JOHN DEERE

COMPONENT TECHNICAL MANUAL

PowerTech® 10.5 & 12.5 L Diesel Engines
Level 6 Electronic Fuel Systems
Fuel Systems with Lucas EUIs

CTM188 14MAY03 (English)

POWERTECH 10.5 L & 12.5 L Diesel Engines Level 6 Electronic Fuel Systems With Lucas EUIs

TECHNICAL MANUAL

14MAY03 (ENGLISH)

For complete service information also see:

POWERTECH® **10.5 L & 12.5 L Diesel Engines—Base Engine . . . .**	**CTM100**
Alternators and Starter Motors	**CTM77**
OEM Engine Accessories	**CTM67 (English Only)**

John Deere Power Systems

LITHO IN U.S.A.

Introduction

Foreword

This manual is written for an experienced technician. Special tools required in performing certain service work are identified in this manual and are recommended for use.

This manual (CTM188) covers the dual rail and single rail fuel systems on 10.5 L and 12.5 L engines with John Deere Level 6 electronic fuel control. It is one of three volumes. The following two companion manuals cover the base engine and Lucas electronic fuel systems:

- CTM100—10.5 L and 12.5 L Diesel Engines—Base Engine
- CTM115—10.5 L and 12.5 L Diesel Engines—Lucas Electronic Fuel Systems With Lucas EUIs

This new CTM includes single rail fuel system, dual rail fuel system and electrical engine control repair procedures formerly in CTM100, Groups 35, 36 and 45 (9NOV99).

A complete set of all three manuals covering 10.5 L and 12.5 L engines can be procured by ordering CTM650 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 in this manual, be alert to the potential for personal injury.

Use this component technical manual in conjunction with the base engine repair manual (CTM100) and the respective machine technical manual. See the repair manual for information on component removal and installation, and gaining access to the components.

This manual is divided in three parts: repair, theory of operation and diagnostics. Repair procedures are provided for the fuel system and electrical engine control system. The theory of operation section contains information that explains how these engine subsystems operate. The diagnostics section helps identify the cause of engine problems.

Applicable special tools and other materials needed to do the job, specifications, and helpful reference materials are covered in separate groups toward end of manual.

Engine Training Guide (DSEGET550A) is available to give the service technician a detailed overview of general engine construction and design features. This manual is recommended prior to performing major service procedures on *POWERTECH*® 10.5 L and 12.5 L engines.

Fundamental service information is available from other sources covering basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic type of failures and their causes.

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

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.

CTM115,IFC –19–12JAN99–1/1

John Deere Dealers

SECTION 01—GROUP 001 (Engine Identification)

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

SECTION 01—GROUP 002 (Fuels)

- Updated general information on diesel fuels.

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

- Added fuel system repair procedures formerly in CTM100, Group 35.
- Revised procedure for replacement of fuel filters and water separator.
- Revised procedure for adjusting electronic unit injector preload.

SECTION 02—GROUP 091 (Single Rail Fuel System Repair and Adjustments)

- Added fuel system repair procedures formerly in CTM100, Group 36.
- Revised repair procedure for fuel filter/water separator.
- Revised procedure for adjusting electronic unit injector preload.

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

- Added electrical engine control repair procedures formerly in CTM100, Group 45.
- Revised procedures for repair of electrical connectors.

SECTION 03—GROUP 130 (Electronic Fuel System Operation)

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

SECTION 03—GROUP 140 (Electronic Fuel System Operation)

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

SECTION 04—GROUP 150 (Observable Diagnostics and Tests)

- Revised diagnostic procedures for low pressure fuel system.
- New diagnostic procedure for diagnostic gauge.

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

- Revised and new trouble code diagnostic and test procedures for John Deere Level 6 electronic controlled fuel system.

SECTION 05 (Tools and Other Materials)

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

SECTION 06 (Specifications)

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

OUO1004,0000C48 –19–20DEC00–1/1

Contents

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 Information

Contents

Handle Fluids Safely—Avoid Fires

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

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

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

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

TS227 –UN–23AUG88

Avoid Fires

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

Store Safely

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

Cooling System

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 voltmeter or hydrometer.

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

TS204 –UN–23AUG88

Battery Explosions

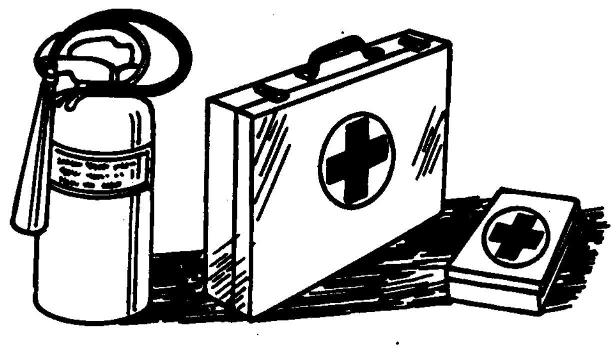
DX,SPARKS –19–03MAR93–1/1

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

First Aid Kit

DX,FIRE2 –19–03MAR93–1/1

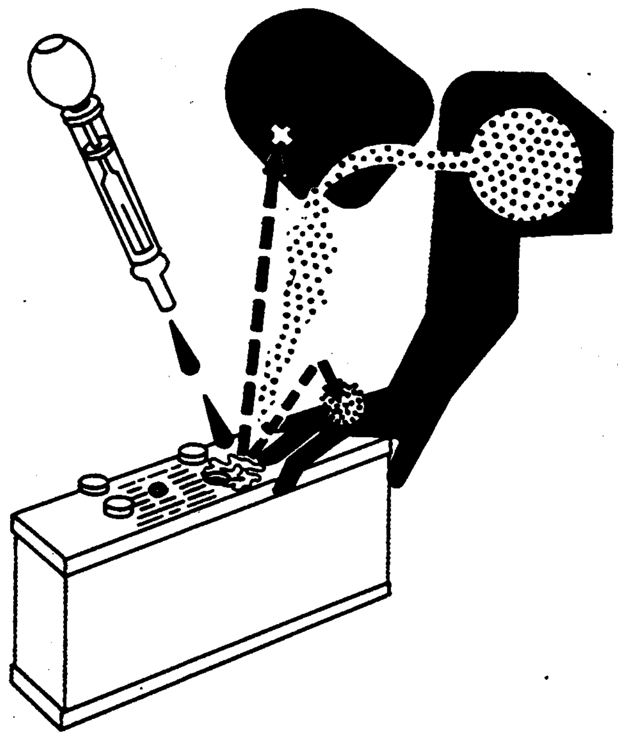
Handling Batteries Safely

Explosion

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.



Acid

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

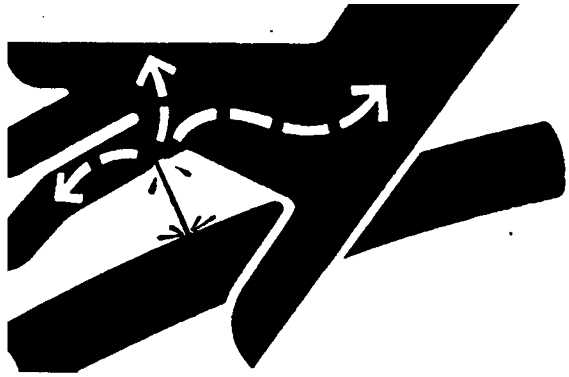
Avoid High-Pressure Fluids

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

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

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

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



X9811 –UN–23AUG88

High-Pressure Fluids

DX,FLUID –19–03MAR93–1/1

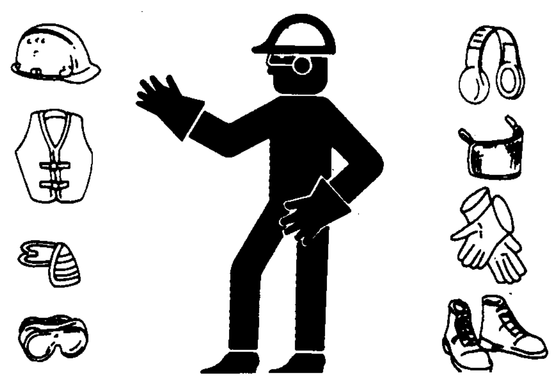
Wear Protective Clothing

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

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

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

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



TS206 –UN–23AUG88

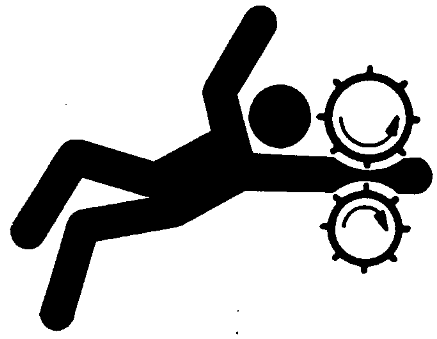
Protective Clothing

DX,WEAR –19–10SEP90–1/1

Service Engines Safely

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near engine 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

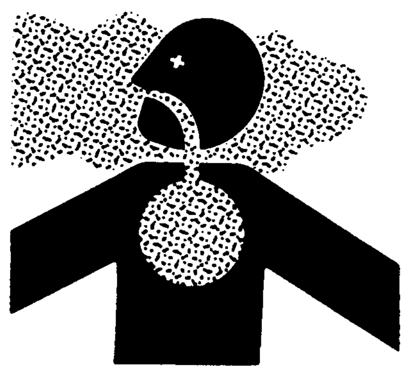
Moving Parts

DX,LOOSE –19–04JUN90–1/1

Work In Ventilated Area

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

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



TS220 –UN–23AUG88

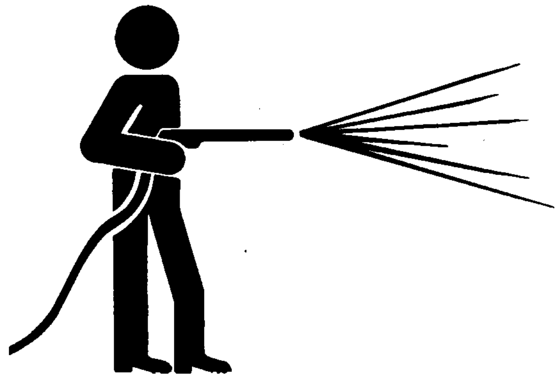
Engine exhaust fumes

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

Clean Work Area

DX,CLEAN –19–04JUN90–1/1

Remove Paint Before Welding or Heating

Avoid potentially toxic fumes and dust.

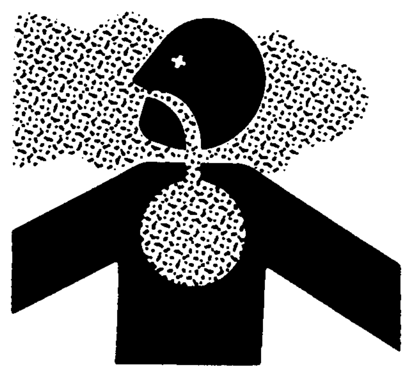
Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

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

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

Dispose of paint and solvent properly.



TS220 –UN–23AUG88

Toxic Fumes

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.

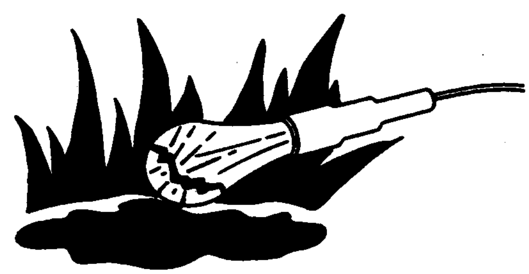
TS953 –UN–15MAY90

Flammable Spray

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

Work Area Safely

DX,LIGHT –19–04JUN90–1/1

Practice Safe Maintenance

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

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

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

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

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

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

TS218 –UN–23AUG88

Keep Area Clean

DX,SERV –19–17FEB99–1/1

Use Proper Tools

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

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.

TS779 –UN–08NOV89

Proper Tools

DX,REPAIR –19–17FEB99–1/1

Dispose of Waste Properly

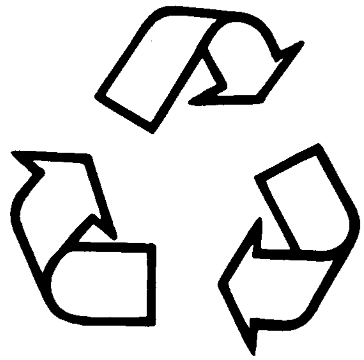
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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

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

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

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



TS1133 –UN–26NOV90

Recycle Waste

DX,DRAIN –19–03MAR93–1/1

Live With Safety

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

TS231 –19–07OCT88

Safety Systems

DX,LIVE –19–25SEP92–1/1

Engine Model Designation

Example: John Deere Engine Model—6105HRW01

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

6105HRW01 Engine

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

Aspiration Code

A .... Turbocharged and air-to-coolant aftercooled
H .... Turbocharged and air-to-air aftercooled

User Code

DW .... Davenport (Heavy-Duty Industrial) Works
F .... OEM
RW .... Waterloo (Tractor) Works
T .... Dubuque (Construction Equipment) Works
T8 .... Cameco
Z .... Zweibrucken (Forage Harvester) Works

Application Code

01, 02, etc., ... Code for specific application

RG8427 –UN–21MAY98

Engine Serial Number Plate

RG,RG34710,23 –19–11OCT00–1/1

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.

1. Example 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:

RG6105H000000
RG .... Factory code producing engine
6105H .... Engine model designation
000000 .... Sequential number

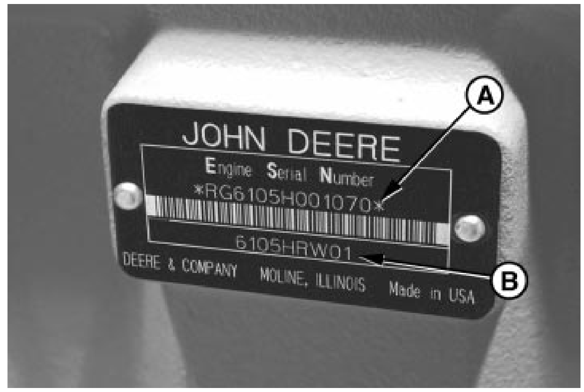
Factory Code Producing Engine
RG .... Waterloo Engine Works

Engine Model Designation
6105H .... See Engine Model Designation on previous page

Sequential Number
000000 .... 6-digit sequential number

2. Engine Application Data (B)

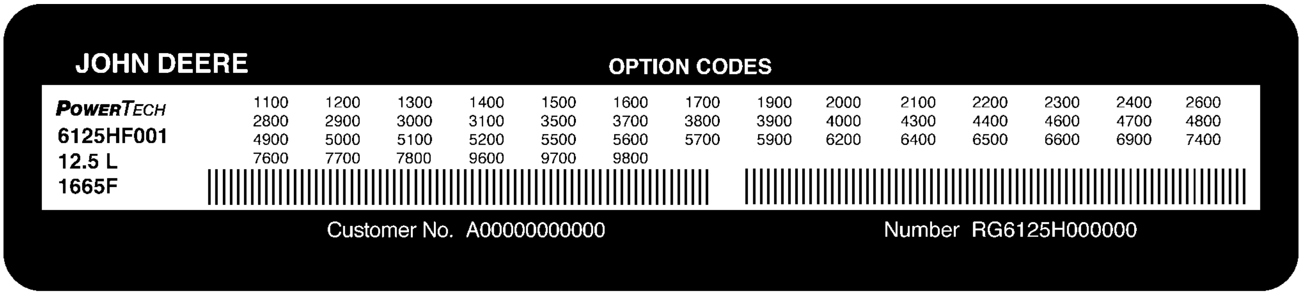
   The second line of information on the engine serial number plate identifies the engine/Deere machine or OEM relationship. See ENGINE APPLICATION CHART later in this Group.



Example Engine Serial Number Plate

RG,RG34710,24 –19–07NOV00–1/1

Engine Option Code Label



RG8740 –UN–12JUL99

Option Code Label

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

When in need of parts or service, furnish your authorized servicing dealer or engine distributor with these numbers.

DPSG,OUO1004,917 –19–30JUN99–1/1

Engine Application Chart

John Deere Agricultural Equipment Applications

Machine Model No.	Engine Model
TRACTORS — 4-WHEEL DRIVE	
9200	6105HRW01, 6125HRW02, 6125HRW05 (30000—)
9300	6125HRW01, 6125HRW11, 6125HRW07 (30000—)
9400	6125HRW02, 6125HRW12, 6125HRW09 (30000—)
9220	6125HRW10
9320	6125HRW13
9420	6125HRW14
9520	6125HRW15
TRACTORS — LTV TRACKS	
9300T	6125HRW03, 6125HRW06 (30000—)
9400T	6125HRW04, 6125HRW08 (30000—)
9320T	6125HRW13
9420T	6125HRW14
9520T	6125HRW15
COMBINES	
9750 STS	6125HH002
9750 STS CS	6125HH003
9880	6125HH004
FORAGE HARVESTERS — SELF-PROPELLED	
6750	6125HZ002, 6125HZ006
6850	6125HZ001, 6125HZ005
7300	6125HZ007
7400	6125HZ008
7500	6125HZ009
CANE HARVESTER (CAMECO)	
CH2500	6125AT801

Machine Model No.	Engine Model
LOADERS	
744H Loader—4-Wheel Drive	6125ADW01
744H/MH Log Loader	6125ADW01, 6125HDW01 (30000—)
824H	6125HDW01
844H	6125HDW03
EXCAVATORS	
230 LC Excavator	6125ADW70
450C LC Excavator	6125HT001 (30000—)

Continued on next page RG,RG34710,25 –19–11OCT00–1/2

Machine Model No.	Engine Model
OEM	
OEM	6105AF001
	6105HF001
	6125AF001
	6125HF001
	6125HF070 (30000—)
MARINE	
Marine	6125AFM01

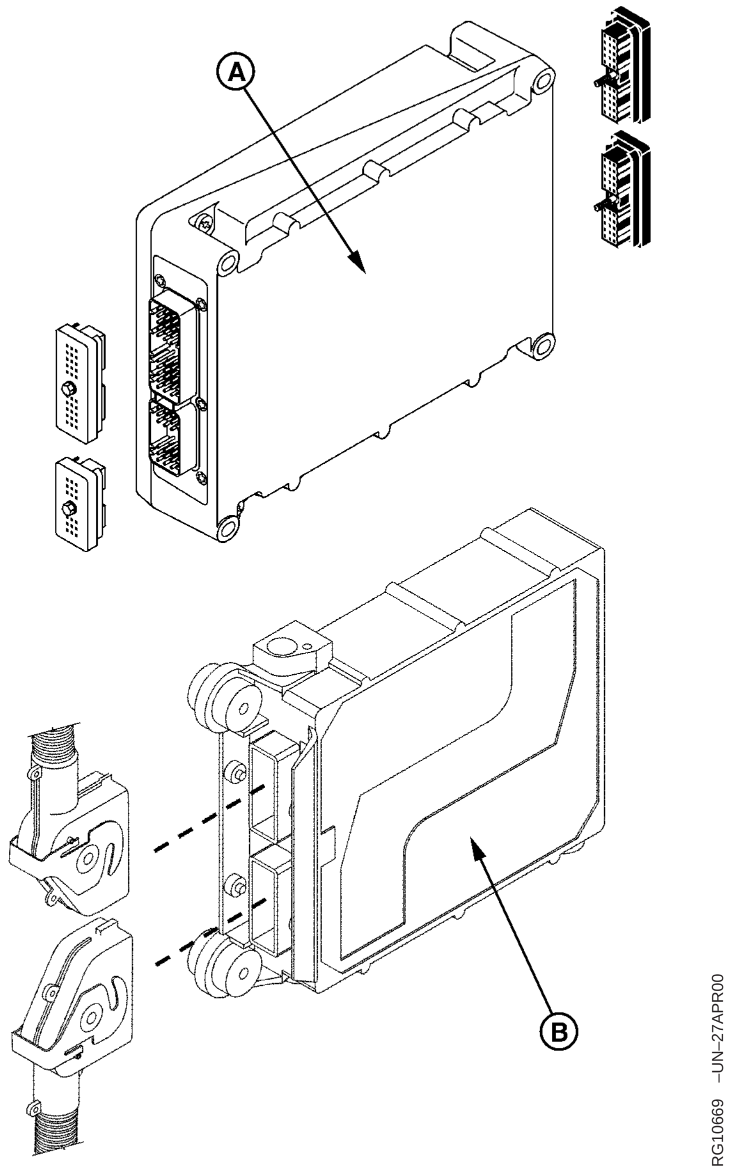
RG,RG34710,25 –19–11OCT00–2/2

Distinguishing ECUs

The John Deere Level 6 ECU is used on later 10.5 L/12.5 L Diesel Engines. This manual (CTM 188) supports all diagnostics, theory of operation, and tests for engines that use this controller. This controller (A) has 4 connectors going into it.

The Lucas ECU is used on earlier 10.5 L/12.5 L Diesel Engines. CTM 115 supports all diagnostic, theory of operation, and tests for engines that use this controller. The Lucas Controller (B) has 2 connectors going into it. Please refer to the drawing below to determine the controller that is being used.

Continued on next page DPSG,RG40854,477 –19–10DEC99–1/2



Distinguishing between the Lucas and the John Deere Level 6 ECU

A—John Deere Level 6 ECU **B—Lucas ECU**

DPSG,RG40854,477 –19–10DEC99–2/2

Lubricants and Coolant

NOTE: Refer to Section 01, Group 002 of CTM100 Base Engine Manual for information on lubricants and coolants.

OUO1004,0000C15 –19–17NOV00–1/1

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

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

RG40854,0000027 –19–03MAR03–1/1

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.

RG41221,00000FE –19–03MAR03–1/1

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

RG40854,0000028 –19–03MAR03–1/1

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%.

Diesel fuel in the European Union requires sulfur content less than 0.05%.

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

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

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

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

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

DX,FUEL5 –19–24JAN00–1/1

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.

DIESELSCAN is a trademark of Deere & Company

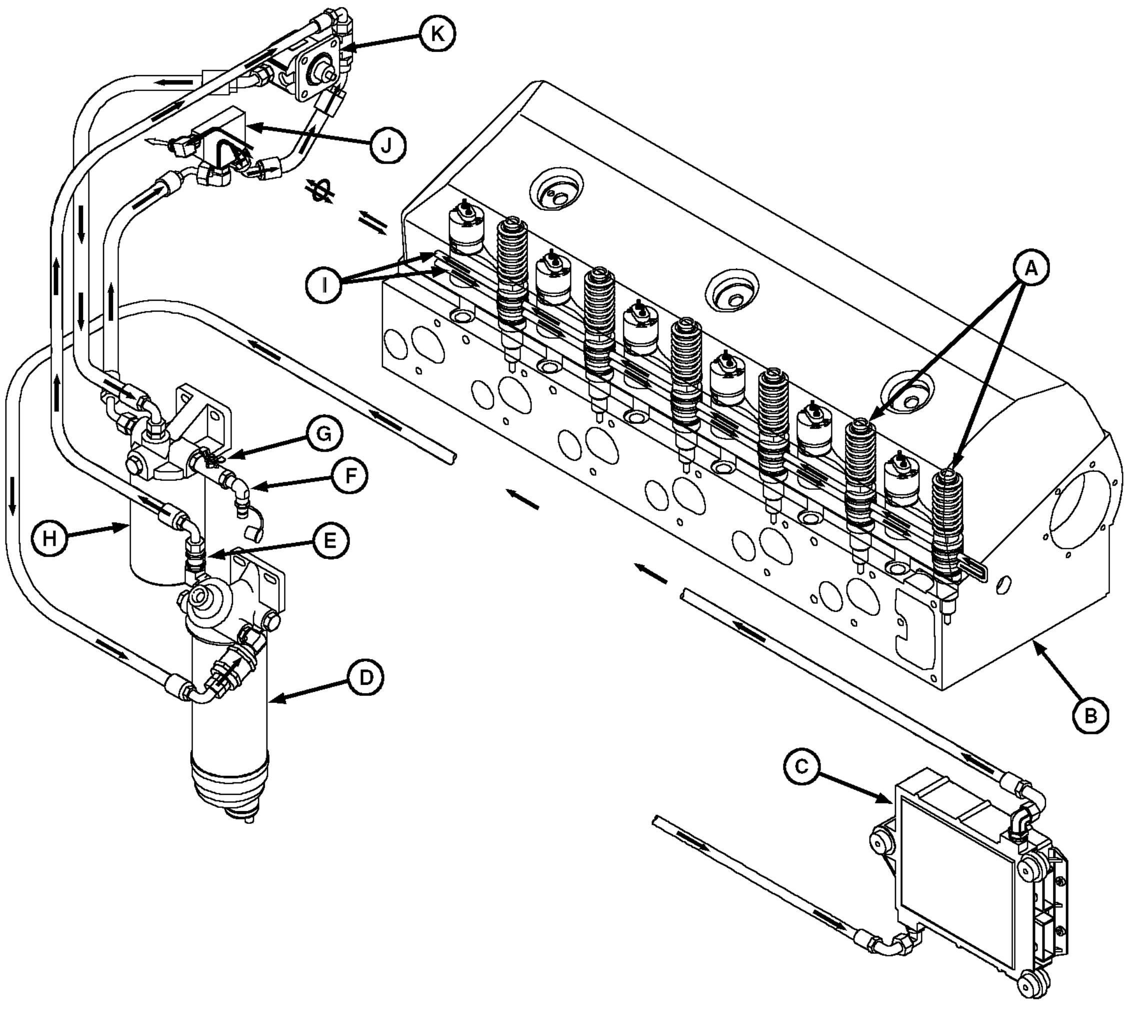
DX,FUEL6 –19–06DEC00–1/1

Section 02
Repair and Adjustments

Contents

02

Dual Rail Fuel System Components (Earlier Engines)



Dual Rail Fuel System Components (Earlier Engines)

A—Electronic Unit Injector (EUI) (6 used)
B—Cylinder Head
C—ECU (Engine Control Unit)
D—Primary Fuel Filter/Water Separator/Primer Pump
E—Check Valve
F—Diagnostic Fitting
G—Air Purge Valve[1]
H—Final Fuel Filter
I—Fuel Supply Rails
J—Fuel Manifold
K—Fuel Supply Pump

Earlier 10.5 L engines (S.N.— 003763) and 12.5 L engines (S.N.— 010966) have the dual rail fuel system shown above. The dual rail system is covered in this Group. Later engines have a single rail fuel system and are covered in Group 091.

[1]*On some applications, purge valve (G) is installed in-line on opposite side of filter header.*

Continued on next page OUO1004,0000C36 –19–18DEC00–1/2

6125ADW engines and 6125HF(AF) are shown above. 6015HRW and 6125HRW engines have fuel system components located on left side of engine as viewed from flywheel end as shown in FLUSH FUEL RAILS later in this Group. Service procedures are same for both engines.

IMPORTANT: **During engine repair, cleanliness of the fuel supply rails (I) in cylinder head (B) is extremely important due to fuel flow through passages. Think of the fuel rails as internal passages of an injection pump; therefore, the same cleanliness must be maintained.**

OUO1004,0000C36 –19–18DEC00–2/2

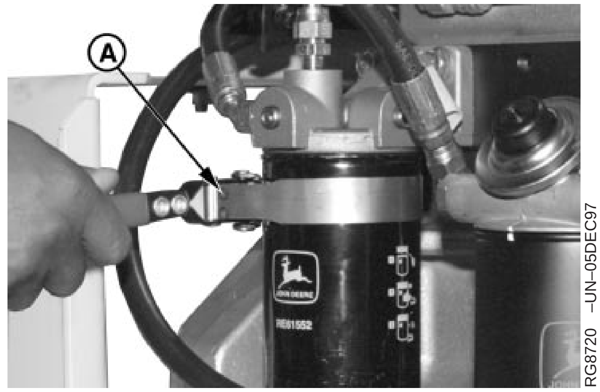
Replace Final (Secondary) Fuel Filter Element

Remove Final Fuel Filter

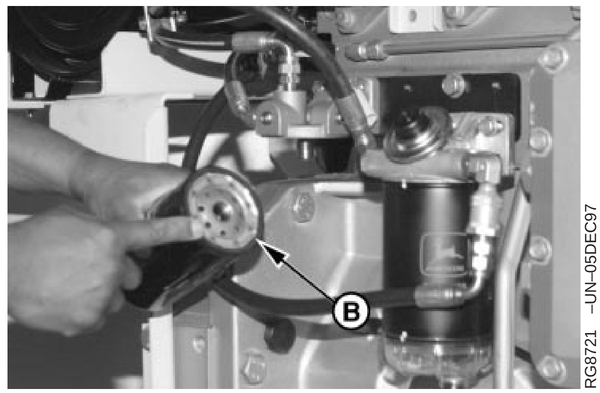
1. Close fuel shut-off valve at bottom of fuel tank (not illustrated).

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

3. Remove final fuel filter using a suitable filter wrench (A). Dispose of fuel and filter in an environmentally safe manner.



Removing Final Fuel Filter



Installing Final Fuel Filter

A—Fuel Filter Wrench
B—Filter Gasket/O-Ring

Install New Final Fuel Filter

1. If removed, install fuel filter mounting bracket and tighten cap screws to the following specifications.

Specification	
Fuel Filter Header-to-Bracket—Torque	50 N•m (37 lb-ft)
Fuel Filter Bracket-to-Head—Torque	35 N•m (26 lb-ft)
Fuel Filter Bracket-to-Block—Torque	65 N•m (48 lb-ft)
Fuel Filter-to-Air Intake—Torque	25 N•m (18 lb-ft)

2. Clean filter gasket sealing surface with a clean, lint-free towel.

3. Apply a light coating of clean engine oil to filter gasket/O-ring (B).

4. Fill filter element with clean diesel fuel.

5. Install filter element onto threaded adapter and tighten until gasket contacts sealing surface on mounting base. Then, tighten an additional 3/4 turn.

6. Open fuel shut-off valve and bleed the fuel system. See BLEED FUEL SYSTEM later in this Group.

RG,RG34710,258 –19–26OCT00–1/1

Replacing Primary Fuel Filter/Water Separator

Remove Primary Fuel Filter/Water Separator

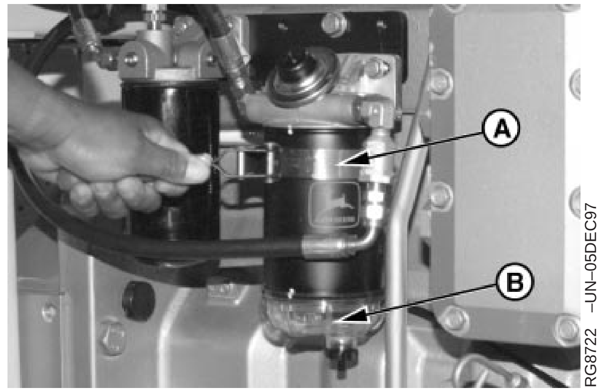
1. Close fuel shut-off valve at bottom of fuel tank (not illustrated).

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

3. Remove primary fuel filter using a suitable filter wrench (A). Drain filter element and sediment bowl into appropriate container.

4. Clamp filter element in a vise and remove clear water separator bowl (B).

5. Thoroughly clean sediment bowl and dry with compressed air.



Removing Primary Fuel Filter

A—Filter Wrench
B—Clear Water Separator Bowl

Continued on next page

RG,RG34710,259 –19–03AUG99–1/2

Install Primary Fuel Filter/Water Separator

1. If removed, install fuel filter mounting bracket and tighten cap screws to the following specifications.

Specification

Fuel Filter Bracket-to-Head—Torque	35 N•m (26 lb-ft)
Fuel Filter Bracket-to-Block—Torque	65 N•m (48 lb-ft)
Primary Fuel Filter Header-to-Bracket—Torque	50 N•m (37 lb-ft)

2. Lubricate sediment bowl O-ring with clean engine oil and install onto new filter element. Tighten bowl an additional 1/2 turn after O-ring contacts filter element.

3. Apply a light coating of engine oil to filter gasket/O-ring (A).

4. Close sediment bowl drain adapter and fill filter element with clean diesel fuel.

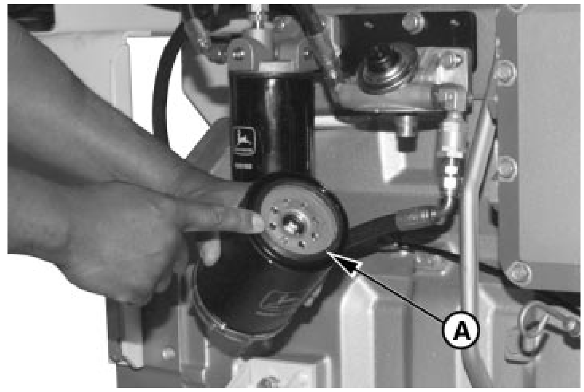
5. Install filter element onto threaded adapter and tighten until gasket contacts sealing surface on mounting base. Then, tighten an additional 1-1/2 turn.

6. Install any plugs removed from filter header and tighten to specifications.

Specification

Primary Fuel Filter Header Plugs—Torque	47 N•m (35 lb-ft)

7. Open fuel shut-off valve and bleed the fuel system. See BLEED FUEL SYSTEM in this Group.



RG8723 –UN–05DEC97

Installing Primary Fuel Filter

A—Filter Gasket/O-Ring

RG,RG34710,259 –19–03AUG99–2/2

Remove and Install Air Purge Valve

NOTE: Purge valves are located on outlet side of fuel filter.

1. Disconnect fuel line (B) or remove elbow (D) as required.

2. Remove air purge valve.

3. Install air purge valve. Tighten line (B) to specifications.

Specification

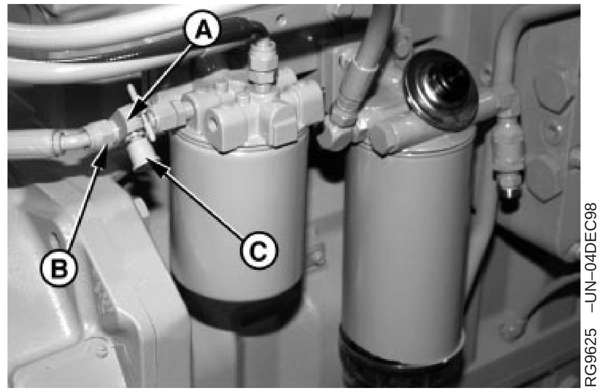
Fuel Line-to-Fuel Filter/Air Purge Valve—Torque .... 24 N•m (18 lb-ft)

4. Install elbow (D) and diagnostic port fitting (E) if removed. Tighten diagnostic fitting to specifications.

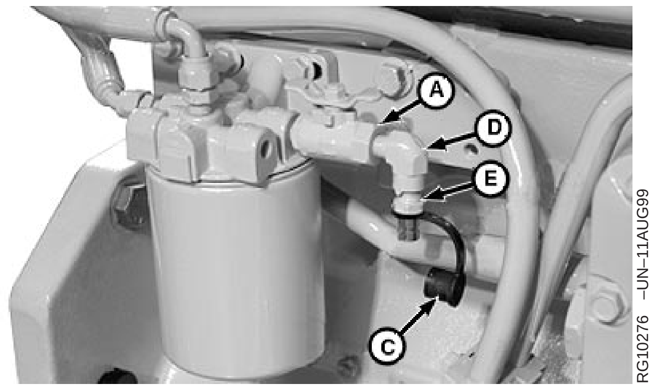
Specification

Air Purge Valve Diagnostic Port Fitting—Torque .... 24 N•m (18 lb-ft)

5. Install cap (C).



In-Line Purge Valve



Header Mounted Purge Valve

A—Purge Valve
B—Filter Outlet Line
C—Cap
D—Elbow
E—Diagnostic Port Fitting

DPSG,OUO1004,975 –19–03AUG99–1/1

Remove and Install Primary Fuel Filter Check Valve

NOTE: Fuel filter check valve is located in an outlet port on the fuel filter header. Depending on engine application, it may be located on left or right-hand side of header. Additionally, check valve may connect directly to header port or to elbow (C).

1. Disconnect fuel line (A) and remove check valve (B). Remove O-rings from both ends of check valve.

2. Apply LOCTITE® 242 Thread Lock and Sealer to threads on check valve and install valve on elbow (C) or header. Tighten valve to specifications.

Specification

Fuel Filter Check Valve to Fuel Filter Header or Elbow on Header—Torque .... 46 N•m (34 lb-ft)

3. If elbow (C) was removed, apply LOCTITE® 242 Thread Lock and Sealer to threads of elbow and install in fuel filter header. Tighten elbow lock nut to specifications.

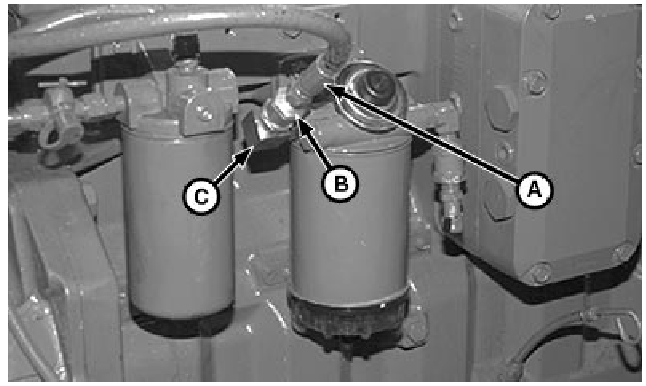
Specification

Elbow, Fuel Filter Check Valve-to-Filter Header—Torque .... 46 N•m (34 lb-ft)

4. Connect fuel line (A) and tighten to specifications.

Specification

Fuel Line-to-Fuel Filter Check Valve—Torque... 24 N•m (18 lb-ft)



Fuel Filter Check Valve

A—Fuel Filter Outlet Line
B—Check Valve
C—Elbow

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DPSG,OUO1004,976 –19–03AUG99–1/1

Remove and Install Fuel System Surge Tank (6125ADW01/70 Engines)

1. Disconnect fuel line from adapter (C) (shown disconnected).

2. Disconnect fuel line (E).

   Cap and plug all lines and fittings to prevent fuel system contamination.

3. Remove surge tank (A) from mounting bracket (B).

4. If fuel line adapters (C) and (F) are removed, install new O-rings in adapters and install adapters in surge tank. Tighten adapters to the following specifications.

Specification

Surge Tank Fuel Line Adapter
(Top)—Torque .... 46 N•m (34 lb-ft)
Surge Tank Fuel Line Adapter
(Bottom)—Torque .... 39 N•m (29 lb-ft)

5. If removed, install mounting bracket (B) and tighten cap screws to specifications.

Specification

Surge Tank Mounting
Bracket-to-Cylinder Head Cap
Screws—Torque .... 130 N•m (95 lb-ft)

6. Install surge tank on mounting bracket with end labeled “TOP” (D) in the up position as shown. Center cap screws in surge tank slots and tighten to specifications.

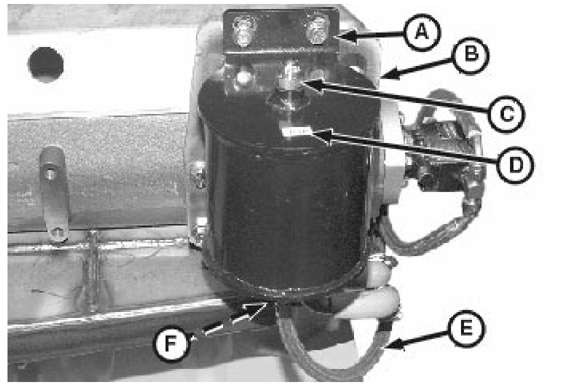
Specification

Surge Tank-to-Mounting Bracket
Cap Screws—Torque .... 50 N•m (37 lb-ft)

7. Connect fuel lines and tighten to specifications.

Specification

Surge Tank Fuel Lines—Torque .... 24 N•m (18 lb-ft)



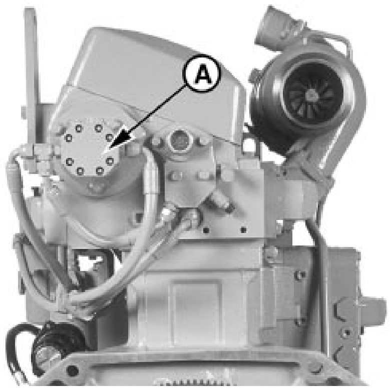
RG10292 –UN–09SEP99

Surge Tank

A—Surge Tank
B—Mounting Bracket
C—Line Adapter (Fuel Tank Return Line)
D—Label (Marked “TOP”)
E—Fuel Line (Surge Tank-to-Fuel Manifold)
F—Line Adapter (Fuel Manifold Line)

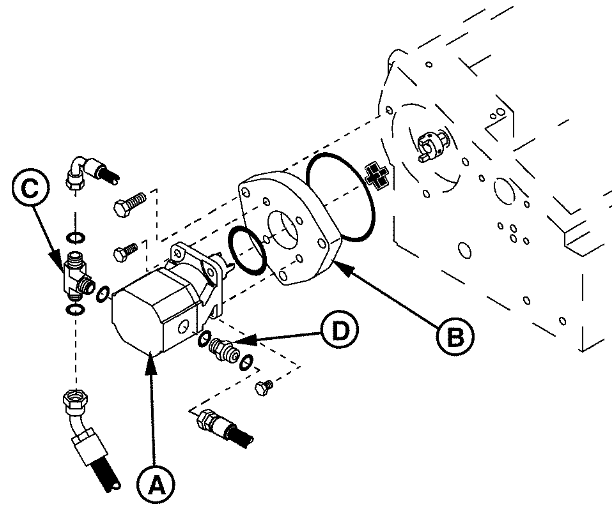
DPSG,OUO1004,1007 –19–26OCT00–1/1

Remove and Install Dual Rail Fuel Supply Pump



RG8566A –UN–05DEC97

Fuel Supply Pump



RG8777 –UN–05DEC97

Fuel Supply Pump Exploded View

A—Fuel Supply Pump **B—Mounting Bracket** **C—Tee Fitting** **D—Straight Fitting**

IMPORTANT: Plug or cap all fuel system connections and passages as lines or components are removed to keep debris out using JDG998 Fuel System Cap Plug Kit.

Remove Fuel Manifold

NOTE: Label fuel lines as they are disconnected to ensure correct reassembly.

1. Remove three fuel lines connected to fuel supply pump (A). Cap all lines and fittings to keep debris out of fuel system.

2. Remove four cap screws securing supply pump to mounting bracket (B) and remove pump. Remove and discard O-ring.

NOTE: Fuel supply pump is not serviceable; replace pump if determined to be defective.

3. Remove tee fitting (C) and straight fitting (D) from pump and clean thoroughly if pump is to be replaced.

Install Fuel Supply Pump

1. Install tee fitting and straight fitting onto new pump (using new O-rings) in same orientation as on original pump. Tighten fittings securely.

2. Ensure that drive coupler set screw is tightened to specifications on supply pump drive shaft with end of shaft flush with coupler ID. Check drive coupler on camshaft drive pin also; adjust as needed.

Specification

Fuel Supply Pump and Camshaft Drive Coupler Set Screws—Torque .... 4 N•m (3 lb-ft)

3. Position new rubber spider (vibration absorber) on drive coupler. Position new O-ring on face of supply pump.

4. If removed, apply AR54749 Soap Lubricant to new O-ring on supply pump mounting bracket (B) and install. Tighten mounting bracket cap screws to specifications.

Continued on next page

Specification

Fuel Supply Pump Mounting Bracket Cap Screws—Torque	50 N•m (37 lb-ft)

5. Install fuel supply pump with rubber spider properly meshed with coupler on rear of camshaft.

6. Install four cap screws and tighten to specifications.

Specification

Fuel Supply Pump-to-Bracket—Torque	25 N•m (18 lb-ft)

IMPORTANT: Before connecting ORFS fuel line fittings, be sure O-ring is correctly positioned in the groove of fitting. Tighten fitting ONLY to specified torque. DO NOT OVERTIGHTEN.

7. Install three fuel lines and tighten to specifications.

Specification

Fuel Line ORFS Fittings—Torque	24 N•m (18 lb-ft)

RG,RG34710,260 –19–04AUG99–2/2

Remove and Install Dual Rail Fuel Manifold

IMPORTANT: Plug or cap all fuel system connections and fuel rail passages as lines or components are removed to keep debris out using JDG998 Fuel System Cap Plug Kit.

Remove Fuel Manifold

1. Disconnect wiring lead from fuel temperature sensor (E).

2. Remove three fuel lines from fuel manifold (A). Cap all lines and fittings to keep debris out of fuel system.

IMPORTANT: Plug fuel rails with clean plugs from JDG998 Fuel System Cap Plug Kit to keep dirt and debris out even if rail is to be open for a short period of time.

3. Remove two cap screws securing fuel manifold to cylinder head and remove manifold. Remove O-ring (B) and discard.

Install Fuel Manifold

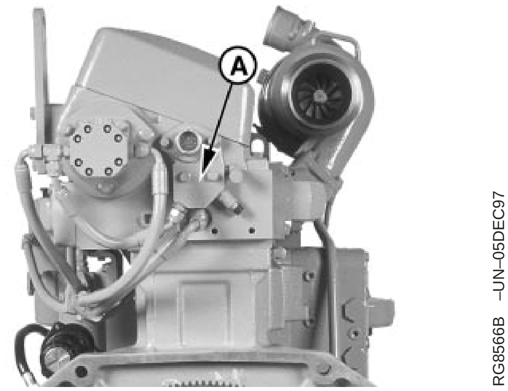
1. Install fuel manifold using new O-ring. Tighten cap screws to specifications.

Specification	
Dual Rail Fuel Manifold-to-Head—Torque	35 N•m (26 lb-ft)

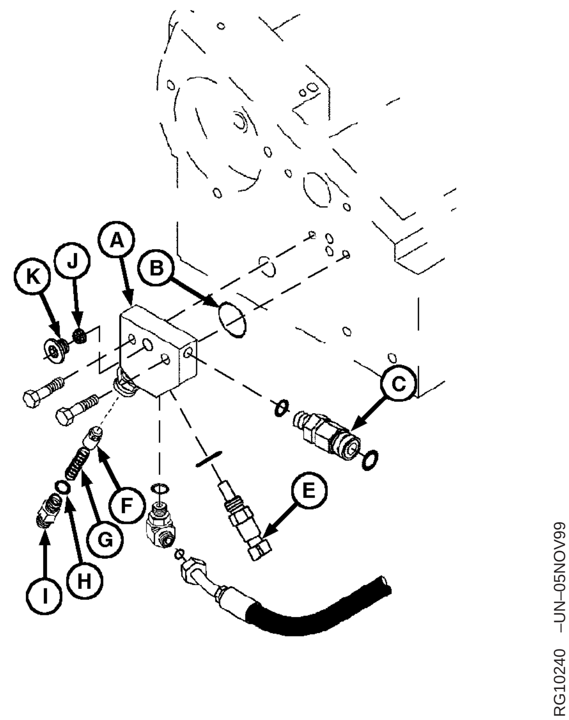
IMPORTANT: Before connecting ORFS fuel line fittings, be sure O-ring is correctly positioned in the groove of fitting. Tighten fitting ONLY to specified torque. DO NOT OVERTIGHTEN.

2. Install fuel lines with O-rings and tighten to specifications.

Specification	
Fuel Lines-to-Fuel Manifold—Torque	24 N•m (18 lb-ft)



Fuel Manifold



Fuel Manifold Exploded View

A—Fuel Manifold
B—O-Ring
C—Check Valve
D—Not Used
E—Temperature Sensor
F—Pressure Regulating Valve
G—Spring
H—O-Ring
I—Fitting
J—Screen[1]
K—Plug

[1]*On earlier engines, screen was located in end of check valve (C).*

Continued on next page RG,RG34710,261 –19–13AUG99–1/2

3. Install fuel temperature sensor wiring lead.

RG,RG34710,261 –19–13AUG99–2/2

Inspect Fuel Pressure Regulating Valve and Return Check Valve

1. Carefully remove parts (A—C). Do not drop pressure regulating valve (C).

IMPORTANT: The pressure regulating valve (C) should come out with the spring. If the valve is stuck in the fuel manifold, replace the fuel manifold and flush the fuel rail. See REMOVE AND INSTALL DUAL RAIL FUEL MANIFOLD earlier in this Group. See FLUSH FUEL RAILS later in this Group.

2. Inspect the pressure regulating valve for debris. If debris is found, clean valve assembly and flush the fuel rail. See FLUSH FUEL RAILS later in this Group.

3. Remove fuel return check valve from manifold block.

4. Inspect screen (D) in end of check valve or remove plug and screen (E) from manifold block and check for debris. Clean screen as required.

5. Reinstall parts in reverse order of removal. Hand tighten return check valve.

6. Whenever the fuel manifold is serviced, air must be removed from the fuel galley.

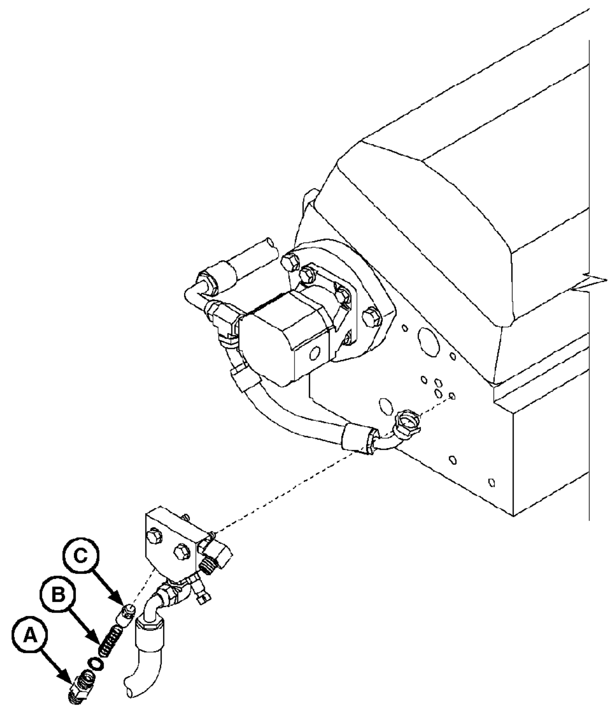
   Loosen return check valve (F) and operate hand primer on fuel filter until air is removed and fuel is leaking past the O-ring.

   Tighten check valve to specifications.

Specification

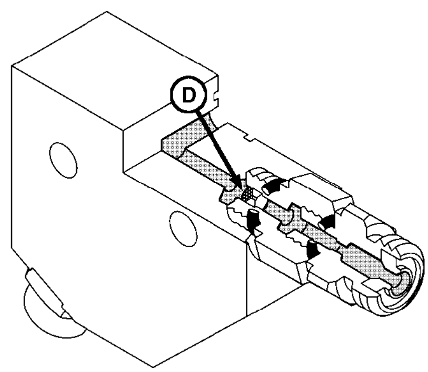
Fuel Return Check Valve (On Manifold)—Torque	33 N•m (24 lb-ft)

A—Fitting
B—Spring
C—Pressure Regulating Valve
D—Screen (Early Engines)
E—Screen (Later Engines)
F—Check Valve



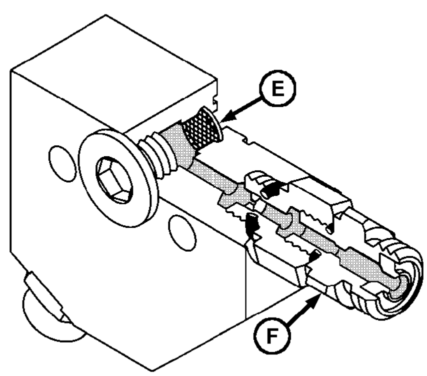
RG10348 –UN–14SEP99

Pressure Regulating Valve



RG10347 –UN–14SEP99

Check Valve with Screen



RG10346 –UN–14SEP99

Fuel Screen and Check Valve

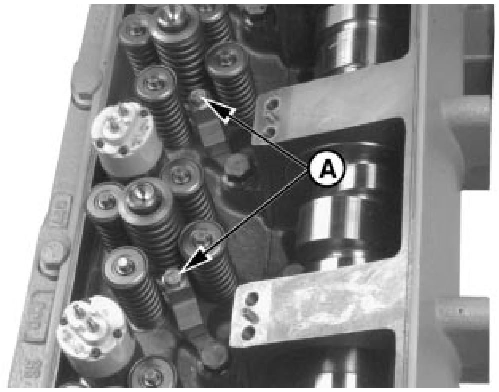
Continued on next page DPSG,OUO1004,1023 –19–08SEP99–1/2

7. Bleed fuel system. See BLEED FUEL SYSTEM later in this Group.

DPSG,OUO1004,1023 –19–08SEP99–2/2

Remove and Install Electronic Unit Injectors

IMPORTANT: Electronic unit injectors on dual rail fuel systems are different from injectors on single rail systems. Use the appropriate injector for engine/fuel system applications. Replace injector with the same type removed. DO NOT intermix injectors.



RG8279 –UN–05DEC97

Unit Injector Clamp Screws

A—Clamp Cap Screws

1. Remove rocker arm cover. See REMOVE AND INSTALL ROCKER ARM COVER in CTM100, Section 02, Group 020.

2. Remove rocker arm shaft assembly. See REMOVE ROCKER ARM ASSEMBLY in CTM100, Section 02, Group 020.

3. Disconnect fuel lines and drain fuel from lines and fuel rail in cylinder head.

4. Reconnect lines (or install cap plugs from JDG998 Fuel System Cap Plug Kit) to keep debris out of fuel system.

5. Remove injector hold-down clamp cap screws (A).

Continued on next page

RG,RG34710,262 –19–04AUG99–1/5

6. Pry upward on the injector hold-down clamp (A) against cylinder head using a prybar (B) as shown.

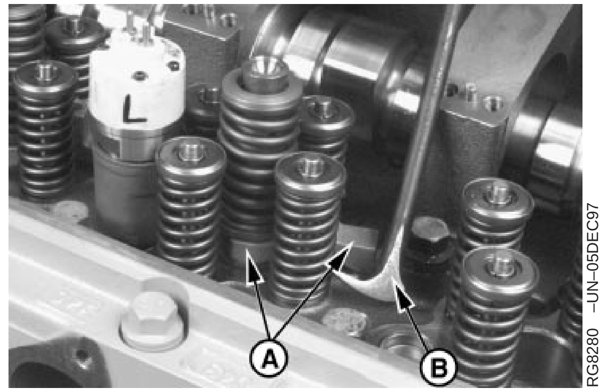
7. Remove injector and clamp from cylinder head. Label injector for installation in same cylinder location as removed.

8. Immediately plug injector bore with clean cap plug to keep debris out of fuel system.

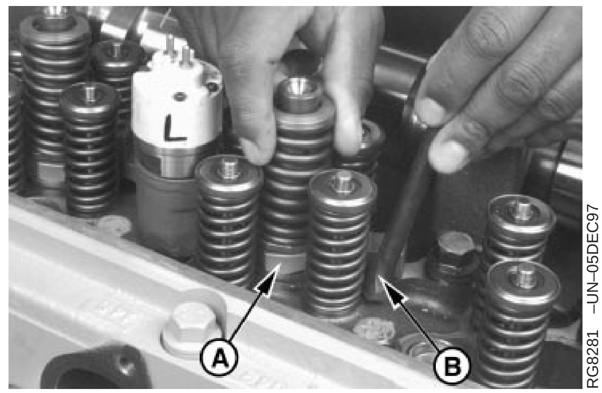
9. Remove injector O-rings (C) and discard.

10. Store injector in a clean, lint-free container.

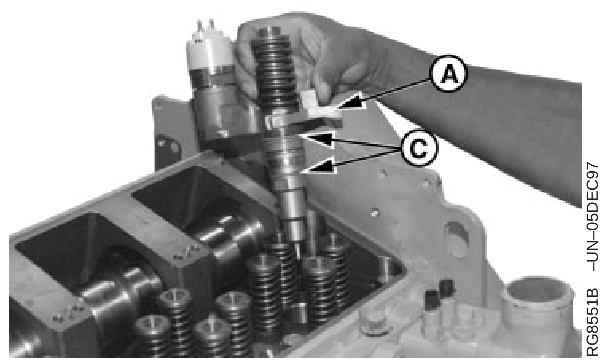
A—Hold-Down Clamp
B—Prybar
C—Injector O-Rings



Position Prybar



Removing Unit Injector



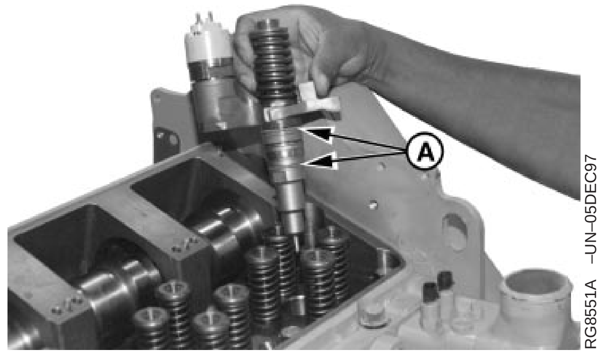
Unit Injector Removed

Continued on next page RG,RG34710,262 –19–04AUG99–2/5

Install Electronic Unit Injectors

1. Remove cap plug from injector bore in cylinder head. Clean entire sleeve using a clean, lint-free cloth wrapped around a wooden stick.

2. Install two new O-rings (A) on unit injector body. Lubricate O-rings with clean engine oil or AMOJELL lubricant.



Installing Unit Injector

A—O-Rings

Continued on next page RG,RG34710,262 –19–04AUG99–3/5

IMPORTANT: Press on top of injector plunger with palm of hand to properly seat O-rings and center injector between valve springs.

NOTE: New EUI hold-down clamp cap screws have pre-applied sealant.

3. Install unit injector with hold-down clamp into same cylinder as removed (solenoid outward toward exhaust manifold side of engine at equal distance between exhaust valve springs). Apply LOCTITE® 242 Thread Lock and Sealer to **used** hold-down cap screw. Initially tighten cap screw to specifications.

Specification

Electronic Unit Injector
Hold-Down Clamp Cap Screws—
Initial Torque.. 20 N•m (15 lb-ft)

4. Mark head of cap screw at twelve o'clock position (A) (viewed from rear) using a paint stick.

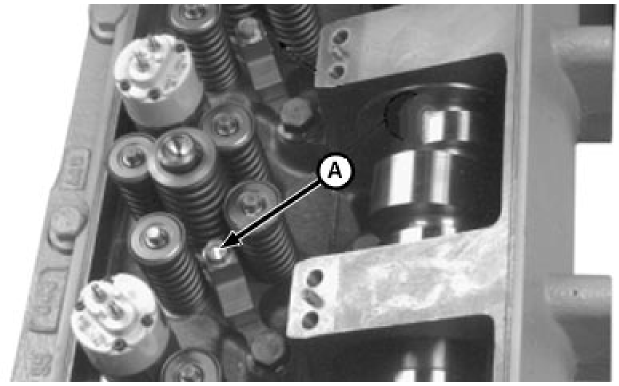
5. Install 13 mm swivel socket on head of cap screw. Position ratchet handle (B) parallel with centerline of engine camshaft/crankshaft.

   Torque-turn cap screw to the following specification.

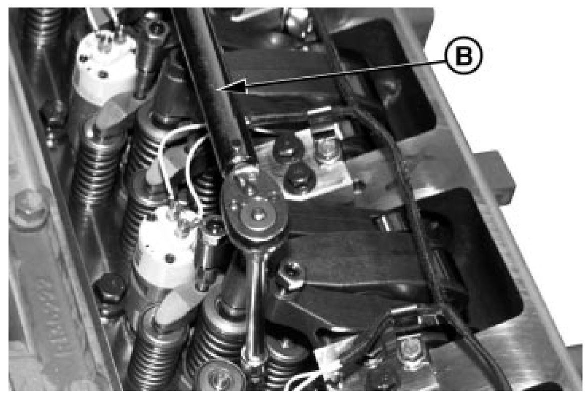
Specification

Electronic Unit Injector
Hold-Down Clamp Cap Screws—
Final Torque-Turn.. 90—100°

6. Remove socket from head of cap screw and verify that mark has been tightened/turned at least 90° but not more than 100° from its original position.



Injector Hold-Down Clamp Screws



Torque-Turn EUI

A—Clamp Cap Screw
B—Ratchet Handle

02
090
17

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RG,RG34710,262 –19–04AUG99–4/5

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.

7. Reconnect injector solenoid wiring leads onto solenoid studs. Apply LOCTITE® 222 Small Screw Thread Locker (TY24311) to studs and tighten retaining nuts (B) to specifications.

Specification

Electronic Unit Injector Harness Connector Nuts—Torque	2 N•m (1.75 lb-ft) (18 lb-in.)

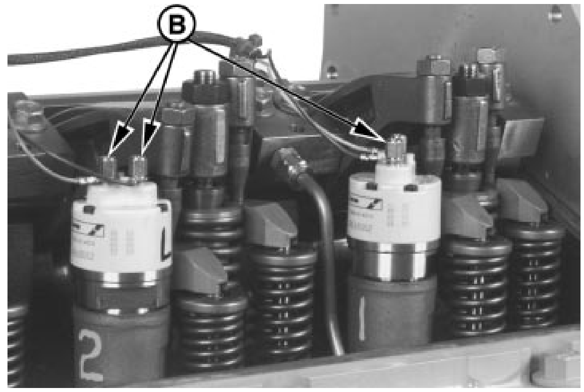
8. Install valve bridges, push tubes, and rocker arm assembly. Adjust valve stem-to-bridge clearances. See INSTALL ROCKER ARM ASSEMBLY in CTM100, Section 02, Group 020.

9. If removed or loosened, tighten all harness and line clamps to specifications.

Specification

Fuel Line Clamps—Torque	5 N•m (4 lb-ft)
Electronic Unit Injector Harness-to-Shaft Clamps—Torque	35 N•m (26 lb-ft)
Electronic Unit Injector Wiring Connector Bracket-to-Head—Torque	25 N•m (18 lb-ft)

10. Adjust electronic unit injector preload as detailed later in this Group.



RG8263 –UN–05DEC97

Wiring Terminal Nuts

B—Retaining Nuts

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RG,RG34710,262 –19–04AUG99–5/5

Adjust Electronic Unit Injector Preload

1. Remove plug from cylinder block and install JDG820 Flywheel Turning Tool (B).

IMPORTANT: Timing pin MUST BE installed in slot of camshaft first. Then install second timing pin in crankshaft slot by carefully rocking flywheel back and forth.

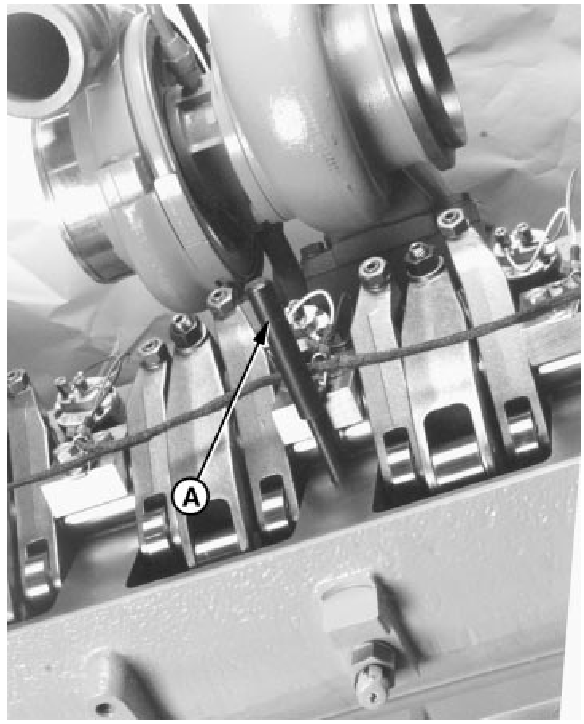
2. Rotate engine flywheel in running direction (counterclockwise as viewed from rear) until JDG971 Timing Pin (A) engages single timing slot (D) in camshaft. The proper timing slot can be found by viewing camshaft timing lobe through camshaft timing pin bore while rotating engine. The double timing slot (E) will be at approximately 11 o'clock (viewed from rear of engine) when pin is installed in slot (D).This ensures that engine is locked at TDC of No. 1 cylinder's compression stroke. Intake and exhaust rocker arms on No. 1 cylinder should be loose.

