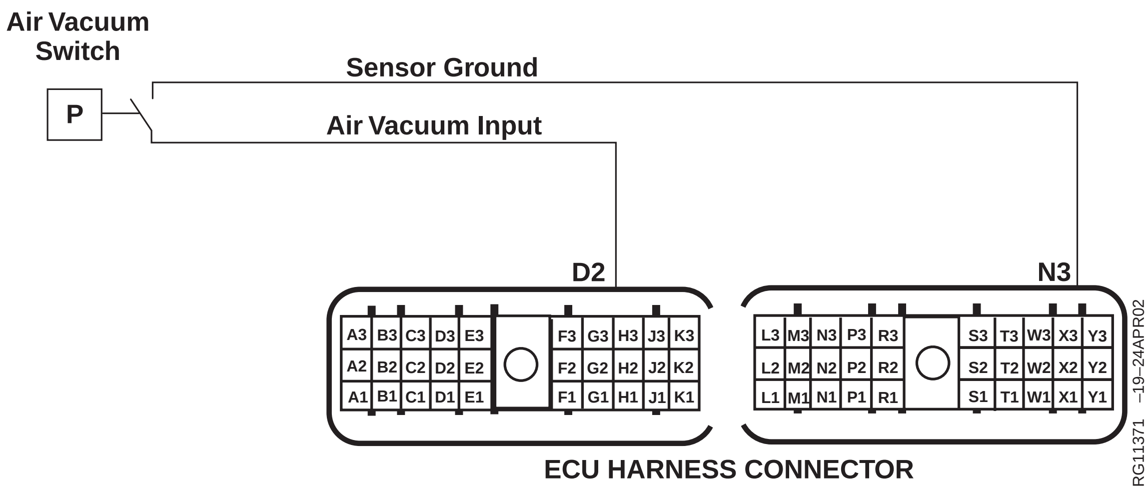
❸ **Failures Causing High MAT Check**	*NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.* Check the following items that can cause high intake air temperature: • Excessively high ambient air temperature. • Faulty intake air heater. • Restricted, dirty, or damaged charge air cooler (refer to service manuals provided by the equipment manufacturer). • Loose cooling fan belt (charge air cooling). • Malfunctioning cooling fan (charge air cooling). • Damaged cooling fan shroud (charge air cooling). • Restricted or damaged intake air piping.	**Cause of high MAT found:** Repair and retest. **No cause of high MAT found:** GO TO ❸ – – –1/1

❹ **Monitor MAT During Operation**	1. Start the diagnostic software. 2. Start engine. 3. Monitor the manifold air temperature and parameters of any system that may affect engine temperatures. Record data and analyze. 4. If code does not set, operate engine under conditions similar to those in which the code had set. Record data and analyze.	**Operating parameters suggest a problem:** Troubleshoot and repair. **Operating parameters reveal nothing unusual:**. Check MAT sensor. GO TO ❸ Input voltage to ECU may be too low due to faulty sensor or sensor wiring. Check for faulty MAT sensor or grounded sensor input and return circuits by performing testing under 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW – – –1/1

❺ **Manifold Air Pressure Sensor Check**	*NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.* 1. Ignition ON, engine running at full load rated speed. 2. Using the ECU diagnostic software, read manifold air pressure. *NOTE: Make sure to record this value for later use.* 3. Ignition OFF. 4. Remove the manifold air pressure sensor. 5. Install a mechanical gage in the sensor port. 6. Ignition ON, engine running at full load rated speed. 7. Read the manifold air pressure on the gage.	Values are not within 10% of each other: Replace manifold air pressure sensor. Values within 10% of each other: Input voltage to ECU may be too low due to faulty sensor or sensor wiring. Check for grounded sensor input and return circuits by performing testing under 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW – – –1/1

000107.00 — Air Filter Restriction



Air Pressure Switch

- The air pressure switch is located on the clean side of the air filter. Depending on application, the switch and ECU will be set up for either normally closed or normally open.

DTC 000107.00 will set if:

- The air pressure switch changes state due to excessively low air pressure (high vacuum).

If DTC 000107.00 sets, the following will occur:

- ECU will set a warning light.
- Engine performance will degrade according to the degree of restriction.

DPSG,RG40854,315 –19–28MAR02–1/1

000107.00 — Air Filter Restriction

The ECU senses a change in state of the air filter pressure switch.

RG41221,0000094 –19–28MAR02–1/1

000107.00 Air Filter Restriction Diagnostic Procedure

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❶ **Air Filter Restriction Test**	*NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER RESTRICTION supporting information.* Check air filter and all air intake ducting for restrictions.	**Restriction found in air filter:** Replace or clean air filter. **No problem found with air filter:** GO TO ❷

– – –1/1

❷ **Air Intake Restriction Test**	*NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER RESTRICTION supporting information.* Inspect air intake system on suction side of turbo for any source of blockage. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).	**Restriction found in intake system:** Replace, repair, or clean components as needed. **No problem found with intake system:** GO TO ❸

– – –1/1

❸ **Connector Check**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER RESTRICTION supporting information.* Without disconnecting, visually inspect the ECU connectors and the air filter switch connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❹ **No Problem found:** Repair and retest.

– – –1/1

❹ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER RESTRICTION supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000107.00 occurs:** GO TO ❺ **000107.00 does not occur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❺. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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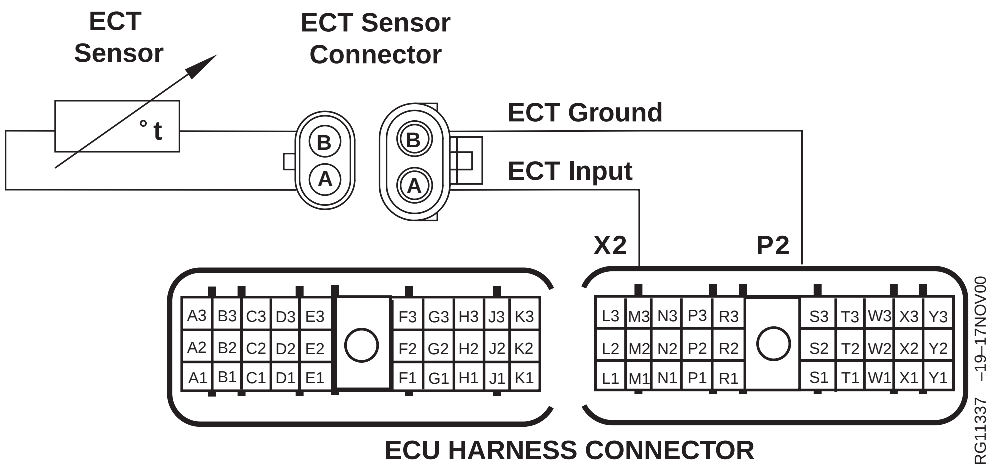
❺ **Switch Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER RESTRICTION supporting information.* 1. Disconnect the air filter pressure switch. 2. Disconnect the harness from the ECU. 3. Check the switch circuit for opens, grounds, and poor connections.	**Wiring problem found:** Repair and retest. **Wiring OK:** Switch may be out of calibration. Replace switch and retest.

– – –1/1

000110.00 — Engine Coolant Temperature Extremely High



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. 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.

DTC 000110.00 will set if:

- The ECU senses a coolant temperature on OEM applications above 115°C (239°F). For most severe engine coolant temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

If DTC 000110.00 sets, the following will occur:

- Engine protection is enabled. See ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 20% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

DPSG,RG40854,175 –19–18APR02–1/1

000110.00 — Engine Coolant Temperature Extremely High

The ECU senses a coolant temperature above specifications.

RG41221,0000095 –19–16APR03–1/1

000110.00 Engine Coolant Temperature Extremely High Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH supporting information.* Without disconnecting, visually inspect the ECU connectors and the ECT sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **ECT Sensor and Circuit Test**	*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 to verify that engine coolant temperature is above extremely high specification. *NOTE: On OEM applications, the most severe ECT specification is 115°C (239°F). For the most severe ECT spec on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**Temperature at or above specification:** Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86). **Temperature significantly less than specification:** Verify that ECT sensor input and return circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest.

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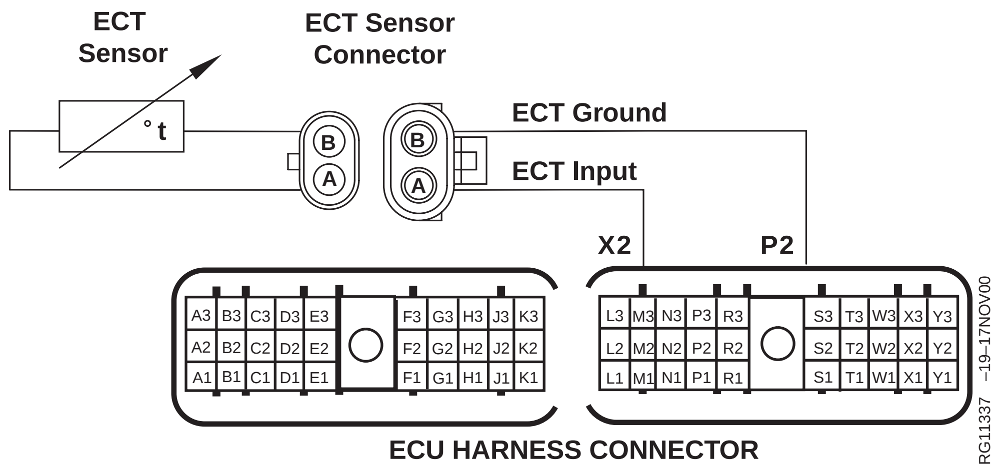
000110.03 — Engine Coolant Temperature Input Voltage High



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. 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 earlier in this manual.

DTC 000110.03 will set if:

- The input voltage in the sensor circuit rises to a level that is outside the normal operating range. The voltage corresponds to a temperature that is lower than what is physically possible for engine coolant temperature.

If DTC 000110.03 sets, the following will occur:

- When in start mode, the ECU will default the ECT to 0°C (32°F).
- 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,RG40854,176 –19–02APR03–1/1

000110.03 — Engine Coolant Temperature Input Voltage High

The input voltage in the sensor circuit rises to a level that is outside the normal operating range. Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open circuit. Less probable is a short from the 5V input wire to a power source.

RG41221,0000096 –19–18APR02–1/1

000110.03 Engine Coolant Temperature Input Voltage High Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* Without disconnecting connectors, visually inspect the ECU connectors and the temperature sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Use the diagnostic gage on the instrument panel OR connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000110.03 reoccurs:** GO TO ❸ **000110.03 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **“Sensor Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor terminals.	**Less than 100K ohms:** Sensor not open. GO TO ❹ **More than 100K ohms:** Excessively high resistance in the sensor. Replace and retest. – – –1/1

❹ **Input Circuit “Open or Short?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition ON. 2. Temperature sensor still disconnected. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground.	**Above 5.5V:** Sensor 5V input wire shorted to a higher voltage source. GO TO ❺ **4.5-5.5V:** Input OK. Check ground circuit. GO TO ❼ **Less than 4.5V:** Open or high resistance in input wiring. GO TO ❻ – – –1/1

❺ **“Harness Shorted to Higher Voltage?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect 30-pin connectors from ECU. 3. Ignition ON. 4. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground	**Above 5.5V:** Harness or connected wiring shorted to a higher voltage source. Repair and retest. **0V:** Harness wiring OK. Remove and test ECU. GO TO ❾ – – –1/1

❻ **“Harness Input Wiring Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect the circuit’s 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Sensor still disconnected. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor’s input wiring in the harness.	**Near zero ohms:** Input wiring OK. Remove and test ECU. GO TO ❾ **Significantly above zero ohms:** Open or high resistance in input wiring. Repair and retest. – – –1/1

❼ **“Ground Circuit Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Use a multimeter and JT07328 Connector Adapter Test Kit to check resistance from the return terminal in the sensor connector to a good chassis ground.	**Near zero ohms:** Ground circuit OK. Reconnect and retest. **Significantly above zero ohms:** Open or high resistance in ground circuit. GO TO ❽ – – –1/1

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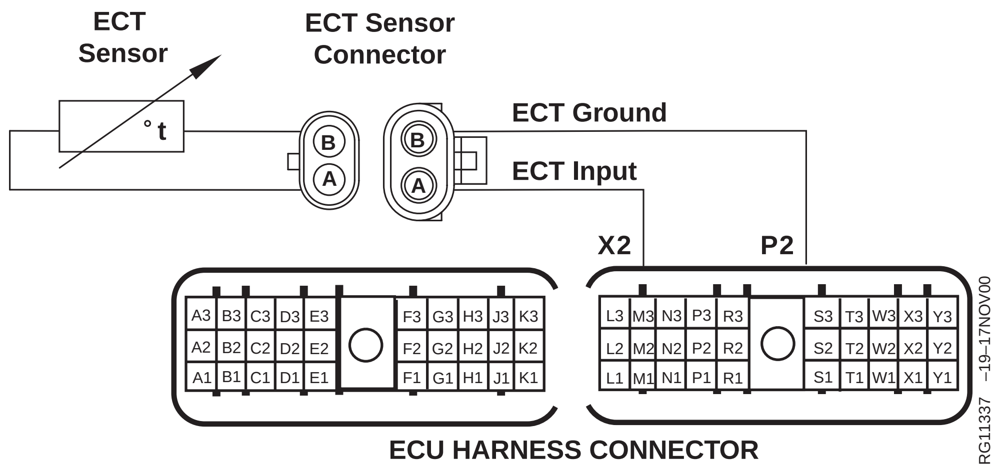
❽ **“Harness Ground Wiring Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the circuit’s 30-pin connector from the ECU. Inspect connector and ECU pins. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor’s ground wiring in the harness.	**Near zero ohms:** Wiring OK. Remove and test ECU. GO TO ❿ **Significantly above zero ohms:** Open or high resistance in ground wiring. Repair and retest. – – –1/1

❾ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit’s input and ground pins the ECU.	**1.5K to 3.5K ohms:** ECU OK. Reinstall and retest. **Below 1.5K or above 3.5K ohms:** Faulty ECU. Replace and retest. – – –1/1

10 **ECU Ground Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. ECU removed. 2. Using a multimeter and JT07328 Connector Adapter Test Kit, measure resistance between the sensor circuit's ground pin and pin C3 or C2 in the ECU.	**Near zero ohms:** ECU OK. Reinstall and retest. **2 ohms or more:** Faulty ECU. Replace and retest. – – –1/1

000110.04 — Engine Coolant Temperature Input Voltage Low



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. 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 earlier in this manual.

DTC 000110.04 will set if:

- Input voltage in the sensor circuit drops to a level that is outside its normal operating range. The voltage corresponds to a temperature that is higher than what is physically possible for engine coolant temperature .

If DTC 000110.04 sets, the following will occur:

- When in start mode, the ECU will default the ECT to 0°C (32°F).
- 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,RG40854,177 –19–02APR03–1/1

000110.04 — Engine Coolant Temperature Input Voltage Low

Input voltage in the sensor circuit drops to a level that is outside its normal operating range. Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault on this circuit is low resistance to ground (grounded circuit).

RG41221,0000097 –19–18APR02–1/1

000110.04 Engine Coolant Temperature Input Voltage Low Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.* Without disconnecting connectors, visually inspect the ECU connectors and the temperature sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000110.04 occurs:** GO TO ❸ **000110.04 does not occur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **“Sensor Shorted?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect the sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor pins.	**More than 100 ohms:** Sensor not shorted. GO TO ❹ **Less than 100 ohms:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

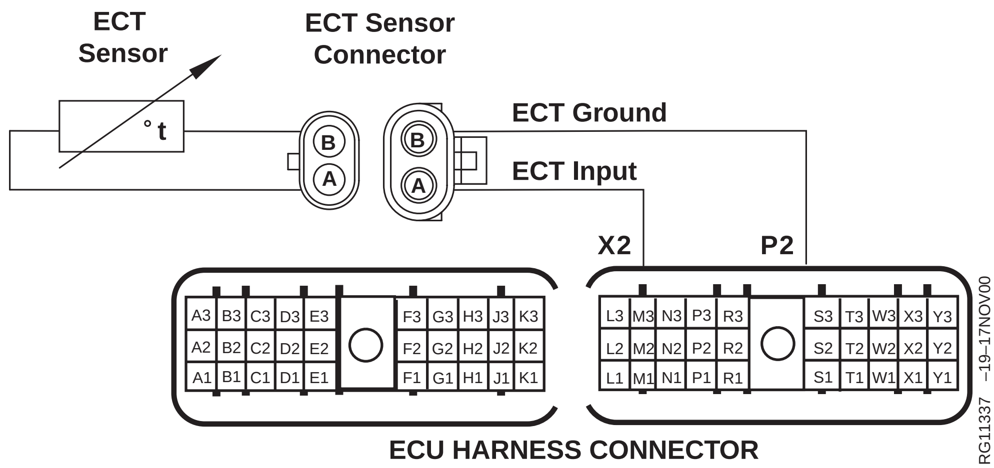
❹ **“Sensor Grounded?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between each sensor pin and a good chassis ground.	**Both pins 1M ohms or more:** Sensor OK. Check wiring. GO TO ❺ **Any one pin less than 1M ohms:** Low resistance to ground. Replace sensor and retest. – – –1/1

❺ **“Grounded Input Circuit?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground.	**1000 ohms or more:** Input circuit OK. Reconnect and retest. **Less than 1000 ohms:** GO TO ❻ – – –1/1

❻ **“Harness Input Wiring Grounded?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect the circuit’s 30-pin connector from the ECU. Inspect connector and ECU pins. 3. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground.	**1M ohms or greater:** Input wiring OK. Remove and test ECU. GO TO ❼ **Less than 1M ohms:** Input wire shorted to ground. Repair and retest. – – –1/1

❼ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input and ground pins in the ECU.	**1.5K to 3.5K ohms:** ECU OK. Reinstall and retest. **Below 1.5K or above 3.5K ohms:** Faulty ECU. Replace and retest. – – –1/1

000110.15 — Engine Coolant Temperature High Least Severe



04
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,200

NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. 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.

DTC 000110.15 will set if:

- The ECU senses engine coolant temperature above 110°C (230°F). For moderately high engine coolant temperature specification, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

If DTC 000110.15 sets, the following will occur:

- The ECU will set a Blinking Info Light

RG41221,000010B –19–03APR03–1/1

000110.15 — Engine Coolant Temperature High Least Severe

The ECU senses a coolant temperature above specifications.

RG41221,000010C –19–03APR03–1/1

000110.15 Engine Coolant Temperature High Least Severe Diagnostic Procedure

– – –1/1

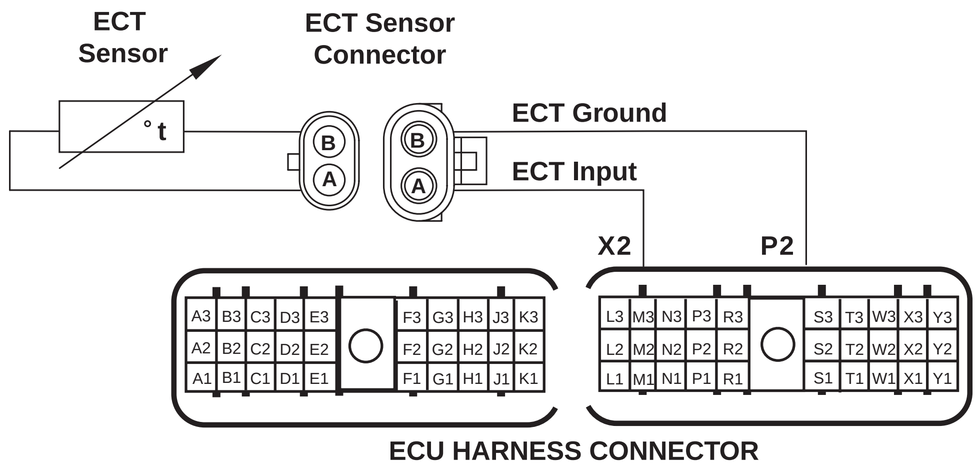
❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE supporting information.* Without disconnecting, visually inspect the ECU connectors and the ECT sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **ECT Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE supporting information.* Under the conditions where DTC 000110.15 occurs, use a temperature gauge to verify that engine coolant temperature is above the moderately high specification.	**Temperature at or above specification:** Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL diagnostic procedure in Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86). **Temperature significantly less than specification:** Verify that ECT sensor input and return circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest.

– – –1/1

000110.16 — Engine Coolant Temperature Moderately High



RG11337 –19–17NOV00

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,202

NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. 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.

DTC 000110.16 will set if:

- The ECU senses engine coolant temperature on OEM applications above 105°C (221°F). For moderately high engine coolant temperature specification, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

If DTC 000110.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

DPSG,RG40854,178 –19–18APR02–1/1

000110.16 — Engine Coolant Temperature Moderately High

The ECU senses a coolant temperature above specifications.

RG41221,0000098 –19–16APR03–1/1

000110.16 Engine Coolant Temperature Moderately High Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH supporting information.* Without disconnecting, visually inspect the ECU connectors and the ECT sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **ECT Sensor and Circuit Test**	*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, using a temperature gauge, verify that engine coolant temperature is above the moderately high specification. *NOTE: On OEM applications, the most severe ECT specification is 105°C (221°F). For the most severe ECT spec on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*	**Temperature at or above specification:** Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL diagnostic procedure in Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86). **Temperature significantly less than specification:** Verify that ECT sensor input and return circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest.

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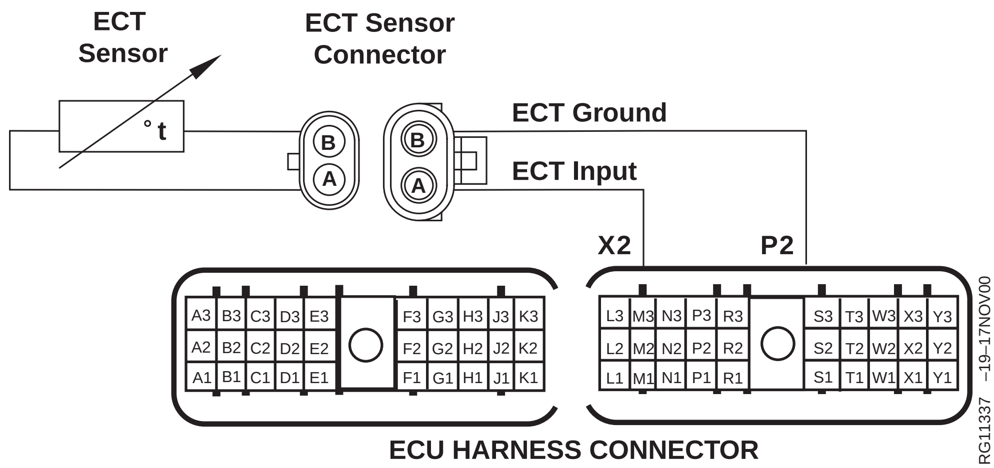
000110.31 — Engine Coolant Temperature High



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. 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.

DTC 000110.31 will set if:

- The ECU senses engine coolant temperature between 107°C (225°F) and 110°C (230°F). For high engine coolant temperature specifications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

If DTC 000110.31 sets, the following will occur:

- The amount of fuel injected will be decreased to 94% of the max fuel for each available torque curve.
- This code will not display on the Info Center. This code can be read only through the ECU diagnostic software.

RG41221,000010D –19–03APR03–1/1

000110.31 — Engine Coolant Temperature High

The ECU senses engine coolant temperature between 107°C (225°F) and 110°C (230°F).

RG41221,000010F –19–03APR03–1/1

000110.31 Engine Coolant Temperature High Diagnostic Procedure

– – –1/1

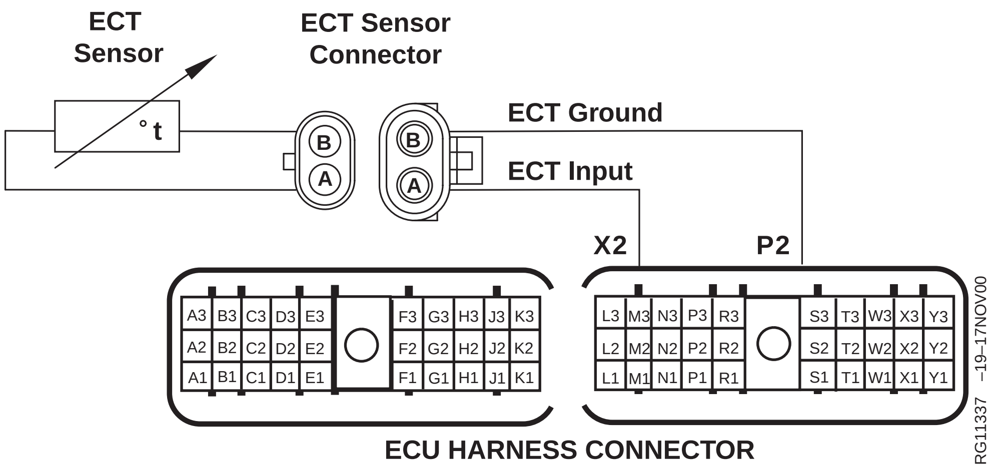
❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.31 ENGINE COOLANT TEMPERATURE HIGH supporting information.* Without disconnecting, visually inspect the ECU connectors and the ECT sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **ECT Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.31 ENGINE COOLANT TEMPERATURE HIGH supporting information.* Under the conditions where DTC 000110.31 occurs, use a temperature gauge to verify that engine coolant temperature is above the high specification.	**Temperature at or above specification:** Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL diagnostic procedure in Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86). **Temperature significantly less than specification:** Verify that ECT sensor input and return circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest.

– – –1/1

000111.01 — Engine Coolant Level Low



Engine Coolant Temperature Switch

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. 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.

DTC 000111.01 will set if:

- The coolant temperature rises to such an extreme level that it is assumed that the sensor is no longer submerged in coolant.

If DTC 000111.01 sets, the following occur:

- Engine protection is enabled. See ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  – With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  – With Derate Feature: On OEM applications, the engine derates 40% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

DPSG,RG40854,179 –19–18APR02–1/1

000111.01 — Engine Coolant Level Low

The coolant temperature rises to such an extreme level (124°C [255°F]) that it is assumed that the sensor is no longer submerged in coolant.

RG41221,0000099 –19–28MAR02–1/1

000111.01 Engine Coolant Level Low Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information.* Without disconnecting, visually inspect the ECU connectors and the coolant temperature sensor connector, for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Coolant Level Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information.* **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 ❸ **Coolant level low:** Determine cause of low coolant level, repair problem, and retest.

– – –1/1

❸ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information.* 1. Use the diagnostic gauge OR 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 running. 3. Start the ECU diagnostic software, if applicable. 4. Make note of all active DTCs, then clear all DTCs. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000111.01 reoccurs:** GO TO ❹ **000111.01 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❹. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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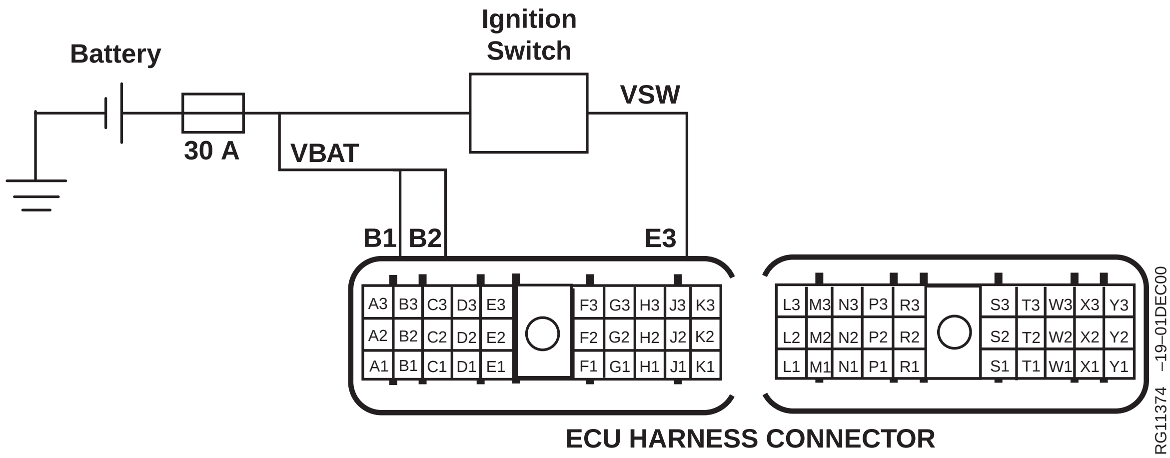
❹ **Coolant Temperature Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information.* 1. Ignition OFF. 2. Disconnect coolant temperature sensor connector. 3. Ignition ON, engine OFF. 4. Using the ECU diagnostic software, read DTCs.	**000111.01 reoccurs:** Short to ground in coolant temperature sensor input circuit. **000111.01 doesn't reoccur:** Faulty coolant temperature sensor.

– – –1/1

000158.17 — ECU Power Down Error



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

DTC 000158.17 will set if:

- ECU is unable to complete proper power down procedures after detecting a key-off condition. The ECU detects voltage on the switched voltage input wire to the ECU.

If DTC 000158.17 sets, the following will occur:

- If ECU will not power down, the vehicle battery might become drained.

DPSG,RG40854,210 –19–28MAR02–1/1

000158.17 — ECU Power Down Error

ECU is unable to complete proper power down procedures after detecting a key-off condition.

RG41221,000009A –19–28MAR02–1/1

000158.17 ECU Power Down Error Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see 000158.17 ECU POWER DOWN ERROR supporting information.* Without disconnecting, visually inspect the ECU connectors and the ignition switch wiring, for contamination, damage, or poor positioning.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Cycle ignition OFF for 20 seconds, then back ON. 6. Read DTCs.	**000158.17 reoccurs:** GO TO ❸ **000158.17 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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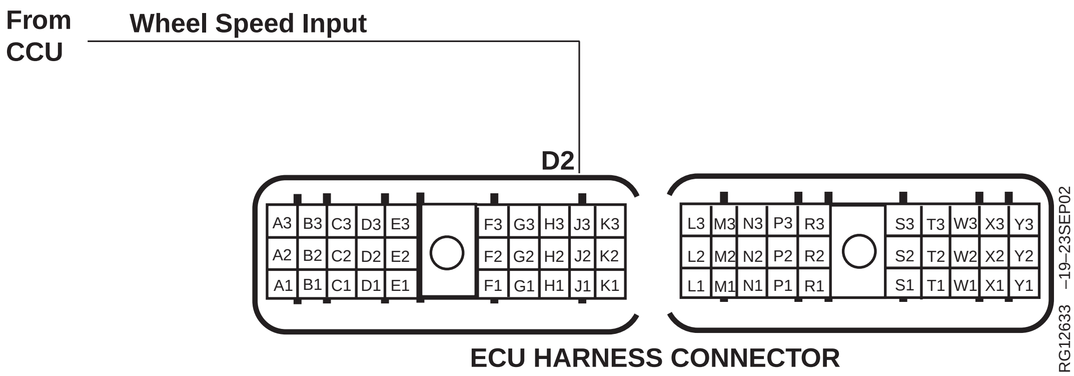
❸ **Wiring and Ignition Switch Test**	*NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure voltage between terminal E3 of the ECU connector on the engine harness and a good chassis ground. 4. While observing multimeter still connected to terminal E3, turn the ignition key through all of its positions EXCEPT “On.” Also observe multimeter while manipulating wiring at ignition switch.	**Any measurement above 3.0 volts:** ECU power supply wire from ignition shorted to battery voltage OR Faulty ignition switch **All measurements below 3.0 volts:** Faulty ECU – – –1/1

000160.02 — Wheel Speed Input Noise



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,214

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:

- Road speed limiting function is disabled and the ECU may limit engine speed to a set rpm.

RG41221,000004B –19–17SEP02–1/1

000160.02 — Wheel Speed Input Noise

The ECU detects noise on the wheel speed input.

RG41221,000004C –19–17SEP02–1/1

000160.02 Wheel Speed Input Noise Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.* Without disconnecting, visually inspect the ECU, CCU, and the wheel speed sensor connectors for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

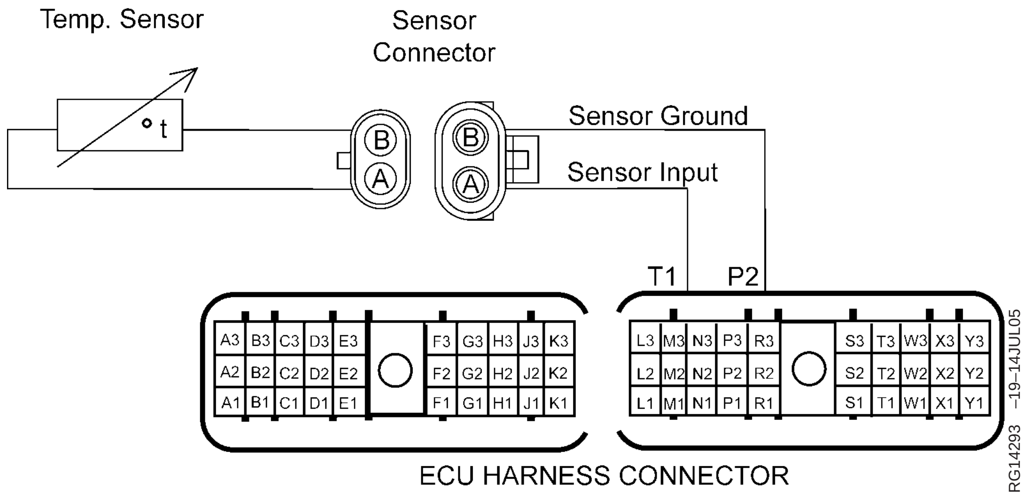
– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.* 1. Warm engine to normal operating temperatures. 2. Ignition OFF. 3. Use the diagnostic gauge OR 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. 4. Ignition ON, engine OFF. 5. Start the ECU diagnostic software, if applicable. 6. Make note of any DTCs, then clear all DTCs. 7. Ignition ON, engine OFF. 8. Read DTCs.	**000160.02 reoccurs:** GO TO ❸ **000160.02 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

– – –1/1

❸ **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 connections • Alternator connections • Chassis ground connections, battery ground connection • Corrosion, dirt, or paint can cause intermittent and “noisy” connections 2. Other possible causes of DTC 000160.02: • Electromagnetic interference (EMI) from an incorrectly installed 2-way radio. • Interference from some radar source. • Possible burrs on the wheel speed timing gear notches. Should be clean, square edges.	– – –1/1

000171.03 — Ambient Air Temperature Input Voltage High



NOTE: The ambient air temperature sensor is used on the 850J Crawler.

Ambient Air Temperature Sensor

- The ambient air temperature sensor is a thermistor (temperature sensitive resistor) that is typically threaded into the intake air ducting prior to the air filter. The ambient air temperature sensor is used to measure the temperature of the air outside of the engine for use by systems supplied with the application, such as air conditioning and cold-weather starting. The sensor's variable resistance causes the input voltage to the ECU to vary. Higher air temperatures result in lower input voltages to the ECU, lower temperatures result in higher voltages. For further sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000171.03 will set if:

- Input voltage in the sensor circuit rises to a level that is outside the normal operating range.

If DTC 000171.03 sets, the following will occur:

DPSG,RG40854,173 –19–02APR03–1/1

000171.03 — Ambient Air Temperature Input Voltage High

Input voltage in the sensor circuit rises to a level that is outside its normal operating range. Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open circuit. Less probable is a short from the 5V input wire to a power source.

WL30140,000001C –19–16AUG05–1/1

000171.03 Ambient Air Temperature Input Voltage High Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see 000171.03—AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information above.* Without disconnecting connectors, visually inspect the ECU connectors and the temperature sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see supporting information above.* 1. Use the diagnostic gage on the instrument panel OR connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000171.03 reoccurs:** GO TO ❸ **000171.03 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **"Sensor Open?" Test**	*NOTE: For wiring and theory of operation information, see 000171.03—AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor terminals.	**Less than 100K ohms:** Sensor not open. GO TO ❹ **More than 100K ohms:** Excessively high resistance in the sensor. Replace and retest.

– – –1/1

❹ **Input Circuit "Open or Short?" Test**	*NOTE: For wiring and theory of operation information, see 000171.03—AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition ON. 2. Temperature sensor still disconnected. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground.	**Above 5.5V:** Sensor 5V input wire shorted to a higher voltage source. GO TO ❺ **4.5-5.5V:** Input OK. Check ground circuit. GO TO ❼ **Less than 4.5V:** Open or high resistance in input wiring. GO TO ❻

– – –1/1

❺ **“Harness Shorted to Higher Voltage?” Test**	*NOTE: For wiring and theory of operation information, see 000171.03—AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect 30-pin connectors from ECU. 3. Ignition ON. 4. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground	**Above 5.5V:** Harness or connected wiring shorted to a higher voltage source. Repair and retest. **0V:** Harness wiring OK. Remove and test ECU. GO TO ❾ – – –1/1

❻ **“Harness Input Wiring Open?” Test**	*NOTE: For wiring and theory of operation information, see 000171.03—AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect the circuit’s 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Sensor still disconnected. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor’s input wiring in the harness.	**Near zero ohms:** Input wiring OK. Remove and test ECU. GO TO ❾ **Significantly above zero ohms:** Open or high resistance in input wiring. Repair and retest. – – –1/1

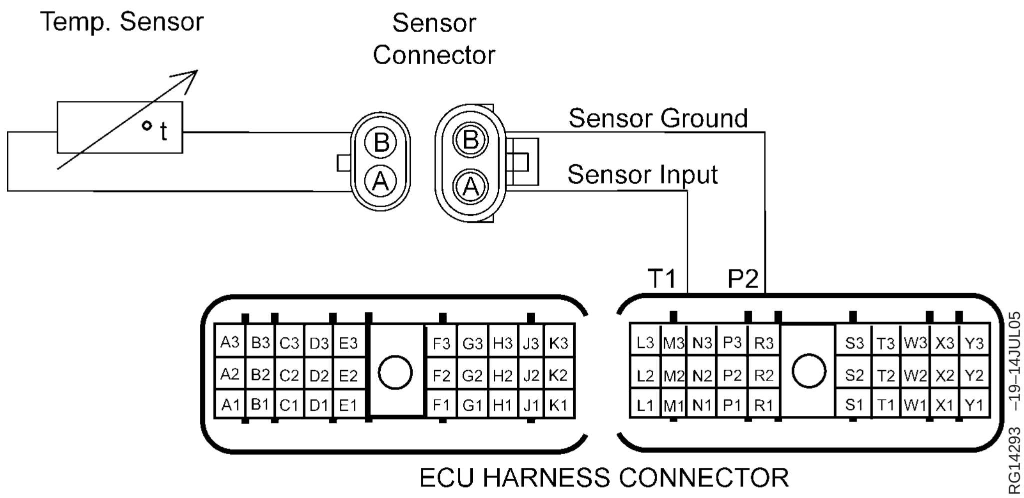
❼ **“Ground Circuit Open?” Test**	*NOTE: For wiring and theory of operation information, see 000171.03—AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Use a multimeter and JT07328 Connector Adapter Test Kit to check resistance from the return terminal in the sensor connector to a good chassis ground.	**Near zero ohms:** Ground circuit OK. Reconnect and retest. **Significantly above zero ohms:** Open or high resistance in ground circuit. GO TO ❽ – – –1/1

❽ **“Harness Ground Wiring Open?” Test**	*NOTE: For wiring and theory of operation information, see 000171.03—AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the circuit’s 30-pin connector from the ECU. Inspect connector and ECU pins. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor’s ground wiring in the harness.	**Near zero ohms:** Wiring OK. Remove and test ECU. GO TO ❿ **Significantly above zero ohms:** Open or high resistance in ground wiring. Repair and retest. – – –1/1

❾ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation information, see 000171.03—AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input and ground pins the ECU.	**1.5K to 3.5K ohms:** ECU OK. Reinstall and retest. **Below 1.5K or above 3.5K ohms:** Faulty ECU. Replace and retest. – – –1/1

❿ **ECU Ground Circuit Test**	*NOTE: For wiring and theory of operation information, see 000171.03—AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. ECU removed. 2. Using a multimeter and JT07328 Connector Adapter Test Kit, measure resistance between the sensor circuit's ground pin and pin C3 or C2 the ECU.	**Near zero ohms:** ECU OK. Reconnect and retest. **2 ohms or more:** Faulty ECU. Replace and retest. – – –1/1

000171.04 — Ambient Air Temperature Input Voltage Low



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NOTE: The ambient air temperature sensor is used on the 850J Crawler.

Ambient Air Temperature Sensor

- The ambient air temperature sensor is a thermistor (temperature sensitive resistor) that is typically threaded into the intake air ducting prior to the air filter. The ambient air temperature sensor is used to measure the temperature of the air outside of the engine for use by systems supplied with the application, such as air conditioning and cold-weather starting. The sensor's variable resistance causes the input voltage to the ECU to vary. Higher air temperatures result in lower input voltages to the ECU, lower temperatures result in higher voltages. For further sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000171.04 will set if:

- Input voltage in the sensor circuit drops to a level that is outside the normal operating range.

If DTC 000171.04 sets, the following will occur:

DPSG,RG40854,173 –19–02APR03–1/1

000171.04 — Ambient Air Temperature Input Voltage Low

Input voltage in the sensor circuit drops to a level that is outside its normal operating range. Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault is low resistance to ground (grounded circuit).

WL30140,000001D –19–16AUG05–1/1

000171.04 Ambient Air Temperature Input Voltage Low Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see 0000171.04 AMBIENT AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* Without disconnecting connectors, visually inspect the ECU connectors and the temperature sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see 0000171.04 AMBIENT AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000171.04 occurs:** GO TO ❸ **000171.04 does not occur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **"Sensor Shorted?" Test**	*NOTE: For wiring and theory of operation information, see 0000171.04 AMBIENT AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect the sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor pins.	**More than 100 ohms:** Sensor not shorted. GO TO ❹ **Less than 100 ohms:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

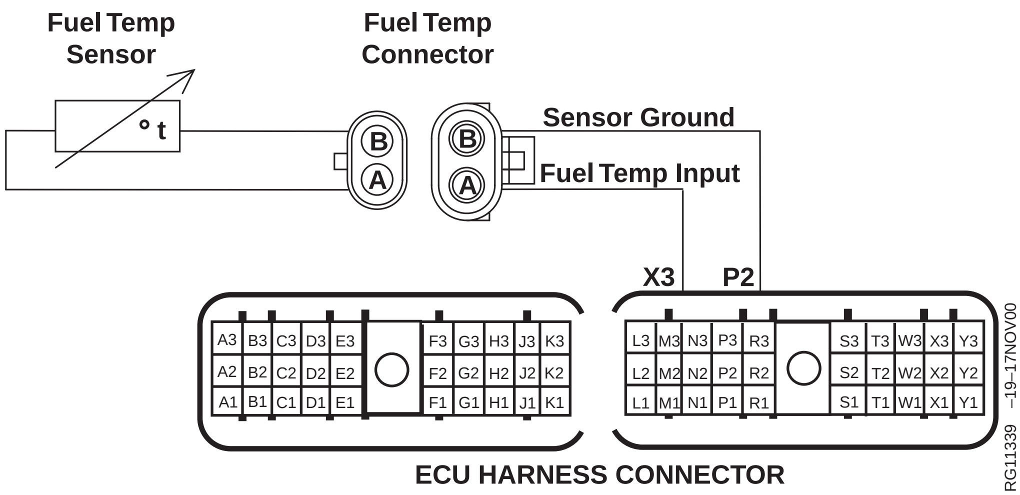
❹ **"Sensor Grounded?" Test**	*NOTE: For wiring and theory of operation information, see 0000171.04 AMBIENT AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between each sensor pin and a good chassis ground.	**Both pins 1M ohms or more:** Sensor OK. Check wiring. GO TO ❺ **Any one pin less than 1M ohms:** Low resistance to ground. Replace sensor and retest. – – –1/1

❺ **"Grounded Input Circuit?" Test**	*NOTE: For wiring and theory of operation information, see 0000171.04 AMBIENT AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground.	**1000 ohms or more:** Input circuit OK. Reconnect and retest. **Less than 1000 ohms:** GO TO ❻ – – –1/1

❻ **"Harness Input Wiring Grounded?" Test**	*NOTE: For wiring and theory of operation information, see 0000171.04 AMBIENT AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 3. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground.	**1M ohms or greater:** Input wiring OK. Remove and test ECU. GO TO ❼ **Less than 1M ohms:** Input wire shorted to ground. Repair and retest. – – –1/1

❼ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation information, see 0000171.04 AMBIENT AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input and ground pins in the ECU.	**1.5K to 3.5K ohms:** ECU OK. Reinstall and retest. **Below 1.5K or above 3.5K ohms:** Faulty ECU. Replace and retest. – – –1/1

000174.00 — Fuel Temperature High Most Severe



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the base of the fuel filter. It is used to measure the fuel temperature. 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 and lower temperatures result in higher voltages.
  Fuel density drops as fuel temperature increases. The ECU uses the fuel temperature sensor input to calculate fuel density and adjust the fuel delivery accordingly. For further fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000174.00 will set if:

- The ECU senses fuel temperature on OEM applications above 70° C (158° F). For the most severe fuel temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

If DTC 000174.00 sets, the following will occur:

- Engine protection is enabled. See ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  – With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG41221,00000DB –19–18APR02–1/1

000174.00 — Fuel Temperature High Most Severe

The ECU senses fuel temperature above specifications.

RG41221,00000DC –19–16APR03–1/1

000174.00 Fuel Temperature High Most Severe Diagnostic Procedure

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❶ **Preliminary Check**	Before using this diagnostic procedure: 1. Ensure that fuel level in tank is not extremely low. 2. If engine is equipped with a fuel cooler, make sure cooler is clean.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000174.00 FUEL TEMPERATURE HIGH MOST SEVERE supporting information.* Without disconnecting, visually inspect the ECU connectors and the fuel temperature sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❸ **Problem found:** Repair and retest.

– – –1/1

❸ **Fuel Supply Pressure Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.00 FUEL TEMPERATURE HIGH MOST SEVERE supporting information.* Determine the fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE in Section 04, Group 150 earlier in this manual.	**Fuel pressure within specification:** GO TO ❹ **Fuel pressure below specification:** Determine cause of low supply pressure. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE in Group 150 earlier in this manual.

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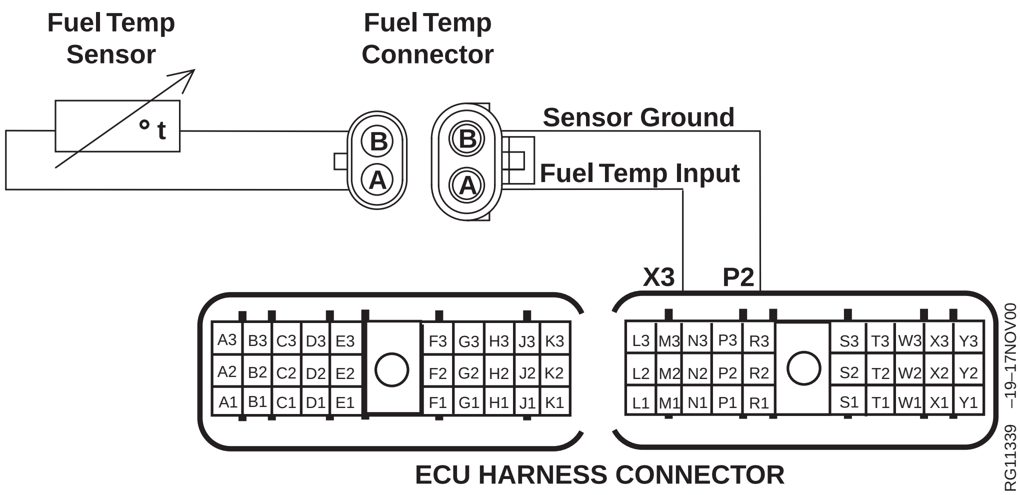
❹ **Restricted Fuel Return Line Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.00 FUEL TEMPERATURE HIGH MOST SEVERE supporting information.* Check for restricted fuel return line. See CHECK FOR RESTRICTED FUEL RETURN LINE in Section 04, Group 150 earlier in this manual.	**No restrictions found:** Faulty high pressure fuel pump overflow valve OR Faulty fuel cooler OR Faulty high pressure fuel pump **Restrictions found:** Determine cause of restriction, repair, and retest – – –1/1

000174.03 — Fuel Temperature Input Voltage High



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NOTE: *Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the base of the fuel filter. It is used to measure the fuel temperature. 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 and lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for variation in fuel density caused by varying fuel temperatures. For further fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000174.03 will set if:

- Input voltage in the sensor circuit rises to a level that is outside its normal operating range. The voltage corresponds to a temperature that is lower than what is physically possible for fuel temperature.

If DTC 000174.03 sets, the following will occur:

- The ECU will use a default “limp-home” value of 40°C (104°F).
- Engine power may be slightly effected.

DPSG,RG40854,211 –19–02APR03–1/1

000174.03 — Fuel Temperature Input Voltage High

The input voltage in the sensor circuit rises to a level that is outside the normal operating range. Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open circuit. Less probable is a short from the 5V input wire to a power source.

RG41221,000009B –19–01APR02–1/1

000174.03 Fuel Temperature Input Voltage High Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* Without disconnecting connectors, visually inspect the ECU connectors and the temperature sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Use the diagnostic gage on the instrument panel OR connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000174.03 reoccurs:** GO TO ❸ **000174.03 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **"Sensor Open?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor terminals.	**Less than 100K ohms:** Sensor not open. GO TO ❹ **More than 100K ohms:** Excessively high resistance in the sensor. Replace and retest. – – –1/1

❹ **Input Circuit "Open or Short?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition ON. 2. Temperature sensor still disconnected. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground.	**Above 5.5V:** Sensor 5V input wire shorted to a higher voltage source. GO TO ❺ **4.5-5.5V:** Input OK. Check ground circuit. GO TO ❼ **Less than 4.5V:** Open or high resistance in input wiring. GO TO ❻ – – –1/1

❺ **"Harness Shorted to Higher Voltage?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect 30-pin connectors from ECU. 3. Ignition ON. 4. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground	**Above 5.5V:** Harness or connected wiring shorted to a higher voltage source. Repair and retest. **0V:** Harness wiring OK. Remove and test ECU. GO TO ❾ – – –1/1

❻ **"Harness Input Wiring Open?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Sensor still disconnected. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's input wiring in the harness.	**Near zero ohms:** Input wiring OK. Remove and test ECU. GO TO ❾ **Significantly above zero ohms:** Open or high resistance in input wiring. Repair and retest. – – –1/1

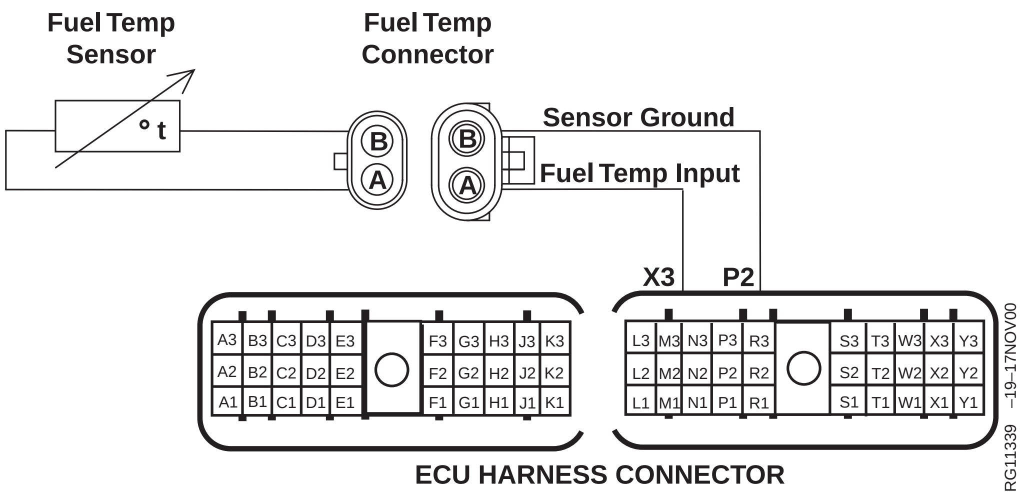
❼ **"Ground Circuit Open?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Use a multimeter and JT07328 Connector Adapter Test Kit to check resistance from the return terminal in the sensor connector to a good chassis ground.	**Near zero ohms:** Ground circuit OK. Reconnect and retest. **Significantly above zero ohms:** Open or high resistance in ground circuit. GO TO ❽ – – –1/1

❽ **"Harness Ground Wiring Open?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's ground wiring in the harness.	**Near zero ohms:** Wiring OK. Remove and test ECU. GO TO ❿ **Significantly above zero ohms:** Open or high resistance in ground wiring. Repair and retest. – – –1/1

❾ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input and ground pins in the ECU.	**1.5K to 3.5K ohms:** ECU OK. Reinstall and retest. **Below 1.5K or above 3.5K ohms:** Faulty ECU. Replace and retest. – – –1/1

10 ECU Ground Circuit Test	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. ECU removed. 2. Using a multimeter and JT07328 Connector Adapter Test Kit, measure resistance between the sensor circuit's ground pin and pin C3 or C2 in the ECU.	**Near zero ohms:** ECU OK. Reinstall and retest. **2 ohms or more:** Faulty ECU. Replace and retest. – – –1/1

000174.04 — Fuel Temperature Input Voltage Low



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NOTE: *Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the base of the fuel filter. It is used to measure the fuel temperature. 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 and lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for variation in fuel density caused by varying fuel temperatures. For further fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000174.04 will set if:

- Input voltage in the sensor circuit drops to a level that is outside its normal operating range. The voltage corresponds to a temperature that is higher than what is physically possible for fuel temperature.

If DTC 000174.04 sets, the following will occur:

- The ECU will use a default “limp-home” value of 40°C (104°F).
- Engine power may be slightly effected.

DPSG,RG40854,212 –19–02APR03–1/1

000174.04 — Fuel Temperature Input Voltage Low

Input voltage in the sensor circuit drops to a level that is outside its normal operating range. Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault is low resistance to ground (grounded circuit).

RG41221,000009C –19–01APR02–1/1

000174.04 Fuel Temperature Input Voltage Low Diagnostic Procedure

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❶ Visual Inspection of Connectors and Wiring	**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.** *NOTE: For wiring and theory of operation information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* Without disconnecting connectors, visually inspect the ECU connectors and the temperature sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ Intermittent Fault Test	*NOTE: For wiring and theory of operation information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000174.04 occurs:** GO TO ❸ **000174.04 does not occur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **"Sensor Shorted?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect the sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor pins.	**More than 100 ohms:** Sensor not shorted. GO TO ❹ **Less than 100 ohms:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

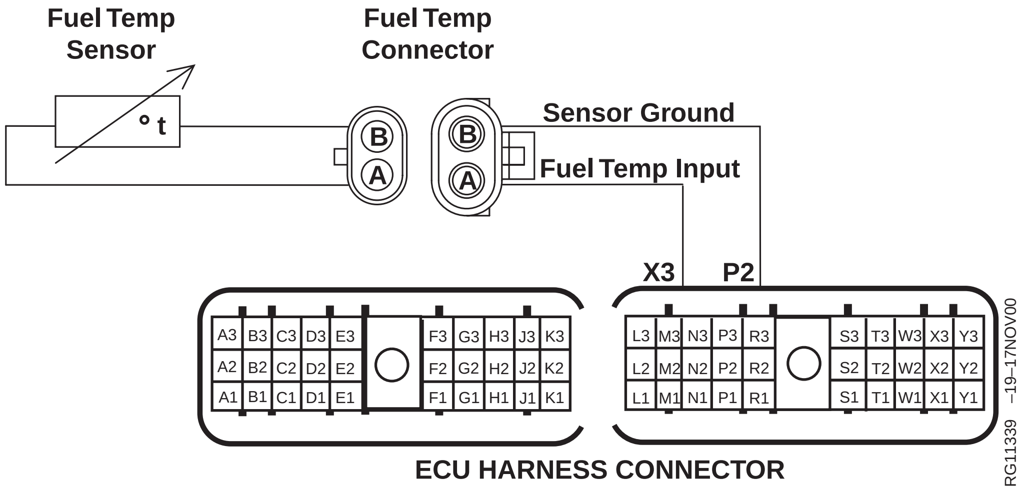
❹ **"Sensor Grounded?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between each sensor pin and a good chassis ground.	**Both pins 1M ohms or more:** Sensor OK. Check wiring. GO TO ❺ **Any one pin less than 1M ohms:** Low resistance to ground. Replace sensor and retest. – – –1/1

❺ **"Grounded Input Circuit?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground.	**1000 ohms or more:** Input circuit OK. Reconnect and retest. **Less than 1000 ohms:** GO TO ❻ – – –1/1

❻ **"Harness Input Wiring Grounded?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 3. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground.	**1M ohms or greater:** Input wiring OK. Remove and test ECU. GO TO ❼ **Less than 1M ohms:** Input wire shorted to ground. Repair and retest. – – –1/1

❼ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input and ground pins in the ECU.	**1.5K to 3.5K ohms:** ECU OK. Reinstall and retest. **Below 1.5K or above 3.5K ohms:** Faulty ECU. Replace and retest. – – –1/1

000174.16 — Fuel Temperature High Moderately Severe



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the base of the fuel filter. It is used to measure the fuel temperature. 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 and lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for variation in fuel density caused by varying fuel temperatures. For further fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000174.16 will set if:

- The ECU senses fuel temperature on OEM applications above 65°C (149°F). For fuel temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

If DTC 000174.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

DPSG,RG40854,873 –19–01APR02–1/1

000174.16 — Fuel Temperature High Moderately Severe

The ECU senses fuel temperature above specifications.

RG41221,000009D –19–16APR03–1/1

000174.16 Fuel Temperature High Moderately Severe Diagnostic Procedure

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❶ **Preliminary Check**	Before using this diagnostic procedure: 1. Ensure that fuel level in fuel tank is not extremely low. 2. If engine is equipped with a fuel cooler, make sure cooler is clean.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest

– – –1/1

❷ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information.* Without disconnecting, visually inspect the ECU connectors and the fuel temperature sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❸ **Problem found:**

– – –1/1

❸ **Fuel Supply Pump Pressure Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information.* Determine the fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE in Section 04, Group 150 earlier in this manual.	**Fuel pressure within specification:** GO TO ❹ **Fuel pressure below specification:** Determine cause of low supply pressure as outlined in CHECK FUEL SUPPLY PRESSURE in Group 150 earlier in this manual. Repair problem and retest.

– – –1/1

❹ **Restricted Fuel Return Line Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information.* Check return fuel line for restrictions. See CHECK FOR RESTRICTED FUEL RETURN LINE in Group 150 earlier in this manual.	**Fuel return line NOT restricted:** Verify that fuel temperature input and ground circuit 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

000189.00 — Engine Speed Derate

The ECU detects a condition that requires an engine speed derate.

Engine Speed Derate

- The engine speed derate trouble code is set to indicate that the ECU has detected a condition requiring derate.

DTC 000189.00 will set if:

- The ECU detects a condition that requires an engine speed derate.

If DTC 000189.00 sets, the following will occur:

- The ECU will limit engine speed to low idle.

If DTC 000189.00 sets:

- Check for stored or active DTCs that indicate the reason for the speed derate.

RG41221,0000110 –19–03APR03–1/1

000190.00 — Engine Overspeed Extreme

The ECU detects that engine speed exceeds:

- 2800 rpm (marine)
- 3000 rpm (D-series dump truck)
- 3300 rpm (7020 tractor, 4920 Sprayer)
- 3600 rpm (7710/7810 tractor, industrial)

Pump Position Sensor and Crankshaft Position Sensor

- The pump position and crankshaft position sensors are both inductive type pickup sensors that detect notches on their respective gears/timing wheel. The ECU uses the crankshaft position input to determine engine speed and precise piston position in relation to TDC.

DTC 000190.00 will set if:

- The ECU detects that engine speed exceeds the value programmed into the ECU.

If DTC 000190.00 sets, the following will occur:

- The ECU will stop sending current to the PCVs. This will eliminate the flow of fuel to the HPCR. Fueling will restart when rpm falls to a predetermined value.

RG41221,00000DE –19–03APR03–1/1

000190.01 — Engine Overload Moderate

The ECU detects moderate engine overload condition of 120 minutes duration.

If too large of a propeller is installed on a boat the resulting propeller load curve will cause the engine to operate in higher torque, lower speed conditions than normal. The engine may fail if operated at these conditions for a prolonged amount of time.

NOTE: The values in the following explanation are the initial software values. Your ECU may be programmed differently.

DTC 000190.01 will set if an overload condition has existed for 120 minutes.

Overload Detection “Persistence” Timer:

- It takes 4 minutes above the overload curve to set an overload “condition.” It takes 4 minutes below the curve to clear the condition.
- As long as more time is spent above the curve than below the curve, the overload condition will eventually be detected. Likewise, once the condition is detected it may some minutes to clear.
- If the ECU is reset at any time, the persistence timer is initialized to 2 minutes (50% of the counter).
- When engine is not running, the 4 minute timer holds its current value.

Secondary Timer:

- Once the overload condition is detected, a secondary timer starts. After 118 minutes, the fault will set.
- If the overload condition clears as described above, the secondary timer is reset to 0 and the fault is cleared.
- If the ECU is reset at any point after an overload condition was detected, the secondary timer value is stored and the fault is cleared. If an overload condition is detected again, the stored secondary timer value is used. If the overload condition goes away, the stored secondary timer value is then cleared (no faults would be set).

Continued on next page

One can monitor an engine operating above or below the overload curve through the DST which can monitor the 4-minute timer.

If DTC 000190.01 sets, the following will occur:

- A warning light will come on.

WL30140,0000021 –19–16AUG05–2/2

000190.16 — Engine Overspeed Moderate

The ECU detects that engine speed exceeds 2700 rpm (marine).

Pump Position Sensor and Crankshaft Position Sensor

- The pump position and crankshaft position sensors are both inductive type pickup sensors that detect notches on their respective gears/timing wheel. The ECU uses the crankshaft position input to determine engine speed and precise piston position in relation to TDC.

DTC 000190.16 will set if:

- The ECU detects that engine speed exceeds the value programmed into the ECU.

If DTC 000190.16 sets, the following will occur:

- The ECU will stop sending current to the PCVs. This will eliminate the flow of fuel to the HPCR. If engine speed drops below 2520 rpm (marine), fueling will restart.

RG41221,00000DF –19–03APR03–1/1

000190.18 — Engine Overload Severe

The ECU detects severe engine overload condition of 30 minutes duration.

If too large of a propeller is installed on a boat the resulting propeller load curve will cause the engine to operate in higher torque, lower speed conditions than normal. The engine may fail if operated at these conditions for a prolonged amount of time.

NOTE: The values in the following explanation are the initial software values. Your ECU may be programmed differently.

DTC 000190.18 will set if an overload condition has existed for 30 minutes.

Overload Detection "Persistence" Timer:

- It takes 4 minutes above the overload curve to set an overload "condition." It takes 4 minutes below the curve to clear the condition.
- As long as more time is spent above the curve than below the curve, the overload condition will eventually be detected. Likewise, once the condition is detected it may some minutes to clear.
- If the ECU is reset at any time, the persistence timer is initialized to 2 minutes (50% of the counter).
- When engine is not running, the 4 minute timer holds its current value.

Secondary Timer:

- Once the overload condition is detected, a secondary timer starts. After 28 minutes, the fault will set.
- If the overload condition clears as described above, the secondary timer is reset to 0 and the fault is cleared.
- If the ECU is reset at any point after an overload condition was detected, the secondary timer value is stored and the fault is cleared. If an overload condition is detected again, the stored secondary timer value is used. If the overload condition goes away, the stored secondary timer value is then cleared (no faults would be set).

Continued on next page

WL30140,0000022 –19–16AUG05–1/2

One can monitor an engine operating above or below the overload curve through the DST which can monitor the 4-minute timer.

If DTC 000190.18 sets, the following will occur:

- A warning light will come on.

WL30140,0000022 –19–16AUG05–2/2

000237.02 — Vehicle Identification Number Invalid

The ECU detects a VIN on the CCU, ECU, or ICU that does not match the VIN of the other two controllers.

Vehicle Identification Number (VIN)

- The VIN includes information pertaining to the vehicle model number, the vehicle serial number, and the option code that is available for each specific vehicle. There are several checks set up in the ECU to verify that all of the correct electronic controllers are being used.
  After power on, the ECU will wait 50 seconds and then request the VIN. If no responses are received, the ECU will try 2 more times in 50 second increments. After a valid response, the ECU will wait 1 hour before requesting the VIN.

DTC 000237.02 will set if:

- The ECU detects a vehicle product identification number on the CCU, ECU or ICU that does not match what the other two controllers have.
- The ECU is unable to communicate with the CCU or ICU.

If DTC 000237.02 sets, the following will occur:

- ECU will derate the engine to 90% of full power.
- DTC 000237.02 will NOT reset with a key cycle.
- DTC 001569.31 will set.

If DTC 000237.02 sets:

Perform or check the following, as applicable.

- If a controller was just re-programmed there may be a problem with the released software.
- Place vehicle in diagnostic mode.
- Check the Vehicle Identification Number on the CCU, ECU, and ICU by looking at Address 251. The controllers' VIN must match the Product Identification Number (PIN).
- Place the original controller back on the vehicle if it was removed for any reason. Otherwise reprogram the controller(s).
- CAN bus communication problems can cause this code.
- For additional information, see the vehicle diagnostic manual.

RG41221,0000111 –19–03APR03–1/1

000237.13 — Vehicle Identification Option Code Invalid

The ECU detects an option code on the ECU that does not match the option code of the other controllers.

If DTC 000237.13 sets, the following will occur:

- ECU will derate the engine to low idle.
- DTC 000189.00 will also set.

If DTC 000237.13 sets:

Perform or check the following, as applicable.

- If a controller was just re-programmed there may be a problem with the released software.
- Place vehicle in diagnostic mode.
- Check the Vehicle Identification Number on the CCU, ECU, and ICU by looking at Address 251. The controllers' VIN must match the Product Identification Number (PIN).
- Place the original controller back on the vehicle if it was removed for any reason. Otherwise reprogram the controller(s).
- CAN bus communication problems can cause this code.
- For additional information, see the vehicle diagnostic manual.

RG41221,0000112 –19–03APR03–1/1

000237.31 — Vehicle Model Number Invalid

The ECU detects a vehicle model number on the CCU, ECU, or ICU that does not match the vehicle model number of the other two controllers.

Vehicle Identification Number (VIN)

- The VIN includes information pertaining to the vehicle model number, the vehicle serial number, and the option code that is available for each specific vehicle. There are several checks set up in the ECU to verify that all of the correct electronic controllers are being used.
  After power on, the ECU will wait 50 seconds and then request the VIN. If no responses are received, the ECU will try 2 more times in 50 second increments. After a valid response, the ECU will wait 1 hour before requesting the VIN.

DTC 000237.31 will set if:

- The ECU detects a vehicle model number on the CCU, ECU, or ICU that does not match the vehicle model number of the other two controllers.

If DTC 000237.31 sets, the following will occur:

- ECU will derate the engine to low idle.
- DTC 000189.00 will also be present.

If DTC 000237.31 sets:

Perform or check the following, as applicable.

- If a controller was just re-programmed there may be a problem with the released software.
- Place vehicle in diagnostic mode.
- Check the Vehicle Identification Number on the CCU, ECU, and ICU by looking at Address 251. The controllers' VIN must match the Product Identification Number (PIN).
- Place the original controller back on the vehicle if it was removed for any reason. Otherwise reprogram the controller(s).
- CAN bus communication problems can cause this code.
- For additional information, see the vehicle diagnostic manual.

RG41221,0000113 –19–03APR03–1/1

000523.09 — Gear Selection Invalid

The ECU does not receive vehicle gear selection information or it is invalid.

Gear Selection

- Self Propelled Forage Harvester: The SPFH controller transmits the vehicle gear selection to the ECU over the CAN bus.
- Articulated Dump Truck: The TCU controller transmits ETC2 (electronic transmission controller #2) message to the ECU over the CAN bus.

The ECU uses this information to select the correct governor curve mode.

DTC 000523.09 will set if:

- The ECU does not receive vehicle gear selection information or it is invalid.

If DTC 000523.09 sets, the following will occur:

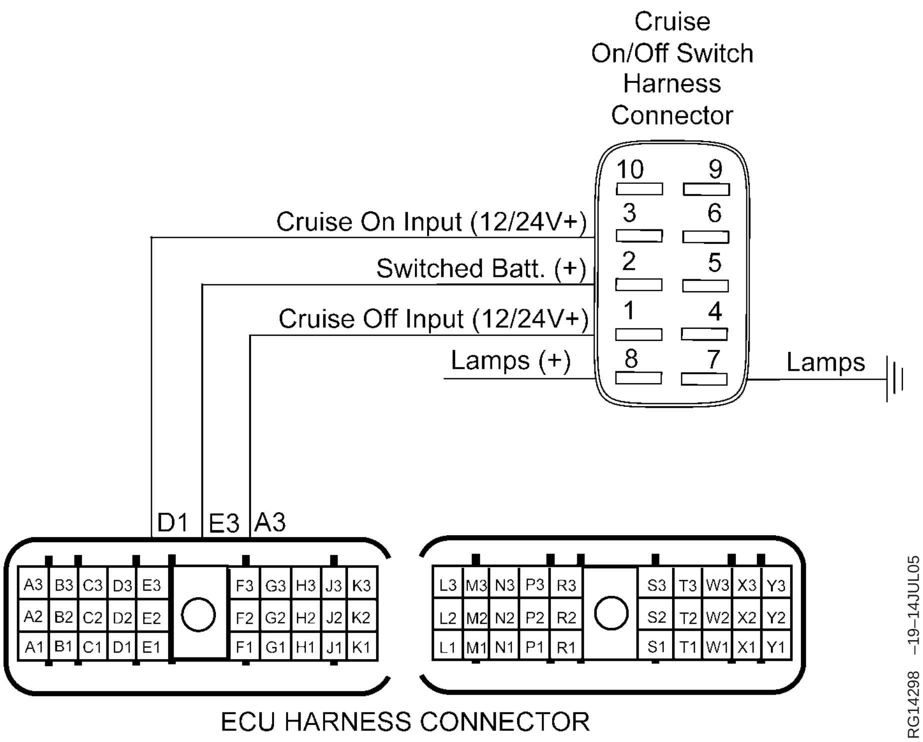
- The ECU limits engine speed to 1650 rpm in transport mode (SPFH).
- The ECU defaults to Torque Parameter 0 (Dump Truck).
- DTC 000639.13 may also be present. If so, diagnose it first.

If DTC 000523.09 sets:

- Using the DST or SERVICE ADVISOR™, monitor DTCs on the active code display parameter.
- 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 in the SPFH test manual.

RG41221,0000053 –19–23SEP02–1/1

000596.31 — Cruise Control On/Off Switch Inputs Shorted



NOTE: This DTC is used on the D-Series Grader.

Cruise Control On/Off Switch

- For further information, see CRUISE CONTROL OPERATION in Section 03, Group 140.

DTC 000596.31 will set if:

- Voltage is sensed on both the On and the Off cruise control circuits.

If DTC 000596.31 sets, the following will occur:

- Cruise control will be disabled.

DPSG,RG40854,173 –19–02APR03–1/1

000596.31 — Cruise Control On/Off Inputs Shorted

Voltage is sensed on both the On and the Off cruise control circuits. The probable cause of this fault is a bad On/Off switch. Another cause might be a short to power in the On or Off circuit between the switch and ECU.

WL30140,000001E –19–16AUG05–1/1

000596.31 Cruise Control On/Off Inputs Shorted Diagnostic Procedure

04
160
,257

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see CRUISE CONTROL ON/OFF INPUTS SHORTED supporting information.* Without disconnecting connectors, visually inspect the ECU, Cruise On/Off switch connectors, and any connectors between the instrument panel and engine harness for contamination, damage, or poor positioning. Check wiring for damage. Check switch for positive engagement in both positions.	**No problem found:** GO TO ❷ **Faulty connection(s), wiring, or switch:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see CRUISE CONTROL ON/OFF INPUTS SHORTED supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000596.31 occurs:** GO TO ❸ **000596.31 does not occur:** Manipulate the On/Off switch and wiring while monitoring the error codes. If code returns, note where the error occured. GO TO ❸ If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

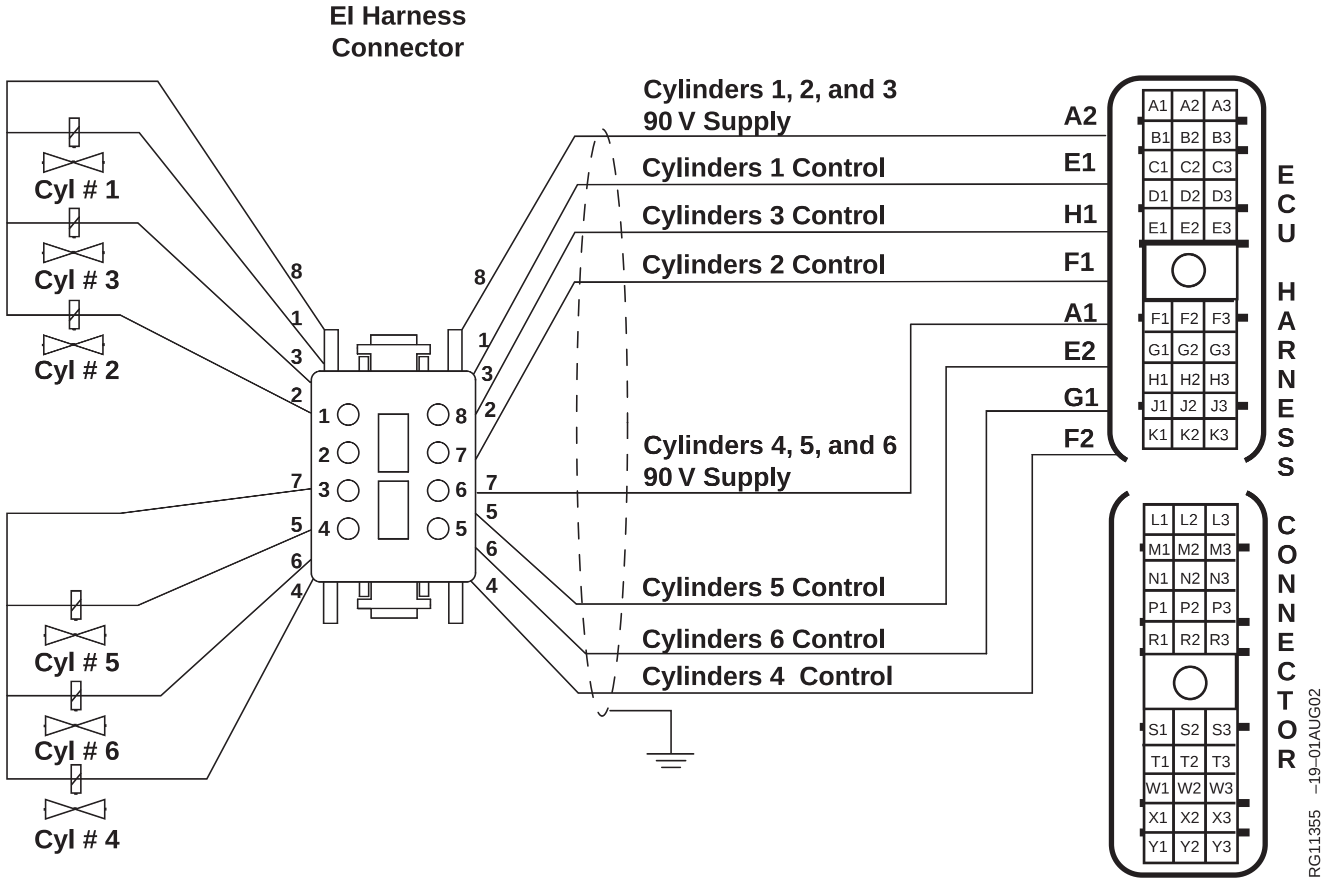
– – –1/1

❸ **Switch Test**	*NOTE: For wiring and theory of operation information, see CRUISE CONTROL ON/OFF INPUTS SHORTED supporting information.* 1. Clear DTCs. 2. Ignition OFF. 3. Disconnect Cruise Control On/Off switch. 4. Ignition ON, engine OFF. 5. Read DTCs.	**000596.31 occurs:** Switch OK. Short in switch wiring or connector. GO TO ❹ **000596.31 does not occur:** Faulty Cruise Control On/Off switch. Replace and retest. – – –1/1

❹ **Short Circuit Test (part 1)**	*NOTE: For wiring and theory of operation information, see CRUISE CONTROL ON/OFF INPUTS SHORTED supporting information.* 1. Ignition OFF. 2. With switch still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistances in the switch connector between terminal 1 and terminals 2, 3, and 8 in succession. Minimum allowed resistances between terminals: • 1 and 2: 100K • 1 and 3: 4K • 1 and 8: 100K	**All circuits above specifications:** Cruise Off circuit OK. Fault is in Cruise On circuit. GO TO ❺ **One or more circuits below specifications:** Short between circuits that measured low resistances. Repair and retest. – – –1/1

❺ **Short Circuit Test (part 2)**	*NOTE: For wiring and theory of operation information, see CRUISE CONTROL ON/OFF INPUTS SHORTED supporting information.* 1. Ignition OFF. 2. With switch still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistances in the switch connector between terminal 3 and terminals 2 and 8 in succession. Minimum allowed resistances between terminals: • 3 and 2: 100K • 3 and 8: 100K	The short is between circuits that measured low resistances. Repair and retest. – – –1/1

000611.03 — Electronic Injector Wiring Shorted To Power Source



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000611.03 will set if:

- The ECU detects that injector wiring is shorted to a power source.

If DTC 000611.03 sets, the following will occur:

- With DTC 000611.03 active, the ECU doesn't control the system any differently. Depending on the cause of this code, a cylinder misfire or gray smoke may be observed.

DPSG,RG40854,213 –19–01APR02–1/1

000611.03 — Electronic Injector Wiring Shorted To Power Source

The ECU detects that injector wiring is shorted to a power source.

RG41221,000009E –19–04JAN01–1/1

000611.03 Electronic Injector Wiring Shorted To Power Source Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000611.03 ELECTRONIC INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.* Without disconnecting, visually inspect the ECU connectors and the EI harness connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.03 ELECTRONIC INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.* **IMPORTANT: Other DTCs may be set with 000611.03. Follow this procedure first, make repairs as directed.** 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000611.03 reoccurs:** GO TO ❸ **000611.03 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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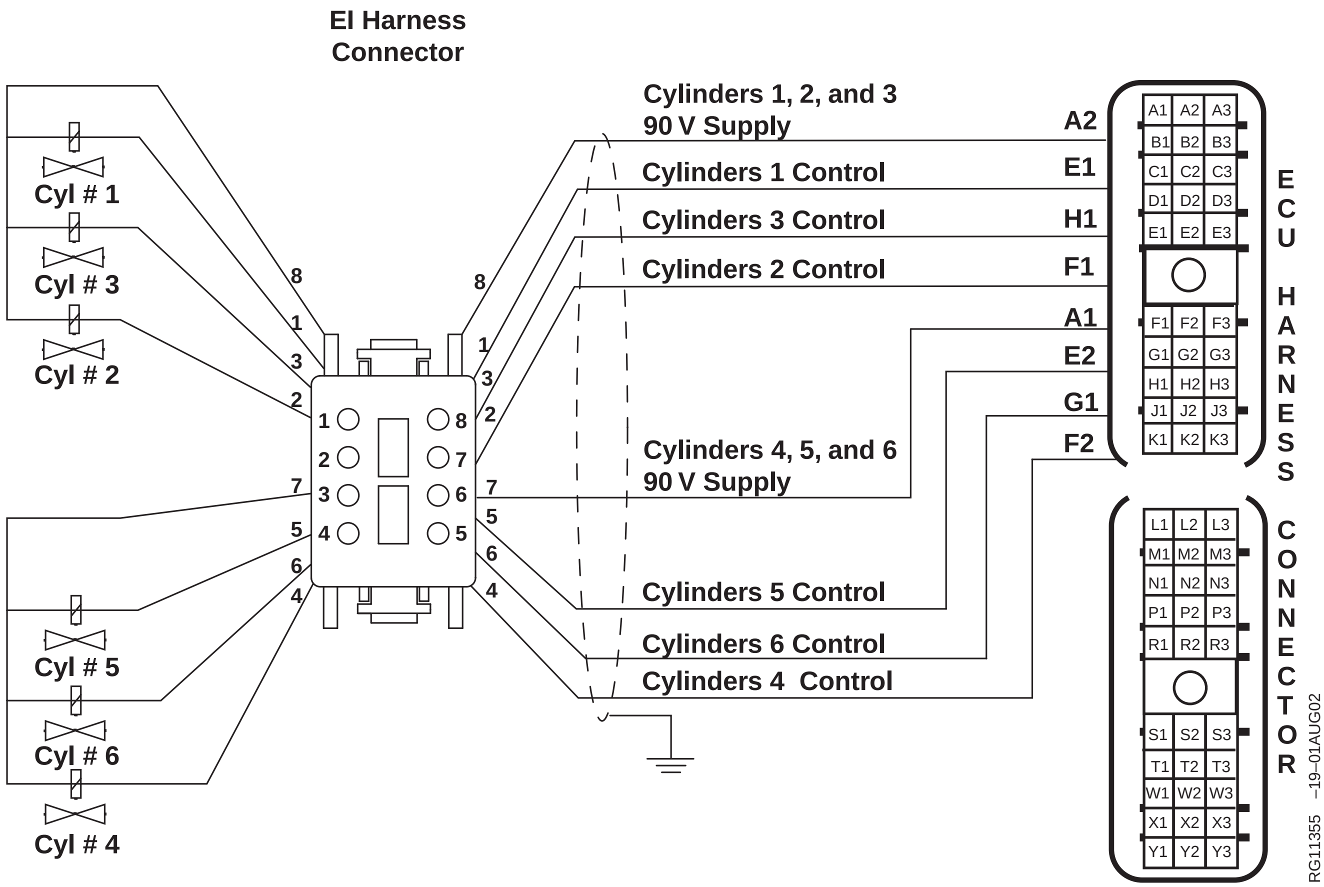
❸ **Engine Operation Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.03 ELECTRONIC INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.* 1. Ignition ON, engine running. 2. Run engine at high idle 3. Observe engine performance for: • Exhaust smoke • Engine misfire • High-idle speed	**Engine has white-gray smoke, a maximum engine speed of 900 RPM, and a lack of response:** GO TO ❹ **Engine has a misfire, little to no smoke, and goes to or near maximum engine speed:** GO TO ❺ – – –1/1

❹ **Short in 90V Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.03 ELECTRONIC INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Disconnect the EI wiring harness connector at rear of cylinder head. 4. Using a multimeter, measure resistance between: • The Fuel Injector 90 V terminal A2 in the harness end of the of the ECU connector and all the terminals in both of the 30-way ECU connectors. • The Fuel Injector 90 V terminal A1 in the harness end of the of the ECU connector and all the terminals in both of the 30-way ECU connectors.	**All measurements greater than 20k ohms:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **One or more measurements less than 20k ohms:** Short in EI 90 V circuit – – –1/1

❺ **Short in EI Control Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.03 ELECTRONIC INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.* 1. Using the ECU diagnostic software, perform Cylinder Cutout Test. For instructions on how to run this test, seeENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST earlier in this Group. *NOTE: After performing the Cylinder Cutout Test you should be able to identify one or more cylinders that did not effect the way the engine ran. This will be the cylinder(s) referred to in the following test.* 2. Ignition OFF. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Disconnect EI wiring harness connector on the side of the cylinder head. 5. Using a multimeter, measure resistance between the control terminal of the EI identified in the Cylinder Cutout Test, at the ECU connector and all other terminals in both 30-way ECU connectors on the engine harness.	**All measurements greater than 20k ohms:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **One or more measurements less than 20k ohms:** Short in EI control circuit – – –1/1

000611.04 — Electronic Injector Wiring Shorted To Ground



Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000611.04 will set if:

- The ECU detects that injector wiring is shorted to ground.

If DTC 000611.04 sets, the following will occur:

- With DTC 000611.04 active, the ECU doesn't control the system any differently. Depending on the cause of this code, the engine may not start, run rough, or have excessive black smoke.

DPSG,RG40854,214 –19–01APR02–1/1

000611.04 — Electronic Injector Wiring Shorted To Ground

The ECU detects that injector wiring is shorted to ground.

RG41221,000009F –19–01APR02–1/1

000611.04 Electronic Injector Wiring Shorted To Ground Diagnostic Procedure

NOTE: Before using this diagnostic procedure, Without disconnecting, visually inspect the ECU connectors and the EI harness connector for contamination, damage, or poor positioning. Check wiring for damage.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.* Without disconnecting, visually inspect the ECU connectors and the EI harness connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.* **IMPORTANT: Other DTCs may be set with 000611.04 Follow this procedure first, make repairs as directed.** 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running at high idle or cranking for 15 seconds. 6. Read DTCs.	**000611.04 reoccurs:** GO TO ❸ **000611.04 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Engine Operation Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Ignition ON, engine cranking for 15 seconds or running at high idle. 2. Observe engine performance.	**Engine will not start:** GO TO ❺ **Engine runs rough and has excessive black smoke:** GO TO ❹ – – –1/1

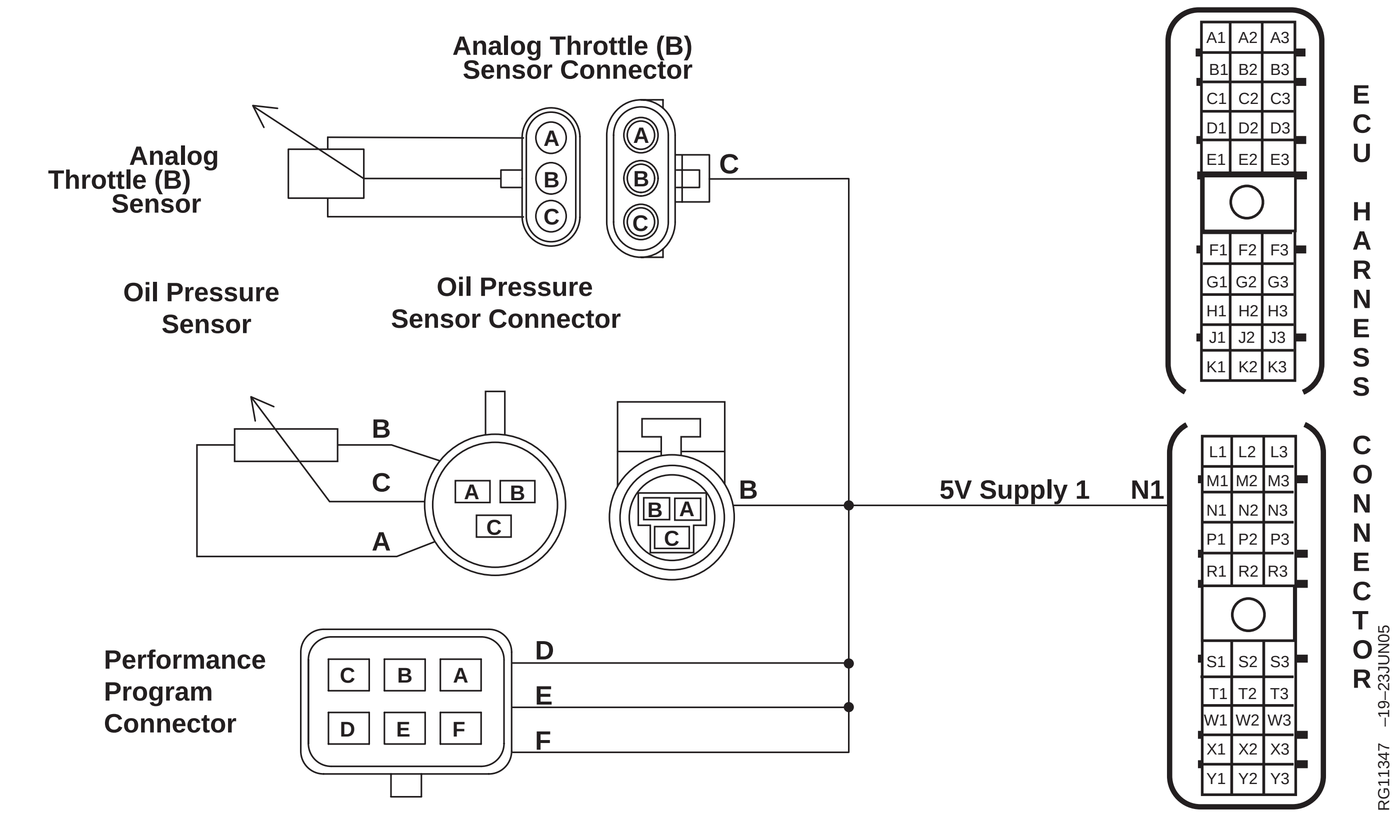
❹ **Short in EI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Using the ECU diagnostic software, perform Cylinder Cutout Test. For instructions on how to run this test, seeENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST earlier in this Group. *NOTE: After performing the Cylinder Cutout Test you should be able to identify one or more cylinders that did not effect the way the engine ran. This will be the cylinder(s) referred to in the following test.* 2. Ignition OFF. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Disconnect EI wiring harness connector on side of cylinder head. 5. Using a multimeter, measure resistance between: • Terminal A2 in the harness end of the 30-way ECU connector and all other terminals in both 30-way ECU connectors and a good chassis ground. • Terminal A1 in the harness end of the 30-way ECU connector and all other terminals in both 30-way ECU connectors and a good chassis ground.	**All measurements greater than 20k ohms:** GO TO ❻ **Any measurement less than 20k ohms:** Short in ECU wiring harness – – –1/1

❺ **Short in ECU Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Disconnect EI wiring harness connector at side of cylinder head. 4. Using a multimeter, measure resistance between: • Terminal A1 in the harness end of the ECU connector and all other terminals in both 30-way ECU connectors and a good chassis ground. • Terminal A2 in the harness end of the ECU connector and all other terminals in both 30-way ECU connectors and a good chassis ground.	**All measurements greater than 20k ohms:** GO TO ❻ **Any measurement less than 20k ohms:** Short in ECU wiring harness – – –1/1

❻ **ECU and EI Wiring Connection Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Ignition OFF. 2. EI wiring harness connector at side of cylinder head disconnected. 3. Using a multimeter, measure resistance between: • Terminal 7 in the cylinder head side of the EI wiring harness and a good chassis ground. • Terminal 8 in the cylinder head side of the EI wiring harness and a good chassis ground.	**Any measurement less than 20k ohms:** GO TO ❼ **All measurements greater than 20k ohms:** Faulty EI wiring connection OR Faulty ECU connection OR Faulty ECU – – –1/1

❼ **EI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Ignition OFF. 2. Remove rocker cover. 3. Disconnect all electrical connections from the 6 EIs. 4. Using a multimeter, measure resistance between: • One terminal on an EI and the EI body. • The other terminal on the EI and the EI body 5. Perform the above measurements on all 6 of the EIs.	**Measurements greater than 20k ohms:** Faulty EI wiring harness **Any measurement less than 20k ohms:** Faulty EI(s) – – –1/1

000620.03 — Sensor Supply 1 Voltage High



Sensor Supply Voltage

- The ECU monitors the voltage on the 5-volt supply circuit.

Sensor Supply 1

- Sensor Supply 1 may supply 5 volts to one or more of the following:
  - Analog (panel-mounted or foot pedal) Throttle
  - PWM Throttle
  - Performance Program Connector
  - Oil pressure sensor (most applications with an oil pressure sensor use Sensor Supply 2)
  - Possibly other components, depending on application

DTC 000620.03 will set if:

- The ECU detects a supply voltage greater than required on the ECU 5-volt supply 1 circuit.

If DTC 000620.03 sets, the following will occur:

- Possibly numerous faults will set. The engine may derate and/or throttle operation may be affected. Sensor readings may be incorrect.

RG41221,00000E5 –19–01APR02–1/1

000620.03 — Sensor Supply 1 Voltage High

The ECU detects a voltage above specification on the ECU 5-volt sensor supply 1 (excitation) circuit. The most likely source of this code is a short to a higher voltage source.

RG41221,00000E6 –19–01APR02–1/1

000620.03 Sensor Supply 1 Voltage High Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY 1 VOLTAGE HIGH supporting information.* Without disconnecting, visually inspect the ECU connectors and all connectors associated with components that use Sensor Supply 1 for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY 1 VOLTAGE HIGH supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000620.03 reoccurs:** GO TO ❸ **000620.03 doesn’t reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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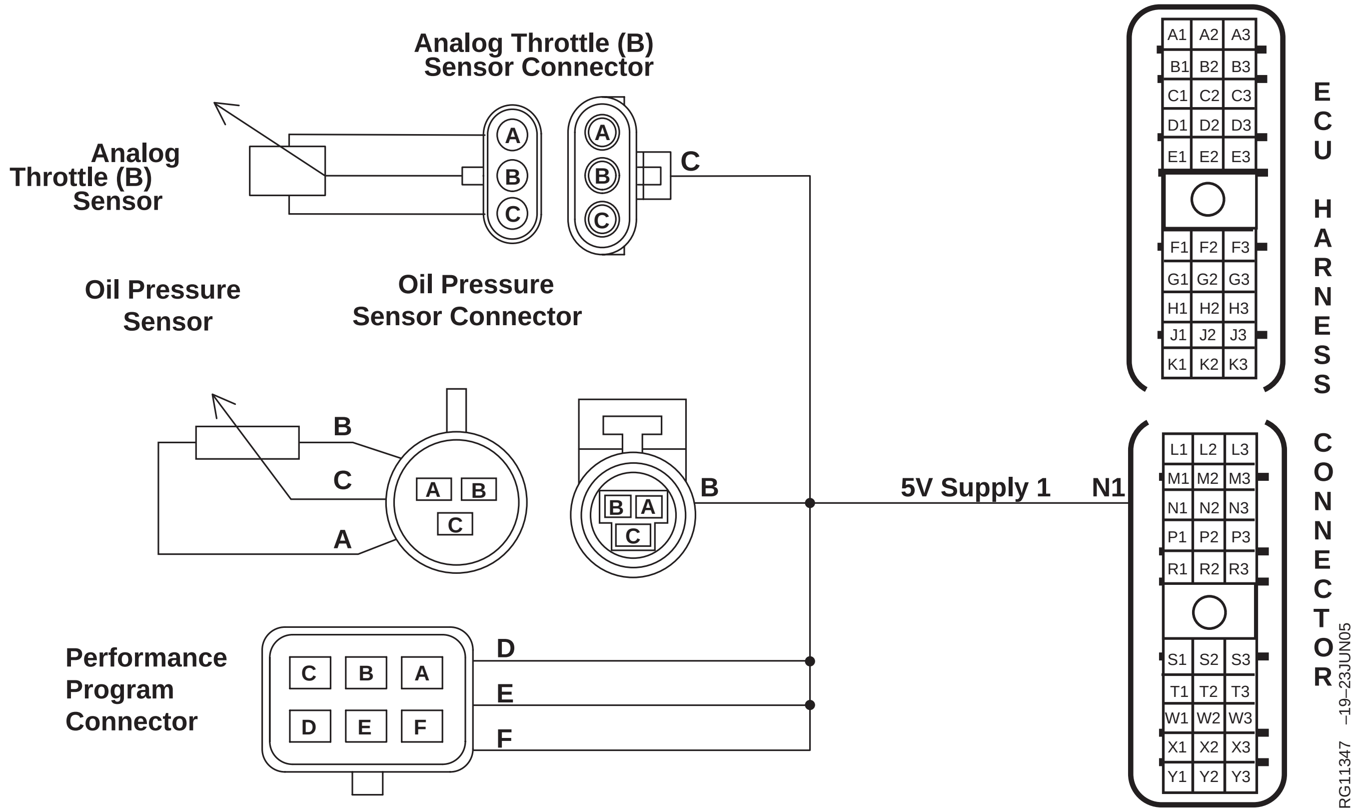
❸ **ECU Voltage Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY 1 VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Ignition ON, engine OFF. 4. Using a multimeter, measure voltage between harness connector terminal N1 and a good chassis ground.	**0 Volts:** GO TO ❺ **5.5V or more:** ECU OK. GO TO ❹ – – –1/1
❹ **“Short in Connected Harness or Engine Harness?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY 1 VOLTAGE HIGH supporting information.* 1. Ignition ON, engine OFF. 2. ECU still disconnected. 3. While measuring voltage between terminal N1 and a good chassis ground, one by one disconnect any other harnesses that are attached to the engine harness. Start with the 21-pin connector to the instrument panel.	**Voltage drops to 0 Volts:** The short is in the harness that caused the voltage to drop to zero when disconnected. Repair and retest. **Voltage remains above 5.5V:** Short in engine harness. Repair and retest. – – –1/1
❺ **Harness Wire-to-Wire Resistance Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY 1 VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. ECU still disconnected. 3. Using a multimeter, measure resistance between harness connector terminal N1 and terminals E3, B1, and B2.	**Near ______ ohms:** Test ECU. GO TO ❻. **Any test significantly above ______ ohm:** Short in engine harness. Repair and retest. – – –1/1
❻ **ECU Resistance Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY 1 VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, measure resistance between ECU pin N1 and C2 (system ground).	**50K - 90K ohms:** ECU OK. Reinstall and retest.. **Less than 50K or more than 90K ohms:** Faulty ECU. Replace and retest. – – –1/1

000620.04 — Sensor Supply 1 Voltage Low



Sensor Supply Voltage

- Ehe ECU monitors the voltage on the 5 volt supply circuit.

Sensor Supply 1

- Sensor Supply 1 may supply 5 volts to one or more of the following:
  – Analog Throttle
  – PWM Throttle
  – Performance Program Connector
  – Oil pressure sensor (most applications use Sensor Supply 2)
  – Possibly other components, depending on application

DTC 000620.03 will set if:

- The ECU detects a supply voltage less than required on the ECU 5 volt Sensor Supply 1 circuit.

If DTC 000620.03 sets, the following will occur:

- Possibly numerous faults will set. The engine may derate and/or throttle operation may be affected. Sensor readings may be incorrect.

RG41221,00000E7 –19–01APR02–1/1

000620.04 — Sensor Supply 1 Voltage Low

The ECU detects a voltage below specification on the ECU 5V Sensor Supply 1 (excitation) circuit. This can be caused by a short to ground.

RG41221,00000E8 –19–18APR02–1/1

000620.04 Sensor Supply 1 Voltage Low Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY 1 VOLTAGE LOW supporting information.* Without disconnecting, visually inspect the ECU connectors and all connectors associated with components that use this 5V supply for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY 1 VOLTAGE LOW supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000620.04 reoccurs:** GO TO ❸ **000620.04 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. GO TO ❸

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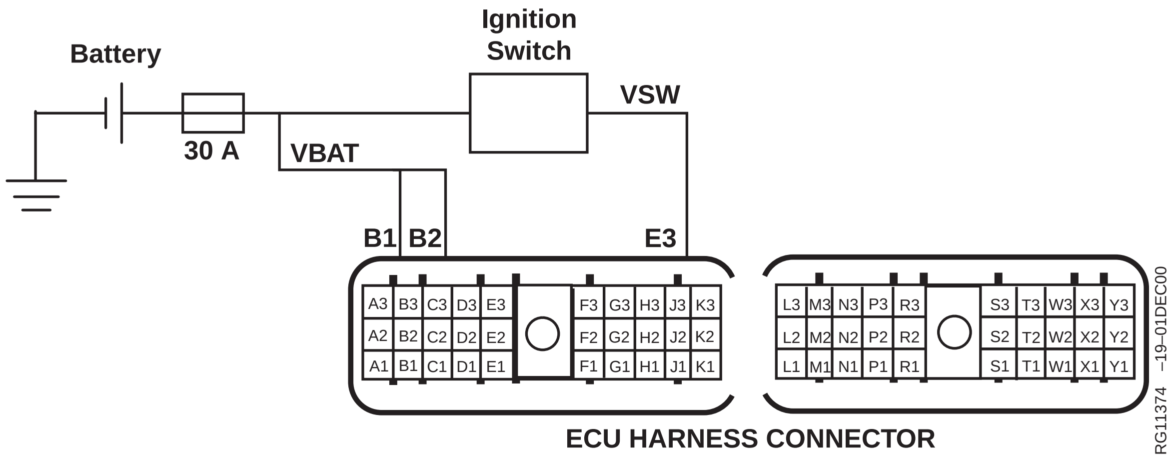
❸ **“Problem in Connected Harness?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY 1 VOLTAGE LOW supporting information.* 1. Ignition ON, engine OFF. 2. While monitoring Sensor Supply 1 voltage, one-by-one disconnect harnesses that are connected to the engine harness. Start by disconnecting the 21-pin connector from the instrument panel.	**Voltage returns to normal (4.5-5.5 Volts):** The ground is in the harness that when disconnected caused the voltage to return to normal. If the harness to the instrument panel is at fault, check the throttle circuit. Repair and retest. **Voltage remains below 4.5V:** GO TO ❹ – – –1/1

❹ **“Problem in Performance Program Connector?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY 1 VOLTAGE LOW supporting information.* 1. Ignition ON, engine OFF. 2. Remove the cap from the 6-pin Performance Program Connector. Inspect the jumpers for poor or improper connection. Note jumper configuration so jumpers can be correctly reconnected when testing is done. 3. One-by one, remove jumpers while monitoring Sensor Supply 1 voltage.	**Voltage returns to normal (4.5-5.5 Volts):** The ground is in the connector or jumpered circuit. Repair and retest. **Voltage remains below 4.5V:** Reconnect jumpers and GO TO ❺ – – –1/1

❺ **“Problem in Engine Harness or ECU?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY 1 VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. All harnesses still disconnected from engine harness. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between terminal N1 and all other terminals in both 30-pin connectors.	**All more than 1M ohms:** Harness OK. Remove and test ECU. GO TO ❻ **Significantly less than 1M ohms:** Sensor 5V supply circuit shorted to this circuit. Repair and retest. – – –1/1

❻ **ECU Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY 1 VOLTAGE LOW supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between ECU pin N1 and C2 (system ground).	**50K - 90K ohms:** ECU OK. Reinstall and retest. **Less than 50K or more than 90K ohms:** Faulty ECU. Replace and retest. – – –1/1

000627.01 — Electronic Injector Supply Voltage Problem



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the solenoids of individual EIs by closing and opening the individual EI ground circuits.

DTC 000627.01 will set if:

- The ECU detects an injector voltage supply problem.

If DTC 000627.01 sets, the following will occur:

- The EIs will not work properly.

DPSG,RG40854,215 –19–01APR02–1/1

000627.01 — Electronic Injector Supply Voltage Problem

The ECU detects an injector voltage supply problem.

RG41221,00000A2 –19–01APR02–1/1

000627.01 Electronic Injector Supply Voltage Problem Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000627.01 ELECTRONIC INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.* Without disconnecting, visually inspect the ECU connectors and all ECU grounds for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000627.01 ELECTRONIC INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make notes of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000627.01 reoccurs:** GO TO ❸ **000627.01 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **ECU Power Check**	*NOTE: For wiring and theory of operation information, see DTC 000627.01 ELECTRONIC INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure voltage between a good chassis ground and: • Terminal B1 in the ECU connector on the engine harness. • Terminal B2 in the ECU connector on the engine harness.	**Substantially less than battery voltage:** GO TO ❹ **At or near battery voltage:** Faulty ECU connection OR Faulty ECU – – –1/1

❹ **Battery Voltage Check**	*NOTE: For wiring and theory of operation information, see DTC 000627.01 ELECTRONIC INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.* Using a multimeter, measure battery voltage at the battery across both terminals	**At or near battery voltage:** Faulty ECU power supply fuse OR Faulty ECU connection OR Open or short in ECU power circuit **Substantially less than battery voltage:** Faulty battery or charging system. – – –1/1

000629.13 — ECU Error

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:

- Engine will not start or run.

DPSG,RG40854,216 –19–30JUN99–1/1

000629.13 — ECU Error

The ECU detects an internal problem.

RG41221,00000A3 –19–01APR02–1/1

000629.13 ECU Error Diagnostic Procedure

– – –1/1

❶ **ECU Test**	*NOTE: For theory of operation information, see DTC 000629.13 ECU ERROR supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000629.13 reoccurs:** Faulty ECU **000629.13 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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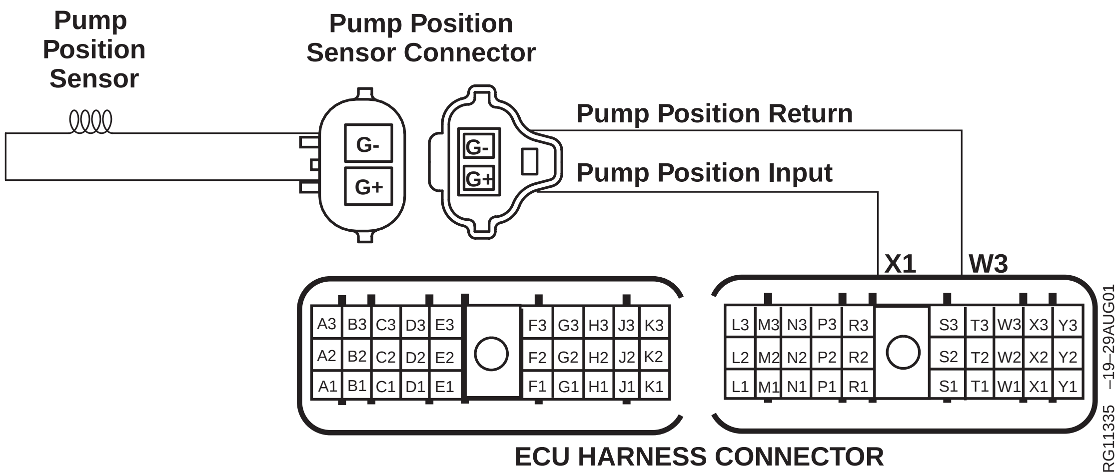
000636.02 — Pump Position Sensor Input Noise



Pump Position Sensor

- The pump position sensor is located in the side of the high pressure fuel pump. It is an inductive type pickup sensor that detects notches in the pump position timing wheel. The ECU uses the pump position input to determine cylinder identification to keep the pump in time with the engine. The pump position timing wheel is comprised of 6 evenly spaced notches with one additional notch. The ECU uses the additional notch to determine cylinder #1 is approaching Top-Dead-Center (TDC). For further pump position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

DTC 000636.02 will set if:

- The ECU detects excessive noise (extra pulses) on the Pump Position Sensor input.

If DTC 000636.02 sets, the following will occur:

- If a crankshaft position sensor trouble code accompanies DTC 000636.02, the engine will die and won’t restart until at least one of the two codes is repaired.
- ECU will use only the crankshaft position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,217 –19–01APR02–1/1

000636.02 — Pump Position Sensor Input Noise

The ECU detects excessive noise (extra pulses) on the Pump Position Sensor input.