3. Remove threaded plug from crankshaft timing hole below oil cooler and filter housing assembly.

IMPORTANT: DO NOT insert timing pin full depth into cylinder block crankshaft timing hole when rotating engine flywheel until double slot on camshaft timing lobe is at approximately 11 o'clock (viewed from rear of engine) to avoid crankshaft counterweight bending timing pin.

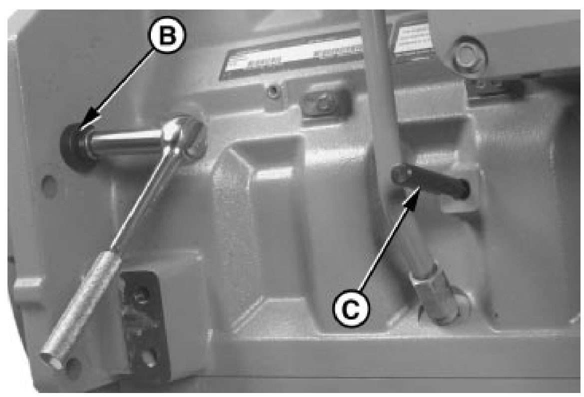
4. Slightly move engine flywheel back and forth with turning tool until a second JDG971 Timing Pin (C) can be installed in slot in crankshaft. This ensures that camshaft and crankshaft are in sync (properly timed).

A—JDG971 Timing Pin
B—JDG820 Flywheel Turning Tool
C—JDG971 Timing Pin
D—Single Timing Slot
E—Double Timing Slot



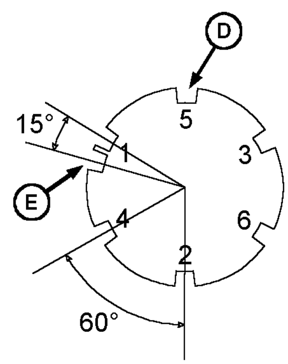
RG8228A –UN–05DEC97

JDG971 Timing Pin in Camshaft



RG8227D –UN–05DEC97

JDG971 Timing Pin in Crankshaft



RG11165 –UN–30OCT00

Camshaft Timing Slot

Continued on next page RG,RG34710,263 –19–03NOV00–1/3

If timing pin does not enter crankshaft timing slot, crankshaft is not properly timed with camshaft. Crankshaft MUST BE timed to camshaft. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in CTM100, Section 02, Group 050.

RG,RG34710,263 –19–03NOV00–2/3

5. Loosen lock nut (A) and loosen cylinders Nos. 3, 5, and 6 injector rocker arm adjusting screws (B) to relieve tension.

6. Slowly tighten adjusting screw until rocker arm roller contacts camshaft lobe at 0.0 clearance.

7. Tighten adjusting screw an additional 1/2 turn (180°) to preload injector. Tighten adjusting screw lock nut to specifications while holding adjusting screw stationary.

Specification

Electronic Unit Injector Adjusting Screw Lock Nut—Torque .... 65 N•m (48 lb-ft)

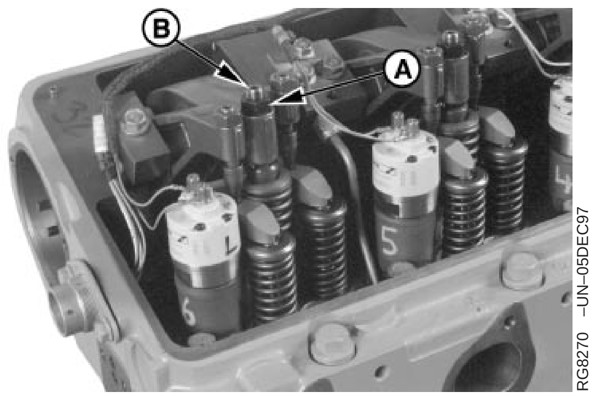
8. Remove both timing lock pins, rotate crankshaft one full revolution (360°) and pin crankshaft only. Engine will now be locked at No. 6 TDC.

9. Set injector preload on cylinders Nos. 1, 2, and 4.

10. Install plug in timing pin hole in block and tighten to specifications.

Specification

Timing Pin Plug in Cylinder Block—Torque .... 33 N•m (24 lb-ft)



Unit Injector Adjusting Screw

A—Lock Nut
B—Adjusting Screws

RG,RG34710,263 –19–03NOV00–3/3

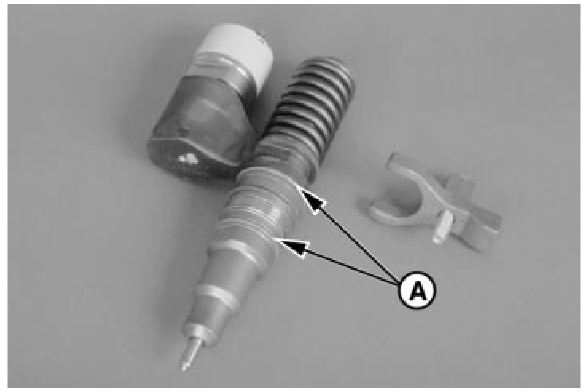
Replace Electronic Unit Injector O-Rings

1. The electronic unit injector's two external O-rings (A) must be replaced whenever injector is removed.

2. Fuel system diagnosis will determine if unit injector is not functioning properly. Refer to Section 04, Groups 150 and 160, as required.

3. Replaced unit injectors will be returned by your authorized servicing dealer to the manufacturer for testing and rebuilding.

A—O-Rings



RG8567 –UN–05DEC97

Unit Injector and Clamp

RG,RG34710,264 –19–20NOV00–1/1

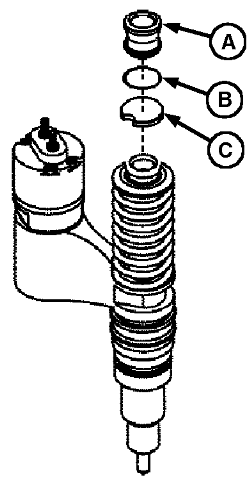
Replace Electronic Unit Injector Thrust Sleeve, Pad and O-Ring

1. Using an O-ring pick, remove O-ring (B).

2. Remove thrust socket (A) and pad (C).

3. Coat parts with clean engine oil and install in reverse order.

A—Thrust Socket
B—O-Ring
C—Thrust Pad

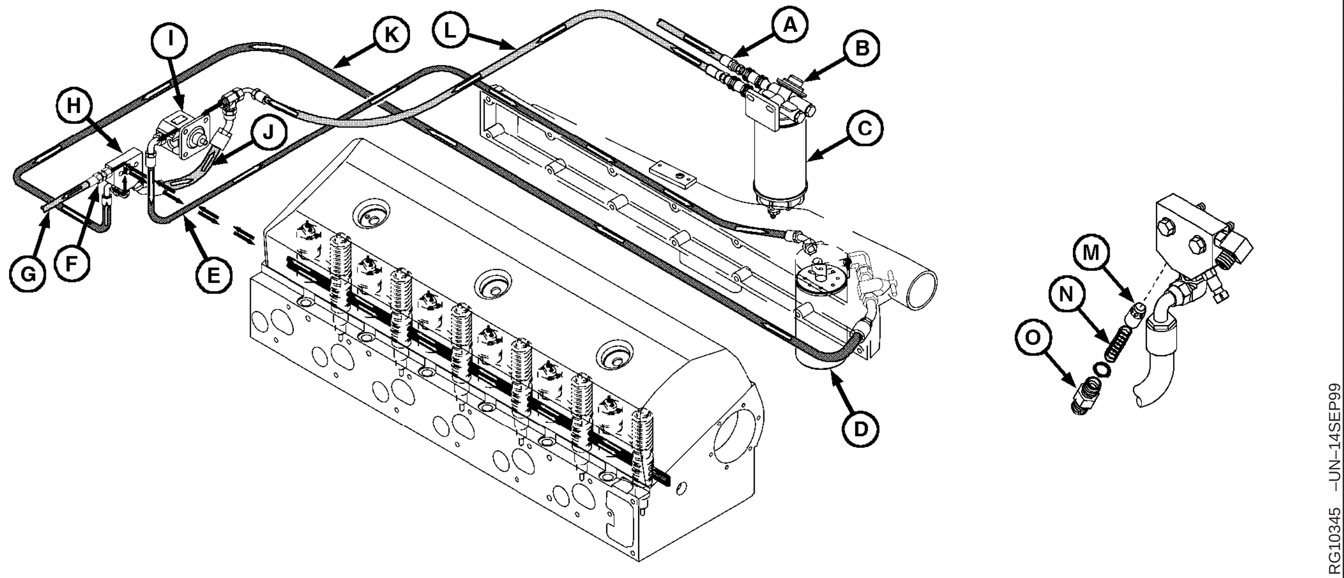


RG10352 –UN–16SEP99

Electronic Unit Injector

DPSG,OUO1004,1027 –19–15SEP99–1/1

Flush Fuel Rails



Flush Fuel Rail (Dual Rail Fuel System)

A—Primary Filter Inlet Check Valve
B—Hand Primer Pump
C—Primary Filter
D—Final Filter
E—Transfer Pump-to-Final Filter (High Pressure)
F—Return-to-Tank Check Valve
G—Return-to-Tank Fuel Line (Low Pressure)
H—Fuel Manifold
I—Fuel Supply Pump
J—Recirculation Fuel Line (Low Pressure)
K—Fuel Inlet Line-to-Fuel Manifold (High Pressure)
L—Primary Filter Outlet-to-Supply Pump Inlet (Low Pressure)
M—Pressure Regulating Valve
N—Spring
O—Fitting

Whenever the fuel system is opened for major service, flush the fuel rails in cylinder head.

1. Disconnect recirculation fuel line (J) from pressure regulating valve and remove parts (M—O). Reinstall fitting (O) and connect fuel line, leaving spring (N) and valve (M) out.

2. Disconnect recirculation line (J) from fuel supply pump inlet fitting and install cap on inlet fitting. Attach the clear line from JT03513 Fuel Supply System Test Kit to the end of the recirculation line and place end in a bucket or route to fuel tank.

3. Operate hand primer pump (B) until clear fuel flows out of the recirculating line into the bucket/fuel tank.

4. Pinch off the recirculation line **(not the plastic line from test kit)** from the fuel manifold to the bucket just long enough to start the engine. When engine starts, release line and allow fuel to flow into bucket/fuel tank. Run engine for five minutes.

5. Stop engine.

6. Disconnect fuel line and remove fitting (O). Install valve (M), spring (N) and fitting (O). Connect fuel line.

7. Remove cap from fuel supply pump inlet fitting and remove clear test line from recirculation line. Connect recirculation line to pump inlet fitting.

8. Tighten fuel lines to specifications.

Specification	
Fuel Line ORFS Fittings—Torque	24 N•m (18 lb-ft)

Continued on next page

DPSG,OUO1004,1024 –19–08SEP99–1/2

9. Whenever the fuel manifold is opened, air must be removed from the fuel galley.

   Loosen return check valve (F) and operate hand primer on fuel filter until air is removed and fuel is leaking past the O-ring.

   Tighten check valve to specifications.

Specification

Fuel Return Check Valve (On Manifold)—Torque	33 N•m (24 lb-ft)

DPSG,OUO1004,1024 –19–08SEP99–2/2

Bleed Fuel System

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.

1. Drain water and contaminants from clear water separator sediment bowl (C) by opening drain valve and operating primer until bowl is clear of water and debris.

2. Loosen secondary (final) fuel filter outlet line (A) or remove cap (E) and open air purge valve (D), (if equipped).

3. Pump hand primer (B) on primary filter until a steady flow of fuel (without bubbles) comes out of connection.

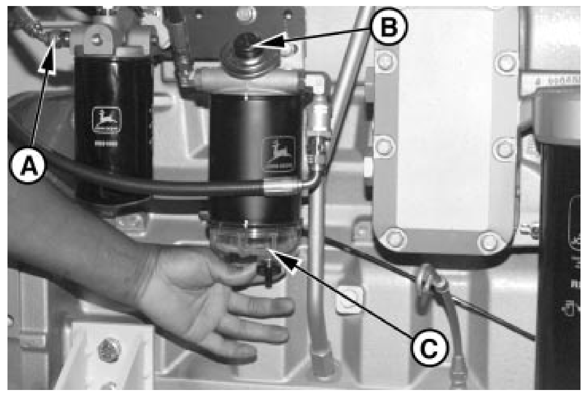
4. Continue pumping hand primer and simultaneously close purge valve or tighten outlet line connection to specifications. DO NOT overtighten.

Specification

Fuel Filter Outlet Line—Torque	24 N•m (18 lb-ft)

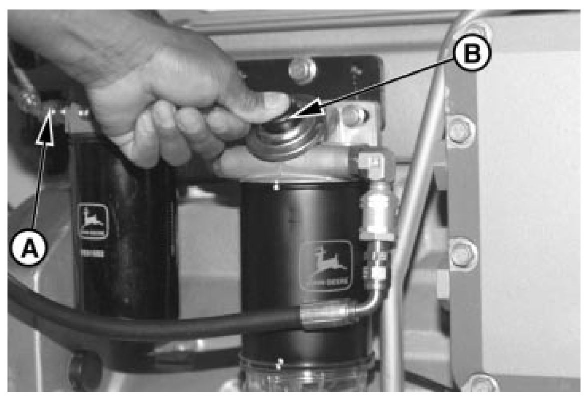
5. Start engine and run at high idle for 5—10 minutes.

A—Fuel Filter Outlet Line
B—Hand Primer
C—Clear Water Separator Sediment Bowl
D—Air Purge Valve
E—Cap



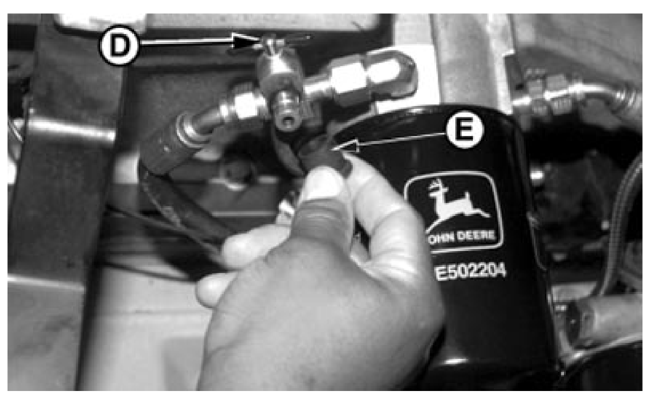
RG8714A –UN–05DEC97

Draining Water Separator



RG8725 –UN–05DEC97

Bleeding Fuel System



RG10250 –UN–30JUL99

Air Purge Valve

RG,RG34710,265 –19–04AUG99–1/1

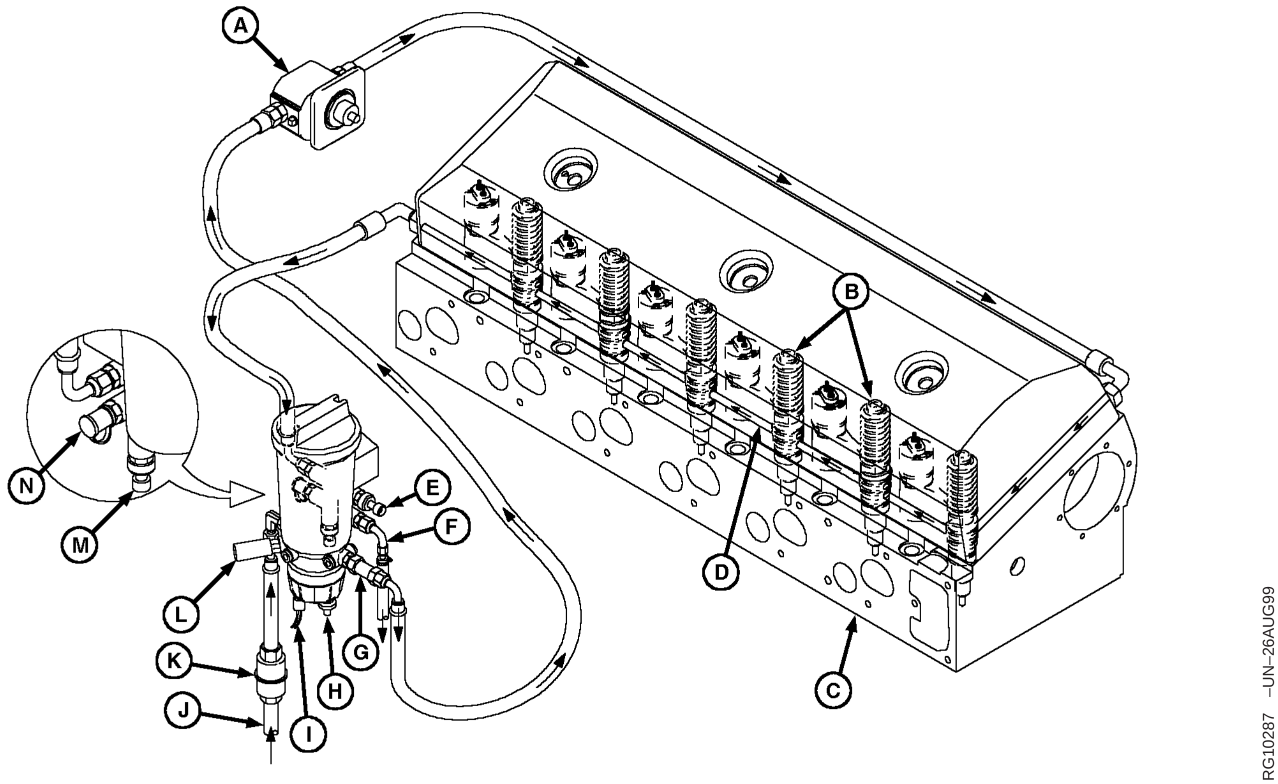
General Information

Later 10.5 L engines S.N. (003764 —) and 12.5 L engines S.N. (010967 —) have the single rail fuel system covered in this Group. Earlier engines have the dual rail fuel system covered in Group 090.

IMPORTANT: Always use a new (dry) fuel filter element whenever an existing element is removed from the filter housing. Reusing a wet element may cause fuel to overflow from the filter housing during insertion of filter element. Also, trapped air in the core of a wet filter element may cause the engine to stall and not restart without additional system purging.

DPSG,OUO1004,1125 –19–20OCT99–1/1

Single Rail Fuel System Components (Later Engines)



Single Rail Fuel System Components (Later Engines)

A—Fuel Supply Pump
B—Electronic Unit Injector (EUI) (6 used)
C—Cylinder Head
D—Fuel Rail
E—Fuel Pressure Sensor
F—Return Line to Fuel Tank[1]
G—Check Valve
H—Water Drain
I—Water in Fuel Sensor
J—Inlet Line from Fuel Tank
K—Pre-Filter (Optional)
L—Fuel Primer
M—Fuel Temperature Sensor[2]
N—Diagnostic Test Port

The single rail fuel system is used on later engines: 10.5 L engines S.N. (003764—) and 12.5 L engines (010967—).

NOTE: Fuel flow through cylinder head may vary by engine application. Supply pump (A) may be mounted as shown with fuel entering the front left side of the cylinder head and exiting the back of the head. On some machine applications, the fuel supply pump is rotated 180° and the fuel lines **on cylinder head** *are reversed, with fuel entering the back of the head and exiting the front left side of the head.*

6125ADW engines and 6125HF(AF) shown above. 6015HRW and 6125HRW engines have fuel system components located on left side of engine as viewed from flywheel end. Service procedures are same for both engines.

[1]Low pressure regulating valve is inside this filter housing bore.

[2]High pressure regulating valve and filter screen is inside this filter housing bore behind temperature sensor.

Continued on next page

IMPORTANT: During engine repair, cleanliness of the fuel supply rail (D) in cylinder head (C) is extremely important due to fuel flow through passage. Think of the fuel rails as internal passages of an injection pump; therefore, same cleanliness must be maintained when disconnecting inlet and outlet lines to fuel supply rail.

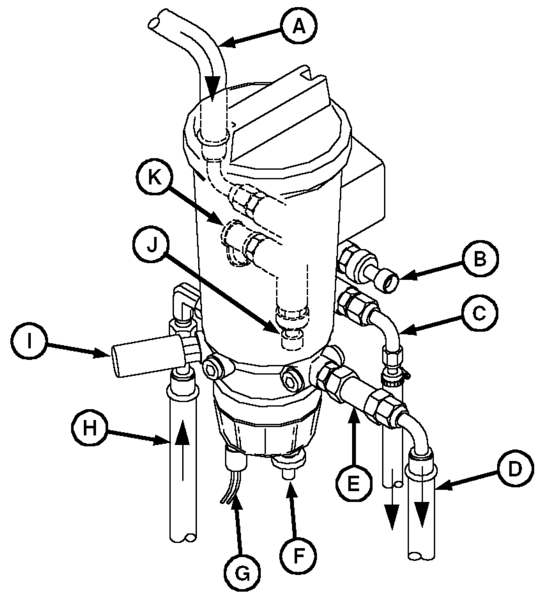
DPSG,OUO1004,996 –19–26OCT00–2/2

Fuel Filter/Water Separator Assembly

Torque specifications for fuel filter assembly are as follows:

Fuel Filter Assembly—Specification

Fuel Line ORFS Fittings—Torque	24 N•m (18 lb-ft)
Fitting (Fuel Return from Rail)—Torque	33 N•m (24 lb-ft)
Fuel Pressure Sensor—Torque	14 N•m (124 lb-in.)
Fitting (Fuel Pressure Sensor)—Torque	14 N•m (124 lb-in.)
Fitting (Fuel Return to Tank)—Torque	33 N•m (24 lb-ft)
Fitting (Fuel Outlet to Supply Pump)—Torque	33 N•m (24 lb-ft)
Fitting (Fuel Inlet from Tank)—Torque	33 N•m (24 lb-ft)
Fuel Primer—Torque	14 N•m (124 lb-in.)
Fuel Primer-to-Fuel Filter Housing Adapter (Single Rail Fuel System)—Torque	11 N•m (97 lb-in.)
Fuel Temperature Sensor—Torque	14 N•m (124 lb-in.)
Check Valve and Fitting—Torque	33 N•m (24 lb-ft)
Diagnostic Test Port and Fitting—Torque	14 N•m (124 lb-in.)
Filter Housing Plugs—Torque	7 N•m (62 lb-in.)
Filter Cap—Torque	11 N•m (100 lb-in.)
Water Separator Bowl—Torque	6 N•m (55 lb-in.)
Fuel Filter Return Tube (Inside Filter Housing)—Torque	20 N•m (15 lb-ft)
Fuel Filter Assembly-to-Bracket Cap Screws—Torque	50 N•m (37 lb-ft)
Fuel Filter Bracket-to-Cylinder Block Cap Screws—Torque	65 N•m (48 lb-ft)



Fuel Filter/Water Separator Assembly

A—Fuel Return (From Fuel Rail)
B—Fuel Pressure Sensor
C—Fuel Return (To Fuel Tank)
D—Fuel Outlet (To Supply Pump)
E—Check Valve
F—Water Drain
G—Water in Fuel Sensor
H—Fuel Inlet (From Fuel Tank)
I—Fuel Primer
J—Fuel Temperature Sensor
K—Diagnostic Test Port

OUO1004,0000BC1 –19–26OCT00–1/1

Replacing Fuel Filter/Water Separator

Remove Old Fuel Filter Element

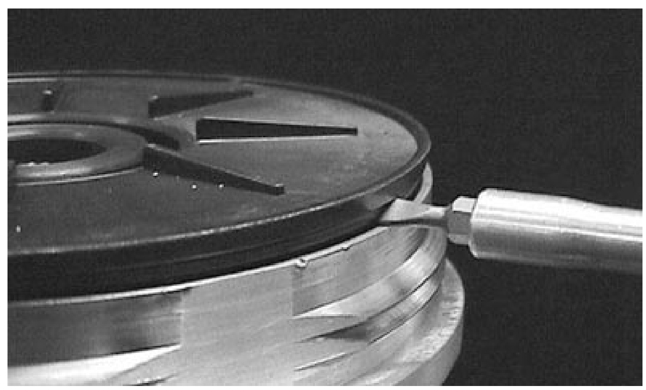
CAUTION: If engine has been running, engine and fuel filter housing may be hot.

1. Close fuel shut-off valve (if equipped).
2. Clean entire area surrounding fuel filter assembly to keep debris from entering fuel system.
3. Remove cap from fuel filter housing. If cap is too tight, a wrench or pliers may be used to loosen cap, as shown.

Filter Cap

DPSG,OUO1004,1015 –19–24AUG99–1/5

4. Relieve vacuum in filter housing by operating hand primer until fuel filter “pops up”. If filter does not “pop up” after about 30 strokes of primer, a small screwdriver may be used, as shown, to **carefully** pry under filter flange to relieve vacuum in the housing.



Relieve Vacuum

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DPSG,OUO1004,1015 –19–24AUG99–2/5

5. Lift filter element up in housing until filter seal clears inlet tube inside housing. Continue to hold filter suspended straight up in top of housing to drain fuel from filter.

6. Allow fuel to drain completely from filter into housing. Carefully begin rotating filter from housing, as shown, until completely upside down to ensure minimal leakage from fuel filter.

7. Place filter in container suitable for diesel fuel.

IMPORTANT: Reusing fuel filter once removed from housing may result in trapped air in the filter, causing fuel to overflow from the filter housing during insertion of filter element and/or cause the engine to stall and not restart without additional system purging.

RG10304 –UN–02SEP99

Remove Filter Element

Continued on next page

DPSG,OUO1004,1015 –19–24AUG99–3/5

Remove and Install Water Separator Bowl

IMPORTANT: Use the least amount of force as necessary with strap wrench when removing and installing separator bowl to prevent plastic bowl from cracking.

1. Disconnect wiring connector from water-in-fuel sensor.

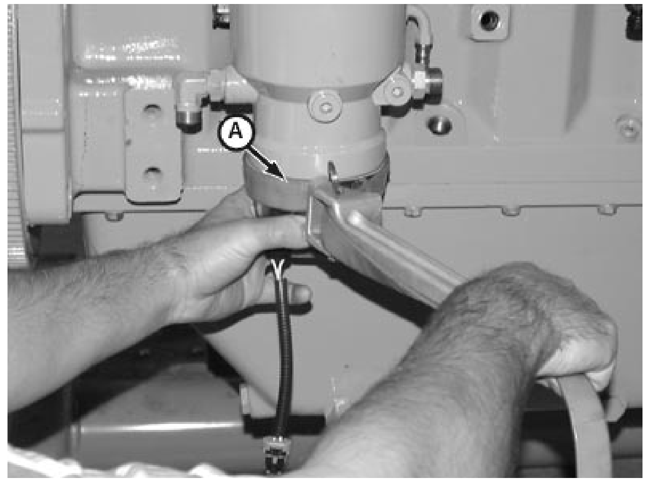
2. Drain fuel from separator bowl.

3. Position a strap wrench (A) as close as possible to top edge of separator bowl. While applying pressure with strap wrench, grip bowl and twist with other hand, as shown, to remove bowl.

4. Install separator bowl and tighten by hand until seal makes contact. Tighten to the following specification.

Specification	
Water Separator Bowl-to-Filter Housing—Torque	6 N•m (55 lb-in.)

5. Connect wiring to water-in-fuel sensor.



RG10351 –UN–13SEP99

Water Separator Bowl

A—Strap Wrench

Continued on next page

DPSG,OUO1004,1015 –19–24AUG99–4/5

Install New Fuel Filter Element

1. Check to ensure that the fuel level in the filter housing is between the MIN (B) and MAX (A) fuel levels indicated on the outside of the housing and on the corresponding marks on the center tube. If the fuel is below the MIN level, carefully open the fuel supply shut-off valve a small amount (if equipped) to add fuel.

   Operate the hand primer to add more fuel if required or if the unit is not equipped with a fuel supply shut-off valve.

IMPORTANT: Fuel level below the MIN indication may result in trapped air in the filter causing the engine to stall and not restart without additional system purging. Fuel level above the MAX indication may cause fuel to overflow from the filter housing during insertion of filter element.

Always use a new filter element whenever an existing element has been removed from filter housing.

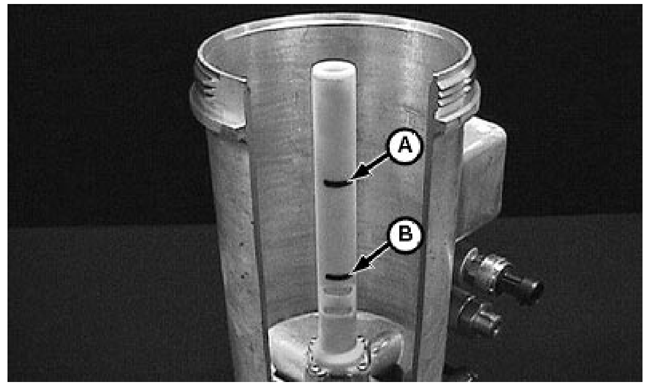
2. Insert **new** (dry) fuel filter into filter housing.

3. Reinstall fuel filter cap and tighten by hand to the following specification.

Specification	
Fuel Filter Cap/Cover-to-Housing—Torque	11 N•m (100 lb-in.)

4. Open the fuel supply shut-off valve (if equipped).

5. Restart engine and allow to run for 5 minutes minimum at slow idle.



RG10305 –UN–02SEP99

Fuel Level in Filter Housing

A—Maximum Level 63 mm (2-1/2 In.) from Top of Housing
B—Minimum Level 127 mm (5 In.) from Top of Housing

DPSG,OUO1004,1015 –19–24AUG99–5/5

Remove and Install Low Pressure Regulating Valve

1. Close fuel shut-off valve, if equipped.

NOTE: On high fuel tank applications without fuel shut-off valve, fuel tank return line must be pinched before disconnecting, then plugged,

2. Disconnect fuel tank return line from filter housing and drain fuel into clean container.

3. Remove low pressure regulating valve parts (A—G).

   To remove valve seat (B), use a standard wire tie strap with approximate 5/16 x 3/16 inch square head. Insert tie strap head through bore of valve seat, rotate to catch lip of seat and remove seat.

4. Clean and inspect all parts. Replace all O-rings and seals.

5. Install parts in reverse order.

   Install valve seat (B) (O-ring end first) into bore of filter housing. Make sure it is firmly seated in bore.

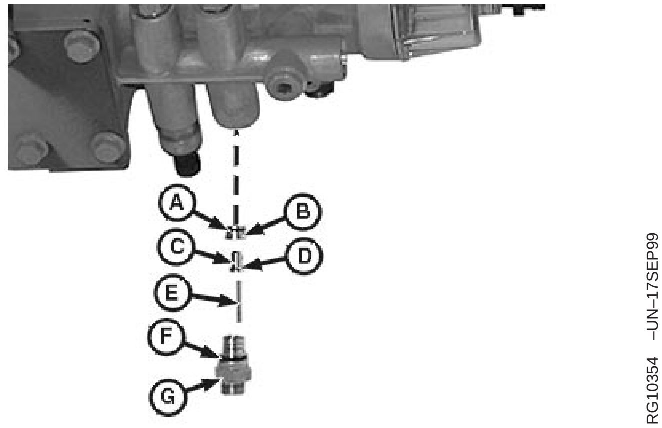
   Install seal (D) with tapered edge of seal into lip of regulating valve (C).

   Spring (E) is color coded red, identifying it as the low pressure spring.

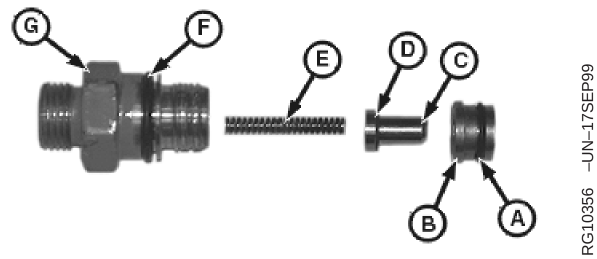
   Tighten valve housing (G) to specifications.

Specification

Low Pressure Regulating
Valve-to-Filter Housing—Torque .... 18 N•m (13 lb-ft)



Low Pressure Regulating Valve



Valve Components

A—O-Ring
B—Valve Seat
C—Low Pressure Regulating Valve
D—Seal
E—Spring, Low Pressure (Color Coded Red)
F—O-Ring
G—Valve Housing

DPSG,OUO1004,1029 –19–26OCT00–1/1

Remove and Install High Pressure Regulating Valve

1. Close fuel shut-off valve, if equipped.

NOTE: *On high fuel tank applications without fuel shut-off valve, fuel tank return line must be pinched before disconnecting, then plugged,*

2. Disconnect fuel tank return line from filter housing and drain fuel into clean container.
3. Open valve on water separator bowl and drain filter housing.
4. Remove fuel temperature sensor (F). See REMOVE AND INSTALL FUEL TEMPERATURE SENSOR in Group 110.
5. Remove high pressure regulating valve (C).
6. To remove screen (A), see REMOVE AND INSTALL 100 MICRON INTERNAL FILTER HOUSING SCREEN INSERT next in this Group.

NOTE: *High pressure regulating valve is not repairable. Do not disassemble valve. If defective, replace entire assembly.*

7. Clean and inspect all parts. Replace all O-rings.
8. Install parts in reverse order.

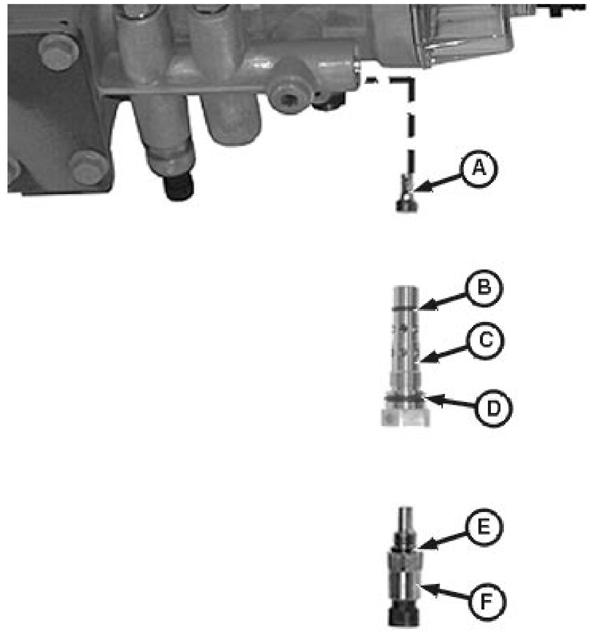
   If removed, install screen (A). See REMOVE AND INSTALL 100 MICRON INTERNAL FILTER HOUSING SCREEN INSERT next in this Group.

   Tighten regulating valve to specifications.

Specification

High Pressure Regulating
Valve-to-Filter Housing—Torque .... 14 N•m (124 lb-in.)

9. Install fuel temperature sensor (F). See REMOVE AND INSTALL FUEL TEMPERATURE SENSOR in Group 110.



RG11168 –UN–30OCT00

High Pressure Regulating Valve

A—Screen
B—O-Ring
C—High Pressure Regulating Valve
D—O-Ring
E—O-Ring
F—Fuel Temperature Sensor

Continued on next page

DPSG,OUO1004,1014 –19–26OCT00–1/2

10. Add fuel to filter housing between minimum and maximum marks on housing. Fuel can be added by throttling the fuel shut-off valve (if equipped), or by removing cover and adding fuel from a clean container.

DPSG,OUO1004,1014 –19–26OCT00–2/2

Remove and Install 100 Micron Internal Filter Housing Screen Insert

1. Remove fuel temperature sensor (F). See REMOVE AND INSTALL FUEL TEMPERATURE SENSOR in Group 110.

   Remove high pressure regulating valve (C). See REMOVE AND INSTALL HIGH PRESSURE REGULATING VALVE earlier in this Group.

IMPORTANT: If allen wrench is pushed too far into 10 micron screen during removal and installation, screen may be damaged. Tie a rubber band (K) approximately 10 mm (3/8 in.) from end of allen wrench, as shown, to prevent screen damage.

NOTE: Screen is approximately 91 mm (3-5/8 in.) up in bore of filter housing. Use a long allen wrench.

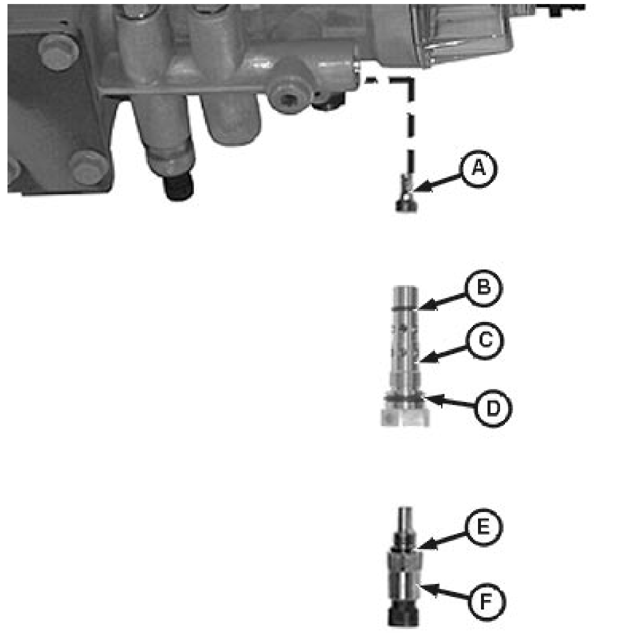
2. Attach a rubber band (K) on end of 5 mm allen wrench and remove 10 micron screen (A) from filter housing.

3. Clean and inspect screen.

4. Using allen wrench with rubber band, install screen in filter housing and tighten to the following specification.

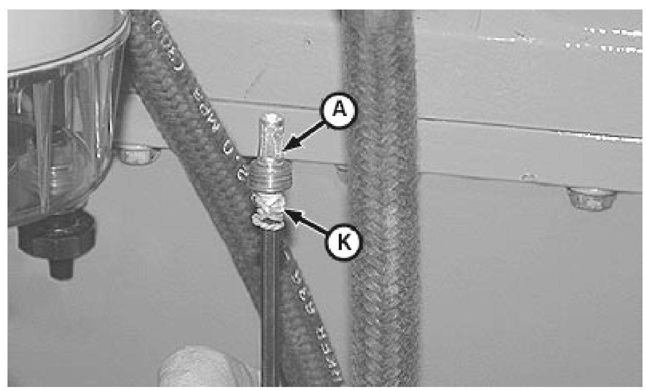
Specification	
100 Micron Internal Filter Housing Screen—Torque	5 N•m (44 lb-in.)

5. Install pressure regulating valve parts (B—D). See REMOVE AND INSTALL HIGH PRESSURE REGULATING VALVE earlier in this Group. Install fuel temperature sensor parts (E) and (F). See REMOVE AND INSTALL FUEL TEMPERATURE SENSOR in Group 110.



RG11168 –UN–30OCT00

High Pressure Regulating Valve



RG10358 –UN–17SEP99

Remove Screen

A—100 Micron Screen
B—O-Ring
C—High Pressure Regulating Valve
D—O-Ring
E—O-Ring
F—Fuel Temperature Sensor
K—Allen Wrench with Rubber Band

DPSG,OUO1004,1030 –19–26OCT00–1/1

Remove and Install Fuel Filter Check Valve

1. Close fuel shut-off valve (if equipped).

2. Disconnect fuel line (shown disconnected) and remove check valve (B). Remove O-rings (A) and (C) from both ends of check valve.

3. Install check valve in filter housing and tighten to specifications.

Specification

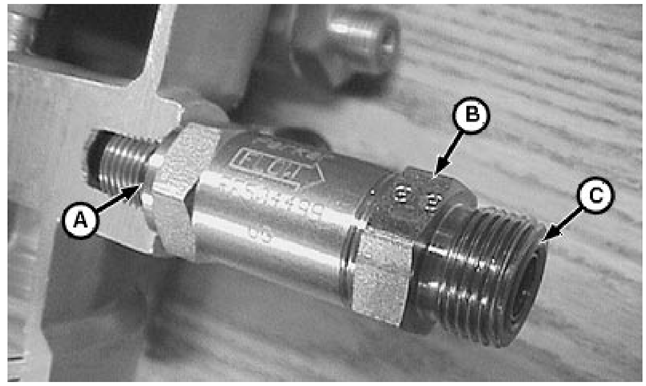
Fuel Filter Check Valve to Fuel Filter Housing—Torque .... 33 N•m (24 lb-ft)

4. Connect fuel line and tighten to specifications.

Specification

Fuel Line-to-Fuel Filter Check Valve—Torque.. 24 N•m (18 lb-ft)

5. Open fuel shut-off valve.



RG10307 –UN–31AUG99

Fuel Filter Check Valve

A—O-Ring
B—Check Valve
C—O-Ring

DPSG,OUO1004,1016 –19–18DEC00–1/1

Remove and Install Primer Pump

1. Remove primer pump (A).

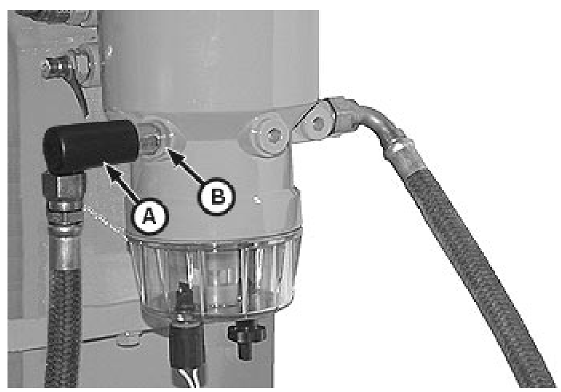
2. If required, remove adapter (B).

3. Clean and inspect parts.

4. Install primer pump and adapter with new O-rings and tighten to specifications.

Specification

Fuel Primer (Single Rail Fuel System)—Torque... 14 N•m (124 lb-in.)
Fuel Primer-to-Fuel Filter Housing Adapter (Single Rail Fuel System)—Torque... 11 N•m (97 lb-in.)



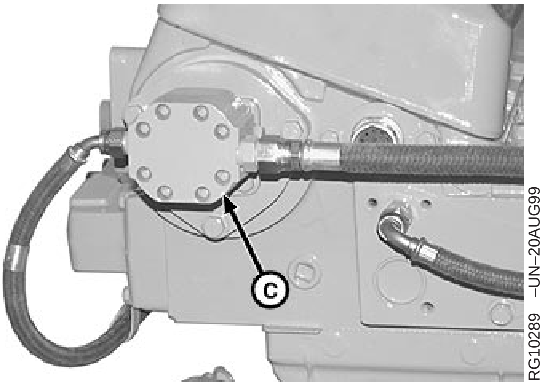
RG10360 –UN–30SEP99

Primer Pump

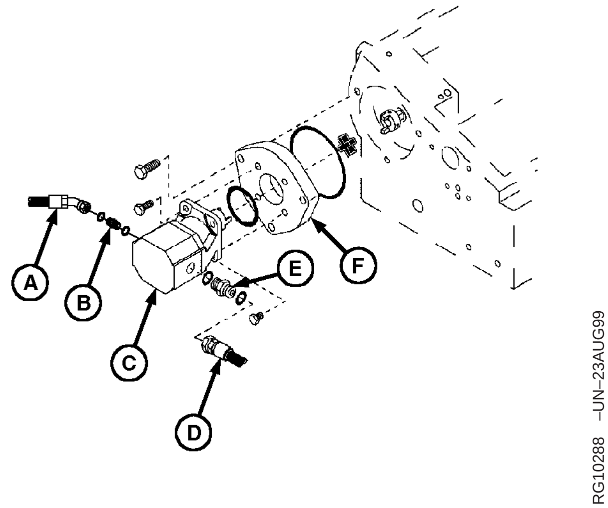
A—Primer Pump
B—Adapter

DPSG,OUO1004,1032 –19–26OCT00–1/1

Remove and Install Single Rail Fuel Supply Pump



Fuel Supply Pump



Removing Fuel Supply Pump

A—Supply Pump Outlet Line
B—Fitting
C—Fuel Supply Pump
D—Supply Pump Inlet Line
E—Fitting
F—Mounting Bracket

IMPORTANT: Plug or cap all fuel system connections and passages as lines or components are removed to keep debris out using JDG998 Fuel System Cap Plug Kit.

Remove Fuel Supply Pump

NOTE: Fuel flow through cylinder head may vary by engine application. Supply pump (A) may be mounted as shown with fuel entering the front left side of the cylinder head and exiting the back of the head. On some machine applications, the fuel supply pump is rotated 180° and the fuel lines **on cylinder head** *are reversed, with fuel entering the back of the head and exiting the front left side of the head.*

Add a reference mark (supply pump-to-cylinder head) and label fuel lines as they are disconnected, to ensure correct reinstallation of supply pump.

1. Remove two fuel lines (A) and (D) connected to fuel supply pump. Cap all lines and fittings to keep debris out of fuel system.

2. Remove four cap screws securing supply pump to mounting bracket (F) and remove pump. Remove and discard O-ring.

NOTE: Fuel supply pump is not serviceable; replace pump if determined to be defective.

3. Remove fittings (B) and (E) from pump and clean thoroughly if pump is to be replaced.

Install Fuel Supply Pump

1. Install fittings onto new pump using new O-rings. Tighten fittings securely.

2. Ensure that drive coupler set screw is tightened to specifications on supply pump drive shaft with end of shaft flush with coupler ID. Check drive coupler on camshaft drive pin also; adjust as needed.

Specification

Fuel Supply Pump and Camshaft Drive Coupler Set Screws—Torque .... 4 N•m (3 lb-ft)

Continued on next page

DPSG,OUO1004,1000 –19–13AUG99–1/2

3. Position new rubber spider (vibration absorber) on drive coupler. Position new O-ring on face of supply pump.

4. If removed, apply AR54749 Soap Lubricant to new O-ring on supply pump mounting bracket (F) and install. Tighten mounting bracket cap screws to specifications.

Specification

Fuel Supply Pump Mounting Bracket Cap Screws—Torque .... 50 N•m (37 lb-ft)

5. Install fuel supply pump with rubber spider properly meshed with coupler on rear of camshaft.

6. Install four cap screws and tighten to specifications.

Specification

Fuel Supply Pump-to-Bracket—Torque.. 25 N•m (18 lb-ft)

IMPORTANT: Before connecting ORFS fuel line fittings, be sure O-ring is correctly positioned in the groove of fitting. Tighten fitting ONLY to specified torque. DO NOT OVERTIGHTEN.

7. Install two fuel lines and tighten to specifications.

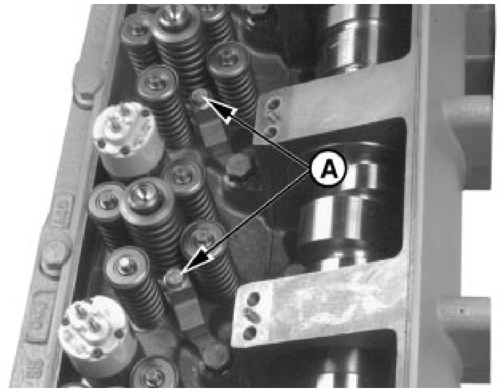
Specification

Fuel Line ORFS Fittings—Torque.. 24 N•m (18 lb-ft)

DPSG,OUO1004,1000 –19–13AUG99–2/2

Remove and Install Electronic Unit Injectors (Single Rail Fuel System)

IMPORTANT: Electronic unit injectors on dual rail fuel systems are different than injectors on single rail systems. Use the appropriate injector for engine/fuel system applications. Additionally, early single rail fuel systems for engines S.N. (—29999) use different injectors than later single rail systems for engines S.N. (30000—). Replace injector with the same type removed. DO NOT intermix injectors. See parts catalog for correct applications.



RG8279 –UN–05DEC97

Unit Injector Clamp Screws

A—Clamp Cap Screws

1. Remove rocker arm cover. See REMOVE AND INSTALL ROCKER ARM COVER in CTM100, Section 02, Group 020.

2. Remove rocker arm shaft assembly. See REMOVE ROCKER ARM ASSEMBLY in CTM100, Section 02, Group 020.

3. Disconnect fuel lines and drain fuel from lines and fuel rail in cylinder head.

4. Reconnect lines (or install cap plugs from JDG998 Fuel System Cap Plug Kit) to keep debris out of fuel system.

5. Remove injector hold-down clamp cap screws (A).

Continued on next page DPSG,OUO1004,1001 –19–26OCT00–1/5

6. Pry upward on the injector hold-down clamp (A) against cylinder head using a prybar (B) as shown.

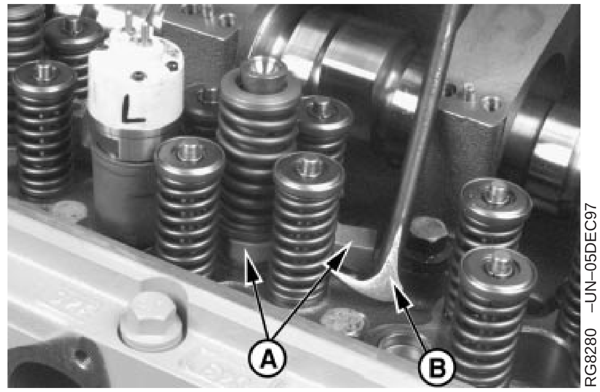
7. Remove injector and clamp from cylinder head. Label injector for installation in same cylinder location as removed.

8. Immediately plug injector bore with clean cap plug to keep debris out of fuel system.

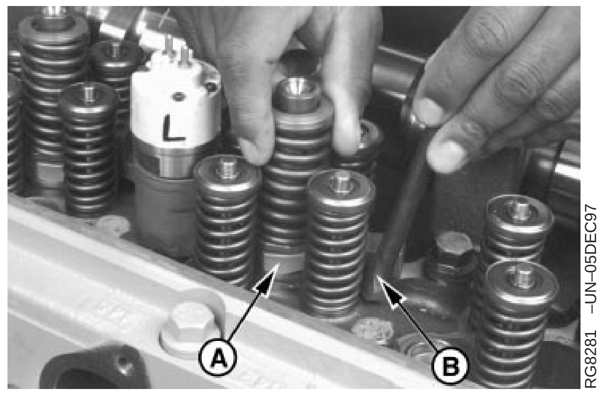
9. Remove injector O-rings (C) and discard.

10. Store injector in a clean, lint-free container.

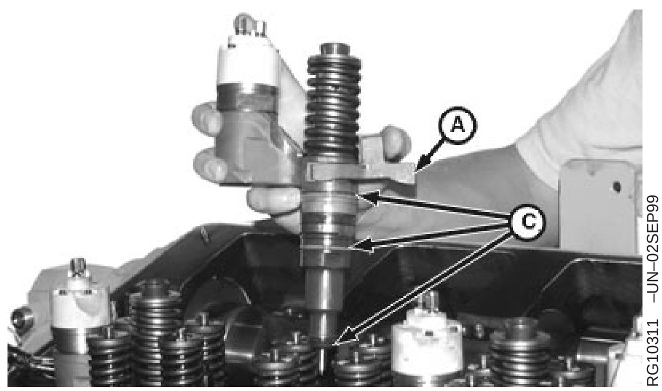
A—Hold-Down Clamp
B—Prybar
C—Injector O-Rings



Position Prybar



Removing Unit Injector



Unit Injector Removed

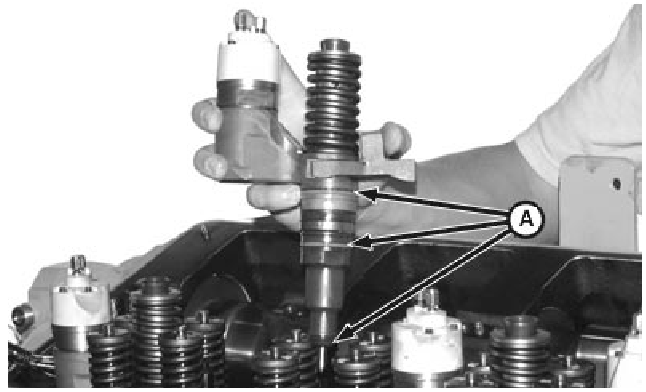
Continued on next page DPSG,OUO1004,1001 –19–26OCT00–2/5

Install Electronic Unit Injectors

1. Remove cap plug from injector bore in cylinder head. Clean entire sleeve using a clean, lint-free cloth wrapped around a wooden stick.

2. Install three new O-rings (A) on unit injector body. Lubricate O-rings with clean engine oil or AMOJELL lubricant.

A—O-Rings



Installing Unit Injector

Continued on next page DPSG,OUO1004,1001 –19–26OCT00–3/5

IMPORTANT: Press on top of injector plunger with palm of hand to properly seat O-rings and center injector between valve springs.

NOTE: New EUI hold-down clamp cap screws have pre-applied sealant.

3. Install unit injector with hold-down clamp into same cylinder as removed (solenoid outward toward exhaust manifold side of engine at equal distance between exhaust valve springs). Apply LOCTITE® 242 Thread Lock and Sealer to **used** hold-down cap screw. Initially tighten cap screw to specifications.

Specification

Electronic Unit Injector
Hold-Down Clamp Cap Screws—
Initial Torque.. 20 N•m (15 lb-ft)

4. Mark head of cap screw (A) at twelve o'clock position (viewed from rear) using a paint stick.

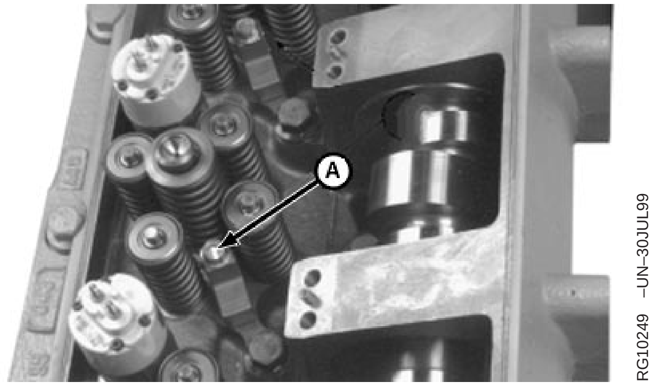
5. Install 13 mm swivel socket on head of cap screw. Position ratchet handle (B) parallel with centerline of engine camshaft/crankshaft.

   Torque-turn cap screw to the following specification.

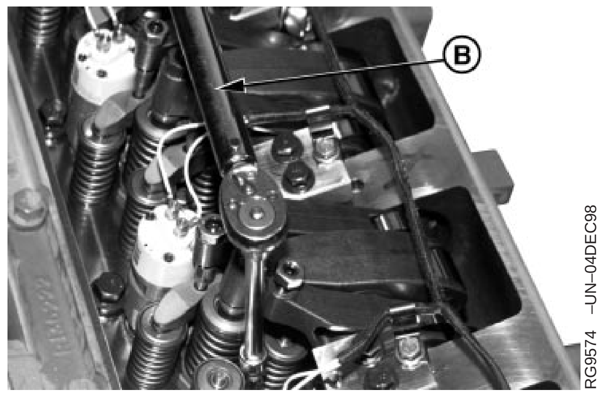
Specification

Electronic Unit Injector
Hold-Down Clamp Cap Screws—
Final Torque-Turn.. 90—100°

6. Remove socket from head of cap screw and verify that mark has been tightened/turned at least 90° but not more than 100° from its original position.



Injector Hold-Down Clamp Screws



Torque-Turn EUI

A—Clamp Cap Screw
B—Ratchet Handle

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Continued on next page DPSG,OUO1004,1001 –19–26OCT00–4/5

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.

7. Reconnect injector solenoid wiring leads onto solenoid studs. Apply LOCTITE® 222 Small Screw Thread Locker (TY24311) to studs and tighten retaining nuts (A) to specifications.

Specification

Electronic Unit Injector Wiring Harness Connector Nuts—Torque .... 2 N•m (18 lb-in.)

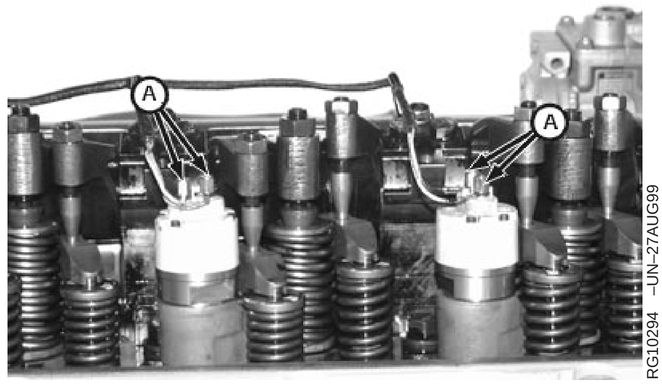
8. Install valve bridges, push tubes, and rocker arm assembly. Adjust valve stem-to-bridge clearances. See INSTALL ROCKER ARM ASSEMBLY in CTM100, Section 02, Group 020.

9. If removed or loosened, tighten all harness and line clamps to specifications.

Specification

Fuel Line Clamps—Torque .... 5 N•m (44 lb-in.)
Electronic Unit Injector Harness-to-Shaft Clamps—Torque .... 35 N•m (26 lb-ft)
Electronic Unit Injector Wiring Connector Bracket-to-Rear of Head—Torque .... 25 N•m (18 lb-ft)

10. Adjust electronic unit injector preload as detailed later in this Group.



Wiring Terminal Nuts

A—Retaining Nuts

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DPSG,OUO1004,1001 –19–26OCT00–5/5

Adjust Electronic Unit Injector Preload

1. Remove plug from cylinder block and install JDG820 Flywheel Turning Tool (B).

IMPORTANT: Timing pin MUST BE installed in slot of camshaft first. Then install second timing pin in crankshaft slot by carefully rocking flywheel back and forth.

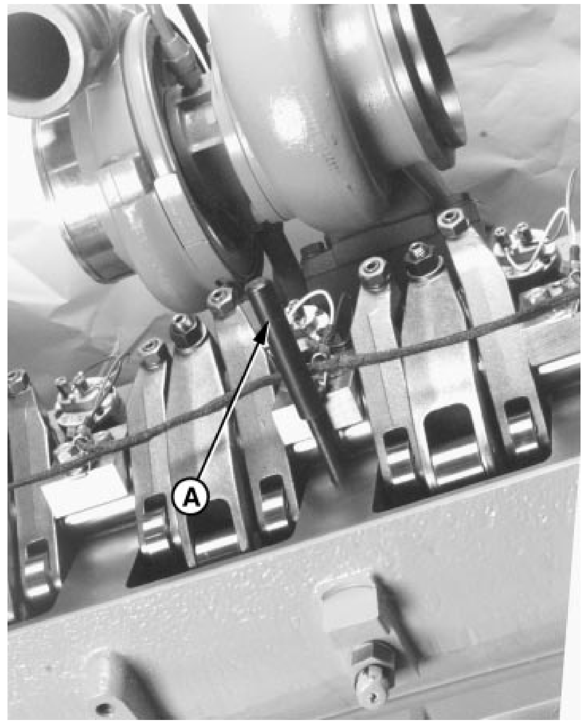
2. Rotate engine flywheel in running direction (counterclockwise as viewed from rear) until JDG971 Timing Pin (A) engages single timing slot (D) in camshaft. The proper timing slot can be found by viewing camshaft timing lobe through camshaft timing pin bore while rotating engine. The double timing slot (E) will be at approximately 11 o'clock (viewed from rear of engine) when pin is installed in slot (D).This ensures that engine is locked at TDC of No. 1 cylinder's compression stroke. Intake and exhaust rocker arms on No. 1 cylinder should be loose.

3. Remove threaded plug from crankshaft timing hole below oil cooler and filter housing assembly.

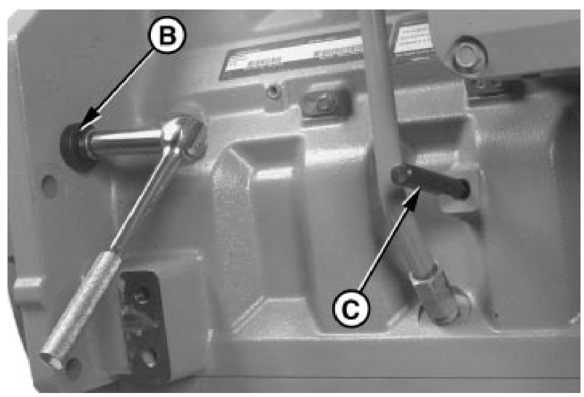
IMPORTANT: DO NOT insert timing pin full depth into cylinder block crankshaft timing hole when rotating engine flywheel until double slot on camshaft timing lobe is at approximately 11 o'clock (viewed from rear of engine) to avoid crankshaft counterweight bending timing pin.

4. Slightly move engine flywheel back and forth with turning tool until a second JDG971 Timing Pin (C) can be installed in slot in crankshaft. This ensures that camshaft and crankshaft are in sync (properly timed).

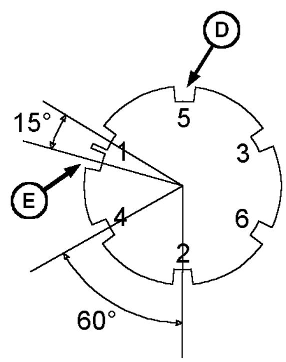
A—JDG971 Timing Pin
B—JDG820 Flywheel Turning Tool
C—JDG971 Timing Pin
D—Single Timing Slot
E—Double Timing Slot



JDG971 Timing Pin in Camshaft



JDG971 Timing Pin in Crankshaft



Camshaft Timing Slot

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If timing pin does not enter crankshaft timing slot, crankshaft is not properly timed with camshaft. Crankshaft MUST BE timed to camshaft. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in CTM100, Section 02, Group 050.

02
091
21

RG,RG34710,263 –19–03NOV00–2/3

5. Loosen lock nut (A) and loosen cylinders Nos. 3, 5, and 6 injector rocker arm adjusting screws (B) to relieve tension.

6. Slowly tighten adjusting screw until rocker arm roller contacts camshaft lobe at 0.0 clearance.

7. Tighten adjusting screw an additional 1/2 turn (180°) to preload injector. Tighten adjusting screw lock nut to specifications while holding adjusting screw stationary.

Specification

Electronic Unit Injector Adjusting Screw Lock Nut—Torque .... 65 N•m (48 lb-ft)

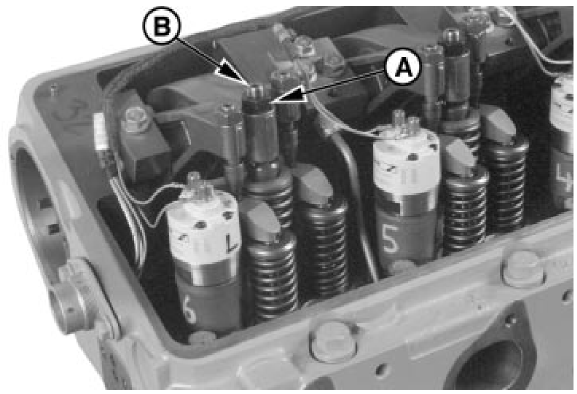
8. Remove both timing lock pins, rotate crankshaft one full revolution (360°) and pin crankshaft only. Engine will now be locked at No. 6 TDC.

9. Set injector preload on cylinders Nos. 1, 2, and 4.

10. Install plug in timing pin hole in block and tighten to specifications.

Specification

Timing Pin Plug in Cylinder Block—Torque .... 33 N•m (24 lb-ft)



Unit Injector Adjusting Screw

A—Lock Nut
B—Adjusting Screws

RG,RG34710,263 –19–03NOV00–3/3

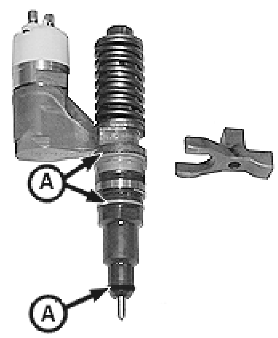
Replace Electronic Unit Injector O-Rings

1. The electronic unit injector's three external O-rings (A) must be replaced whenever injector is removed.

2. Fuel system diagnosis will determine if unit injector is not functioning properly. Refer to Section 04, Groups 150 and 160, as required.

3. Replaced unit injectors will be returned by your authorized servicing dealer to the manufacturer for testing and rebuilding.