RG41221,00000A4 –19–01APR02–1/1

000636.02 Pump Position Sensor Input Noise Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000636.02 PUMP POSITION SENSOR INPUT NOISE supporting information.* Without disconnecting, visually inspect the ECU connectors and the pump position sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.02 PUMP POSITION SENSOR INPUT NOISE supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of all DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000636.02 reoccurs:** GO TO ❸ **000636.02 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group

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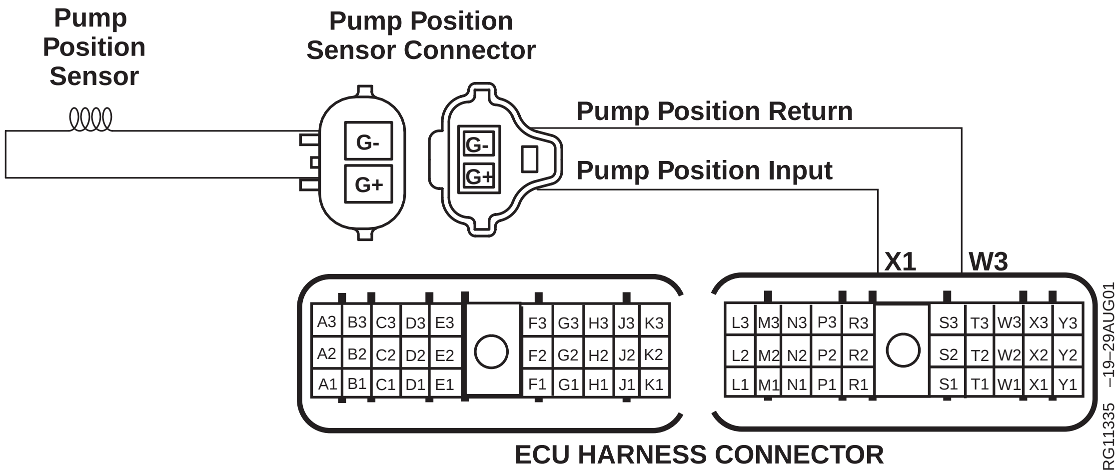
❸ **Noise Detection Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.02 PUMP POSITION SENSOR INPUT NOISE supporting information.* 1. 000636.02 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose 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 high pressure pump speed sensor and ECU connectors. 2. Other possible causes of 000636.02: • Electromagnetic interference (EMI) from an incorrectly installed 2-way radio. • Interference from some radar source. • Possible burrs on the high pressure pump timing wheel notches, should be clean, square edges.	**Problem found:** Repair and retest. – – –1/1

000636.08 — Pump Position Sensor Input Missing



Pump Position Sensor

- The pump position sensor is located in the side of the high pressure fuel pump. It is an inductive type pickup sensor that detects notches in the pump position timing wheel. The ECU uses the pump and crank position inputs to ensure that fuel is injected at the proper time to the proper cylinder. The pump position timing wheel is comprised of 6 evenly spaced notches with one additional notch. The ECU uses the additional notch to determine cylinder #1 is approaching Top-Dead-Center (TDC). For further pump position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

DTC 000636.08 will set if:

- The ECU does not detect the Pump Position Sensor input.

If DTC 000636.08 sets, the following will occur:

- If a crankshaft position sensor trouble code accompanies DTC 000636.08, the engine will die and won’t restart until at least one of the two codes is repaired.
- ECU will use only the crankshaft position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,218 –19–18APR02–1/1

000636.08 — Pump Position Sensor Input Missing

The ECU does not detect input from the Pump Position Sensor. Three things will cause this to happen: An open return circuit, an open input circuit, or the input circuit shorted to ground.

RG41221,00000A5 –19–01APR02–1/1

000636.08 Pump Position Sensor Input Missing Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* Without disconnecting, visually inspect the ECU connectors and the pump position sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**0000636.08 reoccurs:** GO TO ❸ **0000636.08 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **“Sensor Open or Shorted?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. Ignition OFF. 2. Disconnect pump position sensor. Inspect connector. 3. Using a multimeter, measure resistance between both terminals of the pump position sensor.	**Between 1850 and 2450 ohms:** Sensor not open or shorted. GO TO ❹ **Below 1850 ohms or above 2450 ohms:** Faulty pump position sensor. Replace and retest. – – –1/1

❹ **“Sensor Grounded?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected 2. Using a multimeter, measure resistance between each terminal of the pump position sensor and a good chassis ground.	**1M ohms or more:** Sensor OK. Check ground circuit. GO TO ❺ **less than 1M ohms:** Faulty pump position sensor. Replace and retest. – – –1/1

❺ **“Return (Ground) Circuit Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Using a multimeter, measure resistance between the return terminal in the sensor connector and a good chassis ground.	**2 ohms or less:** Return circuit OK. Check input circuit. GO TO ❼ **More than 2 ohms:** Open or high resistance in return circuit. GO TO ❻ – – –1/1

❻ **Return (Ground) Circuit “Open Wiring?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Remove the circuit’s 30-pin connector from the ECU. Inspect connector terminals and ECU pins. 3. Using a multimeter, measure resistance between the return circuit terminal in the sensor connector and ECU connector.	**2 ohms or less:** Return wiring OK. Remove and test ECU. GO TO ⓫ **More than 2 ohms:** Open or high resistance in return wiring. Repair and retest. – – –1/1

❼ **Input Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Using a multimeter, measure resistance between the input terminal in the sensor connector and a good chassis ground.	**Between 90K and 140K ohms:** Input circuit OK. Reconnect and retest. **Less than 90K ohms:** Check for low resistance to ground in the input circuit. GO TO ❾ **More than 140K ohms:** Check for open (high resistance) in the input circuit. GO TO ❽ – – –1/1

❽ **"Input Circuit Wiring Open?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. Ignition OFF. 2. Sensor and ECU still disconnected. 3. Using a multimeter, measure resistance between the circuit's input terminal in the sensor connector and ECU connector.	**2 ohms or less:** Input wiring OK. Remove and test ECU. GO TO ⓬ **More than 2 ohms:** Open or high resistance in harness wiring. Repair and retest. – – –1/1

❾ **"Input Circuit Wiring Grounded?" Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Remove the circuit's 30-pin connector from the ECU. Inspect connector terminals and ECU pins. 3. Using a multimeter, measure resistance between the input terminal in the sensor connector and a good chassis ground.	**1M ohms or more:** Input not grounded. Check for wire-to-wire short. GO TO ❿ **Less than 1M ohms:** Input wire shorted (low resistance) to ground. Repair and retest. – – –1/1

10 "Input Circuit Wiring Shorted in Harness?" Test	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected. 2. The circuit's 30-pin connector still disconnected from the ECU. 3. Using a multimeter, measure resistance between the input terminal in the sensor connector and all other terminals in the ECU connectors.	**1M ohms or more:** Harness input wiring OK. Remove and test ECU. GO TO 12 **Less than 1M ohms:** Input wire shorted (low resistance) wire-to-wire in harness wiring. Repair and retest. – – –1/1

11 ECU "Return Circuit Open?" Test	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor's return pin and C2 or C3 (system ground) pin in the ECU.	**Near zero ohms:** ECU OK. Reinstall and retest. **More than 2 ohms:** Faulty ECU. Replace and retest. – – –1/1

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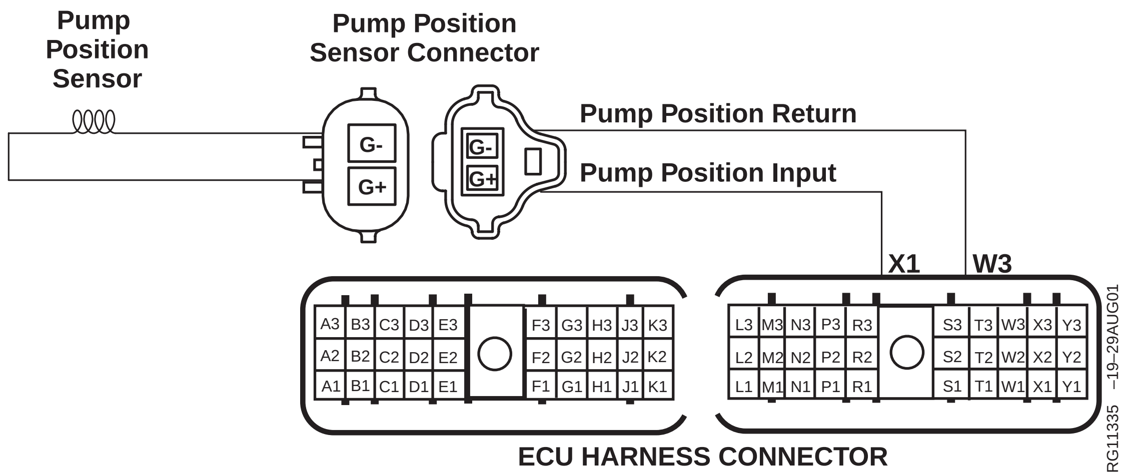
12 ECU "Input Circuit Open?" Test	*NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor's input pin and pin C2 or C3 (ECU system ground) in the ECU.	**Between 90K and 140K ohms:** ECU OK. Reinstall and retest. **Less than 90K ohms:** Faulty ECU. Replace and retest. **More than 140K ohms:** Faulty ECU. Replace and retest. – – –1/1

000636.10 — Pump Position Sensor Input Pattern Error



Pump Position Sensor

- The pump position sensor is located in the side of the high pressure fuel pump. It is an inductive type pickup sensor that detects notches in the pump position timing wheel. The ECU uses the pump position input to determine cylinder identification to keep the pump in time with the engine. The pump position timing wheel is comprised of 6 evenly spaced notches with one additional notch. The ECU uses the additional notch to determine cylinder #1 is approaching Top-Dead-Center (TDC). For further pump position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

DTC 000636.10 will set if:

- The ECU detects an improper pattern on the Pump Position Sensor input.

If DTC 000636.10 sets, the following will occur:

- If a crankshaft position sensor trouble code accompanies DTC 000636.10, the engine will die and won’t restart until at least one of the two codes is repaired.
- ECU will use only the crankshaft position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,219 –19–01APR02–1/1

000636.10 — Pump Position Sensor Input Pattern Error

The ECU detects an improper pattern on the Pump Position Sensor input.

RG41221,00000A6 –19–01APR02–1/1

000636.10 Pump Position Sensor Input Pattern Error Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.* Without disconnecting, visually inspect the ECU connectors and the pump position sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make notes of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000636.10 reoccurs:** GO TO ❸ **000636.10 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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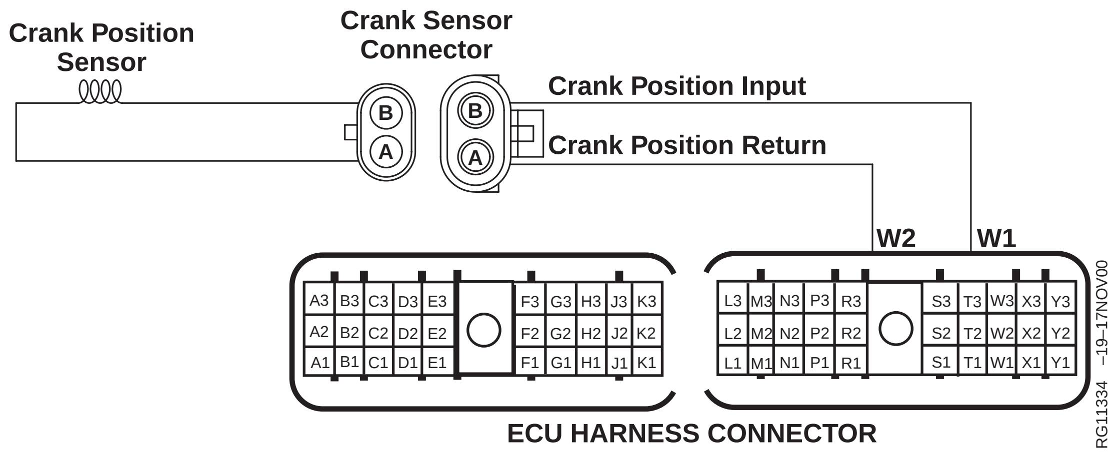
❸ **Pump Position Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.* 1. Ignition OFF. 2. Disconnect pump position sensor connector. 3. Using a multimeter, measure resistance between both terminals of the pump position sensor connector on the engine harness.	**Between 1850 and 2450 ohms:** GO TO ❹ **Below 1850 ohms or above 2450 ohms:** Faulty pump position sensor – – –1/1

❹ **Open in Pump Position Input and Return Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.* 1. Ignition OFF. 2. Disconnect pump position sensor connector. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between: • Terminal G (+) of the pump position sensor connector and terminal X1 in the ECU connector on the engine harness. • Terminal G (-) of the pump position sensor connector and terminal W2 in the ECU connector on the engine harness.	**Both measurements 5 ohms or less:** GO TO ❺ **Either measurement greater than 5 ohms:** Open in pump position sensor input wire OR Open in pump position sensor return wire OR Terminals G (+) and G (-) in the pump position sensor harness connector possibly inverted – – –1/1

❺ **Pump Position Sensor Input Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.* 1. Ignition OFF. 2. Pump Position sensor connector and ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal X1 in the ECU connector on the engine harness and the following: • A good chassis ground. • All other terminals in both ECU connectors.	**All measurements greater than 2k ohms:** GO TO ❻ **Any measurement less than 2k ohms:** Faulty pump position sensor input wiring harness. – – –1/1

❻ **Pump Position Sensor Return Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.* 1. Ignition OFF. 2. Pump Position Sensor connector and ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal W3 in the ECU connector on the engine harness and the following: • A good chassis ground. • All other terminals in both ECU connectors.	**All measurements greater than 2k ohms:** Faulty ECU connector OR Faulty ECU. **Any measurement less than 2k ohms:** Faulty pump position sensor return wiring harness. – – –1/1

000637.02 — Crankshaft Position Input Noise



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Crankshaft Position Sensor

- The crankshaft position sensor is an inductive type pickup sensor that detects notches on the oil pump drive gear. The ECU uses the crankshaft position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the pump position sensor input to determine piston position in relation to the firing order. Based on information from the crank and pump position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EIs accordingly. For further crankshaft position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

DTC 000637.02 will set if:

- The ECU detects excessive noise (extra pulses) on the crankshaft position input.

If DTC 000637.02 sets, the following will occur:

- If an pump position sensor trouble code accompanies DTC 000637.02, the engine will die and won’t restart until at least one of the two codes is repaired.
- ECU will use only the pump position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,220 –19–01APR02–1/1

000637.02 — Crankshaft Position Input Noise

The ECU detects excessive noise (extra pulses) on the crankshaft position input.

RG41221,00000A7 –19–01APR02–1/1

000637.02 Crankshaft Position Input Noise Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANKSHAFT POSITION INPUT NOISE supporting information.* Visually inspect ECU connectors and the crankshaft position sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANKSHAFT POSITION INPUT NOISE supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of all DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000637.02 reoccurs:** GO TO ❸ **000637.02 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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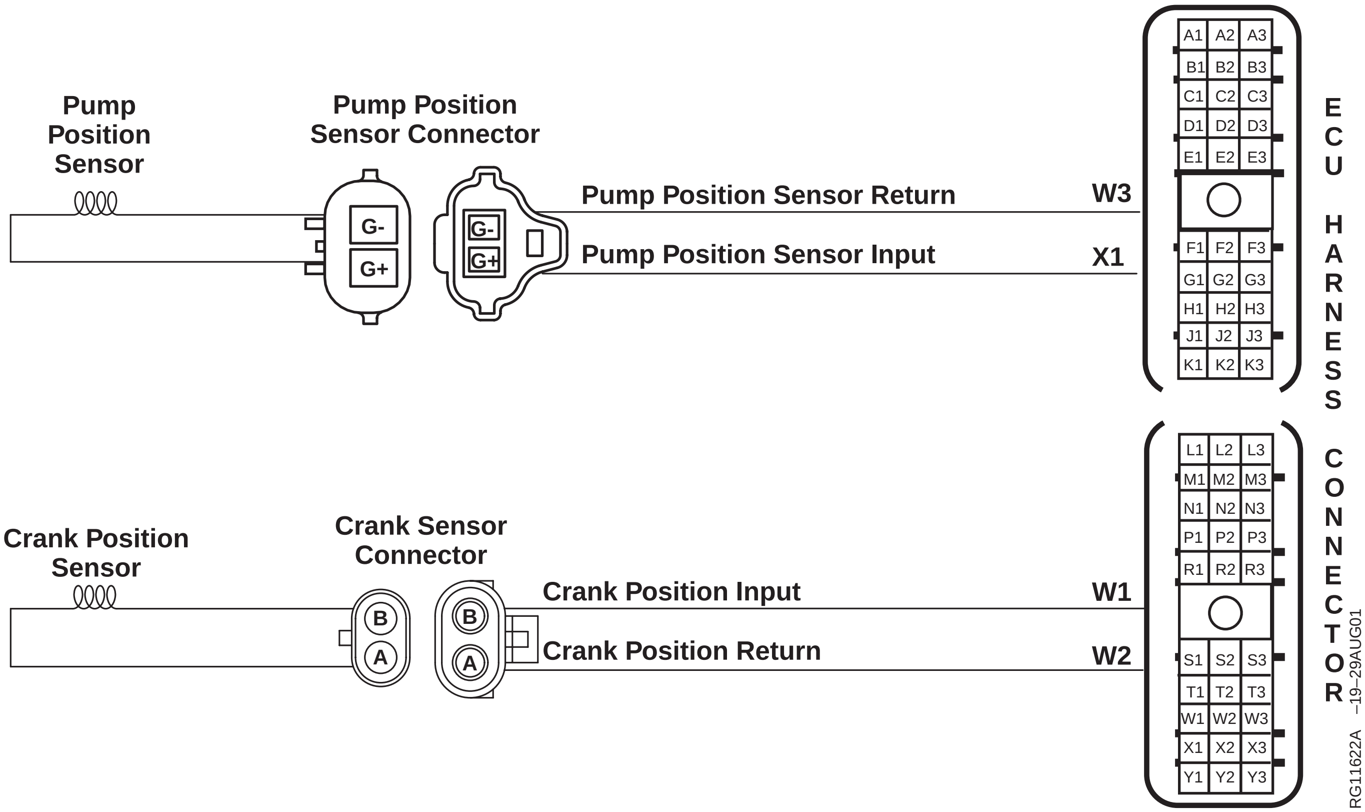
❸ **Noise Detection Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANKSHAFT POSITION INPUT NOISE supporting information.* 1. 000637.02 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose 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 crankshaft position sensor wiring. • Check wiring for proper pin location in the crankshaft position sensor and ECU connectors. 2. Other possible causes of 000637.02: • Electromagnetic interference (EMI) from an incorrectly installed 2-way radio. • Interference from some radar source. • Possible broken teeth on the crankshaft timing ring.	**Problem found:** Repair and retest. – – –1/1

000637.07 — Crankshaft Position/Pump Position Timing Moderately Out of Sync



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Pump Position Sensor and Crankshaft Position Sensor

- The pump position and crankshaft position sensors are both inductive-type pickup sensors that detect notches on the fuel pump camshaft and the engine crankshaft gear. The ECU uses the crankshaft position input to determine engine speed and precise piston position in relation to TDC. Using the pump position sensor input, the ECU is able to determine when a cylinder is at the end of the compression stroke. Based on this information, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EIs accordingly. A known relationship between the pump position sensor signal and the crankshaft position sensor signal allows the ECU to recognize when one signal is not in sync with the other. For further pump position and crankshaft position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

DTC 000637.07 will set if:

- The ECU detects that the pump position and crankshaft position inputs are not in sync with each other.

If DTC 000637.07 sets, the following will occur:

- Depending on the cause of the trouble code, the engine may die, and then it may or may not restart.
- If the engine dies and won’t restart, it is possible that disconnecting the crankshaft position sensor will allow the engine to start.
- If the engine continues to run, it will develop low power.

DPSG,RG40854,316 –19–01APR02–1/1

000637.07 — Crankshaft Position/Pump Position Timing Moderately Out of Sync

The ECU detects that the pump position and crankshaft position inputs are not in sync with each other.

RG41221,00000A8 –19–01APR02–1/1

000637.07 Crankshaft Position/Pump Position Timing Moderately Out of Sync Diagnostic Procedure

IMPORTANT: If pump position sensor is bad through diagnosis of pump position sensor related DTCs, replace high pressure fuel pump. Pump Position Sensor is NOT serviceable.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANKSHAFT POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.* Visually inspect ECU connectors and the crankshaft position sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANKSHAFT POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of all DTCs, then clear all DTCs. 5. Ignition ON, engine running or cranking 6. Read DTCs.	**000637.07 reoccurs:** GO TO ❸ **000637.07 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ Pump Position Timing Check	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANKSHAFT POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.* Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING in Section 04, Group 150 earlier in this manual.	**Timing is OK:** GO TO ❹ **Timing out of sync:** Adjust timing and retest. – – –1/1

❹ Crankshaft Position Sensor Test	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANKSHAFT POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.* 1. Ignition OFF. 2. Disconnect crankshaft position sensor connector. 3. Using a multimeter, measure resistance between both terminal of the crankshaft position sensor.	**Measurement between 2500 and 3500 ohms:** GO TO ❺ **Measurement below 2500 ohms or above 3500 ohms:** Faulty crankshaft position sensor – – –1/1

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❺ Pump Position Sensor Test	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANKSHAFT POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.* 1. Ignition OFF. 2. Disconnect pump position sensor connector. 3. Using a multimeter, measure resistance between both terminals of the pump position sensor.	**Measurement between 1850 and 2450 ohms:** GO TO ❻ **Measurement below 1850 ohms or above 2450 ohms:** Faulty pump position sensor – – –1/1

❻ Crankshaft Position Sensor Observable Test	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANKSHAFT POSITION INPUT PATTERN ERROR supporting information.* 1. Remove crankshaft position sensor. 2. Inspect sensor for cracks, corrosion, or any foreign material on the end of the sensor. 3. Using a mirror and a flashlight, inspect the crankshaft .	**All components OK:** GO TO ❼ **Fault found in a component:** Repair or replace component as needed. – – –1/1

❼ **Open in Crankshaft Position Sensor Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANKSHAFT POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.* 1. Ignition OFF. 2. Disconnect crankshaft position sensor connector. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between: • Terminal A of the crankshaft position sensor connector AND terminal W2 in the ECU connector on the engine harness. • Terminal B of the crankshaft position sensor connector AND terminal W1 in the ECU connector on the engine harness.	**Both measurements 5 ohms or less:** GO TO ❽ **Either measurement greater than 5 ohms:** Open in crankshaft position sensor input wire OR Open in crankshaft position sensor return wire OR Open in crankshaft position sensor connector OR Terminals A and B in the crankshaft position sensor harness connector possibly inverted – – –1/1

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❽ **Short in Crankshaft Position Sensor Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANKSHAFT POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.* 1. Ignition OFF. 2. Crankshaft position sensor connector and both 30-way ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal W1 in the ECU connector on the engine harness and the following: • A good chassis ground. • All other terminals in both 30-way ECU connectors. 4. Using a multimeter, measure resistance between terminal W2 in the ECU connector on the engine harness and the following: • A good chassis ground. • All other terminals in both ECU connectors.	**All measurements greater than 2k ohms:** GO TO ❾ **Any measurement less than 2k ohms:** Faulty crankshaft position sensor wiring or connector. – – –1/1

9 Open in Pump Position Sensor Wiring Test	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANKSHAFT POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.* 1. Ignition OFF. 2. Disconnect pump position sensor connector. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between: • Terminal G+ of the pump position sensor connector AND terminal X1 in the ECU connector on the engine harness. • Terminal G- of the pump position sensor connector AND terminal W3 in the ECU connector on the engine harness.	**Both measurements 5 ohms or less:** GO TO 10 **Either measurement greater than 5 ohms:** Open in pump position sensor input wire OR Open in pump position sensor return wire OR Open in pump position sensor connector OR Terminals A and B in the pump position sensor harness connector possibly inverted – – –1/1

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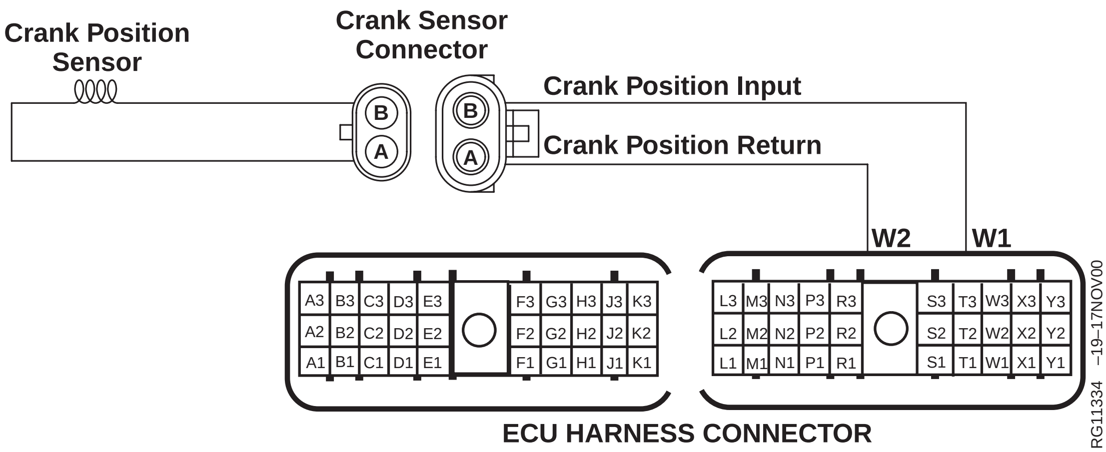
,304

10 Pump Position Sensor Wiring Test	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANKSHAFT POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.* 1. Ignition OFF. 2. Pump Position Sensor connector and both 30-way ECU connectors still disconnected. 3. Using a multimeter measure resistance between terminal X1 in the ECU connector on the engine harness and the following: • A good chassis ground. • All other terminals in both ECU connectors. 4. Using a multimeter measure resistance between terminal W3 in the ECU connector on the engine harness and the following: • A good chassis ground. • All other terminals in both ECU connectors.	**All measurements greater than 2k ohms:** Faulty ECU connector OR Faulty ECU **Any measurement less than 2k ohms:** Shorted pump position sensor wiring or connector. – – –1/1

000637.08 — Crankshaft Position Input Missing



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Crankshaft Position Sensor

- The crankshaft position sensor is an inductive type pickup sensor that detects notches on the oil pump drive gear. The ECU uses the crankshaft position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the pump position sensor input to determine piston position in relation to the firing order. Based on information from the crank and pump position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EIs accordingly. For further crankshaft position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

DTC 000637.08 will set if:

- The ECU does not detect the crankshaft position input.

If DTC 000637.08 sets, the following will occur:

- If a pump position sensor trouble code accompanies DTC 000637.08, the engine will die and won’t restart until at least one of the two codes is repaired.
- ECU will use only the pump position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,221 –19–01APR02–1/1

000637.08 — Crankshaft Position Input Missing

The ECU does not detect the crankshaft position input.

RG41221,00000A9 –19–01APR02–1/1

000637.08 Crankshaft Position Input Missing Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* Without disconnecting, visually inspect the ECU connectors and the pump position sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**0000637.08 reoccurs:** GO TO ❸ **0000637.08 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **“Sensor Open or Shorted?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. Ignition OFF. 2. Disconnect sensor. Inspect connector. 3. Using a multimeter, measure resistance between both terminals of the position sensor.	**Between 1850 and 2450 ohms:** Sensor not open or shorted. GO TO ❹ **Below 1850 ohms or above 2450 ohms:** Faulty position sensor. Replace and retest. – – –1/1

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❹ **“Sensor Grounded?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected 2. Using a multimeter, measure resistance between each terminal of the position sensor and a good chassis ground.	**1M ohms or more:** Sensor OK. Check ground circuit. GO TO ❺ **less than 1M ohms:** Faulty position sensor. Replace and retest. – – –1/1

❺ **“Return (Ground) Circuit Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Using a multimeter, measure resistance between the return terminal in the sensor connector and a good chassis ground.	**2 ohms or less:** Return circuit OK. Check input circuit. GO TO ❼ **More than 2 ohms:** Open or high resistance in return circuit. GO TO ❻ – – –1/1

❻ **Return (Ground) Circuit “Open Wiring?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Remove the circuit’s 30-pin connector from the ECU. Inspect connector terminals and ECU pins. 3. Using a multimeter, measure resistance between the return circuit terminal in the sensor connector and ECU connector.	**2 ohms or less:** Return wiring OK. Remove and test ECU. GO TO ⓫ **More than 2 ohms:** Open or high resistance in return wiring. Repair and retest. – – –1/1

❼ **Input Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Using a multimeter, measure resistance between the input terminal in the sensor connector and a good chassis ground.	**Between 10K and 25K ohms:** Input circuit OK. Reconnect and retest. **Less than 10K ohms:** Check for low resistance to ground in the input circuit. GO TO ❾ **More than 25K ohms:** Check for open (high resistance) in the input circuit. GO TO ❽ – – –1/1

❽ **“Input Circuit Wiring Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. Ignition OFF. 2. Sensor and ECU still disconnected. 3. Using a multimeter, measure resistance between the circuit’s input terminal in the sensor connector and ECU connector.	**2 ohms or less:** Input wiring OK. Remove and test ECU. GO TO ⓬ **More than 2 ohms:** Open or high resistance in harness wiring. Repair and retest. – – –1/1

❾ **“Input Circuit Wiring Grounded?” Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected. 2. Remove the circuit’s 30-pin connector from the ECU. Inspect connector terminals and ECU pins. 3. Using a multimeter, measure resistance between the input terminal in the sensor connector and a good chassis ground.	**1M ohms or more:** Input not grounded. Check for wire-to-wire short. GO TO ❿ **Less than 1M ohms:** Input wire shorted (low resistance) to ground. Repair and retest. – – –1/1

10 "Input Circuit Wiring Shorted in Harness?" Test	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. Ignition OFF, sensor still disconnected. 2. The circuit's 30-pin connector still disconnected from the ECU. 3. Using a multimeter, measure resistance between the input terminal in the sensor connector and all other terminals in the ECU connectors.	**1M ohms or more:** Harness input wiring OK. Remove and test ECU. GO TO 12 **Less than 1M ohms:** Input wire shorted (low resistance) wire-to-wire in harness wiring. Repair and retest. – – –1/1

11 ECU "Return Circuit Open?" Test	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor's return pin and C2 or C3 (system ground) pin in the ECU.	**Near zero ohms:** ECU OK. Reinstall and retest. **More than 2 ohms:** Faulty ECU. Replace and retest. – – –1/1

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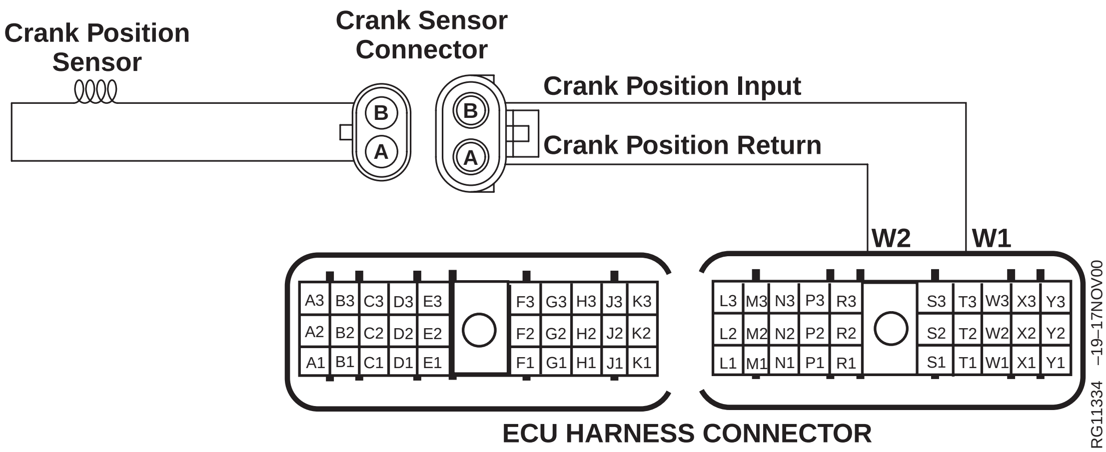
12 ECU "Input Circuit Open?" Test	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANKSHAFT POSITION INPUT MISSING supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between the input pin and pin C2 or C3 (ECU system ground) in the ECU.	**Between 10K and 25K ohms:** ECU OK. Reinstall and retest. **Less than 10K ohms:** Faulty ECU. Replace and retest. **More than 25K ohms:** Faulty ECU. Replace and retest. – – –1/1

000637.10 — Crankshaft Position Input Pattern Error



Crankshaft Position Sensor

- The crankshaft position sensor is an inductive type pickup sensor that detects notches on the oil pump drive gear. The ECU uses the crankshaft position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the pump position sensor input to determine piston position in relation to the firing order. Based on information from the crank and pump position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EIs accordingly. For further crankshaft position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

DTC 000637.10 will set if:

- The ECU detects an improper pattern on the crankshaft position input.

If DTC 000637.10 sets, the following will occur:

- If a pump position sensor trouble code accompanies DTC 000637.10, the engine will die and won’t restart until at least one of the two codes is repaired.
- ECU will use only the pump position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,222 –19–01APR02–1/1

000637.10 — Crankshaft Position Input Pattern Error

The ECU detects an improper pattern on the crankshaft position input.

RG41221,00000AA –19–01APR02–1/1

000637.10 Crankshaft Position Input Pattern Error Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANKSHAFT POSITION INPUT PATTERN ERROR supporting information.* Visually inspect ECU connectors and crankshaft position sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANKSHAFT POSITION INPUT PATTERN ERROR supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000637.10 reoccurs:** GO TO ❸ **000637.10 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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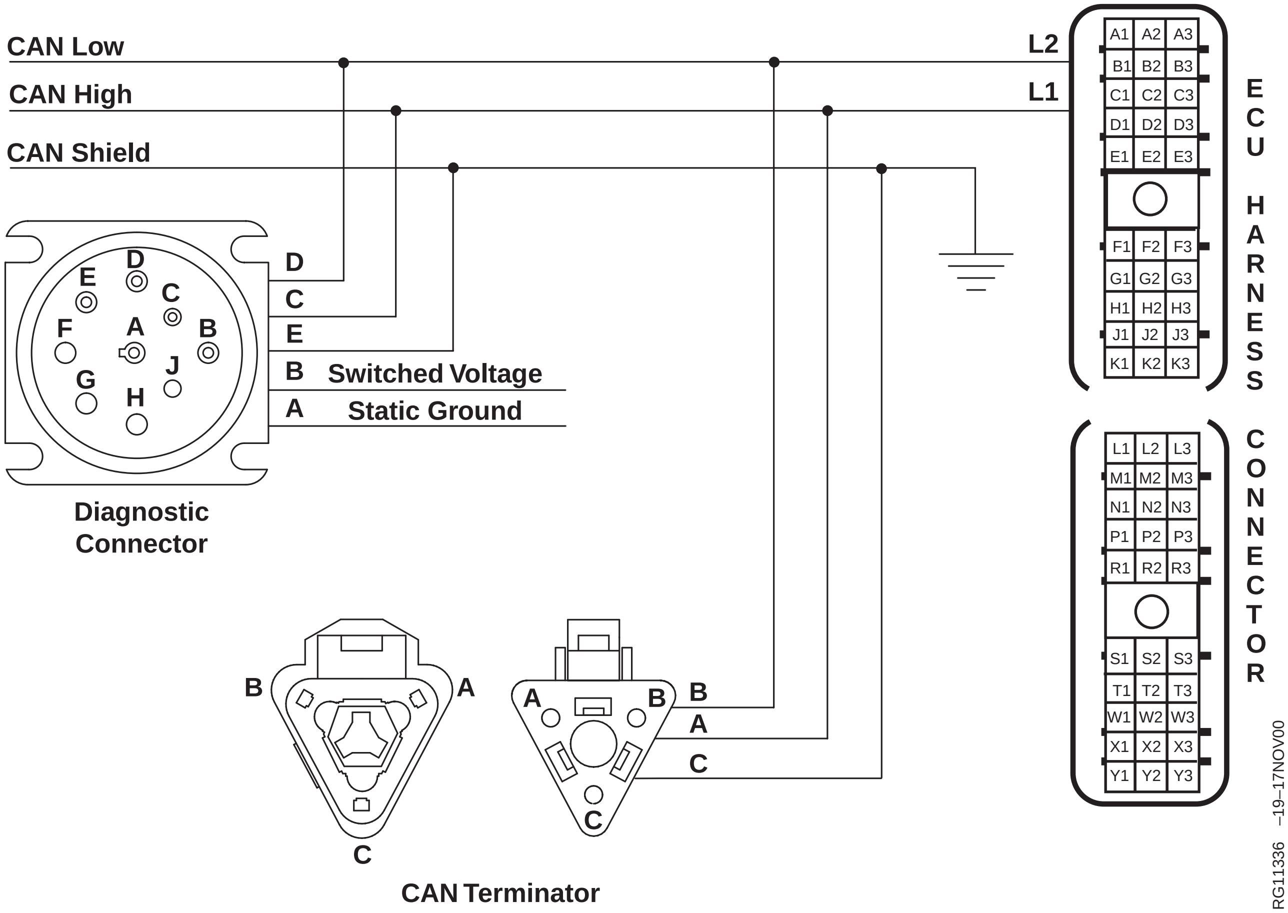
❸ **Crankshaft Position Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANKSHAFT POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF. 2. Disconnect crankshaft position sensor connector. 3. Using a multimeter, measure resistance between both terminals of the crankshaft position sensor.	**Measurement between 2500 and 3500 ohms:** GO TO ❹ **Measurement below 2500 ohms or above 3500 ohms:** Faulty crankshaft position sensor. – – –1/1

❹ **Crankshaft Position Sensor Observable Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANKSHAFT POSITION INPUT PATTERN ERROR supporting information.* 1. Remove crankshaft position sensor. 2. Inspect sensor for cracks, corrosion, or any foreign material on the end of the sensor. 3. Using a mirror and a flashlight, inspect the crankshaft .	**All components OK:** GO TO ❺ **Fault found in a component:** Repair or replace component as needed. – – –1/1

❺ **Crankshaft Position Sensor Wiring Open Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANKSHAFT POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF. 2. Crankshaft position sensor connector still disconnected. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between: • Terminal A of the crankshaft position sensor connector and terminal W2 in the ECU connector on the engine harness. • Terminal B of the crankshaft position sensor connector and terminal W1 in the ECU connector on the engine harness.	**Both measurements 5 ohms or less:** GO TO ❻ **Either measurement greater than 5 ohms:** Open in crankshaft position sensor input wire OR Open in crankshaft position sensor return wire OR Open in crankshaft position sensor connector OR Terminals A and B in the crankshaft position sensor harness connector possibly inverted. – – –1/1

❻ **Crankshaft Position Sensor Return Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANKSHAFT POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF. 2. Crankshaft position sensor connector and ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal W2 in the ECU connector on the engine harness and the following: • A good chassis ground. • All other terminals in both ECU connectors.	**All measurements greater than 2k ohms:** GO TO ❻ **Any measurement less than 2k ohms:** Faulty crankshaft position sensor return wiring or connector. – – –1/1
❼ **Crankshaft Position Sensor Input Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANKSHAFT POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF. 2. Crankshaft position sensor connector and ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal W1 in the ECU connector on the engine harness and the following: • A good chassis ground. • All other terminals in both ECU connectors.	**All measurements greater than 2k ohms:** GO TO ❼ **Any measurement less than 2k ohms:** Faulty crankshaft position sensor input wiring OR Faulty crankshaft position sensor connector. – – –1/1
❽ **Pump Position Timing Check**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANKSHAFT POSITION INPUT PATTERN ERROR supporting information.* Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING in Group 150 earlier in this manual.	**Pump Position timing is OK:** Faulty ECU **Pump Position timing is out of sync:** Adjust timing and recheck. – – –1/1

000639.13 — CAN Bus Error



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NOTE: *Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*

Controller Area Network (CAN)

- CAN is a network in which the individual controllers on a machine communicate to 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 application, engine operation may or may not be effected.

RG41221,000003A –19–01APR02–1/1

000639.13 — CAN Bus Error

The ECU detects a problem communicating on CAN.

RG41221,00000AB –19–01APR02–1/1

000639.13 CAN Bus Error Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information.* Visually inspect ECU connectors, diagnostic connector, and the CAN terminator for contamination, damage, or improper positioning.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000639.13 reoccurs:** GO TO ❸ **000639.13 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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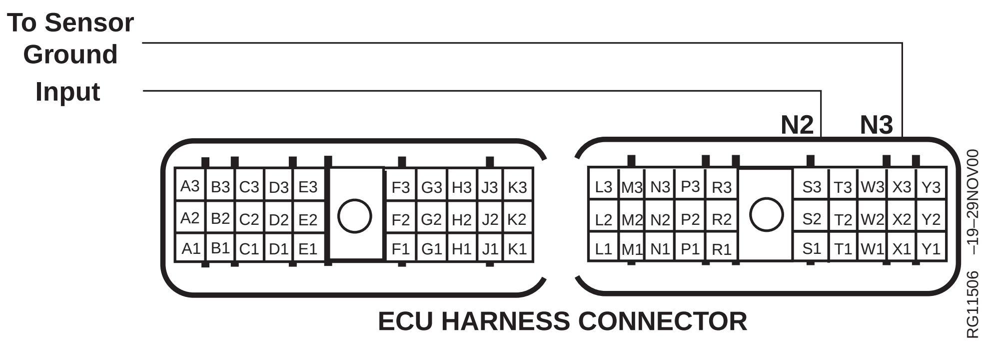
❸ **Application Relate DTCs Test**	*NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information.* If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs.	**No CAN related DTCs found on other controllers:** GO TO ❹ **Found CAN related DTCs on other controllers:** Refer to diagnostic procedures for controller. Repair cause of throttle related DTC and retest. – – –1/1

❹ **Resistance Between CAN High and Low Test**	*NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure resistance between terminals L1 and L2 in the ECU connector on the engine harness.	**Between 55-65 ohms:** Faulty ECU connector OR Faulty ECU **Less than 55 ohms or greater than 65 ohms:** Open or short in CAN wiring harness. – – –1/1

000640.31 — Engine Shutdown - Vehicle Request

The ECU receives a valid engine shutdown signal.

RG41221,000003F –19–01APR02–1/2



Engine Shutdown Signal

- The engine shutdown—vehicle request signal is a binary (True/Not True) input to the ECU that will cause the ECU to shut the engine down. N2 is a pull-up circuit, so the input signal will be a drop in voltage due to the circuit being grounded when the shutdown switch closes.
  On tracked tractors, the shutdown signal is sent by the steering control unit.

DTC 000640.31 will set if:

- The ECU receives a valid engine shutdown signal.

If DTC 000640.31 sets, the following will occur:

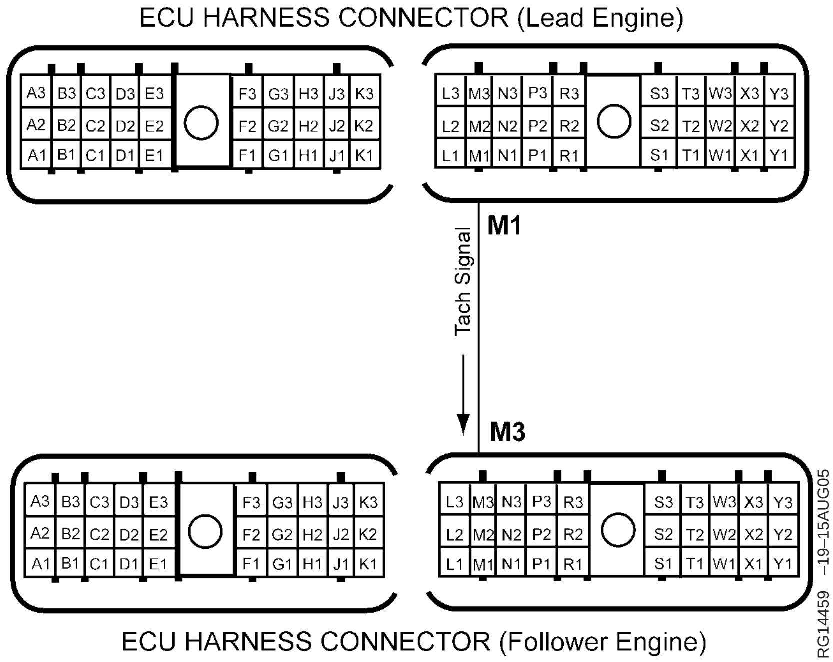
- The engine will shut down.

If DTC 000640.31 sets:

- Check for other stored or active trouble codes on the ECU and other controllers on the machine that indicate the reason for the shutdown. Refer to the equipment's diagnostic manual.

RG41221,000003F –19–01APR02–2/2

000644.02 — External Speed Command Input Erratic



Tachometer signal erratic or intermittent

Dual Engine Synchronization (Marine only)

This feature allows the synchronous operation of two engines through a two-throttle, lead-follow system: one ECU is programmed as the Lead and the other as the Follower. When the system is successfully engaged, the follower ECU receives the lead ECU's tachometer output signal. For more information on dual engine synchronization, see ENGINE SYNCHRONIZATION CONTROL in Group 140 earlier in this manual.

DTC 000644.02 will set if:

- The tachometer signal between the ECUs is erratic or intermittent. This is most likely caused by radiated or conducted electrical "noise" from some part of the engine

If DTC 000644.02 sets, the following will occur:

- Synchronization will be disabled and normal throttle control will return to the follower engine.
- The code will set on the ECU receiving the tachometer signal. This will be the ECU of the follower engine.

If DTC 000640.31 sets:

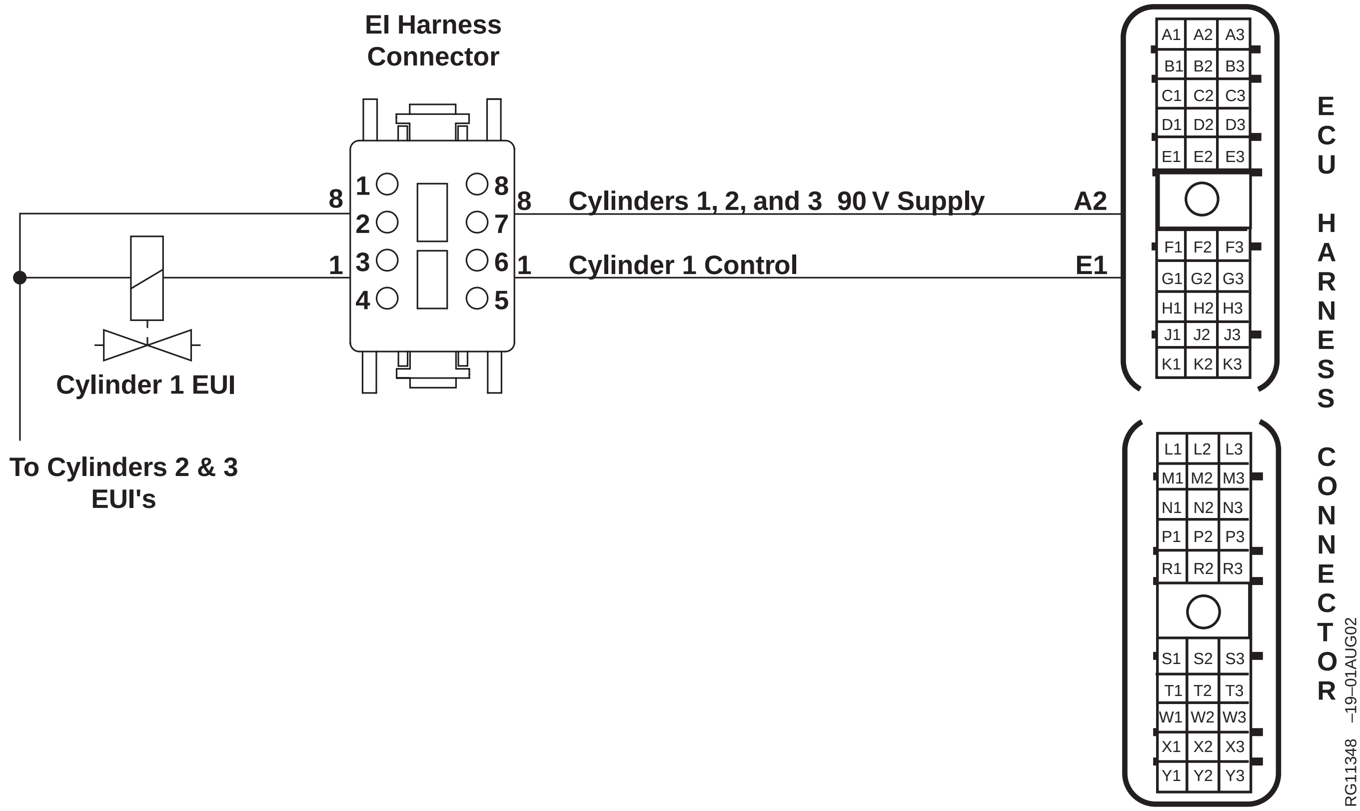
Check loose electrical ground or power connections, including:

- All harness connectors.
- Alternator connections.
- Frame and battery ground connections.
- Electromagnetic interference (EMI) from an incorrectly installed 2-way radio.
- Interference from some radar source.

Also, corrosion, dirt, or paint can cause intermittent and "noisy" connections.

WL30140,000001B –19–15AUG05–1/1

000651.05 — Cylinder #1 EI Circuit Open



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000651.05 will set if:

- The ECU detects an open in the Cylinder #1 EI circuit.

If DTC 000651.05 sets, the following will occur:

- Cylinder #1 EI will not fire.

DPSG,RG40854,223 –19–01APR02–1/1

000651.05 — Cylinder #1 EI Circuit Open

The ECU detects an open in the Cylinder #1 EI circuit.

RG41221,00000AD –19–01APR02–1/1

000651.05 Cylinder #1 EI Circuit Open Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EI CIRCUIT OPEN supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EI CIRCUIT OPEN supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000651.05 reoccurs:** GO TO ❸ **000651.05 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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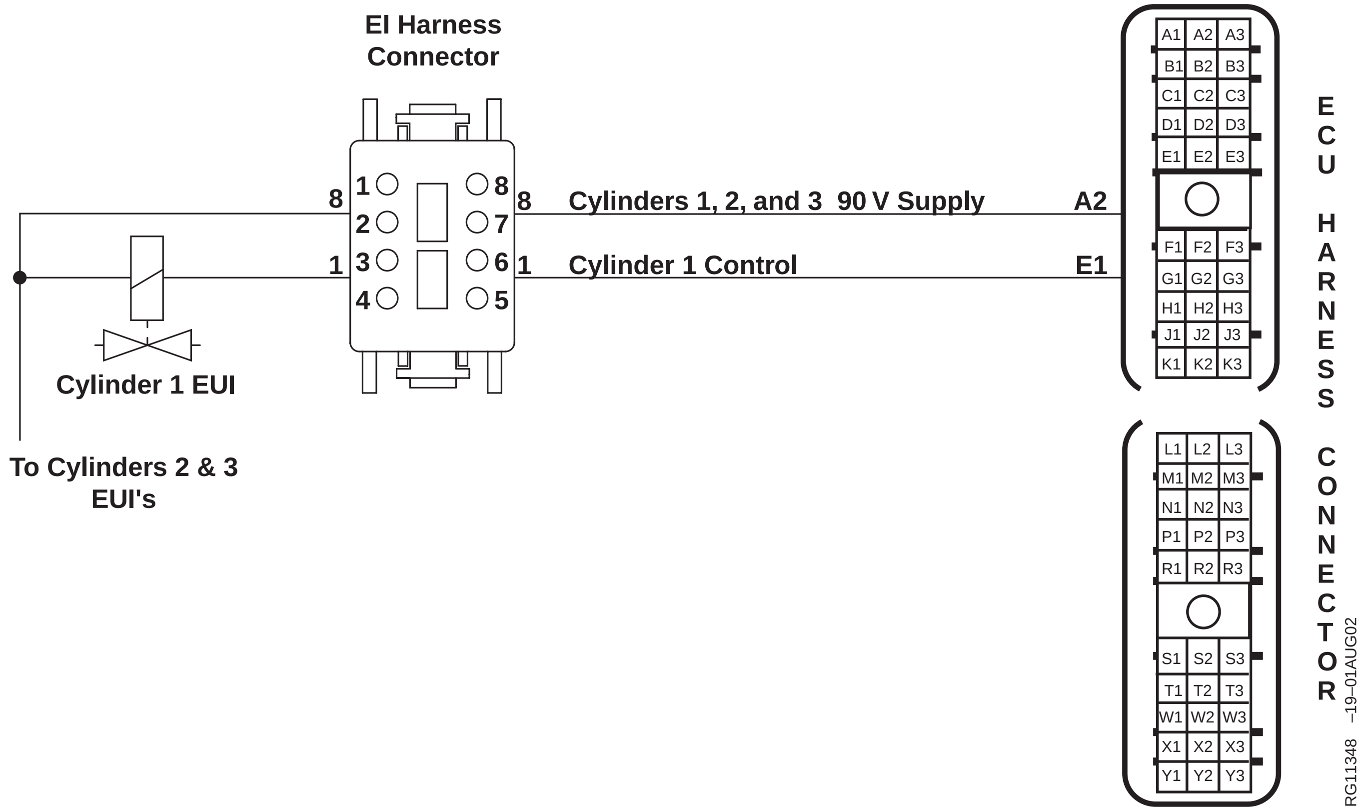
❸ **Open Wire in 90V Supply or EI Control Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between: • Terminal 1 in the harness end of the injector wiring harness connector and terminal E1 in the harness end of ECU connector. • Terminal 8 in the harness end of the injector wiring harness connector and terminal A2 in the harness end of the ECU connector.	**Both measurements 5 ohms or less:** GO TO ❹ **Measurement between terminals 1 and E1 greater than 5 ohms:** Open in wire between terminal 1 and E1. **Measurement between terminals 8 and A2 greater than 5 ohms:** Open in wire between terminal 8 and A2. – – –1/1
❹ **Cylinder 1 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EI CIRCUIT OPEN supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 1 EI and a known good EI. 3. Using a multimeter measure resistance between: • The two terminals on cylinder 1 EI. • The two terminals on the known good EI. 4. Compare the measurement between the two EIs. *NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 1 EI solenoid. – – –1/1

❺ **EI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. 2. Cylinder 1 EI wires still disconnected from EI. 3. Disconnect EI wiring harness connector from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 1 EI harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head (either 1 or 8, the EIs are not polarity sensitive). • The other cylinder 1 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EI harness in head. – – –1/1

000651.06 — Cylinder #1 EI Circuit Shorted



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000651.06 will set if:

- The ECU detects a short in the Cylinder #1 EI circuit.

If DTC 000651.06 sets, the following will occur:

- Cylinder #1 EI will not fire.

DPSG,RG40854,224 –19–01APR02–1/1

000651.06 — Cylinder #1 EI Circuit Shorted

The ECU detects a short in the Cylinder #1 EI circuit.

RG41221,00000AE –19–01APR02–1/1

000651.06 Cylinder #1 EI Circuit Shorted Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EI CIRCUIT SHORTED supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EI CIRCUIT SHORTED supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000651.06 reoccurs:** GO TO ❸ **000651.06 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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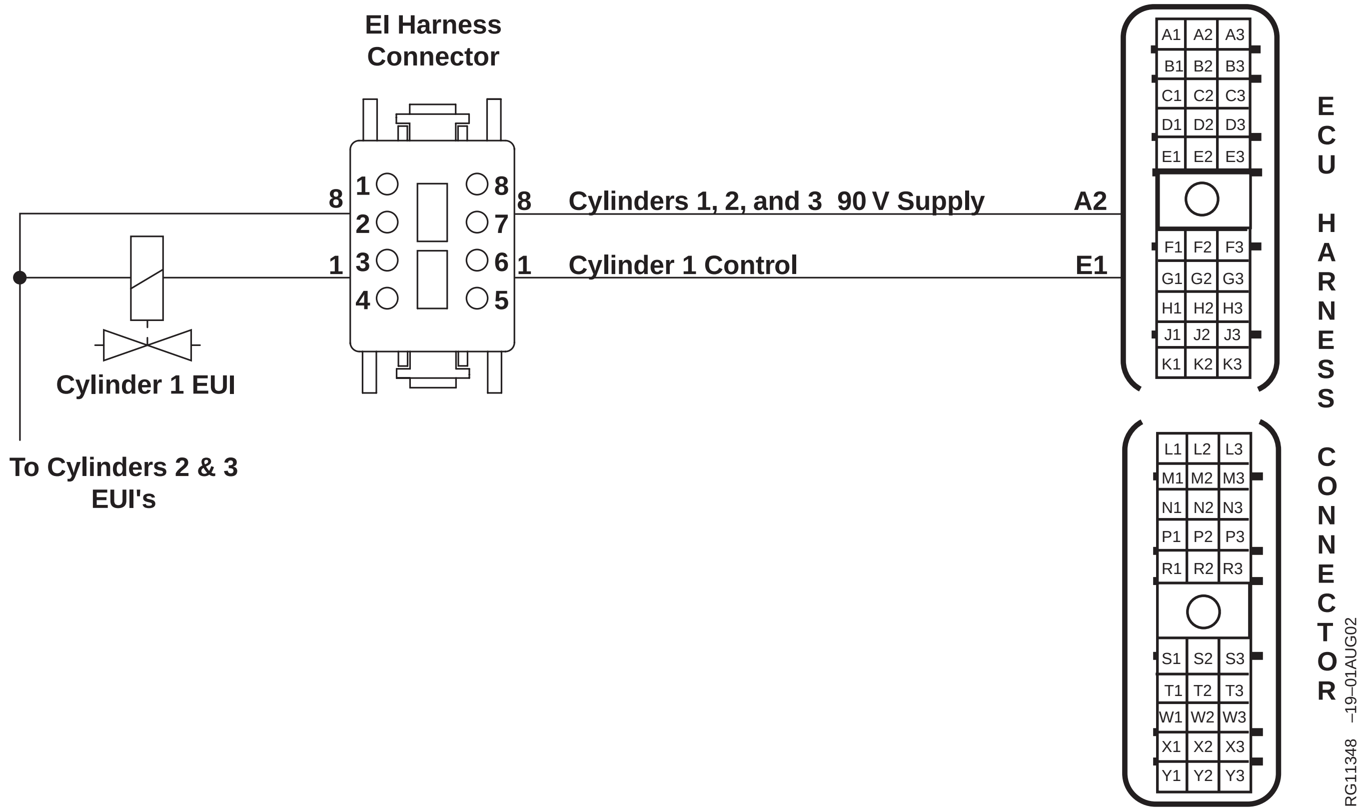
❸ **Short in EI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. ⚠ **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between terminal 1 in the harness end of EI wiring connector and the following: • Terminal 8 in the harness end of the EI wiring harness connector. • Terminal 7 in the harness end of the EI wiring harness connector.	**Both measurements greater than 20k ohms:** GO TO ❹ **Either measurement less than 20k ohms:** Short in ECU wiring harness. – – –1/1

❹ **Cylinder 1 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 1 EI and a known good EI. 3. Using a multimeter, measure resistance between: • The two terminals on cylinder 1 EI. • The two terminals on the known good EI. 4. Compare the measurements between the two EIs. *NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 1 EI solenoid. – – –1/1

❺ **EI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. 2. Keep cylinder 1 EI wires disconnected from EI. 3. Keep EI wiring harness connector at side of cylinder head disconnected. 4. Using a multimeter, measure resistance between: • Both of the cylinder 1 EI harness eyelets.	**Greater than 20k ohms:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Less than 20k ohms:** Faulty EI wiring harness. – – –1/1

000651.07 — Cylinder #1 EI Fuel Delivery Failure



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000651.07 will set if:

- The fuel rail pressure does not drop at the injection of fuel to EI #1.

If DTC 000651.07 sets, the following will occur:

- Engine will miss at EI #1.

RG41221,00000E0 –19–01APR02–1/1

000651.07 — Cylinder #1 EI Fuel Delivery Failure

The fuel rail pressure does not drop at the injection of fuel to EI #1.

RG41221,00000E1 –19–01APR02–1/1

000651.07 Cylinder #1 EI Fuel Delivery Failure Diagnostic Procedure

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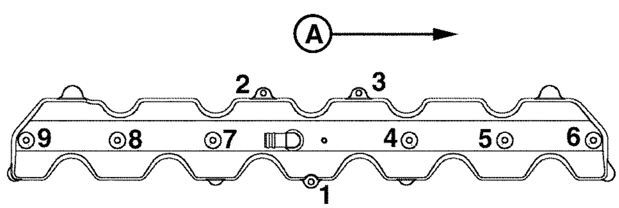
❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000651.07 CYLINDER #1 EI FUEL DELIVERY FAILURE supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **EI Wiring Harness Check**	*NOTE: For wiring and theory of operation information, see DTC 000651.07 CYLINDER #1 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electrical shock hazard if engine is cranking or running.** 2. Remove rocker arm cover with vent tube. 3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification. **Specification** Solenoid Wire Retaining Nuts—Torque .... 1.9 N•m (1.4 lb-ft) (17 lb-in.) 4. Install rocker arm cover with vent tube. Tighten capscrews in order shown to specification. **Specification** Rocker Arm Cover Capscrews—Torque.. 8 N•m (6 lb-ft)  RG11620A –UN–11DEC00 *Order to Tighten Rocker Arm Cover Capscrews* **A—Front of Engine**	**All retaining nuts tighten to specification:** GO TO ❸ **Retaining nut(s) loose:** Tight retaining nut(s) to specification and retest. – – –1/1

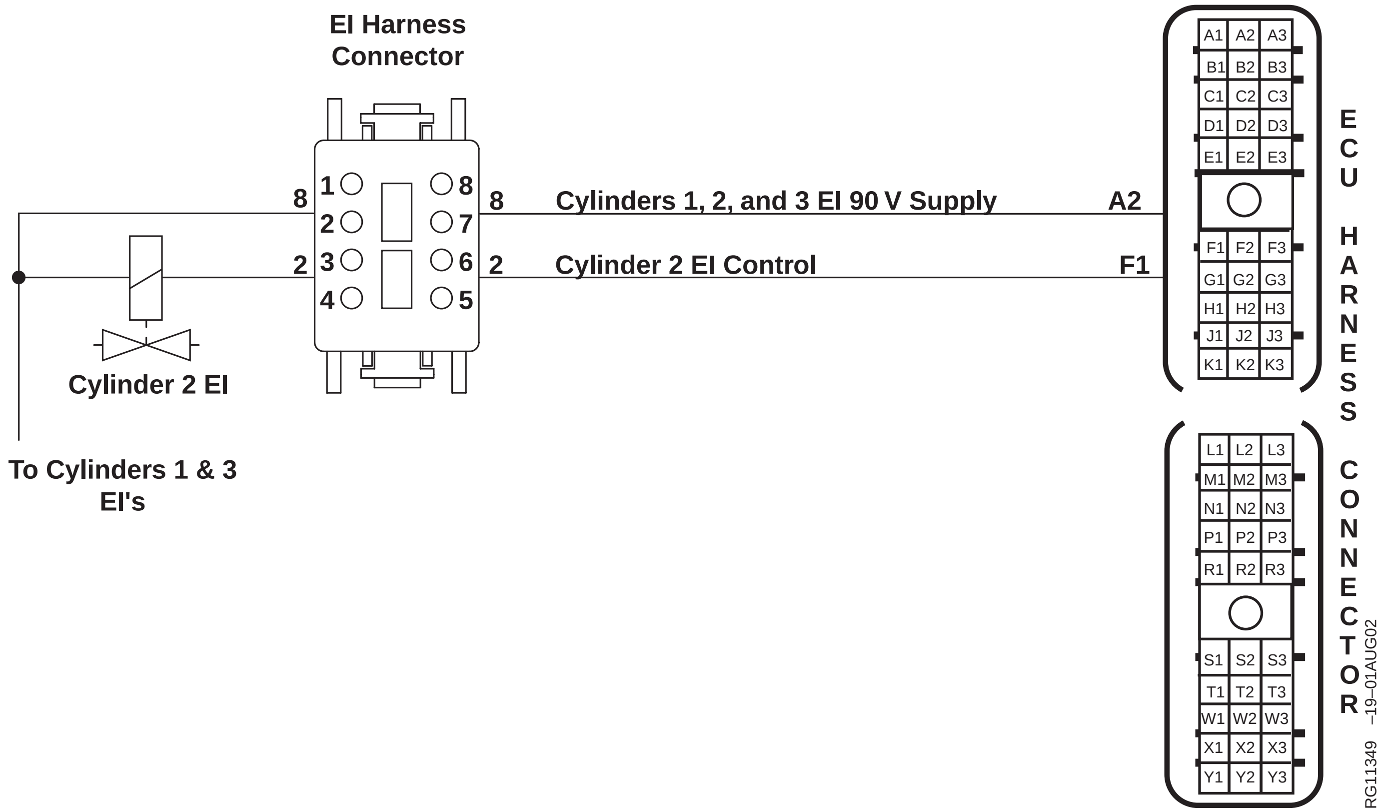
❸ **EI Fuel Line Restriction Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.07 CYLINDER #1 EI FUEL DELIVERY FAILURE supporting information.* Check fuel lines for restrictions between HPCR and the fuel inlet at EI #1.	**No restrictions found:** GO TO ❹ **Restrictions found:** Repair or replace fuel line and retest – – –1/1

❹ **Flow Limiter Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.07 CYLINDER #1 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition ON, engine running under condition that sets code. 2. Using the ECU diagnostic software, verify that DTC 000651.07 is an ACTIVE code. 3. Listen to flow limiter that corresponds to EI #1 while turning ignition OFF. *NOTE: It is very difficult to distinguish the difference between EI #1 and the other 5 flow limiters clicking. Make sure EI #1 makes the click. It will take 5-30 seconds for the ball to reseat.*	**Flow damper clicks:** GO TO ❺ **Flow damper does not click:** Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW LIMITERS in Section 02, Group 090 earlier in this manual. – – –1/1

❺ **Fuel Fitting Leakage Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.07 CYLINDER #1 EI FUEL DELIVERY FAILURE supporting information.* Check the high pressure fuel supply line fitting at the fuel inlet connector for cracks and leaks. If this connection is faulty, fuel leakage should be visible.	**No cracks found:** GO TO ❻ **Cracks found:** Replace fuel fitting or fuel line and retest. – – –1/1

❻ **Fuel Inlet Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.07 CYLINDER #1 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition OFF. 2. Disconnect the high pressure fuel line from the inlet connector for EI #1. 3. Using a 1/2" hose grip pliers, remove the fuel inlet connector. 4. Inspect the fuel inlet connector for nicks, burrs, or other damage. 5. Inspect fuel inlet connector O-ring for damage. 6. When inspection is completed, reinstall inspected or install new fuel inlet connector using JDG1460 Fuel Inlet Connector Installer. There will be some resistance as the O-ring on the connector enters the cylinder bore. Keep installing until inlet connector connects with the EI. 7. Install the high pressure fuel line to the inlet connector. Tighten to specification: **Specification** High Pressure Fuel Line to Fuel Inlet Connector Fittings—Torque .... 53 N•m (39 lb-ft)	**Inlet connector and O-ring functions properly:** Faulty EI OR Faulty ECU **Faulty inlet connector or O-ring:** Replace inlet connector using steps 6 and 7 in this procedure and retest. – – –1/1

000652.05 — Cylinder #2 EI Circuit Open



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000652.05 will set if:

- The ECU detects an open in the Cylinder #2 EI circuit.

If DTC 000652.05 sets, the following will occur:

- Cylinder #2 EI will not fire.

DPSG,RG40854,223 –19–01APR02–1/1

000652.05 — Cylinder #2 EI Circuit Open

The ECU detects an open in the Cylinder #2 EI circuit.

RG41221,00000AF –19–01APR02–1/1

000652.05 Cylinder #2 EI Circuit Open Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EI CIRCUIT OPEN supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EI CIRCUIT OPEN supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000652.05 reoccurs:** GO TO ❸ **000652.05 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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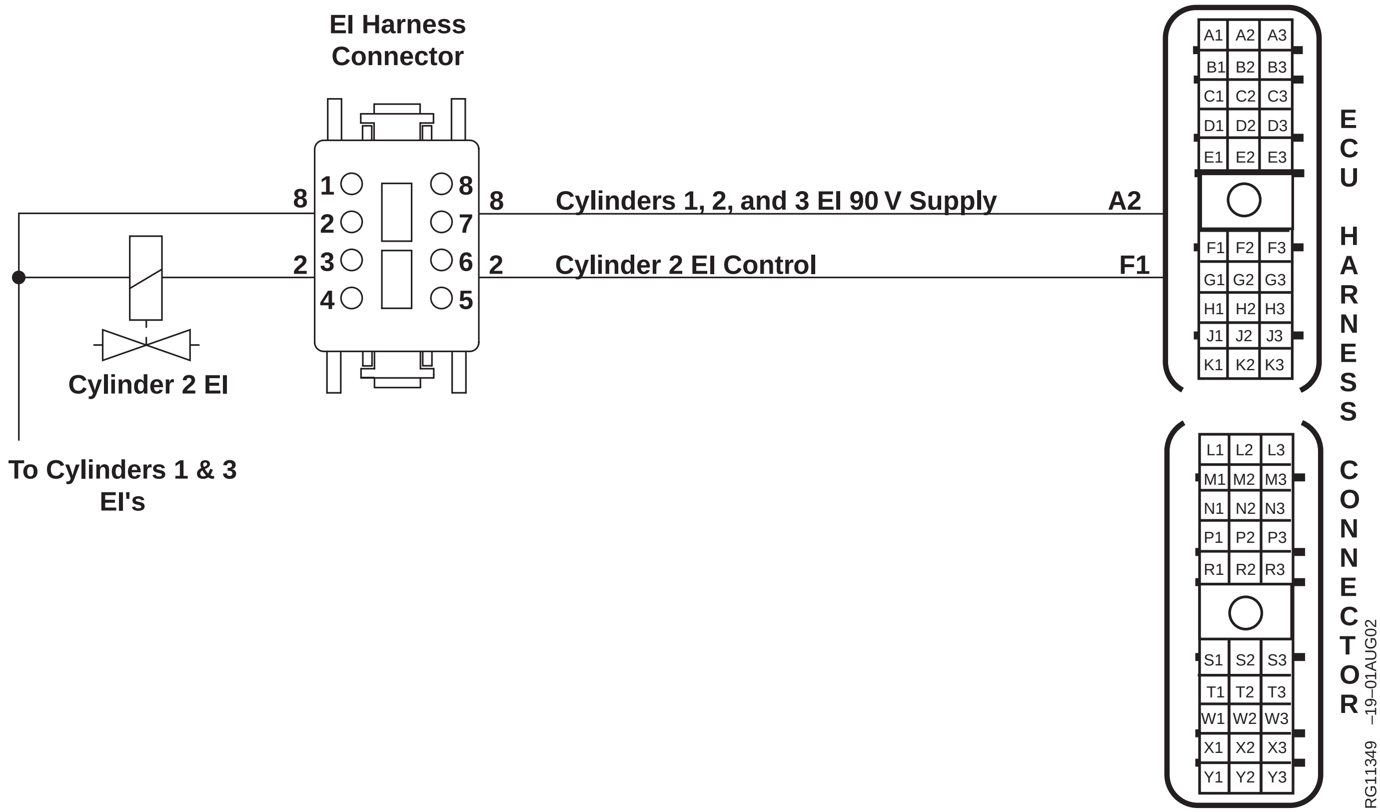
❸ **Open Wire in 90V Supply or EI Control Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between: • Terminal 2 in the harness end of the injector wiring harness connector and terminal F1 in the harness end of ECU connector. • Terminal 8 in the harness end of the injector wiring harness connector and terminal A2 in the harness end of the ECU connector.	**Both measurements 5 ohms or less:** GO TO ❹ **Measurement between terminals 2 and F1 greater than 5 ohms:** Open in wire between terminal 2 and F1. **Measurement between terminals 8 and A2 greater than 5 ohms:** Open in wire between terminal 8 and A2. – – –1/1

❹ **Cylinder 2 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EI CIRCUIT OPEN supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 2 EI and a known good EI. 3. Using a multimeter measure resistance between: • The two terminals on cylinder 2 EI. • The two terminals on the known good EI. 4. Compare the measurement between the two EIs. *NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 2 EI solenoid. – – –1/1

❺ **EI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. 2. Cylinder 2 EI wires still disconnected from EI. 3. Disconnect EI wiring harness connector from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 2 EI harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head (either 2 or 8, the EIs are not polarity sensitive). • The other cylinder 2 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EI harness in head. – – –1/1

000652.06 — Cylinder #2 EI Circuit Shorted



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI’s for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000652.06 will set if:

- The ECU detects a short in the Cylinder #2 EI circuit.

If DTC 000652.06 sets, the following will occur:

- Cylinder #2 EI will not fire.

000652.06 — Cylinder #2 EI Circuit Shorted

The ECU detects a short in the Cylinder #2 EI circuit.

RG41221,00000B0 –19–01APR02–1/1

000652.06 Cylinder #2 EI Circuit Shorted Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000652.06 reoccurs:** GO TO ❸ **000652.06 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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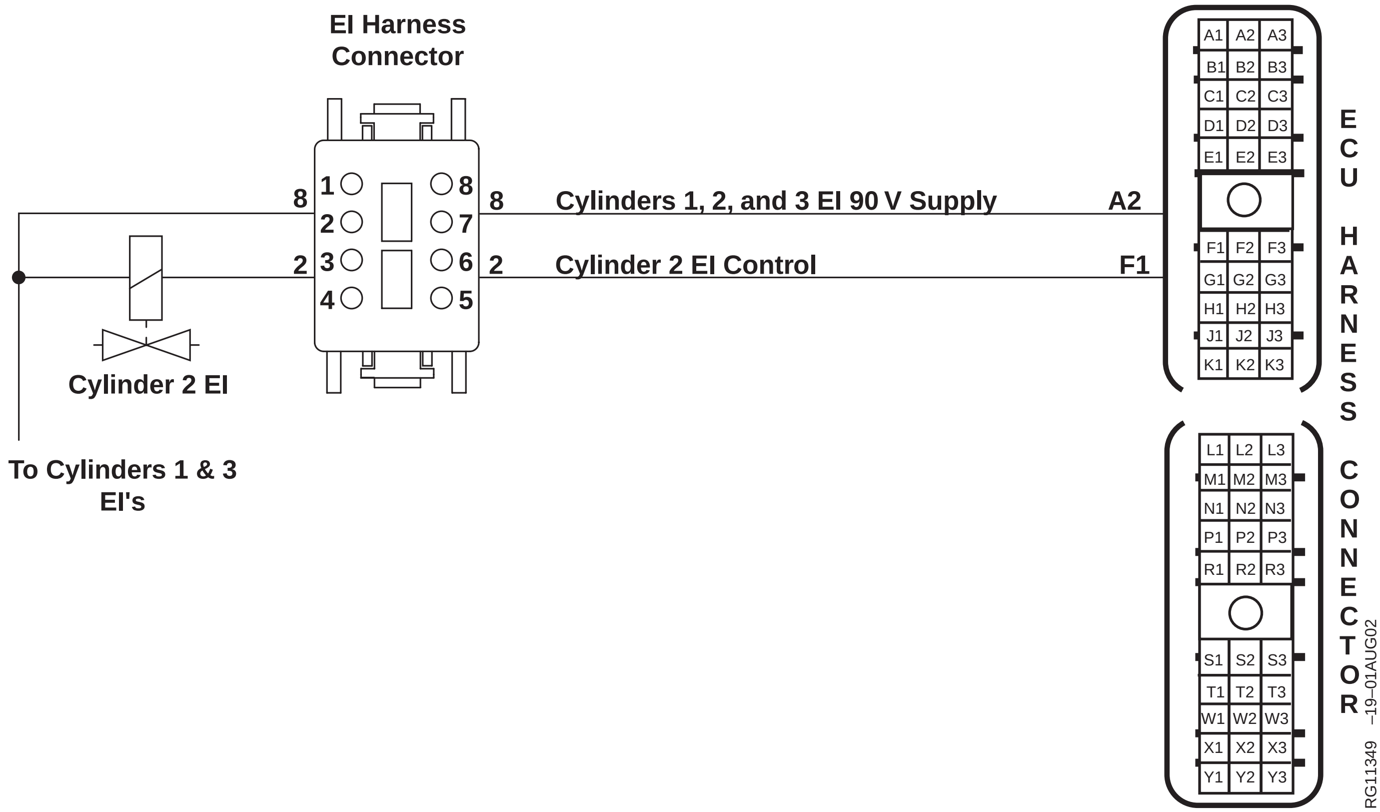
❸ **Short in EI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. ⚠ **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between terminal 2 in the harness end of EI wiring connector and the following: • Terminal 8 in the harness end of the EI wiring harness connector. • Terminal 7 in the harness end of the EI wiring harness connector.	**Both measurements greater than 20k ohms:** GO TO ❹ **Either measurement less than 20k ohms:** Short in ECU wiring harness. – – –1/1

❹ **Cylinder 2 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 2 EI and a known good EI. 3. Using a multimeter, measure resistance between: • The two terminals on cylinder 2 EI. • The two terminals on the known good EI. 4. Compare the measurements between the two EIs. *NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 2 EI solenoid. – – –1/1

❺ **EI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. 2. Keep cylinder 2 EI wires disconnected from EI. 3. Keep EI wiring harness connector at side of cylinder head disconnected. 4. Using a multimeter, measure resistance between: • Both of the cylinder 2 EI harness eyelets.	**Greater than 20k ohms:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Less than 20k ohms:** Faulty EI wiring harness. – – –1/1

000652.07 — Cylinder #2 EI Fuel Delivery Failure



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000652.07 will set if:

- The fuel rail pressure does not drop at the injection of fuel to EI #2.

If DTC 000652.07 sets, the following will occur:

- Engine will miss at EI #2.

RG41221,00000E0 –19–01APR02–1/1

000652.07 — Cylinder #2 EI Fuel Delivery Failure

The fuel rail pressure does not drop at the injection of fuel to EI #2.

RG41221,00000E1 –19–24JAN01–1/1

000652.07 Cylinder #2 EI Fuel Delivery Failure Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI FUEL DELIVERY FAILURE supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ EI Wiring Harness Check

NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI FUEL DELIVERY FAILURE supporting information.

1. Ignition OFF.

CAUTION: Possible strong electrical shock hazard if engine is cranking or running.

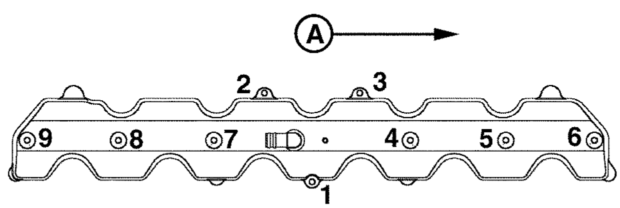
2. Remove rocker arm cover with vent tube.

3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification.

Specification
Solenoid Wire Retaining Nuts—Torque .... 1.9 N•m (1.4 lb-ft) (17 lb-in.)

4. Install rocker arm cover with vent tube. Tighten capscrews in order shown to specification.

Specification
Rocker Arm Cover Capscrews—Torque.. 8 N•m (6 lb-ft)



RG11620A –UN–11DEC00

Order to Tighten Rocker Arm Cover Capscrews

A—Front of Engine

All retaining nuts tighten to specification: GO TO ❸

Retaining nut(s) loose: Tight retaining nut(s) to specification and retest.

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❸ EI Fuel Line Restriction Test

NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI FUEL DELIVERY FAILURE supporting information.

Check fuel lines for restrictions between HPCR and the fuel inlet at EI #2.

No restrictions found: GO TO ❹

Restrictions found: Repair or replace fuel line and retest

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❹ Flow Limiter Test

NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI FUEL DELIVERY FAILURE supporting information.

1. Ignition ON, engine running under condition that sets code.

2. Using the ECU diagnostic software, verify that DTC 000652.07 is an ACTIVE code.

3. Listen to flow limiter that corresponds to EI #2 while turning ignition OFF.

   NOTE: It is very difficult to distinguish the difference between EI #2 and the other 5 flow limiters clicking. Make sure EI #2 makes the click. It will take 5-30 seconds for the ball to reseat.

Flow damper clicks: GO TO ❺

Flow damper does not click: Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW LIMITERS in Section 02, Group 090 earlier in this manual.

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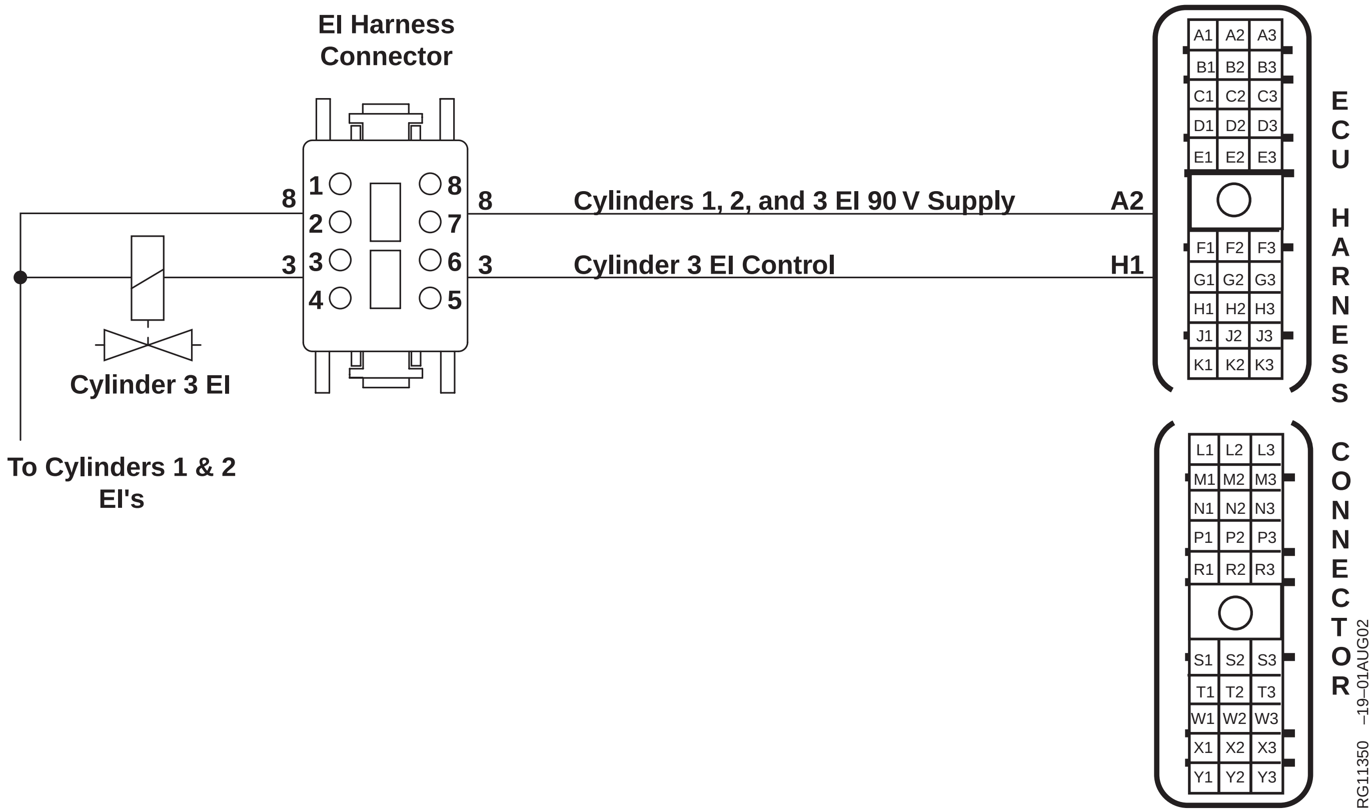
❺ **Fuel Fitting Leakage Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI FUEL DELIVERY FAILURE supporting information.* Check the high pressure fuel supply line fitting at the fuel inlet connector for cracks and leaks. If this connection is faulty, fuel leakage should be visible.	**No cracks found:** GO TO ❻ **Cracks found:** Replace fuel fitting or fuel line and retest. – – –1/1

❻ **Fuel Inlet Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition OFF. 2. Disconnect the high pressure fuel line from the inlet connector for EI #2. 3. Using a 1/2" hose grip pliers, remove the fuel inlet connector. 4. Inspect the fuel inlet connector for nicks, burrs, or other damage. 5. Inspect fuel inlet connector O-ring for damage. 6. When inspection is completed, reinstall inspected or install new fuel inlet connector using JDG1460 Fuel Inlet Connector Installer. There will be some resistance as the O-ring on the connector enters the cylinder bore. Keep installing until inlet connector connects with the EI. 7. Install the high pressure fuel line to the inlet connector. Tighten to specification: **Specification** High Pressure Fuel Line to Fuel Inlet Connector Fittings—Torque .... 53 N•m (39 lb-ft)	**Inlet connector and O-ring functions properly:** Faulty EI OR Faulty ECU **Faulty inlet connector or O-ring:** Replace inlet connector using steps 6 and 7 in this procedure and retest. – – –1/1

000653.05 — Cylinder #3 EI Circuit Open



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000653.05 will set if:

- The ECU detects an open in the Cylinder #3 EI circuit.

If DTC 000653.05 sets, the following will occur:

- Cylinder #3 EI will not fire.

DPSG,RG40854,227 –19–01APR02–1/1

000653.05 — Cylinder #3 EI Circuit Open

The ECU detects an open in the Cylinder #3 EI circuit.

RG41221,00000B1 –19–01APR02–1/1

000653.05 Cylinder #3 EI Circuit Open Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EI CIRCUIT OPEN supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EI CIRCUIT OPEN supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000653.05 reoccurs:** GO TO ❸ **000653.05 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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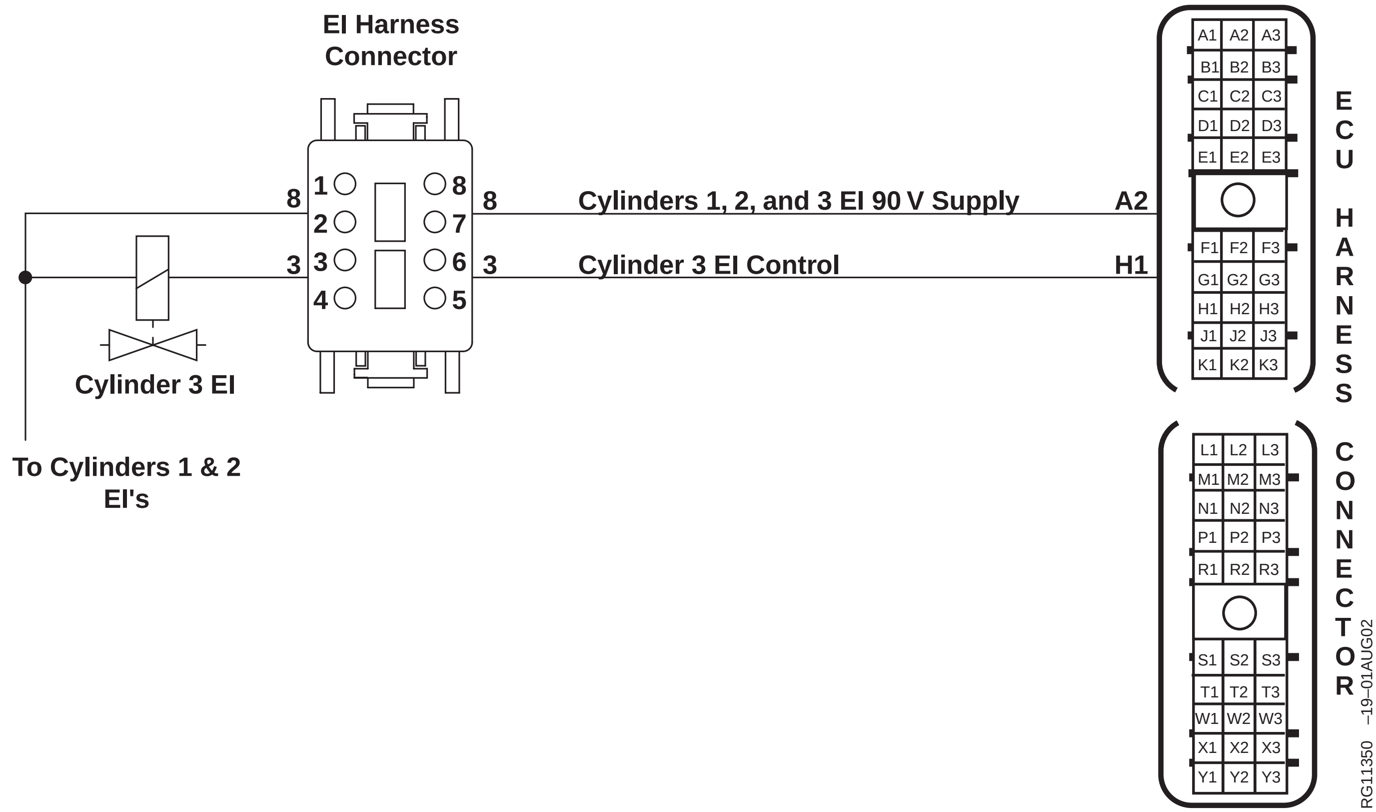
❸ **Open Wire in 90V Supply or EI Control Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between: • Terminal 3 in the harness end of the injector wiring harness connector and terminal H1 in the harness end of ECU connector. • Terminal 8 in the harness end of the injector wiring harness connector and terminal A2 in the harness end of the ECU connector.	**Both measurements 5 ohms or less:** GO TO ❹ **Measurement between terminal 3 and H1 greater than 5 ohms:** Open in wire between terminal 3 and H1. **Measurement between terminals 8 and A2 greater than 5 ohms:** Open in wire between terminal 8 and A2. – – –1/1

❹ **Cylinder 3 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EI CIRCUIT OPEN supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 3 EI and a known good EI. 3. Using a multimeter measure resistance between: • The two terminals on cylinder 3 EI. • The two terminals on the known good EI. 4. Compare the measurement between the two EIs. *NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 3 EI solenoid. – – –1/1

❺ **EI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. 2. Cylinder 3 EI wires still disconnected from EI. 3. Disconnect EI wiring harness connector from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 3 EI harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head (either 3 or 8, the EIs are not polarity sensitive). • The other cylinder 3 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EI harness in head. – – –1/1

000653.06 — Cylinder #3 EI Circuit Shorted



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000653.06 will set if:

- The ECU detects a short in the Cylinder #3 EI circuit.

If DTC 000653.06 sets, the following will occur:

- Cylinder #3 EI will not fire.

DPSG,RG40854,228 –19–01APR02–1/1

000653.06 — Cylinder #3 EI Circuit Shorted

The ECU detects a short in the Cylinder #3 EI circuit.

RG41221,00000B2 –19–01APR02–1/1

000653.06 Cylinder #3 EI Circuit Shorted Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EI CIRCUIT SHORTED supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EI CIRCUIT SHORTED supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000653.06 reoccurs:** GO TO ❸ **000653.06 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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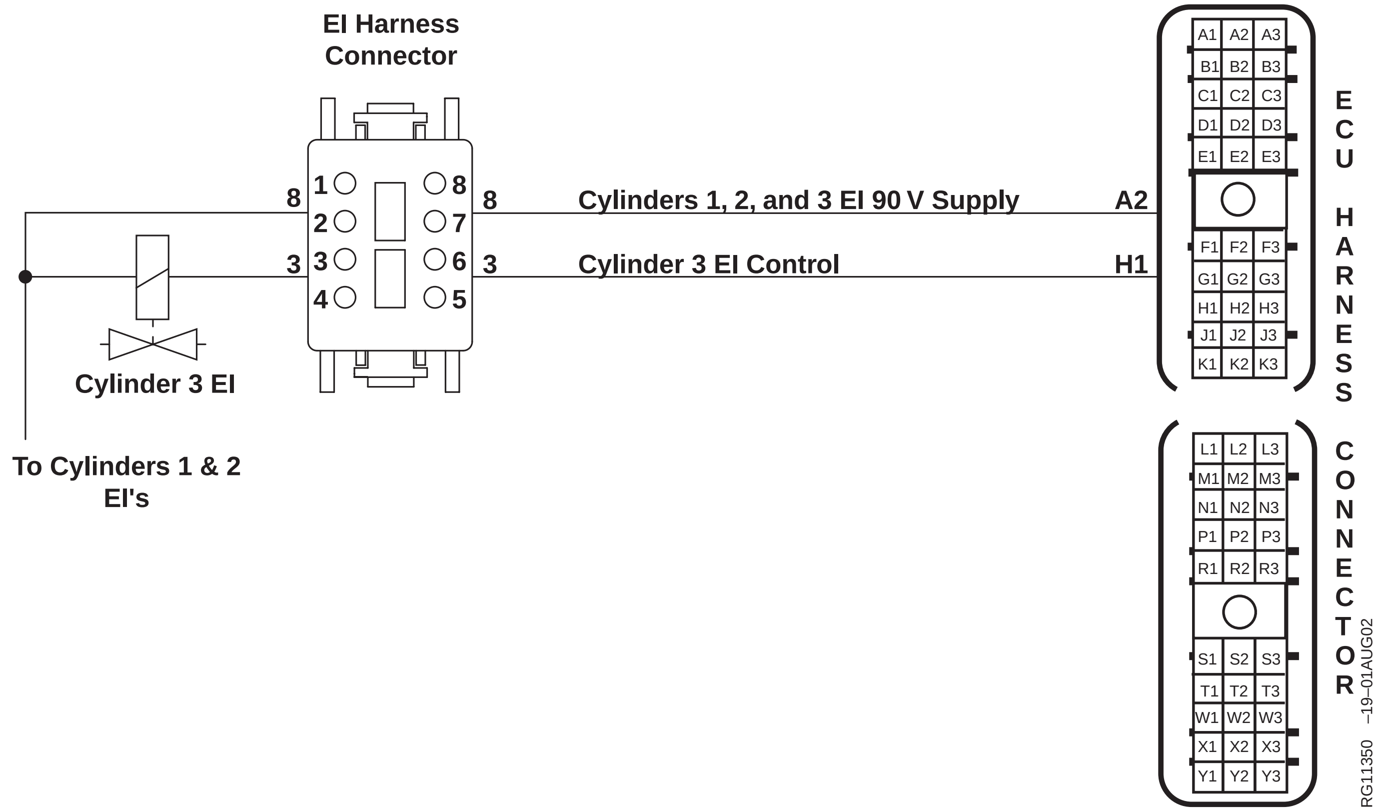
❸ **Short in EI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between terminal 3 in the harness end of EI wiring connector and the following: • Terminal 8 in the harness end of the EI wiring harness connector. • Terminal 7 in the harness end of the EI wiring harness connector.	**Both measurements greater than 20k ohms:** GO TO ❹ **Either measurement less than 20k ohms:** Short in ECU wiring harness. – – –1/1
❹ **Cylinder 3 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 3 EI and a known good EI. 3. Using a multimeter, measure resistance between: • The two terminals on cylinder 3 EI. • The two terminals on the known good EI. 4. Compare the measurements between the two EIs. *NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 3 EI solenoid. – – –1/1
❺ **EI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. 2. Keep cylinder 3 EI wires disconnected from EI. 3. Keep EI wiring harness connector at side of cylinder head disconnected. 4. Using a multimeter, measure resistance between: • Both of the cylinder 3 EI harness eyelets.	**Greater than 20k ohms:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Less than 20k ohms:** Faulty EI wiring harness. – – –1/1

000653.07 — Cylinder #3 EI Fuel Delivery Failure



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000653.07 will set if:

- The fuel rail pressure does not drop at the injection of fuel to EI #3.

If DTC 000653.07 sets, the following will occur:

- Engine will miss at EI #3.

RG41221,00000E0 –19–01APR02–1/1

000653.07 — Cylinder #3 EI Fuel Delivery Failure

The fuel rail pressure does not drop at the injection of fuel to EI #3.

RG41221,00000E1 –19–24JAN01–1/1

000653.07 Cylinder #3 EI Fuel Delivery Failure Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000653.07 CYLINDER #3 EI FUEL DELIVERY FAILURE supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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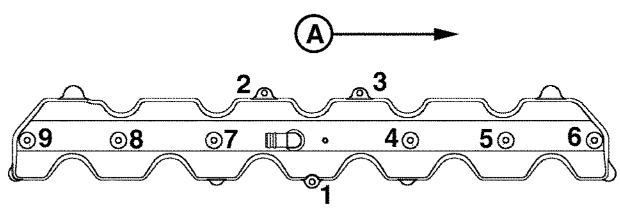
❷ **EI Wiring Harness Check**	*NOTE: For wiring and theory of operation information, see DTC 000653.07 CYLINDER #3 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electrical shock hazard if engine is cranking or running.** 2. Remove rocker arm cover with vent tube. 3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification. **Specification** Solenoid Wire Retaining Nuts—Torque .... 1.9 N•m (1.4 lb-ft) (17 lb-in.) 4. Install rocker arm cover with vent tube. Tighten capscrews in order shown to specification. **Specification** Rocker Arm Cover Capscrews—Torque.. 8 N•m (6 lb-ft)  RG11620A –UN–11DEC00 *Order to Tighten Rocker Arm Cover Capscrews* **A—Front of Engine**	**All retaining nuts tighten to specification:** GO TO ❸ **Retaining nut(s) loose:** Tight retaining nut(s) to specification and retest. – – –1/1

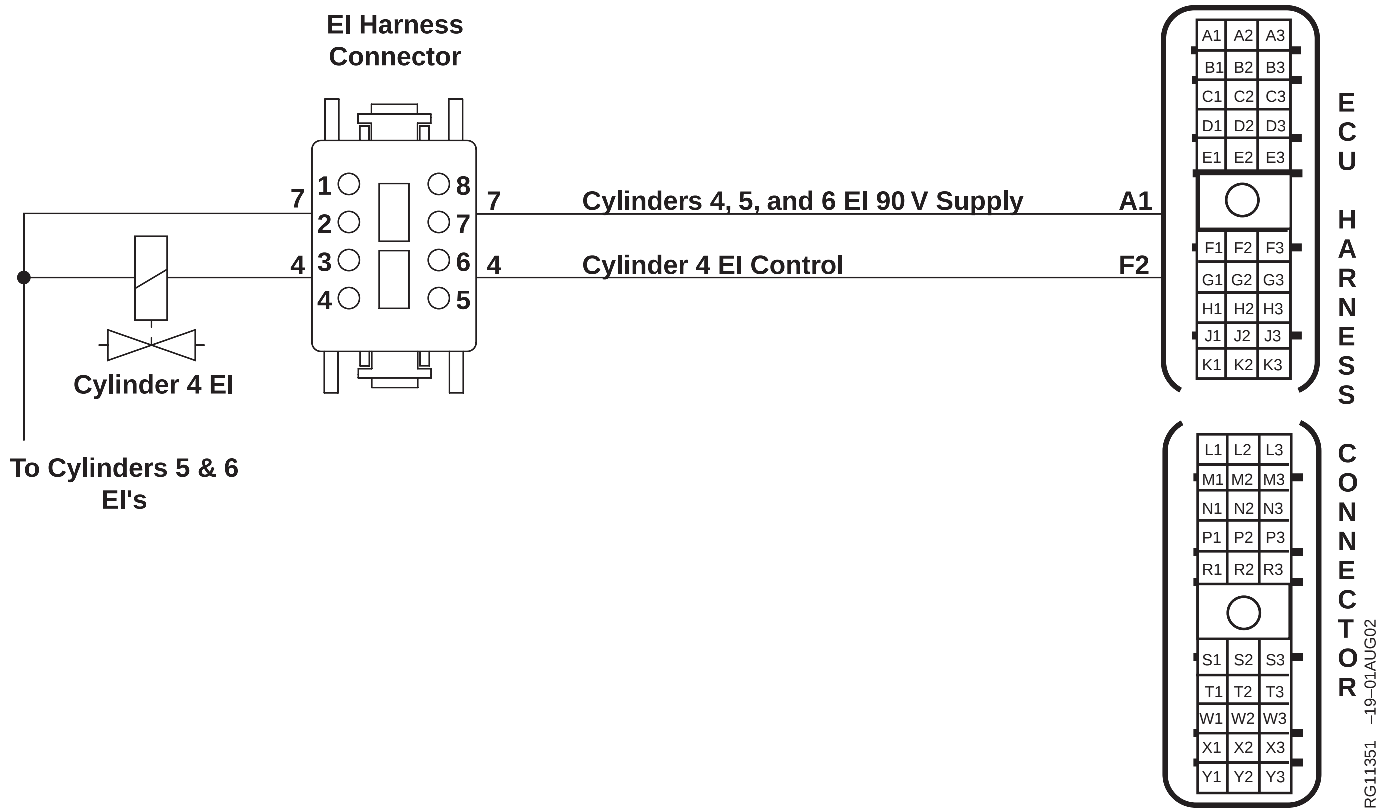
❸ **EI Fuel Line Restriction Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.07 CYLINDER #3 EI FUEL DELIVERY FAILURE supporting information.* Check fuel lines for restrictions between HPCR and the fuel inlet at EI #3.	**No restrictions found:** GO TO ❹ **Restrictions found:** Repair or replace fuel line and retest – – –1/1

❹ **Flow Limiter Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.07 CYLINDER #3 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition ON, engine running under condition that sets code. 2. Using the ECU diagnostic software, verify that DTC 000653.07 is an ACTIVE code. 3. Listen to flow limiter that corresponds to EI #3 while turning ignition OFF. *NOTE: It is very difficult to distinguish the difference between EI #3 and the other 5 flow limiters clicking. Make sure EI #3 makes the click. It will take 5-30 seconds for the ball to reseat.*	**Flow damper clicks:** GO TO ❺ **Flow damper does not click:** Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW LIMITERS in Section 02, Group 090 earlier in this manual. – – –1/1

❺ **Fuel Fitting Leakage Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.07 CYLINDER #3 EI FUEL DELIVERY FAILURE supporting information.* Check the high pressure fuel supply line fitting at the fuel inlet connector for cracks and leaks. If this connection is faulty, fuel leakage should be visible.	**No cracks found:** GO TO ❻ **Cracks found:** Replace fuel fitting or fuel line and retest. – – –1/1

❻ **Fuel Inlet Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.07 CYLINDER #3 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition OFF. 2. Disconnect the high pressure fuel line from the inlet connector for EI #3. 3. Using a 1/2” hose grip pliers, remove the fuel inlet connector. 4. Inspect the fuel inlet connector for nicks, burrs, or other damage. 5. Inspect fuel inlet connector O-ring for damage. 6. When inspection is completed, reinstall inspected or install new fuel inlet connector using JDG1460 Fuel Inlet Connector Installer. There will be some resistance as the O-ring on the connector enters the cylinder bore. Keep installing until inlet connector connects with the EI. 7. Install the high pressure fuel line to the inlet connector. Tighten to specification: **Specification** High Pressure Fuel Line to Fuel Inlet Connector Fittings—Torque .... 53 N•m (39 lb-ft)	**Inlet connector and O-ring functions properly:** Faulty EI OR Faulty ECU **Faulty inlet connector or O-ring:** Replace inlet connector using steps 6 and 7 in this procedure and retest. – – –1/1

000654.05 — Cylinder #4 EI Circuit Open



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000654.05 will set if:

- The ECU detects an open in the Cylinder #4 EI circuit.

If DTC 000654.05 sets, the following will occur:

- Cylinder #4 EI will not fire.

DPSG,RG40854,229 –19–01APR02–1/1

000654.05 — Cylinder #4 EI Circuit Open

The ECU detects an open in the Cylinder #4 EI circuit.

RG41221,00000B3 –19–01APR02–1/1

000654.05 Cylinder #4 EI Circuit Open Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EI CIRCUIT OPEN supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EI CIRCUIT OPEN supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000654.05 reoccurs:** GO TO ❸ **000654.05 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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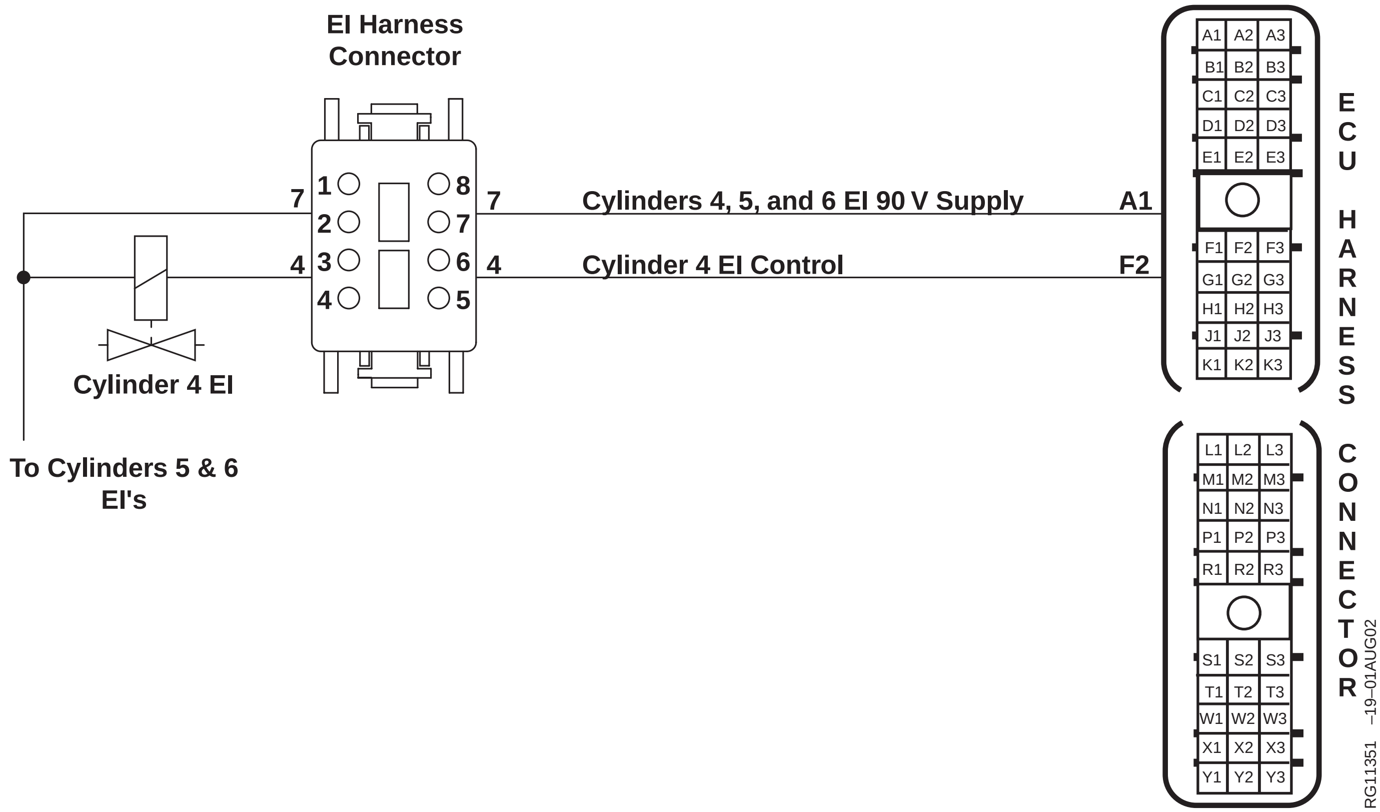
❸ **Open Wire in 90V Supply or EI Control Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between: • Terminal 4 in the harness end of the injector wiring harness connector and terminal F2 in the harness end of ECU connector. • Terminal 7 in the harness end of the injector wiring harness connector and terminal A1 in the harness end of the ECU connector.	**Both measurements 5 ohms or less:** GO TO ❹ **Measurement between terminals 4 and F2 greater than 5 ohms:** Open in wire between terminal 4 and F2. **Measurement between terminals 7 and A1 greater than 5 ohms:** Open in wire between terminal 7 and A12. – – –1/1
❹ **Cylinder 4 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EI CIRCUIT OPEN supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 4 EI and a known good EI. 3. Using a multimeter measure resistance between: • The two terminals on cylinder 4 EI. • The two terminals on the known good EI. 4. Compare the measurement between the two EIs. *NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 4 EI solenoid. – – –1/1

❺ **EI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. 2. Cylinder 4 EI wires still disconnected from EI. 3. Disconnect EI wiring harness connector from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 4 EI harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head (either 4 or 7, the EIs are not polarity sensitive). • The other cylinder 4 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EI harness in head. – – –1/1

000654.06 — Cylinder #4 EI Circuit Shorted



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000654.06 will set if:

- The ECU detects a short in the Cylinder #4 EI circuit.

If DTC 000654.06 sets, the following will occur:

- Cylinder #4 EI will not fire.

DPSG,RG40854,230 –19–01APR02–1/1

000654.06 — Cylinder #4 EI Circuit Shorted

The ECU detects a short in the Cylinder #4 EI circuit.