A—O-Rings



RG10313 –UN–02SEP99

Unit Injector and Clamp

DPSG,OUO1004,1031 –19–20NOV00–1/1

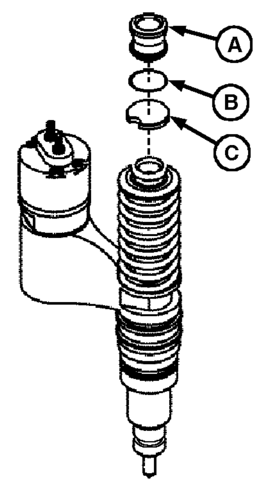
Replace Electronic Unit Injector Thrust Sleeve, Pad and O-Ring

1. Using an O-ring pick, remove O-ring (B).

2. Remove thrust socket (A) and pad (C).

3. Coat parts with clean engine oil and install in reverse order.

A—Thrust Socket
B—O-Ring
C—Thrust Pad



RG10353 –UN–16SEP99

Electronic Unit Injector

DPSG,OUO1004,1028 –19–15SEP99–1/1

Bleed Fuel System

NOTE: Under normal conditions, fuel system bleeding is not required. Priming system with hand primer (B) is normally sufficient. If necessary to bleed the system, use the following procedure.

1. Drain water and contaminants from clear water separator sediment bowl by opening drain valve (C) and operating primer (B) until bowl is clear of water.

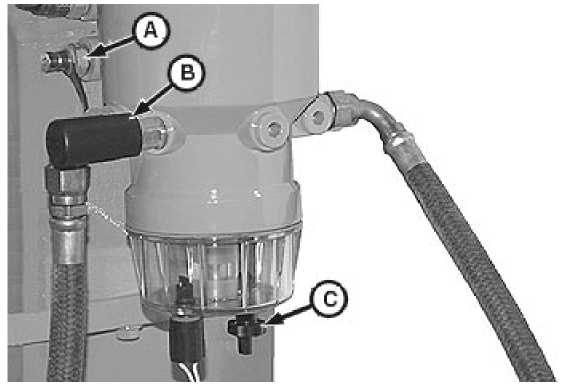
2. Close drain valve (C).

3. Attach a DR fitting and clear drain line to diagnostic fitting (A) and place end of line in suitable container for diesel fuel.

4. Pump hand primer (B) until a steady flow of fuel (without bubbles) comes out of line.

5. Disconnect line from diagnostic fitting.

6. Start engine and run for five minutes at slow idle.



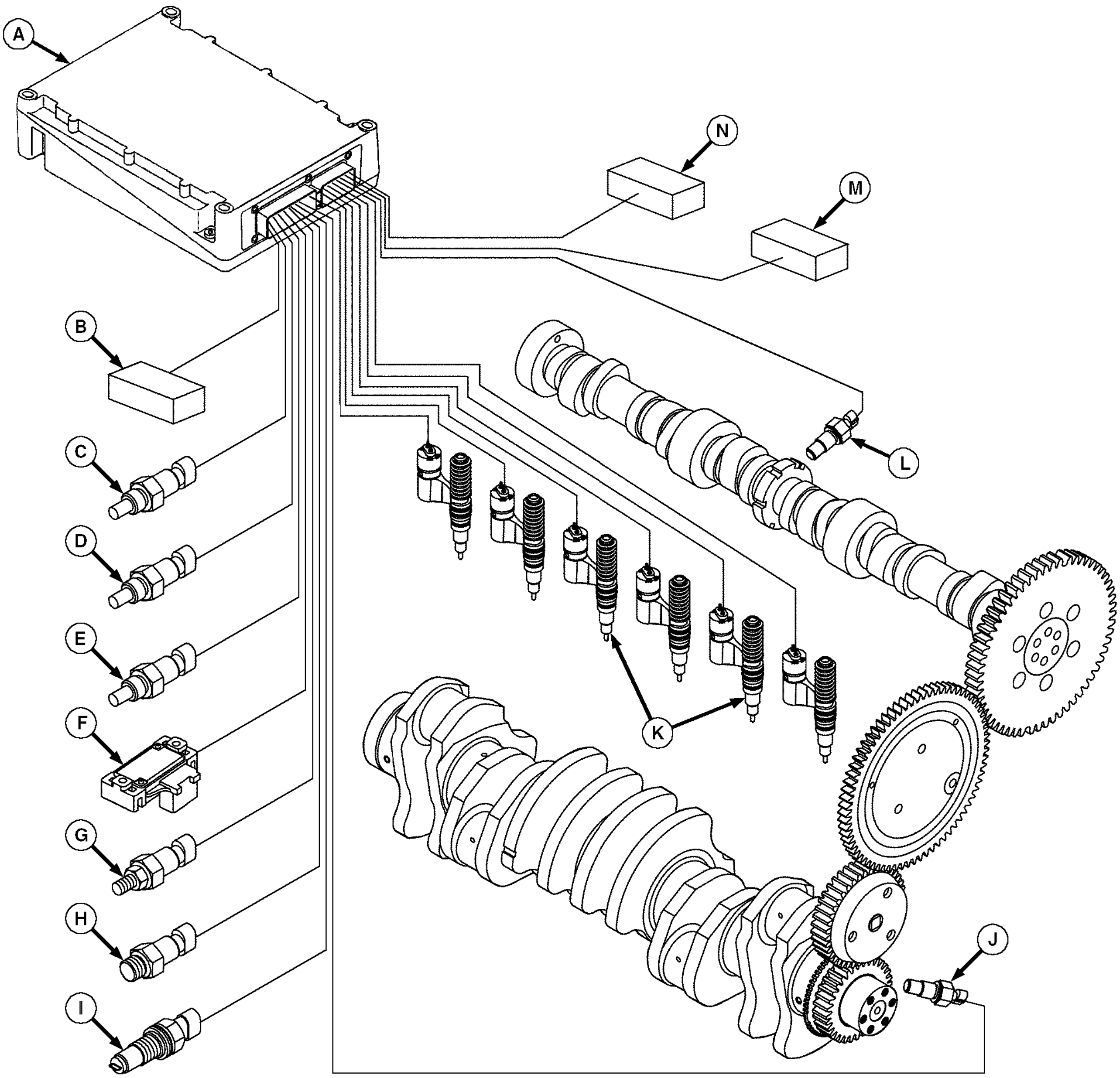
RG10309 –UN–02SEP99

Bleed Fuel System

A—Diagnostic Port
B—Hand Primer
C—Water Drain Valve

DPSG,OUO1004,1004 –19–26OCT00–1/1

John Deere Level 6 Electronic Control System



Electronic Control System

A—Engine Control Unit (ECU)
B—Throttle Position Sensor
C—Coolant Temperature Sensor (1 or 2 used)
D—Fuel Temperature Sensor
E—Manifold Air Temperature (MAT) Sensor
F—Manifold Absolute Pressure (MAP) Sensor
G—Oil Pressure Sensor
H—Fuel Pressure Sensor[1]
I—Water-in-Fuel Sensor[1]
J—Crankshaft Position Sensor
K—Electronic Unit Injector (6 used)
L—Camshaft Position Sensor
M—Diagnostic Reader
N—Vehicle Output Monitor

[1] *Sensor is on later model engines with single fuel filter assembly.*

Continued on next page OUO1004,0000C41 –19–20DEC00–1/2

NOTE: Electronic control system diagnosis will determine if a sensor is not functioning properly. Refer Section 04, Groups 150 and 160 as required.

IMPORTANT: DO NOT pressure wash the engine control unit (ECU).

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

1. Disconnect ECU-to-vehicle frame ground connection.
2. Disconnect all other connectors from ECU.
3. Connect welder ground close to welding point and make sure ECU and other electrical components are not in the ground path.

The ECU mounting bracket is attached to the cylinder block. If removed, reinstall and tighten mounting bracket cap screws to the following specifications.

Specification

ECU Mounting Bracket-to-Cylinder Block Lower Cap Screws—Torque .... 68 N•m (55 lb-ft)
ECU Mounting Bracket-to-Cylinder Block Upper Front Cap Screw—Torque... 110 N•m (81 lb-ft)

OUO1004,0000C41 –19–20DEC00–2/2

Remove and Install Coolant Temperature Sensor

NOTE: Your engine may be equipped with either one or two coolant temperature sensor(s) (A).

The ECU monitors coolant temperature for engine protection purposes and starting. Using the coolant temperature signal, the ECU will derate engine power as coolant temperature becomes excessive. The ECU will also adjust fuel delivery during start-up during low coolant temperature conditions.

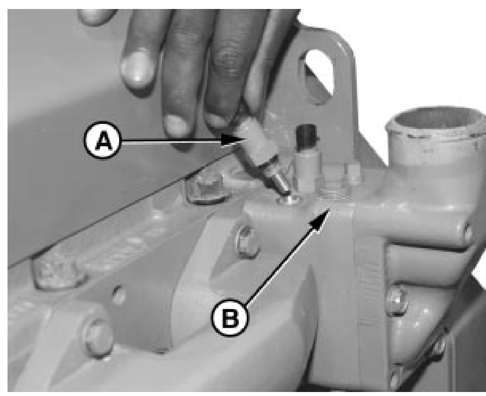
1. Disconnect coolant temperature sensor wiring connector and remove sensor from thermostat housing (B).

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

Specification

Coolant Temperature Sensor—Torque .... 10 N•m (7.5 lb-ft)

3. Install sensor wiring connector.

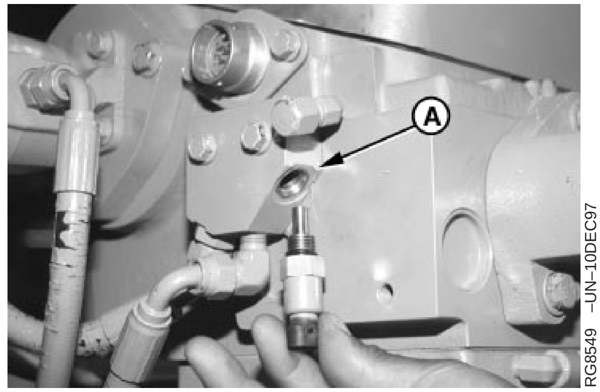


ECT Sensor

A—Coolant Temperature Sensor
B—Thermostat Housing

RG,RG34710,269 –19–13AUG99–1/1

Remove and Install Fuel Temperature Sensor (Dual Rail System)



Fuel Temperature Sensor

A—Fuel Manifold

The ECU monitors fuel temperature to determine fuel density and adjust delivery as necessary.

1. Disconnect fuel temperature sensor wiring connector and remove sensor from fuel manifold (A).

NOTE: Plug bore with clean cap plug after removal of sensor.

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

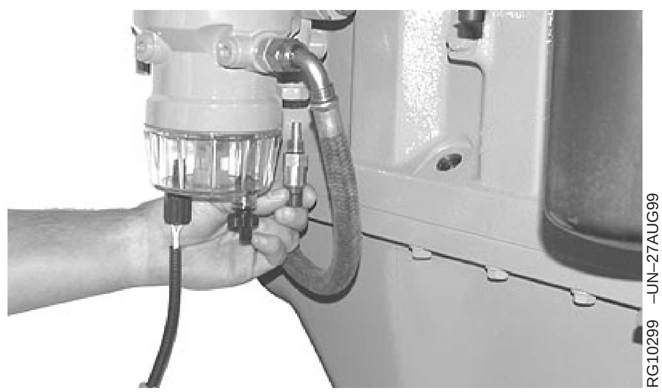
Specification

Fuel Temperature Sensor-to-Fuel Manifold (Dual Rail Fuel System)—Torque.. 10 N•m (7.5 lb-ft)

3. Install sensor wiring connector.

RG,RG34710,270 –19–13AUG99–1/1

Remove and Install Fuel Temperature Sensor (Single Rail System)



Fuel Temperature Sensor

The ECU monitors fuel temperature to determine fuel density and adjust delivery as necessary.

1. Disconnect fuel temperature sensor wiring connector and remove sensor from fuel filter housing.

NOTE: Plug bore with clean cap plug after removal of sensor.

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

Specification

Fuel Temperature Sensor-to-Fuel Filter Housing (Single Rail Fuel System)—Torque.. 14 N•m (10 lb-ft)

3. Install sensor wiring connector.

DPSG,OUO1004,1008 –19–23AUG99–1/1

Remove and Install Fuel Pressure Sensor (Single Rail Fuel System)

Fuel Pressure Sensor (Later Engines with Single Rail Fuel Systems Only)

The ECU monitors fuel pressure to protect the electronic unit injectors from low fuel pressure conditions. The ECU will generate a diagnostic trouble code (or warning light in some applications) when a low fuel pressure condition exists.

1. Disconnect fuel pressure sensor wiring connector and remove sensor from fuel filter housing.

NOTE: Plug bore with clean cap plug after removal of sensor.

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

Specification	
Fuel Pressure Sensor-to-Fuel Filter Housing (Single Rail Fuel System)—Torque	14 N•m (10 lb-ft)

3. Install sensor wiring connector.

DPSG,OUO1004,1010 –19–18DEC00–1/1

Remove and Install Water-in-Fuel Sensor (Single Rail Fuel System)

Water-in-Fuel Sensor (Later Engines with Single Rail Fuel Systems Only)

The ECU monitors water in fuel to protect the electronic unit injectors. The ECU will generate a diagnostic trouble code (or warning light in some applications) when water is detected in the fuel.

1. Disconnect water in fuel sensor wiring connector and remove sensor from water separator bowl.

NOTE: Plug bore with clean cap plug after removal of sensor.

2. Coat sensor O-ring with JDT405 High Temperature Grease and install sensor in water separator bowl.Tighten to specifications.

Specification	
Water-in-Fuel Sensor-to-Water Separator Bowl (Single Rail Fuel System)—Torque	14 N•m (10 lb-ft)

3. Install sensor wiring connector.

DPSG,OUO1004,1011 –19–18DEC00–1/1

Remove and Install Oil Pressure Sensor

The ECU monitors engine oil pressure for engine protection purposes. Under low oil pressure conditions, the ECU will derate engine power and in some applications, may shut the engine down. A diagnostic trouble code or warning light is generated.

1. Disconnect oil pressure sensor wiring connector and remove sensor from oil cooler housing.

2. Coat sensor O-ring with JDT405 High Temperature Grease. Coat threads of sensor with LOCTITE® 592 Pipe Sealant with TEFLON®. Install sensor in oil cooler housing and tighten to specifications.

Specification

Engine Oil Pressure Sensor—
Torque .... 9 N•m (80 lb-in.)
Engine Oil Pressure Sensor
Adapter-to-Filter Housing—
Torque .... 11 N•m (97 lb-in.)

3. Install sensor wiring connector.

RG10296 –UN–27AUG99

Oil Pressure Sensor

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TEFLON is a registered trademark of Du Pont Co.

DPSG,OUO1004,1012 –19–26OCT00–1/1

Remove and Install Manifold Air Temperature (MAT) Sensor


RG8548 –UN–20MAY98

Manifold Air Temperature (MAT) Sensor

The ECU uses the manifold air temperature and manifold absolute pressure sensor signals for engine airflow calculations.

1. Disconnect manifold air temperature sensor wiring connector.

2. Remove sensor from bottom side of intake manifold (6105H and 6125H engines) or aftercooler (6105A engines).

3. Coat O-ring with JDT405 High Temperature Grease.

4. Install MAT sensor in bottom side of intake manifold or aftercooler. Tighten to specifications.

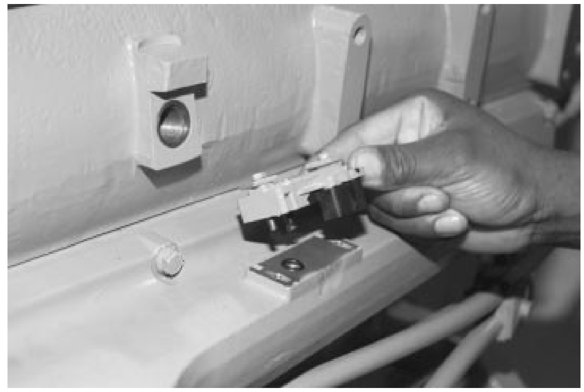
Specification

Manifold Air Temperature (MAT) Sensor—Torque .... 10 N•m (7.5 lb-ft)

5. Install sensor wiring connector.

RG,RG34710,271 –19–13AUG99–1/1

Remove and Install Manifold Absolute Pressure (MAP) Sensor



Manifold Absolute Pressure (MAP) Sensor

The ECU uses the manifold absolute pressure and manifold air temperature sensor signals for engine airflow calculations.

1. Disconnect manifold absolute pressure sensor hose (6105A and 6125A engines) and/or wiring connector.

2. Remove sensor from intake manifold or aftercooler.

3. Remove two cap screws and remove sensor.

4. Coat O-ring with JDT405 High Temperature Grease.

5. Install sensor on intake manifold or aftercooler. Tighten two cap screws to specifications.

Specification

Manifold Absolute Pressure
(MAP) Sensor—Torque .... 7 N•m (5 lb-ft)

6. Connect hose (6105A and 6125A engines) and /or wiring connector.

RG,RG34710,272 –19–13AUG99–1/1

Remove and Install Camshaft Position Sensor

Camshaft Position Sensor

IMPORTANT: Camshaft position sensor MUST BE removed for camshaft removal and installation.

The ECU monitors the position of the camshaft and crankshaft to determine piston position and the optimum time to start and stop injecting fuel. The camshaft position sensor monitors camshaft position and sends it to the ECU.

1. Disconnect camshaft position sensor wiring connector.

2. Remove sensor from cylinder head.

3. Coat O-ring with JDT405 High Temperature Grease.

4. Install sensor in cylinder head. Tighten to specifications.

Specification

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

RG,RG34710,273 –19–13AUG99–1/1

Remove and Install Crankshaft Position Sensor

NOTE: Crankshaft vibration damper and front seal shown removed.

The ECU monitors the position of the crankshaft and camshaft to determine piston position and the optimum time to start and stop injecting fuel. The crankshaft position sensor monitors crankshaft position and sends it to the ECU.

1. Disconnect crankshaft position sensor wiring connector.

2. Remove sensor (B) from timing gear cover.

3. Before installing sensor, check sensor-to-crankshaft timing wheel dimension, using one of the following methods.

   Measure sensor depth using JDG1334 Depth Checking Tool:

   Install JDG1334 Depth Checking Tool (G) in sensor bore in timing gear cover and tighten by hand.

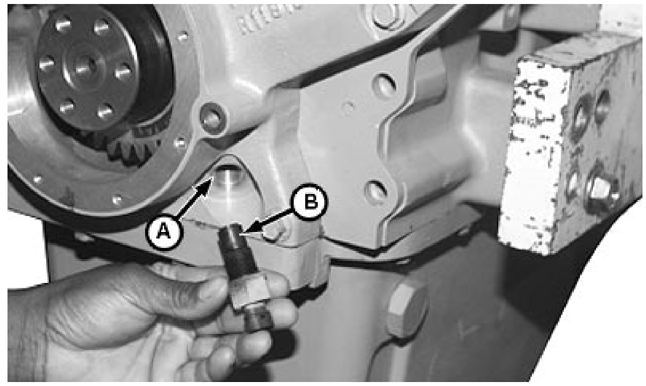
   Push in on pin (C) until it firmly contacts timing wheel (H).

   Check position of pin end (C) in relation to top surface of tool as shown in (D, E and F).

   If the lower shoulder of the pin extends above the top surface of the depth tool (D), sensor depth is too low. Add one R60756 shim to sensor when installing.

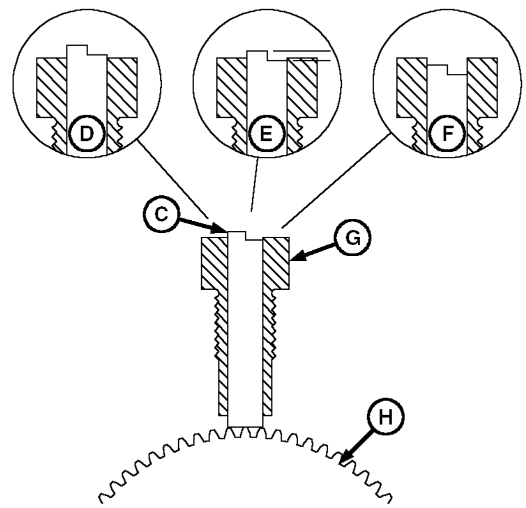
   If the lower shoulder of the pin is within ranges of marks (E), sensor depth is correct and no shim is required. (The correct sensor depth is between the top of the pin and the lower shoulder of the pin flush with the top surface of the depth tool.)

   If pin end is below top surface of depth tool (F), sensor is too high. Further investigation is required. Contact your Dealer DTAC representative.



RG10290 –UN–24AUG99

Crankshaft Position Sensor



RG10380 –UN–19OCT99

Using JDG1334 Depth Checking Tool

A—Machined Mounting Surface (Spotface)
B—Crankshaft Position Sensor
C—Pin (In JDG1334 Depth Checking Tool)
D—Sensor Depth Low (Shim Required)
E—Sensor Depth Correct (No Shim Required)
F—Sensor Depth too High (Requires Investigation)
G—JDG1334 Depth Checking Tool
H—Crankshaft Timing Wheel

Continued on next page

RG,RG34710,274 –19–13AUG99–1/2

If JDG1334 Depth Checking Tool is not available, use a depth gauge to measure distance from sensor spotface (machined mounting surface) (A) on timing gear cover to face of crankshaft timing wheel tooth and compare to following specifications.

Specification

Crankshaft Position Sensor Spotface (Mounting Surface)-to-Crankshaft Timing Wheel Tooth—Distance.......................... 36.7—38.2 mm (1.44—1.50 in.)

If distance is less than 36.7 mm (1.44 in.), install R60756 shim when installing sensor. If distance is greater than 38.2 mm (1.50 in.), further investigation is required. Contact your Dealer DTAC representative.

4. Coat O-ring on sensor with JDT405 High Temperature Grease.

5. Install sensor (and shim if required) in timing gear cover. Tighten to specifications.

Specification

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

RG,RG34710,274 –19–13AUG99–2/2

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.

NOTE: See ELECTRONIC CONTROL SYSTEM OVERVIEW in Section 03, Group 140 for diagrams showing location of sensors and connectors. For vehicle engines, refer to machine Operation and Tests manual for complete wiring diagrams, including connectors.

IMPORTANT: If for some reason the connectors are not connected, such as when the fuel injection 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.

OUO1004,0000C37 –19–18DEC00–1/1

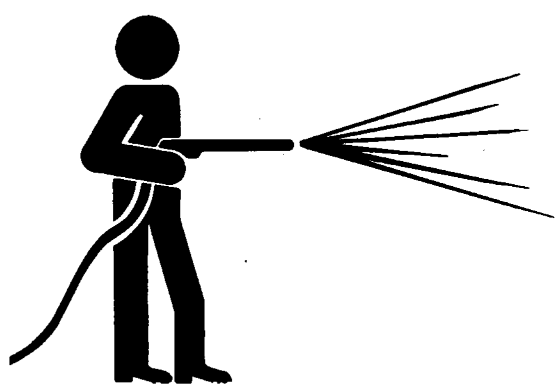
Use Electrical Insulating Compound

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: 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

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 –19–03NOV99–1/4

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*

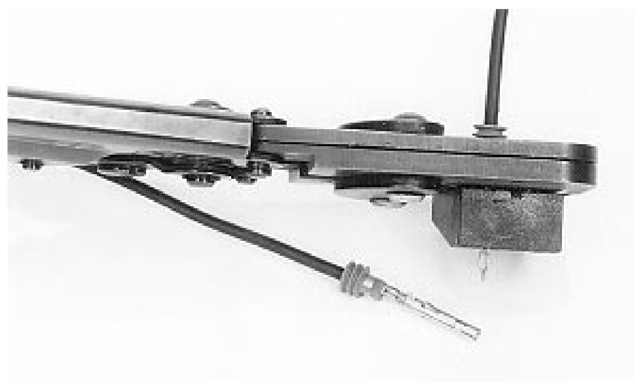
TS0136 –UN–23AUG88

AG,OUOD008,296 –19–03NOV99–2/4

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

Continued on next page

AG,OUOD008,296 –19–03NOV99–3/4

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.

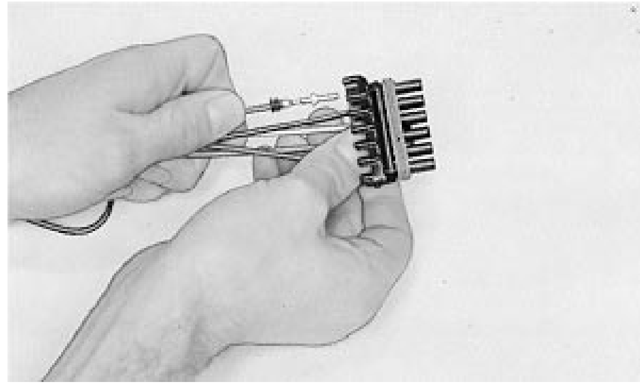
Correct terminal installation for sleeve (A) and pin (B) is illustrated.

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

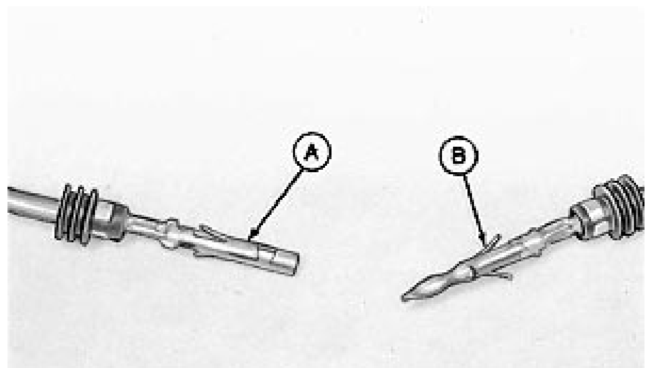
11. Repair or transfer remaining wires.

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 –19–03NOV99–4/4

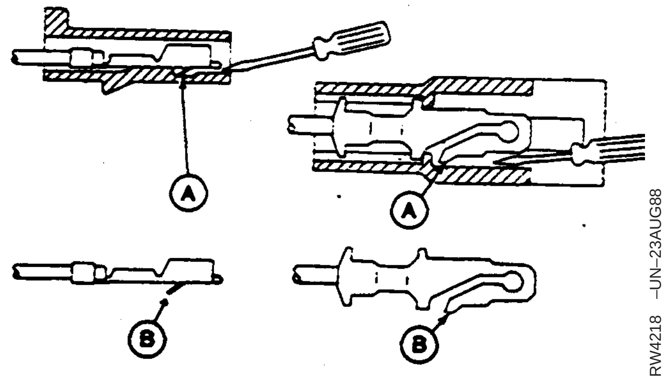
Remove Blade Terminals from Connector Body

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

1. Insert JDG776 or JDG777 Terminal Extraction 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 it's original position before installing into a connector.



A—Locking Tang
B—Original Position

[1]*Included in JT07195B Electrical Repair Kit*

AG,OUOD008,297 –19–27OCT99–1/1

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.

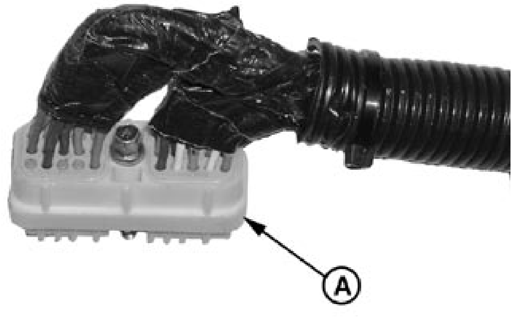
NOTE: Extraction tool must be used from the back of the connector.

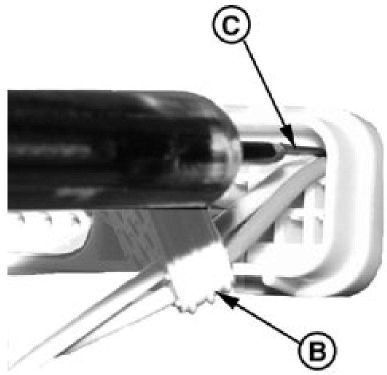
5. Using JDG776 Terminal Extraction Tool (C), angle the tip so it slides along the top edge of the connector. Make sure the extraction tool is centered in the connector cavity and push the tool in until resistance is felt.

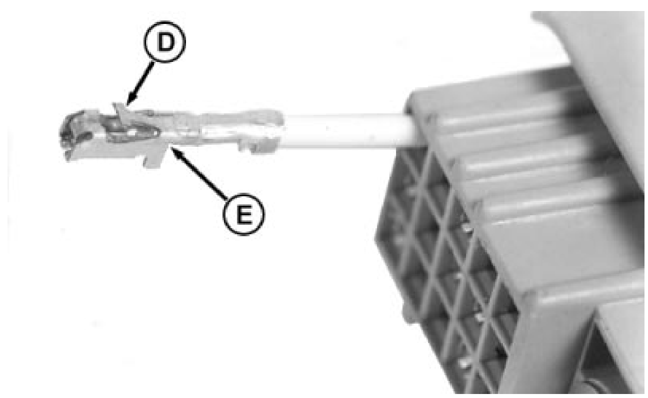
6. With extraction tool inserted into the connector, gently rotate tool clockwise and counter-clockwise (no more than 1/8 turn each direction) to depress the terminal locking tang (D).

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.







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 –19–03NOV99–1/2

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.

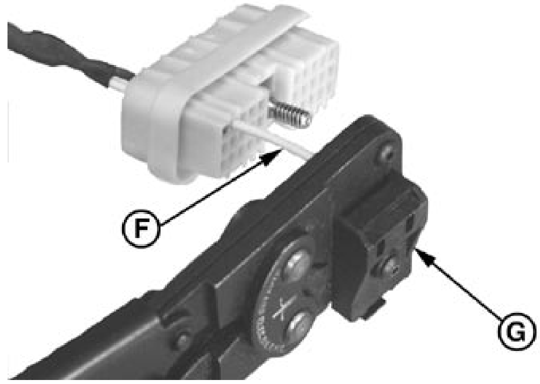
13. Make sure terminal locking tang (D) on new terminal is in outward position. Pull wire back into connector cavity until terminal locks.

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

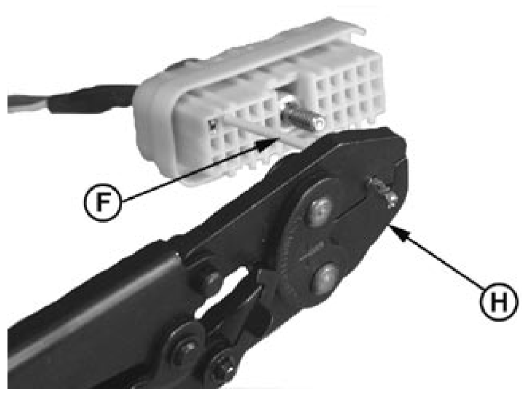
14. Push on the wire to make sure terminal is locked into the connector.

15. Slide the connector seal back into the connector. Make sure seal is in it's original position.

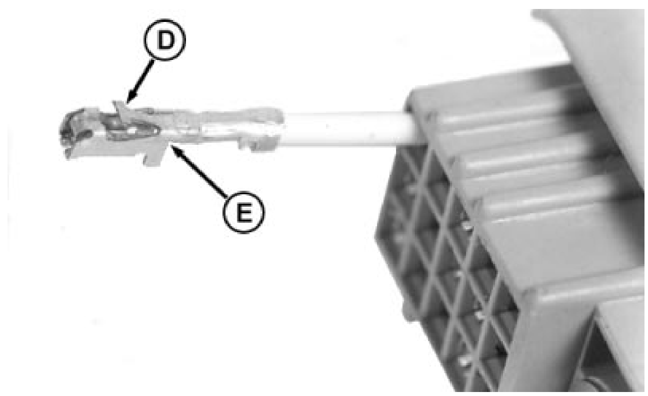
16. Retape the wires and add the required tie bands to the harness.



RG12234A –UN–13MAR02



RG12233A –UN–13MAR02



RW16935A –UN–05AUG98

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

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

AG,OUOD008,298 –19–03NOV99–2/2

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

1. Disconnect the METRI-PACK connector. Remove the tie bands and tape.

2. Remove secondary lock (A).

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

4. Insert JDG776 or JDG777 Terminal Extraction Tool[1] (B) into connector cavity (C) pushing the terminal locking tab inward.

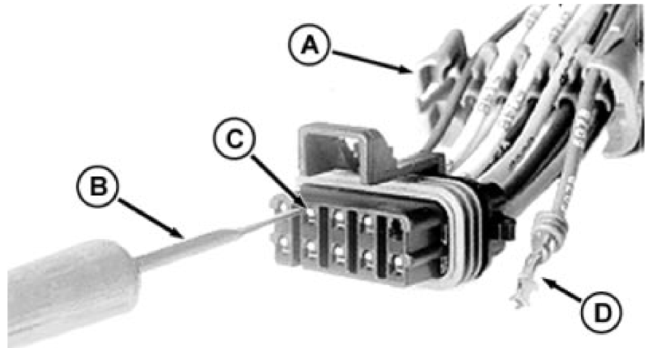
NOTE: Use JDG776 Extraction Tool with 56, 280, and 630 Series METRI-PACK terminals. Use JDG777 Extraction Tool with 150 Series METRI-PACK terminals.

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.



RW77137 –UN–08DEC98

TS0136 –UN–23AUG88

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 –19–03NOV99–1/3

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 –19–03NOV99–2/3

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.

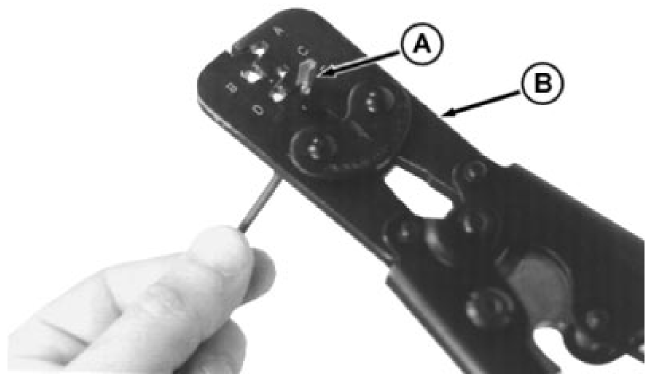
13. Push terminal into the correct connector cavity until terminal locks.

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

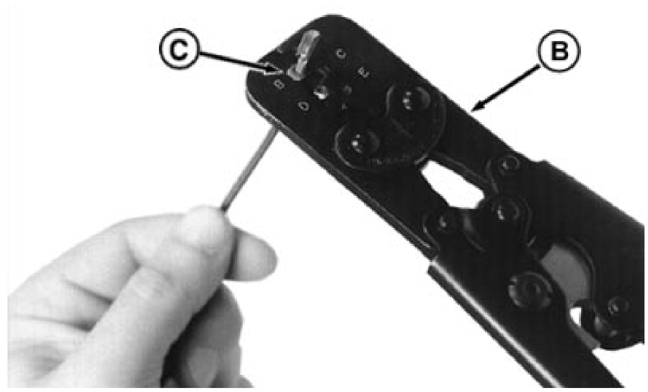
15. Place the secondary lock back on the connector.

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 –19–03NOV99–3/3

Repair DEUTSCH™ Connectors

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

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

3. Select correct size extractor tool for size of wire to be removed:

   - JDG361 Extractor Tool - 12—14 Gauge 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.

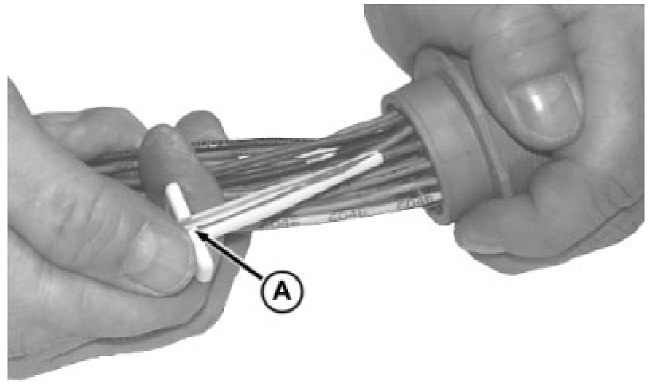
IMPORTANT: DO NOT twist tool when inserting in connector.

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.



RW77142 –UN–07DEC98

A—Handle

DEUTSCH is a trademark of Deutsch Company

[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

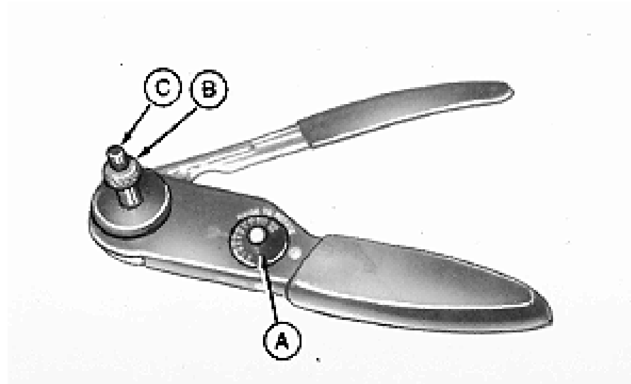
[4]Included in JDG155 Electrical Repair Tool Kit

Continued on next page

AG,OUOD008,304 –19–03NOV99–1/4

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

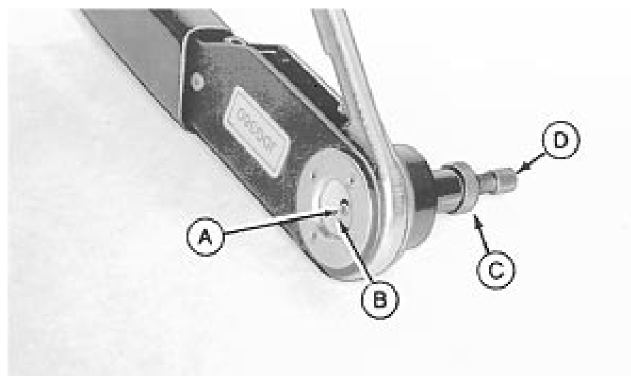
[1]*Included in JDG359 Electrical Repair Kit*

AG,OUOD008,304 –19–03NOV99–2/4

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 –19–03NOV99–3/4

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.

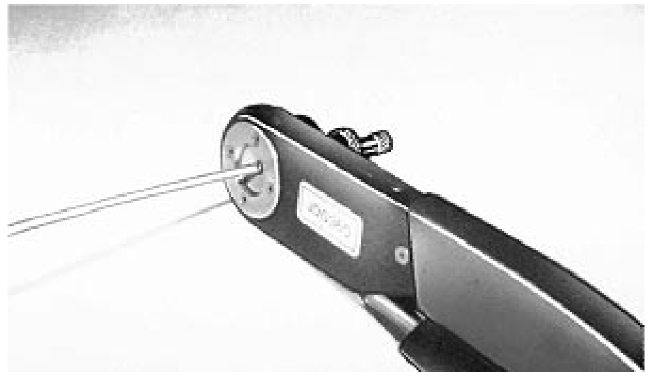
17. Push terminal straight into correct connector cavity until positive stop is felt.

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

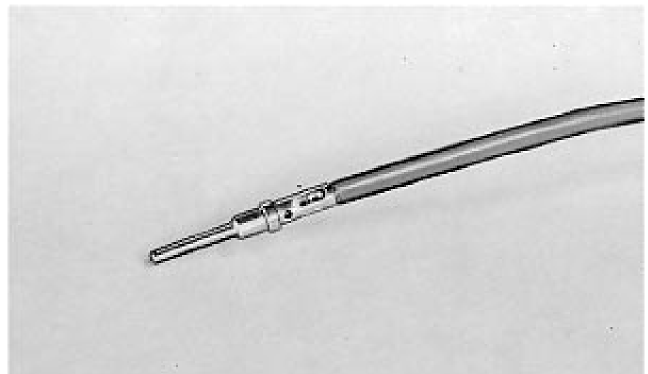
18. Gently pull on wire to verify terminal is locked into the connector.

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

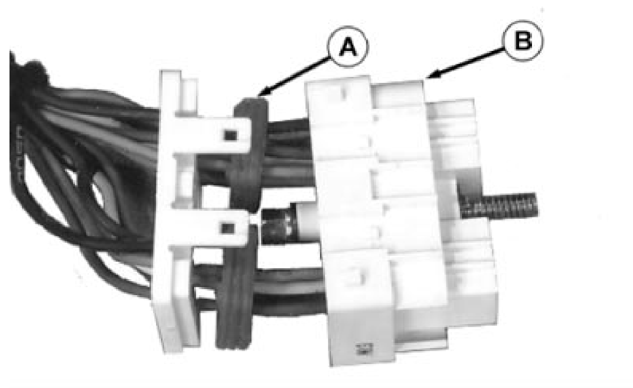
AG,OUOD008,304 –19–03NOV99–4/4

Repair CINCH Connectors

NOTE: Identify wire color locations with connector terminal letters.

1. Open connector body and slide rubber packings (A) from connector body (B).

A—Rubber Packings
B—Connector Body



RW77090 –UN–28APR98

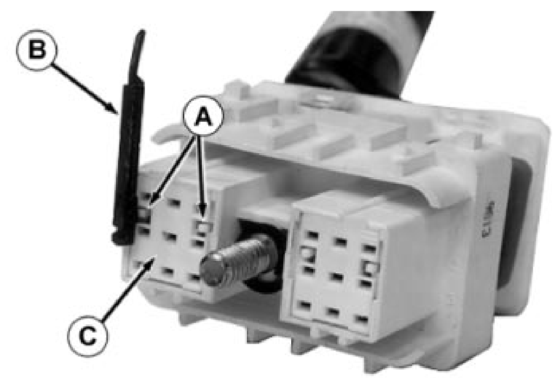
Cinch Connector

AG,OUOD008,305 –19–03NOV99–1/3

NOTE: Beveled side of removal tool blade must face latch (A).

Removal tool is stored in connector body.

2. Install removal tool (B).
3. Rotate tool clockwise to release latch and lift secondary lock (C).
4. Release other latch.
5. Remove secondary lock.



RW77091 –UN–28APR98

Cinch Blade Tool

A—Latch
B—Removal Tool
C—Secondary Lock

Continued on next page AG,OUOD008,305 –19–03NOV99–2/3

Extractor[1]

6.Insert tip (A) of removal tool into upper contact opening (B).

02
110
26

7. Hold tool fully seated and pull wire from connector body and rubber packing.

8. Remove old contact and strip 6 mm (1/4 in.) of insulation from wire using JDG145 Universal Electrical Pliers[2].

9. Crimp new contact on wire using JDG144 Crimping Pliers[2].

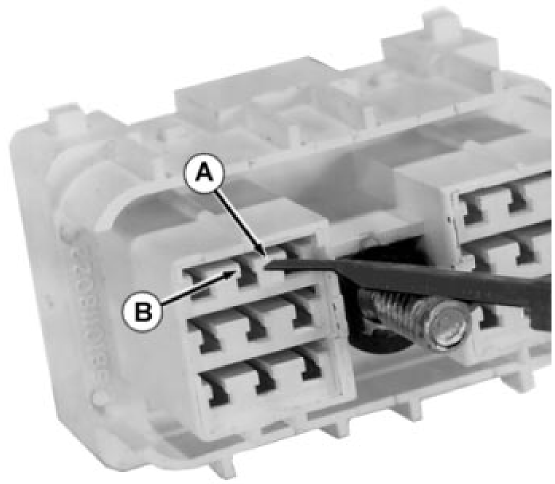
10. Push contact through rubber packing and into new connector body until fully seated.

11. Pull on wire slightly to ensure contact is locked in position.

12. Install remaining wires to correct terminals in new connector.

13. Install secondary lock.

14. Close connector body.



RW77092 –UN–28APR98

Removing and Installing Contact

A—Tip
B—Contact Opening

[1]*Included in JT07195B Technician's Electrical Repair Kit*

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

AG,OUOD008,305 –19–03NOV99–3/3

Section 03
Theory of Operation

Contents

03

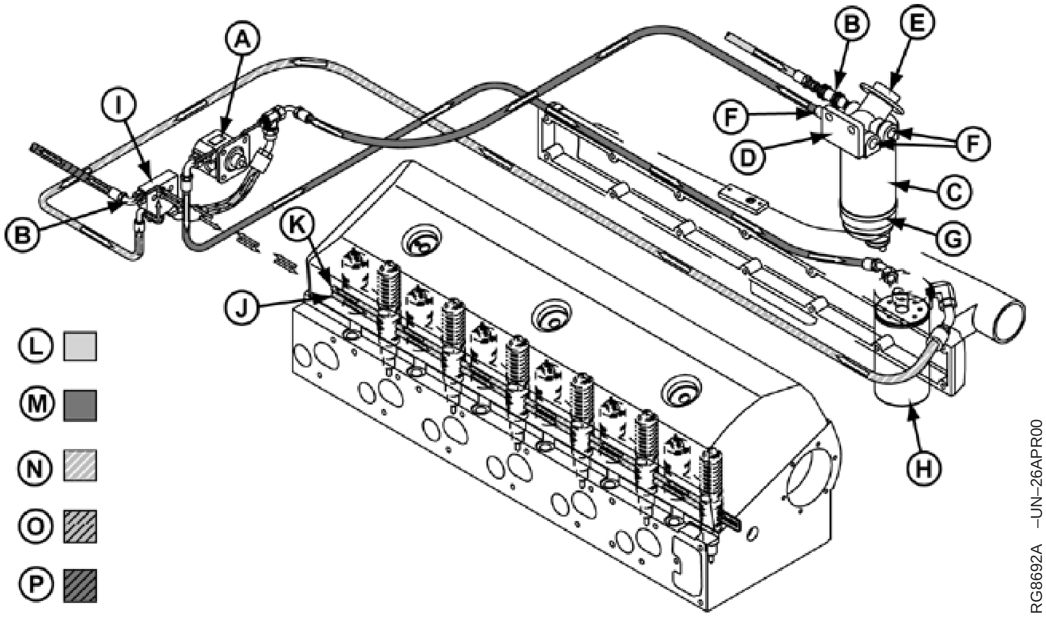
About This Group

This group of the manual contains information on the operation of the dual rail low pressure fuel system. The group is divided into the following headings:

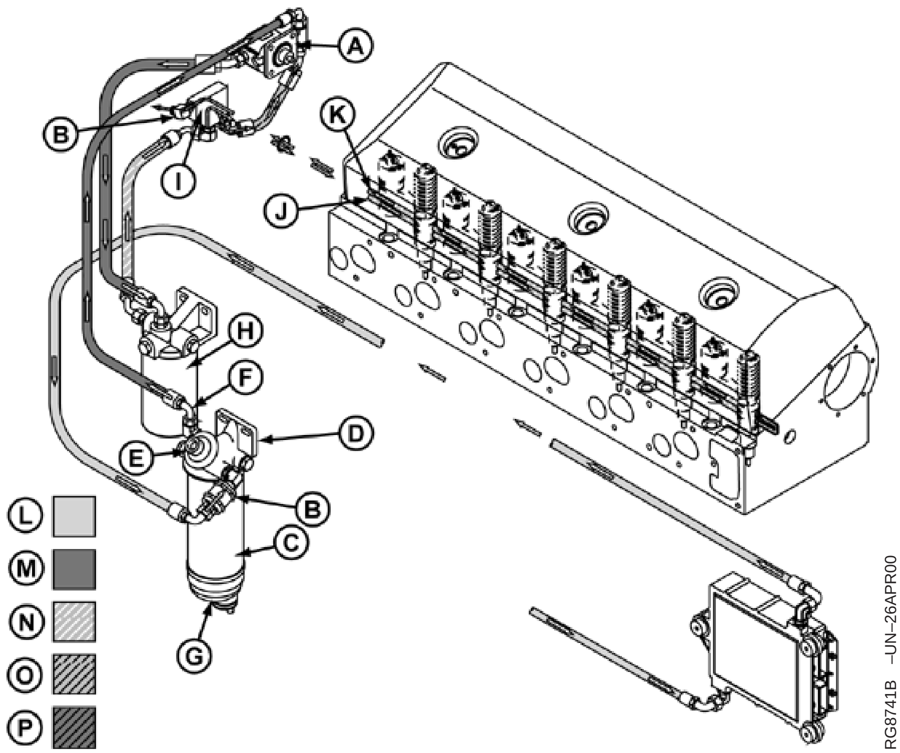
- Low Pressure Fuel System Flow Diagram
- Low Pressure Fuel Supply System Operation
- Electronic Unit Injector (EUI) Operation

OUO1004,0000C4D –19–21DEC00–1/1

Low Pressure Dual Rail Fuel Supply System Operation



John Deere Applications Fuel System



OEM Applications Fuel System

A—Fuel Transfer Pump
B—In-line Check Valves
C—Primary Filter
D—Primary Filter Base
E—Hand Primer Pump
F—Primary Filter Base Outlets
G—Water Separator Bowl
H—Final Filter
I—Fuel Manifold
J—Fuel Supply Rail
K—Fuel Return Rail
L—Suction Fuel from Tank
M—Primary-Filtered Fuel
N—Final-Filtered Fuel
O—Recirculated Fuel
P—Return-to-Tank Fuel

Continued on next page

RG,RG34710,1525 –19–30SEP97–1/2

The fuel transfer pump (A) draws fuel from the fuel tank through an in-line check valve (B) into the primary filter base (D) contains a hand-primer pump (E) and three outlet passages (F). The water separator bowl (G), which screws to the bottom of the fuel filter base. A self venting drain valve is mounted on the bottom of the clear bowl.

Fuel flows from one of the primary filter base outlets to the inlet of the fuel transfer pump mounted on the rear of the head. The fuel transfer pump is a gear type pump. The pump shaft is coupled to the end of the camshaft. The fuel transfer pump contains a pressure regulating valve for system over-pressure protection. A bypass valve in the pump base allows fuel to bypass the gears during hand priming.

Fuel flows from the outlet of the fuel transfer pump to the inlet of the final fuel filter (H). The spin-on final filter is the last clean-up of the fuel before entering the engine.

Fuel flows from the outlet of the final filter to the fuel manifold (I) mounted on the rear of the cylinder head. The fuel manifold contains a fuel temperature sensor, pressure regulating valve, return to tank orifice, and passages to route fuel into and out of the cylinder head. On some applications, the fuel manifold also contains a fuel pressure sensing switch. The fuel pressure regulator will maintain fuel pressure at 410–480 kPa (4.1–4.8 Bar) (60–70 psi).

Fuel flows from the fuel manifold into the fuel supply rail in the cylinder head. Fuel rails are drilled passages in the cylinder head that route fuel to each unit injector. The fuel supply rail (J) is the bottom drilled passage; the return fuel rail (K) is the top drilled passage. The two passages are connected at the front of the head.

Excess fuel not needed by the electronic unit injectors flows from the cylinder head into the fuel manifold. The fuel flows past the fuel temperature sensor. At this point the fuel is routed in one of two directions. The return to tank orifice will cause approximately 10% of the fuel to flow back to the fuel tank. The return-to-tank fuel enters the tank at the bottom to prevent fuel drain-back. The remaining 90% of the fuel will flow past the pressure regulating valve and return to the inlet of the fuel transfer pump to be recirculated through the cylinder head.

RG,RG34710,1525 –19–30SEP97–2/2

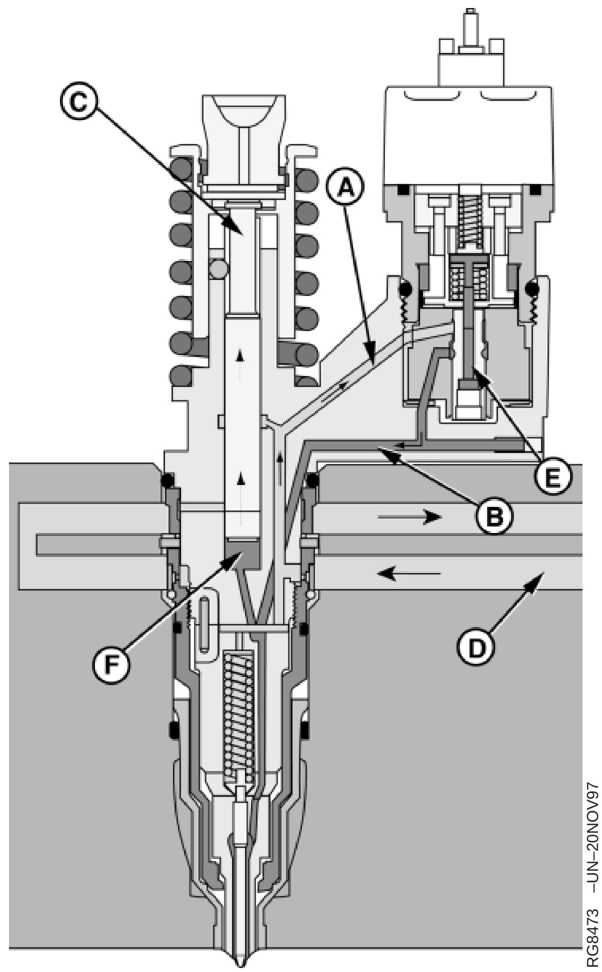
Electronic Unit Injector (EUI) Operation on the Dual Rail Fuel System

The electronic unit injector pumping action is created by the up and down movement of the plunger. The plunger movement is caused by the rotation of the camshaft and the rocking action of the rocker arms. The larger return spring will move the plunger up as the camshaft rotates and relaxes the force on the rocker arm.

RG,RG34710,1527 –19–30SEP97–1/5

EUI Fill Cycle - Dual Rail Fuel System

The electronic unit injector will fill with fuel when the plunger (C) is moving up. Fuel from the fuel supply rail (D) enters fuel passage (A) of the unit injector. Fuel flows past the open spill valve (E) into fuel passage (B). Passage B routes fuel into the plunger cylinder (F), which fills as the plunger moves up.



EUI Fill Cycle

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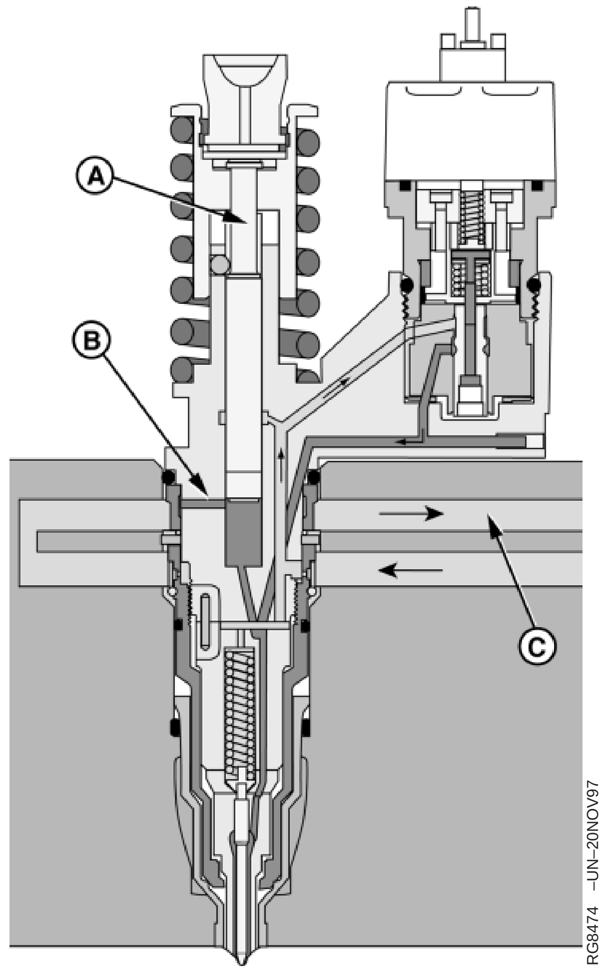
RG,RG34710,1527 –19–30SEP97–2/5

EUI Vent Cycle - Dual Rail Fuel System

The vent cycle begins when the plunger (A) nears the top of the fill cycle stroke. At this point a vent port (B) will be uncovered and fuel and any trapped air can flow to the return fuel rail (C).



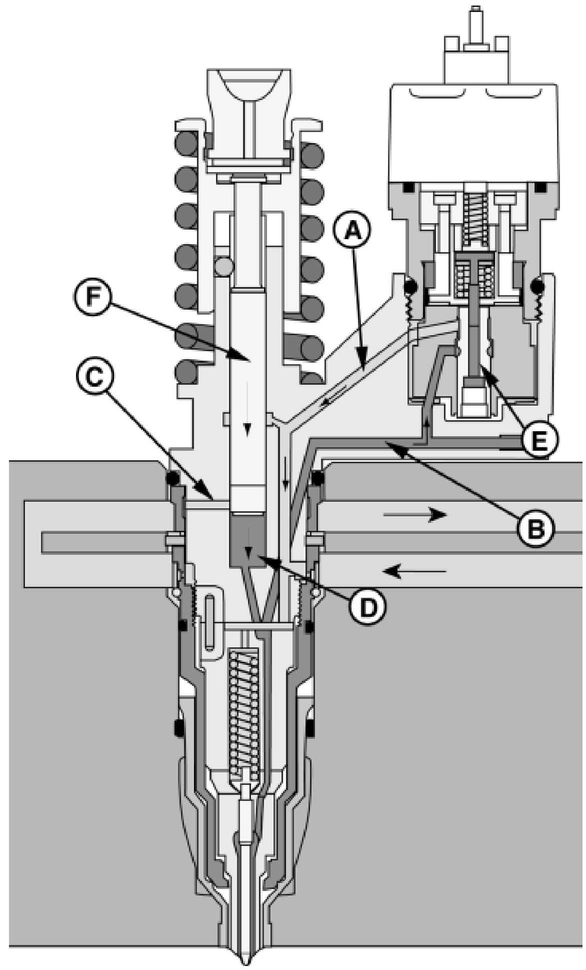
EUI Vent Cycle

Continued on next page RG,RG34710,1527 –19–30SEP97–3/5

EUI Pumping Cycle - Dual Rail Fuel System

The pumping cycle begins when the camshaft lobe pushes on the rocker arm to cause the plunger (F) to start moving down. During the first downward movement of the plunger, the vent port (C) will close.

Further downward movement of the plunger will force fuel from the plunger cylinder (D). Fuel will flow out fuel passage (B), through the open spill valve (E), into fuel passage (A) and back to the fuel supply rail (G). This flow will continue until the injection cycle begins.



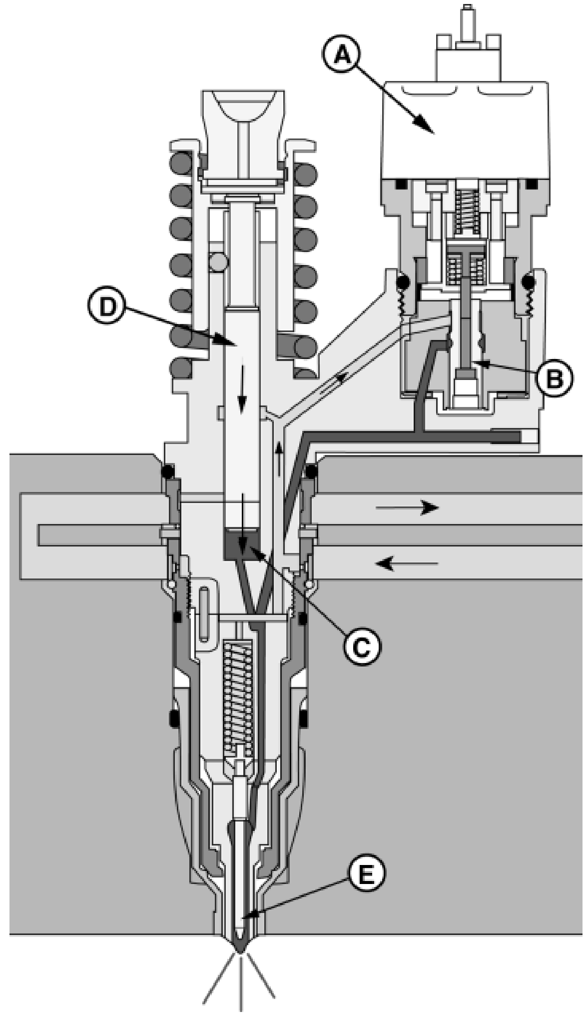
EUI Pumping Cycle

Continued on next page RG,RG34710,1527 –19–30SEP97–4/5

EUI Injection Cycle - Dual Rail Fuel System

The injection cycle will start when the Engine Control Unit (ECU) energizes the EUI solenoid (A). This will occur during the downward stoke of the plunger.

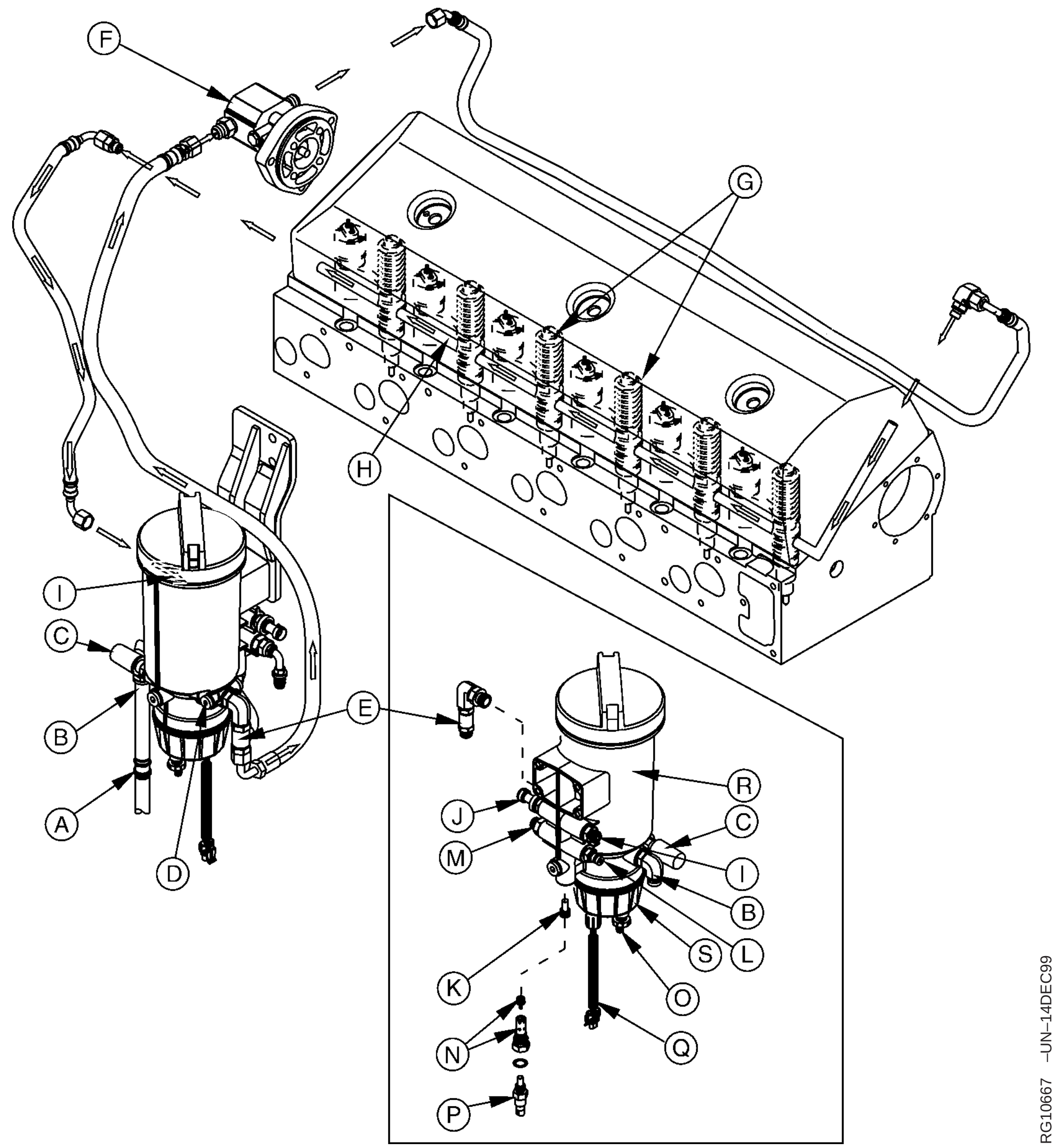
The energized solenoid will close the spill valve (B). With the spill valve closed, fuel can not escape from the plunger cylinder (C). The downward movement of the plunger (D) will cause the fuel pressure to rise. When the pressure reaches 30,000 kPa (300 bar) (4350 psi), the injector needle (E) will start to move up and injection will begin. As the plunger continues to move down, pressure will rapidly rise to approximately 160,000 kPa (1600 bar) (23,200 psi). Injection will continue until the ECU de-energizes the solenoid. The spill valve will then open allowing fuel pressure to drop rapidly. The injector needle will close and injection will stop.