RG41221,00000B4 –19–01APR02–1/1

000654.06 Cylinder #4 EI Circuit Shorted Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EI CIRCUIT SHORTED supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EI CIRCUIT SHORTED supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000654.06 reoccurs:** GO TO ❸ **000654.06 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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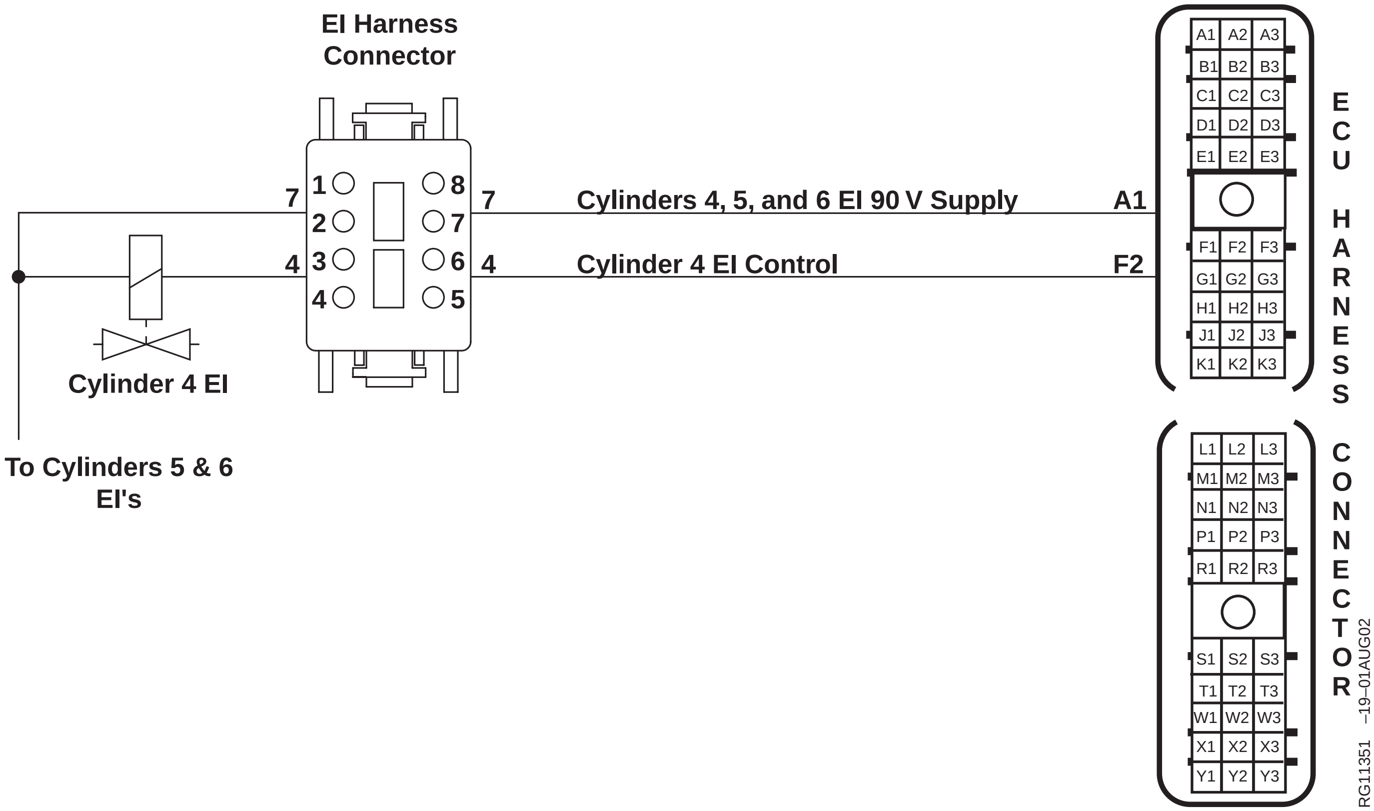
❸ **Short in EI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. ⚠ **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between terminal 4 in the harness end of EI wiring connector and the following: • Terminal 8 in the harness end of the EI wiring harness connector. • Terminal 7 in the harness end of the EI wiring harness connector.	**Both measurements greater than 20k ohms:** GO TO ❹ **Either measurement less than 20k ohms:** Short in ECU wiring harness. – – –1/1

❹ **Cylinder 4 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 4 EI and a known good EI. 3. Using a multimeter, measure resistance between: • The two terminals on cylinder 4 EI. • The two terminals on the known good EI. 4. Compare the measurements between the two EIs. *NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 4 EI solenoid. – – –1/1

❺ **EI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. 2. Keep cylinder 4 EI wires disconnected from EI. 3. Keep EI wiring harness connector at side of cylinder head disconnected. 4. Using a multimeter, measure resistance between: • Both of the cylinder 4 EI harness eyelets.	**Greater than 20k ohms:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Less than 20k ohms:** Faulty EI wiring harness. – – –1/1

000654.07 — Cylinder #4 EI Fuel Delivery Failure



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI’s for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000654.07 will set if:

- The fuel rail pressure does drop at the injection of fuel to EI #4.

If DTC 000654.07 sets, the following will occur:

- Engine will miss at EI #4.

RG41221,00000E0 –19–01APR02–1/1

000654.07 — Cylinder #4 EI Fuel Delivery Failure

The fuel rail pressure does drop at the injection of fuel to EI #4.

RG41221,00000E1 –19–24JAN01–1/1

000654.07 Cylinder #4 EI Fuel Delivery Failure Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000654.07 CYLINDER #4 EI FUEL DELIVERY FAILURE supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ EI Wiring Harness Check

NOTE: For wiring and theory of operation information, see DTC 000654.07 CYLINDER #4 EI FUEL DELIVERY FAILURE supporting information.

1. Ignition OFF.

CAUTION: Possible strong electrical shock hazard if engine is cranking or running.

2. Remove rocker arm cover with vent tube.

3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification.

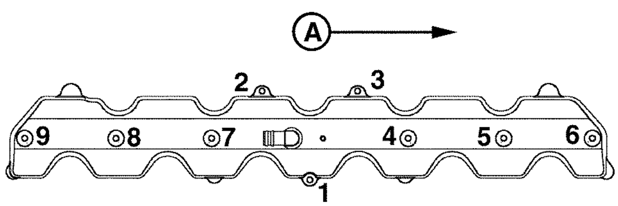
Specification

Solenoid Wire Retaining Nuts—Torque .... 1.9 N•m (1.4 lb-ft) (17 lb-in.)

4. Install rocker arm cover with vent tube. Tighten capscrews in order shown to specification.

Specification

Rocker Arm Cover Capscrews—Torque... 8 N•m (6 lb-ft)



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Order to Tighten Rocker Arm Cover Capscrews

A—Front of Engine

All retaining nuts tighten to specification: GO TO ❸

Retaining nut(s) loose: Tight retaining nut(s) to specification and retest.

– – –1/1

❸ EI Fuel Line Restriction Test

NOTE: For wiring and theory of operation information, see DTC 000654.07 CYLINDER #4 EI FUEL DELIVERY FAILURE supporting information.

Check fuel lines for restrictions between HPCR and the fuel inlet at EI #4.

No restrictions found: GO TO ❹

Restrictions found: Repair or replace fuel line and retest

– – –1/1

❹ Flow Limiter Test

NOTE: For wiring and theory of operation information, see DTC 000654.07 CYLINDER #4 EI FUEL DELIVERY FAILURE supporting information.

1. Ignition ON, engine running under condition that sets code.

2. Using the ECU diagnostic software, verify that DTC 000654.07 is an ACTIVE code.

3. Listen to flow limiter that corresponds to EI #4 while turning ignition OFF.

   NOTE: It is very difficult to distinguish the difference between EI #4 and the other 5 flow limiters clicking. Make sure EI #4 makes the click. It will take 5-30 seconds for the ball to reseat.

Flow damper clicks: GO TO ❺

Flow damper does not click: Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW LIMITERS in Section 02, Group 090 earlier in this manual.

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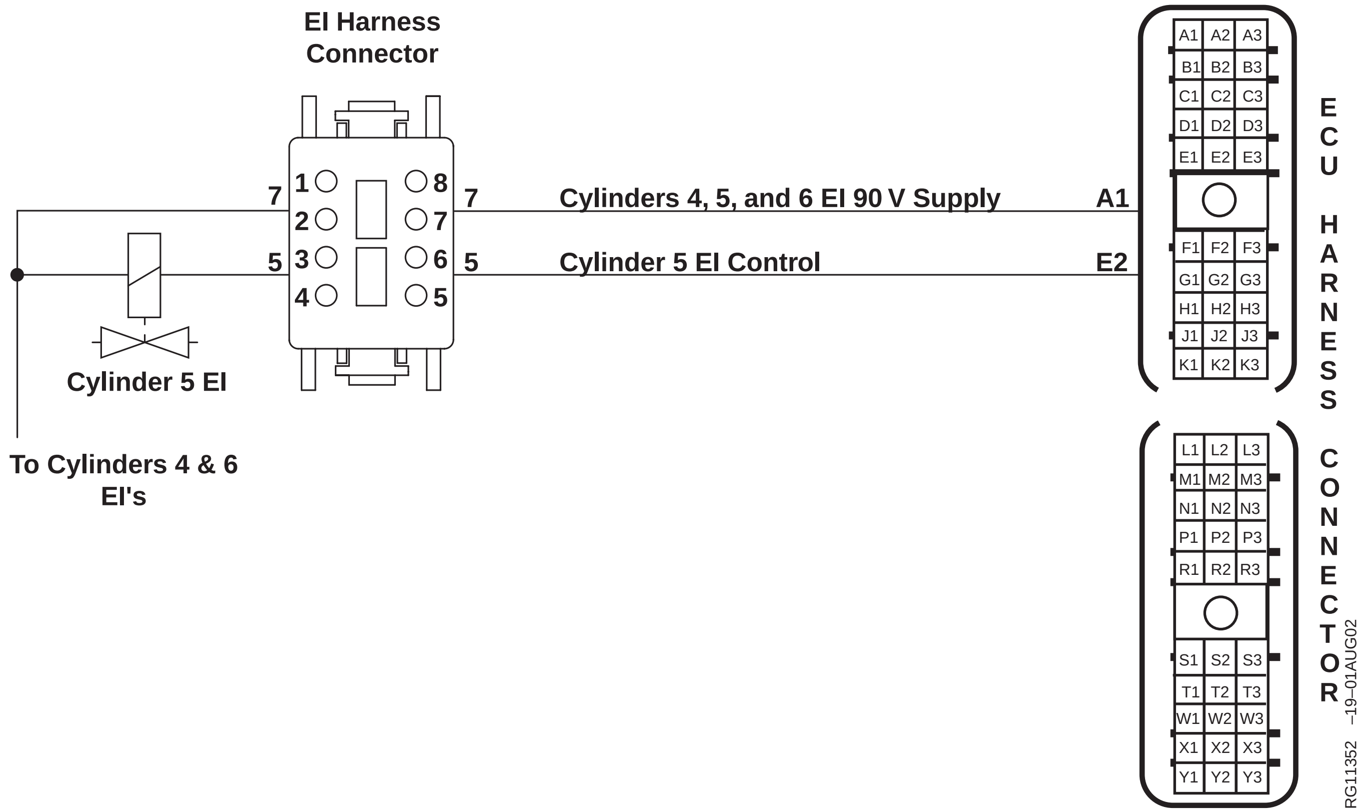
❺ **Fuel Fitting Leakage Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.07 CYLINDER #4 EI FUEL DELIVERY FAILURE supporting information.* Check the high pressure fuel supply line fitting at the fuel inlet connector for cracks and leaks. If this connection is faulty, fuel leakage should be visible.	**No cracks found:** GO TO ❻ **Cracks found:** Replace fuel fitting or fuel line and retest. – – –1/1

❻ **Fuel Inlet Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.07 CYLINDER #4 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition OFF. 2. Disconnect the high pressure fuel line from the inlet connector for EI #4. 3. Using a 1/2” hose grip pliers, remove the fuel inlet connector. 4. Inspect the fuel inlet connector for nicks, burrs, or other damage. 5. Inspect fuel inlet connector O-ring for damage. 6. When inspection is completed, reinstall inspected or install new fuel inlet connector using JDG1460 Fuel Inlet Connector Installer. There will be some resistance as the O-ring on the connector enters the cylinder bore. Keep installing until inlet connector connects with the EI. 7. Install the high pressure fuel line to the inlet connector. Tighten to specification: **Specification** High Pressure Fuel Line to Fuel Inlet Connector Fittings—Torque .... 53 N•m (39 lb-ft)	**Inlet connector and O-ring functions properly:** Faulty EI OR Faulty ECU **Faulty inlet connector or O-ring:** Replace inlet connector using steps 6 and 7 in this procedure and retest. – – –1/1

000655.05 — Cylinder #5 EI Circuit Open



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000655.05 will set if:

- The ECU detects an open in the Cylinder #5 EI circuit.

If DTC 000655.05 sets, the following will occur:

- Cylinder #5 EI will not fire.

DPSG,RG40854,231 –19–01APR02–1/1

000655.05 — Cylinder #5 EI Circuit Open

The ECU detects an open in the Cylinder #5 EI circuit.

RG41221,00000B5 –19–01APR02–1/1

000655.05 Cylinder #5 EI Circuit Open Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EI CIRCUIT OPEN supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EI CIRCUIT OPEN supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000655.05 reoccurs:** GO TO ❸ **000655.05 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Open Wire in 90V Supply or EI Control Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between: • Terminal 5 in the harness end of the injector wiring harness connector and terminal E2 in the harness end of ECU connector. • Terminal 7 in the harness end of the injector wiring harness connector and terminal A1 in the harness end of the ECU connector.	**Both measurements 5 ohms or less:** GO TO ❹ **Measurement between terminals 5 and E2 greater than 5 ohms:** Open in wire between terminal 5 and E2. **Measurement between terminals 7 and A1 greater than 5 ohms:** Open in wire between terminal 7 and A1. – – –1/1

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,372

❹ **Cylinder 5 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EI CIRCUIT OPEN supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 5 EI and a known good EI. 3. Using a multimeter measure resistance between: • The two terminals on cylinder 5 EI. • The two terminals on the known good EI. 4. Compare the measurement between the two EIs. *NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 5 EI solenoid. – – –1/1

❺ **EI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. 2. Cylinder 5 EI wires still disconnected from EI. 3. Disconnect EI wiring harness connector from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 5 EI harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head (either 5 or 7, the EIs are not polarity sensitive). • The other cylinder 5 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EI harness in head. – – –1/1

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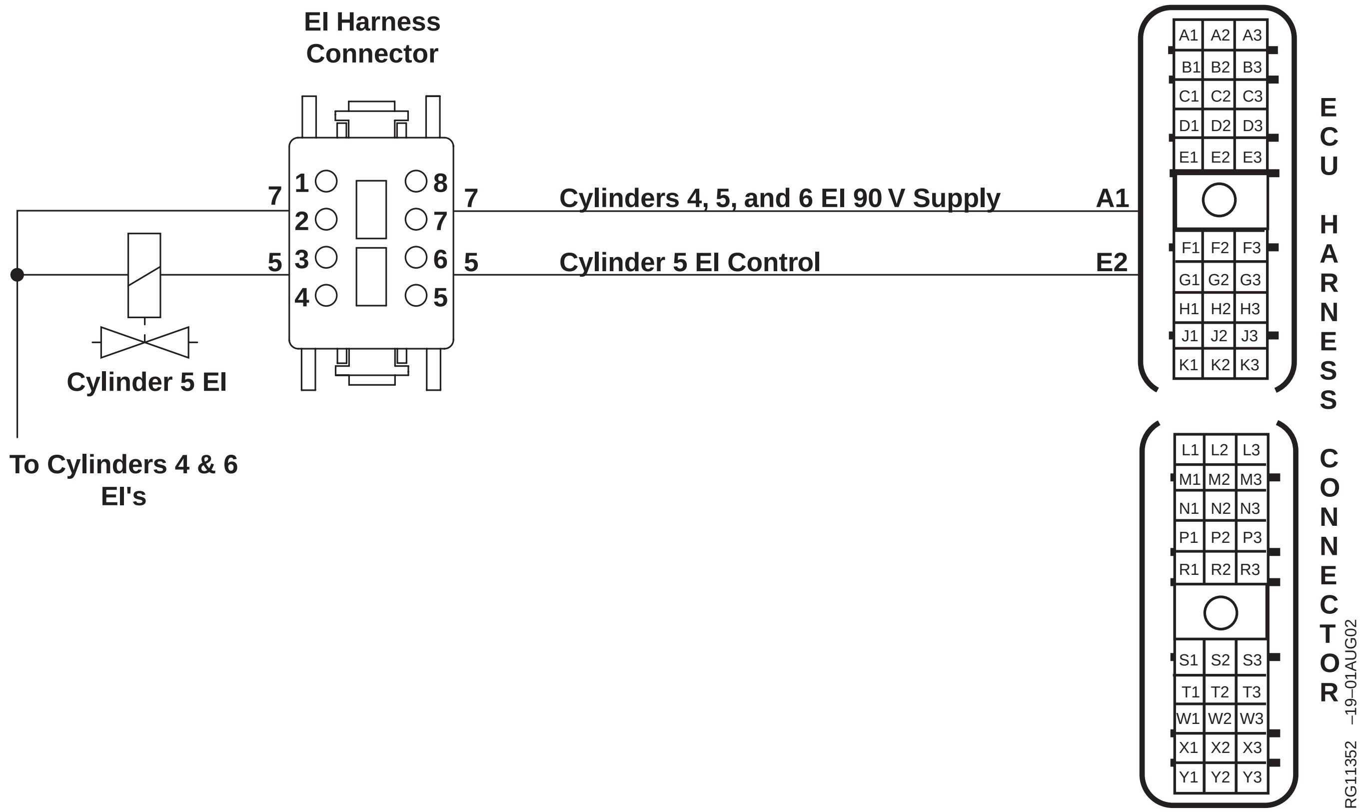
,373

000655.06 — Cylinder #5 EI Circuit Shorted



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI’s for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000655.06 will set if:

- The ECU detects an open in the Cylinder #5 EI circuit.

If DTC 000655.06 sets, the following will occur:

- Cylinder #5 EI will not fire.

DPSG,RG40854,232 –19–01APR02–1/1

000655.06 — Cylinder #5 EI Circuit Shorted

The ECU detects an open in the Cylinder #5 EI circuit.

RG41221,00000B6 –19–01APR02–1/1

000655.06 Cylinder #5 EI Circuit Shorted Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EI CIRCUIT SHORTED supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EI CIRCUIT SHORTED supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000655.06 reoccurs:** GO TO ❸ **000655.06 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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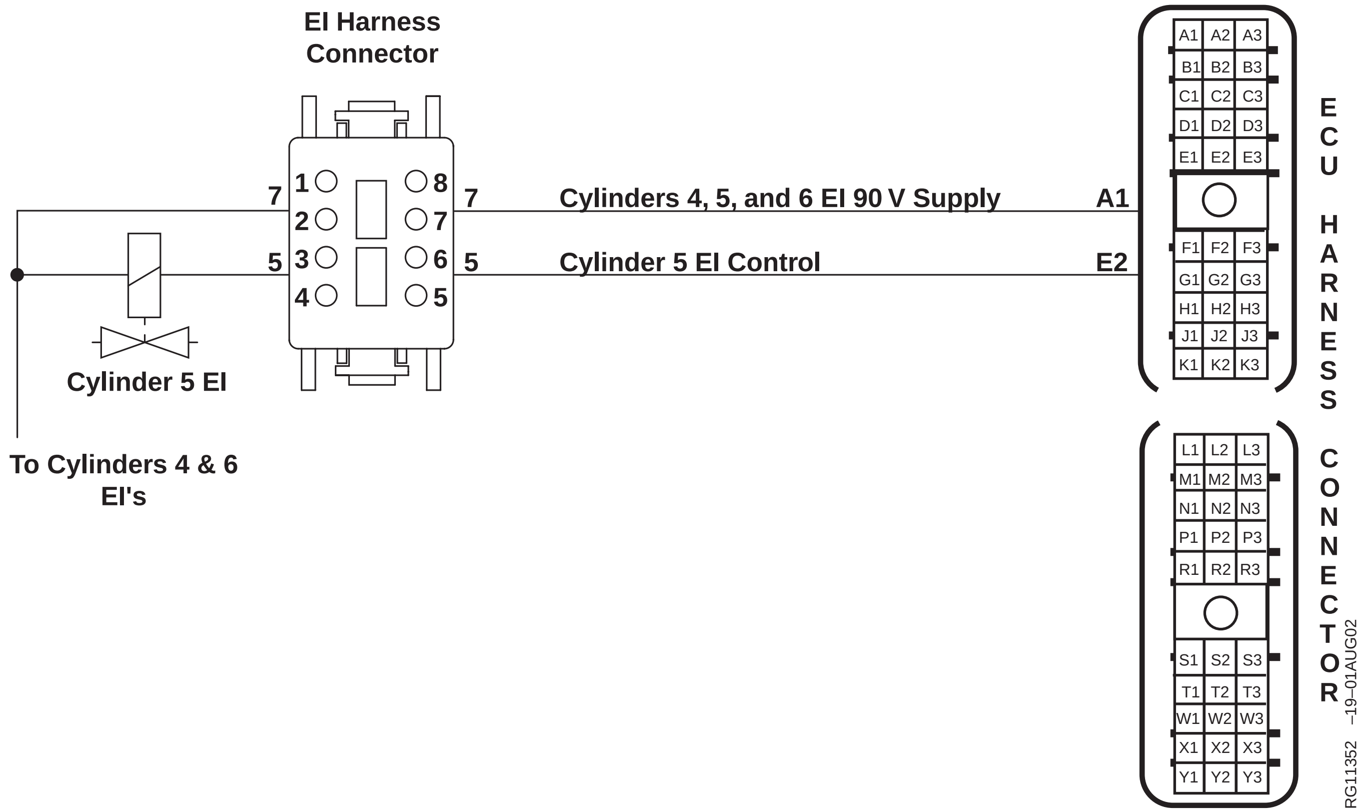
❸ **Short in EI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors.Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between terminal 5 in the harness end of EI wiring connector and the following: • Terminal 8 in the harness end of the EI wiring harness connector. • Terminal 7 in the harness end of the EI wiring harness connector.	**Both measurements greater than 20k ohms:** GO TO ❹ **Either measurement less than 20k ohms:** Short in ECU wiring harness. – – –1/1

❹ **Cylinder 5 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 5 EI and a known good EI. 3. Using a multimeter, measure resistance between: • The two terminals on cylinder 5 EI. • The two terminals on the known good EI. 4. Compare the measurements between the two EIs. *NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 5 injector solenoid. – – –1/1

❺ **EI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. 2. Keep cylinder 5 EI wires disconnected from EI. 3. Keep EI wiring harness connector at side of cylinder head disconnected. 4. Using a multimeter, measure resistance between: • Both of the cylinder 5 EI harness eyelets.	**Greater than 20k ohms:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Less than 20k ohms:** Faulty EI wiring harness. – – –1/1

000655.07 — Cylinder #5 EI Fuel Delivery Failure



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000655.07 will set if:

- The fuel rail pressure does not drop at the injection of fuel to EI #5.

If DTC 000655.07 sets, the following will occur:

- Engine will miss at EI #5.

RG41221,00000E0 –19–01APR02–1/1

000655.07 — Cylinder #5 EI Fuel Delivery Failure

The fuel rail pressure does not drop at the injection of fuel to EI #5.

RG41221,00000E1 –19–01APR02–1/1

000655.07 Cylinder #5 EI Fuel Delivery Failure Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI FUEL DELIVERY FAILURE supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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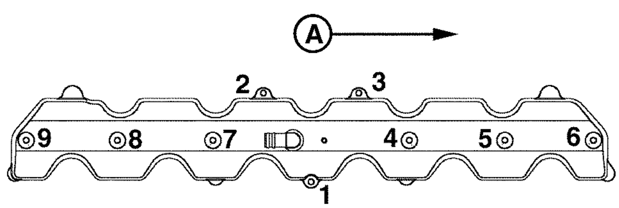
❷ **EI Wiring Harness Check**	*NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electrical shock hazard if engine is cranking or running.** 2. Remove rocker arm cover with vent tube. 3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification. **Specification** Solenoid Wire Retaining Nuts—Torque .... 1.9 N•m (1.4 lb-ft) (17 lb-in.) 4. Install rocker arm cover with vent tube. Tighten capscrews in order shown to specification. **Specification** Rocker Arm Cover Capscrews—Torque.. 8 N•m (6 lb-ft)  RG11620A –UN–11DEC00 *Order to Tighten Rocker Arm Cover Capscrews* **A—Front of Engine**	**All retaining nuts tighten to specification:** GO TO ❸ **Retaining nut(s) loose:** Tight retaining nut(s) to specification and retest. – – –1/1

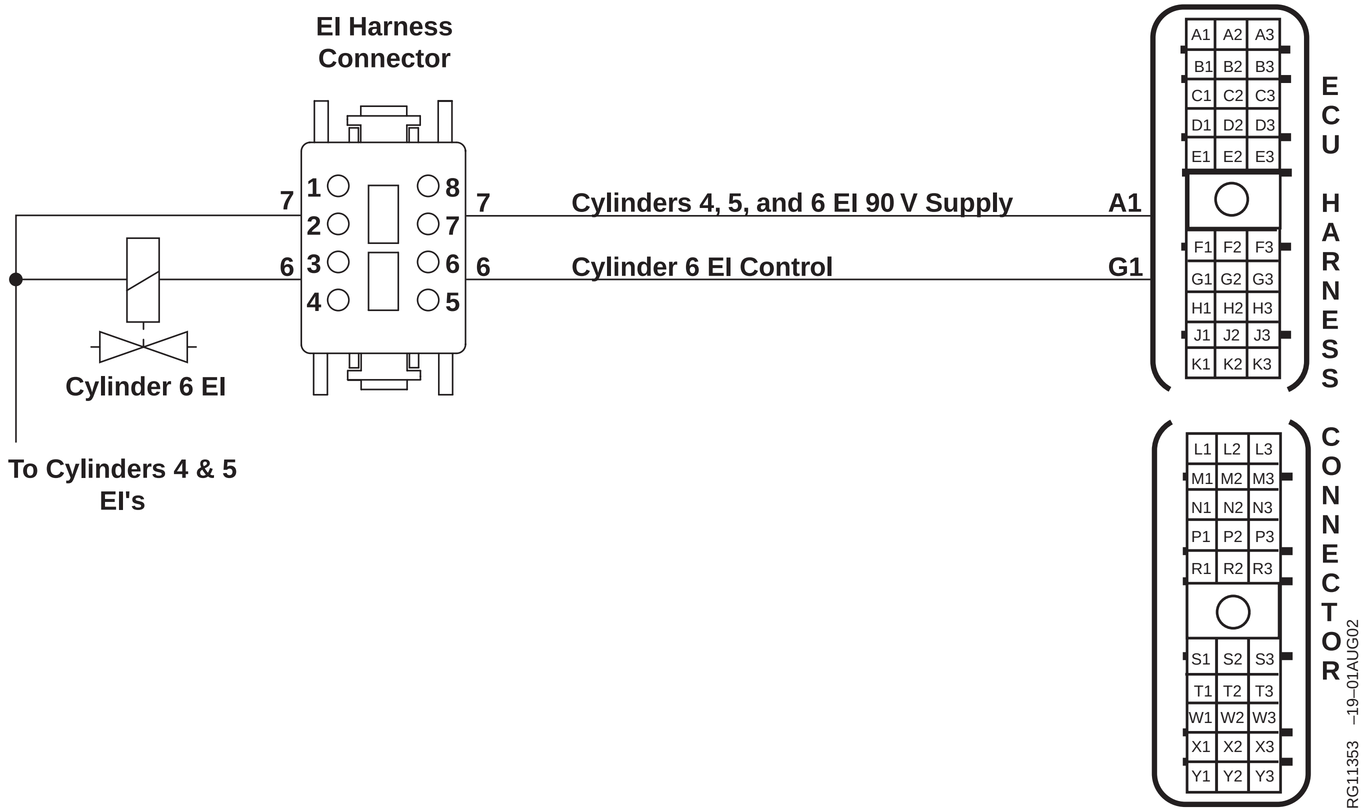
❸ **EI Fuel Line Restriction Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI FUEL DELIVERY FAILURE supporting information.* Check fuel lines for restrictions between HPCR and the fuel inlet at EI #5.	**No restrictions found:** GO TO ❹ **Restrictions found:** Repair or replace fuel line and retest – – –1/1

❹ **Flow Limiter Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition ON, engine running under condition that sets code. 2. Using the ECU diagnostic software, verify that DTC 000655.07 is an ACTIVE code. 3. Listen to flow limiter that corresponds to EI #5 while turning ignition OFF. *NOTE: It is very difficult to distinguish the difference between EI #5 and the other 5 flow limiters clicking. Make sure EI #5 makes the click. It will take 5-30 seconds for the ball to reseat.*	**Flow damper clicks:** GO TO ❺ **Flow damper does not click:** Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW LIMITERS in Section 02, Group 090 earlier in this manual. – – –1/1

❺ **Fuel Fitting Leakage Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI FUEL DELIVERY FAILURE supporting information.* Check the high pressure fuel supply line fitting at the fuel inlet connector for cracks and leaks. If this connection is faulty, fuel leakage should be visible.	**No cracks found:** GO TO ❻ **Cracks found:** Replace fuel fitting or fuel line and retest. – – –1/1

❻ **Fuel Inlet Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition OFF. 2. Disconnect the high pressure fuel line from the inlet connector for EI #5. 3. Using a 1/2” hose grip pliers, remove the fuel inlet connector. 4. Inspect the fuel inlet connector for nicks, burrs, or other damage. 5. Inspect fuel inlet connector O-ring for damage. 6. When inspection is completed, reinstall inspected or install new fuel inlet connector using JDG1460 Fuel Inlet Connector Installer. There will be some resistance as the O-ring on the connector enters the cylinder bore. Keep installing until inlet connector connects with the EI. 7. Install the high pressure fuel line to the inlet connector. Tighten to specification: **Specification** High Pressure Fuel Line to Fuel Inlet Connector Fittings—Torque .... 53 N•m (39 lb-ft)	**Inlet connector and O-ring functions properly:** Faulty EI OR Faulty ECU **Faulty inlet connector or O-ring:** Replace inlet connector using steps 6 and 7 in this procedure and retest. – – –1/1

000656.05 — Cylinder #6 EI Circuit Open



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI's for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000656.05 will set if:

- The ECU detects an open in the Cylinder #6 EI circuit.

If DTC 000656.05 sets, the following will occur:

- Cylinder #6 EI will not fire.

000656.05 — Cylinder #6 EI Circuit Open

The ECU detects an open in the Cylinder #6 EI circuit.

RG41221,00000B7 –19–01APR02–1/1

000656.05 Cylinder #6 EI Circuit Open Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EI CIRCUIT OPEN supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EI CIRCUIT OPEN supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000656.05 reoccurs:** GO TO ❸ **000656.05 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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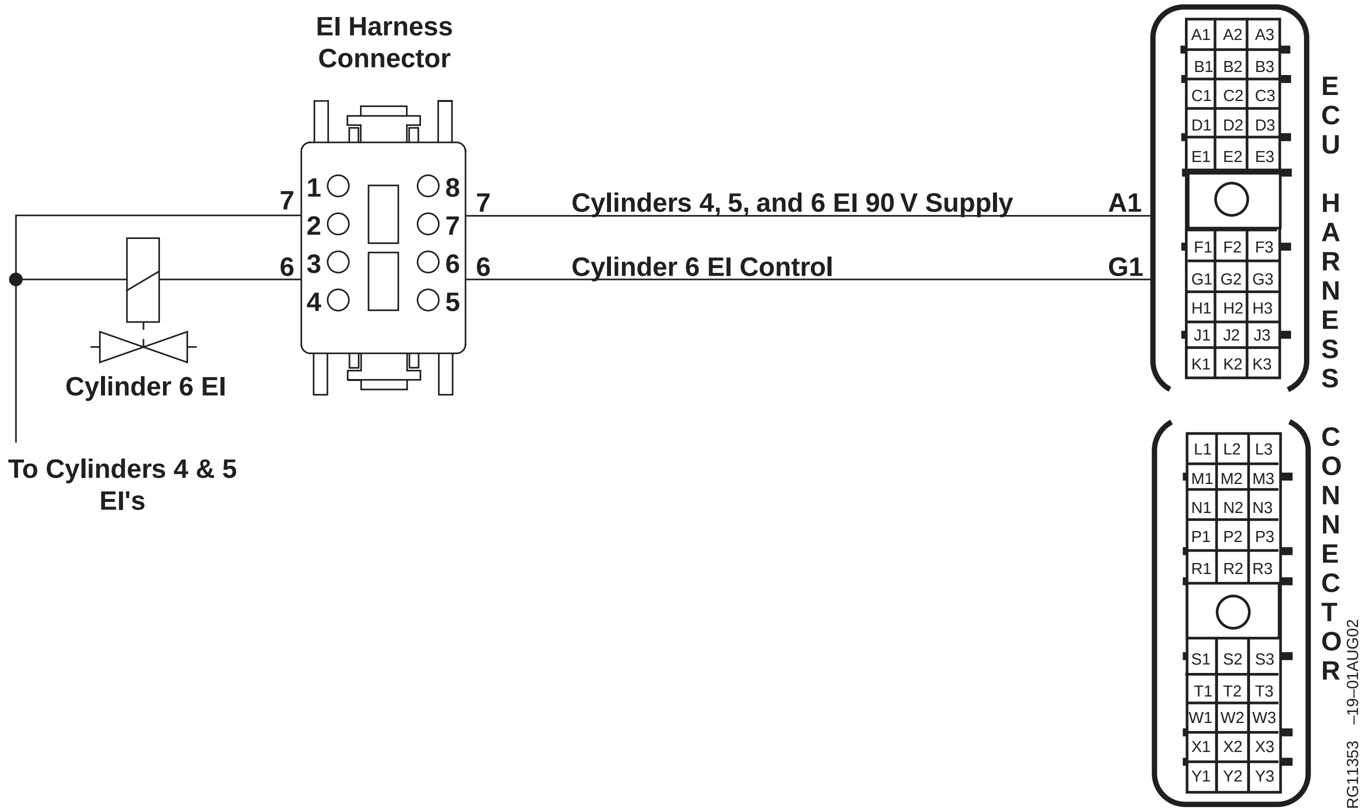
❸ **Open Wire in 90V Supply or EI Control Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between: • Terminal 6 in the harness end of the injector wiring harness connector and terminal G1 in the harness end of ECU connector. • Terminal 7 in the harness end of the injector wiring harness connector and terminal A1 in the harness end of the ECU connector.	**Both measurements 5 ohms or less:** GO TO ❹ **Measurement between terminals 6 and G1 greater than 5 ohms:** Open in wire between terminal 6 and G1. **Measurement between terminals 7 and A1 greater than 5 ohms:** Open in wire between terminal 7 and A1. – – –1/1

❹ **Cylinder 6 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EI CIRCUIT OPEN supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 6 EI and a known good EI. 3. Using a multimeter measure resistance between: • The two terminals on cylinder 6 EI. • The two terminals on the known good EI. 4. Compare the measurement between the two EIs. *NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 6 EI solenoid. – – –1/1

❺ **EI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EI CIRCUIT OPEN supporting information.* 1. Ignition OFF. 2. Cylinder 6 EI wires still disconnected from EI. 3. Disconnect EI wiring harness connector from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 6 EI harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head (either 6 or 7, the EIs are not polarity sensitive). • The other cylinder 6 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EI harness in head. – – –1/1

000656.06 — Cylinder #6 EI Circuit Shorted



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI’s for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000656.06 will set if:

- The ECU detects an open in the Cylinder #6 EI circuit.

If DTC 000656.06 sets, the following will occur:

- Cylinder #6 EI will not fire.

DPSG,RG40854,234 –19–01APR02–1/1

000656.06 — Cylinder #6 EI Circuit Shorted

The ECU detects an open in the Cylinder #6 EI circuit.

RG41221,00000B8 –19–01APR02–1/1

000656.06 Cylinder #6 EI Circuit Shorted Diagnostic Procedure

IMPORTANT: If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EI CIRCUIT SHORTED supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EI CIRCUIT SHORTED supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**000656.06 reoccurs:** GO TO ❸ **000656.06 does not reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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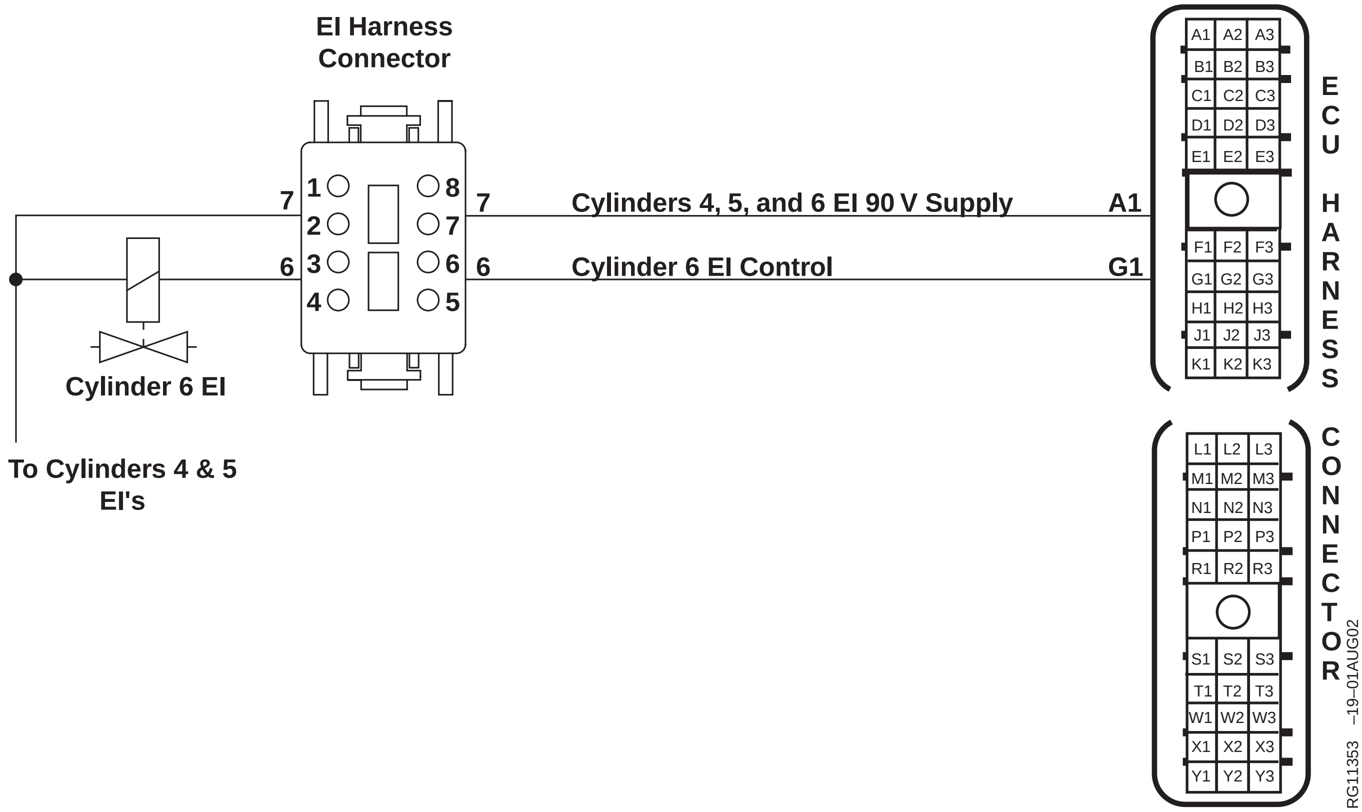
❸ **Short in EI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electric shock hazard if engine is cranking or running!** 2. Disconnect EI wiring harness connector at side of cylinder head. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between terminal 6 in the harness end of EI wiring connector and the following: • Terminal 8 in the harness end of the EI wiring harness connector. • Terminal 7 in the harness end of the EI wiring harness connector.	**Both measurements greater than 20k ohms:** GO TO ❹ **Either measurement less than 20k ohms:** Short in ECU wiring harness. – – –1/1

❹ **Cylinder 6 EI Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover. 2. Disconnect electrical connections to cylinder 6 EI and a known good EI. 3. Using a multimeter, measure resistance between: • The two terminals on cylinder 6 EI. • The two terminals on the known good EI. 4. Compare the measurements between the two EIs. *NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 1.9-3.5 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 6 EI solenoid. – – –1/1

❺ **EI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EI CIRCUIT SHORTED supporting information.* 1. Ignition OFF. 2. Keep cylinder 6 EI wires disconnected from EI. 3. Keep EI wiring harness connector at side of cylinder head disconnected. 4. Using a multimeter, measure resistance between: • Both of the cylinder 6 EI harness eyelets.	**Greater than 20k ohms:** Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU **Less than 20k ohms:** Faulty EI wiring harness. – – –1/1

000656.07 — Cylinder #6 EI Fuel Delivery Failure



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Electronic Injector (EI)

- The fuel in the 8.1 L engine is delivered by 6 (one for each cylinder) electronic injectors (EIs). The EIs are mounted in the cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- Power is supplied to the EI’s for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by another common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

DTC 000656.07 will set if:

- The fuel rail pressure does not drop at the injection of fuel to EI #6.

If DTC 000656.07 sets, the following will occur:

- Engine will miss at EI #6.

RG41221,00000E0 –19–01APR02–1/1

000656.07 — Cylinder #6 EI Fuel Delivery Failure

The fuel rail pressure does not drop at the injection of fuel to EI #6.

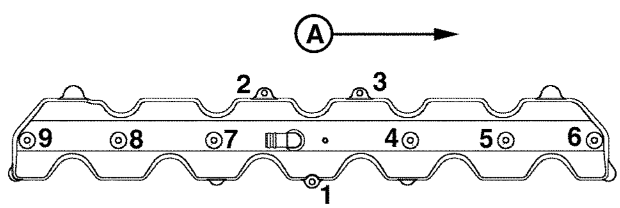
RG41221,00000E1 –19–23AUG02–1/1

000656.07 Cylinder #6 EI Fuel Delivery Failure Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI FUEL DELIVERY FAILURE supporting information.* Visually inspect ECU connectors and the injector harness connector (located at the side of the cylinder head) for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **EI Wiring Harness Check**	*NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition OFF. **CAUTION: Possible strong electrical shock hazard if engine is cranking or running.** 2. Remove rocker arm cover with vent tube. 3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification. **Specification** Solenoid Wire Retaining Nuts—Torque .... 1.9 N•m (1.4 lb-ft) (17 lb-in.) 4. Install rocker arm cover with vent tube. Tighten capscrews in order shown to specification. **Specification** Rocker Arm Cover Capscrews—Torque.. 8 N•m (6 lb-ft)  RG11620A –UN–11DEC00 *Order to Tighten Rocker Arm Cover Capscrews* **A—Front of Engine**	**All retaining nuts tighten to specification:** GO TO ❸ **Retaining nut(s) loose:** Tight retaining nut(s) to specification and retest. – – –1/1

❸ **EI Fuel Line Restriction Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI FUEL DELIVERY FAILURE supporting information.* Check fuel lines for restrictions between HPCR and the fuel inlet at EI #6.	**No restrictions found:** GO TO ❹ **Restrictions found:** Repair or replace fuel line and retest – – –1/1

❹ **Flow Limiter Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition ON, engine running under condition that sets code. 2. Using the ECU diagnostic software, verify that DTC 000656.07 is an ACTIVE code. 3. Listen to flow limiter that corresponds to EI #6 while turning ignition OFF. *NOTE: It is very difficult to distinguish the difference between EI #6 and the other 5 flow limiters clicking. Make sure EI #6 makes the click. It will take 5-30 seconds for the ball to reseat.*	**Flow damper clicks:** GO TO ❺ **Flow damper does not click:** Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW LIMITERS in Section 02, Group 090 earlier in this manual. – – –1/1

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❺ **Fuel Fitting Leakage Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI FUEL DELIVERY FAILURE supporting information.* Check the high pressure fuel supply line fitting at the fuel inlet connector for cracks and leaks. If this connection is faulty, fuel leakage should be visible.	**No cracks found:** GO TO ❻ **Cracks found:** Replace fuel fitting or fuel line and retest. – – –1/1

❻ **Fuel Inlet Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI FUEL DELIVERY FAILURE supporting information.* 1. Ignition OFF. 2. Disconnect the high pressure fuel line from the inlet connector for EI #6. 3. Using a 1/2” hose grip pliers, remove the fuel inlet connector. 4. Inspect the fuel inlet connector for nicks, burrs, or other damage. 5. Inspect fuel inlet connector O-ring for damage. 6. When inspection is completed, reinstall inspected or install new fuel inlet connector using JDG1460 Fuel Inlet Connector Installer. There will be some resistance as the O-ring on the connector enters the cylinder bore. Keep installing until inlet connector connects with the EI. 7. Install the high pressure fuel line to the inlet connector. Tighten to specification: **Specification** High Pressure Fuel Line to Fuel Inlet Connector Fittings—Torque .... 53 N•m (39 lb-ft)	**Inlet connector and O-ring functions properly:** Faulty EI OR Faulty ECU **Faulty inlet connector or O-ring:** Replace inlet connector using steps 6 and 7 in this procedure and retest. – – –1/1

000898.09 — Vehicle Speed or Torque Message Invalid

The ECU does not receive the engine speed or torque message over CAN, or the message is not valid.

CAN (Controlled Area Network) Vehicle Speed or Torque Message

- The CAN transmit the vehicle's desired engine speed or torque to the ECU from another controller.

DTC 000898.09 will set if:

- The ECU does not receive the engine speed or torque message over CAN, or the message 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:

- Use the diagnostic gauge OR 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.
- Read active DTCs and stored DTCs. Diagnose and repair all other DTCs.
- Troubleshoot the unit that is sending the CAN message.
- Troubleshoot the wiring between ECU and the unit that is sending the CAN message.

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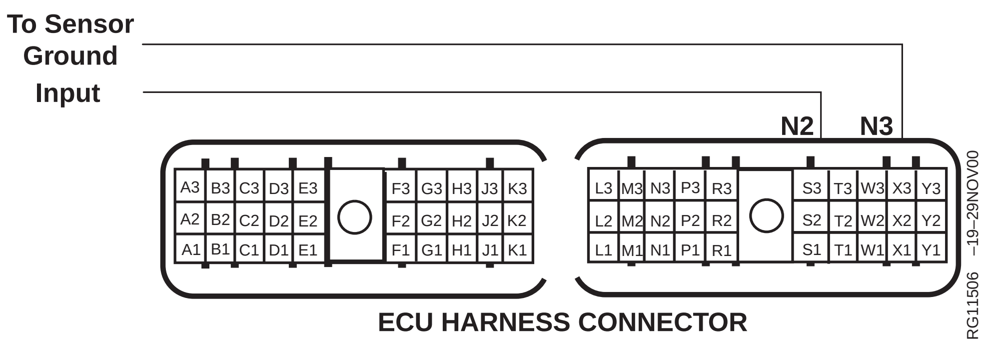
RG41221,000032F –19–01APR02–1/1

000970.31 — Engine Shutdown - Auxiliary Request



The ECU does not read an input voltage.

NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Auxiliary Engine Shutdown Switch

- On OEM applications, the engine shutdown signal is a binary (True/Not True) input to the ECU that will cause the ECU to shut the engine down. N2 is a pull-up circuit, so the input signal will be a drop in voltage due to the circuit being grounded when the shutdown switch closes.

DTC 000970.31 will set if:

- The ECU receives a valid engine shutdown signal.

If DTC 000970.31 sets, the following will occur:

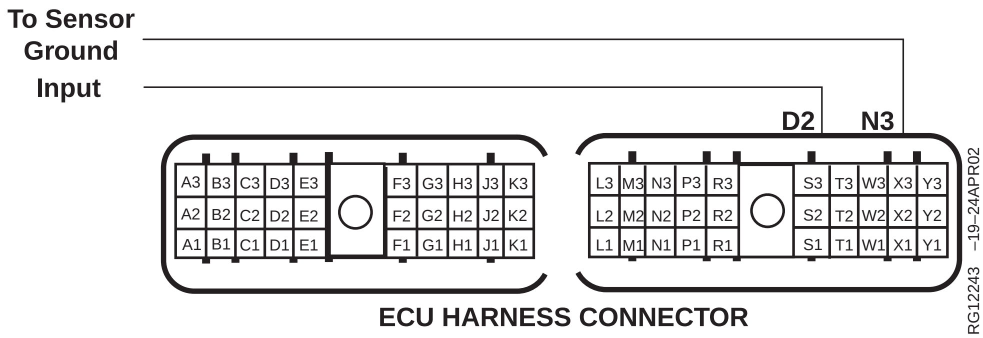
- The ECU will shut the engine down.

If DTC 000970.31 sets:

- Check for other stored or active trouble codes on the ECU that indicate the reason for the shutdown.

DPSG,RG40854,318 –19–01APR02–1/1

000971.31 — External Fuel Derate Switch Active



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The ECU does not read an input voltage.

External Fuel Derate Switch

- On OEM applications, the engine derate signal is a binary (True/Not True) input to the ECU that will cause the ECU to derate the engine down. D2 is a pull-up circuit, so the input signal will be a drop in voltage due to the circuit being grounded when the derate switch closes.

DTC 000971.31 will set if:

- The ECU reads a valid engine derate signal.

If DTC 000971.31 sets, the following will occur:

- Engine protection is enabled. For a basic explanation of engine derating, see ENGINE DERATE AND SHUTDOWN PROTECTION in Section 03, Group 140 earlier in this manual.
  – On OEM applications, the engine derates 2% per minute until the engine is running at 20% of full power. For derate information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

If DTC 000971.31 sets:

- Check for other stored or active trouble codes ECU that indicate the reason for the derate.

RG41221,00000E4 –19–24JAN01–1/1

001069.09 — Tire Size Invalid

The ECU does not receive tire size information or it is invalid.

CAN (Controlled Area Network) Tire Size

- CAN tire size is sent to the ECU by the CCU (Reverser Control Unit) over the CAN bus.

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 1912 rpm when vehicle is in top gear.

If DTC 001069.09 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.

RG41221,000004D –19–17SEP02–1/1

001069.31 — Tire Size Error

The ECU finds the tire size information received over the CAN bus to be incorrect based on the tire size value programmed into the ECU.

CAN (Controlled Area Network) Tire Size

- CAN tire size is sent to the ECU by the RCU (Reverser Control Unit) over the CAN bus.

DTC 001069.31 will set if:

- The ECU finds the tire size information received over the CAN bus to be incorrect based on the tire size value programmed into the ECU.

If DTC 001069.31 sets, the following will occur:

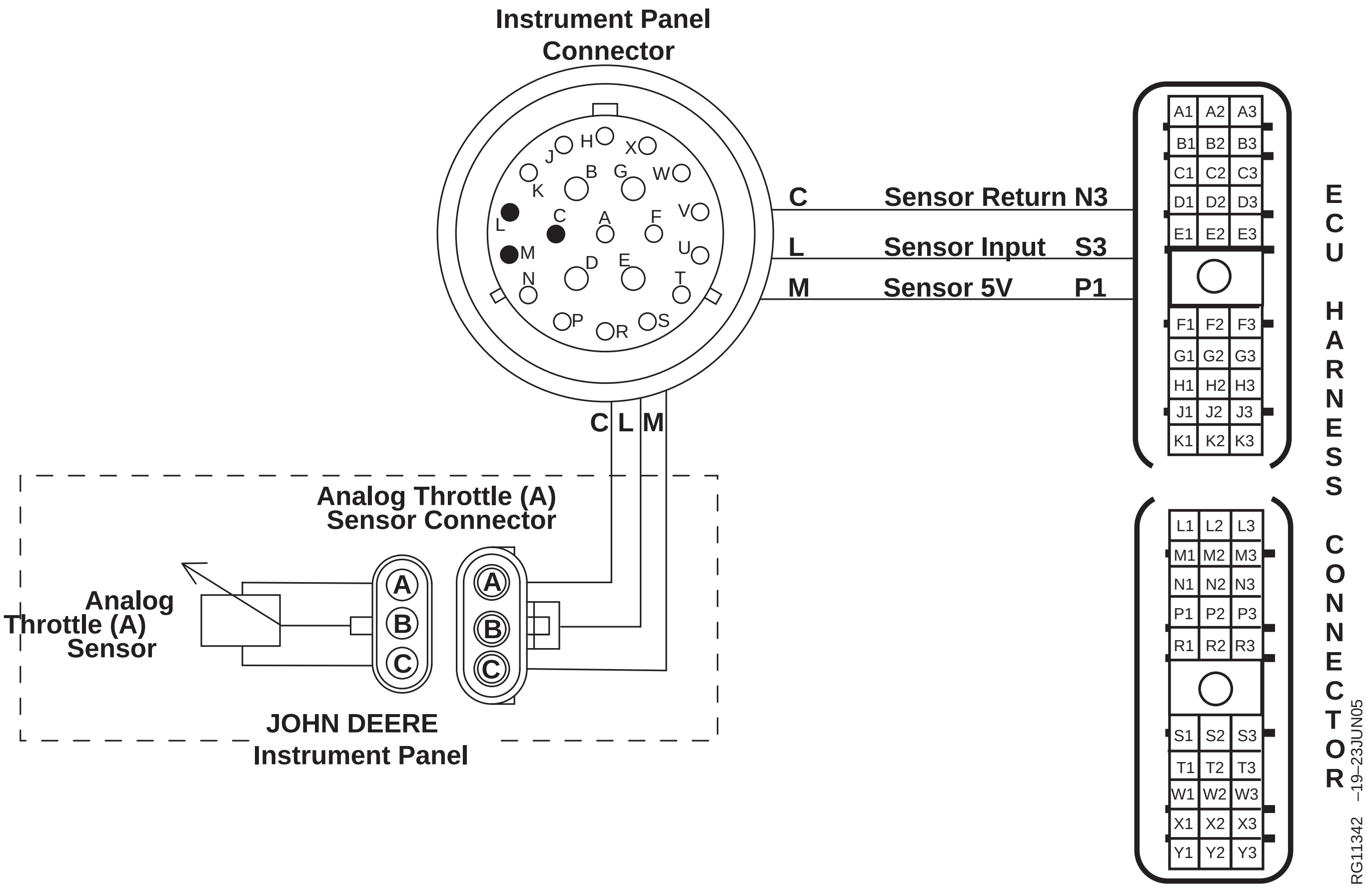
- The ECU will assume the largest tire size.
- The ECU will limit engine speed to 1912 rpm when vehicle is in top gear.