EUI Injection Cycle

RG,RG34710,1527 –19–30SEP97–5/5

Low Pressure Single Rail Fuel Supply System Operation



OEM Applications Single Rail Fuel System

A—Pre-filter
B—Fuel Filter Inlet from Fuel Tank
C—Hand Primer
D—Vacuum Port
E—Fuel Filter Outlet to Transfer Pump (Check Valve)
F—Fuel Transfer Pump
G—EUIs
H—Fuel Rail
I—Fuel Return from Cylinder Head
J—Fuel Pressure Sensor
K—Head Debris Filter
L—Fuel Supply Pressure Quick Connect Port
M—Fuel Filter Housing Outlet to Fuel Tank (Low Pressure Regulating Valve)
N—High Pressure Regulating Valve and Housing
O—Water Drain
P—Fuel Temperature Sensor
Q—Water in Fuel Sensor
R—Fuel Filter Housing
S—Water Separator Bowl

The fuel transfer pump (F) draws fuel from the fuel tank through the pre-filter (A) and fuel filter. The fuel filter is located in the fuel filter housing (R). The fuel filter housing contains a hand primer pump (C) and a water separator bowl (S), which screws to the bottom of the fuel filter housing. A self-venting water drain valve (O) is mounted on the bottom of the clear bowl.

Continued on next page

RG,RG34710,1525 –19–30SEP97–1/2

Fuel flows from the fuel filter outlet (E) to the inlet of the fuel transfer pump which is mounted on the rear of the cylinder head. The pump shaft is coupled to the end of the camshaft. The fuel transfer pump contains a pressure regulating valve for system over-pressure protection. A bypass valve in the pump base allows fuel to bypass the gears during hand priming.

Fuel flows from the transfer pump into the side of the cylinder head, and then it enters the fuel rail (H). The fuel rail is a drilled passage in the cylinder head that routes fuel to each unit injector. The unused fuel is rejected back from the EUIs (G) into the fuel rail and returned to the back of the fuel filter housing (I).

In this portion of the fuel filter housing, the fuel passes by a fuel pressure sensor (J), and then it travels through a head debris filter (K), which is a 10 micron filter. After flowing through the head debris filter, the fuel enters a chamber that includes the fuel supply pressure quick connect port (L). Once the fuel is in this chamber, it will either travel through the low pressure regulating valve (M) or the high pressure regulating valve (N). If fuel goes through the low pressure regulating valve, it will return to the fuel tank. If fuel goes through the high pressure regulating valve, it will pass the fuel temperature sensor (P), which is mounted into the fuel filter housing. The fuel will return to the fuel filter to be cleaned, and it will be recirculated through this system.

RG,RG34710,1525 –19–30SEP97–2/2

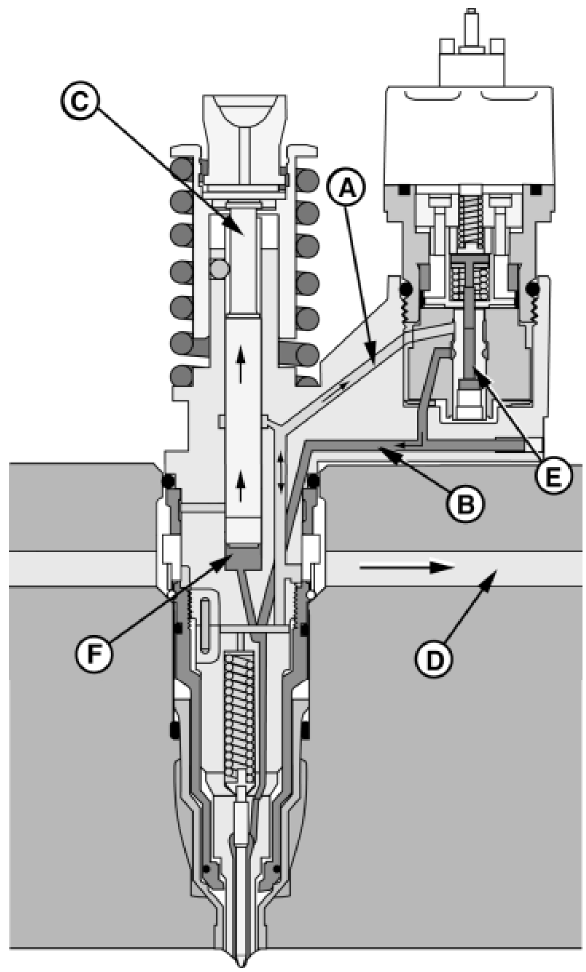
Electronic Unit Injector (EUI) Operation on the Single Rail Fuel System

The electronic unit injector pumping action is created by the up and down movement of the plunger. The plunger movement is caused by the rotation of the camshaft and the rocking action of the rocker arms. The larger return spring will move the plunger up as the camshaft rotates and relaxes the force on the rocker arm.

RG,RG34710,1527 –19–30SEP97–1/5

EUI Fill Cycle - Single Rail Fuel System

The electronic unit injector will fill with fuel when the plunger (C) is moving up. Fuel from the fuel rail (D) enters fuel passage (A) of the unit injector. Fuel flows past the open spill valve (E) into fuel passage (B). Passage B routes fuel into the plunger cylinder (F), which fills as the plunger moves up.



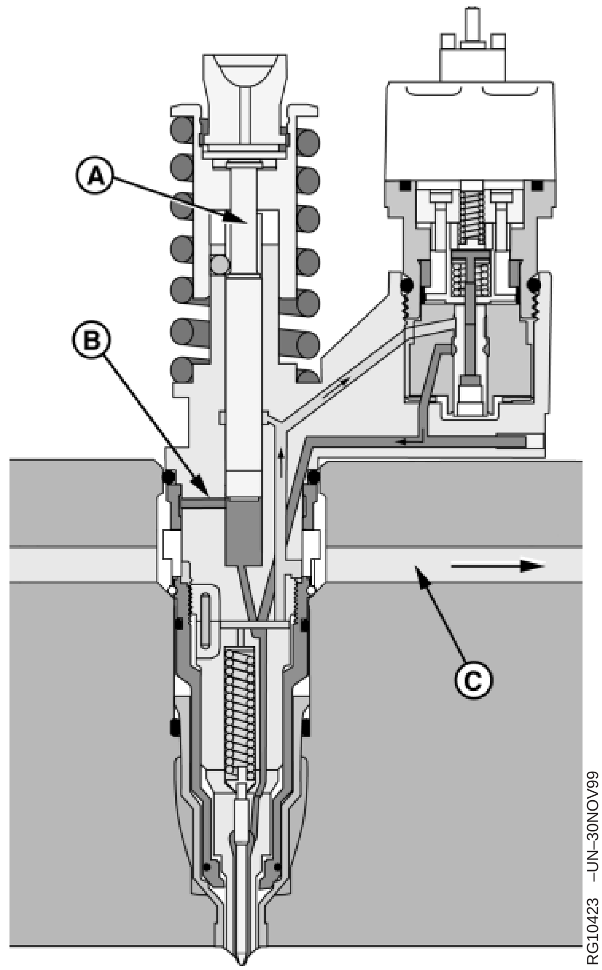
RG10422 –UN–30NOV99

EUI Fill Cycle

Continued on next page RG,RG34710,1527 –19–30SEP97–2/5

EUI Vent Cycle - Single Rail Fuel System

The vent cycle begins when the plunger (A) nears the top of the fill cycle stroke. At this point a vent port (B) will be uncovered and fuel and any trapped air can flow to the fuel rail (C).



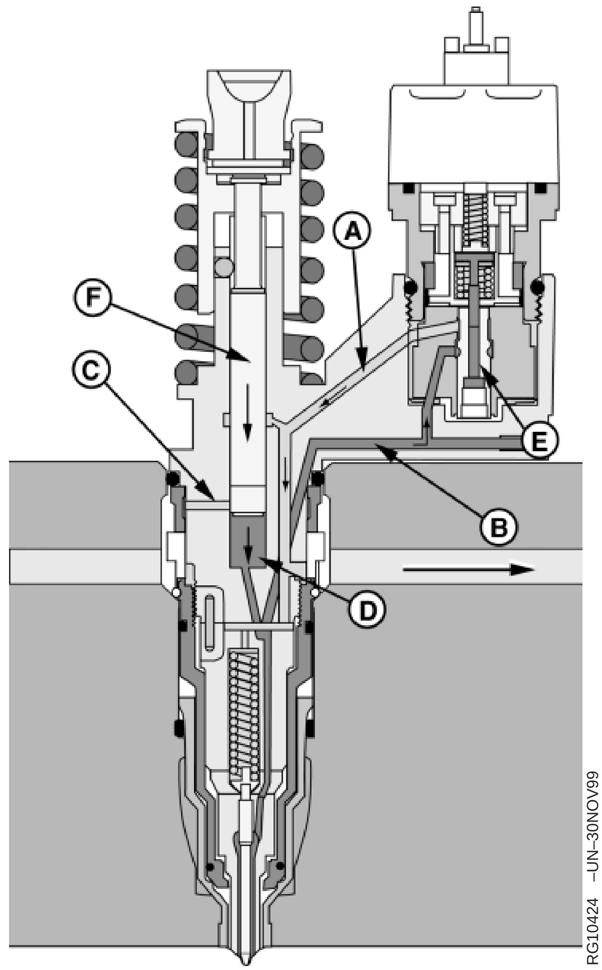
EUI Vent Cycle

Continued on next page
RG,RG34710,1527 –19–30SEP97–3/5

EUI Pumping Cycle - Single Rail Fuel System

The pumping cycle begins when the camshaft lobe pushes on the rocker arm to cause the plunger (F) to start moving down. During the first downward movement of the plunger, the vent port (C) will close.

Further downward movement of the plunger will force fuel from the plunger cylinder (D). Fuel will flow out fuel passage (B), through the open spill valve (E), into fuel passage (A) and back to the fuel rail (G). This flow will continue until the injection cycle begins.



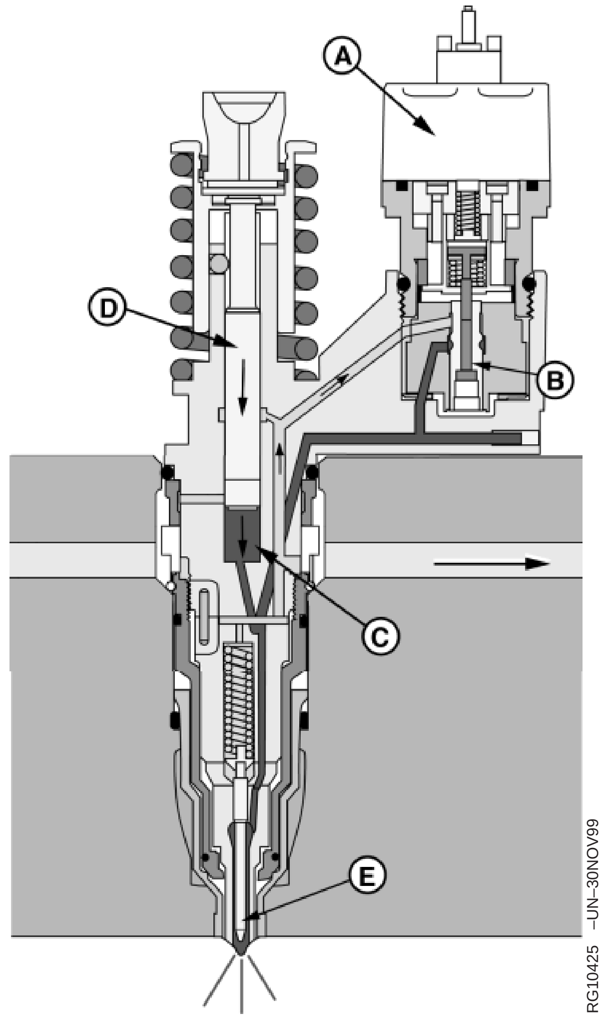
EUI Pumping Cycle

Continued on next page RG,RG34710,1527 –19–30SEP97–4/5

EUI Injection Cycle - Single Rail Fuel System

The injection cycle will start when the Engine Control Unit (ECU) energizes the EUI solenoid (A). This will occur during the downward stoke of the plunger.

The energized solenoid will close the spill valve (B). With the spill valve closed, fuel can not escape from the plunger cylinder (C). The downward movement of the plunger (D) will cause the fuel pressure to rise. When the pressure reaches 30,000 kPa (300 bar) (4350 psi), the injector needle (E) will start to move up and injection will begin. As the plunger continues to move down, pressure will rapidly rise to approximately 160,000 kPa (1600 bar) (23,200 psi). Injection will continue until the ECU de-energizes the solenoid. The spill valve will then open allowing fuel pressure to drop rapidly. The injector needle will close and injection will stop.



EUI Injection Cycle

RG,RG34710,1527 –19–30SEP97–5/5

Electronic Control System Glossary of Terms

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 volt or 0 to 12 volt signals.
Boost	Air pressure in the intake manifold.
CAN	Controller Area Network. The network on vehicles that allows communication between controllers.
DTC	Diagnostic Trouble Code. A code which is stored in the ECU’s memory when the ECU detects a problem in the electronic control system.
DST	Diagnostic Scan Tool. The tool used to read and clear DTCs, read sensor and actuator data, and perform engine tests. The DST consists of an Windows (’95, ’98, ’00) or NT compatible computer and 2 kits available from John Deere Distribution Service Center (DSC): JDIS121 - ECU Communication Hardware Kit and the software which is available through the John Deere Dealer Website.
Digital	A signal which consists of only two-volt levels — usually 0 volts and +5 volts.
ECT	Engine Coolant Temperature (sensor). Measures the temperature of the engine coolant. See MEASURING TEMPERATURE later in this Group for details.
ECU	Engine Control Unit. The computer which controls the fuel, air, and ignition systems on the engine. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
EUI	Electronic Unit Injector. An EUI is an electronically controlled injection pump and injector combined. The ECU controls the start of injection and the amount of fuel injected by energizing and de-energizing the solenoid in the EUI valve housing. See ELECTRONIC UNIT INJECTOR (EUI) OPERATION ON THE DUAL RAIL FUEL SYSTEM or ELECTRONIC UNIT INJECTOR (EUI) OPERATION ON THE SINGLE RAIL FUEL SYSTEM in Group 130 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).
J1587/J1708	The Society of Automotive Engineers (SAE) standard for the electronic components of heavy duty vehicles. J1587 is the software standard. J1708 is the hardware standard.
MAT	Manifold Air Temperature (sensor). Measures the temperature of the air in the intake manifold. See MEASURING TEMPERATURE later in this Group for details.
Multi-State	A type of throttle that allows the engine to run between 1-3 set engine speeds.
PDM	Parallel Data Module. Device used as part of the DST or SERVICE ADVISOR™ that allows communication with the ECU.
PROM	Programmable, Read-Only Memory. The computer chip which contains the calibration information for the engine control system. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
PWM	Pulse Width Modulation. A digital signal (not analog) which consists of a pulse generated at a fixed frequency. When an actuator is controlled by a PWM signal, the on time of the signal is increased or decreased (modulated) to increase or decrease the output of the actuator.
RAM	Random Access Memory. The portion of computer memory within the ECU which changes as the engine is running and is stored while the engine is off. See ENGINE CONTROL UNIT (ECU) later in this Group for details.

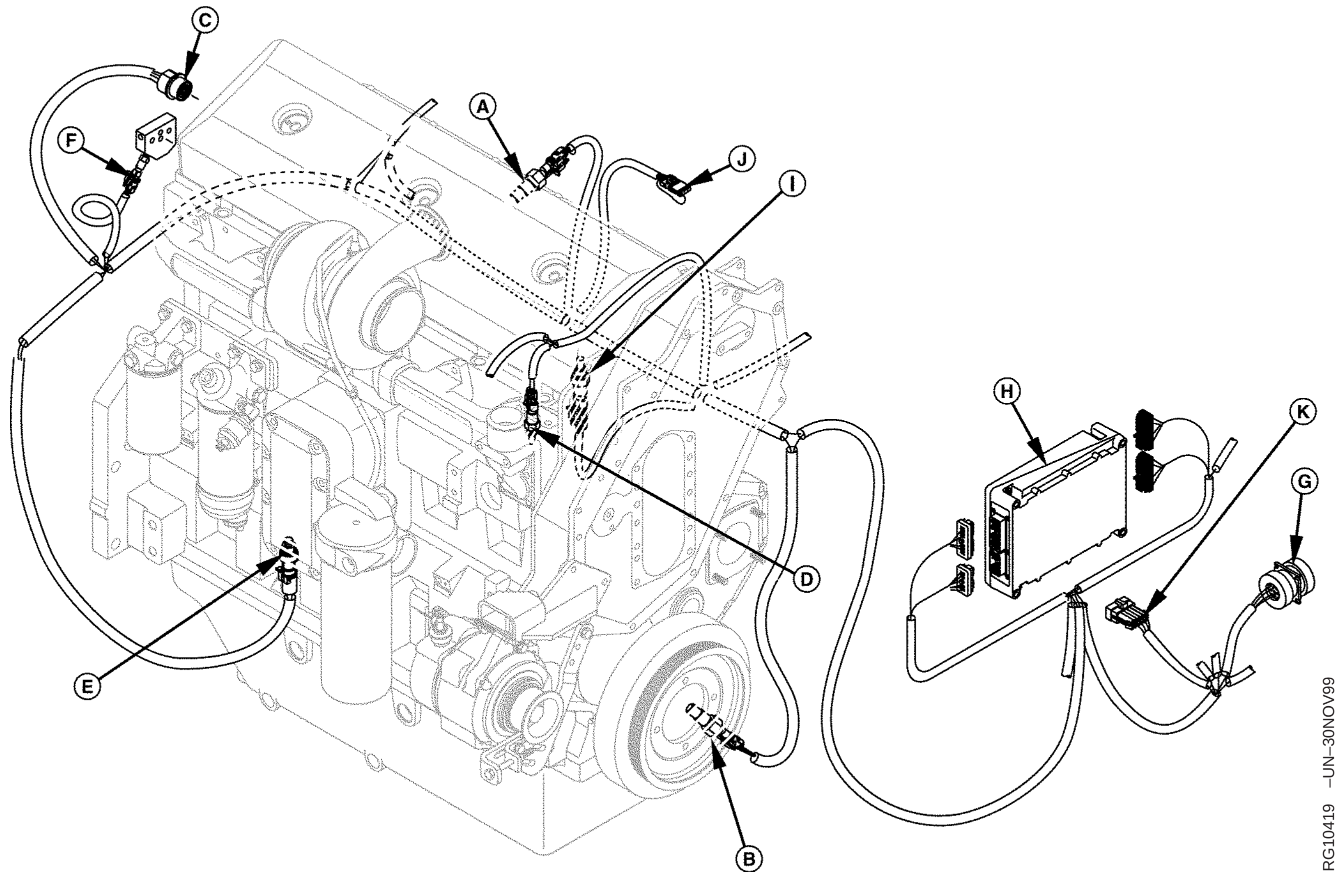
Continued on next page

RG,RG34710,1528 –19–20NOV00–1/2

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.
WIF	Water In Fuel Sensor. The WIF detects water in fuel in the water separator bowl on the fuel filter housing.

RG,RG34710,1528 –19–20NOV00–2/2

Electronic Control System Overview



Electronic Control System Overview for a Dual Rail Fuel System

A—Cam Position Sensor
B—Crank Position Sensor
C—EUI Harness Connector
D—ECT Sensor
E—Oil Pressure Sensor
F—Fuel Temperature Sensor
G—Diagnostic Connector
H—ECU
I—MAT Sensor
J—MAP Sensor Connector
K—Program Performance Connector
L—WIF Sensor
M—Fuel Pressure Sensor

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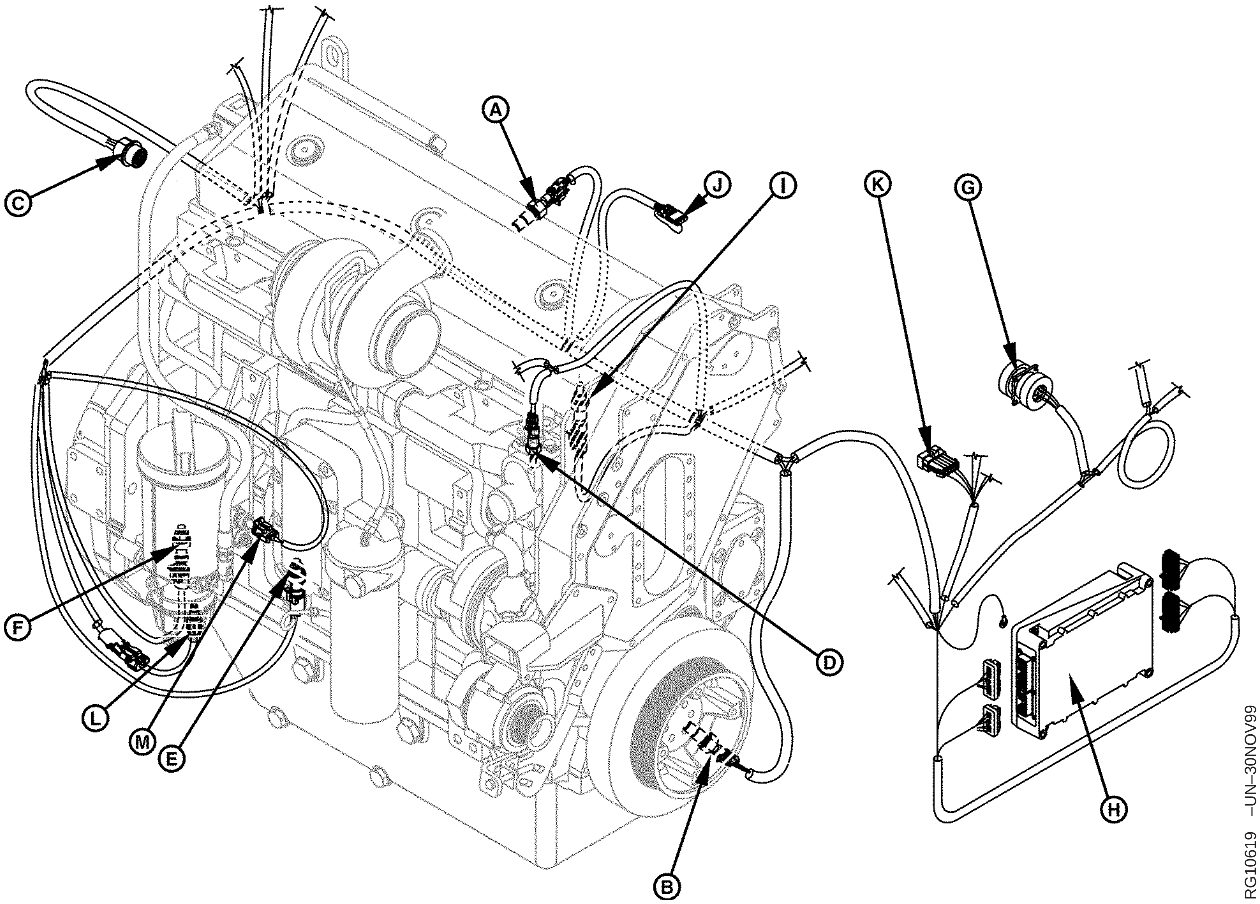
RG,RG34710,1529 –19–30SEP97–1/2



Electronic Control System Overview for a Single Rail Fuel System

A—Cam Position Sensor
B—Crank Position Sensor
C—EUI Harness Connector
D—ECT Sensor
E—Oil Pressure Sensor
F—Fuel Temperature Sensor
G—Diagnostic Connector
H—ECU
I—MAT Sensor
J—MAP Sensor Connector
K—Program Performance Connector
L—WIF Sensor
M—Fuel Pressure Sensor

The electronic control system serves as an engine governor by controlling the Electronic Unit Injectors (EUIs) so that fuel is delivered according to a given set of engine conditions, in 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
- Deliver fuel at optimum piston position
- Provide multiple control modes
- Perform self-diagnosis

RG,RG34710,1529 –19–30SEP97–2/2

Electronic Control System Operation

Engine Starting Mode

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

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

As soon as the ECU determines using the crankshaft position sensor input that the engine is cranking, it will determine using the camshaft 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 compression. 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, the ECU monitors information from the various sensors, then determines the optimum amount of fuel to inject and the optimum injection timing in order to allow the engine to develop high power while maintaining low exhaust emission output. The camshaft and crankshaft position sensors allow the ECU to precisely determine piston position in relation to top-dead-center so that the ECU can command the correct Electronic Unit Injector (EUI) solenoid at the correct time. The ECU controls fuel delivery by energizing and de-energizing the individual solenoids that open and close the EUI spill valves. When the ECU energizes the EUI solenoid, the spill valve closes and injection begins. When the correct amount of fuel has been injected, the ECU de-energizes the solenoid, causing the spill valve to open, and fuel injection to stop.

RG,RG34710,1530 –19–30SEP97–1/1

Monitoring Engine Parameters

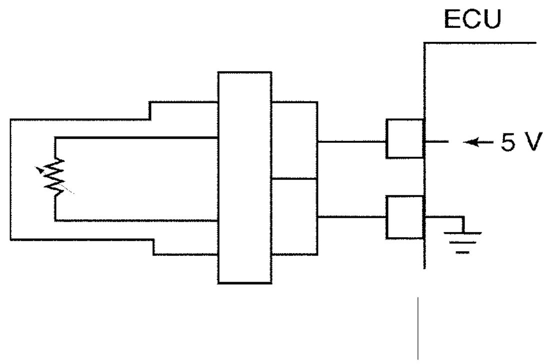
In order for the electronic control system to deliver fuel according to a given set of operating conditions, the following parameters are monitored by the ECU:

- Engine Coolant Temperature (ECT)
- Manifold Air Temperature (MAT)
- Fuel Temperature
- Loss of Coolant Temperature Switch
- Fuel Pressure
- Oil Pressure
- Air Vacuum Switch
- Throttle Position
- Engine Speed
- Water in Fuel Sensor (WIF)

RG,RG34710,1531 –19–30SEP97–1/1

Measuring Temperature

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



RG11819 –UN–17AUG01

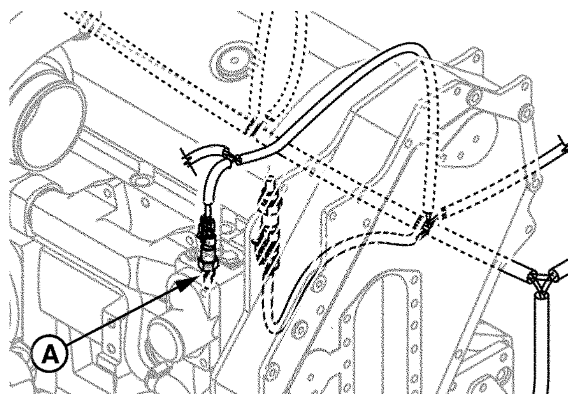
Temperature Sensor Schematic

RG,RG34710,1532 –19–30SEP97–1/4

ECT (Engine Coolant Temperature) Sensor

The ECT (Engine Coolant Temperature) sensor (A) is located in top of the thermostat housing. The ECU monitors coolant temperature for:

- Engine protection purposes — See ENGINE PROTECTION later in this Group.
- Starting fuel quantity determination — The ECU will adjust the amount of fuel delivered during start-up based on 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.



RG10625 –UN–30NOV99

ECT sensor

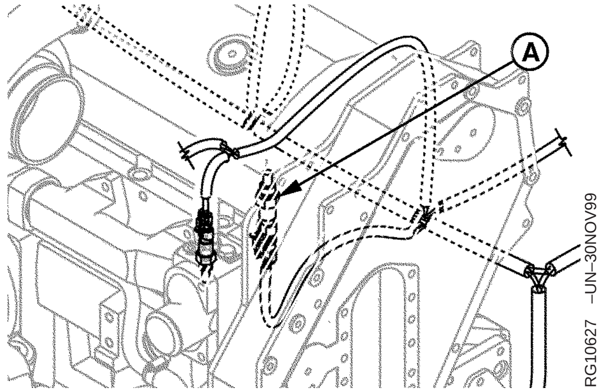
A—ECT Sensor

Continued on next page RG,RG34710,1532 –19–30SEP97–2/4

MAT (Manifold Air Temperature) Sensor

The MAT (Manifold Air Temperature) sensor (A) is an optional component that is located on or near the intake manifold. The ECU monitors manifold air temperature for engine protection purposes. See ENGINE PROTECTION later in this Group.

A—MAT Sensor



MAT sensor

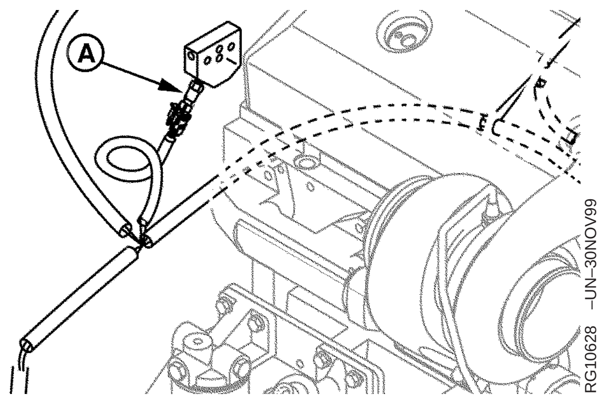
RG,RG34710,1532 –19–30SEP97–3/4

Fuel Temperature Sensor

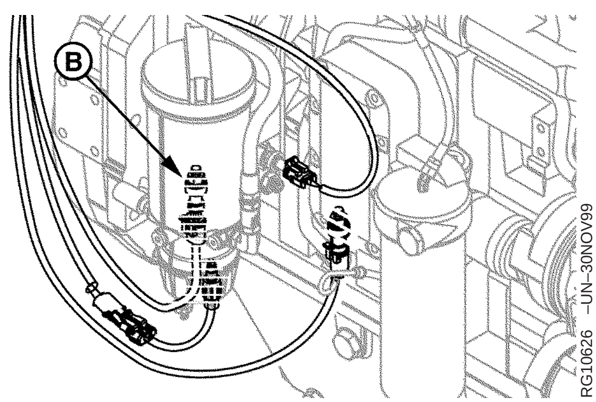
The fuel temperature sensor is located on the fuel manifold at the back of the cylinder head on the dual rail fuel system (A). On the single rail fuel system, it is located on the fuel filter housing behind the fuel filter (B). Using the fuel temperature measurement, the ECU will determine fuel density, and adjust fuel delivery accordingly.

Loss of Coolant Temperature Switch

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



Dual Rail Fuel Temperature Sensor



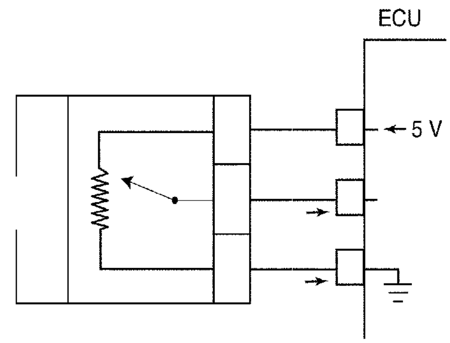
Single Rail Fuel Temperature Sensor

A—Fuel Temperature Sensor on a Dual Rail Fuel System
B—Fuel Temperature Sensor on a Single Rail Fuel System

RG,RG34710,1532 –19–30SEP97–4/4

Measuring Pressure

The system's pressure sensors are pressure sensitive variable resistors. As the pressure changes, sensor resistance changes. The ECU sends a 5 volt reference voltage to the sensor, monitors the voltage returning on the sensor signal wire, and compares the voltage drop to preprogrammed values in the ECU's memory to determine pressure. In addition to pressure sensors, some applications use pressure switches. The Air Vacuum Switch is an example of this type of switch. Pressure switches close when a specific pressure is reached.



RG12827 –UN–30JAN03

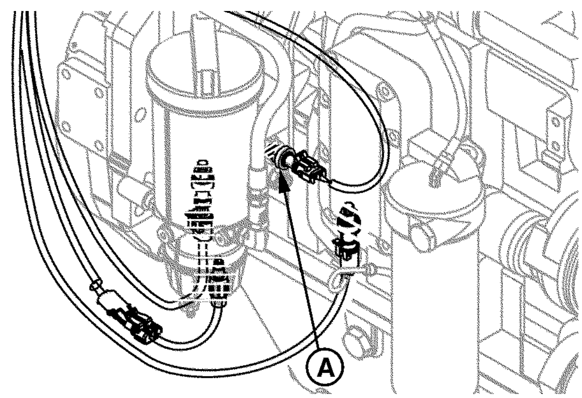
Pressure Sensor Schematic

RG,RG34710,1533 –19–30SEP97–1/3

Fuel Pressure Sensor

The fuel pressure sensor is used on some applications that use the single rail fuel system. The sensor is located behind the fuel filter in the fuel manifold (A). The ECU monitors fuel pressure for engine protection purposes. See ENGINE PROTECTION later in this Group for more information.

A—Fuel Pressure Sensor on Single Rail Fuel System



RG10623 –UN–30NOV99

Fuel Pressure Sensor

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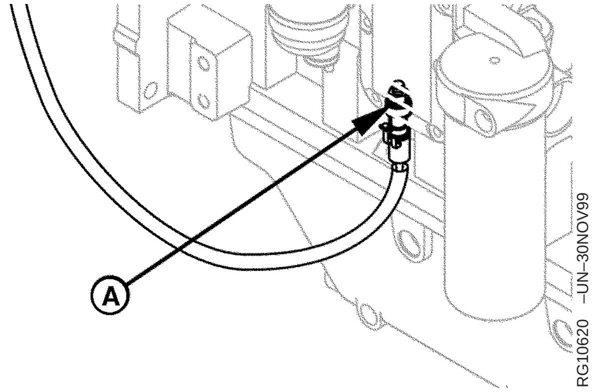
Oil Pressure Sensor

The oil pressure sensor is an optional component that is located in the main engine galley or in the oil cooler (A). The ECU monitors oil pressure for engine protection purposes. See ENGINE PROTECTION later in this Group for more information.

Air Vacuum Switch

The air vacuum switch is an optional component that is used to test for restrictions in the air filter. It's location may vary depending on application. The ECU monitors this for engine protection purposes. See ENGINE PROTECTION later in this Group.



Oil Pressure Sensor

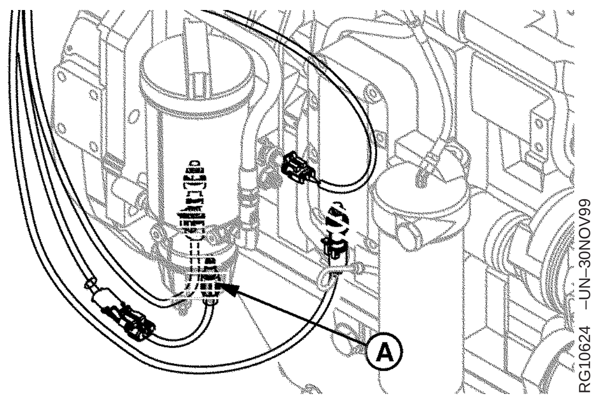
A—Oil Pressure Sensor

RG,RG34710,1533 –19–30SEP97–3/3

Water In Fuel Sensor

The water in fuel sensor is an optional sensor that is located in the water separator bowl in the fuel filter (A). The ECU monitors this for engine protection purposes. See ENGINE PROTECTION later in this Group.

A—Water in Fuel Sensor



Water in Fuel Sensor

DPSG,RG40854,456 –19–14OCT99–1/1

Measuring Throttle Position

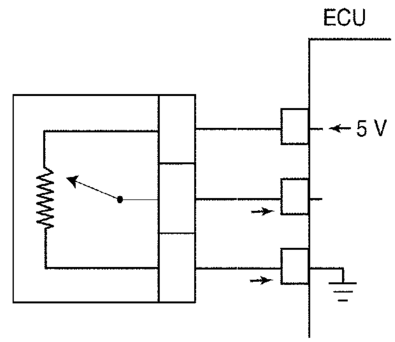
The 10.5 and 12.5 L engines have the option of operating with a pulse-width-modulated (PWM) throttle signal, an analog throttle position sensor output signal, multi-state throttle, or CAN throttle. In some applications, a backup throttle is used.

Continued on next page

RG,RG34710,1534 –19–30SEP97–1/9

Analog Throttle

An analog throttle uses a variable resistor (potentiometer) sensor to measure the position of the throttle. The ECU sends a 5 volt reference voltage to the sensor, monitors the voltage drop across the resistor, and compares the voltage drop to preprogrammed values in the ECU's memory. 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. The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.



RG11820 –UN–15JAN03

Position Sensor

RG,RG34710,1534 –19–30SEP97–2/9

CAN Throttle

CAN throttle is information sent to the ECU by another controller over the CAN bus of the desired throttle position.

RG12349 –19–06MAY02

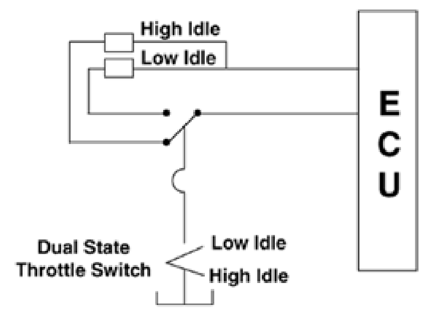
CAN Throttle Schematic

Continued on next page

RG,RG34710,1534 –19–30SEP97–3/9

Dual State Throttle

The dual state throttle is used on applications that use a few fixed engine speeds. There are two available positions, Low Idle and High Idle. The switch uses two different resistors to change the voltage returned to the ECU. The ECU uses an internal conversion table to convert the voltage to a specific engine speed. When the switch is in the low idle position, the current is routed through a 390 ohm resistor. High idle position uses a 1300 ohm resistor. These speeds can be adjusted and saved depending on the needs of the application.



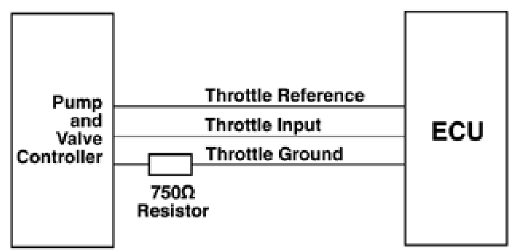
RG12284 –19–26APR02

Dual State Throttle

RG,RG34710,1534 –19–30SEP97–4/9

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 uses 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.



RG12287 –19–26APR02

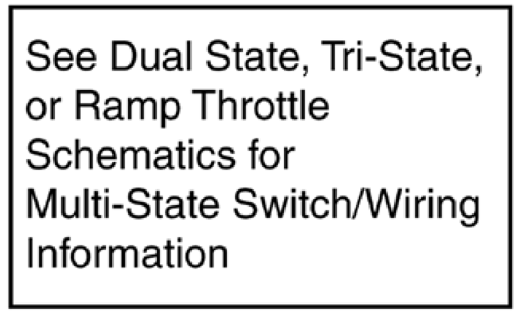
Excavator Throttle

Continued on next page

RG,RG34710,1534 –19–30SEP97–5/9

Multi-state Throttle

The multi-state throttle is used when a few fixed engine speeds are desired. There are three types of multi-state throttles; Dual-state, Tri-state, and Ramp. All of these throttles are wired exactly 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 DUAL STATE THROTTLE, TRI-STATE THROTTLE, or RAMP THROTTLE later in this Measuring Throttle Position section.



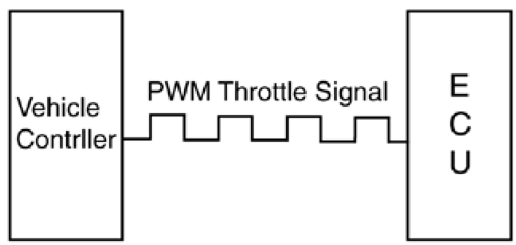
RG12348 –19–06MAY02

Multi-state Throttle Schematic

RG,RG34710,1534 –19–30SEP97–6/9

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.



RG12347 –19–06MAY02

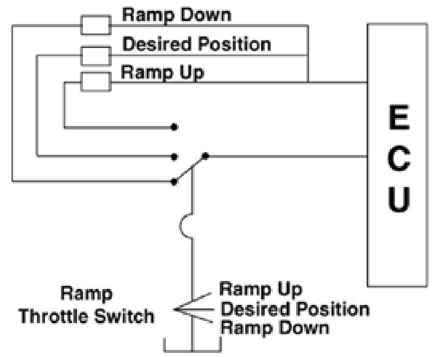
PWM Throttle Schematic

Continued on next page

RG,RG34710,1534 –19–30SEP97–7/9

Ramp Throttle

The ramp throttle allows the operator slowly increase or decrease the engine speed through a three position momentary (spring back to center position) switch. If the switch is held in the upward position, the engine speed will increase in small increments. If the switch is held in the downward position, the engine speed will decrease. Once the desired speed is selected, release the switch into the center position. The switch uses three different resistors to change the voltage returned to the ECU. When the switch is in the desired position (center), the current is routed through a 1300 ohm resistor. When changing engine speed, a 390 ohm resistor to reduce the engine speed and a 3000 ohm resistor to ramp up the engine speed. Speed will remain the same until key cycle or operator change.



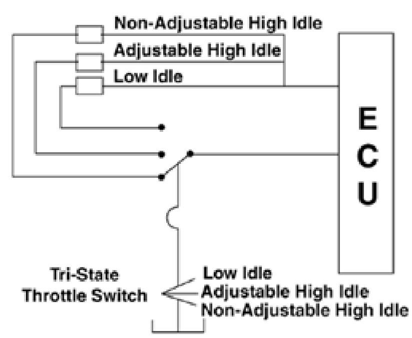
RG12286 –19–26APR02

Ramp Throttle

RG,RG34710,1534 –19–30SEP97–8/9

Tri-State Throttle

The tri-state throttle works very similar to the dual state throttle. This throttle uses a three position switch, Low Idle, Adjustable High Idle, and Non-Adjustable High Idle. The switch uses three different resistors to change the voltage returned to the ECU. The ECU uses an internal conversion table to convert the voltage to a specific engine speed. When the switch is in the low idle position, the current is routed through a 390 ohm resistor, adjustable high idle position uses a 1300 ohm resistor, and non-adjustable high idle position uses a 3000 ohm resistor. These adjustable speeds can be saved depending on the needs of the applications. The non-adjustable high idle is set at the factory to the engine's high idle speed and can not be changed. This position will always set the engine speed to the factory high idle value. The other two positions are adjustable and work exactly like the dual state throttle.



RG12285 –19–26APR02

Tri-State Throttle

RG,RG34710,1534 –19–30SEP97–9/9

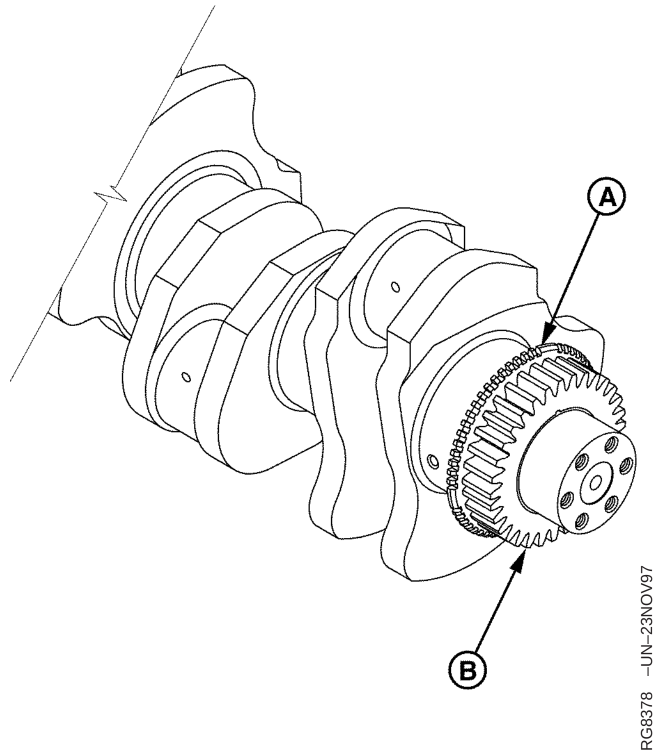
Determining Engine Speed and Piston Position

Engine speed and precise piston position in relation to Top-Dead-Center (TDC) is determined by the ECU using the crankshaft position sensor and the crankshaft timing wheel. Cylinder identification in relation to the engine firing order is determined by the ECU using the camshaft position sensor, and the camshaft timing wheel. Both sensors operate by detecting notches on a timing wheel. When a notch on the timing wheel is directly under the sensor, a voltage is induced. The ECU monitors this voltage to determine timing wheel position.

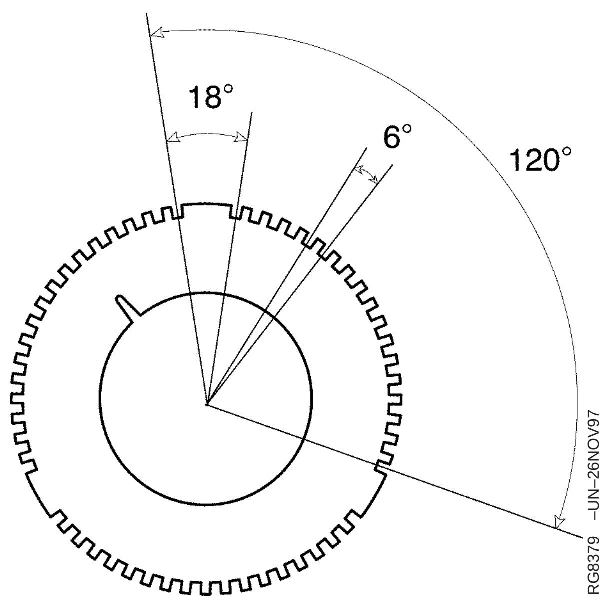
Continued on next page RG,RG34710,1536 –19–30SEP97–1/4

Crankshaft Position

The crank timing wheel (A) is located on the front of the crankshaft, behind the pressed-on crank gear (B). The timing wheel is composed of 54 notches, divided into 3 groups of 18 notches. Before the first notch in each group is a flat area equal to 18° of crankshaft rotation, the following 17 notches are separated by 6° of crankshaft rotation. Each group of 18 notches and a flat area is equal to 120°, or a third of a full turn.



Crankshaft Timing Wheel

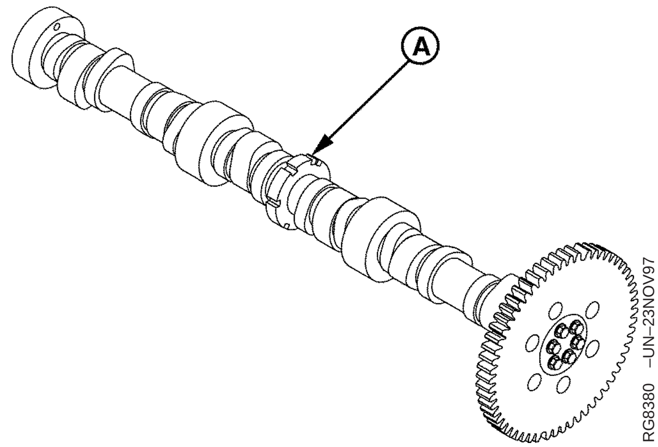


Crankshaft Timing Wheel Notches

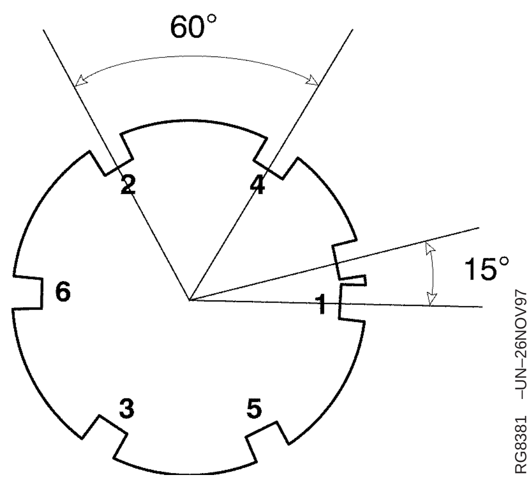
Continued on next page RG,RG34710,1536 –19–30SEP97–2/4

Camshaft Position

The camshaft timing wheel (A) consists of 7 notches cut into the center journal of the camshaft. Six of the 7 notches are evenly spaced at 60° center-to-center. Each of the 6 notches correspond to a cylinder; the 7th notch is located 15° center-to-center before the notch that identifies cylinder number 1. The ECU has the engine firing order stored in memory, therefore it knows that following the notch identifying cylinder 1 will be the notch identifying cylinder 5 etc. The camshaft timing wheel turns at one half the speed of the crankshaft timing wheel.



Camshaft Timing Wheel



Camshaft Timing Wheel Notches

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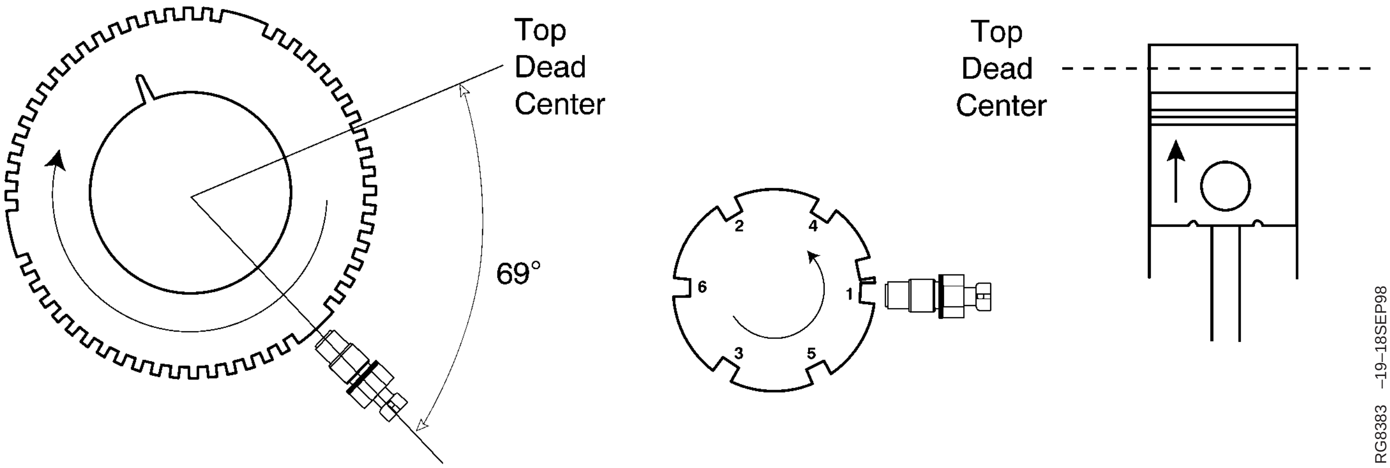


Crankshaft/Camshaft Timing Wheels Relationship

Crankshaft/Camshaft Position Relationship

When the cam position sensor detects the extra notch on the cam timing wheel, the ECU is informed that the notch identifying cylinder 1 is 15° of crank rotation away from the cam position sensor, and the center of the flat area on the crank timing wheel is 30° of crank rotation away from the crank position sensor. One timing cycle will then begin when the cam position sensor is directly in the center of a notch on the cam timing wheel. At this time, the crank position sensor is directly in the center of a flat area on the crank timing wheel, and piston number 1 is 69° of crankshaft rotation away from TDC on the compression stroke. During the previous 120°, the ECU calculated engine speed and determined the optimum time to start injecting fuel and the optimum time to stop injecting (determines fuel amount).

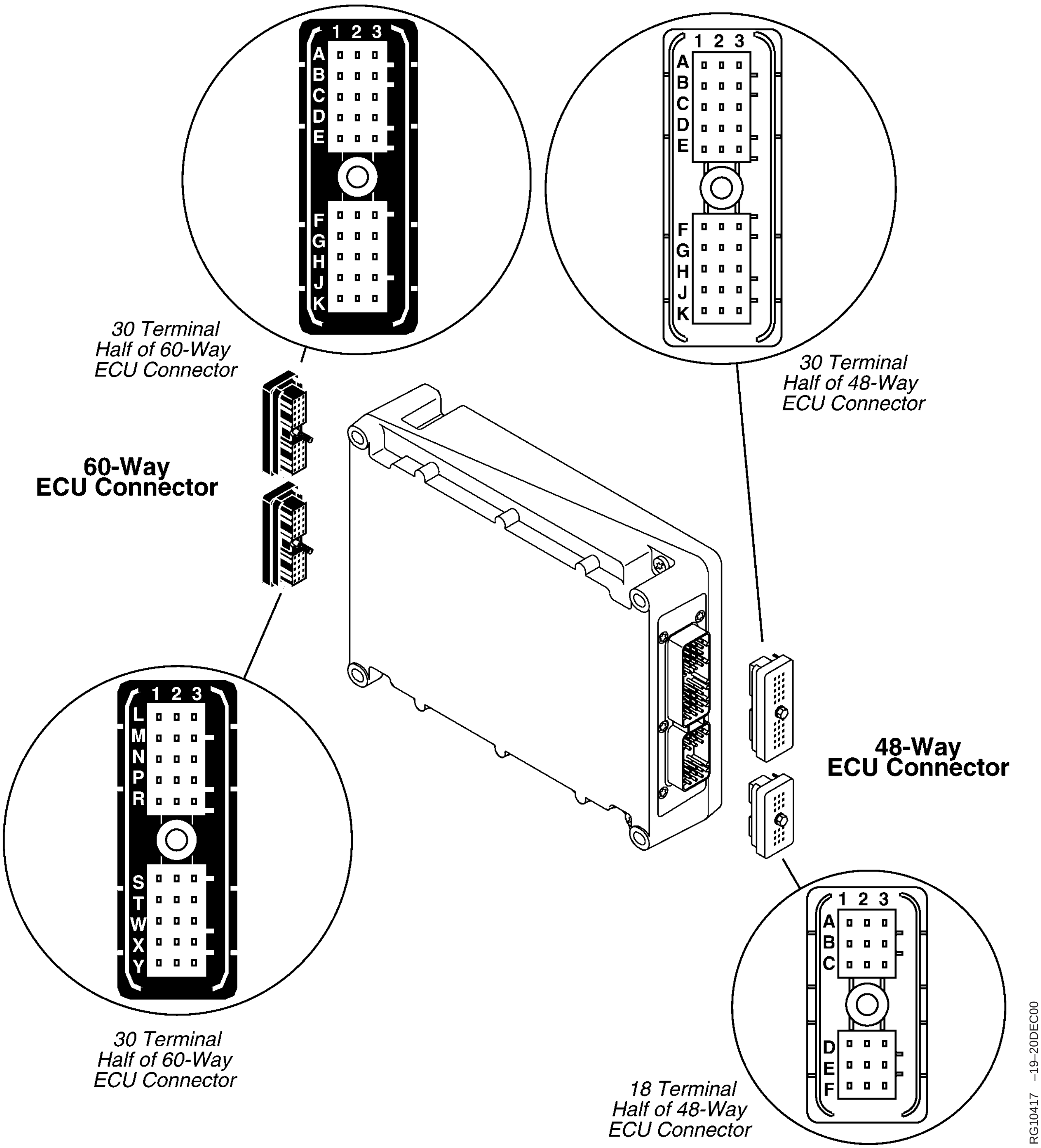
It then monitors each crank timing notch until the time to start injection occurs, at which time it energizes the Electronic Unit Injector (EUI) solenoid to start fuel delivery.

It continues to monitor each crank timing notch until the time to end injection occurs, at which time it will deenergize the EUI solenoid to stop fuel delivery.

In the event of a crank or cam position sensor failure, a “limp-home” mode will allow the ECU to operate with only one position sensor input. If the crank position sensor fails, engine power will be low. If the cam position sensor fails, long cranking times will be required to start the engine. If both sensors fail, the engine will die and won’t restart.

RG,RG34710,1536 –19–30SEP97–4/4

Engine Control Unit (ECU)



Deere Level 6 ECU

The Engine Control Unit (ECU) is the “brains” of the Electronic Control System. The ECU is a self-contained unit containing electronic circuitry and computer software which together perform the following functions:

Continued on next page

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

The ECU connects to the wiring harness through a white, 48-way ECU connector, which is composed of a 30 terminal ECU connector and an 18 terminal ECU connector, and a black, 60-way ECU connector, which is composed of two 30 terminal connectors. The connectors are marked by letters and numbers to help identify the terminals.

The ECU is composed of the following subsystems:

Analog/Digital Converters

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

Central Processing Unit (CPU)

The central processing unit performs the mathematical computations and logical functions that are necessary in controlling injection fuel quantity and injection timing. The CPU commands the Electronic Unit Injectors (EUIs) and 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.

RG,RG34710,1537 –19–30SEP97–2/2

Controller Area Network (CAN)

Controller Area Network (CAN) is used to allow communication between other controllers on the engine or vehicle and for connecting to diagnostic software. All of the controllers that are required to communicate over CAN are connected together using wires forming a bus. J1939 is an SAE standard that utilizes CAN.

Just about any type of information can be communicated over the CAN Bus. This information includes part numbers, serial numbers, engine speed, fan speed, etc. The engine also uses CAN to talk to other vehicle controllers. Depending on the application, aside from transmitting information like throttle position, application requested derates and or engine protection, displaying diagnostic fault codes on vehicle displays, etc., 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 via the CAN Bus.

RG40854,0000006 –19–11APR02–1/1

Cruise Control Operation

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

The cruise control has the normal functions of:

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

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

DPSG,RG40854,457 –19–14OCT99–1/1

Engine Protection

There are two levels of engine protection:

- **Warning** — The warning lamp (if equipped) turns ON.
  Causes:
  – Lower than normal oil pressure
  – Engine coolant temperature higher than normal
  – Higher than normal manifold air temperature
  – Lower than normal fuel supply pressure
  – Higher than normal fuel supply pressure
  – Water in fuel detected
  – High air filter restriction
  – Power derates
- **Shutdown** — The shutdown lamp (if equipped) turns ON.
  Causes:
  – Extremely low oil pressure
  – Extremely high engine coolant temperature
  – Loss of coolant
  – Extremely low fuel supply pressure
  – Water in fuel continuously detected

There are three different engine protection programs available:

- **No Protection** — The operator must reduce the speed of the engine when the “Warning”trouble light is ON, and shutdown the engine when a “Shutdown” trouble light is ON. If a “Shutdown” trouble light occurs, it is the responsibility of the operator to shut down the engine.
- **Engine Protection WITHOUT Shutdown** — The engine will derate either due to a “Warning” or a “Shutdown” trouble light. If a “Shutdown” trouble light occurs, it is the responsibility of the operator to shutdown the engine.
- **Engine Protection with Shutdown** — The engine will derate either due to a “Warning” or a “Shutdown” trouble light. If a “Shutdown” trouble light is detected, the ECU will shut down the engine in 30 seconds. If the problem is corrected within the 30 second delay period, the power will increase at a particular rate until full power is reached. The “Warning” fault lamp will remain ON until the power returns to normal, and at that time, it will shut OFF.

SHUTDOWN OVERRIDE

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

The engine protection shutdowns can be overridden for 30 seconds at a time. This can be used to move a vehicle to a safe location. Each time the switch is pushed, the shutdown timer is reset to 30 seconds, and the engine will run in a derated power mode. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for engine protection features on different sensors on your application.

DPSG,RG40854,458 –19–11APR02–1/1

Different Derate Programs

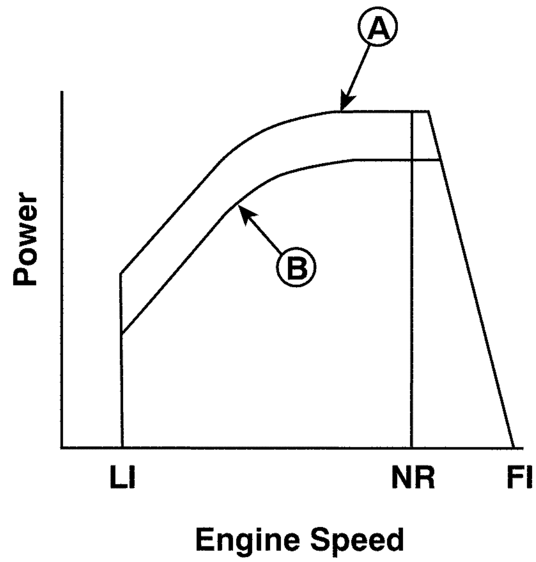
The Electronic Control Unit (ECU) will derate the amount of fuel that is delivered to the engine when sensor inputs exceed normal operating ranges. A Diagnostic Trouble Code (DTC) always accompanies a fuel derate. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for sensor derate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

DPSG,RG40854,459 –19–11APR02–1/1

Multiple Torque Curve Selection

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

For example: a machine can choose multiple torque curves using simple switching arrangement. A simple 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 of this manual and refer to the corresponding torque curve selection for your application.



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

RG8552 –19–18SEP98

Torque Curves

DPSG,RG40854,460 –19–11APR02–1/1

Governor Droop Mode Selection

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

The ECU also has the ability to provide normal and isochronous (0%) droop. The normal droop gives a drop in engine speed with an increase in load or an increase in engine speed with a decrease in load. When in isochronous, the droop is set at 0%, and there is a no change in engine speed with changing loads until engine's torque limit is reached. The factory low idle speed is always set for isochronous governing. Droop selection can be determined by engine speed, load, and cruise control depending on the application. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual and refer to the corresponding governor droop mode for your application.

DPSG,RG40854,461 –19–11APR02–1/1

Engine Control Unit (ECU) Self-Diagnosis

The Engine Control Unit (ECU) has the ability to detect problems internally and in the electronic control system. This includes determining if any sensor input voltages are too high or too low. If the ECU detects a problem with the electronic control system, a Diagnostic Trouble Code (DTC) specific to the failed system will be stored in the ECU's memory.

There are two types of DTCs:

- Active
- Stored

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

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

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

NOTE: If the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™ is used to read a sensor voltage and calculated value, and there is an active DTC for that sensor, the calculated value for that sensor will be the "limp home" value and the voltage will be the actual sensor voltage. Use the voltage during diagnostics unless otherwise directed by a diagnostic chart.

SPN/FMI CODES

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

On all applications with the Level 6 Engine Control Unit (ECU), the ECU transmits SPN/FMI codes over the Controller Area Network (CAN). This allows for service tools such as the DST, SERVICE ADVISOR™, and the Diagnostic Gauge to display active and stored DTCs. When using DST or SERVICE ADVISOR™ the codes will be displayed in a 000000.00 format. For example, SPN 110 FMI 3 will be displayed as 000110.03.

2-DIGIT CODES

Some applications do not display engine codes as an SPN/FMI. In most of these cases, the code is displayed as a 2-digit code. An example of a 2-digit code is 18 for engine coolant temperature input voltage high. If used on an application with multiple controllers, ECU may be displayed in front of the numbers, such as ECU 018. A 2-digit code may be seen on SERVICE ADVISOR™, the on-board display, or when the code is blinked for various reasons. In this manual, it will be necessary to convert these codes to the SPN/FMI code in order to follow the correct diagnostic procedure. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Section 04, Group 160 of this manual.

VIEWING ACTIVE/STORED SPN/FMI CODES

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SERVICE ADVISOR

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RG,RG34710,1540 –19–30SEP97–1/2

DTCs can be viewed on the DST, or SERVICE ADVISOR™, through the Diagnostic Gauge on the John Deere instrument panel. For directions on how to view active codes using the Diagnostic Gauge, see VIEWING ACTIVE DTCS ON DIAGNOSTIC GAUGE in Section 04, Group 160. For directions on how to view stored codes on the diagnostic gauge, see VIEWING STORED DTCS ON DIAGNOSTIC GAUGE in Section 04, Group 160.

CLEARING STORED DTCS

Stored DTCs can be cleared through the DST, or SERVICE ADVISOR™, or through the Diagnostic Gauge on the John Deere instrument panel. For directions on how to clear stored DTCs, see CLEARING STORED DTCS ON DIAGNOSTIC GAUGE in Section 04, Group 160.

RG,RG34710,1540 –19–30SEP97–2/2

Section 04
Diagnostics

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04

Continued on next page

About this Group of the Manual

This group of the manual contains necessary information for observable diagnostics and fuel-related test procedures. Use this information in conjunction with the 10.5 L & 12.5 L Diesel Engines Base Engine Manual (CTM 100). Group 150 is divided into two areas: diagnosing malfunctions and test procedures. The diagnosing malfunctions area is further divided into the following headings, containing the following observable symptoms:

- **(E)** Diagnosing General Engine Malfunctions:
  – E1 - Engine cranks/won't start
  – E2 - Engine misfires/runs irregularly
  – E3 - Engine does not develop full power
  – E4 - Engine emits excessive white exhaust smoke
  – E5 - Engine emits excessive black or gray exhaust smoke
  – E6 - Engine will not crank
  – E7 - Engine idles poorly
  – E8 - Abnormal engine noise
- **(F)** Diagnosing Low Pressure Fuel System Malfunctions
  – F1 - Dual rail fuel supply system check
  – F2 - Excessive fuel consumption on a dual rail fuel system
  – F3 - Fuel in oil on a dual rail fuel system
  – F4 - Single rail fuel supply system check
  – F5 - Excessive fuel consumption on a single rail fuel system
  – F6 - Fuel in oil on a single rail fuel system
- **(D)** Diagnosing ECU Communication Malfunctions:
  – D1 - ECU does not communicate with DST or SERVICE ADVISOR™.
  – D2 - ECU does not communicate with diagnostic gauge

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 of the manual contains the following testing procedures:

- Fuel System Testing Procedures:
  – Check dual rail fuel supply pressure
  – Bleed the dual rail fuel system
  – Check single rail fuel supply pressure
  – Bleed the single rail fuel system

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DPSG,RG40854,323 –19–20DEC00–1/1

E1 - Engine Cranks/Won’t Start

DPSG,RG40854,327 –19–21NOV00–1/1

E1 - Engine Cranks/Won’t Start Diagnostic Procedure

– – –1/1

❶ **E1 - Preliminary Check**	Before using this diagnostic chart: 1. Ensure that fuel quality and quantity are OK 2. Ensure that engine cranking speed is OK 3. Ensure that oil viscosity is correct	**No problems found:** GO TO ❷ **Problem found:** Repair and retest

– – –1/1

❷ **Active DTC Test**	1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Crank engine for 15 seconds 5. Read DTCs using DST or SERVICE ADVISOR™.	**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. **ECU will not communicate with DST or SERVICE ADVISOR:** See D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR in this Group.

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❸ **Cam and Crank Indicators Test**	1. Start cranking engine 2. While cranking, use the DST or SERVICE ADVISOR™ to observe CAM/CRANK parameters (cam noise, crank noise, and crank status). *NOTE: For an explanation of these parameters see DATA PARAMETER DESCRIPTION in Group 160.*	**No cam or crank noise and crank status reaches 15:** GO TO ❺ **Cam or crank noise or crank status does not reach 15:** GO TO ❹

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❹ **Vehicle Wiring Inspection Check**	Inspect the vehicle for possible failures that can cause either of these conditions: . 1. Bad electrical connections 2. Damaged camshaft or crankshaft sensor 3. Damaged camshaft or crank timing ring 4. EMI from improperly installed radio equipment, or other electronic devices. 5. Once the problem is found, repair and retest.	

– – –1/1

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

– – –1/1

❻ **Pilot Injection Test**	While cranking, use the DST or SERVICE ADVISOR™. to read the Pilot Injection parameter.	**Pilot Injection reads ON or N/A:** GO TO ❻ **Pilot Injection reads OFF:** Pilot Injection should be ON if the ECT is below 35°C (95°F). If Pilot Injection is OFF under this condition, determine problem in the ECT sensor circuit.

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❼ Fuel Supply System Check	Check the fuel supply system. • For Dual Rail fuel systems, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK in this Group. • For Single Rail fuel systems, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK in this Group.	**Fuel supply system OK:** GO TO ❽ **Fuel supply system problem found:** Repair fuel supply system problem and retest. – – –1/1

❽ EUI Cap Screw and EUI Harness and Connector Test	1. Ignition OFF 2. Remove rocker arm cover *NOTE: Rocker arm cover gasket is reusable if no visible damage is detected. Do not store cover resting on gasket surface.* 3. Check EUI rocker arms, valve rocker arms, and camshaft operation. 4. Check that the hold down clamp cap screws on all EUIs are tightened to specification. • For Dual Rail fuel systems, see REMOVE AND INSTALL ELECTRONIC UNIT INJECTORS (DUAL RAIL FUEL SYSTEMS) in Section 02, Group 090. • For Single Rail fuel systems, see REMOVE AND INSTALL ELECTRONIC UNIT INJECTORS (SINGLE RAIL FUEL SYSTEMS) in Section 02, Group 091. 5. Inspect EUI harness and EUI harness connector for damage.	**All components operating correctly:** GO TO ❾ **Faulty component found:** Repair faulty component and retest. – – –1/1

❾ Cam to Crank Timing Test	Verify cam/crank timing is correct. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in CTM100, Section 02, Group 050.	**Cam/crank timing OK:** Replace ECU and retest. **Cam/crank timing NOT OK:** See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in CTM100, Section 02, Group 050. – – –1/1

E2 - Engine Misfires/Runs Irregularly

DPSG,RG40854,330 –19–21NOV00–1/1

E2 - Engine Misfires/Runs Irregularly Diagnostic Procedure

– – –1/1

❶ **E2 - Preliminary Check**	Before using this diagnostic chart, check for the following that could cause or be mistaken as miss/rough running: 1. Intake manifold air leaks 2. Engine mechanical problems 3. Transmission problems 4. Engine Accessories, such as A/C, cycling on and off 5. Electromagnetic interference (EMI) from improperly installed radios etc.	**No problems found:** GO TO ❷ **Problem found:** Repair and retest.

– – –1/1

❷ **Active DTC Test**	1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Ignition ON, engine idling 5. Read DTCs using DST or SERVICE ADVISOR™.	**No active DTCs:** GO TO ❸ **Active DTCs present:** Diagnose active DTCs first. If any of the DTCs have an SPN of 636 or 637, diagnose those first.

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❸ **Engine Performance Check**	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.	**Not running rough:** No problem found, verify complaint and try to reproduce conditions of miss/rough running complaint. **Running rough:** GO TO ❺ – – –1/1

❺ **Active DTC Test with Engine Running Rough**	Read DTCs when engine is running rough.	**No active DTCs:** GO TO ❻ **Active DTCs present:** Diagnose active DTCs first. If any of the DTCs have an SPN of 636 or 637, diagnose those first. – – –1/1

❻ **Compression and Misfire Test**	1. Perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Group 160. 2. Make note of the results. 3. Perform the Engine Misfire Test. For instructions, see ENGINE TEST INSTRUCTIONS - CYLINDER MISFIRE TEST in Group 160. 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 on the compression test and DIFFERENT cylinder(s) scored 10% or more lower on the misfire test:** GO TO ❽ **One or more cylinders scored 10% or more lower than the rest on the compression test and the SAME cylinder(s) scored 10% or more lower on the misfire test:** GO TO ❾ **All cylinders scored within 10% of each other on the compression test and one or more cylinders scored 10% or lower than the rest on the misfire test:** GO TO ❿ – – –1/1

❼ **Fuel Supply System Check**	Check the fuel supply system. • For Dual Rail fuel systems, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK in this Group. • For Single Rail fuel systems, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK in this Group.	**Fuel supply system is OK:** GO TO ⓫ **Fuel supply system problem found:** Repair fuel supply system problem and retest – – –1/1

❽ **Inconclusive Test Results**	These types of results indicate either the misfire test or the compression test could not operate correctly. Further engine diagnostics should be performed to determine if the engine misfire is caused by a faulty EUI or by a compression problem.	– – –1/1

9 Low Compression Pressure Check	Determine the cause of low compression pressure on the low scoring cylinders.	– – –1/1
10 Suspected EUI(s) Pre-Load Adjustment Check	1. Check EUI pre-load adjustment on the EUI(s) of the cylinder(s) that tested low on the misfire test. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Section 02, Group 020 of CTM100 2. If EUI pre-load is adjusted properly, replace the EUI(s) of the cylinder(s) that tested low on the misfire test.	– – –1/1
11 EUI and Valve Adjustment Test	Check EUI pre-load adjustment and check valve adjustment. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Section 02, Group 020 of CTM100.	**EUIs and valves properly adjusted:** GO TO 12 **EUIs and valves NOT properly adjusted:** Adjust EUIs and valves to specification and retest. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Section 02, Group 020 of CTM100. – – –1/1
12 Verification Check	1. Ensure there are no engine mechanical problems 2. Ensure there is not something drawing excessive engine power 3. If none of the above problems are found, see E3 - ENGINE DOES NOT DEVELOP FULL POWER in this Group.	– – –1/1

E3 - Engine Does Not Develop Full Power

DPSG,RG40854,333 –19–21NOV00–1/1

E3 - Engine Does Not Develop Full Power Diagnostic Procedure

– – –1/1

❶ **E3 - Preliminary Check**	Before using this diagnostic chart, ensure that: 1. There are no problems with transmission 2. There are no engine mechanical problems 3. There is not an excessive load on the engine 4. There is no unbalanced ballast 5. The air and fuel filters are not restricted or plugged 6. Fuel quality is OK	**Problem not found:** GO TO ❷ **Problem found:** Repair and retest

– – –1/1

❷ **Intermittent Fault Test**	1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Ignition ON, engine idling 5. Read DTCs using DST or SERVICE ADVISOR™. *NOTE: Look for DTCs that indicate a fuel derate is or has been in effect.*	**No DTCs present:** GO TO ❸ **DTCs present:** Go to appropriate diagnostic procedure.

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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.

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❹ **Torque Curve Selection Check**	*NOTE: 6750/6850 Self-Propelled Forage Harvester applications only use one torque curve; therefore, this check is not required.* The ECU on engines has the ability to operate on multiple torque curves. To check that the engine is operating on the correct torque curve under the operating conditions where there is a low power complaint: 1. Recreate the conditions of the low power complaint. 2. Read the Torque Curve Parameter using DST or SERVICE ADVISOR™. 3. Compare the torque curve number with the table in the specification section. See APPLICATION SPECIFICATIONS in Section 06, Group 210.	**The torque curve number displayed IS correct for the operating conditions of the low power complaint:** GO TO ❺ **The torque curve number displayed IS NOT correct for the operating conditions of the low power complaint:** Refer to machine manual to determine components that if faulty could prevent the correct torque curve from being selected OR Faulty torque curve select wiring

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❺ **Governor Droop Mode Selection Check**	1. Operate engine and attempt to recreate the low power condition. 2. Read the Desired Speed Governor parameter and the Maximum Speed Governor parameter using DST or SERVICE ADVISOR™ 3. Compare governor selection to the appropriate chart governor mode chart. See APPLICATION SPECIFICATIONS in Section 06, Group 210.	**Governor selection is correct:** GO TO ❻ **Governor selection is incorrect:** Refer to machine manual to determine components that if faulty could prevent the correct governor from being selected. OR Faulty governor select wiring.

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❻ **Compression and Misfire Test**	1. Perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Group 160. 2. Make note of the results. 3. Perform the Engine Misfire Test. For Instructions, see ENGINE TEST INSTRUCTIONS - CYLINDER MISFIRE TEST in Group 160. 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 on either test:** Go to E2 - ENGINE MISFIRES/RUNS IRREGULARLY in this Group.

– – –1/1

❼ **Throttle Test**	1. Operate engine at full load rated speed 2. At these operating conditions, read the Percent Throttle data parameter using DST or SERVICE ADVISOR™.	**97% or above:** GO TO ❽ **Below 97%:** Refer to machine manual and perform the throttle calibration procedure and retest.

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❽ **Turbocharger Boost Pressure Check**	Check the Turbo Boost pressure. See CHECK INTAKE MANIFOLD PRESSURE (Turbo Boost) in CTM100, Section 04, Group 150.	**Intake manifold pressure in range or above, compared to boost specification:** GO TO ❾ **Intake manifold pressure below range compared to boost specification:** GO TO ❿ – – –1/1

❾ **Fuel Supply System Check**	Check the fuel supply system. • For Dual Rail fuel systems, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK in this Group. • For Single Rail fuel systems, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK in this Group.	**Fuel supply system is OK:** Engine appears to be delivering full power. Check for vehicle problems that could cause an excessive load on the engine. **Fuel supply system problem found:** Repair fuel supply system problem and retest. – – –1/1

❿ **Checking Potential Causes of Low Boost Pressure**	Check for the following that can cause reduced boost pressure: • Restricted air cleaner • Intake air leak • Exhaust air leak • Restriction in exhaust • Faulty turbocharger. See TURBOCHARGER SEVEN-STEP INSPECTION in Section 02, Group 080, of CTM100.	**None of the above problems found:** GO TO ⓫ **Problem found:** Repair and retest. – – –1/1

⓫ **Fuel Supply System Check**	Check the fuel supply system. • For Dual Rail fuel systems, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK in this Group. • For Single Rail fuel systems, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK in this Group.	**Fuel supply system is OK:** GO TO ⓬ **Fuel supply system problem found:** Repair fuel supply system problem and retest – – –1/1

12 **EUI and Valve Adjustment Test**	1. Check EUI pre-load adjustment and check valve adjustment. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Section 02, Group 020 of CTM100. 2. Ensure there are no engine mechanical problems 3. Ensure there isn't something drawing excessive engine power 4. If none of above problems are found, the most likely cause of low power is damaged spill valves in the EUIs. Replace and retest.	– – –1/1

E4 - Engine Emits Excessive White Exhaust Smoke

DPSG,RG40854,490 –19–08FEB00–1/1

E4 - Engine Emits Excessive White Exhaust Smoke Diagnostic Procedure

NOTE: This procedure should be used if the engine emits excessive white exhaust smoke. This type of smoke causes a burning sensation to the eyes. If engine emits a less heavy or bluish exhaust smoke, see L1-EXCESSIVE OIL CONSUMPTION diagnostic procedure in Section 04, Group 150, of CTM100.

– – –1/1

❶ **E4 - Preliminary Check**	Before using this diagnostic procedure: 1. Ensure fuel quantity and quality are OK. 2. Ensure engine coolant temperature is not extremely low.	**Problem not found:** GO TO ❷ **Problem found:** Repair and retest. – – –1/1
❷ **Head Gasket Test**	Check for a failed head gasket. See CHECK FOR HEAD GASKET FAILURES in CTM100, Section 04, Group 150.	**No signs of head gasket failure:** GO TO ❸ **Signs of head gasket failure are found:** See HEAD GASKET INSPECTION AND REPAIR SEQUENCE in Section 02, Group 020, of CTM100. – – –1/1
❸ **Compression Pressure Test**	Perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Group 160 of this manual.	**All cylinders score within 10% of each other:** GO TO ❹ **One or more cylinders scored 10% or lower than the rest:** Investigate problems related to low compression. – – –1/1

❹ **Fuel Pressure Test**	Check fuel pressure. • For Dual Rail fuel systems, see CHECK DUAL RAIL FUEL SUPPLY PRESSURE this Group • For Single Rail fuel systems, see CHECK SINGLE RAIL FUEL SUPPLY PRESSURE this Group.	**Fuel pressure within specification:** GO TO ❻ **Fuel pressure below specification:** GO TO ❺ – – –1/1

❺ **Fuel Supply System Check**	Check the fuel supply system. • For Dual Rail fuel systems, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK in this Group. • For Single Rail fuel systems, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK in this Group.	– – –1/1

❻ **Cam to Crank Timing Test**	Verify cam/crank timing is correct. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in CTM100, Section 02, Group 050.	**Camshaft to crankshaft timing OK:** Ensure there are no engine mechanical problems. If no other problems are found, see E3 - ENGINE DOES NOT DEVELOP FULL POWER. **Camshaft to crankshaft timing not OK:** Adjust cam/crank timing. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in Section 02, Group 050, of CTM100 and retest. – – –1/1

E5 - Engine Emits Excessive Black or Gray Exhaust Smoke

DPSG,RG40854,337 –19–21NOV00–1/1

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

NOTE: This procedure should be used if the engine emits excessive black or gray smoke. If engine emits a less heavy or bluish exhaust smoke, see L1- EXCESSIVE OIL CONSUMPTION diagnostic procedure in CTM100, Section 04, Group 150.

– – –1/1

❶ **E5 - Preliminary Check**	Before using this diagnostic procedure: 1. Ensure fuel quantity and quality are OK. 2. Ensure engine is not excessively loaded. 3. Ensure air filter is not restricted or plugged.	**Problem not 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 all of the following: • CHECK FOR INTAKE AND EXHAUST RESTRICTIONS (CTM100, Section 04, Group 150) • CHECK FOR INTAKE AIR LEAKS (CTM100, Section 04, Group 150) • CHECK FOR EXHAUST AIR LEAKS (CTM100, Section 04, Group 150)	**No restrictions or leaks found:** GO TO ❸ **Restrictions or leaks found:** Repair or replace components as necessary.

– – –1/1

❸ **Turbocharger Failure**	Check for turbocharger failure. See TURBOCHARGER SEVEN-STEP INSPECTION in Section 02, Group 080 of CTM100.	**No turbocharger failure found:** GO TO ❹ **Turbocharger failure found:** Follow appropriate repair procedure found in the above inspection in Section 02, Group 080 of CTM100. – – –1/1

❹ **Valve Lash Test**	Check valve lash. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Section 02, Group 020 of CTM100.	**Valve lash on all valves within specification:** GO TO ❺ **Valve lash on one or more valves out of specification:** Adjust valve lash and retest. – – –1/1

❺ **Cam to Crank Timing Test**	Verify cam/crank timing is correct. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in CTM100, Section 02, Group 050.	**Camshaft to crankshaft timing OK:** Ensure there are no engine mechanical problems. If no other problems are found, see E3 - ENGINE DOES NOT DEVELOP FULL POWER in this Group. **Camshaft to crankshaft timing not OK:** Adjust cam/crank timing. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in Section 02, Group 050 of CTM100, and retest. – – –1/1

E6 - Engine Will Not Crank

Symptom	Problem	Solution
E6 - Engine Will Not Crank	Weak battery	Replace battery.
	Corroded or loose battery connections	Clean battery terminals and connections.
	Defective main switch or start safety switch	Repair switch as required.
	Starter solenoid defective	Replace solenoid.
	Starter defective	Replace starter.
	Start circuit defective	Check for faulty start circuit wiring, fuses, or relays

OUO1004,0000C44 –19–20DEC00–1/1

E7 - Engine Idles Poorly

Symptom	Problem	Solution
E7 - Engine Idles Poorly	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Air leak on suction side of air intake system	Check hose and pipe connections for tightness; repair as required. See AIR INTAKE AND EXHAUST SYSTEM (GROUP 080) SPECIFICATIONS in Section 06, Group 200 of CTM100.
	Electronic control system problem or basic engine problem	See E2 - ENGINE MISFIRES/RUNS IRREGULARLY earlier in this Group.

OUO1004,0000C45 –19–20DEC00–1/1

E8 - Abnormal Engine Noise

Symptom	Problem	Solution
E8 - Abnormal Engine Noise	Worn main or connecting rod bearings	Determine bearing clearance. See CYLINDER BLOCK, LINERS, PISTONS AND RODS (GROUP 030) SPECIFICATIONS in Section 06, Group 200 of CTM100. See CRANKSHAFT, MAIN BEARINGS AND FLYWHEEL (GROUP 040) SPECIFICATIONS in Section 06, Group 200 of CTM100.
	Excessive crankshaft end play	Check crankshaft end play. See CHECK CRANKSHAFT END PLAY in Section 02, Group 040 of CTM100.
	Loose main bearing caps	Check bearing clearance; replace bearings and bearing cap screws as required. See CRANKSHAFT , MAIN BEARINGS, AND FLYWHEEL SPECIFICATIONS in Section 06, Group 200 of CTM100.
	Worn connecting rod bushings and piston pins	Inspect piston pins and bushings. See INSPECT PISTON PINS AND ROD BUSHINGS in Section 02, Group 030 of CTM100.
	Scored pistons	Inspect pistons. See PRELIMINARY LINER, PISTON, AND ROD CHECKS in Section 02, Group 030 of CTM100.
	Worn timing gears or excess back lash	Check timing gear back lash. See ADJUST FRONT TIMING GEAR BACKLASH in Section 02, Group 050 of CTM100.

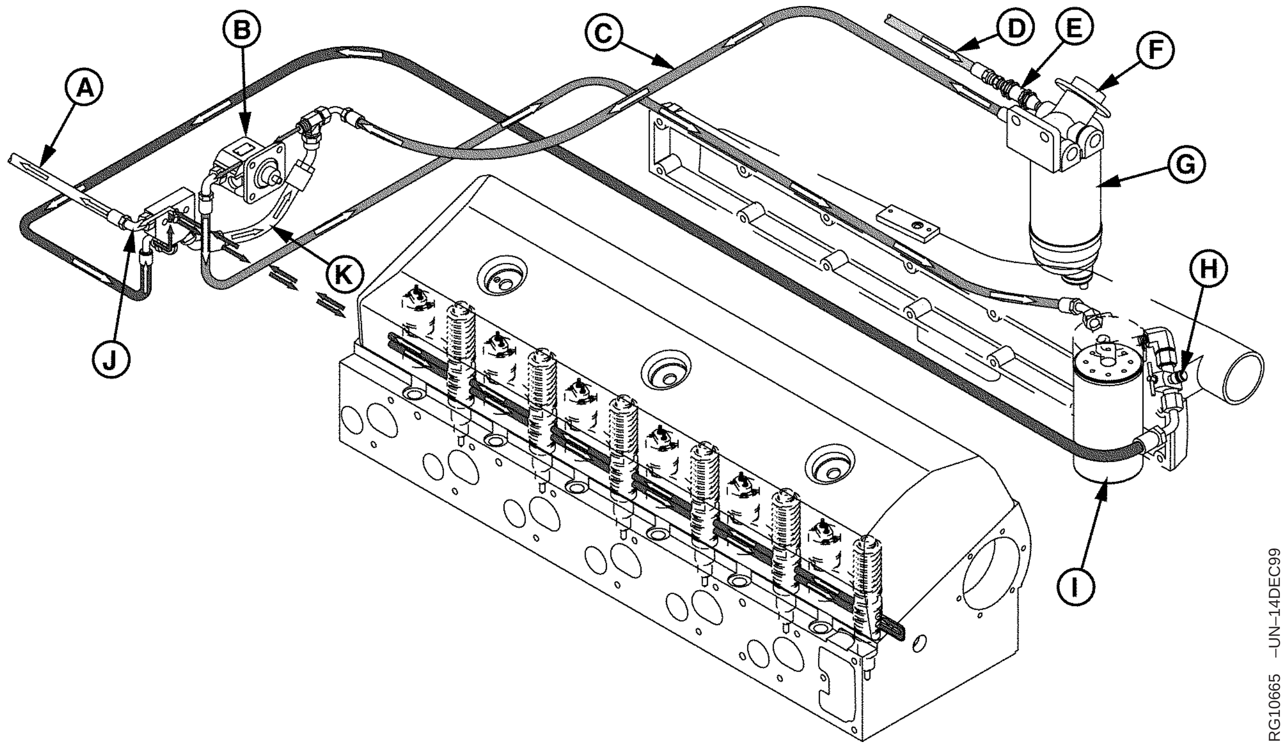
Continued on next page

OUO1004,0000C42 –19–20DEC00–1/2

Symptom	Problem	Solution
	Excessive valve clearance	Check and adjust valve clearance. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Section 02, Group 020 of CTM100.
	Worn camshaft	Inspect camshaft. See VISUALLY INSPECT CAMSHAFT AND ROLLER FOLLOWERS in Section 02, Group 050 of CTM100.
	Worn rocker arm shaft(s)	Inspect rocker arm shafts. See REMOVE ROCKER ARM ASSEMBLY in Section 02, Group 020 of CTM100.
	Insufficient engine lubrication	See: L1- EXCESSIVE OIL CONSUMPTION (Section 04, Group 150 of CTM100) AND L3 - ENGINE OIL PRESSURE LOW (Section 04, Group 150 of CTM100) AND L2 - ENGINE OIL PRESSURE HIGH (Section 04, Group 150 of CTM100)
	Turbocharger noise	See TURBOCHARGER SEVEN-STEP INSPECTION in (Section 02, Group 080 of CTM100).

OUO1004,0000C42 –19–20DEC00–2/2

F1 - Dual Rail Fuel Supply System Check



Dual Rail Fuel Supply System

A—Return to Tank Fuel Line
B—Fuel Transfer Pump
C—Fuel Line between Primary Fuel Filter and Fuel Transfer Pump
D—Fuel Line before Primary Fuel Filter
E—Check Valve on Primary Filter Inlet
F—Hand Primer
G—Primary Fuel Filter
H—Fuel Pressure Quick Connect Port
I—Final Filter
J—Check Valve on Return to Tank Fuel Line
K—Recirculated Fuel Line

For theory of operation information, see LOW PRESSURE DUAL RAIL FUEL SUPPLY SYSTEM OPERATION in Section 03, Group 130.

DPSG,RG40854,475 –19–21NOV00–1/1

F1 - Dual Rail Fuel Supply System Check

OUO1004,0000C78 –19–08JAN01–1/1

F1 - Dual Rail Fuel Supply System Check Diagnostic Procedure

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❶ **Air in Fuel System Test**	*NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. If fuel system has been recently opened (filter changed, line removed etc.) perform fuel system bleed procedure. See BLEED DUAL RAIL FUEL SYSTEM later in this Group and retest. 2. Fit Clear Line from JT03513 Fuel Supply System Test Kit after the check valve on the return-to-tank fuel line (A). 3. Start engine. *NOTE: This may require several sequences of priming and cranking, priming while cranking, and ether.* 4. After engine starts, let run for 10 minutes, then watch clear line for air/bubbles. 5. If engine won’t start, pump hand primer until moderate resistance is felt. Crank the engine. When the clear line loop fills with fuel, watch for bubbles. *NOTE: Air bubbles can be defined as:* • *Normal: bubbles visible on close examination* • *Air infiltration: clusters of bubbles easily visible* • *Foam: fuel discoloration (pink = slight) (white = extreme)*	**Normal:** GO TO ❺ **Air Infiltration or foam detected:** GO TO ❷

– – –1/1

❷ **Transfer Pump Test**	*NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Check the weep hole on the side of the transfer pump (B). 2. If weep hole is wet or damp with fuel, replace the pump and restart at the beginning of this flow diagram. 3. If weep hole is dry, reposition Clear Line between the primary filter outlet and the transfer pump inlet (C). 4. Reconnect the return-to-tank fuel line (A). 5. Perform bleed procedure. See BLEED DUAL RAIL FUEL SYSTEM later in this Group. 6. Crank/start engine. 7. If engine will start, let run for 10 minutes then watch clear line for bubbles. 8. If engine won't start, watch clear line for bubbles while cranking.	**Normal:** Test check valve (J) on the return-to-tank fuel line for leakage. Ensure that bubbles observed aren't a result of the fuel system being opened and that the fuel system is completely bled. **Air Infiltration:** GO TO ❸ – – –1/1

❸ **Primary Fuel Filter Check Valve Test**	*NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Ensure that bubbles observed aren't a result of the fuel system being opened and that the fuel system is completely bled. 2. Using JT03421 and JT02177 fittings, reposition the clear line to the inlet of the primary filter (D). 3. Pump hand primer (F) on primary filter until moderate resistance is felt. 4. Watch the clear line for several minutes to determine if fuel is draining back to the tank.	**Fuel not draining back to tank:** GO TO ❹ **Fuel draining back to tank:** Replace primary filter inlet check valve (E) and retest. – – –1/1

❹ **Leak in Fuel System Check**	*NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Inspect o-ring face fuel line fitting o-rings for damage; ensure fittings are tightened to 24 N•m (18 lb-ft). DO NOT OVERTIGHTEN. 2. Inspect primary filter base, hand primer bulb, primary filter-water separator seal, and fuel strainer canister (if equipped) for signs of leakage. 3. Replace components as necessary. 4. Perform bleed procedure. See BLEED DUAL RAIL FUEL SYSTEM later in this Group and retest.	– – –1/1

❺ **Fuel Supply Pressure Test**	**IMPORTANT: Before disconnecting any fuel line, completely clean any debris from around the fitting. Do not allow debris to enter the fuel line.** *NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Connect a 0-1000 kPa (0-150 psi) pressure gauge to the fuel supply pressure quick connect port (H). 2. Start engine and check fuel pressure at idle and at rated speed 3. If engine won't start, check fuel pressure while cranking.	**Fuel Pressure: 410-480 kPa (60-70 psi) @ idle, 620-690 kPa (90-100 psi) @ rated speed:** GO TO ❻ **Fuel Pressure: 410-480 kPa (60-70 psi) @ idle, Below 620-690 kPa (90 psi) @ rated speed:** GO TO ❼ **Fuel Pressure: Low pressure all conditions; below 100 kPa (15 psi) cranking:** GO TO ❽ **Engine won't start; 100-170 kPa (15-25 psi) cranking:** See E1 - ENGINE CRANKS/WON'T START – – –1/1

❻ **Pump Weep Hole and Check Valve Check**	*NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Check the weep hole on the side of the fuel transfer pump (B). If weep hole is wet with fuel, replace pump and retest. 2. Test the check valve (J) on the return-to-tank fuel line (D) for leakage if it has not been tested. 3. If both of these items check OK, it appears that the fuel system is operating correctly.	– – –1/1

❼ **Fuel Strainer and Filters Replace**	*NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* Change primary (G) and final (I) fuel filters and retest. See: • REPLACE FINAL (SECONDARY) FUEL FILTER ELEMENT in Section 02, Group 090 • REPLACE PRIMARY FUEL FILTER/WATER SEPARATOR in Section 02, Group 090	– – –1/1

8 Pinched-off Recirculation Fuel Line Pressure Test	*NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Pinch-off the recirculation fuel line (K). 2. Start/crank engine and check pressure.	**Pressure does not increase:** GO TO 10 **Pressure increases to at least 414 kPa (60 psi) @ idle; 103-172 kPa (15-25 psi) cranking:** GO TO 9 – – –1/1

9 Pressure Regulator Check	*NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Check pressure regulator on fuel manifold for debris. If no debris is found, replace fuel manifold. See REMOVE AND INSTALL DUAL RAIL FUEL MANIFOLD in Section 02, Group 090. 2. Flush the fuel rail. See FLUSH FUEL RAILS in Section 02, Group 090 3. Perform bleed procedure. See BLEED DUAL RAIL FUEL SYSTEM later in this Group and retest.	– – –1/1

10 Pinched-off Return to Tank Fuel Line and Pinched-off Recirculation Line Fuel Pressure	*NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Keep the recirculation line (K) pinched-off. 2. Pinch-off the return-to-tank fuel line (A). 3. Start/crank engine and check fuel pressure	**Pressure increases to at least 620-827 kPa (90-120 psi) cranking or idling:** Check the orifice at the fuel manifold. **Pressure below 620 kPa (90 psi):** GO TO 11 – – –1/1

11 Transfer Pump Check	*NOTE: For a dual rail fuel system flow diagram, see F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Remove the transfer pump and inspect the drive coupling for a proper fit, cracks, and deterioration. 2. If drive coupling is OK, replace transfer pump. See REMOVE AND INSTALL DUAL RAIL FUEL SUPPLY PUMP in Section 02, Group 090.	– – –1/1

F2 - Excessive Fuel Consumption on a Dual Rail Fuel System

Symptom	Problem	Solution
F2 - Excessive Fuel Consumption on a Dual Rail Fuel System	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.

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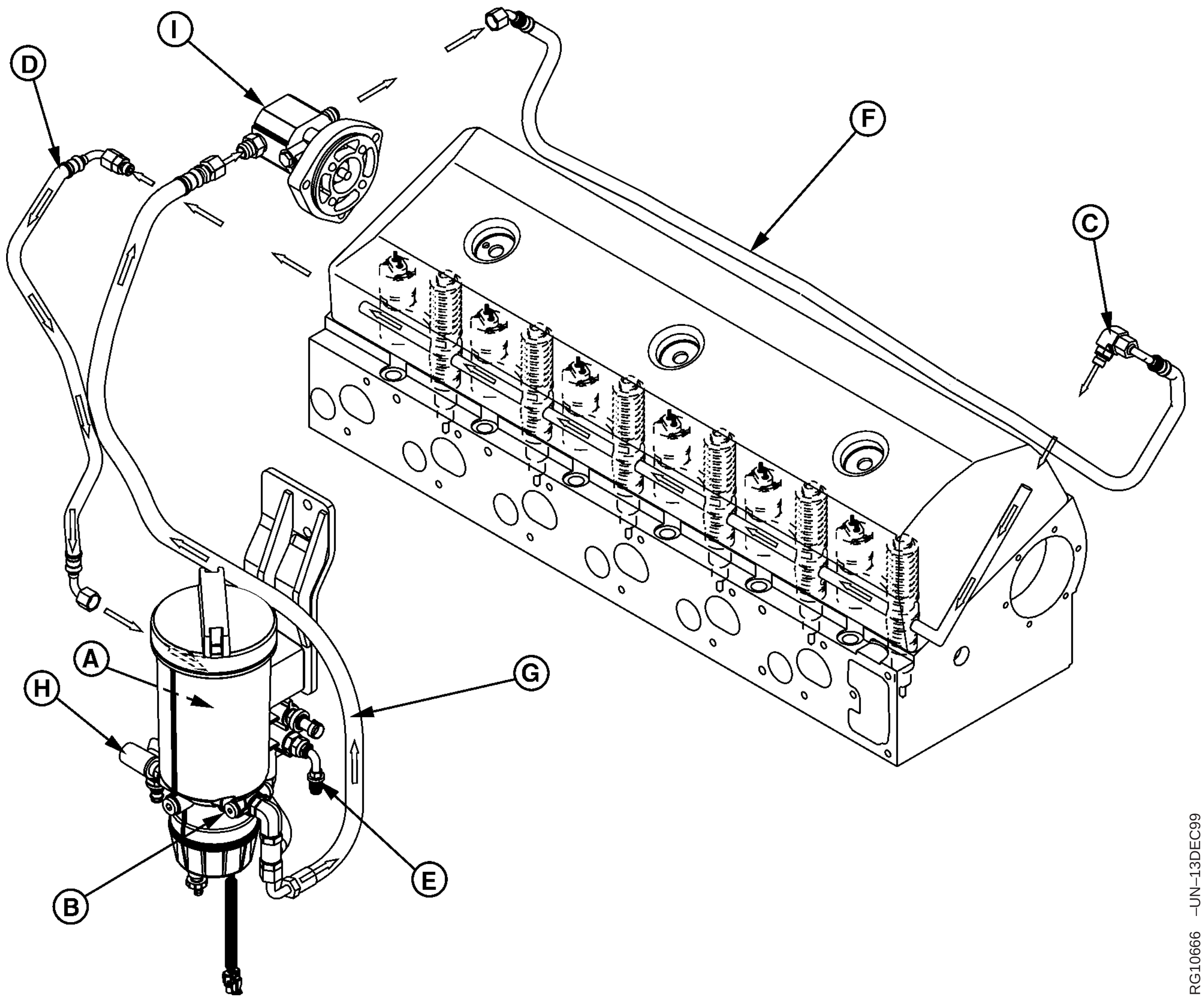
F3 - Fuel in Oil on a Dual Rail Fuel System

Symptom	Problem	Solution
F3 - Fuel in Oil on a Dual Rail Fuel System	Cracked or worn Electronic Unit Injector (EUI) O-ring	Remove suspected EUI, replace EUI O-ring as required. See REMOVE AND INSTALL ELECTRONIC UNIT INJECTORS (DUAL RAIL FUEL SYSTEMS) in Section 02, Group 090.
	Cracked cylinder head	Locate crack, repair/replace components as required.

OUO1004,0000C47 –19–20DEC00–1/1

F4 - Single Rail Fuel Supply System Check



Single Rail Fuel Supply System

A—Fuel Supply Pressure Quick Connect
B—Vacuum Port
C—Fuel Line Entering Cylinder Head
D—Fuel Line Returning to Fuel Filter Housing
E—Return to Tank Fuel Line from Fuel Filter Housing
F—Fuel Line between Transfer Pump and Cylinder Head
G—Fuel Line between Fuel Filter Housing and Transfer Pump
H—Hand Primer
I—Transfer Pump

For theory of operation information, see LOW PRESSURE SINGLE RAIL FUEL SUPPLY SYSTEM OPERATION in Section 03, Group 130.

DPSG,RG40854,474 –19–21NOV00–1/1

F4 - Single Rail Fuel Supply System Check

OUO1004,0000C79 –19–08JAN01–1/1

F4 - Single Rail Fuel Supply System Check Diagnostic Procedure

– – –1/1

❶ **Fuel System Observation and Supply Pressure Test**	*NOTE: For a single rail fuel system flow diagram, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Check for ruptured fuel lines. 2. If fuel system has been recently opened (filter changed, line removed etc.), check affected o-rings on fittings and filter for air leaks. 3. If no leaks found or if engine has been run out of fuel, perform fuel system bleed procedure. See BLEED SINGLE RAIL FUEL SYSTEM later in this Group and retest. 4. Connect a 0-1000 kPa (0-150 psi) gauge to the fuel supply pressure quick connect port (A). 5. Start engine and check fuel pressure at idle and at rated speed. If engine won't start, check fuel pressure while cranking. **Fuel Supply Pressure Specifications:** • Cranking: 135-175 kPa (20-25 psi) • Idle: 410-555 kPa (60-80 psi) • Rated speed: 480-620 kPa (70-90 psi)	**Fuel pressure within specification for ALL conditions:** GO TO ❺ **Fuel pressure below specification for ANY condition:** GO TO ❷

– – –1/1

❷ **Fuel Filter and Pre-filter Test**	*NOTE: For a single rail fuel system flow diagram, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Install a 0 - 760 mm (0-30 in.) Hg gauge at the vacuum port (B). 2. Perform bleed procedure if there is not a quick connect at the vacuum port. See BLEED SINGLE RAIL FUEL SYSTEM later in this Group and retest. 3. Start engine and monitor vacuum at full load rated speed.	**508 mm (20 in.) Hg or less:** GO TO ❸ **Greater than 508 mm (20 in.) Hg:** Plugged fuel filter OR Plugged pre-filter

– – –1/1

❸ **Transfer Pump Test**	**IMPORTANT: Before disconnecting any fuel line, completely clean any debris from around the fitting. Do NOT allow debris to enter the fuel line.** *NOTE: For a single rail fuel system flow diagram, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Connect Pressure Test Fitting from JT03513 Fuel Supply System Test Kit and a 0-1000 kPa (0-150 psi) to the fuel line returning to the fuel filter housing (D) on the fuel filter housing end so the gauge dead ends that line. 2. Check fuel pressure at cranking.	**Fuel pressure above 760 kPa (110 psi):** GO TO ❹ **Fuel pressure equal to or below 760 kPa (110 psi):** Faulty transfer pump – – –1/1

❹ **High Pressure Regulating Valve Test**	*NOTE: For a single rail fuel system flow diagram, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Disconnect pressure gauge at end of fuel line returning to fuel filter housing (D) 2. Reconnect that fuel line to the fuel filter housing. 3. Perform bleed procedure. See BLEED SINGLE RAIL FUEL SYSTEM later in this Group and retest. 4. Connect 0-1000 kPa (0-150 psi) pressure gauge to the fuel supply pressure quick connect port (A). 5. Pinch off the return to tank fuel line (E). 6. Check fuel pressure at cranking, idle, and rated speed **Fuel Supply Pressure Specifications:** • Cranking: 135-175 kPa (20-25 psi) • Idle: 410-555 kPa (60-80 psi) • Rated speed: 480-620 kPa (70-90 psi)	**Fuel pressure within specification for ALL conditions:** Faulty low pressure regulating valve **Fuel pressure below specification for ANY condition:** Faulty high pressure regulating valve OR Faulty head debris filter (100 micron internal filter). – – –1/1

❺ **Air in Fuel Test on Return-to-Tank Fuel Line**	*NOTE: For a single rail fuel system flow diagram, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. If a hard start symptom is being diagnosed, an attempt should be made to recreate conditions of when the hard starting was observed such as early morning starts. 2. Fit clear line from JT03513 Fuel Supply System Test Kit after the low pressure regulating valve on the return-to-tank fuel line. 3. Start/crank engine and watch for air/bubbles in return-to-tank fuel line (E). *NOTE: Air/bubbles can be defined as:* • *Normal: bubbles visible on close examination* • *Air infiltration: clusters of bubbles easily visible* • *Foam: fuel discoloration (pink = slight) (white = extreme)*	**Normal amount of bubbles detected:** GO TO ❽ **Air infiltration or foam detected:** GO TO ❻ – – –1/1

❻ Air in Fuel Test between Transfer Pump and Fuel Filter	**IMPORTANT: Before disconnecting any fuel line, completely clean any debris from around the fitting. Do not allow debris to enter the fuel line.** *NOTE: For a single rail fuel system flow diagram, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Fit a clear line from JT03513 Fuel Supply System Test Kit between transfer pump and fuel filter. 2. Start/crank engine and watch for air/bubbles in fuel line between transfer pump and fuel filter (G). *NOTE: Air bubbles can be defined as:* • *Normal: bubbles visible on close examination* • *Air infiltration: clusters of bubbles easily visible* • *Foam: fuel discoloration (pink = slight) (white = extreme)*	**Normal amount of bubbles detected:** GO TO ❼ **Air infiltration or foam detected:** Inspect fuel filter housing, hand primer, and fuel filter/water separator seal for signs of leakage. Replace components as required. – – –1/1

❼ Leaks in Fuel System Check	*NOTE: For a single rail fuel system flow diagram, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Check the weep hole on the side of the fuel transfer pump. If weep hole is wet, with fuel, replace pump and retest. 2. Check that the hold down cap screw on all EUIs is tightened to spec. See SINGLE RAIL FUEL SYSTEM SPECIFICATIONS in Section 06, Group 200. 3. If torques are correct, remove EUIs and inspect seats for combustion gas leaks. See REMOVE AND INSTALL ELECTRONIC UNIT INJECTORS (SINGLE RAIL FUEL SYSTEMS) in Section 02, Group 091.	– – –1/1

❽ Drainback Test	**IMPORTANT: Before disconnecting any fuel line, completely clean any debris from around the fitting. Do not allow debris to enter the fuel line.** **IMPORTANT: DO NOT start engine at any time during this test.** *NOTE: For a single rail fuel system flow diagram, see F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK supporting information.* 1. Install a clear line between fuel filter outlet and transfer pump(G) 2. Perform bleed procedure. See BLEED SINGLE RAIL FUEL SYSTEM later in this Group. 3. Pump hand primer on fuel filter until the clear line is full. 4. Watch the clear line for several minutes to see if fuel is draining back through the clear lines between: • Fuel filter outlet AND transfer pump • Low pressure regulating valve AND fuel tank	**No drainback observed at these locations:** If all the above items check OK, the fuel system appears to be operating correctly. **Drainback is detected in clear line between low pressure regulating valve and tank (E):** Faulty low pressure regulating valve **Drainback detected in clear line between fuel filter and transfer pump (G):** Faulty check valve after fuel filter – – –1/1

F5 - Excessive Fuel Consumption on Single Rail Fuel System

Symptom	Problem	Solution
F5 - Excessive Fuel Consumption on Single Rail Fuel System	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.

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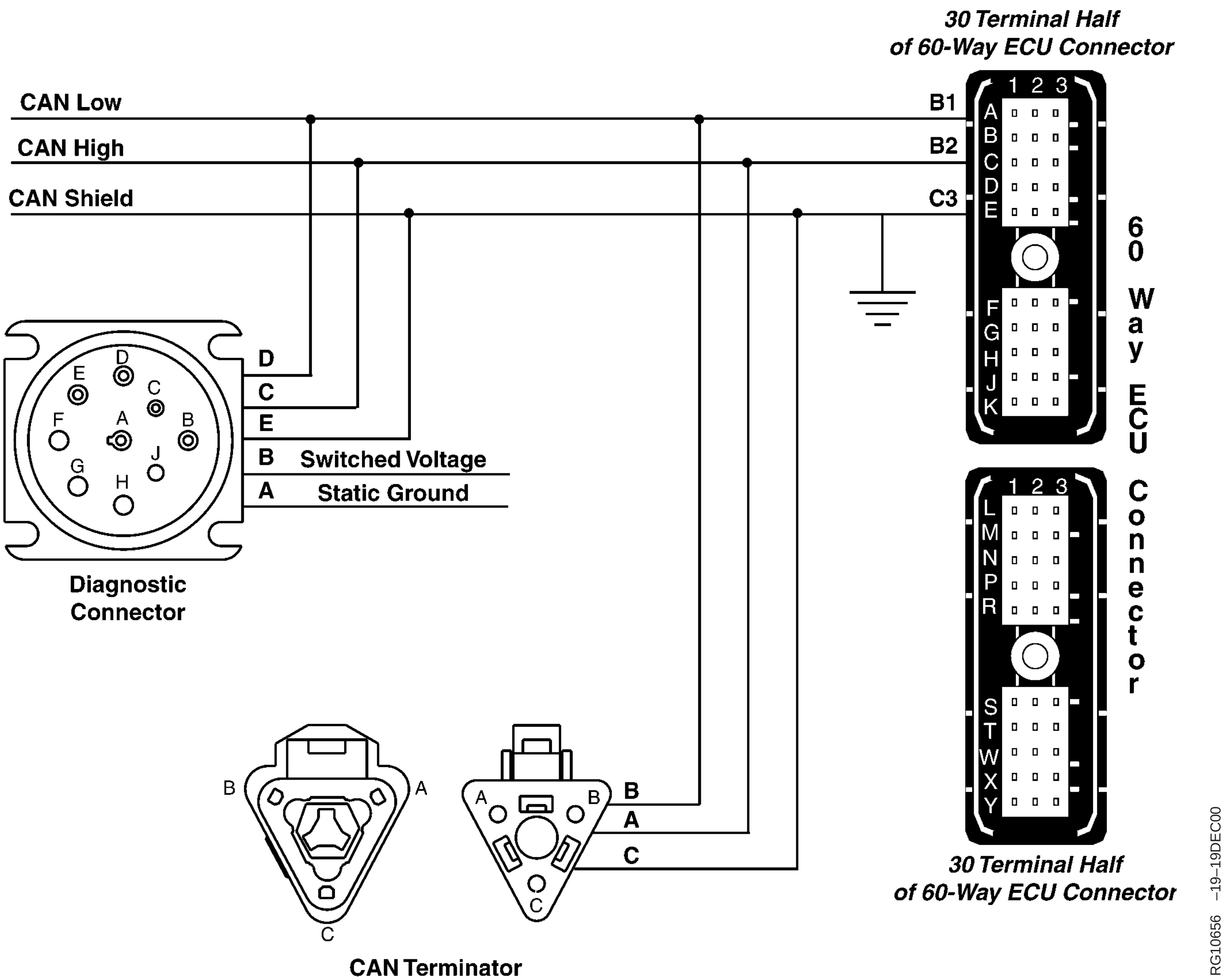
F6 - Fuel in Oil on Single Rail Fuel System

Symptom	Problem	Solution
F6 - Fuel in Oil on Single Rail Fuel System	Cracked or worn Electronic Unit Injector (EUI) O-ring	Remove suspected EUI, replace EUI O-ring as required. See REMOVE AND INSTALL ELECTRONIC UNIT INJECTORS (SINGLE RAIL FUEL SYSTEMS) in Section 02, Group 091.
	Cracked cylinder head	Locate crack, repair/replace components as required.

OUO1004,0000C4A –19–20DEC00–1/1

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



This diagnostic chart should be used if communication between the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™ and the Engine Control Unit (ECU) cannot be established.

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DPSG,RG40854,324 –19–04MAR03–1/1

D1 - ECU Does Not Communicate with DST

OUO1004,0000C7A –19–04MAR03–1/1

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

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❶ **Connection Check**	**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.* Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the diagnostic connector looking for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** 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. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ in Group 160 later in this manual. 2. Make sure all communication cables are properly connected. 3. Ignition ON, engine OFF 4. Start the ECU diagnostic software	**ECU doesn't communicate:** GO TO ❸ **ECU communicates:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, in Group 160.

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❸ **Sensor Voltage Test**	*NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.* 1. Ignition OFF 2. Disconnect any of the following: • 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 selected sensor harness connector.	**4.5 V or above:** GO TO ❺ **Below 4.5 V:** GO TO ❹

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❹ **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 48-way ECU connector 3. Ignition ON 4. Using a multimeter, measure the voltage between a good chassis ground and terminal G1 in the harness end of the 30 terminal half of the 48-way ECU connector.	**10.0 V or above:** Faulty ECU power fuse OR Faulty ECU power wiring OR Faulty ECU **Below 10.0 V:** Key-on signal wire open or shorted to ground OR Faulty ignition switch OR Faulty key-on power fuse

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❺ **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 the power light on the Parallel Data Module (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 Connector 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 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 Port 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 the main harness. 3. Probe terminal A in the diagnostic connector with a test light connected to battery voltage.	**Light ON:** Faulty diagnostic connector OR Open or short to ground in diagnostic connector 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 60-way ECU connector and diagnostic cable from the diagnostic connector 3. Using a multimeter, measure resistance on the harness end of both connectors between: • Terminal D in the diagnostic connector ***and*** terminal B1 in the 60-way ECU connector • Terminal C in the diagnostic connector ***and*** terminal B2 in the 60-way 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 Test**	*NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR™ supporting information.* 1. Ignition OFF 2. 60-way ECU and diagnostic connector still disconnected 3. Using a multimeter, measure resistance between terminals C and D in the harness end of the diagnostic connector.	**Between 45 - 75 ohms:** GO TO ❿ **Less than 45 or greater than 75 ohms:** Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness

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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 ECU 60-way connector 3. Ignition ON 4. Using a multimeter, measure voltage between a good chassis ground and: • Terminal C in the diagnostic connector • Terminal D in the diagnostic connector	**Both measurements between 1.5 - 3.5 V:** Faulty ECU 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 V or greater than 2.5 V:** CAN wiring shorted to ground or voltage OR Faulty ECU

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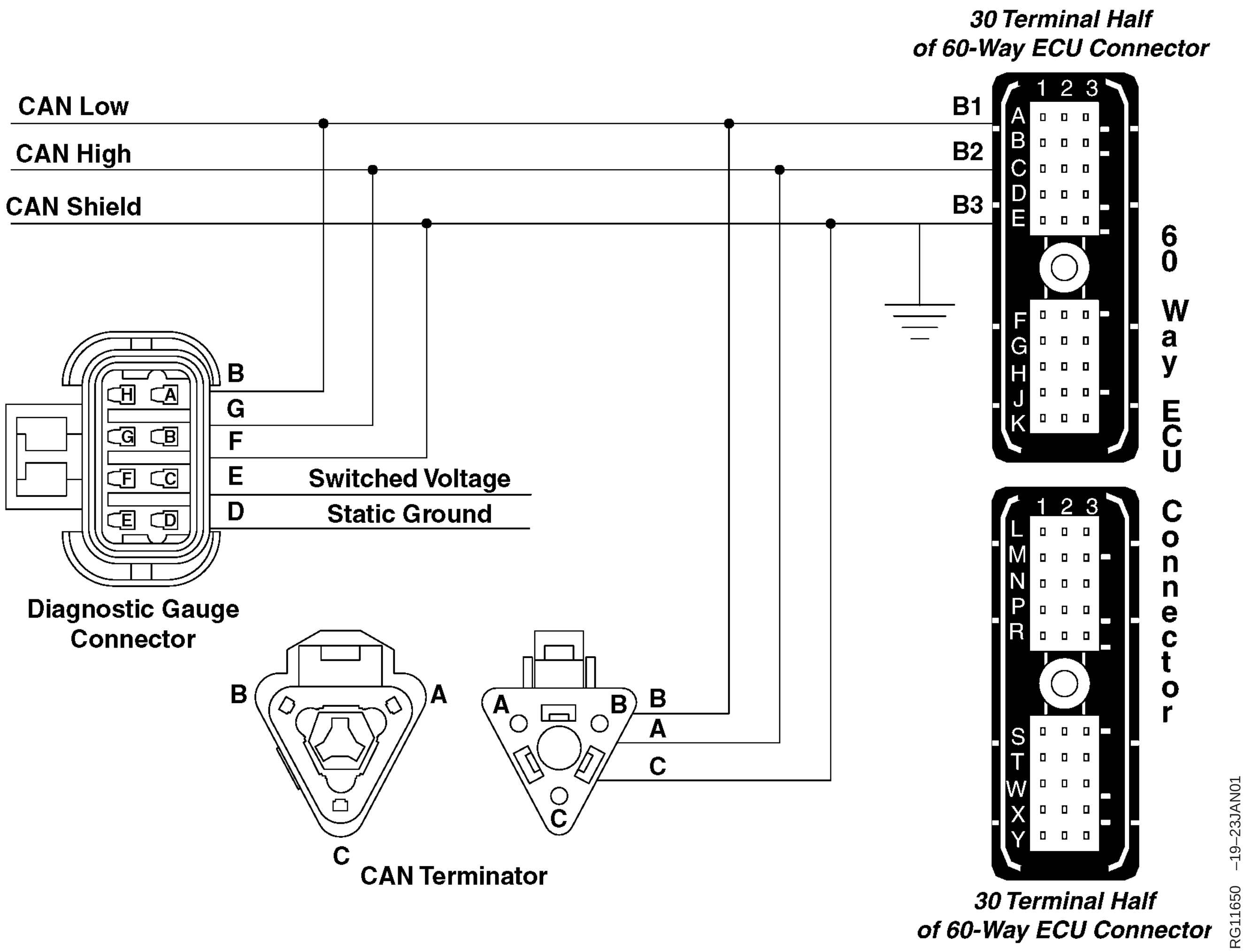
D2 - ECU Does Not Communicate with Diagnostic Gauge



Internal Diagnostic Gauge Errors

- The D2 - ECU Does Not Communicate with Diagnostic Gauge diagnostic procedure should be followed if the diagnostic gauge shows the following error codes or it can not communicate with the ECU:

  – EE-error
  – ACP-Err/No Addr
  – ACP-Err/Bus EP
  – ACP-Err/Bus Error

RG40854,000005C –19–04MAR03–1/1

D2 - ECU Does Not Communicate with Diagnostic Gauge

RG40854,000005D –19–04MAR03–1/1

D2 - Diagnostic Gauge Does Not Communicate with ECU

– – –1/1

❶ Connection Check	**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 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.* Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the diagnostic gauge connector looking for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair connection and retest.

– – –1/1

❷ Intermittent Fault Test	*NOTE: For wiring information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.* 1. Ignition OFF 2. Ignition ON	**Error or no power found in diagnostic gauge:** GO TO ❸ **No error found and power present in diagnostic gauge:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, in Group 160.

– – –1/1

❸ **Sensor Voltage Test**	*NOTE: For wiring information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE 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 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.* 1. Ignition OFF 2. Disconnect 48-way ECU connector 3. Ignition ON 4. Using a multimeter, measure the voltage between a good ground and terminal G1 in the harness end of the 30 terminal half of the 48-way ECU connector.	**10.0 V or above:** Faulty ECU power wiring OR Faulty ECU **Below 10.0 V:** Key-on signal wire open or shorted to ground OR Faulty ignition switch OR Faulty ECU power fuse – – –1/1

❺ **Diagnostic Gauge Power Test**	*NOTE: For wiring information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE 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 Connector Ground Wire Test**	*NOTE: For wiring information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.* 1. Ignition OFF 2. Disconnect the diagnostic cable from the diagnostic connector 3. Probe terminal D in the diagnostic gauge connector with a test light connected to battery voltage.	**Substantially less than battery voltage:** GO TO ❼ **At or near battery voltage:** Open in diagnostic gauge ground wire. – – –1/1

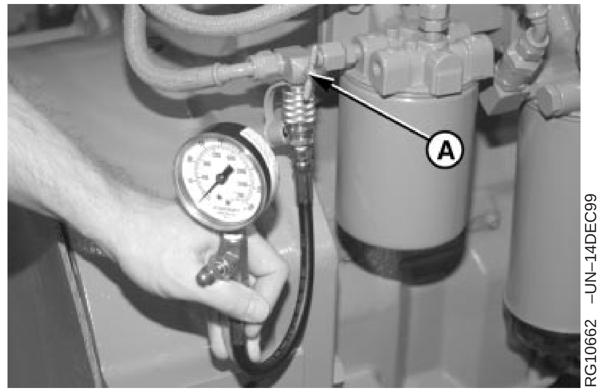
❼ Open in Diagnostic Connector Power Wire	*NOTE: For wiring information, see D2 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.* 1. Ignition OFF 2. Disconnect the diagnostic gauge connector. 3. Probe terminal D in the diagnostic gauge connector with a test light connected to 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 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.* 1. Ignition OFF 2. Disconnect 60-way ECU connector and diagnostic cable from the diagnostic connector 3. Using a multimeter, measure resistance on the harness end of both connectors between: • Terminal B in the diagnostic gauge connector ***and*** terminal B1 in the 60-way ECU connector • Terminal G in the diagnostic gauge connector ***and*** terminal B2 in the 60-way 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 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.* 1. Ignition OFF 2. 60-way ECU and diagnostic 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 - ECU DOES NOT COMMUNICATE WITH DIAGNOSTIC GAUGE supporting information.* 1. Ignition OFF 2. Reconnect ECU 60-way connector 3. Ignition ON 4. Using a multimeter, measure voltage between a good chassis ground and: • Terminal B in the diagnostic gauge connector • Terminal G in the diagnostic gauge connector	**Both measurements between 1.5 - 3.5 V:** Faulty ECU connection OR Faulty diagnostic gauge connector OR Faulty diagnostic software/computer configuration OR Faulty ECU **Either measurement less than 1.5 V or greater than 2.5 V:** CAN wiring shorted to ground or voltage OR Faulty ECU – – –1/1

Check Dual Rail Fuel Supply Pressure



Checking Fuel Supply Pressure

A—Fuel Supply Pressure Quick Connect Port

1. Connect a 0-1000 kPa (0-150 psi) gauge to the Diagnostic Quick-connect on the air purge valve after removing the dust cap and cleaning the quick-disconnect.

2. Open bleed valve

3. Start/crank engine. Fuel transfer pump should maintain minimum pressure shown in specification.

Specification

Fuel Transfer Pump Pressure—
Cranking (Minimum 200 RPM)............ 70–170 kPa (0.7–1.7 bar) (15–25 psi)
Normal (Idle).. 410–480 kPa (4.1–4.8 bar) (60–70 psi)
Rated Speed .... 620–690 kPa (6.2–6.9 bar) (90–100 psi)

DPSG,RG40854,355 –19–07OCT99–1/1

Bleed Dual Rail Fuel System

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.

1. Drain water and contaminants from clear water separator sediment bowl (C) by opening drain valve (A), then operate hand primer (B) until bowl is clear of water and debris.

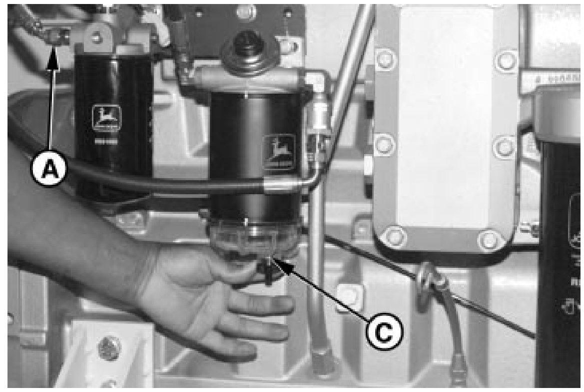
2. Loosen secondary (final) fuel filter outlet line (a) or remove cap and open air purge valve (D), (if equipped).

3. Pump hand primer (B) on primary filter until a steady flow of fuel (without bubbles) comes out of connection.

4. Continue pumping hand primer and simultaneously tighten outlet line connection to 24 N•m (18 lb-ft). DO NOT overtighten.

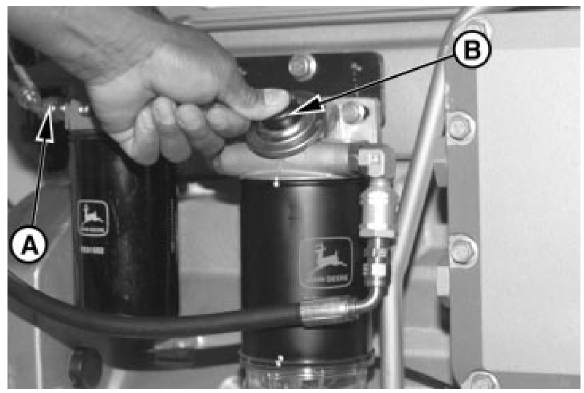
5. Start engine and run at high idle for 3–5 minutes.

NOTE: If both filters were replaced, hand priming will purge air form the secondary filter followed by clean fuel, followed by air from the primary filter. Failure to bleed air from both filters will cause the engine to die due to air trapped in the system



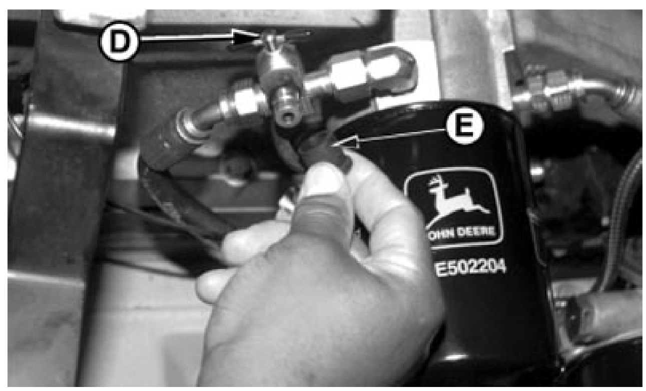
RG8714B –UN–21NOV97

Draining Water Separator



RG8725 –UN–05DEC97

Bleeding Fuel System



RG10250 –UN–30JUL99

Air Purge Valve

RG,RG34710,1551 –19–30SEP97–1/1

Check Single Rail Fuel Supply Pressure

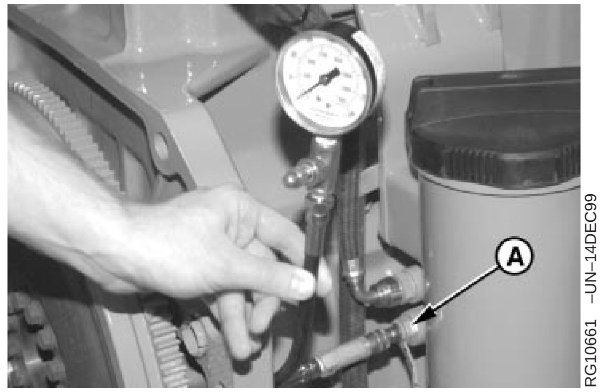
1. Connect a 0-1000 kPa (0-150 psi) gauge to the Diagnostic Quick-connect on the air purge valve after removing the dust cap and cleaning the quick-disconnect.

2. Open bleed valve

3. Start/crank engine. Fuel transfer pump should maintain minimum pressure shown in specification.

Specification

Fuel Transfer Pump Pressure—
Cranking (Minimum 200 RPM).................... 135–175 kPa (1.35–1.75 bar) (20–25 psi)
Normal (Idle)... 410–555 kPa (4.1–5.5 bar) (60–80 psi)
Rated Speed .... 480–620 kPa (4.8–6.2 bar) (70–90 psi)



Checking Fuel Supply Pressure

A—Fuel Supply Pressure Quick Connect Port

DPSG,RG40854,355 –19–07OCT99–1/1

Bleed Single Rail Fuel System

NOTE: Under normal conditions, fuel system bleeding is not required. Priming system with hand primer (B) is normally sufficient. If necessary to bleed the system, use the following procedure.