If DTC 001069.31 sets:

- Using the DST or SERVICE ADVISOR™, monitor DTCs on the active code display parameter. If DTC 001069.09 also occurs, see DTC 001069.09 TIRE SIZE INVALID earlier in this Group.
- If no other stored or active CAN or vehicle related DTCs are found, reprogram tire size by using the tire size calibration program on the vehicle.

RG41221,000004F –19–17SEP02–1/1

001079.03 — Sensor Supply 2 Voltage High



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Sensor Supply Voltage

- The ECU monitors the voltage on the 5-volt supply circuit.

Sensor Supply 2

- Sensor Supply 2 may supply 5 volts to one or more of the following:
  - Secondary Analog Throttle
  - MAP sensor
  - Droop Select Circuits
  - Oil pressure sensor (some applications with an oil pressure sensor use Sensor Supply 1)
  - Possibly other components, depending on application

DTC 001079.03 will set if:

- The ECU detects a supply voltage greater than required on the ECU 5-volt supply 2 circuit.

If DTC 001079.03 sets, the following will occur:

- Possibly numerous faults will set. The engine may derate and/or throttle operation may be affected. Sensor readings may be incorrect.

DPSG,RG40854,875 –19–01APR02–1/1

001079.03 — Sensor Supply 2 Voltage High

The ECU detects a voltage above specification on the ECU 5-volt sensor supply 2 (excitation) circuit. The most likely source of this code is a short to a higher voltage source.

RG41221,00000A0 –19–01APR02–1/1

001079.03 Sensor Supply 2 Voltage High Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY 2 VOLTAGE HIGH supporting information.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using this 5V supply for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY 2 VOLTAGE HIGH supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**001079.03 reoccurs:** GO TO ❸ **001079.03 doesn’t reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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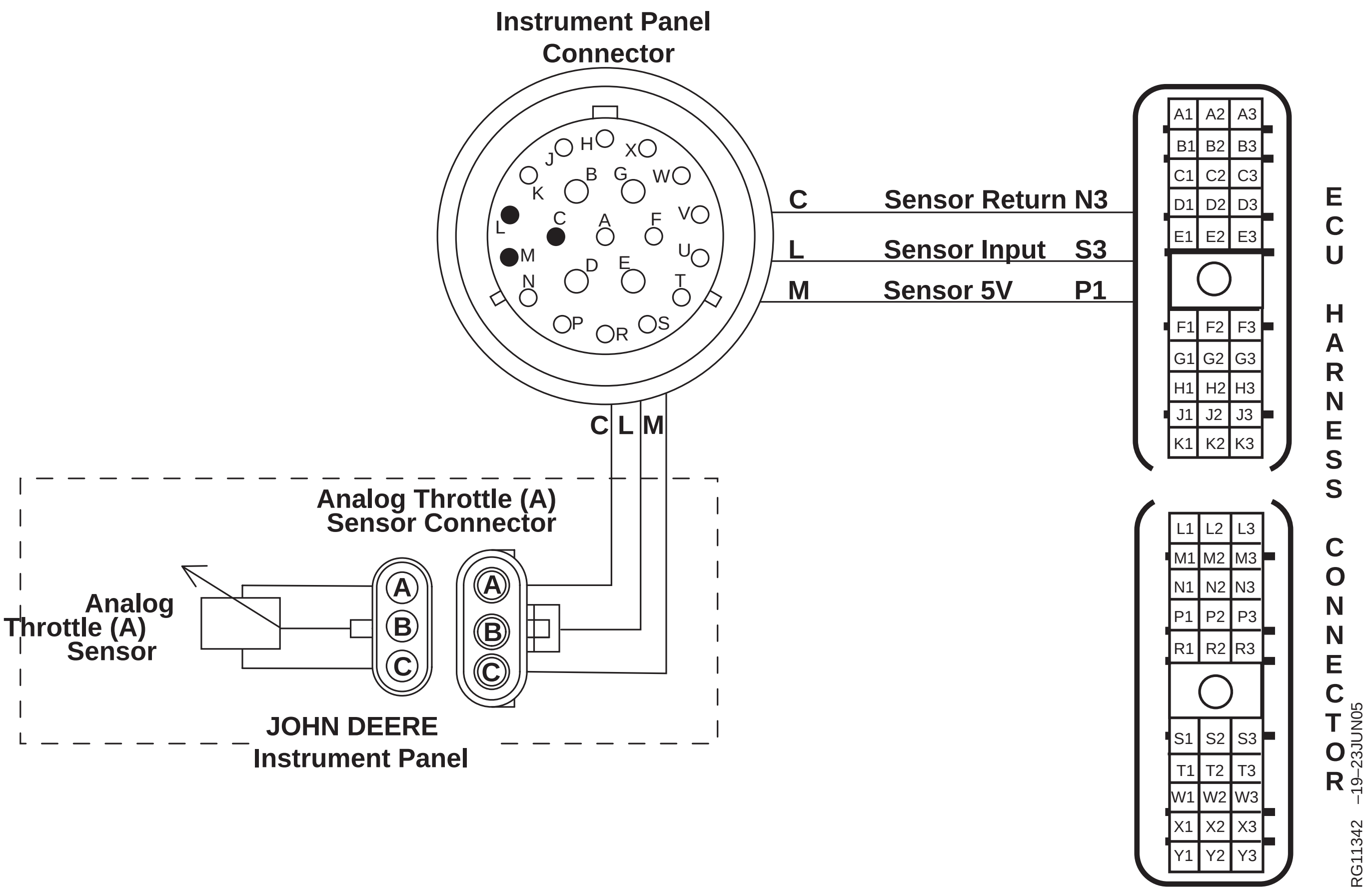
❸ **ECU Voltage Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY 2 VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Ignition ON, engine OFF. 4. Using a multimeter, measure voltage between harness connector terminal P1 and a good chassis ground.	**0 Volts:** GO TO ❺ **5.5V or more:** ECU OK. GO TO ❹ – – –1/1

❹ **“Short in Connected Harness or Engine Harness?” Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY 2 VOLTAGE HIGH supporting information.* 1. Ignition ON, engine OFF. 2. ECU still disconnected. 3. While measuring voltage between terminal P1 and a good chassis ground, one by one disconnect any other harnesses or connectors that are attached to the engine harness. Start with the 21-pin connector to the instrument panel.	**Voltage drops to 0 Volts:** The short is in the harness that caused the voltage to drop to zero when disconnected. Repair and retest. **Voltage remains above 5.5V:** Short in engine harness. Repair and retest. – – –1/1

❺ **Harness Wire-to-Wire Resistance Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY 2 VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. ECU still disconnected. 3. Using a multimeter, measure resistance between harness connector terminal P1 and terminals E3, B1, and B2.	**Near ______ ohms:** Test ECU. GO TO ❻. **Any test significantly above ______ ohm:** Short in engine harness. Repair and retest. – – –1/1

❻ **ECU Resistance Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY 2 VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, measure resistance between ECU pin P1 and C2 (system ground).	**50K - 90K ohms:** ECU OK. Reinstall and retest.. **Less than 50K or more than 90K ohms:** Faulty ECU. Replace and retest. – – –1/1

001079.04 — Sensor Supply 2 Voltage Low



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Sensor Supply Voltage

- The ECU monitors the voltage on the 5-volt supply circuit.

Sensor Supply 2

- Sensor Supply 2 may supply 5 volts to one or more of the following:
  - Secondary Analog Throttle
  - MAP sensor
  - Droop Select Circuits
  - Oil pressure sensor (some applications with an oil pressure sensor use Sensor Supply 1)
  - Possibly other components, depending on application

DTC 001079.04 will set if:

- The ECU detects a supply voltage less than required on the ECU 5-volt supply 2 circuit.

If DTC 001079.04 sets, the following will occur:

- Possibly numerous faults will set. The engine may derate and/or throttle operation may be affected. Sensor readings may be incorrect.

RG41221,00000E7 –19–01APR02–1/1

001079.04 — Sensor Supply 2 Voltage Low

The ECU detects a voltage below specification on the ECU 5V Sensor Supply 2 (excitation) circuit. This can be caused by a short to ground.

RG41221,00000A1 –19–01APR02–1/1

001079.04 Sensor Supply 2 Voltage Low Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY 2 VOLTAGE LOW supporting information.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using this 5V supply for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY 2 VOLTAGE LOW supporting information.* 1. Use the diagnostic gage on the instrument panel or connect and start 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. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs.	**000620.04 reoccurs:** GO TO ❸ **000620.04 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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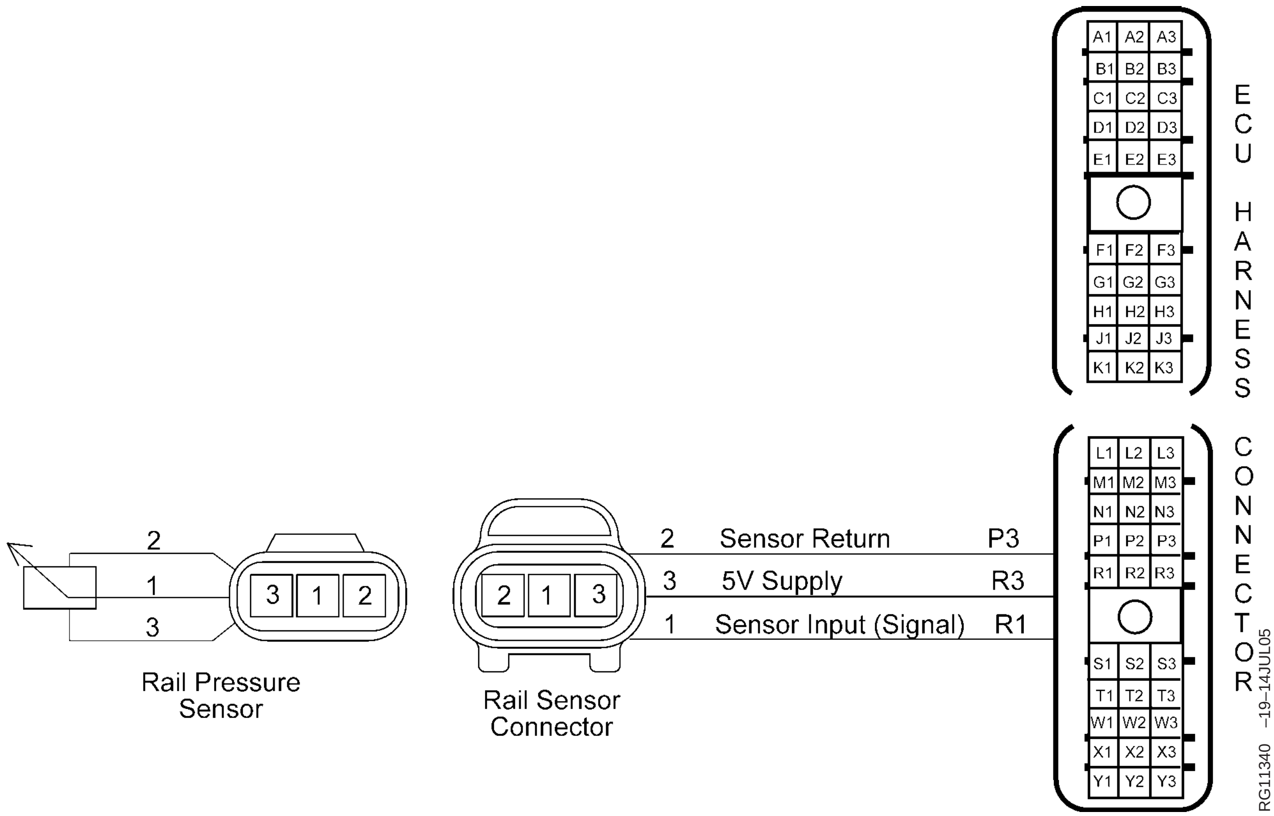
❸ **“Problem in Connected Harness?” Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY 2 VOLTAGE LOW supporting information.* 1. Ignition ON, engine OFF. 2. While monitoring Sensor Supply 2 voltage, one-by-one disconnect harnesses that are connected to the engine harness. Start by disconnecting the 21-pin connector from the instrument panel.	**Voltage returns to normal (4.5-5.5 Volts):** The ground is in the harness that when disconnected caused the voltage to return to normal. If the harness to the instrument panel is at fault, check the throttle circuit. Repair and retest. **Voltage remains below 4.5V:** GO TO ❹ – – –1/1

❹ **“Problem in Engine Harness or ECU?” Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY 2 VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. All harnesses still disconnected from engine harness. 3. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 4. Using a multimeter, measure resistance between terminal P1 and all other terminals in both 30-pin connectors.	**All more than 1M ohms:** Harness OK. Remove and test ECU. GO TO ❺ **Significantly less than 1M ohms:** Sensor 5V supply circuit shorted to this circuit. Repair and retest. – – –1/1

❺ **ECU Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY 2 VOLTAGE LOW supporting information.* 1. ECU removed. 2. Using a multimeter, measure resistance between ECU pin P1 and C2 (system ground).	**50K - 90K ohms:** ECU OK. Reinstall and retest. **Less than 50K or more than 90K ohms:** Faulty ECU. Replace and retest. – – –1/1

001080.03 — Fuel Rail Pressure Sensor Supply Voltage High



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on application. The ECU 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.

Fuel Rail Pressure Sensor Supply

- The ECU supplies 5 volts to the fuel rail pressure sensor, monitors the feedback, and determines the accuracy of the sensor.

DTC 001080.03 will set if:

- The ECU detects a voltage higher than 5.2 volts on the Fuel Rail Pressure Sensor 5 volt supply circuit.

If DTC 001080.03 sets, the following will occur:

- The ECU will command the high pressure fuel pump to stop pumping fuel.

RG41221,0000041 –19–01APR02–1/1

001080.03 — Fuel Rail Pressure Sensor Supply Voltage High

The ECU detects a voltage above specification on the ECU 5 volt sensor supply circuit.

RG41221,00000B9 –19–01APR02–1/1

001080.03 Fuel Rail Pressure Sensor Supply Voltage High Diagnostic Procedure

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❶ Visual Inspection of Connectors and Wiring	**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.** *NOTE: For wiring and theory of operation information, see DTC 001080.03 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE HIGH supporting information.* Without disconnecting, visually inspect the ECU connectors and the fuel rail pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ Intermittent Fault Diagnostics Check	*NOTE: For wiring and theory of operation information, see DTC 001080.03 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE HIGH supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**001080.03 reoccurs:** GO TO ❸ **001080.03 doesn’t reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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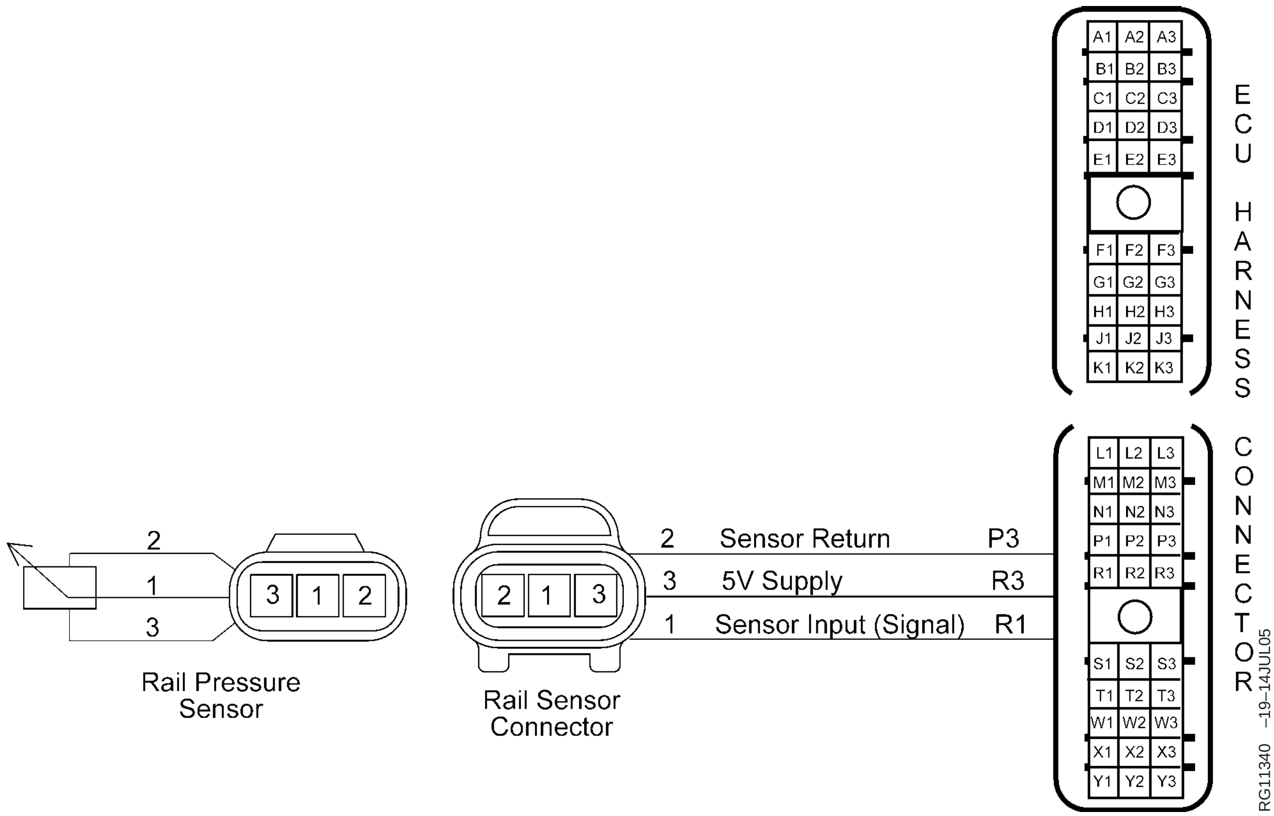
❸ **Short in 5V Supply Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 001080.03 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE HIGH supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure resistance between terminal R3 and all other terminals in both ECU connectors on the engine harness.	**Greater than 10k ohms:** Faulty ECU connection OR Faulty ECU. **10k ohms or less:** Sensor 5V supply circuit shorted to ECU battery voltage supply circuit. – – –1/1

001080.04 — Fuel Rail Pressure Sensor Supply Voltage Low



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on application. The ECU 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.

Fuel Rail Pressure Sensor Supply

- The ECU supplies 5 volts to the fuel rail pressure sensor, monitors the feedback, and determines the accuracy of the sensor.

DTC 001080.04 will set if:

- The ECU detects a voltage lower than 4.6 volts on the Fuel Rail Pressure Sensor 5 volt supply circuit.

If DTC 001080.04 sets, the following will occur:

- The ECU will command the high pressure fuel pump to stop pumping fuel.

RG41221,0000043 –19–01APR02–1/1

001080.04 — Fuel Rail Pressure Sensor Supply Voltage Low

The ECU detects a voltage below specification on the ECU 5 volt sensor supply circuit.

RG41221,00000BA –19–01APR02–1/1

001080.04 Fuel Rail Pressure Sensor Supply Voltage Low Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001080.04 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE LOW supporting information.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using this 5V supply for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001080.04 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of all active DTCs, then clear all DTCs. 5. Ignition OFF. 6. Disconnect the fuel rail pressure sensor. 7. Ignition ON, engine OFF. 8. Read DTCs.	**001080.04 reoccurs:** GO TO ❸ **001080.04 doesn't reoccur:** GO TO ❹

– – –1/1

❸ **5V Supply Circuit Shorted to Ground Test**	*NOTE: For wiring and theory of operation information, see DTC 001080.04 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure resistance between: • Terminal R3 and a good chassis ground. • Terminal R3 and terminal C2 of the ECU connector. • Terminal R3 and terminal C3 of the ECU connector. • Terminal R3 and terminal N3 of the ECU connector. • Terminal R3 and terminal P2 of the ECU connector.	**Greater than 10k ohms:** Faulty ECU connection OR Faulty ECU **10k ohms or less:** Sensor 5V supply circuit shorted to ECU ground circuit. – – –1/1

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,414

❹ **Faulty Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 001080.04 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Ignition ON, engine OFF. 2. Reconnect the fuel rail pressure sensor. 3. Using the diagnostic software, read DTCs	**001080.04 reoccurs:** Fuel rail pressure sensor is faulty. Replace and retest. **001080.04 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

001109.31 — Engine Protection Shutdown Warning

The ECU detects (depending on application) low oil pressure, high engine coolant temperature, water in fuel above the threshold quantity, or loss of engine coolant.

Engine Shutdown Warning:

This code informs the operator that the ECU will shut the engine down because it has detected a condition such as (depending on application) low fuel pressure, water in fuel, low oil pressure, high engine coolant temperature, ECU error or low coolant level. If the ECU is programmed with engine protection with shutdown, the ECU will shut the engine down within 30 seconds. Prior to shutdown, the engine will be derated.

DTC 001109.31 will (depending on application) set if:

- The ECU detects low oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects water in fuel above the threshold quantity for an extended period of time.
- The ECU detects a loss of engine coolant.
- Others as programmed per application.

If DTC 001109.31 sets, the following will occur:

- If the ECU has engine protection with shutdown, it will derate the engine for 30 seconds and will shut the engine down.

If DTC 001109.31 sets:

- Troubleshoot the underlying cause and related DTC.

RG41221,00000E9 –19–01APR02–1/1

001110.31 — Engine Protection Shutdown

The ECU detects (depending on application) low oil pressure, high engine coolant temperature, water in fuel above the threshold quantity, or a loss of engine coolant.

Engine Protection Shutdown:

This code informs the operator that the ECU shut the engine down because it has detected a condition such as (depending on application) low fuel pressure, water in fuel, low oil pressure, high engine coolant temperature, ECU error or low coolant level. If the ECU is programmed with engine protection with shutdown, the ECU has shut the engine down.

DTC 001110.31 will set if:

- The ECU detects low oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects water in fuel above the threshold quantity for an extended period of time.
- The ECU detects a loss of engine coolant.
- Others as programmed per application.

If DTC 001110.31 sets, the following will occur:

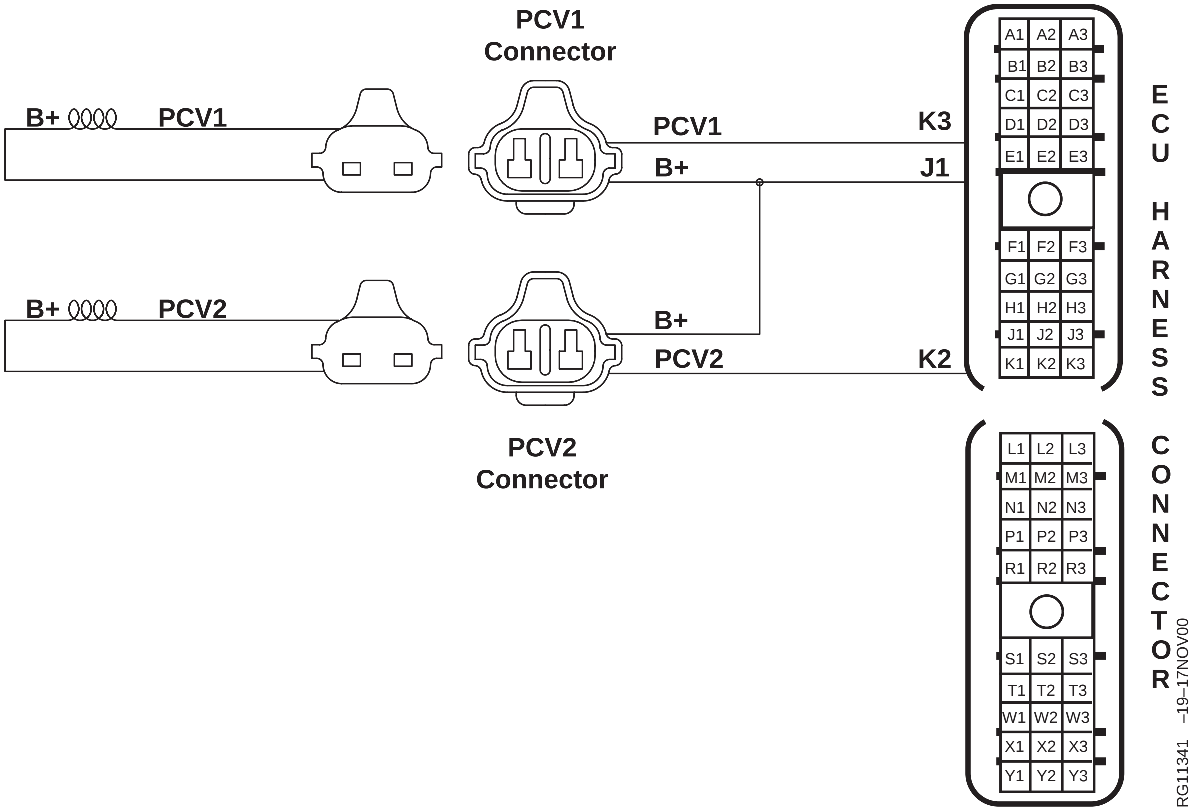
- The ECU will have shut the engine down.

If DTC 001110.31 sets:

- Troubleshoot the underlying cause and related DTC.

DPSG,RG40854,488 –19–01APR02–1/1

001347.05 — Pump Control Valve #1 Error



Pump Control Valve (PCV):

- The Pump Control Valve regulates the volume of fuel discharged by the supply pump to regulate the fuel pressure in the high pressure common rail (HPCR). The solenoid is supplied with constant power. The ECU supplies a ground to the solenoid for a calculated time to discharge the required amount of fuel to the HPCR. The amount of fuel is in direct correlation with the fuel being injected by the electronic injectors. If more fuel is needed the solenoid is energized for a longer period of time. If less fuel is needed, the solenoid is energized for a shorter period of time. For further PCV information, see PUMP CONTROL VALVES (PCVs) in Section 03, Group 140.

DTC 001347.05 will set if:

- The ECU detects an open in the Pump Control Valve #1 circuit.

If DTC 001347.05 sets, the following will occur:

- Only one side of the injection pump will supply fuel to the HPCR.
- Engine should run fine at low idle.
- At high idle or under load, engine will have low power.
- Code 001347.07 (Fuel Rail Pressure Incorrect) may set as a result.

RG41221,0000045 –19–01APR02–1/1

001347.05 — Pump Control Valve #1 Error

The ECU detects an open in the Pump Control Valve #1 circuit.

RG41221,00000BB –19–01APR02–1/1

001347.05 Pump Control Valve #1 Error Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #1 ERROR supporting information.* Without disconnecting, visually inspect the ECU connectors and the PCV #1 connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #1 ERROR supporting information.* 1. Ignition OFF. 2. Disconnect PCV #2. 3. Try starting engine.	**Engine does not start:** GO TO ❸ **Engine starts and runs:** Manipulate the harness wiring while monitoring the the error codes. If code returns or the engine stumbles or shuts off, note where in the harness that the error occured and go to Step 3 below. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **"PCV1 Open or Shorted?" Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #1 ERROR supporting information.* 1. Ignition OFF. 2. Disconnect PCV1. 3. Using a multimeter, measure resistance between both terminals of PCV1.	**Between 1 and 4 ohms:** PCV1 not open or shorted. GO TO ❹ **Below 1 ohm or above 4 ohms:** Faulty PCV1. Replace and retest. – – –1/1

❹ **Power Supply "OK or Not OK" Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #1 ERROR supporting information.* 1. Ignition ON, Engine Idling. 2. PCV1 still disconnected. 3. Using a multimeter, measure voltage between PVC1 connector terminal B+ (battery positive) and a good chassis ground.	**Approx. 8V:** Power supply circuit OK. Check the return (PCV1) circuit. GO TO ❻ **No voltage or low voltage:** Open in power supply circuit. GO TO ❺ – – –1/1

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,420

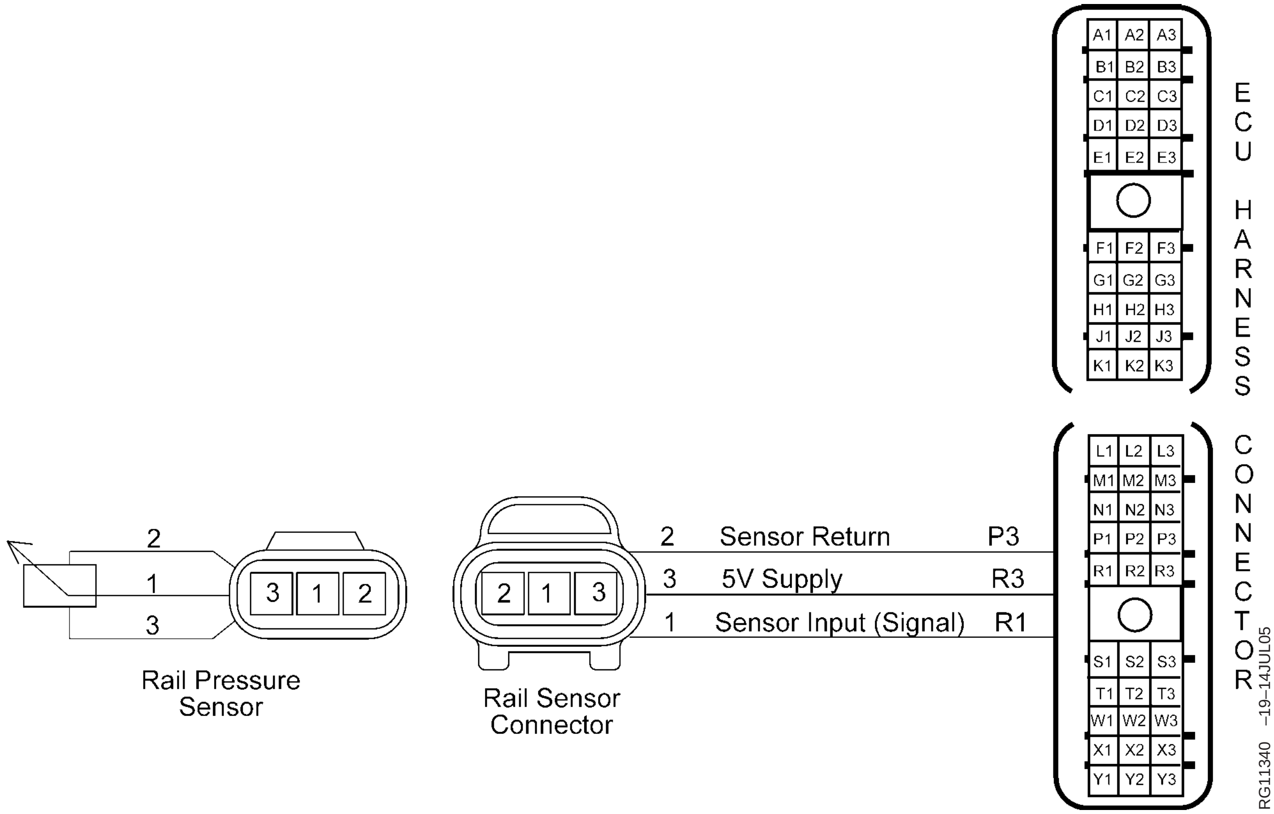
❺ **Power Supply "PCV1 to PCV2 Wiring Open?" Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #1 ERROR supporting information.* 1. Ignition OFF. 2. Disconnect PCV2 connector (PCV1 still disconnected). 3. Using a multimeter, measure resistance between PVC1 terminal B+ and PVC2 terminal B+.	**Less than 2 ohms:** PCV1 to PCV2 wiring OK. Reconnect and retest. **More than 2 ohms:** Open (high resistance) in PCV1 to PCV2 wiring. Repair and retest. – – –1/1

❻ **"PCV1 Return Circuit Open?" Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #1 ERROR supporting information.* 1. Ignition OFF. 2. PCV1 still disconnected. 3. Using a multimeter, measure resistance between the PCV1 connector return terminal and a good chassis ground.	**More than 2.5 ohms:** Open return circuit. GO TO ❼ **Less than 2.5 ohms:** Return circuit OK. Reconnect and retest. – – –1/1

❼ **“Harness Return Wiring Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #1 ERROR supporting information.* 1. Ignition OFF. 2. PCV1 still disconnected. 3. Disconnect circuit’s 30-pin connector from ECU. 4. Using a multimeter, measure continuity of the return circuit in the harness.	**Near zero ohms:** Harness wiring and ECU OK. Check ECU. GO TO ❽ **More than 2 ohms:** Open or high resistance in return wire in harness. Repair and retest. – – –1/1

❽ **“ECU Return Circuit Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #1 ERROR supporting information.* 1. Ignition OFF. 2. PCV1 and ECU still disconnected. 3. Using a multimeter, measure resistance between the circuit’s ECU return pin and system ground (pin C2 or C3).	**More than 2.5 ohms:** Faulty ECU. Replace and retest. **Less than 2.5 ohms:** ECU OK. Reconnect and retest. – – –1/1

001347.07 — Fuel Rail Pressure Incorrect



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Fuel Rail Pressure Sensor:

- The fuel rail pressure sensor uses a pressure transducer to measure the fuel pressure within the rail. The rail pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

DTC 001347.07 will set if:

- The ECU detects fuel rail pressure 5 MPa (50 Bar) (725 psi) above or below the expected pressure.

If DTC 001347.07 sets, the following will occur:

- The ECU will command the high pressure fuel pump to increase or decrease the amount of fuel supplied to the HPCR.
- Engine could miss or run rough.
- Engine may have low power.

RG41221,0000047 –19–01APR02–1/1

001347.07 — Fuel Rail Pressure Incorrect

The ECU detects fuel rail pressure above or below the expected pressure.

RG41221,00000BC –19–01APR02–1/1

001347.07 Fuel Rail Pressure Incorrect Diagnostic Procedure

IMPORTANT: If DTC 001347.07 is accompanied with DTC 001347.05, 000094.03, DTC 000094.04, or DTC 000094.10, follow that diagnostic procedure first.

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.* Without disconnecting, visually inspect the ECU connectors and the rail pressure sensor connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Fuel Rail Pressure Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.* 1. Ignition OFF. 2. Disconnect the fuel rail pressure sensor connector. 3. Try starting the engine.	**Engine starts:** Faulty fuel rail pressure sensor. Replace and retest. **Engine won't start:** GO TO ❸

– – –1/1

❸ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.* 1. Use the diagnostic gauge OR 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 running or cranking 3. Compare fuel rail pressure - desired and fuel rail pressure - actual parameters using DST or SERVICE ADVISOR™. See DATA PARAMETER DESCRIPTION earlier in this Group for an explanation of each. *NOTE: If actual pressure is more than the desired pressure the engine will most likely not start. The ECU will think that there is enough fuel in the rail and will not command the high pressure pump to distribute fuel to the rail.*	**Actual is more than 5 MPa (50 Bar) (725 psi) below Expected:** GO TO ❹ **Actual is more than 5 MPa (50 Bar) (725 psi) above Expected:** GO TO ❽ **Expected and Actual are within 5 MPa (50 Bar) (725 psi) of each other:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❹. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❹ **Fuel Lines/Fittings Leakage Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.* 1. Ignition ON, engine running. 2. Inspect all fuel lines and fittings for leakage.	**No fuel leak(s) present:** GO TO ❺ **Fuel leak(s) present:** Tighten loose fitting to proper specification and retest.

– – –1/1

❺ **Pressure Test Low-Pressure Fuel System**	*NOTE: For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.* 1. Ignition OFF. 2. Connect appropriate pressure gauge from JT05412 Universal Pressure Kit to diagnostic port on either final filter base (—246269) or injection pump (246270—) as applicable. 3. Ignition ON, engine running at idle 4. Read fuel pressure.	**Pressure between 200-240 kPa (2.0-2.4 bar) (30-35 psi):** GO TO ❻ **Pressure below 200 kPa (2.0 bar) (30 psi):** Plugged primary filter OR Plugged final filter OR Restricted fuel line between fuel tank and final filter OR Faulty fuel transfer pump – – –1/1

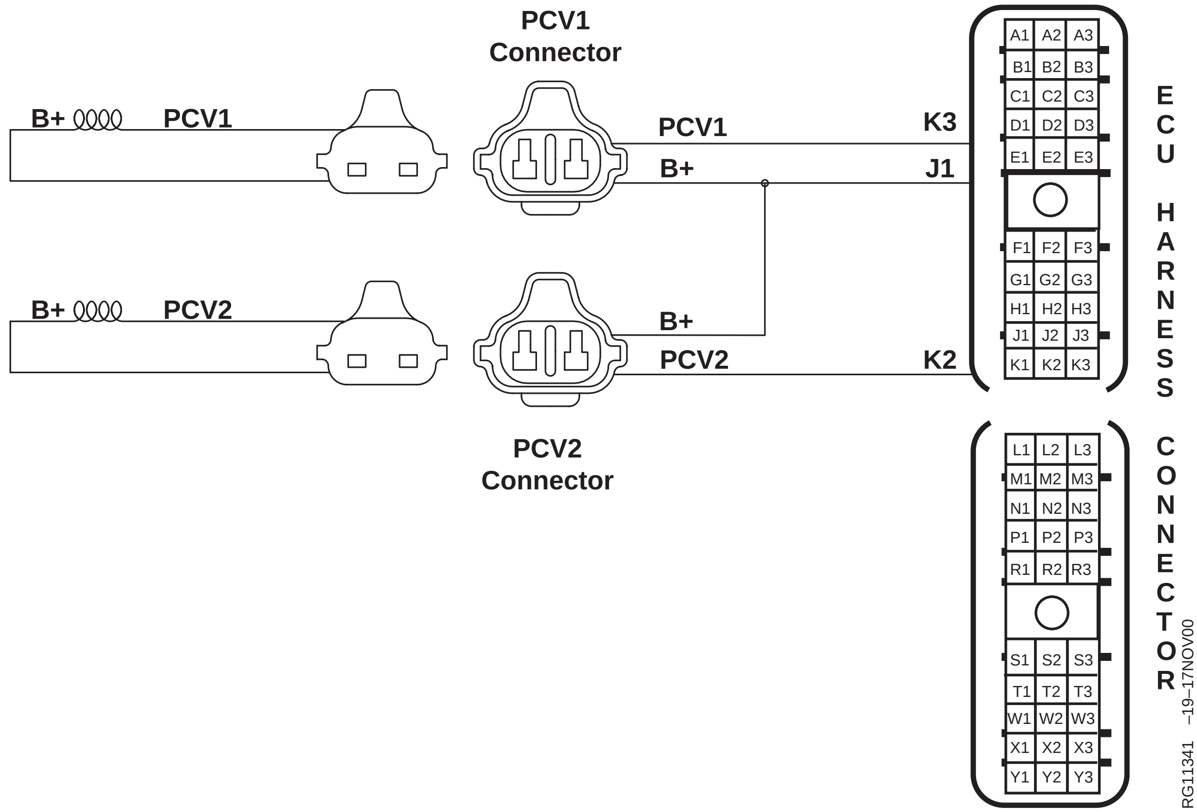
❻ **HPCR Pressure Relief Valve Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.* **CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before 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.** 1.Before removing pressure relief valve, turn engine OFF and let sit for 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail. 2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure relief valve. 3. Disconnect fuel return line fitting at the fuel leak-off line from the pressure relief valve. Do NOT remove the pressure relief valve. 4. Run a clear line from a suitable container for diesel fuel to the pressure relief valve 5. Ignition ON, engine running. 6. Check fuel flow at flow limiter valve.	**Minimal or no fuel present:** GO TO ❼ **Fuel flow is present:** Faulty pressure relief valve. Replace pressure relief valve and retest. See REMOVE AND INSTALL HPCR PRESSURE RELIEF VALVE in Group 090 earlier in this manual. – – –1/1

❼ **Overflow Valve Check**	*NOTE: For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.* 1. Ignition OFF. 2. Disconnect fitting from fuel return line at the fuel leak-off on high pressure fuel pump. 3. Ignition ON, engine running. 4. Check fuel flow at overflow valve.	**Fuel flow is present:** GO TO ❽ **No fuel is present:** Faulty overflow valve. Replace overflow valve and retest. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP OVERFLOW VALVE in Group 090 earlier in this manual. – – –1/1

❽ **Fuel Rail Pressure Signal Shorted Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.* 1. Ignition OFF. 2. Disconnect the fuel rail pressure sensor connector and both ECU connectors. 3. Using a multimeter, measure resistance between terminal R1 in the ECU connector and terminal 1 in the fuel rail pressure sensor connector.	**5 ohms or less:** GO TO ❾ **Greater than 5 ohms:** Open or short in fuel rail pressure sensor signal wire. – – –1/1

❾ **Pump Position Timing Check**	*NOTE: For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.* Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING in Group 150 earlier in this manual.	**Timing out of sync:** Adjust timing and retest. – – –1/1

001347.10 — Pump Control Valve #1 Fuel Flow Not Detected



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NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Pump Control Valve (PCV):

- The Pump Control Valve regulates the volume of fuel discharged by the supply pump to regulate the fuel pressure in the high pressure common rail (HPCR). The solenoid is supplied with constant power. The ECU supplies a ground to the solenoid for a calculated time to discharge the required amount of fuel to the HPCR. The amount of fuel is in direct correlation with the fuel being injected by the electronic injectors. If more fuel is needed the solenoid is energized for a longer period of time. If less fuel is needed, the solenoid is energized for a shorter period of time. For further PCV information, see PUMP CONTROL VALVES (PCVs) in Section 03, Group 140.

DTC 001347.10 will set if:

- Fuel pressure inside the rail does NOT rise to injection pressure.

If DTC 001347.10 sets, the following will occur:

- Depending on application, limited power at higher loads
- Rail pressure may be lower than expected. This should also set DTC 001347.07.

RG41221,00000EA –19–01APR02–1/1

001347.10 — Pump Control Valve #1 Fuel Flow Not Detected

Fuel pressure inside the rail does NOT rise to injection pressure.

RG41221,00000EB –19–01APR02–1/1

001347.10 Pump Control Valve #1 Fuel Flow Not Detected Diagnostic Procedure

IMPORTANT: If DTC 001347.10 is accompanied with DTC 001347.05, follow that diagnostic procedure first.

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001347.10 PUMP CONTROL VALVE #1 FUEL FLOW NOT DETECTED supporting information.* Without disconnecting, visually inspect the ECU connectors and the PCV #1 connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.10 PUMP CONTROL VALVE #1 FUEL FLOW NOT DETECTED supporting information.* 1. Ignition OFF. 2. Disconnect PCV #2 connector. 3. Try starting engine.	**Engine does not start:** GO TO ❸ **Engine starts and runs:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Fuel Line Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.10 PUMP CONTROL VALVE #1 FUEL FLOW NOT DETECTED supporting information.* 1. Ignition OFF. 2. Disconnect fuel line between PCV #1 and the corresponding inlet on the HPCR. 3. Check fuel line for restrictions. *NOTE: You will need to bleed the fuel system when procedure is completed. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) in Section 05, Group 150 later in this manual.*	**No restriction found:** Faulty high pressure fuel pump. Replace and retest. **Restrictions found:** Fix restriction and retest. – – –1/1

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160
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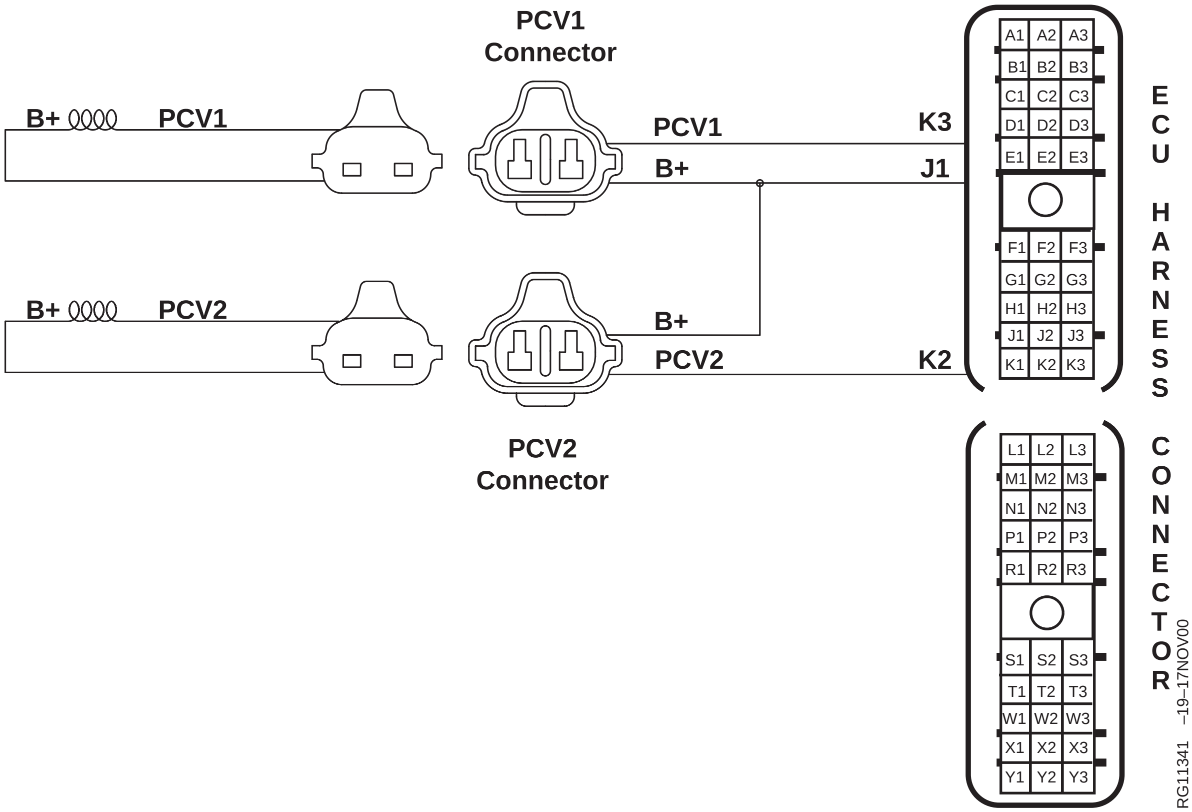
001348.05 — Pump Control Valve #2 Error



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Pump Control Valve (PCV):

- The Pump Control Valve regulates the volume of fuel discharged by the supply pump to regulate the fuel pressure in the high pressure common rail (HPCR). The solenoid is supplied with constant power. The ECU supplies a ground to the solenoid for a calculated time to discharge the required amount of fuel to the HPCR. The amount of fuel is in direct correlation with the fuel being injected by the electronic injectors. If more fuel is needed the solenoid is energized for a longer period of time. If less fuel is needed, the solenoid is energized for a shorter period of time. For further PCV information, see PUMP CONTROL VALVES (PCVs) in Section 03, Group 140.

DTC 001348.05 will set if:

- The ECU detects an open in the Pump Control Valve #2 circuit.

If DTC 001348.05 sets, the following will occur:

- Only one side of the injection pump will supply fuel to the HPCR.
- Engine should run fine at low idle.
- At high idle or under load, engine will have low power.
- Code 001347.07 (Fuel Rail Pressure Incorrect) may set as a result.

RG41221,000004A –19–01APR02–1/1

001348.05 — Pump Control Valve #2 Error

The ECU detects an open in the Pump Control Valve #2 circuit.

RG41221,00000BD –19–01APR02–1/1

001347.05 Pump Control Valve #2 Error Diagnostic Procedure

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❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #2 ERROR supporting information.* Without disconnecting, visually inspect the ECU connectors and the PCV #2 connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #2 ERROR supporting information.* 1. Ignition OFF. 2. Disconnect PCV #1. 3. Try starting engine.	**Engine does not start:** GO TO ❸ **Engine starts and runs:** Manipulate the harness wiring while monitoring the the error codes. If code returns or the engine stumbles or shuts off, note where in the harness that the error occured and go to Step 3 below. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **“PCV2 Open or Shorted?” Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #2 ERROR supporting information.* 1. Ignition OFF. 2. Disconnect PCV2. 3. Using a multimeter, measure resistance between both terminals of PCV2.	**Between 1 and 4 ohms:** PCV1 not open or shorted. GO TO ❹ **Below 1 ohm or above 4 ohms:** Faulty PCV1. Replace and retest. – – –1/1

❹ **Power Supply “OK or Not OK” Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #2 ERROR supporting information.* 1. Ignition ON, Engine Idling. 2. PCV2 still disconnected. 3. Using a multimeter, measure voltage between PVC2 connector terminal B+ (battery positive) and a good chassis ground.	**Approx. 8V:** Power supply circuit OK. Check the return (PCV2) circuit. GO TO ❻ **No voltage or low voltage:** Open in power supply circuit. GO TO ❺ – – –1/1

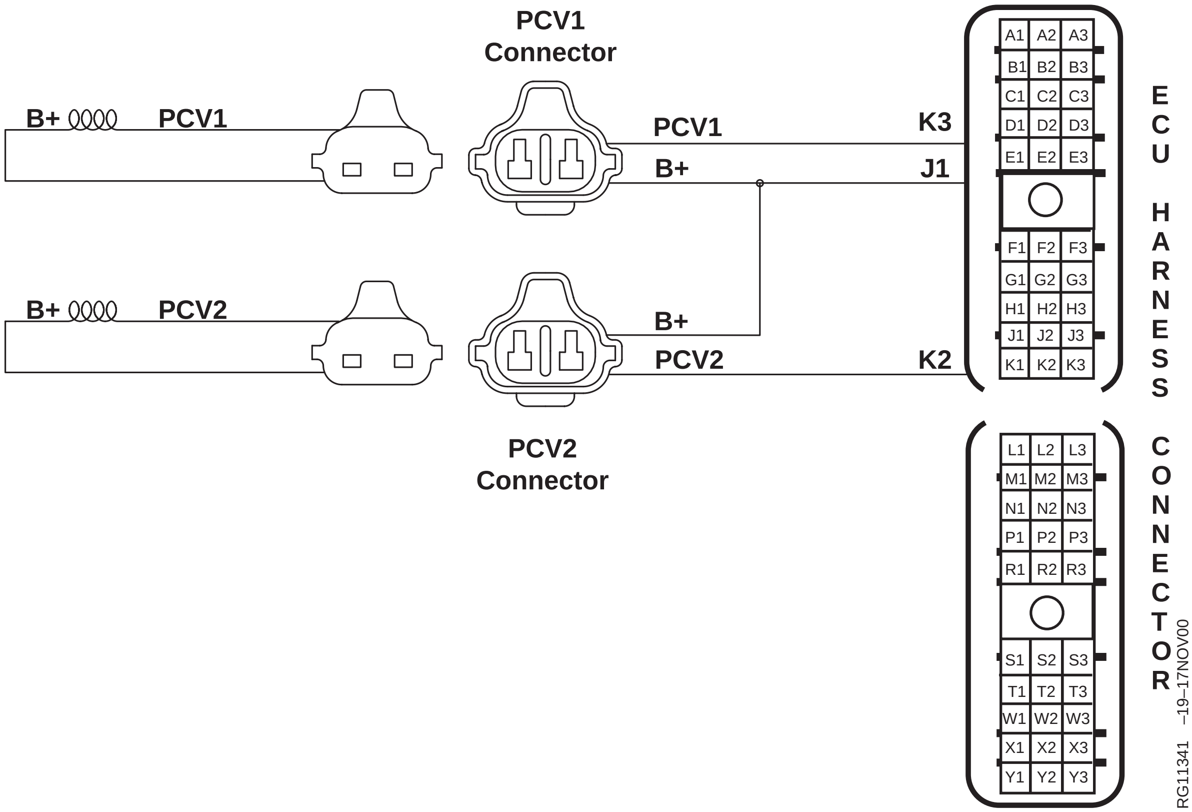
❺ **Power Supply “PCV1 to PCV2 Wiring Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #2 ERROR supporting information.* 1. Ignition OFF. 2. Disconnect PCV1 connector (PCV2 still disconnected). 3. Using a multimeter, measure resistance between PVC2 terminal B+ and PVC1 terminal B+.	**Less than 2 ohms:** PCV1 to PCV2 wiring OK. Reconnect and retest. **More than 2 ohms:** Open (high resistance) in PCV1 to PCV2 wiring. Repair and retest. – – –1/1

❻ **“PCV2 Return Circuit Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #2 ERROR supporting information.* 1. Ignition OFF. 2. PCV2 still disconnected. 3. Using a multimeter, measure resistance between the PCV2 connector return terminal and a good chassis ground.	**More than 2.5 ohms:** Open return circuit. GO TO ❼ **Less than 2.5 ohms:** Return circuit OK. Reconnect and retest. – – –1/1

❼ **“Harness Return Wiring Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #2 ERROR supporting information.* 1. Ignition OFF. 2. PCV2 still disconnected. 3. Disconnect circuit’s 30-pin connector from ECU. 4. Using a multimeter, measure continuity of the return circuit in the harness.	**Near zero ohms:** Harness wiring and ECU OK. Check ECU. GO TO ❽ **More than 2 ohms:** Open or high resistance in return wire in harness. Repair and retest. – – –1/1

❽ **“ECU Return Circuit Open?” Test**	*NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE #2 ERROR supporting information.* 1. Ignition OFF. 2. PCV2 and ECU still disconnected. 3. Using a multimeter, measure resistance between the circuit’s ECU return pin and system ground (pin C2 or C3).	**More than 2.5 ohms:** Faulty ECU. Replace and retest. **Less than 2.5 ohms:** ECU OK. Reconnect and retest. – – –1/1

001348.10 — Pump Control Valve #2 Fuel Flow Not Detected



NOTE: Wiring schematic shows OEM engine applications. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Pump Control Valve (PCV):

- The Pump Control Valve regulates the volume of fuel discharged by the supply pump to regulate the fuel pressure in the high pressure common rail (HPCR). The solenoid is supplied with constant power. The ECU supplies a ground to the solenoid for a calculated time to discharge the required amount of fuel to the HPCR. The amount of fuel is in direct correlation with the fuel being injected by the electronic injectors. If more fuel is needed the solenoid is energized for a longer period of time. If less fuel is needed, the solenoid is energized for a shorter period of time. For further PCV information, see PUMP CONTROL VALVES (PCVs) in Section 03, Group 140.

DTC 001348.10 will set if:

- Rail pressure does rise to injection pressure.

If DTC 001348.10 sets, the following will occur:

- Depending on application, limited power at higher loads
- Rail pressure may be lower than expected. This should also set DTC 001347.07.

RG41221,00000EC –19–01APR02–1/1

001348.10 — Pump Control Valve #2 Fuel Flow Not Detected

Rail pressure does rise to injection pressure.

RG41221,00000EB –19–01APR02–1/1

001348.10 Pump Control Valve #2 Fuel Flow Not Detected Diagnostic Procedure

IMPORTANT: If DTC 001348.10 is accompanied with DTC 001348.05, follow that diagnostic procedure first.

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001348.10 PUMP CONTROL VALVE #2 FUEL FLOW NOT DETECTED supporting information.* Without disconnecting, visually inspect the ECU connectors and the PCV #1 connector for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001348.10 PUMP CONTROL VALVE #2 FUEL FLOW NOT DETECTED supporting information.* 1. Ignition OFF. 2. Disconnect PCV #1 connector. 3. Try starting engine.	**Engine does not start:** GO TO ❸ **Engine starts and runs:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

– – –1/1

❸ **Fuel Line Test**	*NOTE: For wiring and theory of operation information, see DTC 001348.10 PUMP CONTROL VALVE #2 FUEL FLOW NOT DETECTED supporting information.* 1. Ignition OFF. 2. Disconnect fuel line between PCV #1 and the corresponding inlet on the HPCR. 3. Check fuel line for restrictions. *NOTE: You will need to bleed the fuel system when procedure is completed. See BLEED THE FUEL SYSTEM (—246269) or BLEED THE FUEL SYSTEM (246270—) in Section 05, Group 150 later in this manual.*	**No restriction found:** Faulty high pressure fuel pump. Replace and retest. **Restrictions found:** Fix restriction and retest. – – –1/1

001568.02 — Torque Curve Selection Invalid

The ECU receives torque curve selection information over CAN, but the information received is not valid.

CAN (Controller Area Network) Torque Curve Selection

- The ECU has the ability operate the engine on 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 receives torque curve selection information over CAN, but 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:

- If DTC 000639.13 - CAN Bus Error is active, 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 related DTCs. If they do, go to the appropriate diagnostic procedure.

RG41221,000004C –19–13OCT00–1/1

001568.09 — Torque Curve Selection Missing

The ECU does not receive torque curve selection information over CAN.

CAN (Controller Area Network) Torque Curve Selection

- The ECU has the ability operate the engine on 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 does not receive torque curve selection information over CAN.

If DTC 001568.09 sets, the following will occur:

- The ECU will default to the lowest torque curve to continue running.

If DTC 001568.09 sets:

- If DTC 000639.13 - CAN Bus Error is active, 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 related DTCs. If they do, go to the appropriate diagnostic procedure.

RG41221,0000331 –19–01APR02–1/1

001569.31 — Fuel Derate

This code is set when the ECU has detected a condition which, if continues, may damage the engine.

Fuel Derate

The Engine Control Unit (ECU) will limit the amount of fuel that is delivered to the engine when sensor inputs exceed normal operating ranges. A Diagnostic Trouble Code (DTC) always accompanies a fuel derate.

DTC 001569.31 will set if (depending upon application):

- ECU detects a low oil pressure.
- ECU detects a high manifold air temperature.
- ECU detects a high engine coolant temperature.
- The ECU detects water in fuel above the threshold quantity for an extended period of time.
- The ECU detects a loss of engine coolant.
- ECU detects a high fuel temperature.
- ECU detects a security violation.

See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for derate specifications per application.

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. For additional information, refer to ENGINE DERATE AND SHUTDOWN PROTECTION

DPSG,RG40854,320 –19–26AUG99–1/1

001638.00 — Hydraulic Oil Temperature High Most Severe

This code is used by the 4920 Sprayer. It is not an engine code. For diagnostic information, refer to TM2125, 4920 Self-Propelled Sprayer Diagnosis and Tests, Group 15AJ.

WL30140,0000024 –19–16AUG05–1/1

001638.03 — Hydraulic Oil Temperature Sensor Above Normal

This code is used by the 4920 Sprayer. It is not an engine code. For diagnostic information, refer to TM2125, 4920 Self-Propelled Sprayer Diagnosis and Tests, Group 15AJ.

WL30140,0000025 –19–16AUG05–1/1

001638.04 — Hydraulic Oil Temperature Sensor Voltage Below Normal

This code is used by the 4920 Sprayer. It is not an engine code. For diagnostic information, refer to TM2125, 4920 Self-Propelled Sprayer Diagnosis and Tests, Group 15AJ.

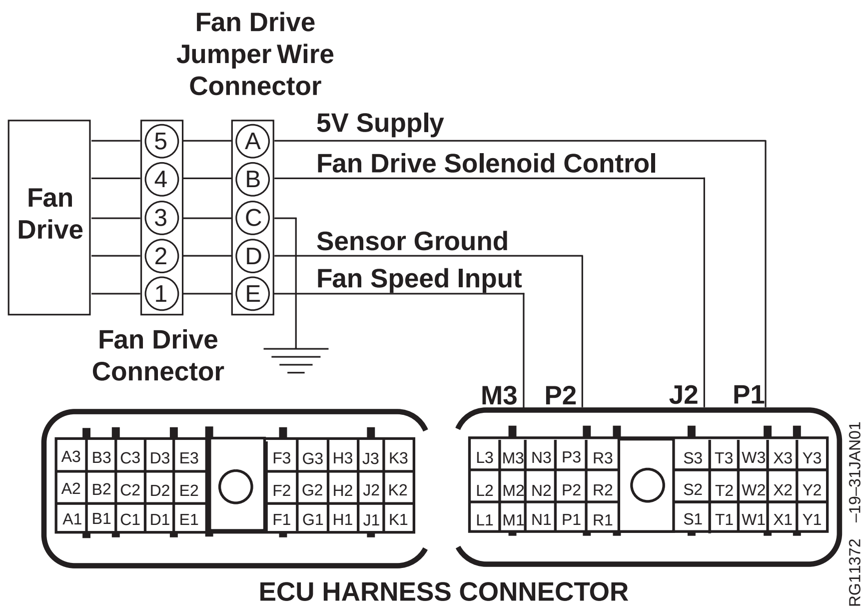
WL30140,0000026 –19–16AUG05–1/1

001638.16 — Hydraulic Oil Temperature High

This code is used by the 4920 Sprayer. It is not an engine code. For diagnostic information, refer to TM2125, 4920 Self-Propelled Sprayer Diagnosis and Tests, Group 15AJ.

WL30140,0000027 –19–16AUG05–1/1

001639.01 — Fan Speed Input Missing



Fan Speed Drive

This code is used on 7020 series tractors.

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 the 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. Code will set in 13 seconds, time to clear is 3 seconds.

If DTC 001639.01 sets, the following will occur:

- The ECU commands the fan to run at the highest possible speed.

RG41221,000004E –19–13OCT00–1/1

001639.01 — Fan Speed Input Missing

The ECU detects that fan speed input is missing.

RG41221,00000D5 –19–01APR02–1/1

001639.01 Fan Speed Input Missing Diagnostic Procedure

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.* Without disconnecting, visually inspect the ECU connectors, the Fan Drive connector, and any connector between for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**001639.01 reoccurs:** GO TO ❸ **001639.01 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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– – –1/1

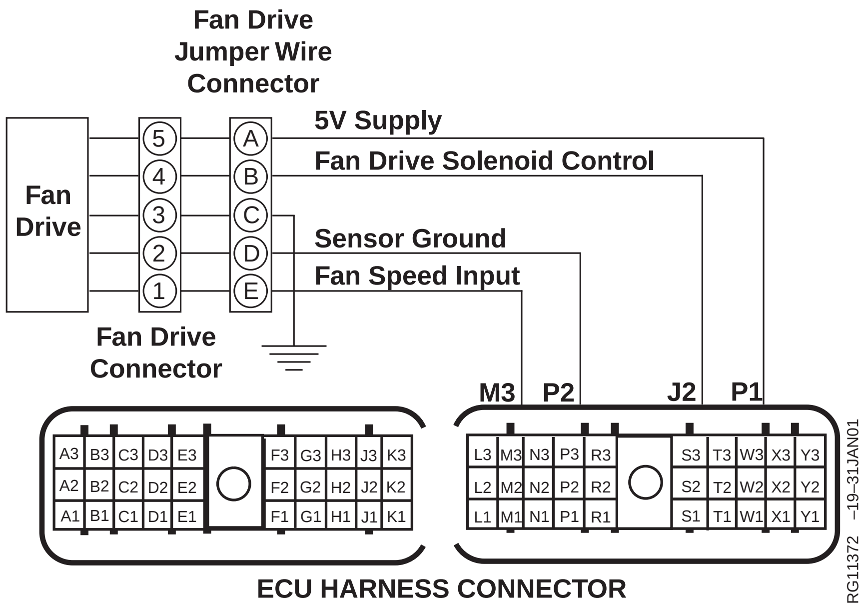
❸ **5 Volt Supply Check**	*NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.* 1. Ignition OFF. ⚠ **CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.** 2. Disconnect Fan Drive connector 3. Ignition ON, engine running. 4. Using a multimeter, measure voltage at fan drive harness connector between terminal 2 and terminal 5 of the fan drive connector.	**4.0 volts or greater:** GO TO ❺ **Less than 4.0 volts:** GO TO ❹ – – –1/1

❹ **Sensor Ground Check**	*NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.* 1. Ignition OFF. ⚠ **CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.** 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 return wire OR Faulty ECU connector OR Faulty ECU – – –1/1

❺ **Fan Input Wire Check**	*NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.* 1. Ignition OFF. ⚠ **CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.** 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Fan drive connector still disconnected. 4. Install a jumper wire between terminals 1 and 2 of the fan drive connector. 5. Using a multimeter, measure resistance between terminal M3 and terminal P2 of the ECU connectors.	**Less than 5 ohms:** GO TO ❻ **5 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 – – –1/1

❻ **Observe Fan Performance**	*NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.* 1. Ignition OFF. **CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.** 2. Connect fan drive connector 3. Ignition ON, engine running. **CAUTION: Keep hands away from fan drive at all times. Hand injury can occur.** 4. Monitor fan to determine if it is operational. *NOTE: Fan operation only occurs when commanded by ECU.*	**Fan runs:** Faulty fan drive connector OR Faulty fan speed sensor **Fan will not run:** Faulty fan drive connector OR Faulty fan drive – – –1/1

001639.16 — Fan Speed Higher Than Expected



04
160
,448

Fan Speed Drive

This code is used on 7020 series tractors.

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 the 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 fan speed 300 rpm higher than Desired Fan Speed. Time to set is 180 seconds, time to clear is 10 seconds. The code is inhibited during warm-up.

If DTC 001639.16 sets, the following will occur:

- There is no change in engine performance.

RG41221,0000052 –19–01APR02–1/1

001639.16 — Fan Speed Higher Than Expected

The ECU detects fan speed higher than expected.

RG41221,00000D6 –19–01APR02–1/1

001639.16 Fan Speed Higher Than Expected Diagnostic Procedure

04
160
,449

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001639.16 FAN SPEED HIGHER THAN EXPECTED supporting information.* Without disconnecting, visually inspect the ECU connectors, the Fan Drive connector, and any connector between for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

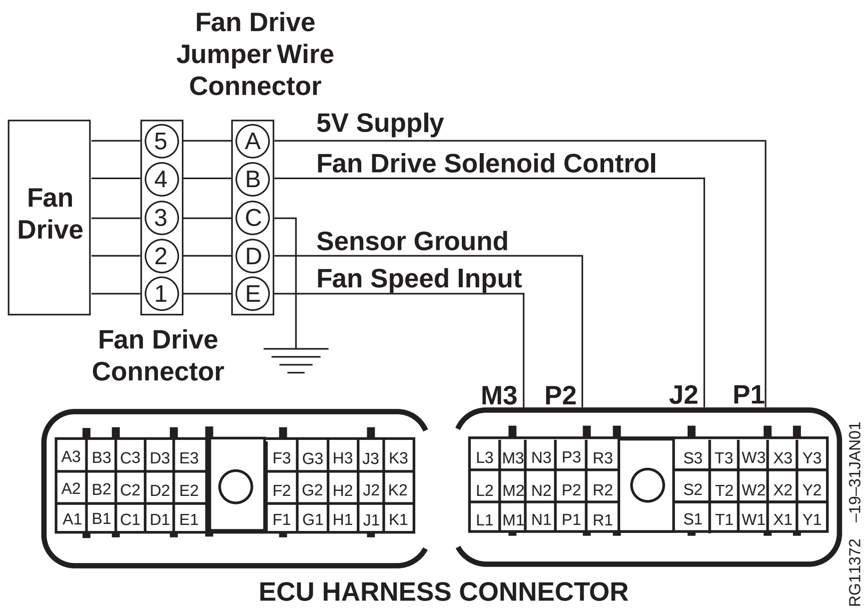
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001639.16 FAN SPEED HIGHER THAN EXPECTED supporting information.* 1. Use the diagnostic gauge OR connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF. 3. Start the ECU diagnostic software, if applicable. 4. Make note of all active DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**001639.16 reoccurs:** GO TO ❸ **001639.16 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

– – –1/1

❸ **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 the fan is no longer running. Hand injury can occur.** 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Disconnect the fan drive connector. 4. Using a multimeter, measure resistance between terminal J2 on the ECU connector and all other terminals on both 30-way ECU connectors.	**All measurements greater than 2000 ohms:** GO TO ❹ **Any measurement lass than 2000 ohms:** Faulty fan drive solenoid control wire – – –1/1

❹ **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

001639.18 — Fan Speed Lower Than Expected



04
160
,452

Fan Speed Drive

This code is used on 7020 series tractors.

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 the 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 fan speed 300 rpm lower than Desired Fan Speed. Code will set in 180 seconds. Time to clear is 10 seconds.

If DTC 001639.18 sets, the following will occur:

- There is no change to engine performance.

RG41221,0000054 –19–13OCT00–1/1

001639.18 — Fan Speed Lower Than Expected

The ECU detects fan speed lower than expected.

RG41221,00000EE –19–01APR02–1/1

001639.18 Fan Speed Lower Than Expected Diagnostic Procedure

IMPORTANT: If DTC 001639.01 also sets, follow that diagnostic procedure first.

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**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.** *NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.* Without disconnecting, visually inspect the ECU connectors, the Fan Drive connector, and any connector between for contamination, damage, or poor positioning. Check wiring for damage.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.* 1. Use the diagnostic gauge OR 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 diagnostic software, if applicable. 4. Make note of all active DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs.	**001639.18 reoccurs:** GO TO ❸ **001639.18 doesn't reoccur:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **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 occurs when commanded by ECU.*	**Fan belt appears normal:** GO TO ❹ **Fan belt slips or is broken:** Determine cause for belt slipping or for broken belt. Repair and retest – – –1/1

❹ **Short in Fan Drive Solenoid Control Wire Check**	*NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.* 1. Ignition OFF. ⚠ **CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.** 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Disconnect the fan drive connector. 4. Ignition ON 5. Using a multimeter, measure resistance between: • Terminal J2 in the harness end of the ECU connector and all other terminals in both 30-way ECU connectors and a good chassis ground.	**All measurements greater than 20k ohms:** GO TO ❺ **Any measurement less than 20k ohms:** Fan drive solenoid control wire shorted to wire that corresponds to measurement – – –1/1

❺ **Fan Speed Solenoid Control Wire Check**	*NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.* 1. Ignition OFF. ⚠ **CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.** 2. Disconnect both 30-way ECU connectors. Inspect ECU pins and connector terminals. 3. Fan drive connector still disconnected. 4. Install a jumper wire between terminal 5 and terminal 4 of the fan drive connector. 5. Using a multimeter, measure resistance between terminal J2 and terminal P1 on the ECU connector.	**5 ohms or less:** GO TO ❻ **Greater than 5 ohms:** Faulty fan drive solenoid control wire OR Faulty fan drive jumper wire connector OR Faulty ECU connector OR Faulty ECU – – –1/1

❻ **Fan Drive Check**	*NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER 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

002005.09 — ACU Signal Missing

The ECU does not receive the torque speed select message from ACU (Armrest Control Unit) over CAN or the message is not valid.

CAN (Controlled Area Network)

- The CAN transmits the vehicle's desired torque speed control to the ECU from the ACU.

DTC 002005.09 will set if:

04
160
,456

- The ECU does not receive the torque speed select message over CAN, or the message is not valid.

If DTC 002005.09 sets, the following will occur:

- Other ECU codes will be set due to loss of throttle information. ECU will respond to these codes according to its programming, such as setting engine speed to low idle.

If DTC 002005.09 sets:

- Use the diagnostic gauge OR 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 diagnostic software, if applicable.
- Read active DTCs and stored DTCs. Diagnose and repair all other DTCs.
- If the ACU has just been replaced, make sure the correct controller was installed and properly programmed.
- If the ACU is OK, check other controllers for active or stored CAN related DTCs and go to the appropriate diagnostic procedure.
- If no other stored or active CAN or vehicle-related DTCs are found, check the CAN wiring between the ACU and the ECU.

RG41221,0000114 –19–03APR03–1/1

002049.09 — Cab Signal Missing

The ECU does not receive the a/c clutch status message from cab controller over CAN or the message is not valid.

CAN (Controlled Area Network)

- The CAN transmits the vehicle's desired a/c (air conditioner) clutch status to the ECU from the cab controller.

DTC 002049.09 will set if:

- The ECU does not receive the a/c clutch status message over CAN, or the message is not valid.

If DTC 002049.09 sets, the following will occur:

- The ECU will default the fan speed to 1200 rpm.

If DTC 002049.09 sets:

- Use the diagnostic gauge OR 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 diagnostic software, if applicable.
- Read active DTCs and stored DTCs. Diagnose and repair all other DTCs.
- If the CAB controller has just been replaced, make sure the correct controller was installed and properly programmed.
- If the CAB controller is OK, check other controllers for active or stored CAN related DTCs and go to the appropriate diagnostic procedure.
- If no other stored or active CAN or vehicle-related DTCs are found, check the CAN wiring between the CAB controller and the ECU.

RG41221,0000115 –19–03APR03–1/1

002071.09 — CCU Signal Missing

The ECU does not receive the CCU (Chassis Control Unit) messages over CAN or the messages are not valid.

CAN (Controlled Area Network)

- The CCU (or CCD on some 7710-series) transmits vehicle information such as transmission oil temperature, tire size, and vehicle speed to the ECU over CAN.

DTC 002049.09 will set if:

- The ECU does not receive the CCU messages over CAN, or the messages are not valid.

If DTC 002049.09 sets, the following will occur:

- The ECU will default to the highest fan speed to compensate for transmission oil temperature.
- The ECU will use a default tire size.
- The ECU will not allow transport boost.

If DTC 002049.09 sets:

- Use the diagnostic gauge OR 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 diagnostic software, if applicable.
- Read active DTCs and stored DTCs. Diagnose and repair all other DTCs.
- If the CCU has just been replaced, make sure the correct controller was installed and properly programmed.
- If the CCU is OK, check other controllers for active or stored CAN related DTCs and go to the appropriate diagnostic procedure.
- If no other stored or active CAN or vehicle-related DTCs are found, check the CAN wiring between the CCU and the ECU.

RG41221,0000116 –19–03APR03–1/1

002580.03 — Brake Pressure Sensor Voltage Above Normal

This code is used by the 4920 Sprayer. It is not an engine code. For diagnostic information, refer to TM2125, 4920 Self-Propelled Sprayer Diagnosis and Tests, Group 15G.

WL30140,000001F –19–16AUG05–1/1

002580.04 — Brake Pressure Sensor Voltage Below Normal

This code is used by the 4920 Sprayer. It is not an engine code. For diagnostic information, refer to TM2125, 4920 Self-Propelled Sprayer Diagnosis and Tests, Group 15G.

WL30140,0000020 –19–16AUG05–1/1

Section 05
Tools

Contents

Group 090 - Electronic 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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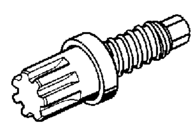
RG41221,0000011 –19–29AUG01–1/9

8.1 Liter Tier 2 Essential Fuel Tool Kit. JDG81T2

This kit is assembled with the most commonly used fuel system repair tools for the 8.1L High Pressure Common Rail engine. This kit includes the following: **JDG1460A** - used to install the fuel inlet connector, **JDG1461** - used to install and remove fuel leak-off connectors, **JDG1463** - used to install and remove fuel lines from the high pressure fuel pump, and **JDG1705** Compression Test Adapter.

RG41221,0000011 –19–29AUG01–2/9

RG7056 –UN–17JUN05

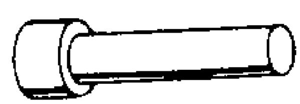


Flywheel Turning Tool JDG820

Used to rotate engine flywheel to lock engine at “TDC” to check high pressure fuel pump timing. Use with JDE81-4 Timing Pin.

RG41221,0000011 –19–29AUG01–3/9

RG5068 –UN–05DEC97



RG5068

Timing Pin JDE81-4

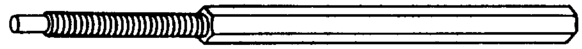
Used to lock engine at “TDC”. Use with JDG820 Flywheel Turning Tool.

Continued on next page

RG41221,0000011 –19–29AUG01–4/9

RG7212 –UN–23NOV97

High Pressure Fuel Pump Timing Pin[1] JDG886



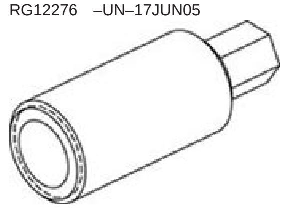
Used to lock high pressure fuel pump timing prior to removal and during installation of pump. Used to check pump static timing.

[1]*Included in JDG81T2 8.1 Liter Tier 2 Essential Fuel Tool Kit*

RG41221,0000011 –19–29AUG01–5/9

RG12276 –UN–17JUN05

Fuel Inlet Connector Installer[1] JDG1460A



Fuel Inlet Connector Installer

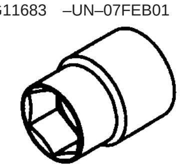
Used to install fuel inlet connectors.

[1]*Included in JDG81T2 8.1 Liter Tier 2 Essential Fuel Tool Kit*

RG41221,0000011 –19–29AUG01–6/9

RG11683 –UN–07FEB01

Fuel Leak-off Connector Socket[1] JDG1461



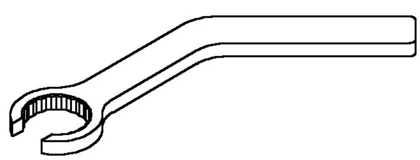
Used to install and remove fuel leak-off connectors.

[1]*Included in JDG81T2 8.1 Liter Tier 2 Essential Fuel Tool Kit*

RG41221,0000011 –19–29AUG01–7/9

RG11684 –UN–07FEB01

15/16” Curved Wrench[1] JDG1463



Used to install and remove fuel lines at high pressure fuel pump.

[1]*Included in JDG81T2 8.1 Liter Tier 2 Essential Fuel Tool Kit*

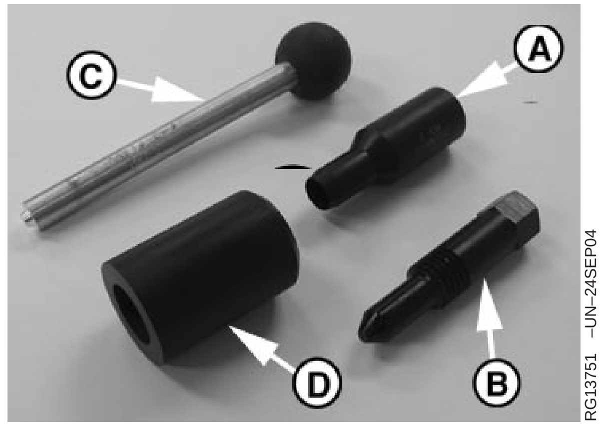
Continued on next page

RG41221,0000011 –19–29AUG01–8/9

Electronic Injector Installation Tool Kit JDG14690

Used to install electronic injectors.

A—JDG1460A-1 Plastic Installation Tool
B—JDG1460A-2 Electronic Injector Alignment Tool
C—JDG1460A-3 Inlet Connector Pusher Tool
D—JDG1460A-4 Electronic Injector Seating Tool



JDG1460A Tool Set

RG41221,0000011 –19–29AUG01–9/9

Fuel System Repair and Adjustment Other Materials

Number	Name	Use
TY24311 (U.S.) CXTY24311 (Canadian) 222 (LOCTITE®)	Pipe Sealant	Apply to threads of electronic injector studs.

LOCTITE is a registered trademark of Loctite Corp.

RG41221,0000002 –19–19MAR01–1/1

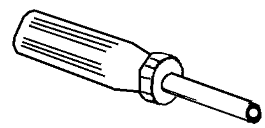
Group 110 - Electronic Engine Control Repair Tools

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

RG41221,000032B –19–08MAR02–1/19

RW25539 –UN–28AUG96



Terminal Extraction Tool[1] JDG364

Used to extract WEATHER PACK™ terminals from electrical connectors.

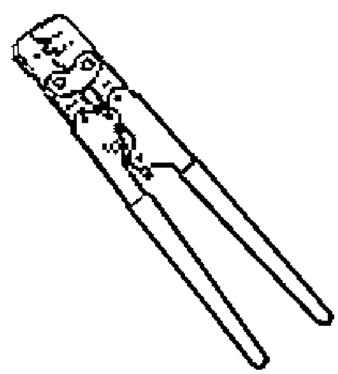
WEATHER PACK is a trademark of Packard Electric

[1]Included in Technician's Electrical Repair Kit - JT07195B

RG41221,000032B –19–08MAR02–2/19

WEATHER PACK™ Crimping Tool JDG783

Used to crimp WEATHER PACK™ male and female terminals on 14-20 gauge wires. This tool crimps both the wire and the seal retainer at the same time.



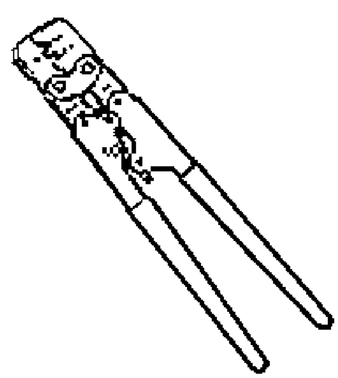
RW25542A –UN–07MAR02

WEATHER PACK is a trademark of Packard Electric

RG41221,000032B –19–08MAR02–3/19

METRI-PACK™ Crimping Tool JDG865

Used to crimp METRI-PACK™ male and female terminals on 14-20 gauge wires.



RW25542A –UN–07MAR02

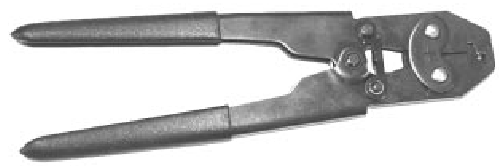
METRI-PACK is a trademark of Packard Electric Inc.

Continued on next page

RG41221,000032B –19–08MAR02–4/19

Packard Crimper JDG707

Used to crimp WEATHER PACK, METRIPACK, SUMITOMO, and YAZAKI male and female terminals on 12-20 gauge wires. This tool crimps the wire and the seal retainer separately.

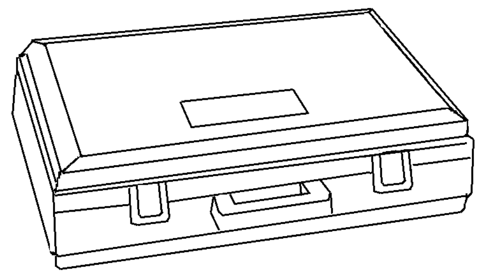


RG11679 –UN–05FEB01

RG41221,000032B –19–08MAR02–5/19

Technician’s Electrical Repair Kit JT07195B

This kit is assembled with the most commonly used terminal extraction tools used to repair wiring harnesses on John Deere applications. This kit includes the following: **JDG140** - CPC and Metrimate terminal extraction tool, **JDG141** - CPC Blade Type terminal extraction tool, **JDG361** - Deutsch 12-14 gauge terminal extraction/insertion tool, **JDG362** - Deutsch 16-18 gauge terminal extraction/insertion tool, **JDG364** - WEATHERPACK terminal extraction tool, **JDG776** - Metripack terminal extraction tool - Wide, **JDG777** - METRI-PACK terminal extraction tool - Narrow, **JDG785** - Deutsch 6-8 gauge terminal extraction/insertion tool, and **JDG939** Metri-Pack Extraction Tool.



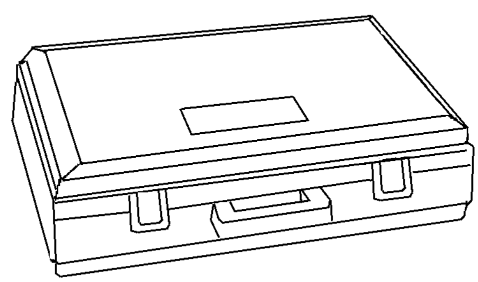
RW25558 –UN–29AUG96

05
170
5

RG41221,000032B –19–08MAR02–6/19

Technician’s Electrical Repair Kit JDG155

This kit is assembled with the most commonly used terminal extraction tools used to repair wiring harnesses on John Deere applications. This kit includes the following: **JDG107** - Holding Plate, **JDG139** - Sure-Seal terminal insertion tool, **JDG140** - CPC and Metrimate terminal extraction tool, **JDG141** - CPC Blade Type terminal extraction tool, **JDG142** - Mate-N-Lock terminal extraction tool, **JDG143** - Mate-N-Lock terminal extraction tool, **JDG144** - Universal Crimping Pliers, **JDG145** - Electrician’s Pliers, and **JDG146** - Carrying Case.



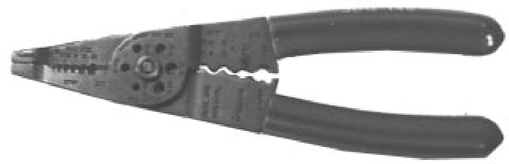
RW25558 –UN–29AUG96

Continued on next page

RG41221,000032B –19–08MAR02–7/19

Electrician's Pliers[1] JDG145

Used to cut, strip, and splice wires.



RG11686 –UN–13FEB01

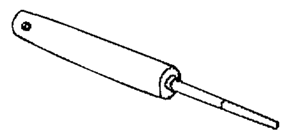
[1]Included in Technician's Electrical Repair Kit - JDG155

RG41221,000032B –19–08MAR02–8/19

RW25541 –UN–20AUG96

METRI-PACK™ Extractor (Wide)[1] JDG776

Used to remove terminals from 56-Series, 280-Series, and 630-Series METRI-PACK™ connectors.



METRI-PACK is a trademark of Packard Electric Inc.

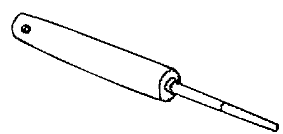
[1]Included in Technician's Electrical Repair Kit - JT07195B

RG41221,000032B –19–08MAR02–9/19

RW25541 –UN–20AUG96

METRI-PACK™ Extractor (Narrow)[1]. JDG777

Used to remove terminals from 150-Series METRI-PACK™, SUMITOMO, and YAZAKI connectors.

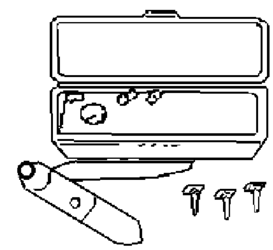


METRI-PACK is a trademark of Packard Electric Inc.

[1]Included in Technician's Electrical Repair Kit - JT07195B

Continued on next page RG41221,000032B –19–08MAR02–10/19

DEUTSCH™ Electrical Repair Tool Kit JDG359



RW25540 –UN–06SEP96

Used to extract terminals from DEUTSCH™ electrical connectors. A special crimping tool is also included to crimp DEUTSCH terminals on wires. The following tools are included: **JDG360** - Deutsch Terminal Crimping Tool, **JDG361** - Deutsch 12-14 gauge terminal extraction/insertion tool (set of 2), **JDG362** - Deutsch 16-18 gauge terminal extraction/insertion tool (set of 2), **JDG363** - Deutsch 20-24 gauge terminal extraction/insertion tool (set of 2), and **JDG1383** Deutsch Terminal Tool.

DEUTSCH is a trademark of Deutsch Co.

RG41221,000032B –19–08MAR02–11/19

12—14 Gauge Extractor (Set of Two)[1] JDG361

RG12278 –UN–22APR02

Deutsch Extraction Tool

Used to remove terminals on 12-14 gauge wires in DEUTSCH connectors.

[1]*Included in DEUTSCH Electrical Repair Kit - JDG359*

Continued on next page RG41221,000032B –19–08MAR02–12/19

16—18 Gauge Extractor (Set of Two)[1] JDG362

Used to remove terminals on 16-18 gauge wires in DEUTSCH connectors.

RG12278 –UN–22APR02

Deutsch Extraction Tool

[1]Included in DEUTSCH Electrical Repair Kit - JDG359

RG41221,000032B –19–08MAR02–13/19

20—24 Gauge Extractor (Set of Two)[1] JDG363

Used to remove terminals on 20-24 gauge wires in DEUTSCH connectors.

RG12278 –UN–22APR02

Deutsch Extraction Tool

[1]Included in DEUTSCH Electrical Repair Kit - JDG359

RG41221,000032B –19–08MAR02–14/19

Crimping Tool[1] JDG360

Used to crimp DEUTSCH closed barrel terminals on 12-24 gauge wires.

TS117A –UN–23JUN05

[1]Included in DEUTSCH Electrical Repair Kit - JDG359

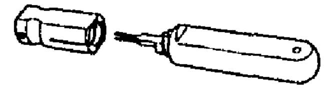
Continued on next page

RG41221,000032B –19–08MAR02–15/19

RG10740 –UN–31MAY00

Terminal Extraction Tool FKM10457

Used to extract female terminals from Level 1 and Level 4 Engine Control Unit (ECU) using Amp connectors.



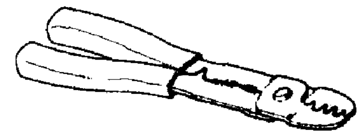
FKM10457

RG41221,000032B –19–08MAR02–16/19

RG10739 –UN–26MAY00

Crimping Pliers[1] JDG144

Universal crimp tool used to crimp terminals on wires. Use crimp tools that are specific for the terminal being crimped, but there is not a specified crimp tool, use this tool.



JDG144

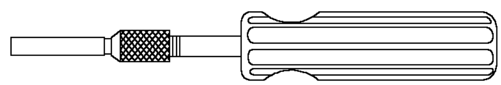
[1]*Included in Technician's Electrical Repair Kit - JDG155*

RG41221,000032B –19–08MAR02–17/19

RG10741 –UN–31MAY00

Terminal Extractor Tool JDG1369

Used to extract terminals from the Level 4 Electronic Engine Controller (ECU) connector on applications that use the Bosch VP44 fuel injection pump.

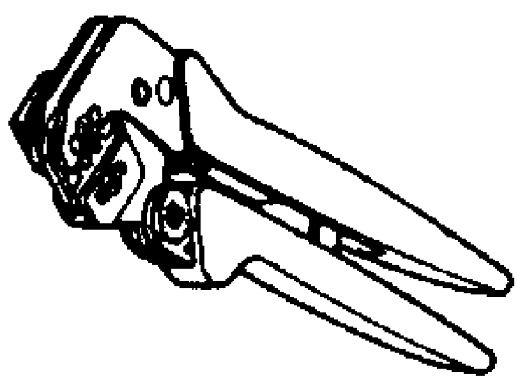


JDG1369

RG41221,000032B –19–08MAR02–18/19

AMP Crimping Tool JDG708

Used to crimp AMP terminals on wires.



JDG708

RG10737 –UN–25MAY00

RG41221,000032B –19–08MAR02–19/19

Control Repair and Adjustment Other Materials

Number	Name	Use
JDT405 (U.S.)	High Temperature Grease	Sensor O-rings.
TY24311 (U.S.) CXTY24311 (Canadian) 222 (LOCTITE®)	Pipe Sealant	Apply to threads of electronic injector studs.
AT66865 (U.S.)	Lubricant	Insulate electrical connectors.

LOCTITE is a registered trademark of Loctite Corp.

RG41221,00000EF –19–25JAN01–1/1

Group 150/160 - Electronic Fuel System Diagnostic Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or in the European Microfiche Tool Catalog (MTC) unless otherwise noted.

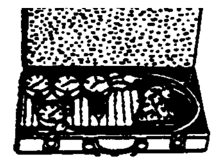
SERVICEGARD is a trademark of Deere & Company.

RG41221,0000012 –19–22SEP00–1/14

Universal Pressure Test Kit JT05412

All indexed and numbered in a unique metal storage box, complete with special hydraulic gauges calibrated in graduations to cover ranges up to 34,500 kPa (5000 psi); quick-disconnect feature for fast hookup. Used for testing engine oil pressure, intake manifold pressure (turbo boost), and fuel transfer pump pressure.

RG5162 –UN–23AUG88

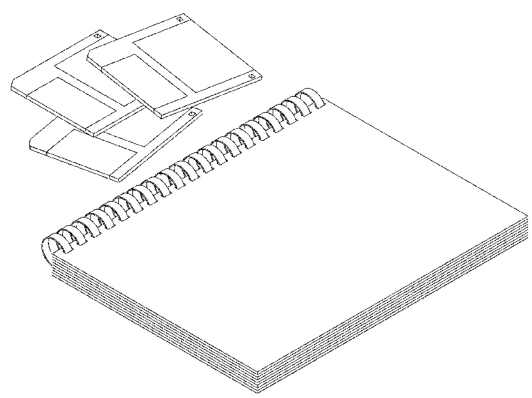


JT05412

RG41221,0000012 –19–22SEP00–2/14

ECU Communication Software Kit. JDIS122

Please refer to your John Deere Dealer website for information on obtaining the latest version of software.



RG8554 –UN–26NOV97

JDIS122

RG41221,0000012 –19–22SEP00–3/14

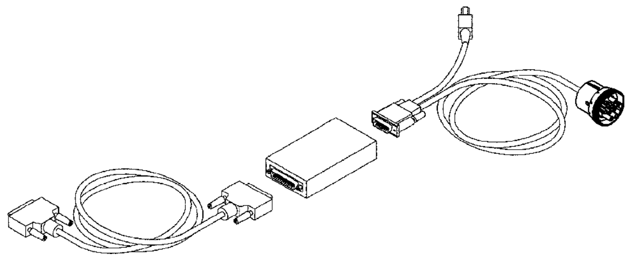
NOTE: Available from John Deere Distribution Service Center (DSC). **United States and Canadian Agricultural dealers DO NOT ORDER without first contacting your Branch or TAM.**

Continued on next page

RG41221,0000012 –19–22SEP00–4/14

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.

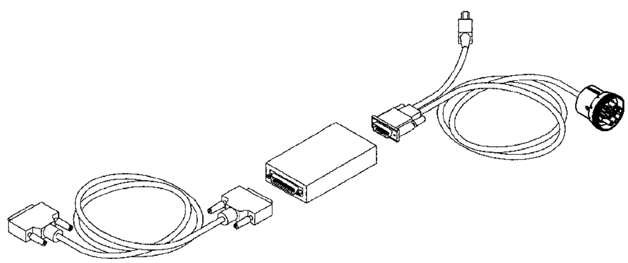


RG11747 –UN–09JUL01

RG41221,0000012 –19–22SEP00–5/14

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.



RG11747 –UN–09JUL01

RG41221,0000012 –19–22SEP00–6/14

NOTE: Available from John Deere Distribution Service Center (DSC). **United States and Canadian Agricultural dealers DO NOT ORDER without first contacting your Branch or TAM.**

Continued on next page RG41221,0000012 –19–22SEP00–7/14

Digital Multimeter JT07306

Test electrical components for voltage, resistance, current flow, or temperature. It is especially good for measuring low voltage or high resistance circuits.

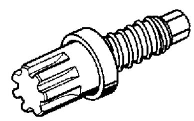

RG11126 –UN–19JUN00

RG41221,0000012 –19–22SEP00–8/14

RG7056 –UN–17JUN05

Flywheel Timing Tool JDG820

Used to rotate engine flywheel to lock engine at “TDC” to check high pressure fuel pump timing. Use with JDE81-4 Timing Pin.

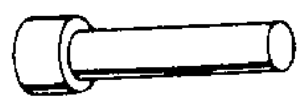


RG41221,0000012 –19–22SEP00–9/14

RG5068 –UN–05DEC97

Timing Pin JDE81-4

Used to lock engine at “TDC”. Use with JDG820 Flywheel Turning Tool.

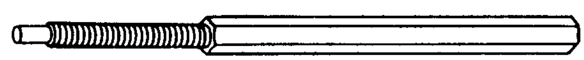

RG5068

RG41221,0000012 –19–22SEP00–10/14

RG7212 –UN–23NOV97

High Pressure Fuel Pump Timing Pin[1] JDG886

Used to lock high pressure fuel pump timing prior to removal and during installation of pump. Used to check pump static timing.



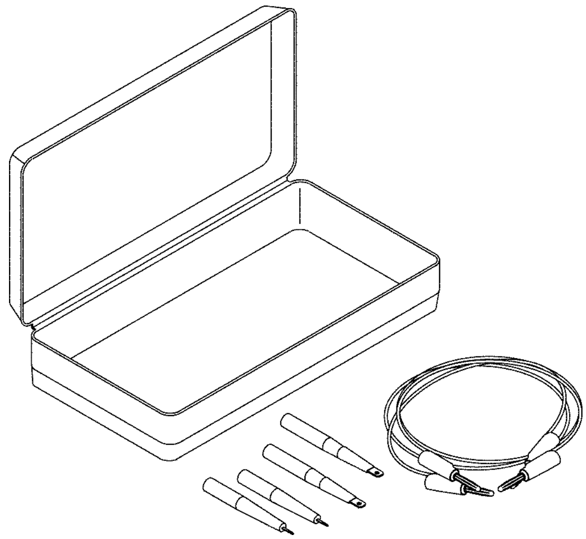
[1] *Included in JDG81T2 8.1 Liter Tier 2 Essential Fuel Tool Kit*

Continued on next page

RG41221,0000012 –19–22SEP00–11/14

Connector Adapter Test Kit JT07328

The adapters in this kit mate with the terminals in engine control system sensors and wiring harness connectors. These adapters should be used when making voltage and resistance measurements in connectors to ensure terminal damage does not occur. In addition, if diagnosis indicates a problem in a harness connector, the appropriate adapter can be used to test the connector terminals for proper fit.



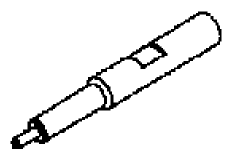
RG8803 –UN–26NOV97

RG41221,0000012 –19–22SEP00–12/14

RG13824 –UN–01DEC04

Compression/Leakdown Adapter JDG1705

Use with JT01674 Compression Tester to check cylinder pressure on the 8.1L PowerTech engine with engine serial numbers 200,000 and higher. JDG1705 has been shippped to all dealers who originally received the JDG81T2 as an ASSET essential tool (Oct-03). This tool is part of the JDG81T2 essential tool kit.

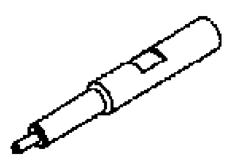


RG41221,0000012 –19–22SEP00–13/14

RG13824 –UN–01DEC04

Compression/Leakdown Adapter JDG1705

Use with JT01674 Compression Tester to check cylinder pressure on the 8.1L PowerTech engine with engine serial numbers 200,000 and higher. JDG1705 has been shippped to all dealers who originally received the JDG81T2 as an ASSET essential tool (Oct-03). This tool is part of the JDG81T2 essential tool kit.



RG41221,0000012 –19–22SEP00–14/14

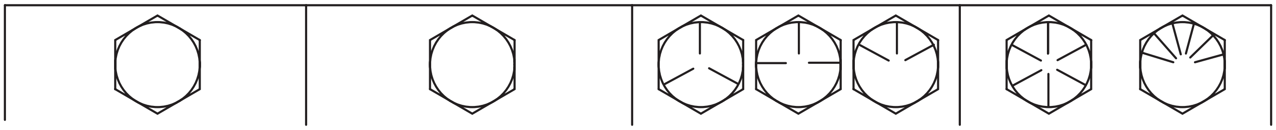
Section 06
Specifications

Contents

Continued on next page

Unified Inch Bolt and Screw Torque Values

TS1671 –UN–01MAY03



Bolt or	SAE Grade 1				SAE Grade 2[a]				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
Screw	Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]	
Size	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N•m	lb-ft	N•m	lb-ft
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N•m	lb-ft	N•m	lb-ft				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N•m	lb-ft	N•m	lb-ft	N•m	lb-ft								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N•m	lb-ft														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

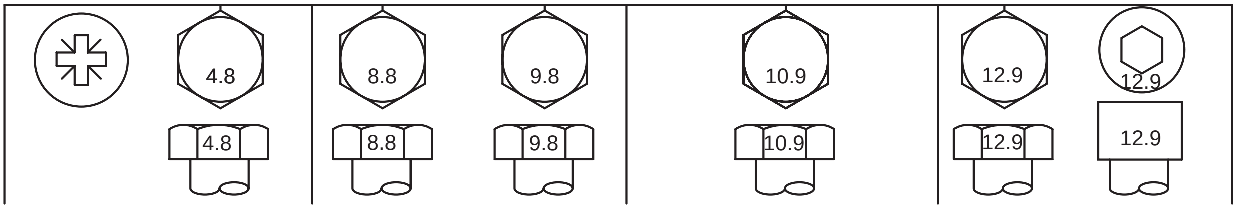
[a] Grade 2 applies for hex cap screws (not hex bolts) up to 6. in (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

[b] "Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C zinc flake coating.

[c] "Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B zinc flake coating.

TORQ1 –19–24APR03–1/1

Metric Bolt and Screw Torque Values



TS1670 –UN–01MAY03

Bolt or	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
Screw	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
Size	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N•m	lb-ft	N•m	lb-ft	N•m	lb-ft								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N•m	lb-ft														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a]"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C zinc flake coating.

[b]"Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B zinc flake coating.

DX,TORQ2 –19–24APR03–1/1

General OEM Engine Specifications

NOTE: **For vehicle engines, see Machine Technical Manual.**

ITEM	UNIT OF MEASURE	6081HF001 (Engine — 199,999)	6081HF070 (Engine 200,000—)
Engine Type	——	In-line, 4 cycle diesel	In-line, 4 cycle diesel
Aspiration	——	Turbocharged and air-to-air after cooled	Turbocharged and air-to-air after cooled
Number of Cylinders	——	6	6
Bore	mm (in.)	116 (4.56)	116 (4.56)
Stroke	mm (in.)	129 (5.06)	129 (5.06)
Displacement	L (cu in.)	8.1 (496)	8.1 (496)
Combustion System	——	Direct Injection	Direct Injection
Compression Ratio	——	15.7:1	15.7:1
Physical Dimensions:			
Width	mm (in.)	597 (23.5)	597 (23.5)
Height	mm (in.)	1152 (45.3)	1152 (45.3)
Length	mm (in.)	1200 (47.6)	1200 (47.6)
Basic Dry Weight	kg (lb)	776 (1710)	776 (1710)
Lubrication System			
Oil Pressure at Rated rpm	kPa (psi)	345 (50)	345 (50)
Oil Pressure at Low Idle	kPa (psi)	210 (30)	210 (30)
In-Crankcase Oil Temp at Rated rpm	°C (°F)	115°C (240°F)	115°C (239°F)
Cooling System (Liquid, pressurized with centrifugal pump)			
Recommended Pressure Cap	kPa (psi)	69 (10)	69 (10)
Coolant Temperature Operating Range	°C (°F)	82°-94°C (180°-202F°)	82°-94°C (180°-202F°)
Coolant Flow (Industrial)	L/min (gal/min)	330 (87)	330 (87)
Coolant Flow (Generator)			
at 1800 rpm	L/min (gal/min)	270 (71)	270 (71)
at 1500 rpm	L/min (gal/min)	210 (55)	210 (55)
Engine Operation System			
Hot Cylinder Compression Pressure with Injectors Removed	kPa	2380-2790 (345-405)	2380-2790 (345-405)
Valve Clearance (Cold)			
Intake	mm (in.)	0.46 (0.018)	0.36 (0.014)
Exhaust	mm (in.)	0.71 (0.028)	0.56 (0.022)
Fuel System			
Injector Opening Pressure (New)	kPa (psi)	29000 (4200)	ECU Programed
Injector Opening Pressure (Used)	kPa (psi)	26200 (3800)	ECU Programed
Injection Pump/Fuel Pump Timing		Timing Lines aligned with flywheel at TDC	
Injection Pump/Fuel Pump Timing			Timing pin inserted with flywheel at TDC

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200
3

RG,RG34710,1026 –19–23OCT97–1/1

Fuel System Component Torque Specifications

Item	Measurement	Specification
Injection Pump	Type	Denso ECD-U2 High Pressure In-Line Fuel Pump
Engine	Operating Speeds	OEM Engines (See Group 01) Vehicle Engines (See Machine Technical Manual)
High Pressure Fuel Pump	Timing	No. 1 Engine Cylinder at TDC Compression Stroke
Primary Fuel Filter to Mounting Bracket Cap Screws	Torque	24 N•m (18 lb-ft.)
Final Fuel Filter to Mounting Bracket Cap Screws	Torque	40 N•m (30 lb-ft.)
Fuel Filter Mounting Bracket to Block Cap Screw and Nut	Torque	61 N•m (45 lb-ft.)
Fuel Line - Attach to Primary and Final Fuel Filters	Torque	27 N•m (20 lb-ft.)
Fuel Hoses	Torque	24 N•m (18 lb-ft)
Fitting — Attach Fuel Line to Primary Fuel Filter	Torque	27 N•m (20 lb-ft.)
Fitting — Attach Fuel Lines to Final Fuel Filter	Torque	27 N•m (20 lb-ft.)
Diagnostic Port on Final Filter Base	Torque	14 N•m (10 lb-ft)
Primary Fuel Filter Bowl to Header	Torque	6 N•m (4 lb-ft.) (50 lb-in.)
Water Separator to Fuel Filter	Torque	8 N•m (6 lb-ft.) (70 lb-in.)
Final Fuel Filter and Bowl to Base	Torque	14 N•m (10 lb-ft.) (125 lb-in.)
Oil Filter Header to Block Cap Screws	Torque	61 N•m (45 lb-ft.)
Oil Filter Header to Block Cap Screws	Torque	61 N•m (45 lb-ft.)
High Pressure Fuel Pump to Block	Torque	48 N•m (35 lb-ft)

Continued on next page
DPSG,OUO1004,883 –19–31AUG01–1/3

Item	Measurement	Specification
High Pressure Fuel Pump–to–Gear Cap Screws	Torque	61 N•m (45 lb-ft)
High Pressure Fuel Pump Drive Gear Cover Cap Screws	Torque	27 N•m (20 lb-ft)
High Pressure Fuel Pump Lube Line Fitting	Torque	4.5 N•m (3.5 lb-ft)
Fitting — High Pressure Fuel Lines to High Pressure Common Rail	Torque	27 N•m (20 lb-ft.)
Fuel Lines - Attach to High Pressure Fuel Pump	Torque	24 N•m (18 lb-ft.)
Fuel Line Clamp Cap Screw	Torque	12 N•m (9 lb-ft)
High Pressure Fuel Pump Overflow Valve	Torque	27 N•m (20 lb-ft)
Hand Primer	Torque	49 N•m (36 lb-ft)
High Pressure Common Rail to Block Cap Screws	Torque	61 N•m (45 lb-ft)
High Pressure Common Rail Leak-off Line Fitting (—246269)	Torque	15 N•m (11 lb-ft)
High Pressure Common Rail Leak-off Hose Fitting (246270—)	Torque	24 N•m (18 lb-ft)
High Pressure Common Rail Pressure Relief	Torque	176 N•m (130 lb-ft)
High Pressure Common Rail Flow Limiter	Torque	176 N•m (130 lb-ft)
Fitting — High Pressure Fuel Lines to Flow Limiters	Torque	27 N•m (20 lb-ft.)
Fitting — High Pressure Injection Line to High Pressure Common Rail	Torque	27 N•m (20 lb-ft)
Rocker Arm Cover Capscrews	Torque	8 N•m (6 lb-ft)
Initial Rocker Arm Clamp—to—Cylinder Head Cap Screw	Torque	30 N•m (22 lb-ft)

Continued on next page

DPSG,OUO1004,883 –19–31AUG01–2/3

Item	Measurement	Specification
Final Rocker Arm Clamp—to—Cylinder Head Cap Screw	Torque Turn	10 N•m + 60 degrees (7 lb-ft + 60 degrees)
Carrier-to-Cylinder Head Cap Screws	Torque	8 N•m (6 lb-ft)
Rocker Arm Cover to Carrier Cap Screws	Torque	8 N•m (6 lb-ft)
Wiring Harness to Rocker Arm Carrier Cap Screws	Torque	8 N•m (6 lb-ft)
Electronic Injector Hold Down Clamp Cap Screws	Torque Turn	10 N•m + 90 degrees (7 lb-ft + 90 degrees)
Two Way Valve Wire Retaining Nuts	Torque	1.9 N•m (1.4 lb-ft) (17 lb-in)
Rocker Arm Clamp to Head Capscrews	Torque	35 N•m (26 lb-ft)
Adjusting Valve Screw Lock Nuts	Torque	27 N•m (20 lb-ft)
Final Filter Relief Valve	Opening Pressure	380 kPa (3.8 bar) (55 psid)
High Pressure Fuel Pump Overflow Valve	Opening Pressure	255 kPa (2.5 bar) (37 psi)
High Pressure Common Rail Pressure Relief Valve	Opening Pressure	170 MPa (1700 bar) (24,700 psi)

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6

DPSG,OUO1004,883 –19–31AUG01–3/3

Engine Sensor Torque Specifications

Item	Measurement	Specification
Crankshaft Position Sensor	Torque	14 N•m (10 lb-ft)
Water-in-Fuel Sensor	Torque	3 N•m (30 lb-in)
Fuel Temperature Sensor	Torque	10 N•m (7 lb-ft)
Engine Coolant Sensor	Torque	10 N•m (7 lb-ft)
Manifold Air Temperature Sensor	Torque	10 N•m (7 lb-ft)
Oil Pressure Sensor	Torque	9 N•m (6.5 lb-ft)
Fuel Rail Pressure Sensor	Torque	98 N•m (72.3 lb-ft)

RG41221,0000057 –19–29AUG01–1/1

Fuel System Diagnostic Specifications

Item	Measurement	Specification
Fuel Transfer Pump Pressure at cranking	Pressure	100-140 kPa (1.0-1.4 bar) (15-20 psi)
Fuel Transfer Pump Pressure at low idle	Pressure	200-240 kPa (2.0-2.4 bar) (30-35 psi)
Fuel Transfer Pump Pressure at full load rated speed	Pressure	410-550 kPa (4.1-5.5 bar) (60-80 psi)
High Pressure Common Rail Pressure at cranking	Pressure	20-40 MPa (200-400 bar) (2900-5800 psi)
High Pressure Common Rail Pressure at low idle	Pressure	40 MPa (400 bar) (5800 psi)
High Pressure Common Rail Pressure at full load rated speed	Pressure	40-140 MPa (400-1400 bar) (5800-20,300 psi)

RG41221,0000078 –19–29AUG01–1/1

Application Specifications

Below is a list of specification tables provided in this section.