1. Drain water and contaminates from clear water separator sediment bowl by opening drain valve (C) and operating primer (B) until bowl is clear of water.
2. Attach an open line to diagnostic port (A) and place end of line in suitable container for diesel fuel.
3. Pump hand primer (B) until a steady flow of fuel (without bubbles) comes out of line.

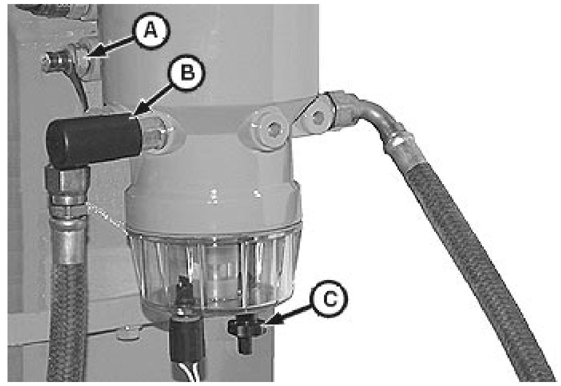
NOTE: It can take up to 200 strokes until fuel comes out steadily.

4. Disconnect line from diagnostic port (A).
5. Pump hand primer (B).

NOTE: If engine has been run out of fuel, 200 strokes will be necessary.

6. Start engine and run for five minutes.

NOTE: If engine does not start after 20 seconds of cranking, pump hand primer an additional 100 strokes, and attempt to start engine again.



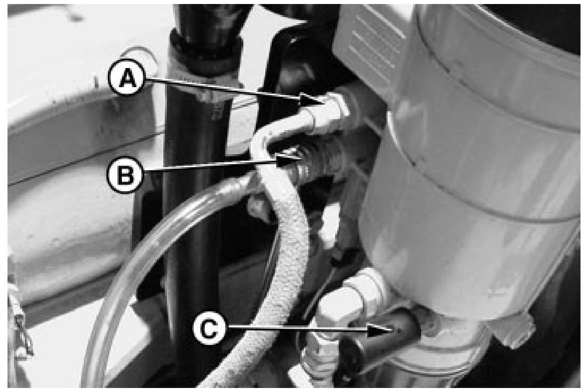
RG10309 –UN–02SEP99

Bleed Fuel System

A—Diagnostic Port
B—Hand Primer
C—Water Drain Valve

DPSG,RG40854,356 –19–07OCT99–1/1

Restarting Engine That Has Run Out Of Fuel (Single Rail Fuel System)



A—Fuel Return Line
B—Diagnostic Port
C—Hand Primer

1. Connect a clear hose or pump with clear hose to the diagnostic port (B). Pump 0.5—1.0 gallons of fuel into a bucket by using hand primer (C) or by installing a electric fuel pump on the line from the diagnostic port.

2. Remove the clear hose/pump from the diagnostic port

3. Remove the fuel return line (A) and cap-off the hose end and hose fitting.

4. Pump hand primer (C) 50 times to build fuel pressure in fuel rail.

5. Start engine and run up to high idle for 1 minute

NOTE: *If engine does not start after 20 seconds of cranking, pump hand primer an additional 50 strokes, wait at least 1 minute to let starter cool down, and attempt to start engine again.*

6. Repeat Step 5 until engine has started

NOTE: *As step 5 is repeated, allow 2-3 minutes between cranking in order to sufficiently cool the starter.*

7. Holding the return line over a bucket, remove the cap and install into filter housing

8. Start engine and run up to high idle for 2 minutes, then stop engine

9. Ignition ON, engine OFF

10. Clear any stored Diagnostic Trouble Codes (DTCs) that may have occurred during this procedure

RG40854,0000005 –19–12NOV01–1/1

About This Group of the Manual

This group of the manual contains necessary information to diagnose the electronic control system. Use this information in conjunction with the 10.5 L & 12.5 L Diesel Engines Base Engine (CTM100).

See the 10.5 L and 12.5 L Diesel Engines Base Engine manual for:

- Removal of base engine components
- Base engine repair procedures
- Base engine disassembly
- Base engine inspection
- Base engine assembly
- Base engine diagnostics and tests

Parts such as sensors, actuators, connectors, and wiring harnesses are serviceable and available.

IMPORTANT: Not under any circumstances, should the Engine Control Unit (ECU) be opened.

NOTE: Instruction is given throughout the diagnostic charts to make resistance and voltage measurements in the ECU/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.

RG,RG34710,1552 –19–20DEC00–1/1

Electrical Concepts

Tests will include making measurements of voltage and resistance and making checks for open circuits and short circuits. An understanding of the following concepts is required to use the diagnostic procedures:

- Voltage (volts)
- Current (amps)
- Resistance (ohms)
- Open Circuit
- Short Circuit

RG,RG34710,1553 –19–30SEP97–1/1

Electrical Circuit Malfunctions

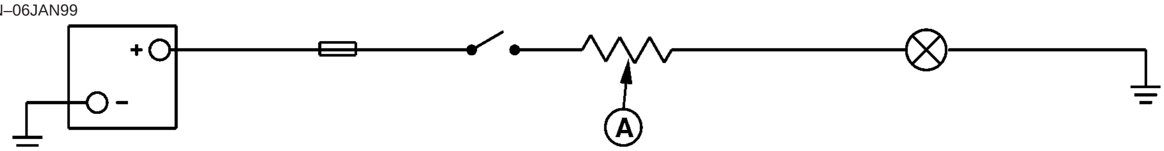
Circuit Malfunctions

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



High Resistance Circuit

A—Unwanted Resistance

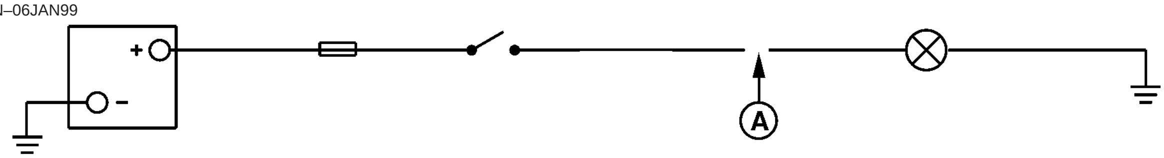
Definition of Circuit Malfunctions

1. **High Resistance Circuit:**

A circuit having unwanted resistance (A) that causes a voltage drop and reduces current flow.

DPSG,RG40854,37 –19–15DEC98–2/6

RG9892 –UN–06JAN99



Open 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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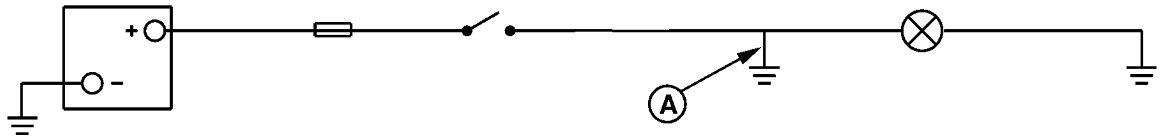
DPSG,RG40854,37 –19–15DEC98–3/6

RG9893 –UN–06JAN99

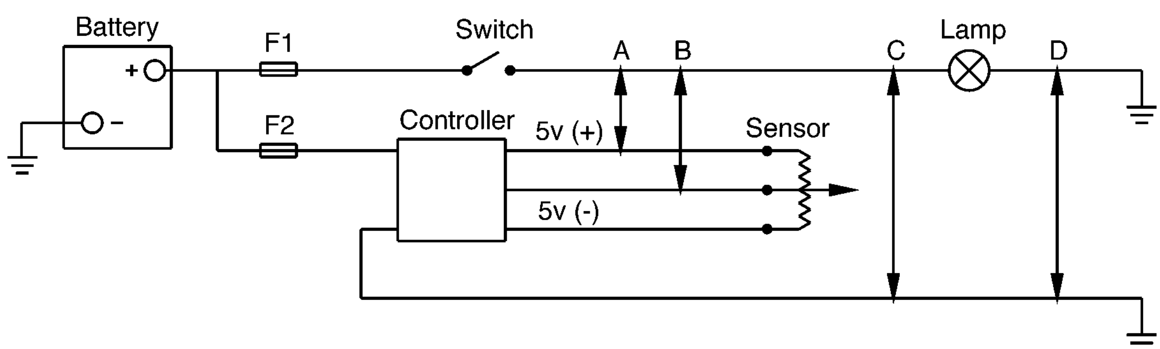


Grounded Circuit

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.

DPSG,RG40854,37 –19–15DEC98–4/6



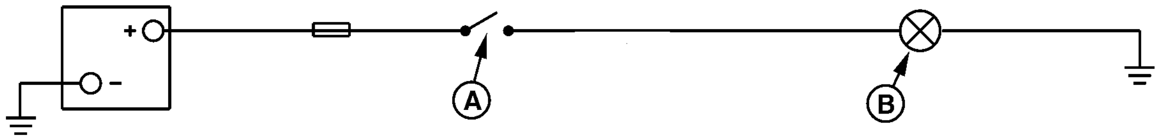
Shorted Circuit

4. **Shorted Circuit:**
   A wire-to-wire contact of two adjacent wires that provides unwanted continuity between the two wires. The following are types of short circuits:
   - Voltage wire shorted to another voltage wire (wires of equal or unequal voltage).
   - Voltage wire shorted to a sensor signal wire (wires of unequal voltage).
   - Voltage wire shorted to a ground wire (wires of battery voltage or regulated voltage, shorted to a ground wire connecting a component to the battery negative terminal).
   - Ground wire shorted to another ground wire (wires of zero voltage).

NOTE: This type of short does not create an observable malfunction. Therefore, no further explanation for trouble shooting is necessary.

Continued on next page DPSG,RG40854,37 –19–15DEC98–5/6

RG9895 –UN–06JAN99



Locations of Circuit Malfunctions

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.

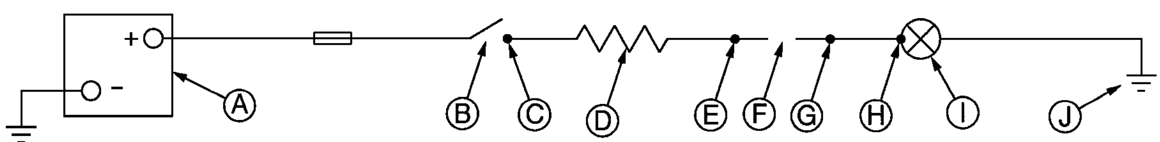
Example: A component may not operate before disconnecting an electrical connection, but it operates after reconnecting the connector.

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 re-established good continuity through the connector.

DPSG,RG40854,37 –19–15DEC98–6/6

Troubleshooting Circuit Malfunctions

RG9896 –UN–06JAN99



Troubleshooting Circuit Malfunctions

A—Battery
B—Switch
C—Component Terminal
D—Unwanted Resistance
E—Circuit Connector
F—Open Circuit
G—Circuit Connector
H—Component Terminal
I—Load (Lamp)
J—Ground

1. **High Resistance Circuit:**

   A "High Resistance" circuit can result in slow, dim or no component operation (for example: loose, corroded, dirty or oily terminals, gauge of wire too small or broken strands of wire).

2. **Open Circuit:**

   An "Open" circuit results in no component operation because the circuit is incomplete (for example: broken wire, terminals disconnected, open protective device or open switch).

   Do the following to isolate the location of a "High Resistance" or "Open" circuit:

   a. 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.

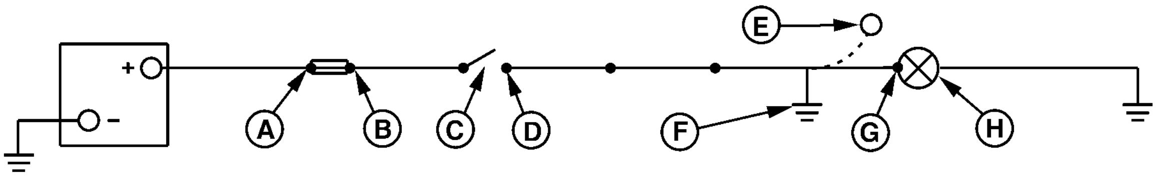
NOTE: The example shows high resistance (D) between (C) and (E) and the open circuit (F) between (E) and (G).

   b. Repair the circuit as required.

   c. Perform an operational check-out on the component after completing the repair.

Continued on next page DPSG,RG40854,38 –19–15DEC98–1/4

RG9897 –UN–06JAN99



Ground Circuit

A—Fuse “A” Terminal
B—Fuse “B” Terminal
C—Switch
D—Component Terminal
E—Wire Terminal
F—Grounded Circuit
G—Component Terminal
H—Load (Lamp)

3. **Ground Circuit:**

A “Grounded” circuit (F) results in no component operation and the fuse or circuit breaker opens (for example: a power wire contacting the machine frame, chassis or component housing).

Do the following to isolate the location of a “Grounded” circuit:

a. Switch (C) must be open (off). Check for continuity to ground between (B) and (C).

- If there is continuity, there is a grounded circuit between (B) and (C). Repair the circuit.
- No continuity, go to step b.

b. Disconnect the load (H) at component terminal (G).

c. With the controlling switch (C) open (off), check for continuity to ground between (D) and (E).

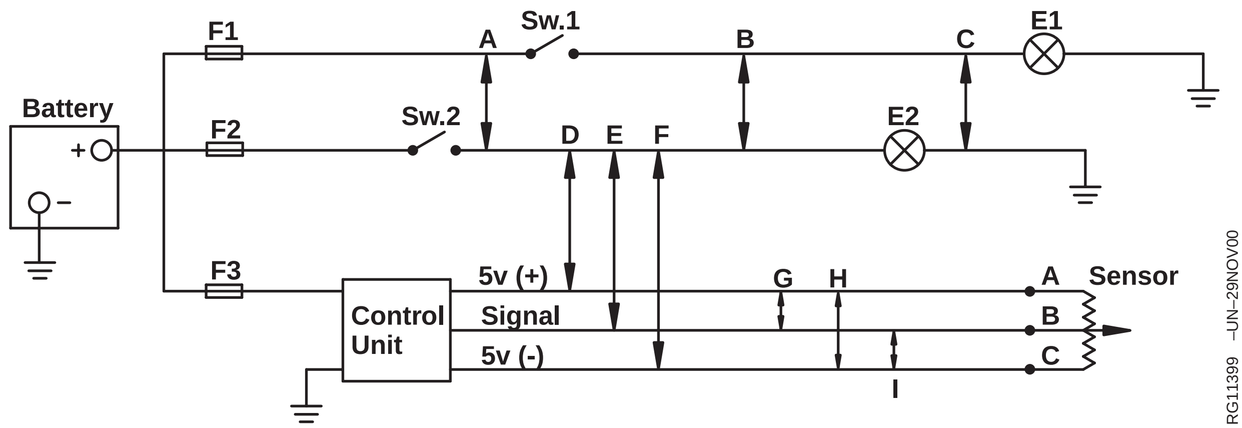
- If there is continuity, there is a grounded circuit between (D) and (E). Repair the circuit.

NOTE: *The example is grounded between (D) and (E) at (F).*

- Perform an operational check-out on the component after completing the repair.

Continued on next page

DPSG,RG40854,38 –19–15DEC98–2/4



Shorted Circuit

4. **Shorted Circuit:**

Machines equipped with several electronic control devices contain wiring harnesses that can become shorted by one of the following ways shown above.

1. Battery wire from fuse (F1) is shorted at (A) to another battery wire after switch (Sw.2).
   - Result: Lamp (E1) is on all of the time.
2. Battery wire from fuse (F1) is shorted at (B) to another battery wire after switches (Sw.1 & 2).
   - Result: Both lamps (E1 & E2) operate on either switch (Sw. 1 or 2).
3. Battery wire from fuse (F1) is shorted at (C) to a ground wire.
   - Result: Fuse (F1) opens after closing switch (Sw. 1)
4. Battery wire from switch (Sw. 2) is shorted at (D) to a regulated voltage wire.
   - Result: The sensor signal voltage is distorted.[1]
5. Battery wire from switch (Sw. 2) is shorted at (E) to the sensor signal voltage wire.
   - Result: The sensor signal is distorted.[1]
6. Battery wire from switch (Sw. 2) is shorted at (F) to the sensor ground wire.
   - Result: Fuse (F2) opens after closing switch (Sw. 2) and the sensor signal is distorted.[1]
7. Controller regulated voltage wire is shorted at (G) to the sensor signal voltage wire.
   - Result: The sensor signal is distorted.
8. Controller regulated voltage wire is shorted at (H) to the sensor ground wire.
   - Result: The sensor signal is distorted.[1]
9. Sensor voltage wire is shorted at (I) to the sensor ground wire.
   - Result: The sensor signal is distorted.[1]

Do the following to isolate a "Shorted Circuit:"

a. Review the machine electrical schematic to identify the circuits for the component that does not operate.

b. Disconnect the components at each end of the circuits, to single out the affected wires.

c. To prevent damage to connector terminals, obtain mating connector terminals from repair parts. DO NOT force meter probes into connector terminals.

[1] *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

d. Connect the meter leads across two of the affected circuits. The meter should show no continuity between the two circuits. Repeat the check across another combination of two circuits until all affected circuits have been checked.

e. Then, connect a meter lead to each affected circuit one at a time and touch the other meter leads to all terminals in the connector. The meter should show no continuity between any two circuits.

   Example: A 37 pin connector contains three wires to a sensor. With one meter probe attached to each of the three wires, one at a time, touch the other meter probe to the remaining 36 wires. If there is continuity between any two wires, the circuit is shorted. Repair the circuit.

f. Alternate Method to Check for Shorted Circuit.

   With the components disconnected at each end of the suspected circuits, turn the key switch on. Connect one meter lead to a good frame ground. With the other meter probe, touch each of the suspected circuits one at a time. If there is a voltage reading, the circuit is shorted to another voltage wire. Repair the circuit.

g. Repair the “Shorted Circuit” as follows:

   - Wires not in a loom: Wrap individual wires with electrical tape or replace the damaged wire and band as required.
   - Wires in a loom: If hot spots exist in shorted area of the harness, replace the harness. If hot 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.

h. Perform an operational check-out on the component after completing the repair.

DPSG,RG40854,38 –19–15DEC98–4/4

Using a Digital Multimeter

RG11126 –UN–19JUN00

Digital Multimeter

It is recommended that a digital multimeter (JT07306 or equivalent with an analog display) be used to make the required measurements in the diagnostic procedures. A knowledge of the operation of the particular meter used is assumed.

Instructions for measuring voltages take the following form:

- Measure voltage from Point A (+) to Point (B) (-)

In this example, the positive test lead from the volt-ohm input of the meter should be connected to Point A and the negative test lead from the common input of the meter should be connected to Point B.

Unless otherwise stated, all voltage measurements are direct current (D.C.).

In making a resistance measurement, be careful to use the correct resistance range on the meter. Disconnect appropriate connectors or turn off key switch, as directed by diagnostic procedures later in this group.

RG,RG34710,1554 –19–30SEP97–1/1

Engine Configuration Data Parameters on Diagnostic Gauge

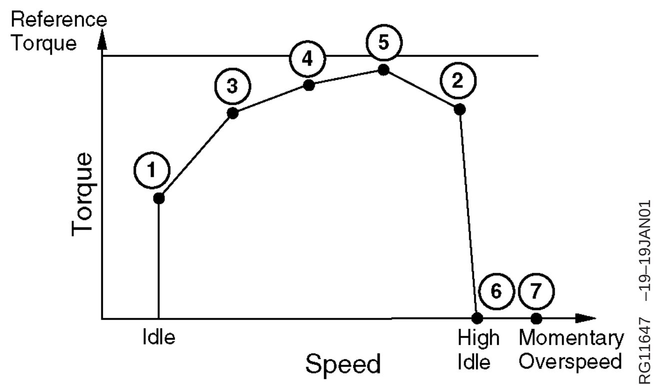
Accessing Engine Configuration Data Parameters:

1. Scroll through the main menu of engine parameters by pressing ***either*** the right or the left touch switch

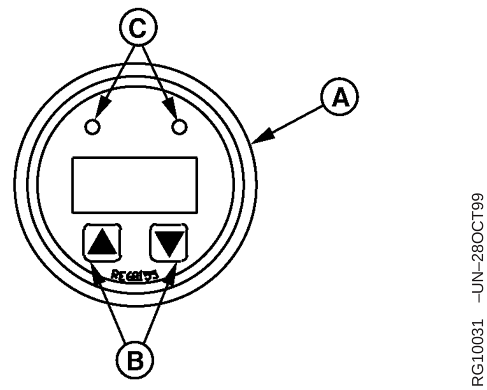
2. Select “E-Config” sub-menu by ***simultaneously*** pressing the right and the left touch switch.

3. Scroll through the “E-Config”sub-menu to view Engine Configuration Parameters by pressing ***either*** the right or the left touch switch until desired parameter is found. The numbers next to the parameters correspond to the number on the graph.

4. In order to exit “E-Config” sub-menu, ***simultaneously*** press the right and left touch switch.



Engine Configuration Map



Diagnostic Gauge

A—Diagnostic Gauge
B—Touch Switches
C—Lights

04
160
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Continued on next page

DPSG,OUOD007,2842 –19–21OCT99–1/2

Engine Configuration Parameter Description		
Parameter Displayed on Diagnostic Gauge	**Units**	**Description**
Speed 1	RPM	Stationary low idle speed of engine which includes influences due to engine temperature and other stationary changes. This is point 1 on the engine configuration map.
Torque 1	%	Torque 1 equals the desired torque of the ECU divided by the reference torque.
Speed 2	RPM	Engine speed at point 2 of the engine configuration map. This is defined as the kick-in point for which torque is reduced to zero.
Torque 2	%	Torque 2 equals the desired torque of the ECU divided by the reference torque.
Speed 3	RPM	Engine speed at point 3 of the engine configuration map. Points 3, 4, and 5 are optional and can be located anywhere between points 1 and 2.
Torque 3	%	Torque 3 equals the desired torque of the ECU divided by the reference torque.
Speed 4	RPM	Engine speed at point 4 of the engine configuration map. Points 3, 4, and 5 are optional and can be located anywhere between points 1 and 2.
Torque 4	%	Torque 4 equals the desired torque of the ECU divided by the reference torque.
Speed 5	RPM	Engine speed at point 5 of the configuration map. Points 3, 4, and 5 are optional and can be located anywhere between points 1 and 2.
Torque 5	%	Torque 5 equals the desired torque of the ECU divided by the reference torque.
Speed 6	RPM	Engine speed of high idle.
Torque 6	%	Torque 6 equals the desired torque of the ECU divided by the reference torque.
Gov Gain	%	Equals the change of torque between points 2 and 6 divided by the change of engine speed between points 2 and 6.
Ref Torque	Nm (ft-lbs)	This parameter is the 100% reference value for all defined indicated engine torque parameters. It is only defined once and doesn’t change if a different 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,OUOD007,2842 –19–21OCT99–2/2

Viewing Active DTCs on Diagnostic Gauge

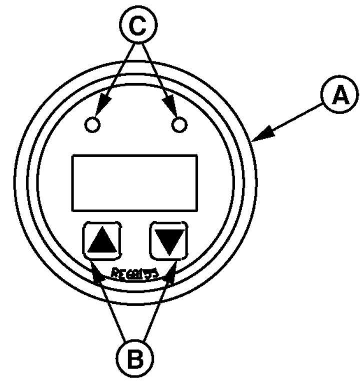
Accessing Active Diagnostic Trouble Codes (DTCs):

1. Scroll through the main menu of engine parameters by pressing ***either*** the right or the left touch switch

2. Select “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

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DPSG,OUOD007,2842 –19–15NOV00–1/1

Viewing Stored DTCs on Diagnostic Gauge

Accessing Stored Diagnostic Trouble Codes (DTCs):

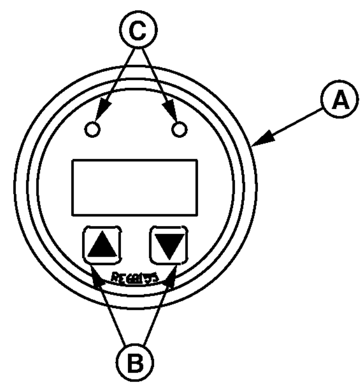
1. Scroll through the main menu of engine parameters by pressing ***either*** the right or the left touch switch

2. Select “DM2Codes” sub-menu by ***simultaneously*** pressing the right and the left touch switch.

3. Scroll through the “DM2Codes”sub-menu to view stored DTCs by pressing ***either*** the right or the left touch switch until all codes are found.

NOTE: If “No Data” is on the gauge, there are no stored codes.

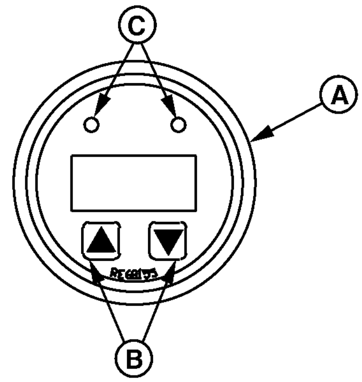
4. In order to exit “DM2Codes” sub menu, ***simultaneously*** press the right and left touch switch



A—Diagnostic Gauge
B—Touch Switches
C—Lights

DPSG,OUOD007,2842 –19–21OCT99–1/1

Clearing Stored DTCs on Diagnostic Gauge



RG10031 –UN–28OCT99

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.

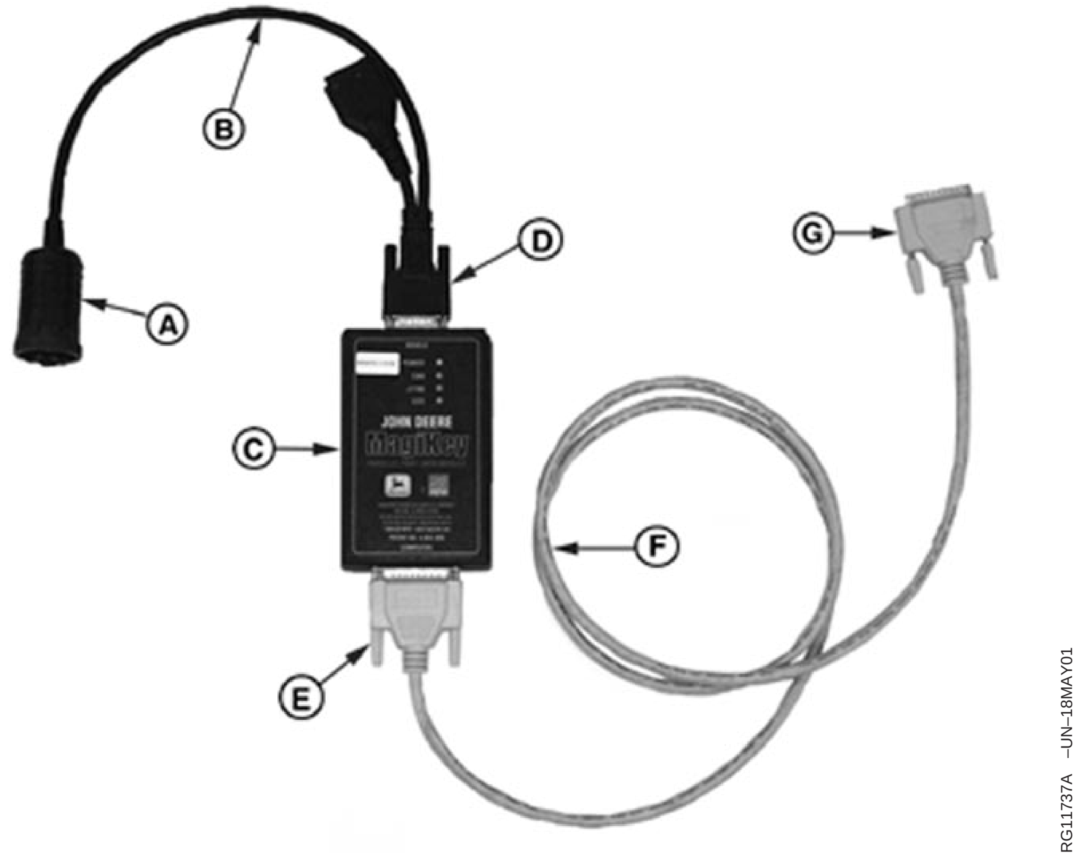
5. If the display reads “***********”, press the right switch for at least 8 seconds.

NOTE: If the switch is held for less than 8 seconds, the sub menu will be exited.

6. If the display reads “* Send * **DM3 *”, the codes have been cleared.

RG40854,000006A –19–22JUN01–1/1

Connecting to Diagnostic Scan Tool (DST) or SERVICE ADVISOR™



Connecting to the DST or SERVICE ADVISOR™

A—Diagnostic Connector Mate
B—John Deere Controller Cable
C—MagiKey
D—26 Pin MagiKey Connector
E—25 Pin MagiKey Connector
F—PC Cable
G—PC Connector

DS10023 ECU Communication Hardware Kit or JDIS121 - ECU Communication Hardware Kit is required to connect the DST or SERVICE ADVISOR™ to the ECU. Please refer to your John Deere Dealer website for obtaining the latest version of software.

The diagnostic connector is a black, circular connector with a square mounting flange and a dust cap. There are nine available pins. Depending on application, the location of the diagnostic connector may vary. On OEM the connector is located near the ECU on the engine wiring harness.

1. Locate diagnostic connector on engine and remove dust cap.
2. Connect John Deere Controller Cable (B) to the diagnostic connector on the engine harness using the diagnostic connector mate (A).
3. Connect the other end of the John Deere Controller Cable (B) to the MagiKey (C) module at the 26 pin MagiKey connector (D).
4. Connect the PC cable (F) to the MagiKey (C) module at the 25 pin MagiKey connector (E).
5. Connect the PC cable (F) to the computer with the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™ installed through the PC connector (G).
6. Key ON, engine off or running, verify that power light on MagiKey is illuminated green.

SERVICE ADVISOR is a trademark of Deere & Company

Continued on next page

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 ORSERVICE ADVISOR™ DIAGNOSTIC PROCEDURE in Group 150 of this manual.
10. If power to the PDM is lost during cranking the engine for the Compression Test, use the Power Adapter. The Power Adapter connects between the PDM and the 26 pin MagiKey connector.
11. When finished, replace the dust cap on the diagnostic connector.

RG12277 –UN–22APR02

Power Adapter

04
160
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RG40854,0000003 –19–22JUN01–2/2

Data Parameter Description

Following is a list of the data parameters that can be read on the Diagnostic Scan Tool (DST). 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 this Group. The DST consists of a Windows ('95, '98 or 2000) or NT compatible computer, JDIS121 - ECU Communication Hardware Kit, and JDIS122 - ECU Communication Software 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.

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Continued on next page

RG,RG34710,1560 –19–21NOV00–1/3

Parameter	Units	Description
Engine Hour Meter	hr -min- sec	Total hours the ECU has run on an engine.
Battery Voltage	volts	Battery volts on most applications can be either 12 or 24 volts.
Engine Speed	rpm	The speed that the crank sensor detects the crank timing wheel to be moving at.
Crank Position Sensor Speed	rpm	The speed of the crank timing wheel. The speed of the crank timing wheel should be 2X's the speed of the cam timing wheel.
Crank Position Status	NA[a]	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.
Crank Position 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 thrown.
Crank 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 thrown.
Cam Position Sensor Speed	rpm	The speed of the cam timing wheel. The speed of the cam timing wheel should be 1/2 the speed of the crank timing wheel.
Cam Position Status	NA[a]	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.
Cam Position Input Noise Indicator	%	A "0" reading means that there is NO noise. Between 0—100, cam noise becomes progressively worse. When 100 is reached, a trouble code is thrown.
Cam Improper Pattern Indicator	%	A "0" reading means that there is NO improper pattern. Between 0—100, the cam pattern becomes progressively more improper. When 100 is reached, a trouble code is thrown.
Engine Coolant Temperature	°C (°F)	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.*
Sensor Supply Voltage	volts	Voltage the ECU supplies to sensors. Typically, this value is 5 volts.
Engine Coolant Temperature Input Voltage	volts	Engine Coolant Temperature sensor input voltage to the ECU
Fuel Pressure	kPa (psi)	On single rail fuel system applications, the ECU monitors fuel pressure.
Fuel Pressure Input Voltage	volts	The input voltage from the fuel pressure sensor that the ECU reads.
Fuel Temperature	°C (°F)	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	Fuel Temperature sensor input voltage to the ECU.

[a]N/A = Not Applicable

Continued on next page RG,RG34710,1560 –19–21NOV00–2/3

Parameter	Units	Description
Manifold Air Temperature	°C (°F)	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	Manifold Air Temperature sensor input voltage to the ECU.
Manifold Absolute Pressure	kPa (psi)	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.*
Engine Oil Pressure	kPa (psi)	Engine Oil Pressure value
Oil Pressure Input Voltage	volts	Oil Pressure sensor input voltage to the ECU.
Throttle Type	NA[a]	Displays which throttle is being used.
Throttle Position	%	Displays percentage of full throttle that the ECU is reading.
Throttle Supply Voltage	volts	Supply voltage that the ECU sends the throttle sensor. Only used with analog throttles.
Analog Throttle (A) Input Voltage	volts	Optional component, not included on all applications. The voltage from the analog throttle (A) position sensor (potentiometer).
Analog Throttle (B) Input Voltage	volts	Optional component, not included on all applications. The voltage from analog throttle (B) position sensor (potentiometer).
Desired Speed Governor	NA[a]	The mode selected is dependent on the application. See GOVERNOR DROOP MODE SELECTION in Section 06, Group 210 of this manual.
Maximum Speed Governor	NA[a]	The mode selected is dependent on the application. See GOVERNOR DROOP MODE SELECTION in Section 06, Group 210 of this manual.
Commanded Power	hp / kW	Desired power that the ECU determines is necessary.
Commanded Torque	Nm / lb-ft	Desired torque that the ECU determines is necessary
Engine Load at Current Speed	%	The percent load of the load for a given torque curve at a given engine speed.
Pilot Injection	N/A[a]	On some applications, a pilot injection feature aids engine starting. On applications with the pilot injection feature, this parameter displays ON when pilot injection is on; OFF when pilot injection is off. On applications that don’t have pilot injection, this parameter will read N/A.
Fuel Mode	NA	This code explains the operation mode of the engine.
Fuel Usage Rate	L (gal)	Total amount of fuel the ECU has commanded the EUIs to deliver during the total hours shown by the Engine Hour Meter parameter.
Torque Curve Number	N/A[a]	On some applications, the ECU limits the max fuel on multiple torque curves. This displays the torque curve the ECU is currently using to limit maximum fuel. Definition of the possible torque curves is found in Specifications. See TORQUE CURVE SELECTION in Section 06, Group 210 of this manual.

[a]N/A = Not Applicable

RG,RG34710,1560 –19–21NOV00–3/3

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™ in Group 160 later in this manual.

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 5 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 an Electronic Unit Injector (EUI). Other information such as the results of a Compression 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 (DTCs)

NOTE: The ECU will not allow the test to run if there are any active DTCs.

- Remove any load to the engine that may change during the test. For example, turn the air conditioner off.

Performing the Cylinder Misfire Test

1. Engine idling.

2. Select Cylinder Misfire Test on the DST or SERVICE ADVISOR™.

3. The test 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 this test is completed, the connectors need to be switched back.

The test operator will be informed by the DST or SERVICE ADVISOR™ 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' 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: It is recommended that the test be run at least 3 times to ensure repeatable, accurate results.

The Compression Test should be performed to help determine the cause of the problem in the cylinder(s) that was above or below average.

RG,RG34710,1561 –19–30SEP97–1/1

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™ in Group 160 later in this manual.

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 pulsing the unit injectors), 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 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. Engine OFF.

2. Select Compression Test on the DST or SERVICE ADVISOR™.

3. The test 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 test operator will be informed by the DST or SERVICE ADVISOR™ 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: It is recommended that 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.

RG,RG34710,1562 –19–30SEP97–1/1

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™ in Group 160 later in this manual.

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 on the DST or SERVICE ADVISOR™. More than one cylinder can be selected at a time, and 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 an Electronic Unit Injector (EUI). 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(s) 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 pressure.
6. Use this data and observations to help in the diagnosis of the problem.

NOTE: It is recommended that the test be run at least 3 times to ensure repeatable, accurate results.

DPSG,RG40854,358 –19–12OCT99–1/1

Reprogramming Engine Control Unit (ECU)

John Deere Ag and Construction dealers are able to reprogram ECUs using SERVICE ADVISOR™. See REPROGRAMMING ENGINE CONTROL UNIT USING SERVICE ADVISOR later in this Group.

OEM Distributors are able to reprogram ECUs using Diagnostic Scan Tool (DST). See REPROGRAMMING ENGINE CONTROL UNIT USING DST later in this Group.

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Downloading Payload File For DST

IMPORTANT: The Engine Serial Number (ESN) for the engine that this instruction is to be performed on is required for downloading the proper payload file.

NOTE: An Internet connection will be needed for steps 1 - 12.

1. Start Internet browser (Internet Explorer version 5.5 or later).

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RG12617 –19–18SEP02

Web Address

2. In the address line (A) type in “http://sds.deere.com” and press the“Enter” key. Log in as required.

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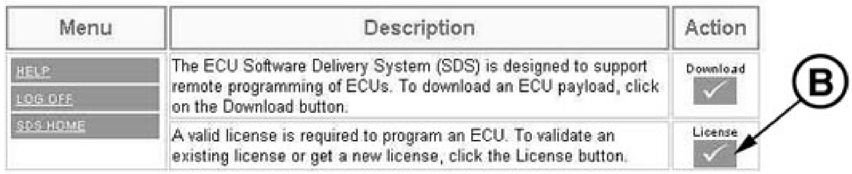
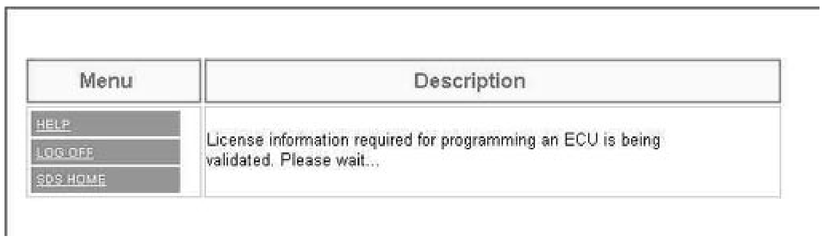


RG12629 –19–19SEP02

Obtaining Valid License



RG12630 –19–19SEP02

Validating License

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NOTE: Steps 3 - 5 only need to be completed the first time this instruction is performed.

3. A license file is required for each computer that will reprogram ECUs. Download the license file to gain permissions. Click on “License”(B). A screen will appear while validating license.

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RG12613 –19–20SEP02

Grant Always Screen

4. Click on “Grant Always” (G).

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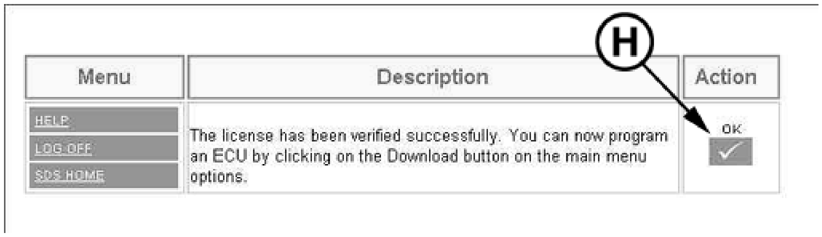

RG12631 –19–19SEP02

Verification Successful

5. Click “OK” (H) when license verification has completed.

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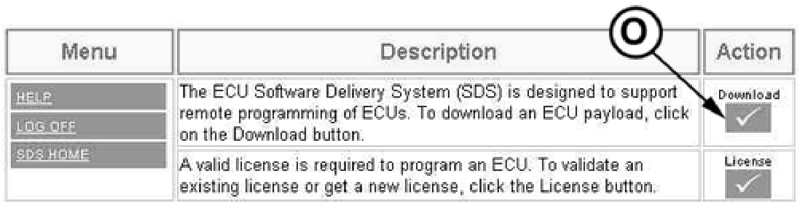

RG12579 –19–06SEP02

6. Click on “Download” button (O). A screen will appear as the system verifies that a valid license file is present.

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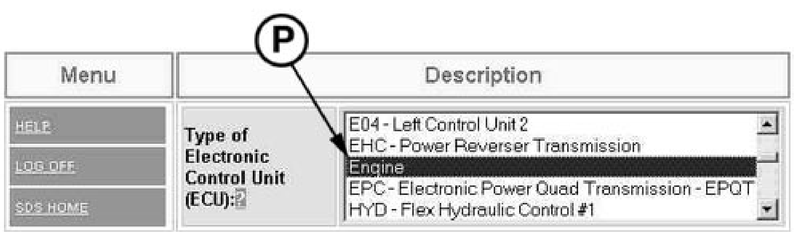

RG12632 –19–19SEP02

Selecting Engine for ECU Type

7. Scroll down and click on “Engine” (P).

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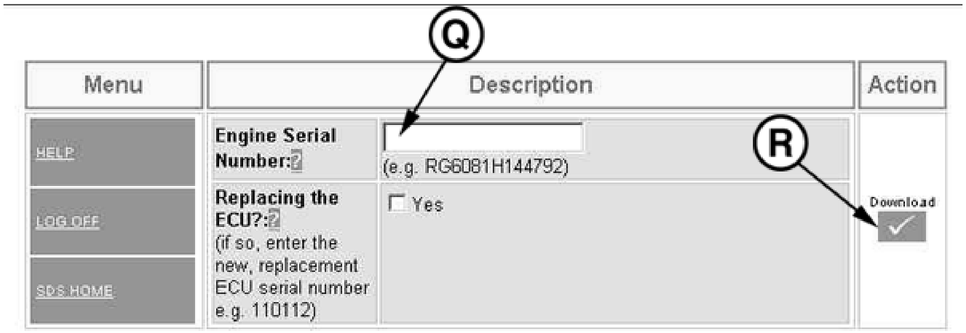

Enter Engine Serial Number (ESN)

8. Click once in the ESN text box (Q) so the cursor is in the box. Type in the ESN into the text field. If you are replacing the current ECU, GO TO 9. If you are reprogramming the existing ECU, click “Download” (R) and GO TO 11.

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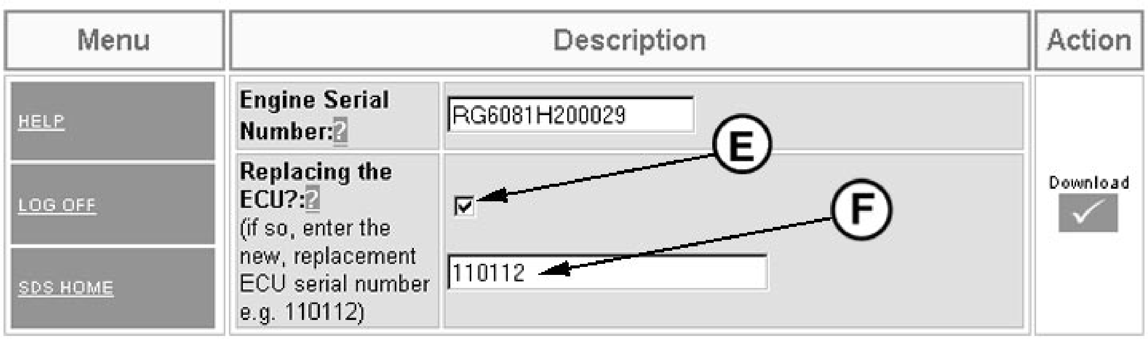


Replacing ECU

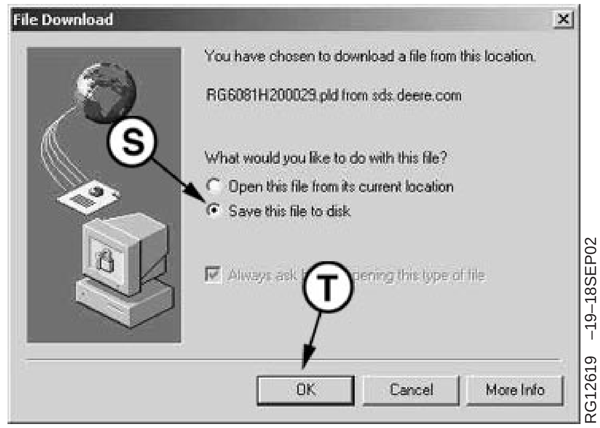
9. If the current machine is being replaced, check the “Replacing the ECU” box (E).

NOTE: *Sometimes the original ECU will not be available for reprogramming. When a new ECU is being programmed to replace the current ECU, the software will tie the engine serial number to the new ECU serial number.*

10. Enter in the new ECU’s serial number (F) located on the ECU label and click “Download”.

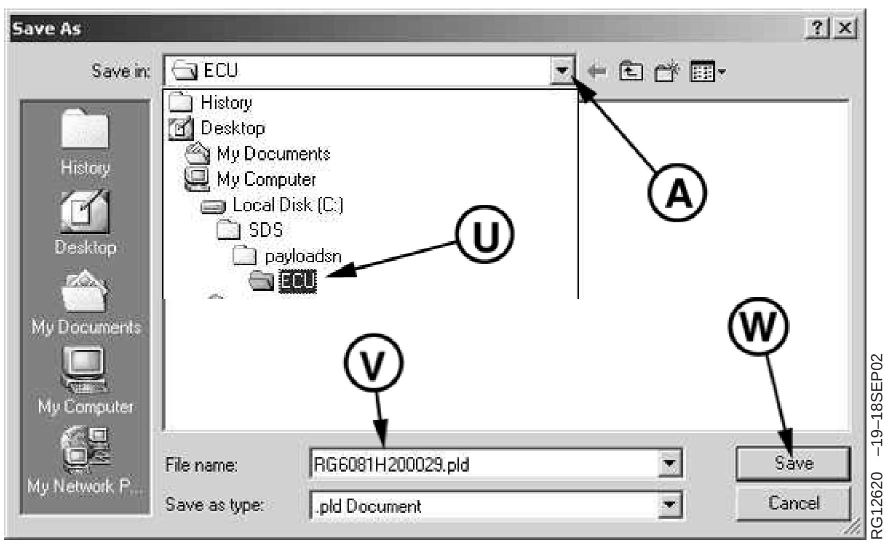
Continued on next page RG41221,0000097 –19–04NOV02–9/11

11. In the ”File Download” window ensure that the “Save this file to disk” button (S) is selected and click “OK” (T).



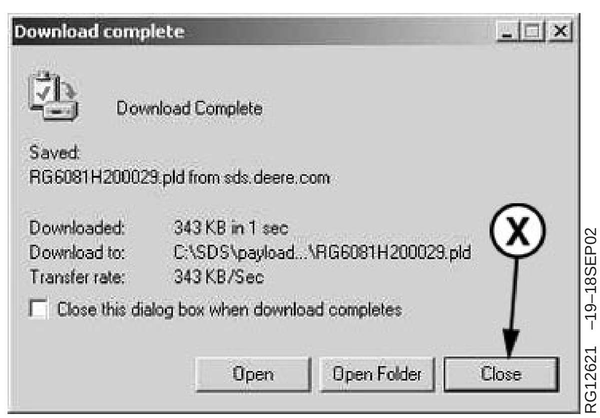
File Download

RG41221,0000097 –19–04NOV02–10/11



Save As Window

12. The “Save As” window will appear. The file must be saved in “C:\SDS\PAYLOADSN\ECU” folder. Click on the pull down menu arrow (A) and navigate to the ECU folder (U). Ensure that file name (V) is the correct number and click “Save” (W). When the file has been successfully downloaded the ”Download Complete” window will appear, click “OK” (X). Close the Internet browser.



Download Complete

RG41221,0000097 –19–04NOV02–11/11

Reprogramming Engine Control Unit (ECU) With DST

IMPORTANT: Diagnostic Scan Tool (DST) Version 4.1 or later must be installed prior to performing the following instructions.

NOTE: Internet connection is not required to program an engine control unit.

1. If payload file has not been downloaded to computer, download now. See DOWNLOADING PAYLOAD FILE FOR DST earlier in this Group.

2. Ignition ON, engine OFF.

3. Connect computer with DST to the Diagnostic Connector on the engine.

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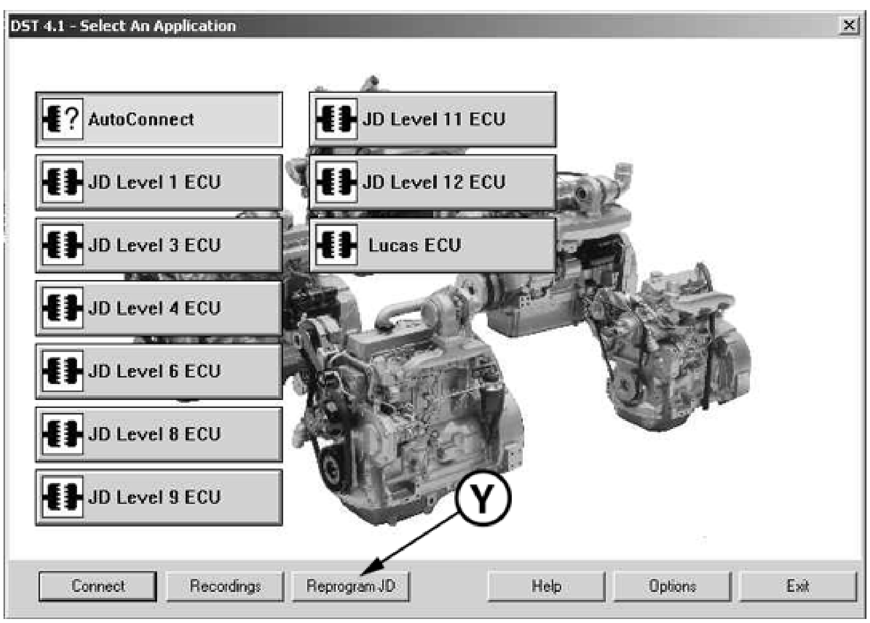

RG12622 –19–18SEP02

DST Main Screen

4. Start the DST software. Click on “Reprogram JD” (Y).

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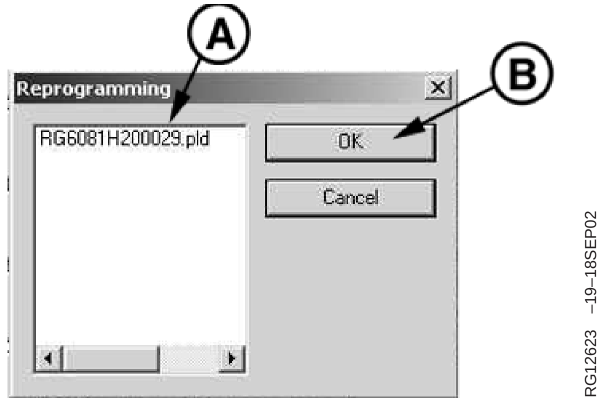
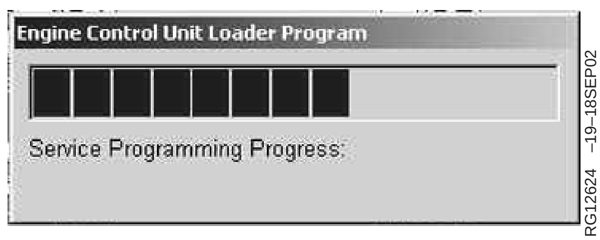
5. Click on the proper payload (A) and click OK (B).



Selecting Payload file for Reprogramming

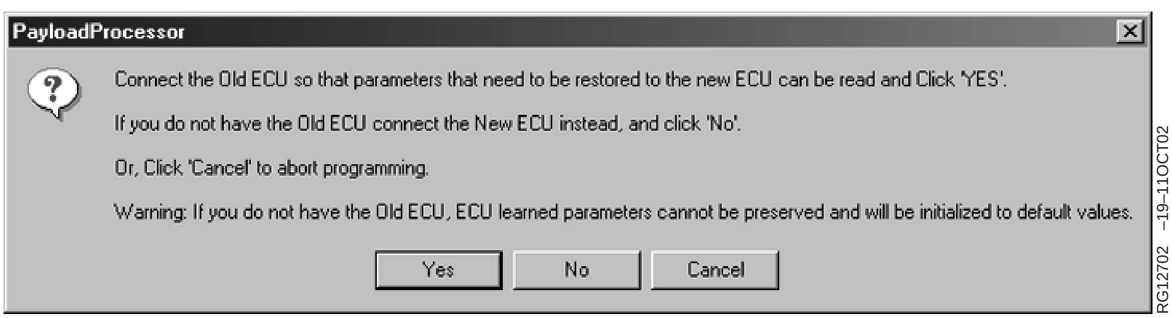
RG41221,0000098 –19–04NOV02–3/9

6. A progress bar will appear while reprogramming the ECU. If the engine is equipped with warning alarms, these may come on while in process of reprogramming and should be ignored.



Status Bar

RG41221,0000098 –19–04NOV02–4/9



7. If the ECU is being replaced, the above message will appear. If you have the old ECU, connect to it and click YES. If the old ECU is not available, click NO.

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RG41221,0000098 –19–04NOV02–5/9

RG12703 –19–14OCT02

8. If the ECU is being replaced, the software will notice that the engine serial number does not match the ECU serial number. This message lets the user know that the ECU expects a different engine serial number to match its ECU serial number. Click “OK” to continue.

RG41221,0000098 –19–04NOV02–6/9

9. When reprogramming the ECU has been successfully completed, the Payload Processor window will appear. Click “OK”.

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Payload Processor Completed

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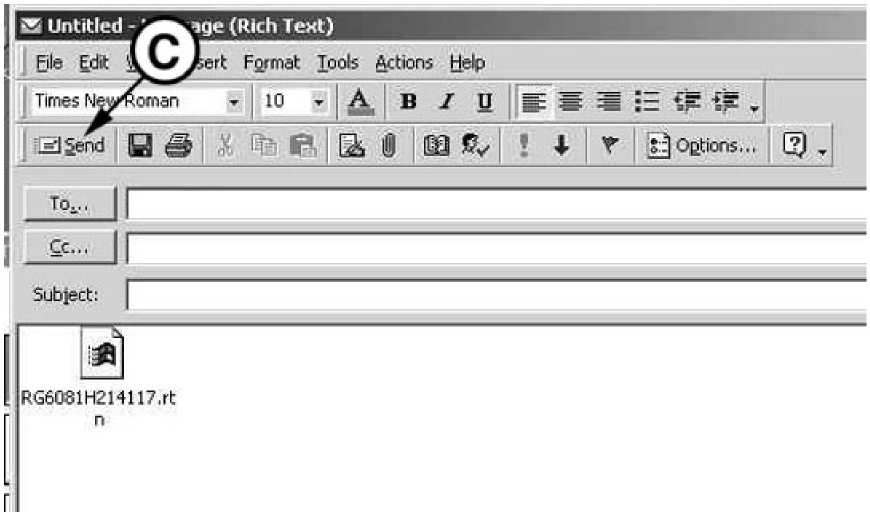
RG41221,0000098 –19–04NOV02–7/9

RG12626 –19–18SEP02

Return File Message



RG12627 –19–24SEP02

Automatic E-mail Generated

10. A return file is created when reprogramming an ECU is completed. The MFT window will appear showing the return file to send back. Click “OK”. This will automatically generate an E-mail message with the proper E-mail address. Click “Send” (C). The next time the mail application is connected to the mail server the message will be sent.

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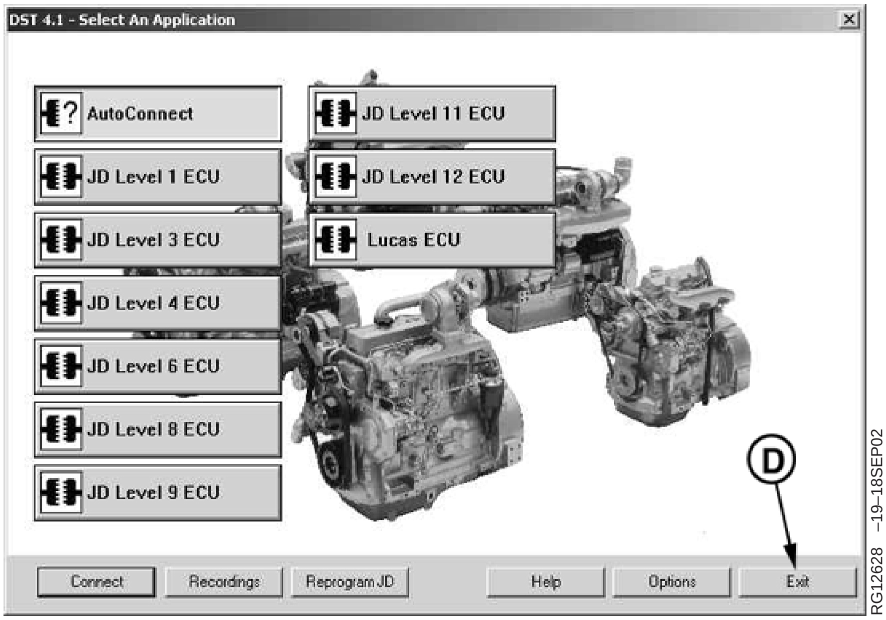

Exit DST Software

11. Once the E-mail has been successfully sent, click “Exit” (D) to close DST.

12. Disconnect computer from diagnostic connector and start engine to ensure proper operation.

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Downloading Payload File For SERVICE ADVISOR™

NOTE: An Internet connection will be needed for steps 1 - 15.

1. Start SERVICE ADVISOR™

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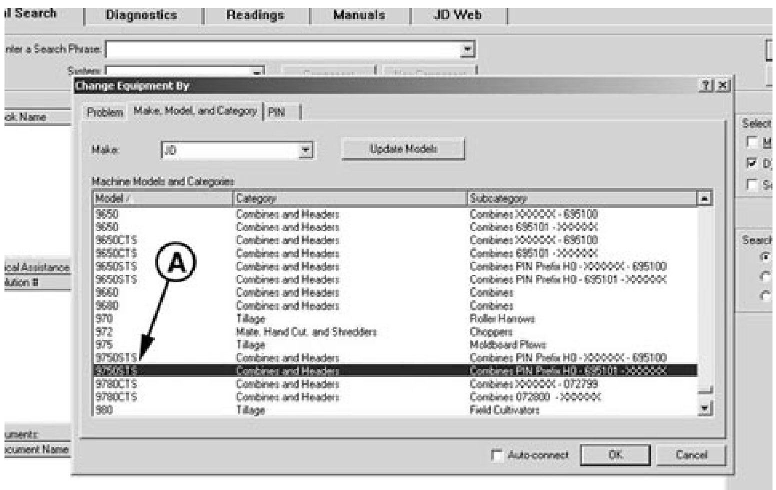
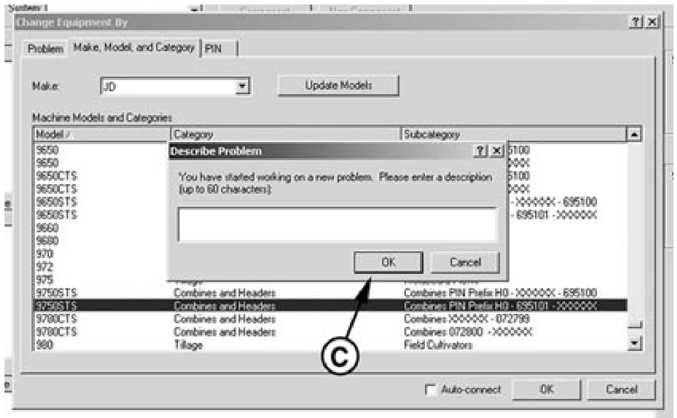


RG12571 –19–06SEP02

2. Select vehicle model (A) with the proper serial number range or if PIN is known select the PIN tab and enter PIN number. Click OK.

Continued on next page RG41221,0000094 –19–04NOV02–2/16



RG12572 –19–06SEP02

3. Describe Problem window will appear, click OK (C).

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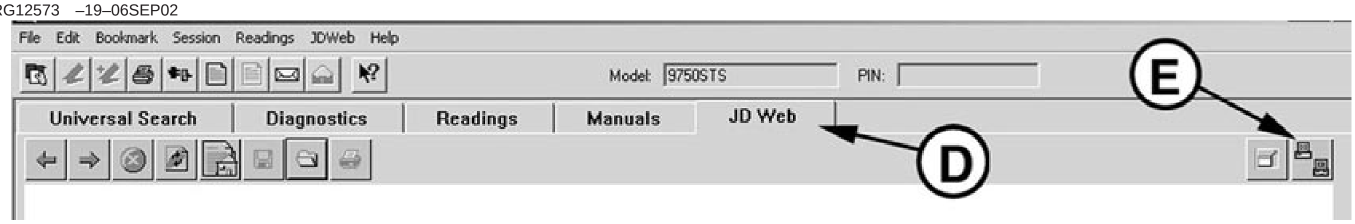
RG12573 –19–06SEP02



4. Click on “JD Web” tab (D). In the upper right hand corner click on “Connect to Network” button (E). Select network connection type and click OK.

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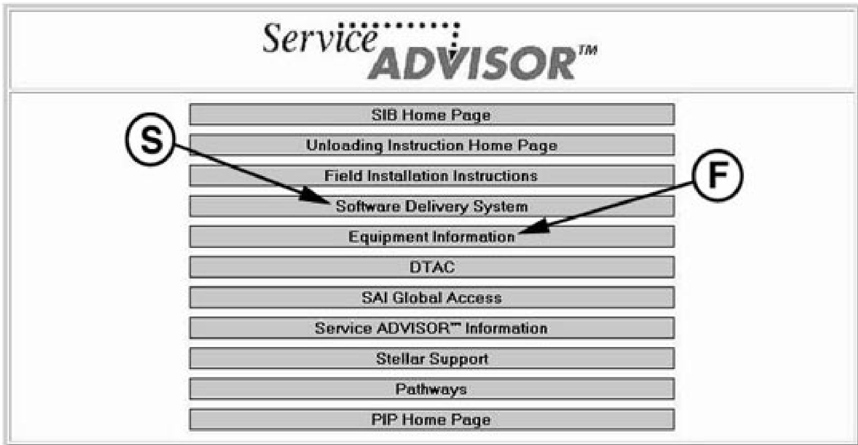

RG12574 –19–06SEP02

NOTE: Menu options may vary on the SERVICE ADVISOR™ menu.

5. If the Engine Serial number (ESN) is available click on "Software Delivery System" button (S) and skip to step 10. With the PIN number only available click on "Equipment Information" (F) button.

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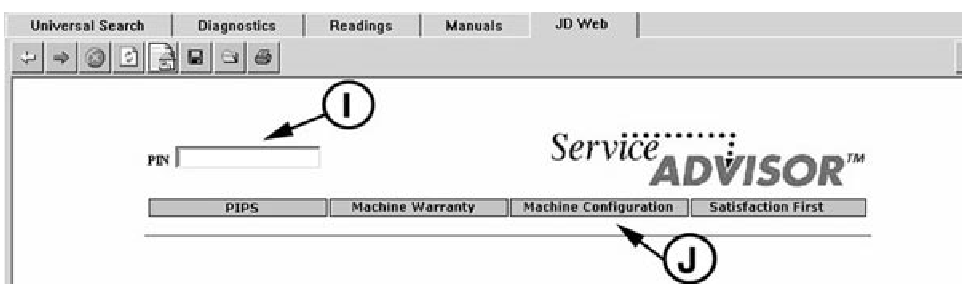

RG12575 –19–06SEP02

6. Enter PIN number (I) if not already filled in, and select “Machine Configuration” (J). Equipment detail information for this vehicle will appear on the screen.