- **Articulated Dump Truck**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Cane Harvester**
  - DERATE SPECIFICATIONS
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Combine**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Crawler - Forestry**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Excavator**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **850/950 Feller Buncher, Forwarder, and Harvester (Forestry)**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Grader**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Loader**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **OEM Engines**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION WITH OC03040 SOFTWARE OR LATER
  - GOVERNOR MODE SELECTION WITH OC03036 SOFTWARE OR EARLIER
  - ECU TERMINAL IDENTIFICATION
  - ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM
  - 6081 OEM APPLICATION INSTRUMENT PANEL/ENGINE START COMPONENTS ELECTRICAL WIRING DIAGRAM
- **Self-Propelled Forage Harvester (SPFH)**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Skidder - Forestry**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Sprayer**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Tractor - 7010 Series**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Tractor - 7020 Series**

Continued on next page

- DERATE SPECIFICATIONS
- TORQUE CURVE SELECTION
- GOVERNOR MODE SELECTION
- ECU TERMINAL IDENTIFICATION
- VEHICLE WIRING - See Vehicle manual.

- **Tractor - 8020 Series**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Tractor - 9120 Series**
  - DERATE SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.

RG40854,0000128 –19–03APR03–2/2

Articulated Dump Truck - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if an engine must be derated.

Derate Specifications for Articulated Dump Trucks				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 113°C (235°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 110°C (230°F)	No derate.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG41221,000000A –19–02AUG02–1/1

Articulated Dump Trucks - Torque Curve Selection

Torque Curve Selection for Level 9 Articulated Dump Trucks	
Torque Curve #	**Conditions**
0	Default when there is a selection failure or security mismatch.
3	Gears R, 1, and 2
4	Gears 3, 4, 5, 6 and N

RG41221,000000B –19–02AUG02–1/1

Articulated Dump Trucks - Governor Mode Selection

Max. Speed Governor Mode Selection for Articulated Dump Trucks	
Governor Mode	**Conditions**
9	Normal and for selection failure due to a missing current gear message
10	Transport (6th) and N for high-speed dumping

RG41221,000000C –19–02AUG02–1/1

Articulated Dump Trucks - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Battery Power	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN, fault lamp, warning lamp
CAN High, CAN Low	L1, L2	Accessible in several connectors on engine harness.
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Engine Coolant Temperature Input	X2	G
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	2
Fuel Rail Pressure Sensor Return	P3	1
Fuel Temperature Input	X3	G
Manifold Air Temperature Input	Y2	G
Oil Pressure Input	T2	S
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV's Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
PWM Throttle Input	R2	4 (Accel. Pedal)
Sensor Return 1 and 2	N3 and P2	(Coolant Temp, Fuel Temp., Manifold Air Temp., Water-in-Fuel) — (Oil Pressure Sensor)
Sensor 5V Supply (Excitation) 1	N1	4 (Accel. Pedal via Resistor)
Sensor 5V Supply (Excitation) 2	P1	+ (Oil Pressure Sensor)
System Ground	C2, C3	Battery (—)
Water In Fuel Input	Y3	G

RG41221,000000D –19–02AUG02–1/1

Cane Harvester - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if an engine must be derated.

Derate Specifications for Cane Harvester				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 40% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 95% of full power.
Engine Coolant Temperature (ECT)	000111.01	Extremely High Temperature (Coolant Level Low)	Above 124°C (255°F). Coolant temperature this high assumes that the sensor is not immersed.	ECU derates engine to 40% of full power in one minute.
External Derate Switch	000971.31	Depends on what is being monitored.	Value set by external device.	ECU will shut down engine.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

WL30140,0000016 –19–01AUG05–1/1

Cane Harvester - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Battery Power	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Accessible in several connectors on engine harness.
Coolant Temperature Input	X2	B
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
External Shutdown	N2	See equipment schematic
Fault Lamp	B3	Ground side of lamp.
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	2
Fuel Rail Pressure Sensor Return	P3	1
Fuel Temperature Input	X3	B
Manifold Air Temperature Input	Y2	B
Oil Pressure Sensor Input	T2	B
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
Sensor Return 1	N3	Manifold Air Temp., Water-in-Fuel, Analog Throttle
Sensor Return 2	P2	A (Oil Pressure Sensor) B (Coolant Temp, Fuel Temp.)
Sensor 5V Supply 1	N1	Analog Throttle, power side.
Sensor 5V Supply 2	P1	Oil Pressure Sensor
System Ground	C2, C3	Battery (-)
Stop Lamp	H3	Power side of lamp.
Tachometer	M1	Tach Input

Continued on next page
WL30140,0000017 –19–01AUG05–1/2

Third Gear Input	T1	B
Water In Fuel Input	Y3	B

WL30140,0000017 –19–01AUG05–2/2

Combines - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if an engine must be derated.

Derate Specifications for Combines				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 40% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 95% of full power.
Engine Coolant Temperature (ECT)	000111.01	Extremely High Temperature (Coolant Level Low)	Above 124°C (255°F). Coolant temperature this high assumes that the sensor is not immersed.	ECU derates engine to 40% of full power in one minute.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG41221,0000332 –19–01APR02–1/1

Combines - Torque Curve Selection

Torque Curve Selection for Level 9 Combines	
Torque Curve #	**Conditions**
0	When none of the below conditions are met.
1	Normal Operation
2	Auger boost ON

RG41221,0000333 –19–01APR02–1/1

Combines - Governor Mode Selection

Desired Speed Governor Mode Selection for Level 9 Combines	
Governor Mode	**Conditions**
0	Normal
8	Low speed governor

Max. Speed Governor Mode Selection for Level 9 Combines	
Governor Mode	**Conditions**
9	High speed governor
10	High speed governor in 3rd gear

RG41221,0000334 –19–01APR02–1/1

Combines - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Air Filter Restriction Switch Input	D2	B
Battery Power	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Accessible in several connectors on engine harness.
Coolant Temperature Input	X2	B
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	2
Fuel Rail Pressure Sensor Return	P3	1
Fuel Temperature Input	X3	B
Manifold Air Temperature Input	Y2	B
Oil Pressure Switch Input	D3	B
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV's Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
Sensor Return 1	N3	A (Oil Pressure Switch, Air Filter Restriction Switch)
Sensor Return 2	P2	B (Coolant Temp, Fuel Temp., Manifold Air Temp., Water-in-Fuel)
Sensor 5V Supply 1	N1	Not Used
Sensor 5V Supply 2	P1	
System Ground	C2, C3	Battery (-)
Third Gear Input	T1	B
Water In Fuel Input	Y3	B

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Crawler (Forestry) - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 118°C (244°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 113°C (235°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Oil Pressure	000100.01	Loss of Oil Pressure	Oil pressure drops below the threshold for running condition.	ECU derates engine 20% per minute until engine runs at 50% of full power.
Water in Fuel	000097.31	Water in Fuel	Water in fuel detected	ECU derates engine 20% per minute until engine runs at 50% of full power.
ECU	002000.13	Vehicle ID	Vehicle ID incorrect for expected ECU (wrong ECU).	ECU derates engine to 50% in one minute.

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Crawler (Forestry) - Torque Curve Selection

Torque Curve Selection for Crawlers	
Torque Curve	**Conditions**
0	Gears 5, 6, 7, and 8
2	Boost

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Crawler (Forestry) - Governor Mode Selection

Desired Speed Governor Mode Selection for Crawlers	
Governor Mode	**Conditions**
0	Desired/All speed governor
1	Low idle set at 1600 rpm on multi-state throttle
2	All speed governor - Invalid multi-state throttle
7	All speed governor - Multi-state throttle set at 0% = 1590 rpm or 100% = 2360.
8	Low speed governor

Max. Speed Governor Mode Selection for Crawlers	
Governor Mode	**Conditions**
9	High speed governor

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Crawler (Forestry) - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Ambient Air Temperature Input	T1	A
Battery Power (fused)	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Can be accessed from several places on engine harness
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Engine Coolant Temperature Input	X2	A
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Manifold Air Temperature Input	Y2	A
Oil Pressure Input	T2	C
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV’s Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
Sensor Return 1 and 2	N3, P2	B (Coolant Temp, Fuel Temp., Manifold Air Temp., Water-in-Fuel) A (Oil Pressure)
Sensor Supply (+5V excitation)	P1	B (Oil Pressure)
System Ground	C2, C3	Battery (-)
Warm-up Indicator Lamp	C1	B
Water In Fuel Input	Y3	A

RG41221,0000016 –19–02AUG02–1/1

Excavators - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications for Excavators				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 75% of full power.
	000110.15	Least Severe Temperature	Above 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 95% of full power.
	000110.16	Moderately High Temperature	Above 113°C (235°F)	ECU derates engine 4% per minute until engine runs at 90% of full power.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

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Excavators - Torque Curve Selection

Torque Curve Selection for Excavators	
Torque Curve #	**Conditions**
1	Default
2	Altitude derate (option)

RG41221,0000339 –19–01APR02–1/1

Excavators - Governor Mode Selection

Desired Speed Governor Mode Selection for Excavators	
Governor Mode	**Conditions**
0	Desired
8	Low speed governor

Max. Speed Governor Mode Selection for Excavators	
Governor Mode	**Conditions**
9	High speed governor

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Excavators - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal
Battery Power (fused)	B1, B2	Battery (+)
Battery Power, Switched	E3	F*
CAN High, CAN Low	L1, L2	Accessible in several connectors on engine harness.
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Engine Coolant Temperature Input	X2	A*
Engine Overtemp Light	C1	B*
Fault Lamp	B3	A
Fuel Pressure Sensor Input	M2	B
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Manifold Air Pressure Input	S2	B
Manifold Air Temperature Input	Y2	A
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV's Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
Sensor Return 1	P2	B (Coolant Temp, Fuel Temp., Manifold Air Temp., Water-in-Fuel) A (MAP, Fuel Pressure sensor
Sensor 5V Supply	P1	C (MAP, Fuel Pressure sensor
System Ground	C2, C3	Ground stud
Throttle Ground	T1	E*
Throttle Input	R2	D*
Throttle Reference	S3	C*
Water In Fuel Input	Y3	A

*Terminals in 8-way connector to Hitachi harness.

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850/950 Feller Bunchers, Forwarders, and Harvesters (Forestry) - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications for 850/950 Feller Bunchers, Forwarders, and Harvesters (Forestry)				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Fuel Temperature	000174.16	Moderately High Temperature	Above 65°C (149°F)	ECU derates engine 2% per minute until engine runs at 80% of full power only on 608 Feller Buncher models..
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Oil Pressure	000100.01	Loss of Oil Pressure	Oil pressure drops below the threshold for running condition.	ECU derates engine 40% per minute until engine runs at 60% of full power.
ECU	002000.13	ECU Source Address	Source address incorrect for expected ECU (wrong ECU).	ECU derates engine 500% per minute until engine runs at 50% of full power.

RG41221,000000E –19–02AUG02–1/1

850/950 Feller Bunchers, Forwarders, and Harvesters (Forestry) - Torque Curve Selection

Torque Curve Selection for 850/950 Feller Bunchers, Forwarders, and Harvesters (Forestry)	
Torque Curve #	**Conditions**
1	Default

RG41221,000000F –19–02AUG02–1/1

850/950 Feller Bunchers, Forwarders, and Harvesters (Forestry) - Governor Mode Selection

Desired Speed Governor Mode Selection for 850/950 Feller Bunchers, Forwarders, and Harvesters (Forestry)	
Governor Mode	**Conditions**
0	Desired/All speed governor
8	Low speed governor

Max. Speed Governor Mode Selection for 850/950 Feller Bunchers, Forwarders, and Harvesters (Forestry)	
Governor Mode	**Conditions**
9	High speed governor

RG41221,0000010 –19–02AUG02–1/1

850/950 Feller Bunchers, Forwarders, and Harvesters (Forestry) - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Battery Power, Fused	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Accessible in several connectors on engine harness
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Engine Coolant Temperature Input	X2	A
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Engine On/Off Signal for Vehicle Hourmeter (Feller Bunchers)	J3	Hourmeter Input
Manifold Air Temperature Input	Y2	A
Oil Pressure Input	T2	C
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV's Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
Sensor Return 1, 2	N3, P2	B (Coolant Temp, Fuel Temp., Manifold Air Temp., Water-in-Fuel) A (Oil Pressure Sensor)
Sensor 5V Supply 1	N1	B (Oil Pressure Sensor)
System Ground	C2, C2	Battery (-), Hourmeter
Water In Fuel Input	Y3	A

RG41221,0000011 –19–07APR03–1/1

Grader - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications for Graders				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Fuel Temperature	000174.16	Moderately High Temperature	Above 65°C (149°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Oil Pressure	000100.01	Loss of Oil Pressure	Oil pressure drops below the threshold for running condition.	ECU derates engine 40% or 60% per minute until engine runs at 60% or 40% of full power.
Water in Fuel	000097.31	Water in Fuel	Water in fuel detected for 1 hour	ECU derates engine 50% per minute until engine runs at 50% of full power..

WL30140,000000E –19–27JUL05–1/1

Grader - Torque Curve Selection

Torque Curve Selection for Graders	
Torque Curve	**Conditions**
1	Default

WL30140,000000F –19–27JUL05–1/1

Grader - Governor Mode Selection

Governor modes available are 9, 10, 11, and 12. Refer to equipment documentation for more information.

WL30140,0000010 –19–27JUL05–1/1

Grader - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Air Heater Relay	J3	86 (Low-power relay)
Battery Power	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Accessible in several connectors on engine harness
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cruise On	A3	See machine wiring diagram
Cruise Off	D1	See machine wiring diagram
Cruise Accel/Set	F3	See machine wiring diagram
Cruise Decel/Resume	G2	See machine wiring diagram
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Engine Coolant Temperature Input	X2	A
Filter Restriction Input	D3	Ground
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Manifold Air Temperature Input	Y2	A
Oil Pressure Input	T2	3
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV's Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
Sensor Return 1	N3	B (Manifold Air Temp., Water-in-Fuel) Analog Throttle
Sensor Return 2	P2	B (Coolant Temp, Fuel Temp.) A (Oil Pressure Sensor) Secondary Throttle
Sensor 5V Supply 1	N1	Analog Throttles
Sensor 5V Supply 2	P1	A (Oil Pressure Sensor) Secondary Throttle

Continued on next page
WL30140,0000011 –19–27JUL05–1/2

Soft Start Relay	H3	A11 (Veh. Load Ctr.)
System Ground	C2, C3	Battery (-), Air Heater Relay
Water In Fuel Input	Y3	A

WL30140,0000011 –19–27JUL05–2/2

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Loader - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications for Loaders				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Water in Fuel	000097.16	Water in Fuel	Water in fuel detected	ECU derates engine 20% per minute until engine runs at 50% of full power when water is detected for more than an hour.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG41221,0000006 –19–02AUG02–1/1

Loader - Torque Curve Selection

Torque Curve Selection for Loaders	
Torque Curve	**Conditions**
1	Default

RG41221,0000007 –19–02AUG02–1/1

Loader - Governor Mode Selection

Desired Speed Governor Mode Selection for Loaders	
Governor Mode	**Conditions**
0	Desired/All speed governor
8	Low speed governor

Max. Speed Governor Mode Selection for Loaders	
Governor Mode	**Conditions**
9	High speed governor

RG41221,0000008 –19–02AUG02–1/1

Loader - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Air Heater Relay	J3	Switch terminal, Low-power relay
Battery Power	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Accessible in several connectors on engine harness
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Engine Coolant Temperature Input	X2	A
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Manifold Air Temperature Input	Y2	A
Oil Pressure Input	T2	3
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV’s Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
Sensor Return 1	N3	B (Manifold Air Temp., Water-in-Fuel) Analog Throttle
Sensor Return 2	P2	B (Coolant Temp, Fuel Temp.) A (Oil Pressure Sensor)
Sensor 5V Supply	P1	B (Oil Pressure Sensor)
System Ground	C2, C3	Battery (-), Air Heater Relay
Water In Fuel Input	Y3	A

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OEM Engines - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Continued on next page RG41221,0000343 –19–01APR02–1/3

Derate Specifications for OEM Engines				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Analog Throttle (A)	000029.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000029.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Analog Throttle (B)	000028.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000028.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
	000111.01	Extremely High Temperature (Coolant Level Low)	Above 124°C (255°F). Coolant temperature this high assumes that the sensor is not immersed.	ECU derates engine to 40% of full power in one minute. Shutdown optional.
External Shutdown Switch	000970.31	Depends on what is being monitored.	Value set by external device.	Customer selectable: ECU shuts down engine immediately or in 30 seconds.
External Derate Switch	000971.31	Depends on what is being monitored.	Value set by external device.	Customer selectable: ECU derates engine at 20% per minute, 50% per minute, or 20% in 10 minutes.
Fuel Rail Pressure	000094.03	High Input Voltage	Above 4.7 Volts	Default fuel rail pressure 160 MPa (1600 bar) (23,206 psi)
	000094.04	Low Input Voltage	Below 0.9 Volts	Default fuel rail pressure 160 MPa (1600 bar) (23,206 psi)
Fuel Temperature	000174.00	Most Severe Temperature	Above 73°C (163°F)	ECU derates engine 2% per minute until engine runs at 60% of full power.
	000174.16	Moderately High Temperature	Above 65°C (149°F)	ECU derates engine 2% per minute until engine runs at 60% of full power.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

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Derate Specifications for OEM Engines				
Oil Pressure	000100.01	Loss of Oil Pressure	Oil pressure drops below the threshold for running condition.	ECU derates engine 40% per minute until engine runs at 40% of full power. Shutdown optional.
	000100.18	Loss of Oil Pressure	Oil pressure drops below the threshold for running condition.	ECU derates engine 2% per minute until engine runs at 80% of full power. Shutdown optional.
Water in Fuel	000097.00	Water in Fuel Most Severe	Water in fuel detected - Most Severe	ECU derates engine to 60% of full power in one minute. Shutdown optional.
	000097.16	Water in Fuel Moderately Severe	Water in fuel detected - Moderately Severe	ECU derates engine 2% per minute until engine runs at 80% of full power. Shutdown optional.

RG41221,0000343 –19–01APR02–3/3

OEM Engines - Torque Curve Selection

Torque Curve Selection for OEM (6081 H) Engines		
Torque Curve	**Engine Application Guideline Power Curve**	**Jumper Wire on Performance Connector:**
1	Intermittent	No jumper wires installed.
2	Continuous	Jumper wire installed between terminal A and F only.
3	Heavy Duty	Jumper wire installed between terminal B and E only.
4	Power Curve 4	Jumper wire installed between terminal A and B only.

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OEM Engines - Governor Mode Selection With OC03040 Software or Later

NOTE: To determine the ECU software for this engine, read ECU Software Part Number using the diagnostic software. The later the software, the higher the number will be.

Desired Speed Governor Mode Selection for OEM Engines	
Governor Mode	**Conditions**
0	Normal Droop - (Default Gainset)
1	Isochronous Droop- (Default Gainset)
2	Normal Droop - (Selectable Gainset)
3	Isochronous Droop- (Selectable Gainset)
6	Engine Cruise

Desired Speed Governor Mode Selection for OEM Engines	
Governor Mode	**Conditions**
9	Normal Droop - (Default Gainset)
10	Isochronous Droop- (Default Gainset)
11	Normal Droop - (Selectable Gainset)
12	Isochronous Droop- (Selectable Gainset)
15	Absolute Maxspeed (used for speed derates)

RG41221,00000F4 –19–03FEB03–1/1

OEM Engines - Governor Mode Selection With OC03036 Software or Earlier

NOTE: To determine the ECU software for this engine, read ECU Software Part Number using the diagnostic software. The earlier the software, the lower the number will be.

Desired Speed Governor Mode Selection for OEM (6081 H) Engines		
Governor Mode	**Conditions**	**Jumper Wire on Performance Connector:**
0	Normal Operation	No jumper wires installed
1	Isochronous Governoring	Jumper wire installed between terminal C and D only.
8	Low speed governor	

Max. Speed Governor Mode Selection for OEM (6081 H) Engines		
Governor Mode	**Conditions**	**Jumper Wire on Performance Connector:**
9	High speed governor	No jumper wires installed
10	Isochronous high speed	Jumper wire installed between terminal C and D only.

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OEM Engines - ECU Terminal Identification

ECU Terminal Function	ECU Pin #	Connector Terminal #	Circuit #	Wire Color
Air Heater Input (ground)	J3	Switch terminal, Low-power relay	429	White
Air Heater Wait Lamp Signal (ground)	C1	lamp ground terminal	474	Yellow
Analog Throttle A 5V Supply	N1	C	911	Brown
Analog Throttle A Input	S3	B	915	Green
Analog Throttle B Input	S1	C	913	Orange
Battery Power	B1, B2	Battery (+)	022	Red
Battery Power, Switched	E3	IGN	012	Red
Bump Down	G3	A	936	Blue
Bump Enable	D1	A	923	Orange
Bump Up	G2	C	955	Green
CAN High	L1	Available in several engine harness connectors.	904	Yellow
CAN Low	L2	905	Green	
Crankshaft Position Sensor Input	W1	B	447	Purple
Crankshaft Position Sensor Return	W2	A	448	Gray
Cruise ON	F3	Cruise On switch, ground side	954	Yellow
Cruise Cancel/Resume/ Turn Around	T3	Cancel/Resume switch, ground side	981	Brown
Cruise Brake Enable	D1	Brake switch, ground side Also clutch switch when applicable	923	Orange
Cruise Set/Accel/Bump Up	G2	Momentary switch, ground side	955	Dk. Green
Cruise Cancel/Resume	G3	Momentary switch, ground side	936	Blue
Customer Loss of Coolant Input	T1	see application schematic	948	Gray
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8	491	Brown
Cylinder 1 EI Control	E1	1	493	Orange
Cylinder 2 EI Control	F1	2	494	Yellow
Cylinder 3 EI Control	H1	3	495	Green
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7	496	Blue
Cylinder 4 EI Control	F2	4	497	Purple
Cylinder 5 EI Control	E2	5	498	Gray
Cylinder 6 EI Control	G1	6	499	White

Continued on next page

RG41221,0000068 –19–01APR02–1/2

Engine Coolant Temperature Input	X2	A	461	Brown
External Derate	D2	see application schematic	939	White
External Shutdown Input	N2	shutdown switch	941	Brown

RG41221,0000068 –19–01APR02–2/2

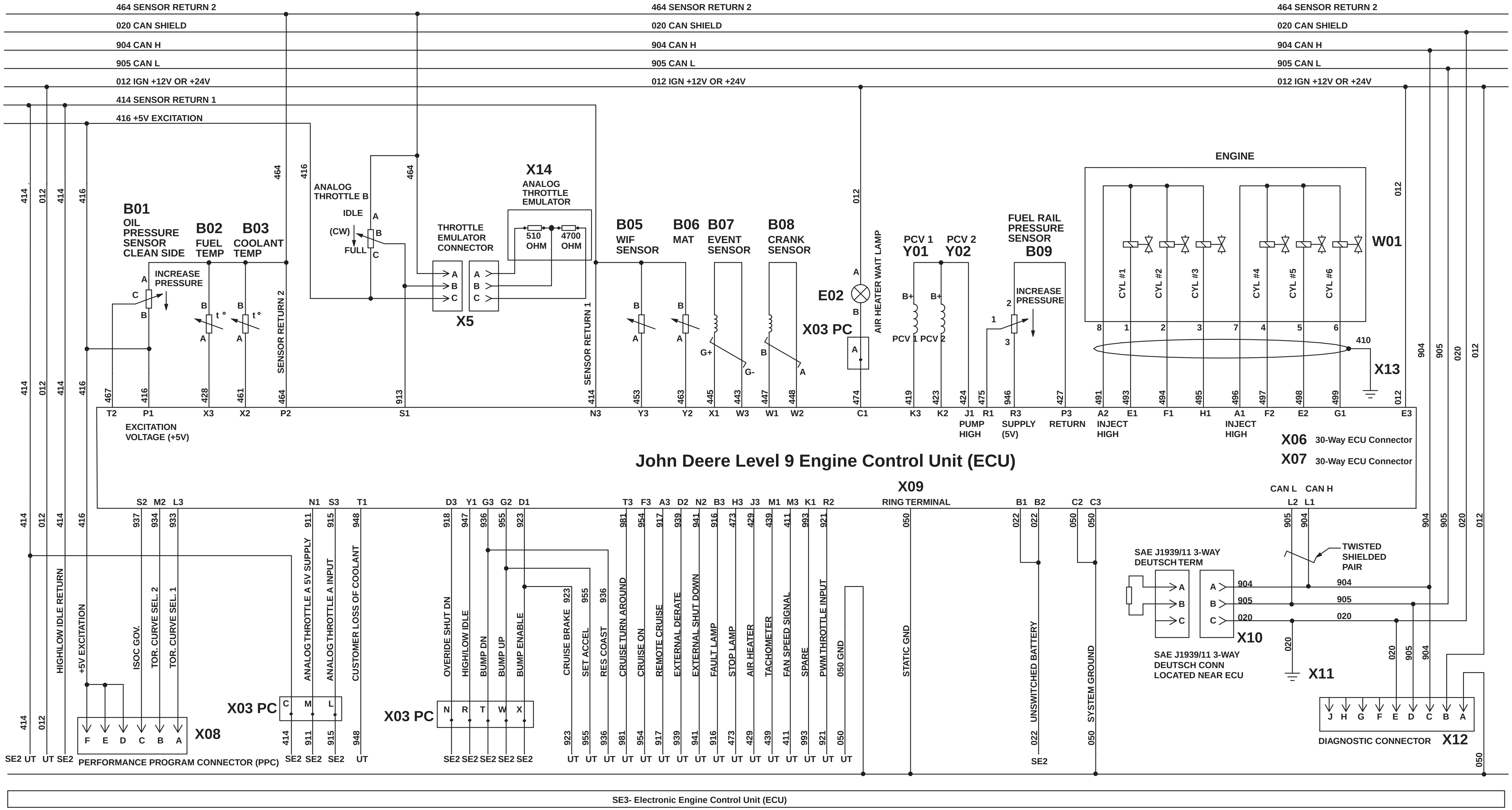
OEM Engines - ECU Terminal Identification - Continued

ECU Terminal Function	ECU Pin #	Connector Terminal #	Circuit #	Wire Color
Fuel Rail Pressure Sensor 5V Supply	R3	3	946	Blue
Fuel Rail Pressure Sensor Input	R1	1	475	Green
Fuel Rail Pressure Sensor Return	P3	2	427	Purple
Fuel Temperature Input	X3	A	428	Gray
High/Low Idle Input	Y1	B	947	Purple
Isochronous Governor	S2	C	937	Purple
MAT Input	Y2	A	463	Orange
Oil Pressure Input	T2	C	467	Purple
PCV 1 Return	K3	PCV1	419	White
PCV 2 Return	K2	PCV2	423	Orange
PCV’s Supply Voltage	J1	B+	424	Yellow
Pump Position Sensor Input	X1	G+	445	Green
Pump Position Sensor Return	W3	G-	443	Orange
PWM Throttle Input	R2	see application schematic	921	Brown
Remote Cruise	A3	see application schematic	917	Purple
Sensor 5V Supply	P1	B (Fuel Pressure, Oil Pressure) C (MAP)	416	Blue
Sensor Return 1	N3	Manifold Air Temp., WIF	914	Yellow
Sensor Return 2	P2	MAP, Oil Pressure, Fuel Temp., Coolant Temp., Fuel Pressure	415	Yellow
Shutdown Override	D3	B	918	Yellow, Gray
Stop Lamp	H3	lamp ground terminal	473	Orange
System Ground	C2, C3	Battery (-)	050	Black
Tachometer	M1	tach input	439	White
Throttle Switch: Dual State, Tri-State, or Ramp	Y1	B	947	Violet
Torque Curve Select 1	L3	A	933	Orange
Torque Curve Select 2	M2	B	934	Yellow
Warning (Fault) Lamp	B3	lamp ground terminal	916	Lt. Blue
WIF Input	Y3	A	453	Orange

RG41221,000006F –19–29AUG01–1/1

Electronic Control System Wiring Diagram

RG11345 –19–24OCT01



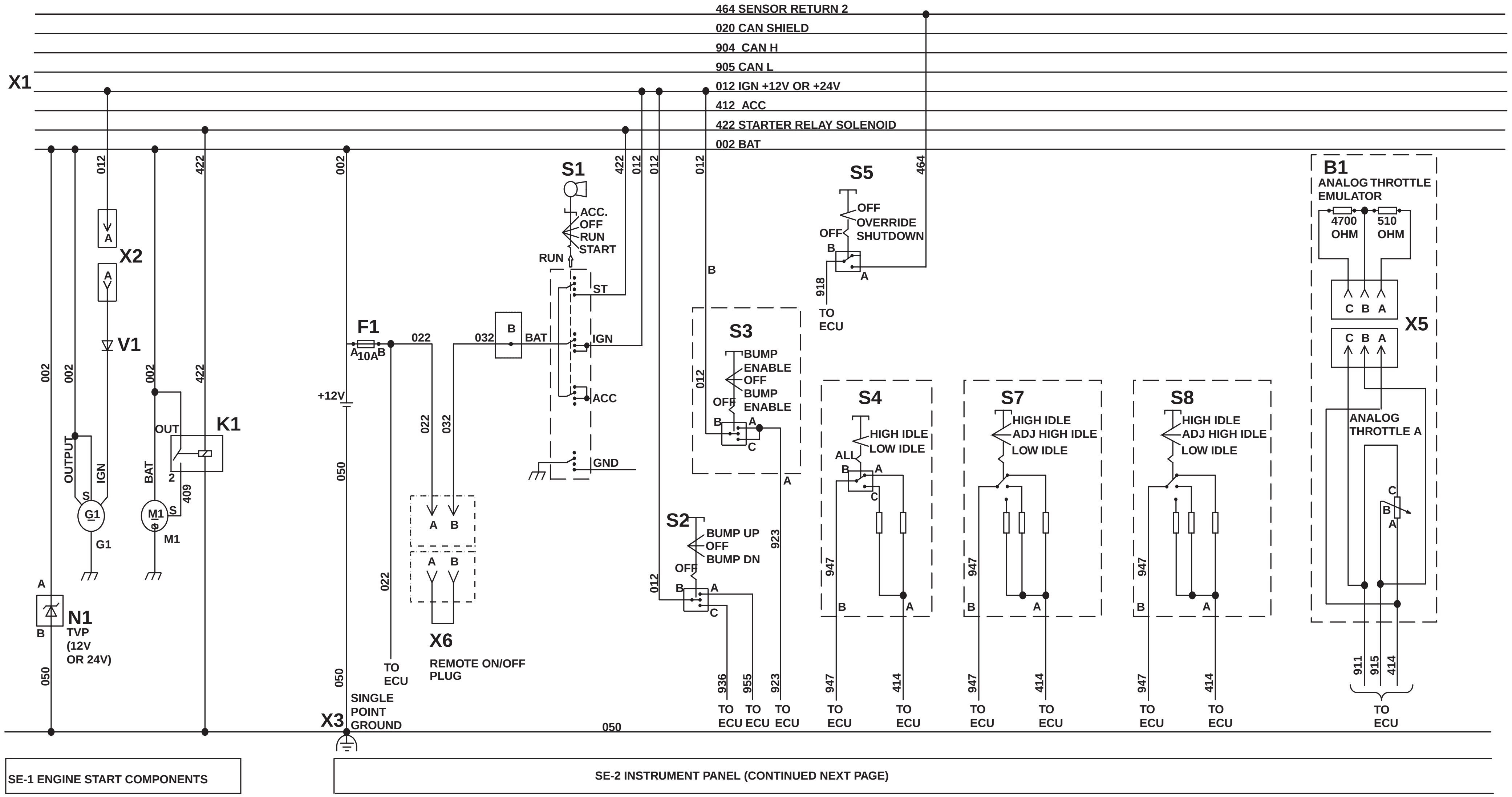
RG41221,000005B –19–13OCT00–1/2

B01—Oil Pressure Sensor
B02—Fuel Temperature Sensor
B03—Coolant Temperature Sensor
B05—Water In Fuel Sensor
B06—Manifold Air Temperature Sensor
B07—Pump Position Sensor
B08—Crankshaft Position Sensor
B09—Fuel Rail Pressure Sensor
E02—Air Heater Wait Lamp
W01—Electronic Injectors (6)
X03—Panel Connector
X06—30-way ECU Connector (A-K)
X07—30-way ECU Connector (L-Y)
X08—Performance Program Connector
X09—ECU Ground Ring Terminal
X10—CAN Terminator
X11—CAN Ground
X12—Diagnostic Connector
X13—Electronic Injector Ground
X14—Analog Throttle (B)
Y01—Pump Control Valve 1
Y02—Pump Control Valve 2

RG41221,000005B –19–13OCT00–2/2

6081 OEM Application Instrument Panel/Engine Start Components Electrical Wiring Diagram

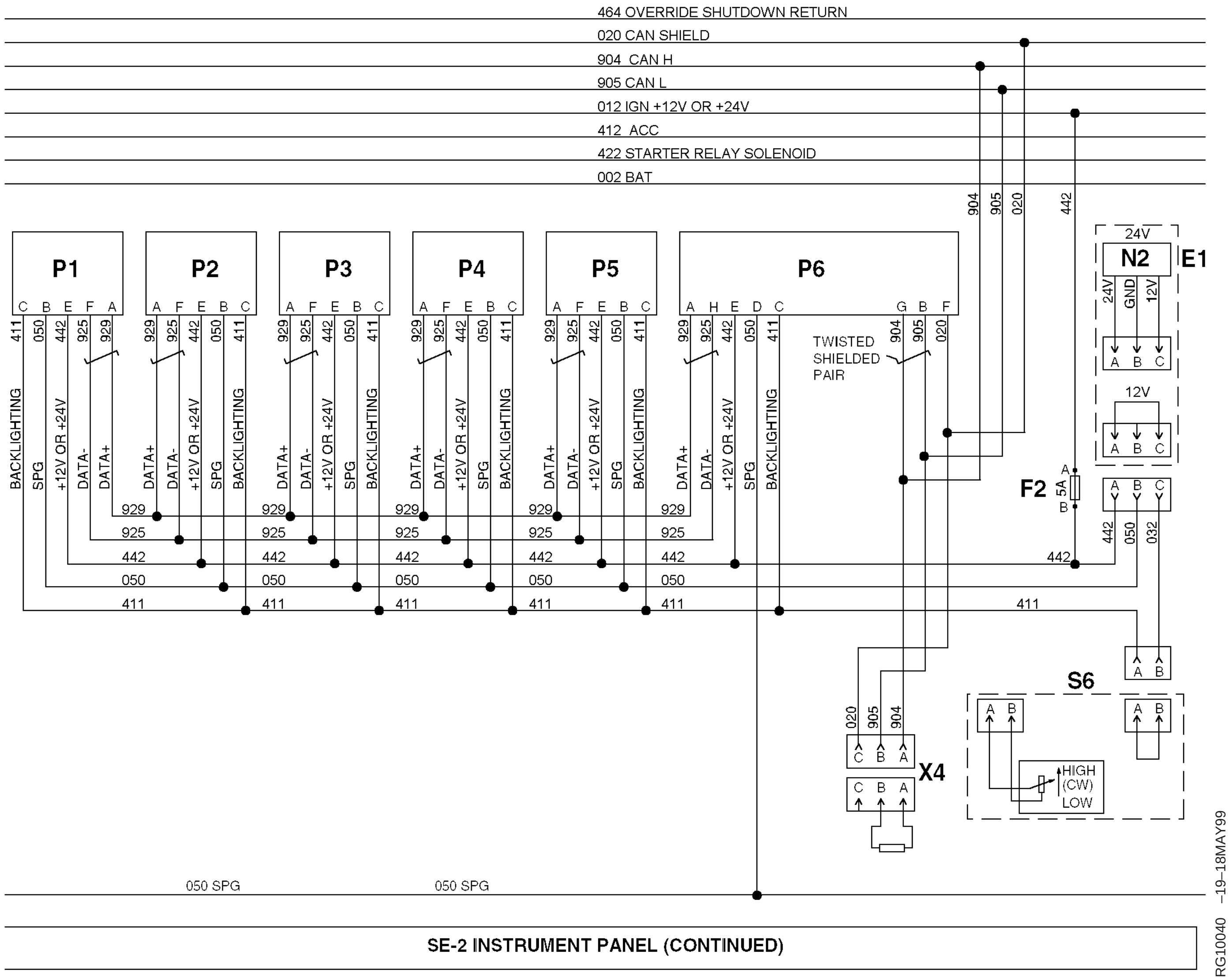
RG12288 –19–23AUG02



B1—Analog Throttle Emulator
E1—Back Light Regulator (24V) or Plug (12V)
F1—Fuse (10 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
S1—Ignition Key Switch
S2—Speed Select Switch (Momentary)
S3—Bump Enable Switch (Momentary
S4—Dual State Throttle Switch
S5—Override Shutdown Switch (Momentary)
S6—Dimmer Control or Jumper Plug
S7—Tri-state Throttle Switch
S8—Ramp Throttle Switch
V1—Diode
X1—Vehicle Harness Connector
X2—Alternator Harness Connector
X3—Single Point Ground
X4—CAN Terminator
X5—Analog Throttle Connector
X6—Remote On/Off Plug

RG41221,000006D –19–21NOV00–1/1

6081 OEM Application Instrument Panel/Engine Start Components Electrical Wiring Diagram - Continued



B1—Analog Throttle Emulator
E1—Back Light Regulator (24V) or Plug (12V)
F1—Fuse (10 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
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
V1—Diode
X1—Vehicle Harness Connector
X2—Alternator Harness Connector
X3—Single Point Ground
X4—CAN Terminator
X5—Analog Throttle Connector
X6—Remote On/Off Plug

RG41221,000006E –19–21NOV00–1/1

Self-Propelled Forage Harvester - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications for Self-Propelled Forage Harvester				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 40% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000111.01	Extremely High Temperature (Coolant Level Low)	Above 124°C (255°F). Coolant temperature this high assumes that the sensor is not immersed.	ECU derates engine to 40% of full power in one minute.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG41221,000001D –19–02AUG02–1/1

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210
38

Self-Propelled Forage Harvester - Torque Curve Selection

Torque Curve Selection for Self-Propelled Forage Harvester	
Torque Curve	**Conditions**
0	Default

RG41221,000001E –19–02AUG02–1/1

Self-Propelled Forage Harvester - Governor Mode Selection

Desired Speed Governor Mode Selection for Self-Propelled Forage Harvester	
Governor Mode	**Conditions**
0	Desired/All speed governor
8	Low speed governor

Max. Speed Governor Mode Selection for Self-Propelled Forage Harvester	
Governor Mode	**Conditions**
9	High speed governor
10	High speed governor in 3rd gear

RG41221,000001F –19–02AUG02–1/1

Self-Propelled Forage Harvester - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Air Vacuum Switch Input	D2	B
Battery Power	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Accessible from several locations on engine harness
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Engine Coolant Level Input	T1	B
Engine Coolant Temperature Input	X2	A
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Manifold Air Temperature Input	Y2	A
Oil Pressure Input	D3	B
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV's Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
Sensor Return 1	N3	See Application Schematic
Sensor Return 2	P2	See Application Schematic
System Ground	C2, C3	Battery (-)
Water In Fuel Input	Y3	A

RG41221,0000020 –19–02AUG02–1/1

Skidders (Forestry) - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications for Skidders				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Oil Pressure	000100.01	Loss of Oil Pressure	Oil pressure drops below the threshold for running condition.	ECU derates engine 20% per minute until engine runs at 60% of full power.
Water in Fuel	000097.31	Water in Fuel	Water in fuel detected	ECU derates engine 20% per minute until engine runs at 50% of full power.
ECU	002000.13	Option Code	ECU code stored in monitor does not match current ECU.	ECU derates engine 50%. Will only idle.

RG41221,0000012 –19–02AUG02–1/1

Skidders (Forestry) - Torque Curve Selection

Torque Curve Selection for Skidders	
Torque Curve	**Conditions**
1	Gears 5, 6, 7, and 8
2	Gears 3 and 4
3	Gears 1, 2, and R

RG41221,0000014 –19–02AUG02–1/1

Skidders (Forestry) - Governor Mode Selection

Desired Speed Governor Mode Selection for Skidders	
Governor Mode	**Conditions**
0	Desired/All speed governor
1	Low idle set at 1600 rpm on multi-state throttle
2	All speed governor - Invalid multi-state throttle
7	All speed governor - Multi-state throttle set at 0% = 1590 rpm or 100% = 2360.
8	Low speed governor

Max. Speed Governor Mode Selection for Skidders	
Governor Mode	**Conditions**
9	High speed governor

RG41221,0000015 –19–02AUG02–1/1

Skidders (Forestry) - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Battery Power (fused)	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Can be accessed from several places on engine harness
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Engine Coolant Temperature Input	X2	A
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Manifold Air Temperature Input	Y2	A
Oil Pressure Input	T2	C
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV’s Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
Sensor Return 1 and 2	N3, P2	B (Coolant Temp, Fuel Temp., Manifold Air Temp., Water-in-Fuel) A (Oil Pressure)
System Ground	C2, C3	Battery (-)
Throttle Input, Tri-State	Y1	B
Water In Fuel Input	Y3	A

RG41221,0000016 –19–02AUG02–1/1

Sprayer - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.15	Least Severe High Temperature	Above 110°C (230°F)	No Derate.
	000110.16	Moderately High Temperature	Above 112°C (234°F)	ECU derates engine 2% per minute until engine runs at 90% of full power.
Engine Oil Temperature Switch (optional)	000100.01	Pressure Low	Below 103 kPa.	ECU derates engine to 60% of full power.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Water in Fuel	000097.31	Water in Fuel	Water in fuel detected	ECU derates engine 20% per minute until engine runs at 50% of full power.

WL30140,0000012 –19–28JUL05–1/1

Sprayer - Torque Curve Selection

Torque Curve Selection for Sprayer	
Torque Curve	**Conditions**
1	Default

WL30140,0000013 –19–28JUL05–1/1

Sprayer - Governor Mode Selection

The sprayer uses an all-speed (variable speed) governor with speed droop. There is a single low-idle speed.

Fast-Idle Governor Mode Selection for Sprayer	
Governor Mode	**Conditions**
0	No CAN message/Error. Default 2450 rpm fast idle, 2450 breakaway
1	Field operation: 2450 rpm fast idle, 2450 breakaway
2	Transport operation: 2540 rpm fast idle, 2450 breakaway (2540 to 65kw)
3	Remote load operation: 1800 rpm fast idle, 1800 rpm breakaway.

WL30140,0000014 –19–28JUL05–1/1

Sprayer - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Air Filter Switch (optional)	D2	B
Battery Power (fused)	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Can be accessed from several places on engine harness
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
ELX Power	G2	E (chassis harness)
Engine Coolant Temperature Input	X2	A
Frequency (Radar Sensor) Input	M3	C
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	2
Fuel Rail Pressure Sensor Return	P3	1
Fuel Temperature Input	X3	A
Manifold Air Temperature Input	Y2	A
Oil Pressure Switch (optional)	D3	A
PCV 1 Return	K2	PCV1
PCV 2 Return	K3	PCV2
PCV's Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
Sensor Return 1	N3	B (Manifold Air Temp., Water-in-Fuel)
Sensor Return 12	P2	B (Coolant Temp, Fuel Temp., Hyd. Oil Press, Hyd Oil Temp.)
Sensor Supply 2 (+5V excitation)	P1	(Hyd. Oil Pressure)
System Ground	C2, C3	Battery (-)
Water In Fuel Input	Y3	A

WL30140,0000015 –19–28JUL05–1/1

Tractors - 7010 Series - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications for Tractors - 7010 Series				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 114°C (237°F)	ECU derates engine 40% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 111°C (232°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 95°C (203°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG41221,0000017 –19–02AUG02–1/1

Tractors - 7010 Series - Torque Curve Selection

Torque Curve Selection for 7010 Series Tractors (IVT)[a]	
Torque Curve	**Conditions**
0	When an error has occurred.
1	Normal Operation
2	Transport Boost
3	Power derate curve.
4	PTO Boost
[a]Infinite Variable Transmission	

Torque Curve Selection for 7010 Series Tractors (APQ)[a]	
Torque Curve	**Conditions**
0	When an error has occurred.
1	Normal Operation
2	Transport Boost
3	Field Cruise or Power derate curve
[a]Auto Power Quad Transmission	

Torque Curve Selection for 7010 Series Tractors (MPQ[a] PR[b] PST)[c]	
Torque Curve	**Conditions**
0	Default
[a]Mechanical Power Quad Transmission	
[b]Power Reverser	
[c]Power Shift Transmission	

RG41221,000001A –19–02AUG02–1/1

Tractors - 7010 Series - Governor Mode Selection

Desire Speed Governor Mode Selection on 7010 Series Tractors (IVT)[a]	
Governor Mode	**Condition**
0	Normal droop
1	Isochronous
2	Isochronous with high gains
3	Droop with high gains
[a]Infinite Variable Transmission	

Max. Speed Governor Mode Selection on 7010 Series Tractors (IVT)[a]	
Governor Mode	**Condition**
9	High speed governor
10	High speed governor Isochronous
[a]Infinite Variable Transmission	

Desire Speed Governor Mode Selection on 7010 Series Tractors (APQ[a] MPQ[b] PR)[c]	
Governor Mode	**Condition**
0	Normal droop
1	Field Cruise - APQ
[a]Auto Power Quad Transmission	
[b]Mechanical Power Quad Transmission	
[c]Power Reverser	

Max. Speed Governor Mode Selection on 7010 Series Tractors (APQ[a] MPQ[b] PR)[c]	
Governor Mode	**Condition**
11	High speed governor - AP - PR - MPQ
12	High speed governor - APQ
[a]Auto Power Quad Transmission	
[b]Mechanical Power Quad Transmission	
[c]Power Reverser	

Desire Speed Governor Mode Selection on 7010 Series Tractors (PST)[a]	
Governor Mode	**Condition**
0	Default
[a]Power Shift Transmission	

Max. Speed Governor Mode Selection on 7010 Series Tractors (PST)[a]	
Governor Mode	**Condition**
11	High speed governor
[a]Power Shift Transmission	

RG41221,000001B –19–03APR03–1/1

Tractors - 7010 Series - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Battery Power	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Available at several connectors on engine harness
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Engine Coolant Temperature Input	X2	A
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Manifold Air Temperature Input	Y2	A
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV’s Supply Voltage	J1	B+
Pump Position Sensor Input	X1	A
Pump Position Sensor Return	W3	B
Sensor Return 1	N3	
Sensor Return 2	P2	
Sensor 5V Supply	P1	
Battery Power, Switched	E3	IGN
System Ground	C2, C2	Battery (-)
Tachometer	M1	Tach. input
Water In Fuel Input	Y3	A

RG41221,000001C –19–02AUG02–1/1

Tractors - 7020 Series - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications for Tractors - 7020 Series				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
ECU Mismatch	000237.02	Serial number	Incorrect Serial #	After 2 hours running, derates engine to 90%.
	000237.13	Option code	Incorrect option code received	Derates to low idle.
	000237.31	VIN #	No valid response to VIN request	Derates to low idle.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 112°C (234°F)	ECU derates engine 2% per minute until engine runs at 90% of full power.
	000110.31	High Temperature	Above 107°C - 110°C (225°F- 230°F)	Power Management Active (7920 only). ECU derates engine 2% per degree C until engine runs at 94% of full power.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Oil Pressure	000100.01	Loss of Oil Pressure	Oil pressure drops below threshold for running condition.	ECU derates engine 40% per minute until engine runs at 40% of full power.
	000100.18	Loss of Oil Pressure	Oil pressure drops below threshold for running condition.	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG41221,0000117 –19–03APR03–1/1

Tractors - 7020 Series - Torque Curve Selection

Torque Curve Selection for 7020 Series Tractors	
Torque Curve	**Conditions**
0	When an error has occurred.
1	Normal Operation
2	Transport Boost (Not used on 30KPQ[a]
3	Constant Power (Field Cruise) (30K —PQ[a]only during engine derate)
4	PTO Boost (IVT[b] only)
[a]Power Quad Transmission	
[b]Infinite Variable Transmission	

RG41221,0000118 –19–03APR03–1/1

Tractors - 7020 Series - Governor Mode Selection

Available Governor Modes—7020 Series Tractors				
Governor Mode	**Description**	**Fast Idle**	**Breakaway**	**Droop**
1	IVT[a] Drooped - Standard Gains	2260	2200	60
2	IVT[a] Isochronous - Standard Gains	2200	2200	0
3	IVT[a] Isochronous - High Speed Gains	2200	2200	0
4	IVT[a] Drooped - High Speed Gains	2260	2200	60
5	PQ[b]/APQ[c] Normal Droop	2210	2150	60
6	PQ[b]/APQ[c] Field Cruise	2100	2100	0
[a]Infinite Variable Transmission				
[b]Power Quad Transmission				
[c]Auto Power Quad Transmission				

RG41221,0000119 –19–03APR03–1/1

Tractors - 7020 Series - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Air Filter Vacuum Switch Input	G3	B
Battery Power	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Available in several engine harness connectors.
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
ELX Power Sense	G2	See vehicle schematic
Engine Coolant Temperature Input	X2	A
Fan Solenoid Control	J2	4
Fan Speed Signal	M3	1
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Manifold Air Temperature Input	Y2	A
Oil Pressure Input	T2	C
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV's Supply Voltage	J1	B+
Pump Position Sensor Input	X1	A
Pump Position Sensor Return	W3	B
Sensor Return 1 and 2	N3, P2	B (Coolant Temp, Fuel Temp., Manifold Air Temp., Water-in-Fuel) A (Oil Pressure) 2 (Fan Speed)
Sensor 5V Supply	P1	B (Oil Pressure) C (MAP) 5 (Fan Speed)
System Ground	C2, C3	Battery (-)
Water In Fuel Input	Y3	A

RG41221,000011A –19–03APR03–1/1

Tractors - 8020 Series - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications for Tractors - 8020 Series				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 112°C (230°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

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Tractors - 8020 Series - Torque Curve Selection

Torque Curve Selection for 8020 Series Wheel and Track Tractors	
Torque Curve	**Conditions**
0	When an error has occurred.
1	Normal Operation
2	When Field Cruise is activated.
3	When in any reverse speed.
4	Hitch down derate
5	Loader derate (8320 power)

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Tractors - 8020 Series - Governor Mode Selection

Desire Speed Governor Mode Selection on 8020 Series Wheel and Track Tractors	
Governor Mode	**Condition**
0	Normal droop
1	Transmission Calibration
2	Field Cruise
3	16th gear/grp 48
4	16th gear/grp 47
5	16th gear/tracks
6	15th gear/30 kph
7	When in any reverse speed
8	Low speed governor

Max. Speed Governor Mode Selection on 8020 Series Wheel and Track Tractors	
Governor Mode	**Condition**
9	High speed governor

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Tractors - 8020 Series - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Battery Power	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Available in several engine harness connectors.
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
Engine Coolant Temperature Input	X2	A
Engine Speed Out	M1	G1
Fan Drive Solenoid Control	J2	B
Fan Speed Signal	M3	E
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Manifold Air Temperature Input	Y2	A
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV’s Supply Voltage	J1	B+
Pump Position Sensor Input	X1	A
Pump Position Sensor Return	W3	B
Sensor Return 1	N3	B
Sensor Return 2	P2	B (sensors) D (Hall effect device—fan drive)
Sensor 5V Supply	P1	A (Hall effect device—fan drive)
System Ground	C2, C3	Battery (-)
Water In Fuel Input	Y3	A

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Tractors - 9120 Series - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if it must derate an engine.

Derate Specifications for Tractors - 9120 Series				
Sensor	**SPN-FMI**	**Parameter**	**Value**	**Derate**
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Above 113°C (235°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.16	Moderately High Temperature	Above 111°C (232°F)	ECU derates engine 2% per minute until engine runs at 90% of full power.
Manifold Air Temperature (MAT)	000105.16	Moderately High Temperature	Above 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Water in Fuel	000097.16	Water in Fuel	Water in fuel detected - Moderately Severe	ECU derates engine 20% per minute until engine runs at 60% of full power.

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Tractors - 9120 Series - Torque Curve Selection

Torque Curve Selection for 9120 Series Tractors	
Torque Curve	**Conditions**
0	Default

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Tractors - 9120 Series - Governor Mode Selection

Desired Speed Governor Mode Selection for 9120 Series Tractors	
Governor Mode	**Conditions**
0	Normal Operation
1	Field Cruise with Isochronous Governoring
8	Low speed governor

Max. Speed Governor Mode Selection for 9120 Series Tractors	
Governor Mode	**Conditions**
9	High speed governor

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Tractors - 9120 Series - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Connector Terminal #
Battery Power	B1, B2	Battery (+)
Battery Power, Switched	E3	IGN
CAN High, CAN Low	L1, L2	Available in several connectors on engine harness
Crankshaft Position Sensor Input	W1	B
Crankshaft Position Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
ELX Power Sense	G2	K4
Engine Coolant Temperature Input	X2	A
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Isochronous Governor	G3	S2
Manifold Air Temperature Input	Y2	A
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV's Supply Voltage	J1	B+
Pump Position Sensor Input	X1	G+
Pump Position Sensor Return	W3	G-
PWM Throttle Input	R2	P1
Sensor Return 1	N3	B
Sensor Return 2	P2	B
System Ground	C2, C3	Battery (-)
Tachometer	M1	A1
Water In Fuel Input	Y3	A

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