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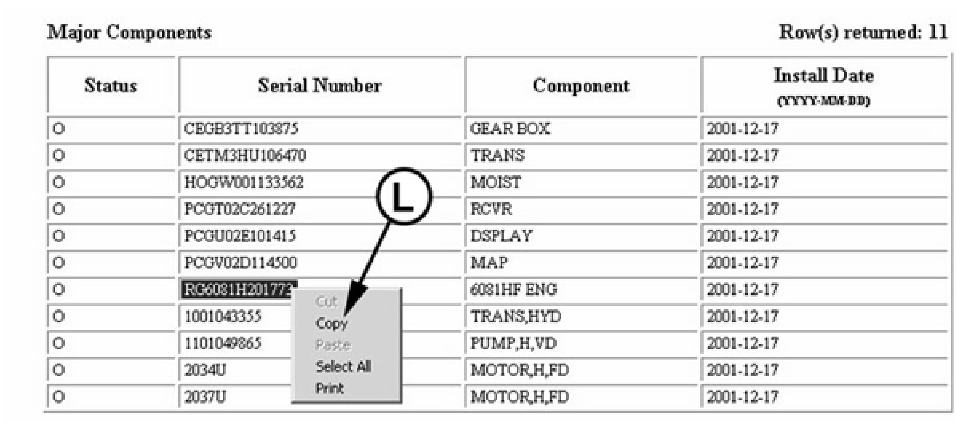

Major Components — Row(s) returned: 11

Status	Serial Number	Component	Install Date (YYYY-MM-DD)
O	CEGB3TT103875	GEAR BOX	2001-12-17
O	CETM3HU106470	TRANS	2001-12-17
O	HOGW001133562	MOIST	2001-12-17
O	PCGT02C261227	RCVR	2001-12-17
O	PCGU02E101415	DSPLAY	2001-12-17
O	PCGV02D114500	MAP	2001-12-17
O	RG6081H201773	6081HF ENG	2001-12-17
O	1001043355	TRANS,HYD	2001-12-17
O	1101049865	PUMP,H,VD	2001-12-17
O	2034U	MOTOR,H,FD	2001-12-17
O	2037U	MOTOR,H,FD	2001-12-17

RG12576 –19–06SEP02

7. Hold left mouse button down and drag across the ESN so that it is highlighted. Click the right mouse button and select "Copy" (L) or record the ESN for later use.

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RG12577 –19–06SEP02

8. Click on the “Home” button (M) within SERVICE ADVISOR™ to go back to the menu.

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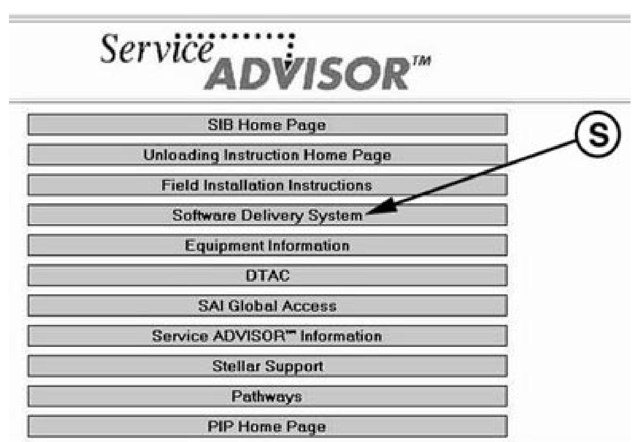
RG41221,0000094 –19–04NOV02–8/16

9. Click on “Software Delivery System” button (S). Login if necessary.



RG12578 –19–06SEP02

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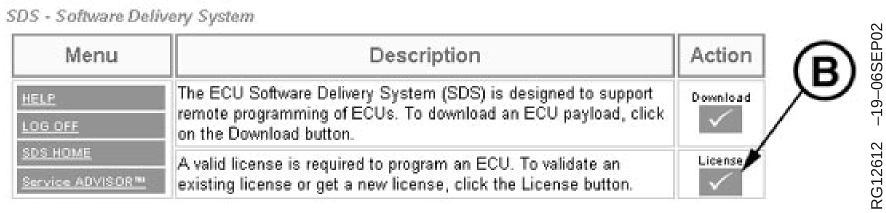
RG41221,0000094 –19–04NOV02–9/16



Obtaining Valid License

Validating License

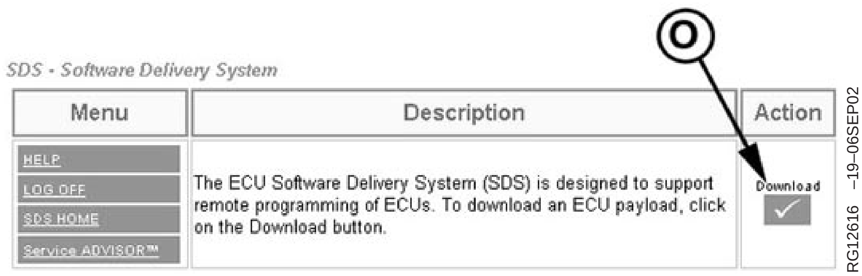


Figure B

NOTE: Steps 10 - 12 only need to be completed the first time this instruction is performed.

10. A license file is required for each computer that will reprogram ECUs. Download the license file to gain permissions. Click on “License” (B). A screen will appear while validating license. If the screen appears as “Figure B” allowing the option to download only, then skip to Step 13.

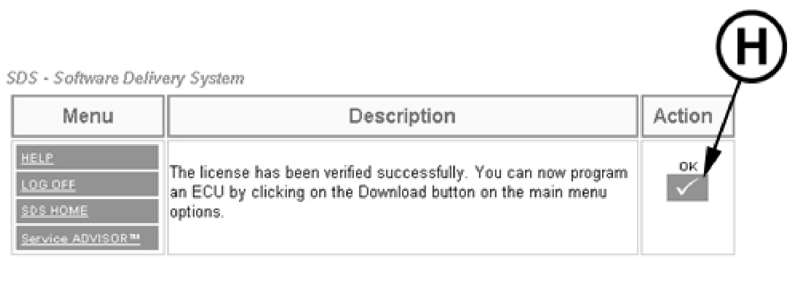
Continued on next page RG41221,0000094 –19–04NOV02–10/16

RG12613 –19–20SEP02

11. Click on "Grant Always" (G).

04
160
38

RG41221,0000094 –19–04NOV02–11/16

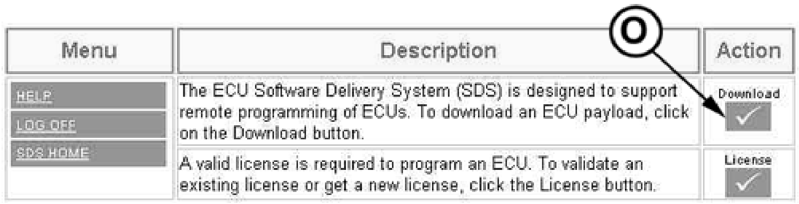


RG12615 –19–06SEP02

12. Click "OK" (H) when license verification has been completed.

Continued on next page

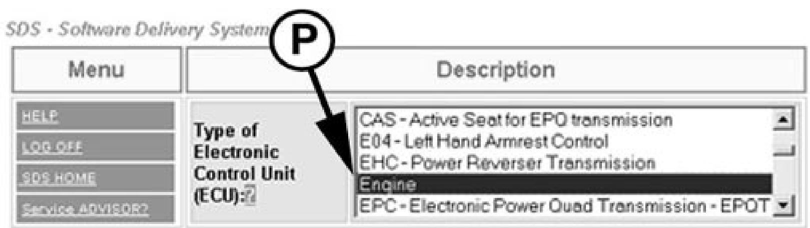
RG41221,0000094 –19–04NOV02–12/16



RG12579 –19–06SEP02

13. Click on “Download” button (O). A screen will appear as the system verifies that a valid license file is present.

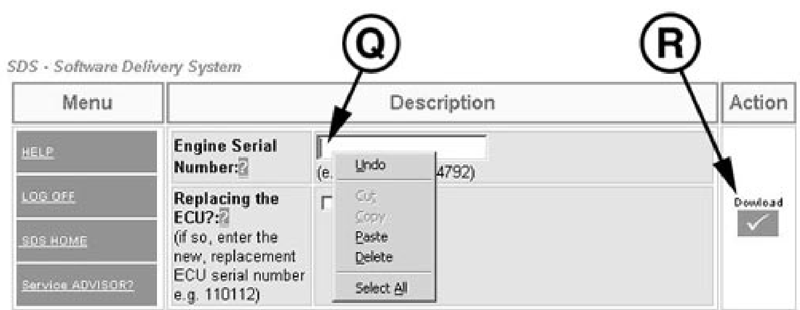
RG41221,0000094 –19–04NOV02–13/16



RG12580 –19–06SEP02

14. Scroll down and click on “Engine” (P).

RG41221,0000094 –19–04NOV02–14/16



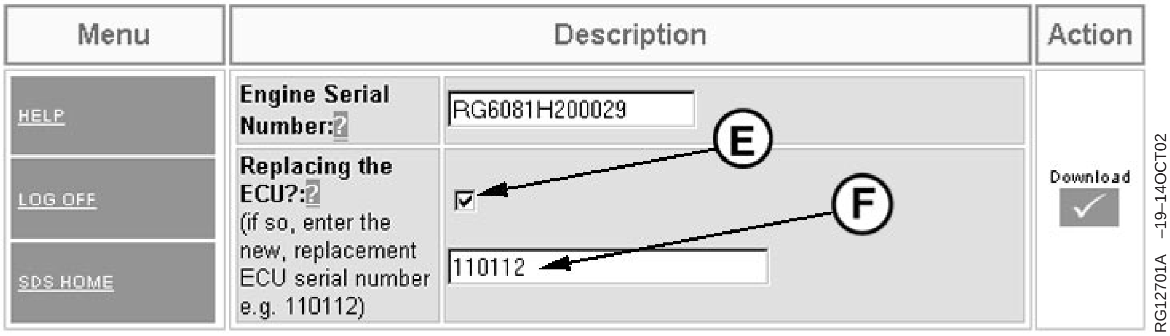
RG12581 –19–06SEP02

15. Click once in the ESN text box (Q) so the cursor is in the box. Type in the ESN or Right click and select "Paste" to copy the ESN into the text field.

If you are replacing the ECU, go to step 16. If you reprogramming the existing ECU, click "Download" (R) and go to step 18.

Continued on next page

RG41221,0000094 –19–04NOV02–15/16



Replacing ECU

16. If the current machine is being replaced, check the “Replacing the ECU” box (E).

NOTE: Sometimes the original ECU will not be available for reprogramming. When a new ECU is being programmed to replace the current ECU, the software will tie the engine serial number to the new ECU serial number.

17. Enter in the new ECU’s serial number (F) located on the ECU label and click “Download”.

IMPORTANT: Service ADVISOR™ software must be closed and reopened prior to programming the ECU.

18. After downloading the ECU payload to the computer, exit SERVICE ADVISOR™

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RG41221,0000094 –19–04NOV02–16/16

Reprogramming Engine Control Unit (ECU) With SERVICE ADVISOR™

IMPORTANT: Ignition ON, engine OFF.

Connect computer with SERVICE ADVISOR™to the Diagnostic Connector in the cab or on the engine.

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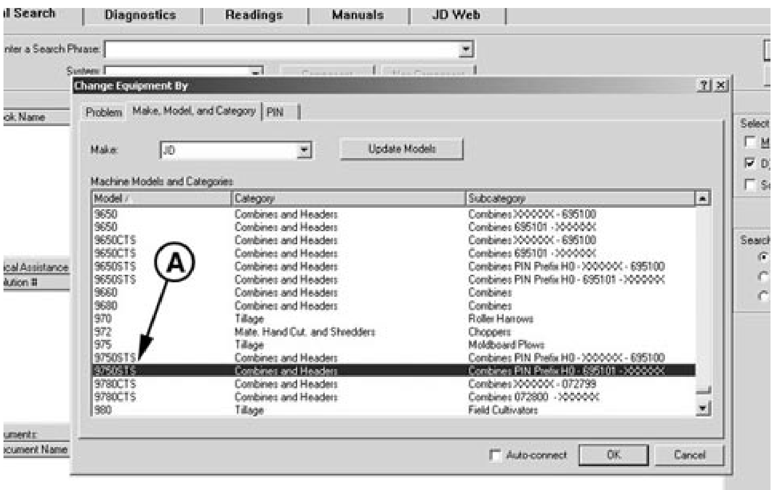
RG41221,0000099 –19–04NOV02–1/8



RG12571 –19–06SEP02

NOTE: Internet connection is not required to program an engine control unit.

1. Start SERVICE ADVISOR™. Select vehicle model (A) with the proper serial number range or if PIN is known select the PIN tab and enter PIN number. Click OK.

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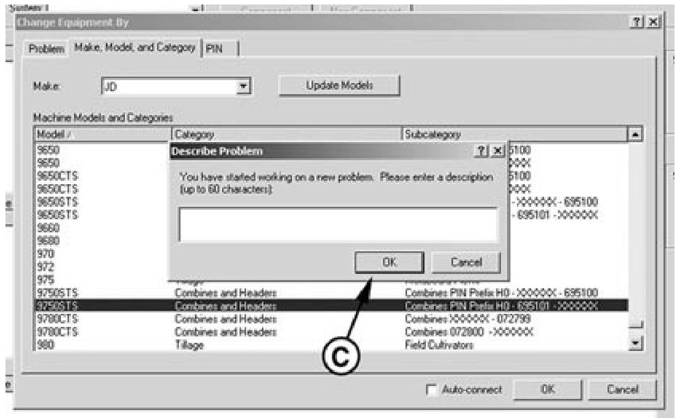
Continued on next page

RG41221,0000099 –19–04NOV02–2/8

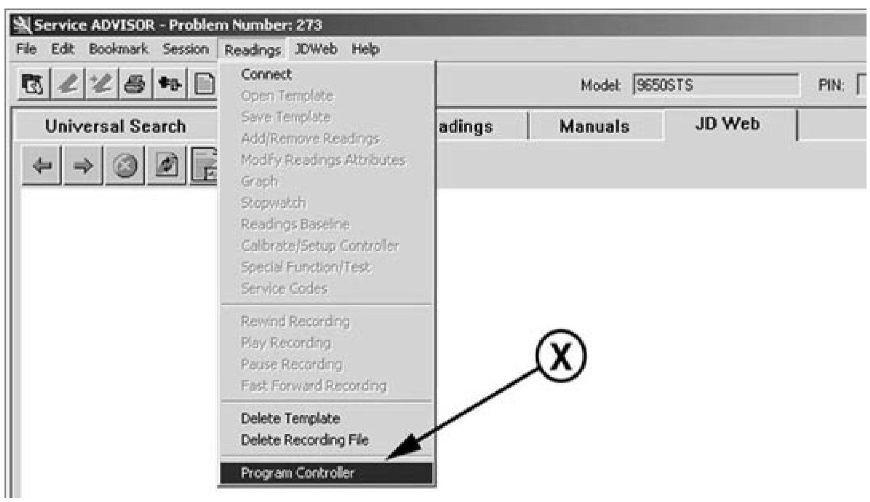


RG12572 –19–06SEP02

2. Describe Problem window will appear, click OK (C).

04
160
42

RG41221,0000099 –19–04NOV02–3/8



RG12582 –19–06SEP02

3. Click on “Readings” pull down menu and select “Program Controller” (X).

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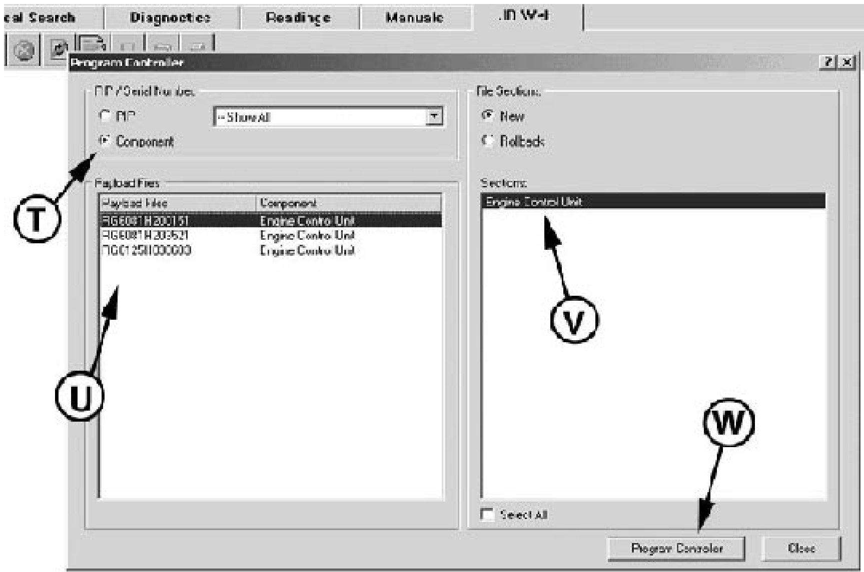
RG41221,0000099 –19–04NOV02–4/8



RG12583 –19–06SEP02

4. Select radio button for "Component" (T). Select the proper payload file for engine ECU (U).

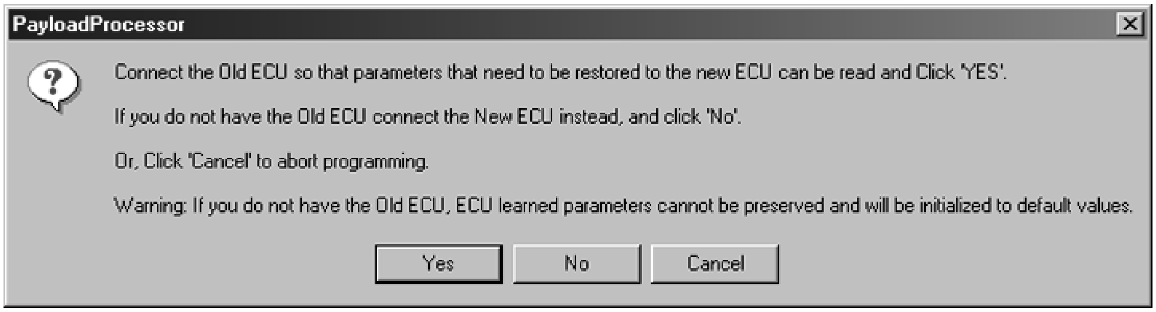
5. Click once on "Engine Control Unit" (V) and click on "Program Controller" (W).

RG41221,0000099 –19–04NOV02–5/8

RG12584 –19–06SEP02

6. A progress bar will appear while reprogramming the ECU. The engine warning light may come on and a warning may sound while in process of reprogramming and should be ignored.

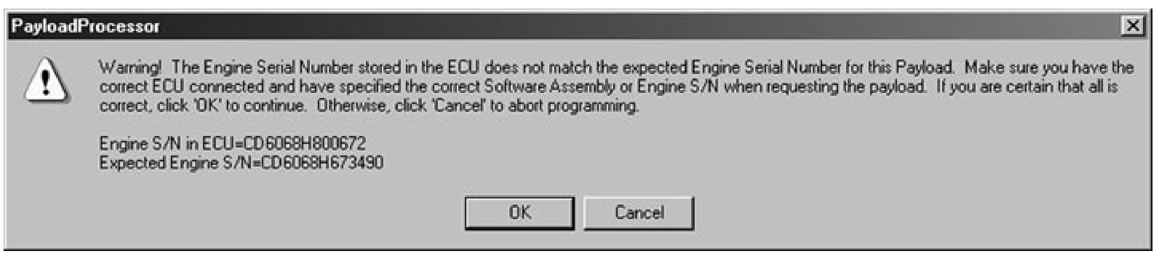
Continued on next page RG41221,0000099 –19–04NOV02–6/8



RG12702 –19–11OCT02

7. If the ECU is being replaced, the above message will appear. If you have the old ECU, connect to it and click YES. If the old ECU is not available, click NO.

RG41221,0000099 –19–04NOV02–7/8



RG12703 –19–14OCT02

8. If the ECU is being replaced, the software will notice that the engine serial number does not match the ECU serial number. This message lets the user know that the ECU expects a different engine serial number to match its ECU serial number. Click “OK” to continue.

9. Disconnect computer from diagnostic connector and start vehicle to ensure proper operation.

RG41221,0000099 –19–04NOV02–8/8

Diagnostic Trouble Codes (DTCs)

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

SPN/FMI CODES

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

On all applications with the Level 6 Engine Control Unit (ECU), the ECU transmits SPN/FMI codes over the Controller Area Network (CAN). This allows for service tools such as the DST, SERVICE ADVISOR™, and the Diagnostic Gauge to display active and stored DTCs. When using DST or SERVICE ADVISOR™ the codes will be displayed in a 000000.00 format. For example, SPN 110 FMI 3 will be displayed as 000110.03.

2-DIGIT CODES

Some applications do not display engine codes as an SPN/FMI. In most of these cases, the code is displayed as a 2-digit code. An example of a 2-digit code is 18 for engine coolant temperature input voltage high. If used on an application with multiple controllers, ECU may be displayed in front of the numbers, such as ECU 018. A 2-digit code may be seen on SERVICE ADVISOR™, the on-board display, or when the code is blinked for various reasons. In this manual, it will be necessary to convert these codes to the SPN/FMI code in order to follow the correct diagnostic procedure. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Section 04, Group 160 of this manual.

VIEWING ACTIVE/STORED SPN/FMI CODES

DTCs can be cleared on the DST, SERVICE ADVISOR™, or through the diagnostic gauge on the John Deere instrument panel. For directions on how to view active codes using the diagnostic gauge, see VIEWING ACTIVE DTCS ON DIAGNOSTIC GAUGE in Section 04, Group 160. For directions on how to view stored codes on the diagnostic gauge, see VIEWING STORED DTCS ON DIAGNOSTIC GAUGE in Section 04, Group 160.

CLEARING STORED DTCS

Stored DTCs can be cleared through the DST, SERVICE ADVISOR™, or through the diagnostic gauge on the John Deere instrument panel. For directions on how to clear stored DTCs, see CLEARING STORED DTCS ON DIAGNOSTIC GAUGE in Section 04, Group 160.

DPSG,RG40854,467 –19–15APR02–1/1

Listing of Diagnostic Trouble Codes (DTCs) on ECU

NOTE: If the DST or SERVICE ADVISOR™ is available, it will show the SPN/FMI trouble code.

Ascending SPN/FMI Codes

SPN	FMI	Definition
000028	03	Throttle Voltage High
	04	Throttle Voltage Low
000029	03	Throttle Voltage High
	04	Throttle Voltage Low
000091	03	Throttle Voltage High
	04	Throttle Voltage Low
	08	PWM Throttle Abnormal Pulse Width
	09	Throttle Invalid
	14	Throttle Voltage Out of Range
000094	01	Fuel Supply Pressure Extremely Low
	03	Fuel Supply Pressure Input Voltage High
	04	Fuel Supply Pressure Input Voltage Low
	16	Fuel Supply Pressure Moderately High
	18	Fuel Supply Pressure Moderately Low
000097	00	Water in Fuel Continuously Detected
	03	Water in Fuel Signal Voltage High
	04	Water in Fuel Signal Voltage Low
	16	Water in Fuel Detected
	31	Water in Fuel Detected
000100	01	Engine Oil Pressure Extremely Low
	03	Engine Oil Pressure Input Voltage High
	04	Engine Oil Pressure Input Voltage Low
	18	Engine Oil Pressure Moderately Low
000102	03	Manifold Air Pressure Input Voltage High
	04	Manifold Air Pressure Input Voltage Low
000105	03	Manifold Air Temperature Input Voltage High
	04	Manifold Air Temperature Input Voltage Low
	16	Manifold Air Temperature Moderately High
000107	00	Air Filter Restriction High
	31	Air Filter Restriction High
000110	00	Engine Coolant Temperature High Most Severe
	03	Engine Coolant Temperature Input Voltage High
	04	Engine Coolant Temperature Input Voltage Low
	15	Engine Coolant Temperature High Least Severe
	16	Engine Coolant Temperature High Moderately Severe
000111	01	Engine Coolant Level Low
000158	17	ECU Power Down Error
000174	03	Fuel Temperature Input Voltage High
	04	Fuel Temperature Input Voltage Low
000177	09	Transmission Oil Temperature Invalid
000523	09	Gear Selection Invalid
000611	03	Injector Wiring Shorted to Power Source
	04	Injector Wiring Shorted to Ground
000620	03	Sensor Supply Voltage High
	04	Sensor Supply Voltage Low

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RG,RG34710,1563 –19–15APR02–1/4

000627	01	Injector Supply Voltage Problem
000629	12	ECU Error
	13	ECU Error
000636	02	Cam Position Input Noise
	08	Cam Position Input Missing
	10	Cam Position Input Pattern Error
000637	02	Crank Position Input Noise
	07	Crank Position/Cam Position Out of Sync
	08	Crank Position Input Missing
	10	Crank Position Input Pattern Error
000639	13	CAN Error
000651	05	Cylinder #1 EUI Circuit Open
	06	Cylinder #1 EUI Circuit Shorted
000652	05	Cylinder #2 EUI Circuit Open
	06	Cylinder #2 EUI Circuit Shorted
000653	05	Cylinder #3 EUI Circuit Open
	06	Cylinder #3 EUI Circuit Shorted
000654	05	Cylinder #4 EUI Circuit Open
	06	Cylinder #4 EUI Circuit Shorted
000655	05	Cylinder #5 EUI Circuit Open
	06	Cylinder #5 EUI Circuit Shorted
000656	05	Cylinder #6 EUI Circuit Open
	06	Cylinder #6 EUI Circuit Shorted
000970	02	Auxiliary Engine Shutdown Switch Signal Invalid
	31	Auxiliary Engine Shutdown Switch Active
000971	31	External Fuel Derate Switch Active
001109	31	Engine Shutdown Warning
001110	31	Engine Shutdown
001569	31	Fuel Derate
002000	13	Security Violation

Continued on next page RG,RG34710,1563 –19–15APR02–2/4

Ascending 2-Digit Codes

2-Digit Code	SPN	FMI	Definition
11			Throttle Voltage High
12			Throttle Voltage Low
13			Throttle Voltage High or PWM Throttle Abnormal Pulse Width
14			Throttle Voltage Low or PWM Throttle Abnormal Pulse Width
15			PWM Throttle Abnormal Pulse Width
21	000102	03	Manifold Air Pressure Input Voltage High
22	000102	04	Manifold Air Pressure Input 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[a]	000094	03	Fuel Supply Pressure Input Voltage High
28	000629	12	ECU Error
		13	ECU Error
29	000094	04	Fuel Supply Pressure Input Voltage Low
31	000651	05	Cylinder #1 EUI Circuit Open
		06	Cylinder #1 EUI Circuit Shorted
32	000652	05	Cylinder #2 EUI Circuit Open
		06	Cylinder #2 EUI Circuit Shorted
33	000653	05	Cylinder #3 EUI Circuit Open
		06	Cylinder #3 EUI Circuit Shorted
34	000654	05	Cylinder #4 EUI Circuit Open
		06	Cylinder #4 EUI Circuit Shorted
35	000655	05	Cylinder #5 EUI Circuit Open
		06	Cylinder #5 EUI Circuit Shorted
36	000656	05	Cylinder #6 EUI Circuit Open
		06	Cylinder #6 EUI Circuit Shorted
37	000174	03	Fuel Temperature Input Voltage High
38	000174	04	Fuel Temperature Input Voltage Low
41	000637	08	Crank Position Input Missing
42	000637	02	Crank Position Input Noise
		10	Crank Position Input Pattern Error
43	000636	08	Cam Position Input Missing
44	000636	02	Cam Position Input Noise
		10	Cam Position Input Pattern Error
45	000637	07	Crank Position/Cam Position Out of Sync
49	000970	02	Auxiliary Engine Shutdown Switch Signal Invalid
50	000094	03	Fuel Supply Pressure Input Voltage High
51	000094	04	Fuel Supply Pressure Input Voltage Low
52	000970	31	Auxiliary Engine Shutdown Switch Active
53	000097	03	Water in Fuel Signal Voltage High
54	000097	04	Water in Fuel Signal Volage Low
55	000105	16	Manifold Air Temperature Moderately High
56	000639	13	CAN Error
57	000094	18	Fuel Supply Pressure Moderately Low
58	000094	01	Fuel Supply Pressure Extremely Low
59	000094	16	Fuel Supply Pressure Moderately High
61	000111	01	Engine Coolant Level Low
62	000110	16	Engine Coolant Temperature High Moderately Severe
63	000110	00	Engine Coolant Temperature High Most Severe

[a]For 744H/MH and LXE 230 Loaders, see T7 - CAN THROTTLE INVALID.

Continued on next page

64	000100	18	Engine Oil Pressure Moderately Low
65	000100	01	Engine Oil Pressure Extremely Low
66	000105	16	Manifold Air Temperature Moderately Low
67	001109	31	Engine Shutdown Warning
68	001569	31	Fuel Derate
75	000097	31	Water in Fuel Detected
76	000097	03	Water in Fuel Input Voltage High
76	000097	04	Water in Fuel Input Voltage Low
84	000158	17	ECU Power Down Error
89	000094	01	Fuel Supply Pressure Extremely Low
91	000651	06	Cylinder #1 EUI Circuit Shorted
92	000652	06	Cylinder #2 EUI Circuit Shorted
93	000653	06	Cylinder #3 EUI Circuit Shorted
94	000654	06	Cylinder #4 EUI Circuit Shorted
95	000655	06	Cylinder #5 EUI Circuit Shorted
96	000656	06	Cylinder #6 EUI Circuit Shorted
97	000627	01	Injector Supply Voltage Problem
98	000611	03	Injector Wiring Shorted to Power Source
99	000611	04	Injector Wiring Shorted to Ground

RG,RG34710,1563 –19–15APR02–4/4

Diagnostic Procedure

Diagnosis of the electronic control system should be performed according to the following procedure:

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly.
2. 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, proceed to the appropriate symptom diagnostic chart 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. It is recommended that JT07328 Connector Adapter Test Kit be used to make measurements in connectors, sensors, and actuators. These adapters will ensure that terminal damage does not occur.

RG,RG34710,1564 –19–30SEP97–1/1

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.

NOTE: The ECU is the component LEAST likely to fail.

Suggestions for diagnosing intermittent faults:

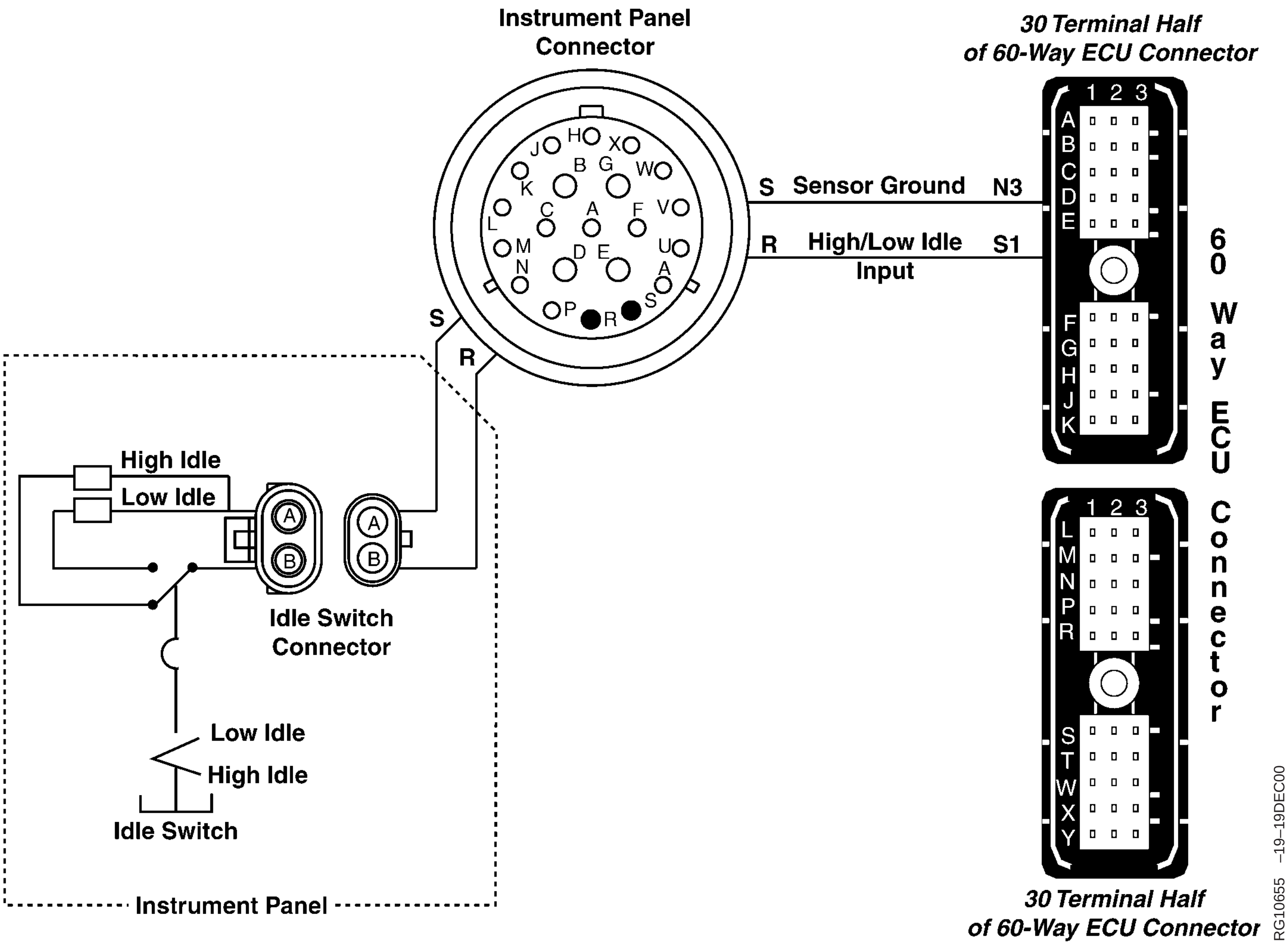
- If diagnostic chart indicates that the problem is intermittent, try to reproduce the operating conditions that were present when the DTC set. The Diagnostic Scan Tool (DST) or SERVICE ADVISOR™ can be used to help locate intermittent problems, as it includes a function called Snap Shot. The Snap Shot 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.

RG,RG34710,1565 –19–30SEP97–1/1

T1 - Multi-state Throttle Input High



Multi-state Throttle Switch

Multi-state throttle is composed of an idle switch that allows engine speed to be at high or low idle. On some applications, there is a bump up and a bump down feature. This allows for high and low idle to be controlled.

On certain applications, an additional throttle is used in addition to the multi-state throttle. If the desired engine speed of the additional throttle is greater than the multi-state throttle, the multi-state throttle will be overridden. When the desired engine speed of the multi-state throttle is greater than the additional throttle, the multi-state throttle will be in total control.

This code will set if:

- The multi-state throttle input voltage exceeds the maximum threshold. The voltage is higher than what is physically possible for the throttle lever to achieve.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the multi-state throttle, and will use the input values from another throttle.
- If the multi-state throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

DPSG,RG40854,298 –19–15APR02–1/1

T1 - Multi-state Throttle Input High

OUO1004,0000C7B –19–15APR02–1/1

T1 - Multi-state Throttle Input High Diagnostic Procedure

– – –1/1

❶ **Connection 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 T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information* Perform a preliminary inspection of the 60-way ECU connector and the multi-state throttle connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine OFF 7. Move the multi-state switch through all the positions 8. Read DTCs	**SPN 91 FMI 3 reoccurs:** GO TO ❸ **SPN 91 FMI 3 doesn’t reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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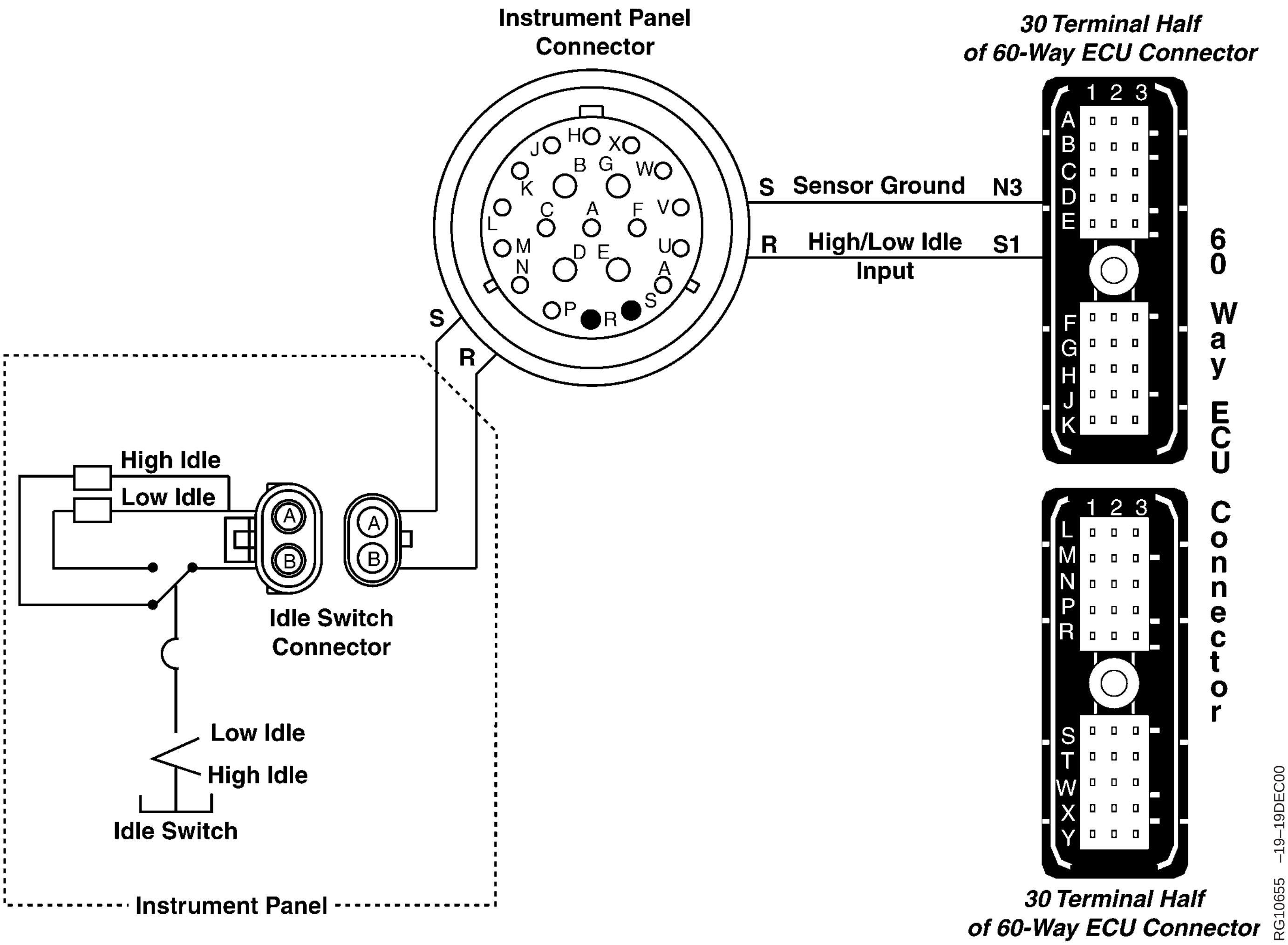
❸ **Multi-state Throttle Switch Test**	*NOTE: For wiring and theory of operation information, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information* 1. Ignition OFF 2. Disconnect multistate throttle switch at two wire connector behind instrument panel. 3. Install a jumper wire between both terminals of the switch harness connector 4. Clear all DTCs 5. Ignition ON, engine OFF 6. Read DTCs	**SPN 91 FMI 3 reoccurs:** GO TO ❹ **SPN 91 FMI 4 occurs:** Faulty multistate throttle switch connector OR Faulty multistate throttle switch – – –1/1

❹ **Multi-state Throttle Input Wire Test**	*NOTE: For wiring and theory of operation information, 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 multistate switch 5 V input terminal and a good chassis ground	**4.0 - 6.0 V:** Open in multistate switch ground circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in multistate switch input circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

T2 - Multi-state Throttle Input Low



Multi-state Throttle Switch

Multi-state throttle is composed of an idle switch that allows engine speed to be at high or low idle. On some applications, there is a bump up and a bump down feature. This allows for high and low idle to be controlled.

On certain applications, an additional throttle is used in addition to the multi-state throttle. If the desired engine speed of the additional throttle is greater than the multi-state throttle, the multi-state throttle will be overridden. When the desired engine speed of the multi-state throttle is greater than the additional throttle, the multi-state throttle will be in total control.

This code will set if:

- The multi-state throttle input voltage drops below the minimum threshold. The voltage is lower than what is physically possible for the throttle lever to achieve.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the multi-state throttle, and will use the input values from another throttle.
- If the multi-state throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

DPSG,RG40854,299 –19–15APR02–1/1

T2 - Multi-state Throttle Input Low

OUO1004,0000C7C –19–15APR02–1/1

T2 - Multi-state Throttle Input Low Diagnostic Procedure

– – –1/1

❶ **Connection 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 T2 - MULTI-STATE THROTTLE INPUT LOW supporting information* Perform a preliminary inspection of the 60-way ECU connector and the multi-state throttle connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information* 1. Ignition ON, engine OFF 2. Read DTCs 3. Make note of any DTCs, then clear all DTCs 4. Ignition ON, engine OFF 5. Move the multistate switch through all the positions 6. Read DTCs	**SPN 91 FMI 4 reoccurs:** GO TO ❸ **SPN 91 FMI 4 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

– – –1/1

❸ **Multi-state Throttle Switch Test**	*NOTE: For wiring and theory of operation information, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition OFF 3. Disconnect multistate throttle switch at two wire connector behind instrument panel 4. Ignition ON, engine OFF 5. Start ECU communication software 6. Clear all DTCs 7. Read DTCs using DST or SERVICE ADVISOR™.	**SPN 91 FMI 4 reoccurs:** Short to ground in multistate input circuit OR Faulty ECU **SPN 91 FMI 3 occurs:** Faulty multistate throttle switch connector OR Faulty multistate throttle switch

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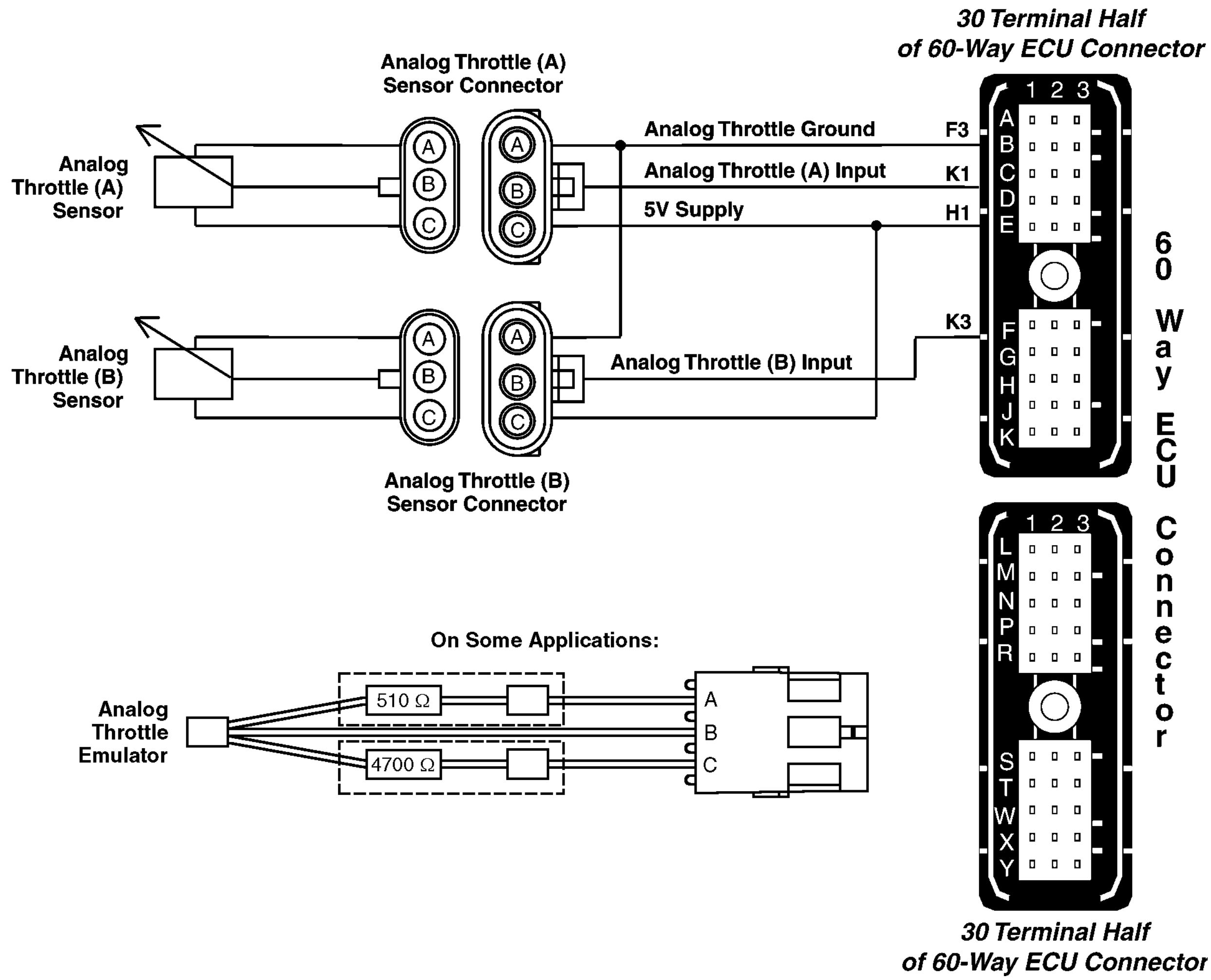
T3 - Analog Throttle (A) Input High



RG10403 –19–19DEC00

NOTE: Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of 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. Since the ECU has the ability to learn different voltages for low and high idle, 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 of 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.

Continued on next page

DPSG,RG40854,77 –19–15APR02–1/2

- 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 only allow idle engine speed.

DPSG,RG40854,77 –19–15APR02–2/2

T3 - Analog Throttle (A) Input High

OUO1004,0000C7D –19–15APR02–1/1

T3 - Analog Throttle (A) Input High Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the analog (A) throttle connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection:** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Analog throttle (A) in the idle position 5. Using the DST or SERVICE ADVISOR™, readanalog throttle (A) voltage parameter. *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 of this manual.*	**4.7 V or greater:** GO TO ❹ **Below 4.7 V:** GO TO ❸

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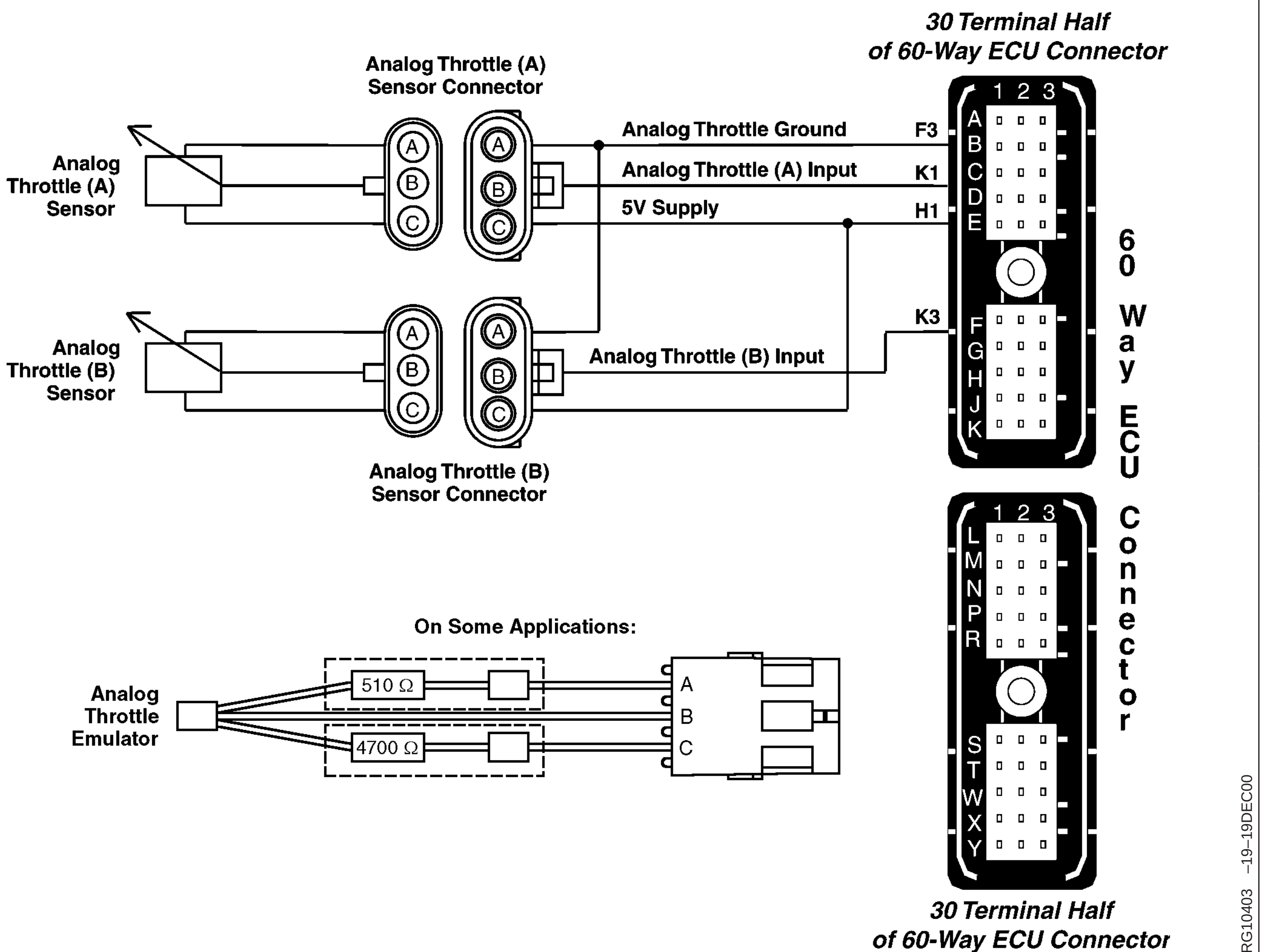
❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation information, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information* While slowly operating the analog throttle (A) through full travel, read the analog throttle (A) voltage parameter. *NOTE: For OEM applications, the 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 of this manual.*	**Goes above 4.7 V:** Faulty analog throttle (A) sensor connector OR Open in analog throttle (A) sensor ground circuit OR Faulty analog throttle (A) sensor **Never goes above 4.7 V:** 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 information, 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. Read the analog throttle (A) voltage parameter *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 of this manual.*	**0.3 V or less:** GO TO ❺ **Above 0.3 V:** Short to voltage in analog throttle (A) input circuit OR Faulty ECU – – –1/1

❺ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation information, 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 ground terminal in throttle (A) sensor harness connector	**Light ON:** Faulty analog throttle (A) sensor connector OR Faulty analog throttle (A) sensor **Light OFF:** Open in analog throttle (A) ground circuit – – –1/1

T4 - Analog Throttle (A) Input Low



NOTE: Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of 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. Since the ECU has the ability to learn different voltages for low and high idle, the voltages above may change depending on application.

This code will set if:

- The analog throttle (A) input voltage goes 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 of 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.

Continued on next page

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- 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 only allow idle engine speed.

DPSG,RG40854,170 –19–15APR02–2/2

T4 - Analog Throttle (A) Input Low

OUO1004,0000C7E –19–15APR02–1/1

T4 - Analog Throttle (A) Input Low Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the analog (A) throttle connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection:** Repair faulty connection.

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Analog throttle (A) in the idle position 5. Read the analog throttle (A) voltage parameter using 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 of this manual.*	**0.3 V or less:** GO TO ❹ **Above 0.3 V:** GO TO ❸

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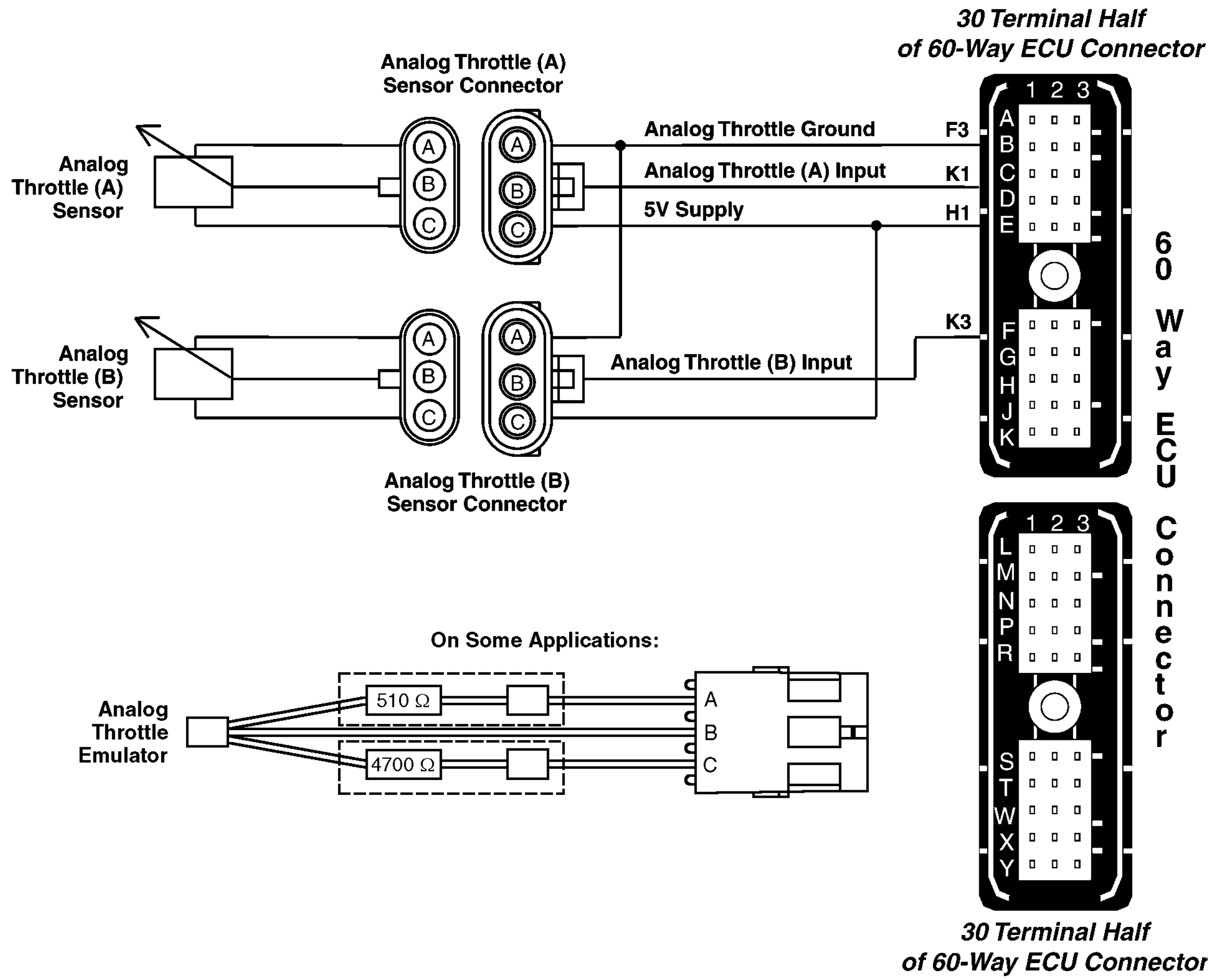
– – –1/1

❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation information, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information* Read the analog throttle (A) voltage parameter while slowly operating the analog throttle (A) through full travel. *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 of this manual.*	**Goes below 0.3 V:** Faulty analog throttle (A) sensor connector OR Open in analog throttle (A) sensor ground circuit OR Faulty analog throttle (A) sensor **Never goes below 0.3 V:** 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 information, 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 in the harness side of the sensor connector 4. Ignition ON, engine OFF 5. Read the analog throttle (A) voltage parameter *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 of this manual.*	**Below 4.7 V:** GO TO ❺ **4.7 V or greater:** Faulty analog throttle (A) sensor connector OR Faulty analog throttle (A) sensor – – –1/1

❺ **Throttle Position 5 V Supply Test**	*NOTE: For wiring and theory of operation information, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information* 1. Ignition OFF 2. Remove jumper wire between the two terminals 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between the throttle (A) ground terminal and the 5 V supply terminal in the sensor harness connector	**4.0 - 6.0 V:** Open in analog throttle (A) input circuit OR Short to ground in analog throttle (A) input circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in analog throttle (A) 5 V supply circuit OR Short to ground in analog throttle (A) 5 V supply circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

T5 - Analog Throttle (B) Input High



RG10403 –19–19DEC00

NOTE: Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of 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. Since the ECU has the ability to learn different voltages for low and high idle, 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 of 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.

Continued on next page

DPSG,RG40854,296 –19–15APR02–1/2

- 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 only allow idle engine speed.

DPSG,RG40854,296 –19–15APR02–2/2

T5 - Analog Throttle (B) Input High

OUO1004,0000C7F –19–15APR02–1/1

T5 - Analog Throttle (B) Input High Diagnostic Procedure

– – –1/1

❶ Connection 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, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the analog (B) throttle connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ Intermittent Fault Test	*NOTE: For wiring and theory of operation information, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Analog throttle (B) in the idle position 5. Read the analog throttle (B) voltage parameter using 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 of this manual.*	**4.7 V or greater:** GO TO ❹ **Below 4.7 V:** GO TO ❸

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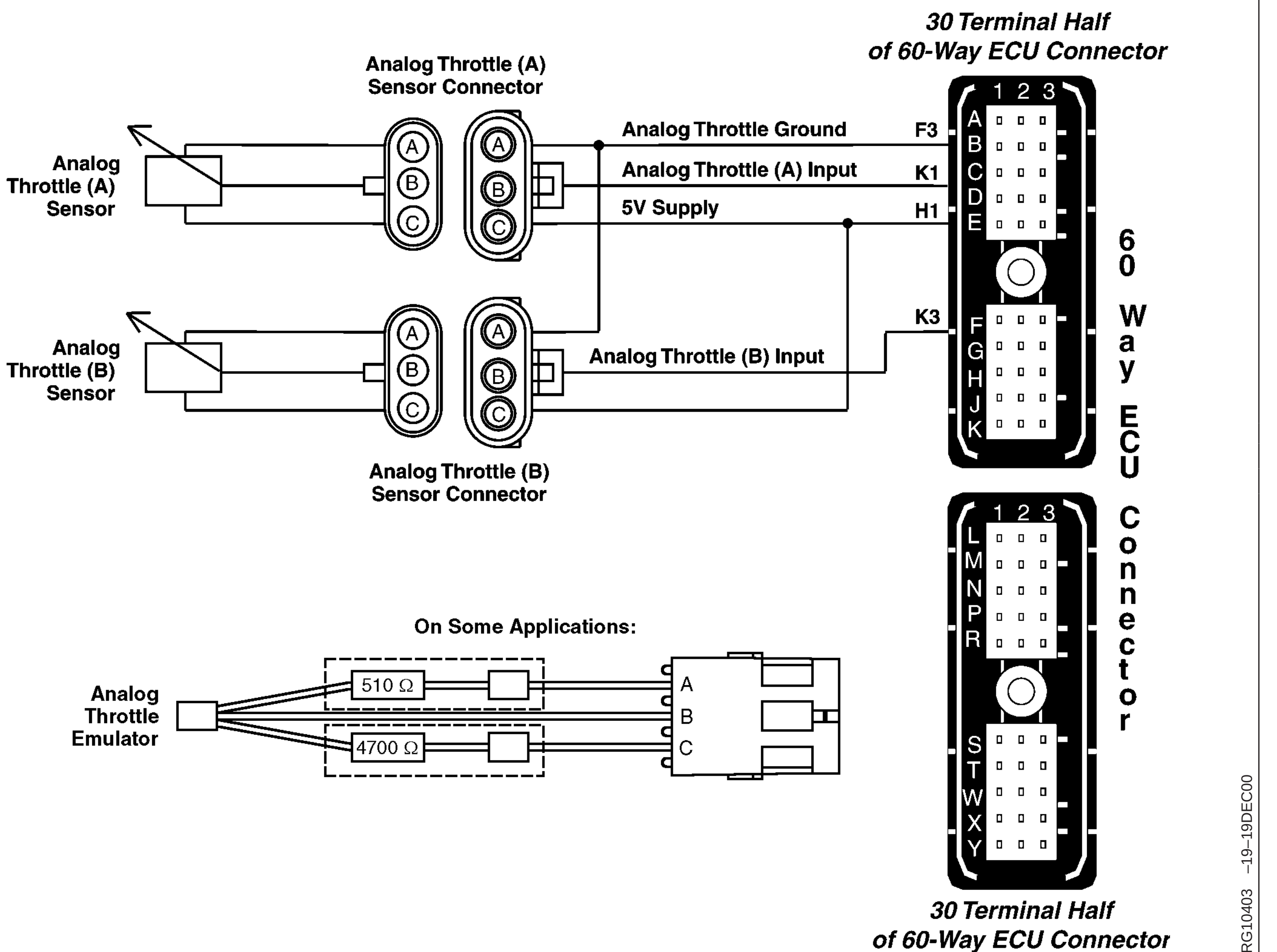
❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation information, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information* Read the analog throttle (B) voltage parameter while slowly operating the analog throttle (B) through full travel *NOTE: For OEM applications, the 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 of this manual.*	**Goes above 4.7 V:** Faulty analog throttle (B) sensor connector OR Open in analog throttle (B) sensor ground circuit OR Faulty analog throttle (B) sensor **Never goes above 4.7 V:** 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 information, 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. Read the analog throttle (B) voltage parameter *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 of this manual.*	**0.3 V or less:** GO TO ❺ **Above 0.3 V:** Short to voltage in analog throttle (B) input circuit OR Faulty ECU – – –1/1

❺ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation information, 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 ground terminal in analog throttle (B) sensor harness connector	**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



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NOTE: Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of 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. Since the ECU has the ability to learn different voltages for low and high idle, the voltages above may change depending on application.

This code will set if:

- The analog throttle (B) input voltage goes 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 of 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.

Continued on next page

DPSG,RG40854,297 –19–15APR02–1/2

- 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 only allow idle engine speed.

DPSG,RG40854,297 –19–15APR02–2/2

T6 - Analog Throttle (B) Input Low

OUO1004,0000C80 –19–08JAN01–1/1

T6 - Analog Throttle (B) Input Low Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the analog (B) throttle connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Analog throttle (B) in the idle position 5. Read the analog throttle (B) voltage parameter using 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 of this manual.*	**0.3 V or less:** GO TO ❹ **Above 0.3 V:** GO TO ❸

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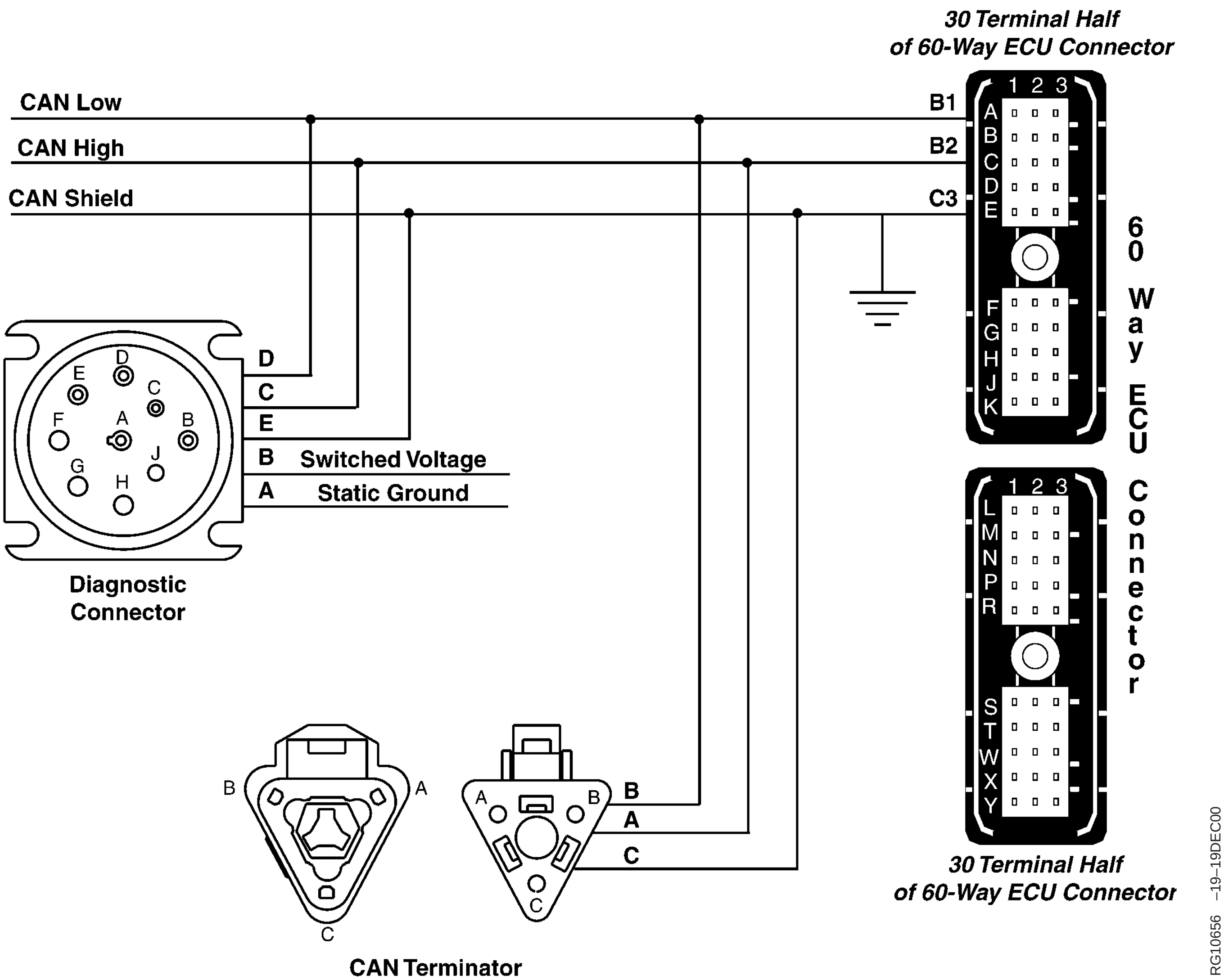
❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation information, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information* Read the analog throttle (B) voltage parameter while slowly operating the analog throttle (B) through full travel. *NOTE: For OEM applications, the 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 of this manual.*	**Goes below 0.3 V:** Faulty analog throttle (B) sensor connector OR Open in analog throttle (B) sensor ground circuit OR Faulty analog throttle (B) sensor **Never goes below 0.3 V:** 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 information, 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 in the harness side of the sensor connector 4. Ignition ON, engine OFF 5. Read the analog throttle (B) voltage parameter *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 of this manual.*	**Below 4.7 V:** GO TO ❺ **4.7 V 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 information, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information* 1. Ignition OFF 2. Remove jumper wire between the two terminals 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between the throttle ground terminal and the 5 V supply terminal in the sensor harness connector	**4.0 - 6.0 V:** Open in analog throttle (B) input circuit OR Short to ground in analog throttle (B) input circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in analog throttle (B) 5 V supply circuit OR Short to ground in analog throttle (B) 5 V supply circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

T7 - CAN Throttle Invalid



NOTE: *Wiring schematic limited view of CAN bus. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

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 only allow idle engine speed.

DPSG,RG40854,209 –19–15APR02–1/1

T7 - CAN Throttle Invalid

OUO1004,0000C81 –19–15APR02–1/1

T7 - CAN Throttle Invalid Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T7 - CAN THROTTLE INVALID supporting information.* Perform a preliminary inspection of the 60-way ECU connector and any connectors associated with the CAN throttle. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T7 - CAN THROTTLE INVALID supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software. 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs using DST or SERVICE ADVISOR™.	**SPN 91 FMI 9 reoccurs:** GO TO ❸ **SPN 91 FMI 9 doesn’t reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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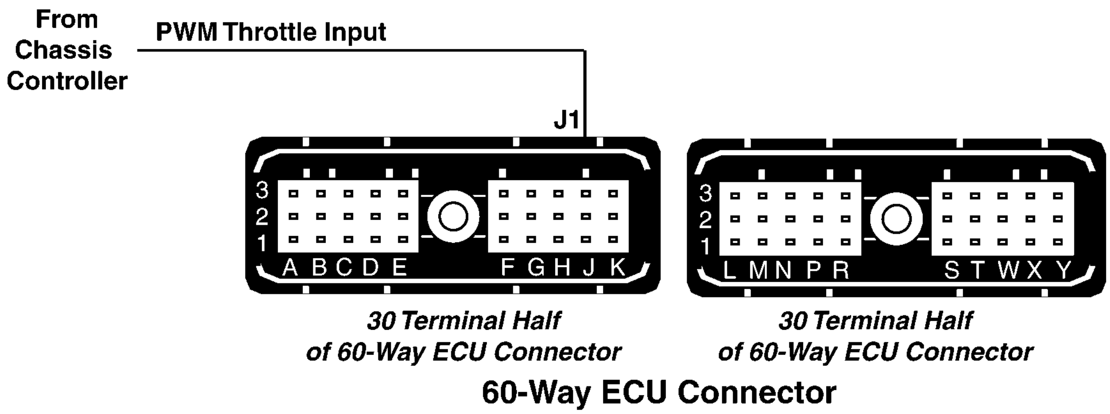
❸ **Application Related DTCs Test**	*NOTE: For wiring and theory of operation information, see T7 - CAN THROTTLE INVALID supporting information.* Check other controllers on application for CAN related DTCs if application has other controllers communicating on CAN bus.	**No CAN related DTCs found on other controllers:** GO TO ❹ **CAN related DTCs on other controllers found:** 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 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 information, see T7 - CAN THROTTLE INVALID supporting information.* 1. Ignition ON 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 - 3.5 V:** Faulty ECU connector or other connector in the CAN system OR Faulty ECU **Either measurement less than 1.5 V or greater than 3.5 V:** CAN wiring shorted to ground or voltage OR Another controller in the CAN system faulty OR Faulty ECU – – –1/1

T8 - PWM Throttle Input High



RG10404 –19–20DEC00

NOTE: Wiring schematic limited view of PWM wiring. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

PWM (Pulse Width Modulated) Throttle Position Input

- The PWM throttle signal is sent to the ECU by the Chassis Computer. The PWM signal is a square wave signal with a constant frequency. The pulse-width of the signal (amount of time the signal is high) varies as throttle input from the Chassis Computer varies.

This code will set if:

- The pulse-width of the PWM signal is greater than the normal operating range of the signal.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the PWM throttle, and will use the input values from another throttle.
- If the PWM throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

DPSG,RG40854,294 –19–15APR02–1/1

T8 - PWM Throttle Input High

OUO1004,0000C82 –19–15APR02–1/1

T8 - PWM Throttle Input High Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T8 - PWM THROTTLE INPUT HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector and any connectors associated with the PWM throttle. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T8 - PWM THROTTLE INPUT HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**SPN 91 FMI 3 reoccurs:** GO TO ❸ **SPN 91 FMI 3 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

– – –1/1

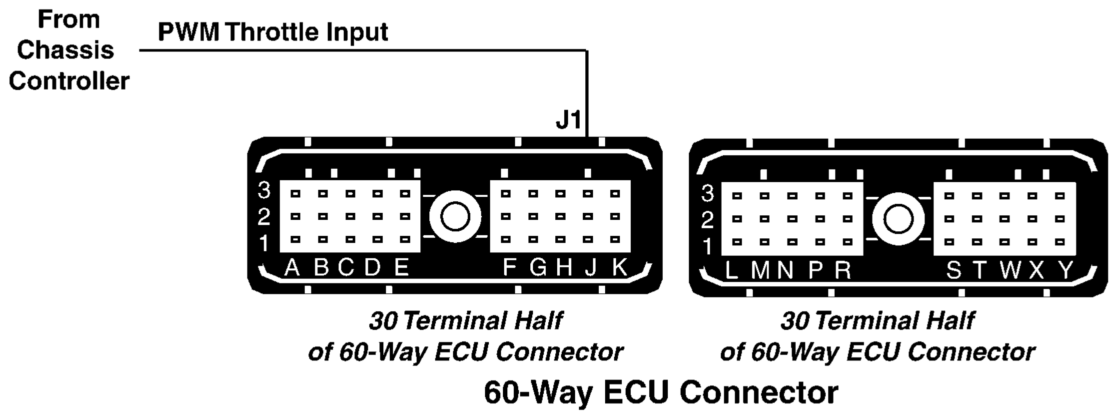
❸ **Application Related DTCs Test**	*NOTE: For wiring and theory of operation information, see T8 - PWM THROTTLE INPUT HIGH supporting information* Check other controllers on application for related DTCs if PWM throttle signal originates from another controller	**Other controllers report no throttle related DTCs:** GO TO ❹ **Other controllers do report a throttle related DTC:** Refer to diagnostic procedures for controller. Repair cause of throttle related DTC and retest. – – –1/1

❹ **Open in PWM Signal Wire Test**	*NOTE: For wiring and theory of operation information, see T8 - PWM THROTTLE INPUT HIGH supporting information* 1. Ignition OFF 2. Disconnect 60-way ECU connector 3. Obtain wiring information for this application and determine the source of the PWM throttle signal 4. Disconnect the connector that outputs the PWM throttle signal 5. Using a multimeter, measure the resistance between terminal J1 of the 60-way ECU connector ***and*** terminal of originating PWM throttle signal	**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 information, see T8 - PWM THROTTLE INPUT HIGH supporting information* 1. Ignition OFF 2. 60-way ECU connector and the other signal source controller still disconnected 3. Using a multimeter measure resistance between terminal J1 in the harness end of the 60-way ECU connector and: • All other terminals in that connector • A good chassis ground	**All measurements greater than 2000 ohms:** GO TO ❻ **Any measurement less than 2000 ohms:** Short in PWM circuit – – –1/1

❻ **PWM Throttle Source Controller Connector Test**	*NOTE: For wiring and theory of operation information, see T8 - PWM THROTTLE INPUT HIGH supporting information* 1. Ignition OFF 2. 60-way ECU connector still disconnected 3. Reconnect PWM signal source connector 4. Ignition ON 5. Using a multimeter, measure voltage while operating the throttle between terminal J1 in the harness end of the 60-way ECU connector ***and*** a good chassis ground	**Between 0.5 V and 4.8V:** Faulty PWM signal source controller OR Wrong ECU for the vehicle OR Faulty ECU connector OR Faulty ECU **Less than 0.5 V or greater than 4.8V:** Faulty PWM throttle signal source controller connector OR Faulty PWM throttle signal source controller – – –1/1

T9 - PWM Throttle Input Low



RG10404 –19–20DEC00

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NOTE: Wiring schematic limited view of PWM wiring. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

PWM (Pulse Width Modulated) Throttle Position Input

- The PWM throttle signal is sent to the ECU by the Chassis Computer. The PWM signal is a square wave signal with a constant frequency. The pulse-width of the signal (amount of time the signal is high) varies as throttle input from the Chassis Computer varies.

This codes will set if:

- The ECU senses that the pulse-width of the PWM signal is lower than the normal operating range of the signal.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the PWM throttle, and will use the input values from another throttle.
- If the PWM throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

DPSG,RG40854,295 –19–15APR02–1/1

T9 - PWM Throttle Input Low

OUO1004,0000C83 –19–15APR02–1/1

T9 - PWM Throttle Input Low Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T9 - PWM THROTTLE INPUT LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector and any connectors associated with the PWM throttle. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T9 - PWM THROTTLE INPUT LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**SPN 91 FMI 4 reoccurs:** GO TO ❸ **SPN 91 FMI 4 doesn't reoccur:** Problem is intermittent. If 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 information, see T9 - PWM THROTTLE INPUT LOW supporting information* Check other controllers on application for related DTCs if PWM throttle signal originates from another controller	**Other controllers report no throttle related DTCs:** GO TO ❹ **Other controllers do report a throttle related DTC:** Refer to diagnostic procedures for controller. Repair cause of throttle related DTC and retest – – –1/1
❹ **Open in PWM Signal Wire Test**	*NOTE: For wiring and theory of operation information, see T9 - PWM THROTTLE INPUT LOW supporting information* 1. Ignition OFF 2. Disconnect 60 way-ECU connector 3. Obtain wiring information for this application and determine the source of the PWM throttle signal 4. Disconnect the connector that outputs the PWM throttle signal 5. Using a multimeter, measure the resistance between terminal J1 of the 60-way ECU connector ***and*** terminal of originating PWM throttle signal	**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 information, see T9 - PWM THROTTLE INPUT LOW supporting information* 1. Ignition OFF 2. 60-way ECU connector and the other signal source controller still disconnected 3. Using a multimeter measure resistance between terminal J1 in the harness end of the 60-way ECU connector and: • All other terminals in that connector • A good chassis ground	**All measurements greater than 2000 ohms:** GO TO ❻ **Any measurement less than 2000 ohms:** Short in PWM circuit – – –1/1

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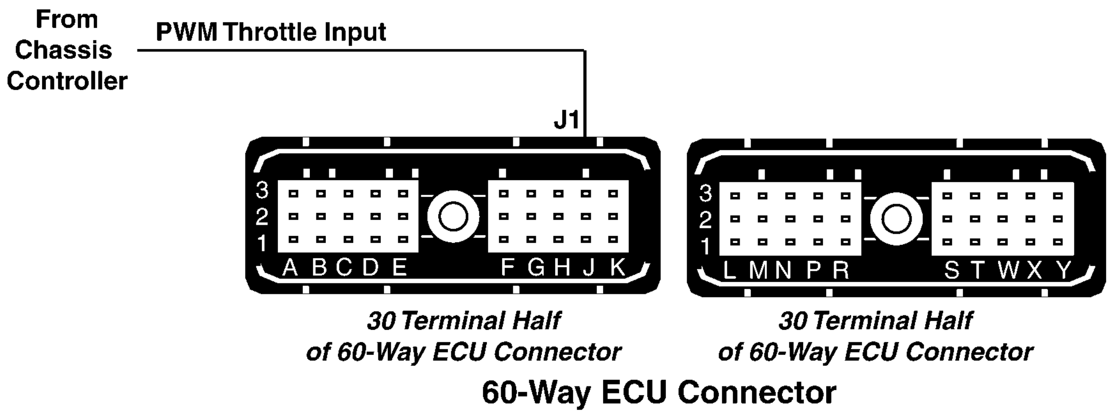
❻ **PWM Throttle Source Controller Connector Test**	*NOTE: For wiring and theory of operation information, see T9 - PWM THROTTLE INPUT LOW supporting information* 1. Ignition OFF 2. 60-way ECU connector still disconnected 3. Reconnect PWM signal source connector 4. Ignition ON 5. Using a multimeter, measure voltage while operating the throttle between terminal J1 in the harness end of the 60-way ECU connector ***and*** a good chassis ground	**Between 0.5 V and 4.8V:** Faulty PWM signal source controller OR Wrong ECU for the vehicle OR Faulty ECU connector OR Faulty ECU **Less than 0.5 V or greater than 4.8V:** Faulty PWM throttle signal source controller connector OR Faulty PWM throttle signal source controller – – –1/1

T10 - PWM Throttle Abnormal Pulse Width



RG10404 –19–20DEC00

NOTE: Wiring schematic limited view of PWM wiring. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

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 only allow idle engine speed.

DPSG,RG40854,171 –19–15APR02–1/1

T10 - PWM Throttle Abnormal Pulse Width

OUO1004,0000C84 –19–15APR02–1/1

T10 - PWM Throttle Abnormal Pulse Width Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information.* Perform a preliminary inspection of the ECU connector and any connectors associated with the PWM throttle. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**SPN 91 FMI 8 reoccurs:** GO TO ❸ **SPN 91 FMI 8 doesn't reoccur:** Problem is intermittent. If 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 information, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information* Check other controllers on application for related DTCs if PWM throttle signal originates from another controller	**Other controllers report no throttle related DTCs:** GO TO ❹ **Other controllers do report a throttle related DTC:** Refer to diagnostic procedures for controller. Repair cause of throttle related DTC and retest. – – –1/1

❹ **Open in PWM Signal Wire Test**	*NOTE: For wiring and theory of operation information, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information* 1. Ignition OFF 2. Disconnect 60 way-ECU connector 3. Obtain wiring information for this application and determine the source of the PWM throttle signal 4. Disconnect the connector that outputs the PWM throttle signal 5. Using a multimeter, measure the resistance between terminal J1 of the 60-way ECU connector ***and*** terminal of originating PWM throttle signal	**5 ohms or less:** GO TO ❺ **Greater than 5 ohms:** Open in PWM throttle signal wire – – –1/1

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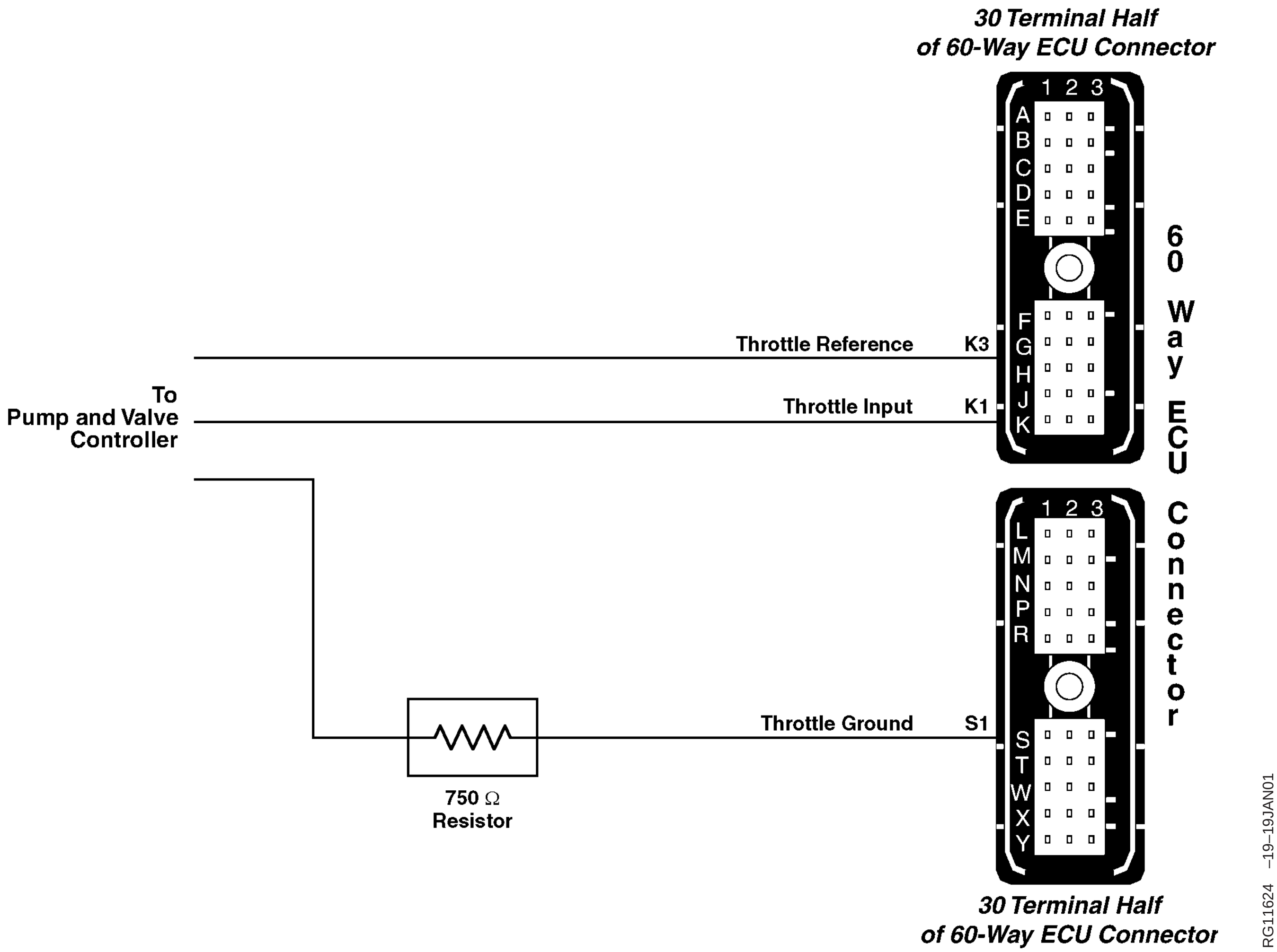
❺ **Short in PWM Circuit Test**	*NOTE: For wiring and theory of operation information, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information* 1. Ignition OFF 2. 60-way ECU connector and the other signal source controller still disconnected 3. Using a multimeter measure resistance between terminal J1 in the harness end of the 60-way ECU connector and: • All other terminals in that connector • A good chassis ground	**All measurements greater than 2000 ohms:** GO TO ❻ **Any measurement less than 2000 ohms:** Short in PWM circuit – – –1/1

❻ **PWM Throttle Source Controller Connector Test**	*NOTE: For wiring and theory of operation information, see T10 - PWM THROTTLE ABNORMAL PULSE WIDTH supporting information* 1. Ignition OFF 2. 60-way ECU connector still disconnected 3. Reconnect PWM signal source connector 4. Ignition ON 5. Using a multimeter, measure voltage while operating the throttle between terminal J1 in the harness end of the 60-way ECU connector ***and*** a good chassis ground	**Between 0.5 V and 4.8V:** Faulty PWM signal source controller OR Wrong ECU for the vehicle OR Faulty ECU connector OR Faulty ECU **Less than 0.5 V or greater than 4.8V:** Faulty PWM throttle signal source controller connector OR Faulty PWM throttle signal source controller – – –1/1

T11 - Excavator Throttle Reference Voltage High



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NOTE: Wiring schematic limited representation of the Excavator Throttle wiring. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

450C LC Excavator Throttle

- The 450C LC 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 throttle reference voltage to 3.75 volts.

RG40854,0000004 –19–15APR02–1/1

T11 - Excavator Throttle Reference Voltage High

OUO1004,0000C85 –19–15APR02–1/1

T11 - Excavator Throttle Reference Voltage High Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs with: • Ignition ON, engine OFF • Ignition ON, engine running *NOTE: If DTCs SPN 29 FMI 3 or SPN 29 FMI 4 are active, follow those DTCs first.*	**SPN 28 FMI 3 reoccurs when engine is off and running:** GO TO ❸ **SPN 28 FMI 3 reoccurs only when engine is running:** GO TO ❹ **SPN 28 FMI 3 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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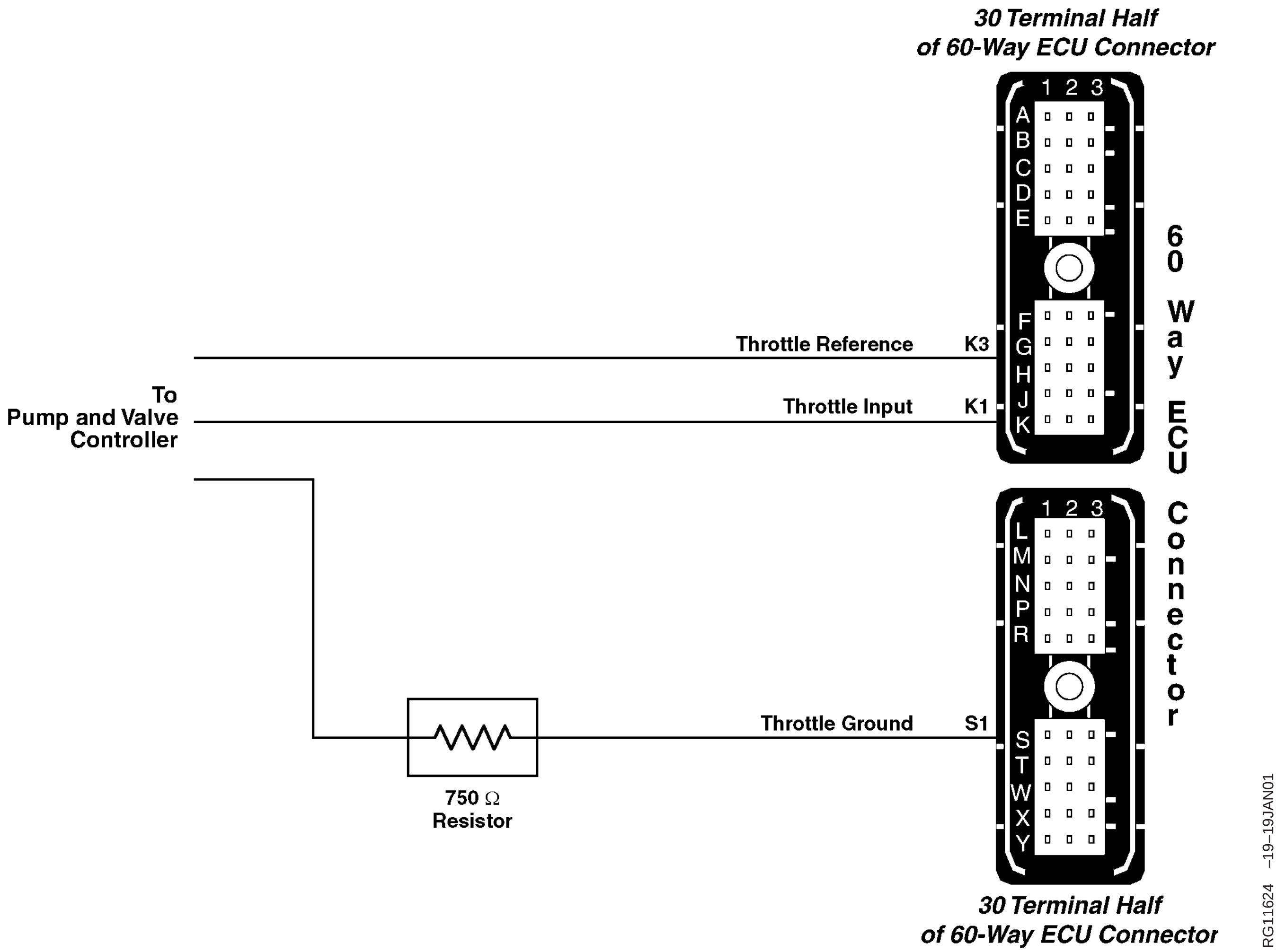
❸ **Throttle Reference Wire Test**	*NOTE: For wiring and theory of operation information, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect ECU 60-way connector 3. Using a multimeter, measure voltage between terminal K3 in the harness end of the 60-way ECU connector ***and*** the ground stud of the Pump and Valve controller.	**3.95 volts or less:** GO TO ❹ **Greater than 3.95 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 information, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH 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

T12 - Excavator Throttle Reference Voltage Low



NOTE: Wiring schematic limited representation of the Excavator Throttle wiring. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

450C LC Excavator Throttle

- The 450C LC 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 goes below 2.7 volts.

If this code sets, the following will occur:

- The ECU will default the excavator throttle reference voltage to 3.75 volts.

RG40854,0000005 –19–15APR02–1/1

T12 - Excavator Throttle Reference Voltage Low

OUO1004,0000C86 –19–15APR02–1/1

T12 - Excavator Throttle Reference Voltage Low Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs with: • Ignition ON, engine OFF • Ignition ON, engine running *NOTE: If DTCs SPN 29 FMI 3 or SPN 29 FMI 4 are active, follow those DTCs first.*	**SPN 28 FMI 4 reoccurs when engine is off and running:** GO TO ❸ **SPN 28 FMI 4 reoccurs only when engine is running:** GO TO ❹ **SPN 28 FMI 4 doesn’t reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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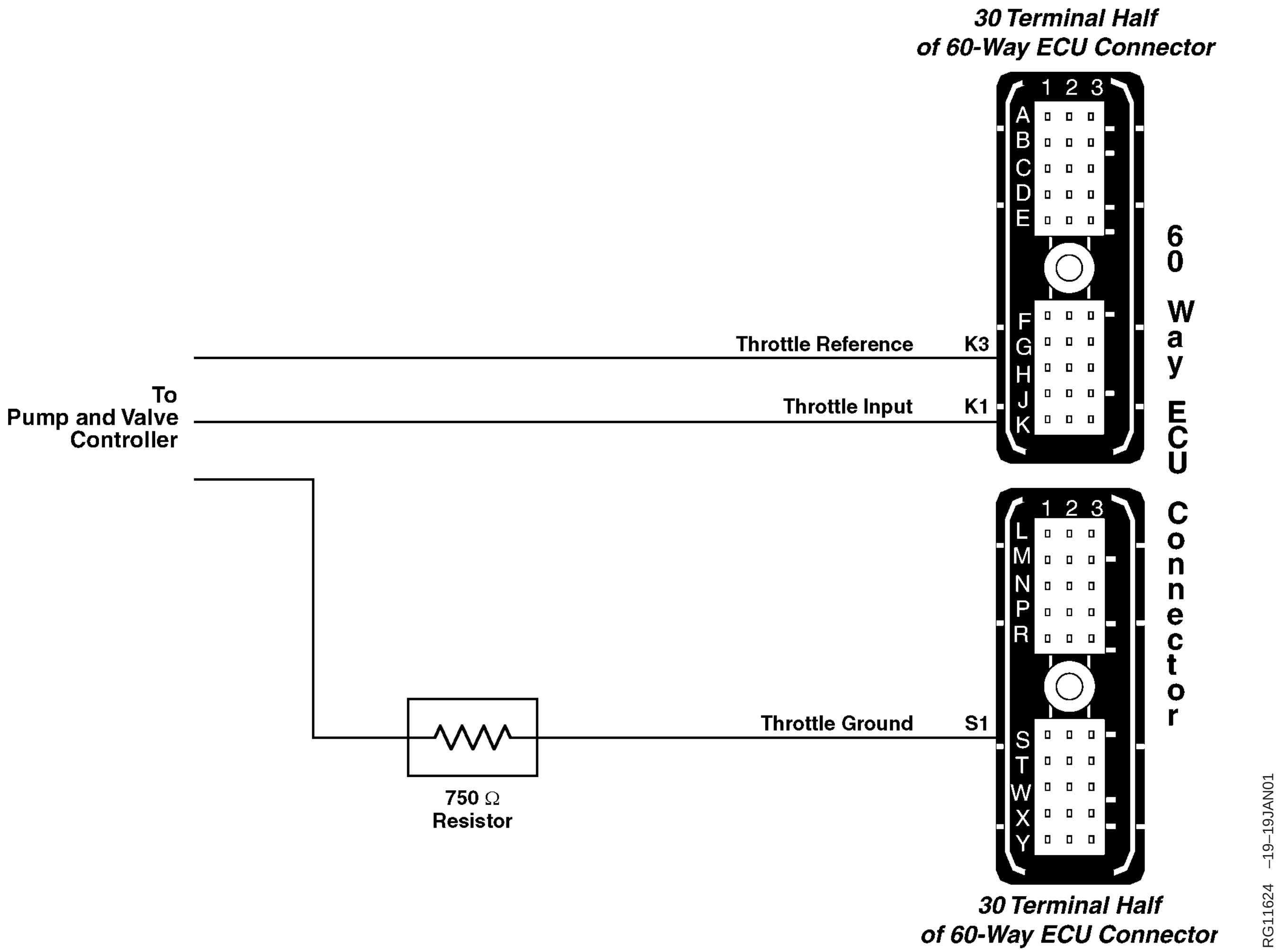
❸ **Throttle Reference Wire Test**	*NOTE: For wiring and theory of operation information, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information* 1. Ignition OFF 2. Disconnect ECU 60-way connector 3. Using a multimeter, measure voltage between terminal K3 in the harness end of the 60-way ECU connector ***and*** the ground pin of the Pump and Valve controller.	**3.55 volts or greater:** GO TO ❹ **Less than 3.55 volts:** Open in throttle reference wire OR Faulty Pump and Valve connector OR Faulty Pump and Valve controller – – –1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation information, 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



NOTE: Wiring schematic limited representation of the Excavator Throttle wiring. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

450C LC Excavator Throttle

- The 450C LC 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 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 2.5 volts.

RG40854,0000006 –19–15APR02–1/1

T13 - Excavator Throttle Ground Voltage High

OUO1004,0000C87 –19–15APR02–1/1

T13 - Excavator Throttle Ground Voltage High Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs with: • Ignition ON, engine OFF • Ignition ON, engine running	**SPN 29 FMI 3 reoccurs when engine is off and running:** GO TO ❸ **SPN 29 FMI 3 reoccurs only when engine is running:** GO TO ❹ **SPN 29 FMI 3 doesn’t reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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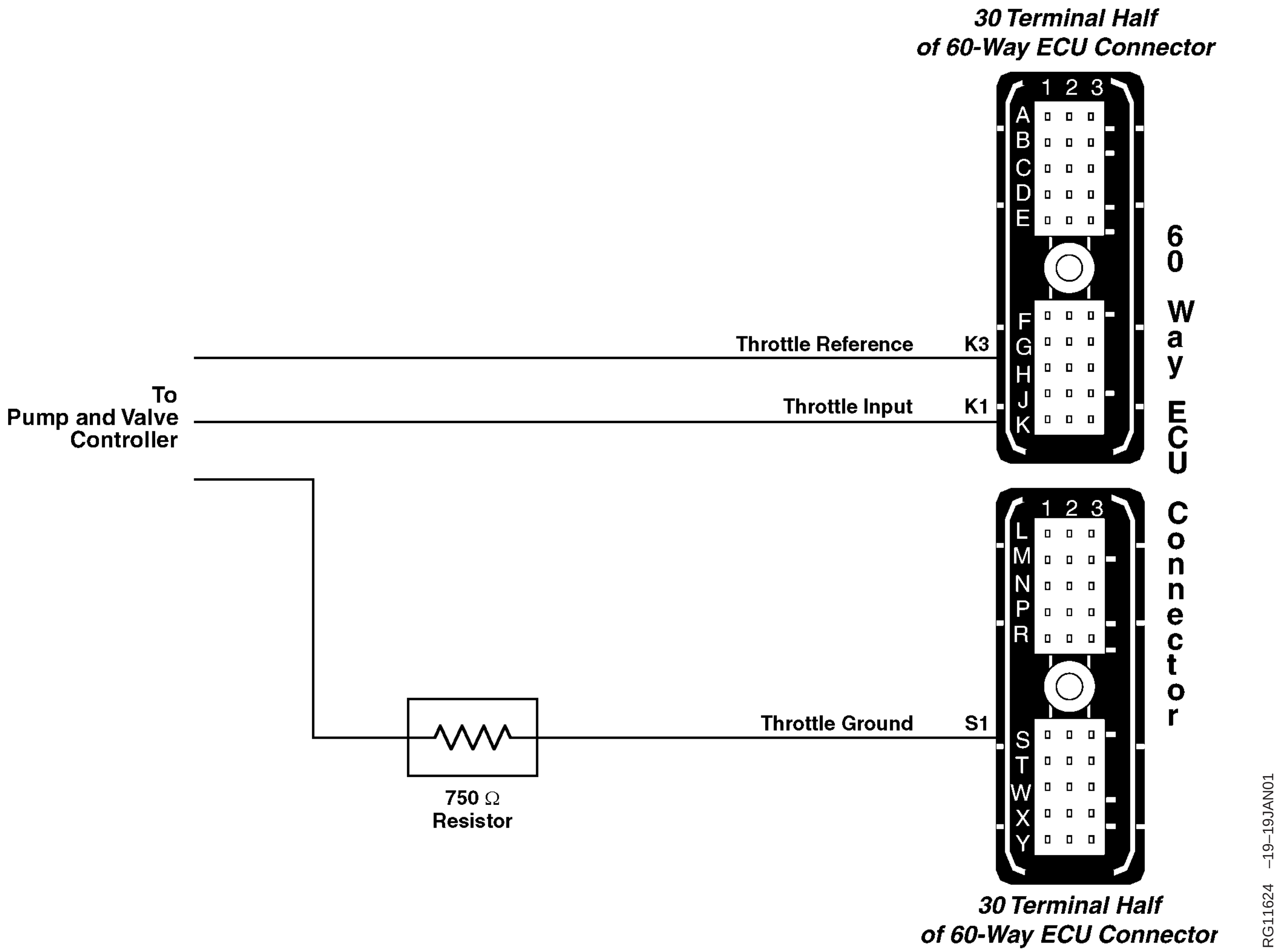
❸ **Throttle Ground Wire Test**	*NOTE: For wiring and theory of operation information, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect ECU 60-way connector 3. Disconnect Pump and Valve Connector 4. Using a multimeter, measure resistance between terminal S1 in the harness end of the 60-way ECU connector ***and*** the throttle ground terminal of the Pump and Valve controller.	**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 information, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect 60-way ECU connector 3. Using a multimeter, measure resistance between terminal S1 in the harness end of the 60-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 connector OR Faulty Pump and Valve controller – – –1/1

❺ **Ground Test**	*NOTE: For wiring and theory of operation information, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH 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

T14 - Excavator Throttle Ground Voltage Low



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NOTE: Wiring schematic limited representation of the Excavator Throttle wiring. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

450C LC Excavator Throttle

- The 450C LC 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 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 2.5 volts.

RG40854,0000007 –19–15APR02–1/1

T14 - Excavator Throttle Ground Voltage Low

OUO1004,0000C88 –19–15APR02–1/1

T14 - Excavator Throttle Ground Voltage Low Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs with: • Ignition ON, engine OFF • Ignition ON, engine running	**SPN 29 FMI 4 reoccurs when engine is off and running:** GO TO ❸ **SPN 29 FMI 4 reoccurs only when engine is running:** GO TO ❹ **SPN 29 FMI 4 doesn’t reoccur:** Problem is intermittent. If 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 information, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information* 1. Ignition OFF 2. Disconnect ECU 60-way connector 3. Using a multimeter, measure resistance between terminal S1 in the harness end of the 60-way ECU connector ***and*** the ground stud of the Pump and Valve controller.	**730 ohms or greater:** GO TO ❹ **Less than 730 ohms:** Short to ground in throttle ground wire between ECU and 750-ohm resistor OR Faulty ECU – – –1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation information, see T14 - EXCAVATOR THROTTLE GROUND 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

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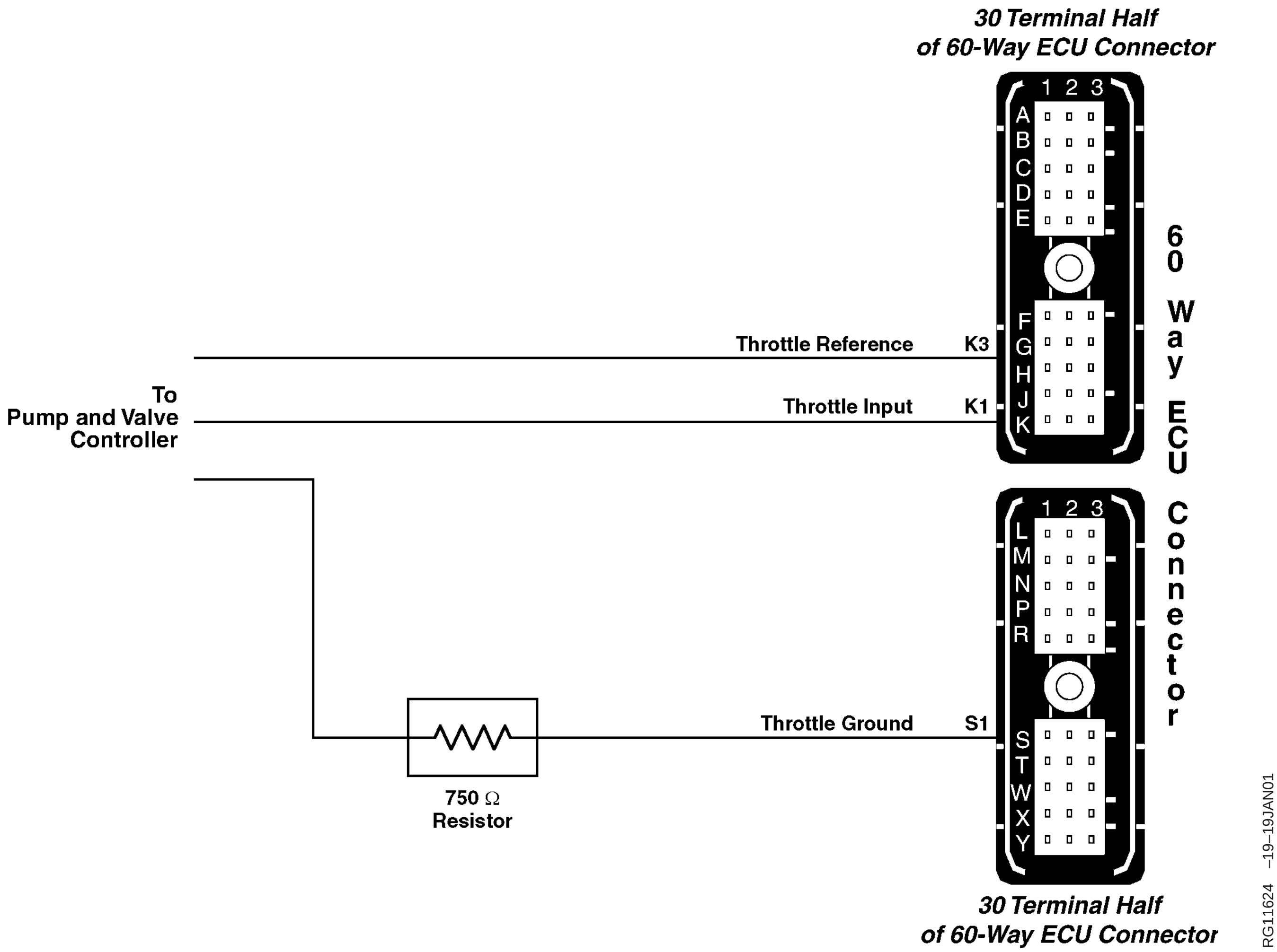
T15 - Excavator Throttle Input Voltage High



NOTE: Wiring schematic limited representation of the Excavator Throttle wiring. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

450C LC Excavator Throttle

- The 450C LC 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 exceeds 4.9 volts.

If this code sets, the following will occur:

- The ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

RG40854,0000008 –19–15APR02–1/1

T15 - Excavator Throttle Input Voltage High

OUO1004,0000C89 –19–15APR02–1/1

T15 - Excavator Throttle Input Voltage High Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs with: • Ignition ON, engine OFF • Ignition ON, engine running *NOTE: If DTCs SPN 29 FMI 3 or SPN 29 FMI 4 are active, follow those DTCs first.* 1. Ignition ON, engine OFF 2. Using the DST, monitor DTCs on the active code display parameter 3. Make note of any DTCs, then clear all DTCs *NOTE: If DTCs SPN 29 FMI 3 or SPN 29 FMI 4 are active, follow those DTCs first.* 4. Using the DST, monitor DTCs on the active code display parameter with: • Ignition ON, engine OFF • Ignition ON, engine running	**SPN 91 FMI 3 reoccurs when engine is off and running:** GO TO ❸ **SPN 91 FMI 3 reoccurs only when engine is running:** GO TO ❹ **SPN 91 FMI 3 doesn't reoccur:** Problem is intermittent. If 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 information, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect ECU 60-way connector 3. Using a multimeter, measure voltage between terminal K1 in the harness end of the 60-way ECU connector ***and*** the ground stud 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 connector OR Faulty Pump and Valve controller

– – –1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation information, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH 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.	

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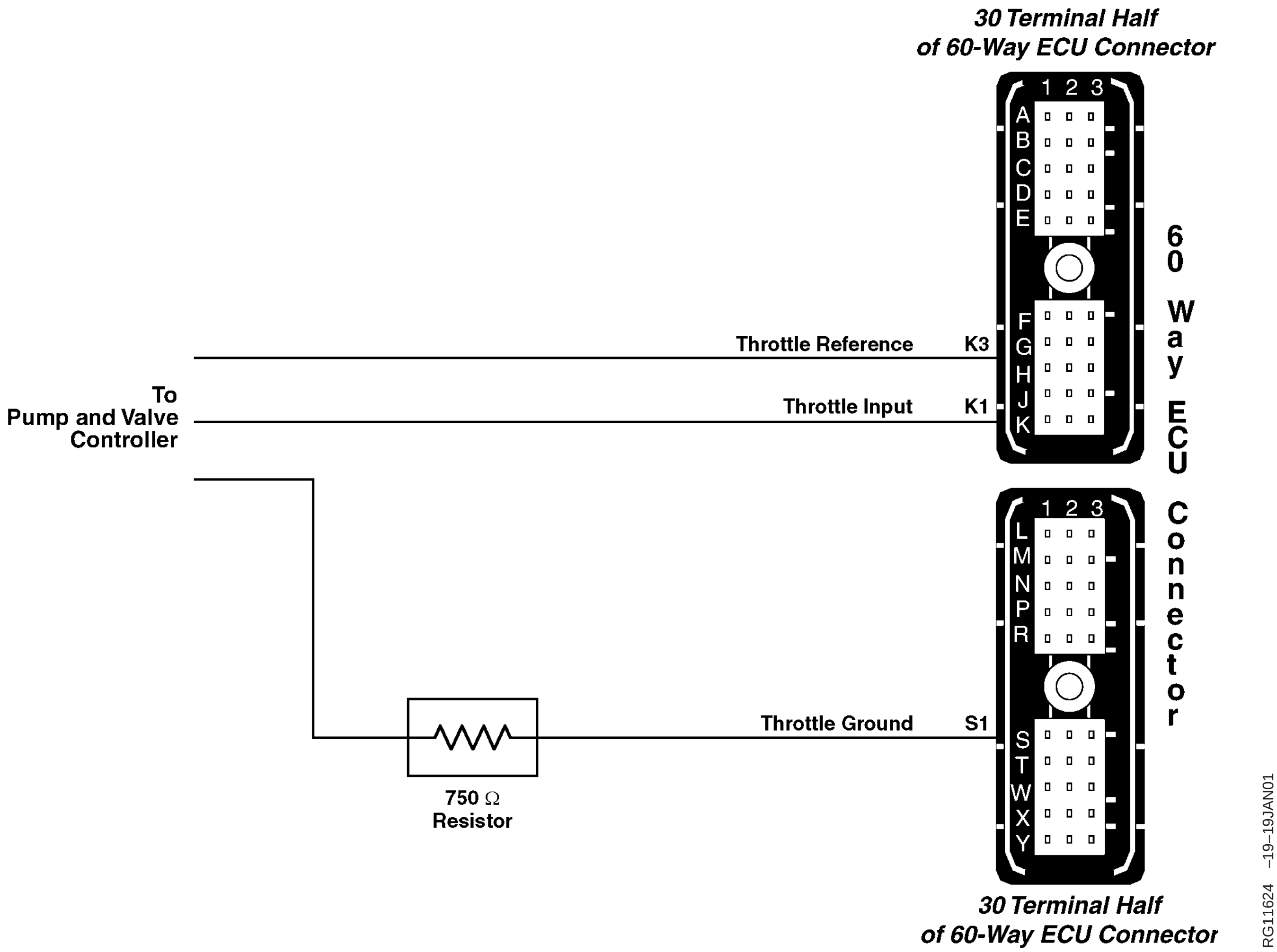
T16 - Excavator Throttle Input Voltage Low



NOTE: Wiring schematic limited representation of the Excavator Throttle wiring. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

450C LC Excavator Throttle

- The 450C LC 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 only allow idle engine speed.

RG40854,0000009 –19–15APR02–1/1

T16 - Excavator Throttle Input Voltage Low

OUO1004,0000C8A –19–15APR02–1/1

T16 - Excavator Throttle Input Voltage Low Diagnostic Procedure

– – –1/1

❶ **Connection 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, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs with: • Ignition ON, engine OFF • Ignition ON, engine running *NOTE: If DTCs SPN 29 FMI 3 or SPN 29 FMI 4 are active, follow those DTCs first.*	**SPN 91 FMI 4 reoccurs when engine is off and running:** GO TO ❸ **SPN 91 FMI 4 reoccurs only when engine is running:** GO TO ❹ **SPN 91 FMI 4 doesn’t reoccur:** Problem is intermittent. If 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 information, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information* 1. Ignition OFF 2. Disconnect ECU 60-way connector 3. Using a multimeter, measure voltage between terminal K1 in the harness end of the 60-way ECU connector ***and*** the ground stud 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 connector OR Faulty Pump and Valve controller – – –1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation information, see T16 - EXCAVATOR THROTTLE INPUT 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

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.

RG41221,0000102 –19–06MAR03–1/1

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

RG41221,00000E2 –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

RG41221,00000E3 –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
Loader	T3 - Analog Throttle (A) Input High
Marine	T5 - Analog Throttle (B) Input High
OEM	T3 - Analog Throttle (A) Input High

RG41221,00000E4 –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
Loader	T4 - Analog Throttle (A) Input Low
Marine	T6 - Analog Throttle (B) Input Low
OEM	T4 - Analog Throttle (A) Input Low

RG41221,00000E5 –19–22JAN03–1/1

000091.03 — Throttle Voltage High

Throttle voltage is above the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure earlier in this Group.

Application	Diagnostic Procedure
Excavator	T15 - Excavator Throttle Input Voltage High
Loader	T8 - PWM Throttle Input High
Marine	T3 - Analog Throttle (A) Input High
OEM	T1 - Multi-state Throttle Input High
Self Propelled Forage Harvester	T3 - Analog Throttle (A) Input High
Tractor	T8 - PWM Throttle Input High

RG41221,00000E6 –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
Excavator	T16 - Excavator Throttle Input Voltage Low
Loader	T9 - PWM Throttle Input Low
Marine	T4 - Analog Throttle (A) Input Low
OEM	T2 - Multi-state Throttle Input Low
Self Propelled Forage Harvester	T4 - Analog Throttle (A) Input Low
Tractor	T9 - PWM Throttle Input Low

RG41221,00000E7 –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
Loader	T10 - PWM Throttle Abnormal Pulse Width
Tractor	T10 - PWM Throttle Abnormal Pulse Width

RG41221,00000E8 –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
Loader	T7 - CAN Throttle Invalid

RG41221,00000E9 –19–22JAN03–1/1

000091.14 — Throttle Voltage Out of Range

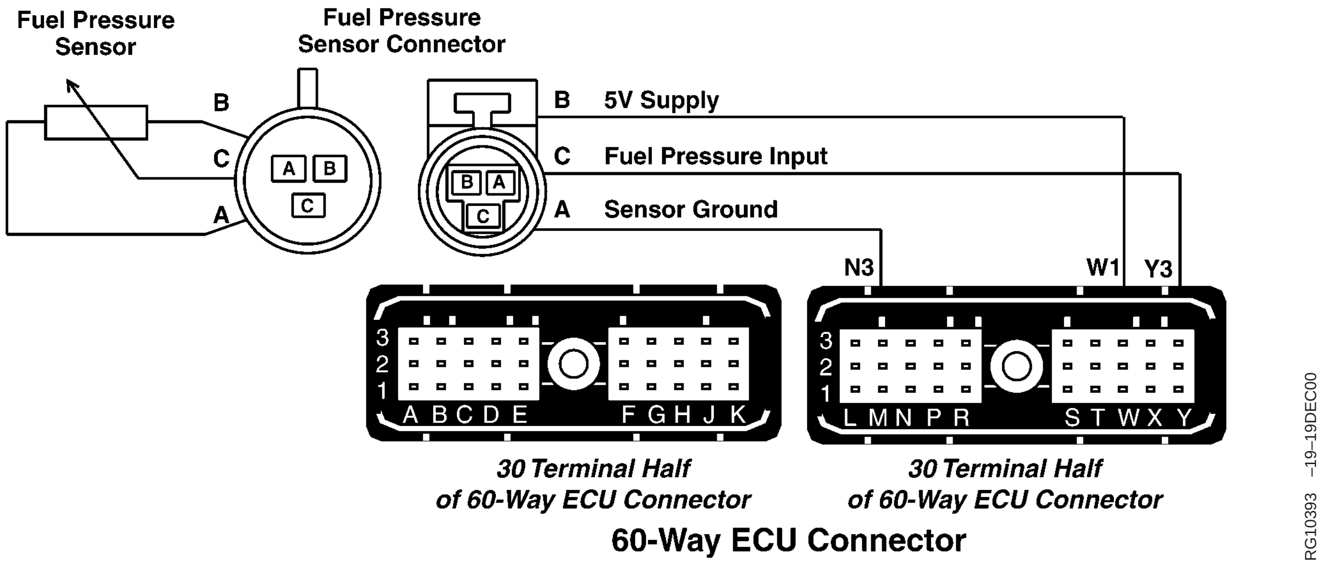
Throttle voltage is above or below the specification.

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
Loader	T22 - Analog Throttle (A) Input Voltage Out of Range

RG41221,0000101 –19–06MAR03–1/1

000094.01 — Fuel Supply Pressure Extremely Low



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NOTE: *Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

Fuel Pressure Sensor

- The fuel pressure sensor uses a pressure transducer to measure the fuel pressure before the transfer pump. It is located in a fuel manifold behind the fuel filter. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel sensor information, see MEASURING PRESSURE in Section 03, Group 140.

DTC 000094.01 will set if:

- The fuel pressure goes below the extremely low fuel pressure specification at a given engine speed.
  – For OEM applications, the extremely low fuel pressure specification is 200 kPa (29 psi) (2 bar) at any engine speed.
  – For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the extremely low fuel pressure specification.

If DTC 000094.01 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of 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 of this manual.

DPSG,RG40854,300 –19–21NOV00–1/1

000094.01 — Fuel Supply Pressure Extremely Low

The fuel pressure goes below the extremely low fuel pressure specification at a given engine speed.

OUO1004,0000C8C –19–08JAN01–1/1

000094.01 Fuel Supply Pressure Extremely Low Diagnostic Procedure

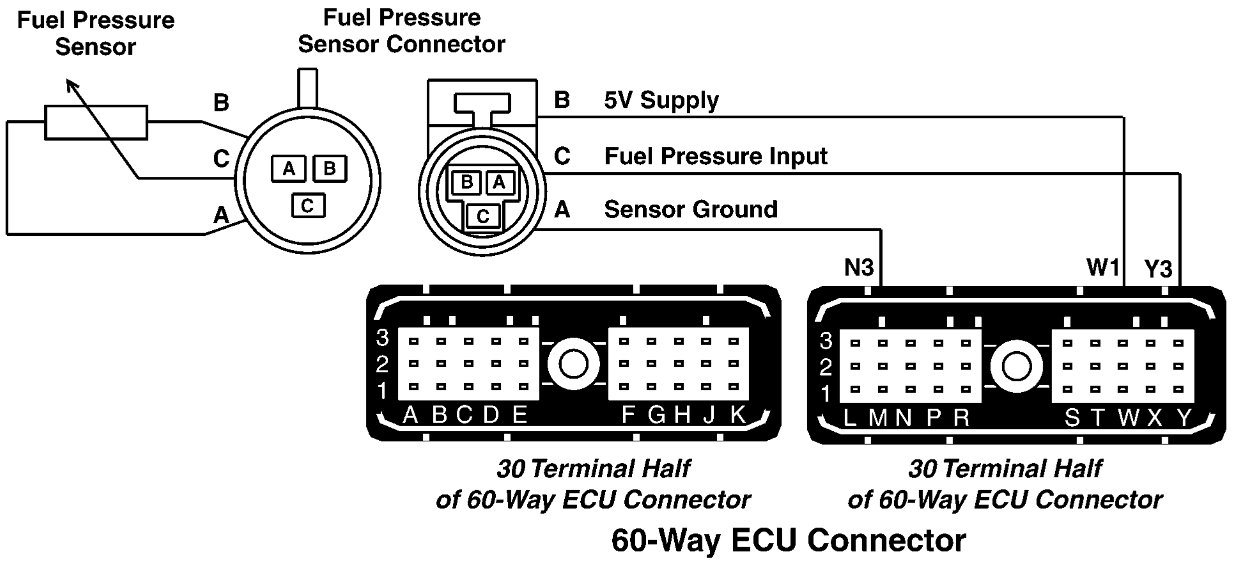
– – –1/1

❶ **DTC 000094.01 - Preliminary Test**	Before using this diagnostic procedure, check for the following that could cause or be mistaken as low fuel pressure: 1. If fuel system has been recently opened (filter changed, line removed etc.), check affected o-rings on fitting and filter for air leaks. 2. If no leaks detected, perform fuel system bleed procedure. See BLEED SINGLE RAIL FUEL SYSTEM in Group 150 and retest. 3. Check fuel quantity. 4. Check for ruptured fuel line.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest. – – –1/1

❷ **Connection 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 000094.01 FUEL SUPPLY PRESSURE EXTREMELY LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector and the fuel pressure sensor connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s) – – –1/1

❸ **Fuel Supply Pressure Test**	*NOTE: For wiring and theory of operation information, see DTC 000094.01 FUEL SUPPLY PRESSURE EXTREMELY LOW supporting information.* 1. Connect a 0-1000 kPa (0-150 psi) gauge to the quick disconnect after removing the dust cap and cleaning the quick disconnect. 2. Start engine and check fuel pressure at idle and at rated speed. If engine won't start, check fuel pressure while cranking. See CHECK SINGLE RAIL FUEL SUPPLY PRESSURE in Group 150. **Fuel Pressure Specifications:** • Cranking: 135-175 kPa (20-25 psi) • Idle: 410-555 kPa (60-80 psi) • Rated speed: 480-620 kPa (70-90 psi)	**Fuel pressure below specification for any condition:** Check fuel system for low supply pressure. See CHECK SINGLE RAIL FUEL SUPPLY PRESSURE in Group 150. **Fuel Pressure within specification for ALL conditions:** Verify that fuel pressure sensor 5 V supply, input, and ground circuits are OK. If fuel pressure sensor circuits are OK, replace fuel pressure sensor and retest. – – –1/1

000094.03 — Fuel Supply Pressure Input Voltage High



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NOTE: *Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

Fuel Pressure Sensor

- The fuel pressure sensor uses a pressure transducer to measure the fuel pressure before the transfer pump. It is located in a fuel manifold behind the fuel filter. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel sensor information, see MEASURING PRESSURE in Section 03, Group 140.

DTC 000094.03 will set if:

- The fuel pressure input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for fuel pressure.
  – For OEM applications, the high fuel pressure input voltage specification is 4.7 volts.
  – For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high fuel pressure input voltage specification.

If DTC 000094.03 sets, the following will occur:

- ECU's fuel pressure engine protection feature disabled.

DPSG,RG40854,301 –19–15APR02–1/1

000094.03 — Fuel Supply Pressure Input Voltage High

The fuel pressure input voltage exceeds the sensor's high voltage specification.

OUO1004,0000C8D –19–15APR02–1/1

000094.03 Fuel Supply Pressure Input Voltage High Diagnostic Procedure

– – –1/1

❶ **Connection 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 000094.03 FUEL SUPPLY PRESSURE INPUT VOLTAGE HIGH supporting information* Perform a preliminary inspection of the 60-way ECU connector, the fuel pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000094.03 FUEL SUPPLY PRESSURE INPUT VOLTAGE HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Ignition ON, engine running allowing engine to warm up. 5. Read the fuel pressure voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the high fuel pressure input voltage specification is 4.7V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.7 V or greater:** GO TO ❸ **Below 4.7 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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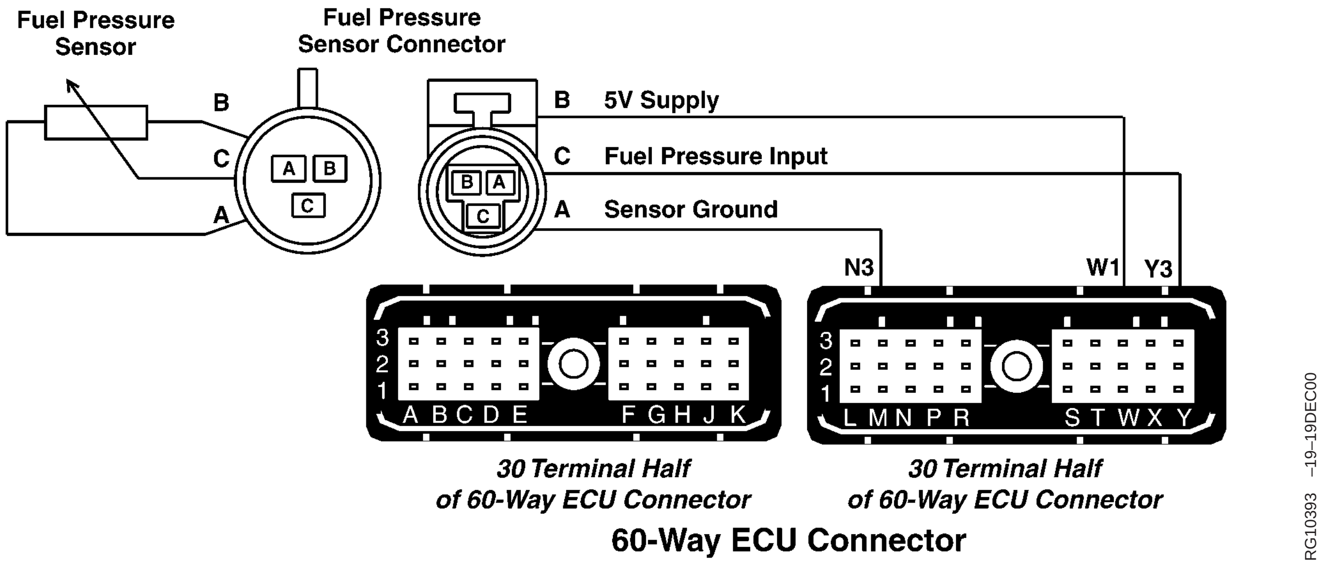
❸ **Fuel Pressure Signal Shorted Test**	*NOTE: For wiring and theory of operation information, see DTC 000094.03 FUEL SUPPLY PRESSURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect fuel pressure sensor connector 3. Ignition ON, engine OFF 4. Read the fuel pressure voltage parameter *NOTE: For OEM applications, the low fuel pressure input voltage specification is 0.3V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 0.3 V:** GO TO ❹ **0.3 V or greater:** Short to voltage in fuel pressure sensor signal circuit OR Faulty ECU – – –1/1

❹ **Fuel Pressure Ground Circuit Open Test**	*NOTE: For wiring and theory of operation information, see DTC 000094.03 FUEL SUPPLY PRESSURE INPUT VOLTAGE HIGH supporting information* Probe fuel pressure sensor ground (Terminal A) in sensor harness connector with a test light connected to battery voltage	**Light ON:** Faulty fuel pressure sensor OR Faulty ECU connection OR Faulty ECU **Light OFF:** Open in fuel pressure sensor ground circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

000094.04 — Fuel Supply Pressure Input Voltage Low



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NOTE: Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Fuel Pressure Sensor

- The fuel pressure sensor uses a pressure transducer to measure the fuel pressure before the transfer pump. It is located in a fuel manifold behind the fuel filter. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel sensor information, see MEASURING PRESSURE in Section 03, Group 140.

DTC 000094.04 will set if:

- The fuel pressure input voltage drops below the sensor's low voltage specification. The voltage is lower than what is physically possible for fuel pressure.
  – For OEM applications, the low fuel pressure input voltage specification is 0.3 volts.
  – For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low fuel pressure input voltage specification.

If DTC 000094.04 sets, the following will occur:

- ECU's fuel pressure engine protection feature disabled.

DPSG,RG40854,302 –19–15APR02–1/1

000094.04 — Fuel Supply Pressure Input Voltage Low

The fuel pressure input voltage drops below the sensor's low voltage specification.

OUO1004,0000C8E –19–15APR02–1/1

000094.04 Fuel Supply Pressure Input Voltage Low Diagnostic Procedure

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❶ **Connection 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 000094.04 FUEL SUPPLY PRESSURE INPUT VOLTAGE LOW supporting information* Perform a preliminary inspection of the ECU connector, the fuel pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000094.04 FUEL SUPPLY PRESSURE INPUT VOLTAGE LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Ignition ON, engine running allowing engine to warm up. 5. Read the fuel pressure voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the low fuel pressure input voltage specification is 0.3V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or less:** GO TO ❸ **Above 0.3 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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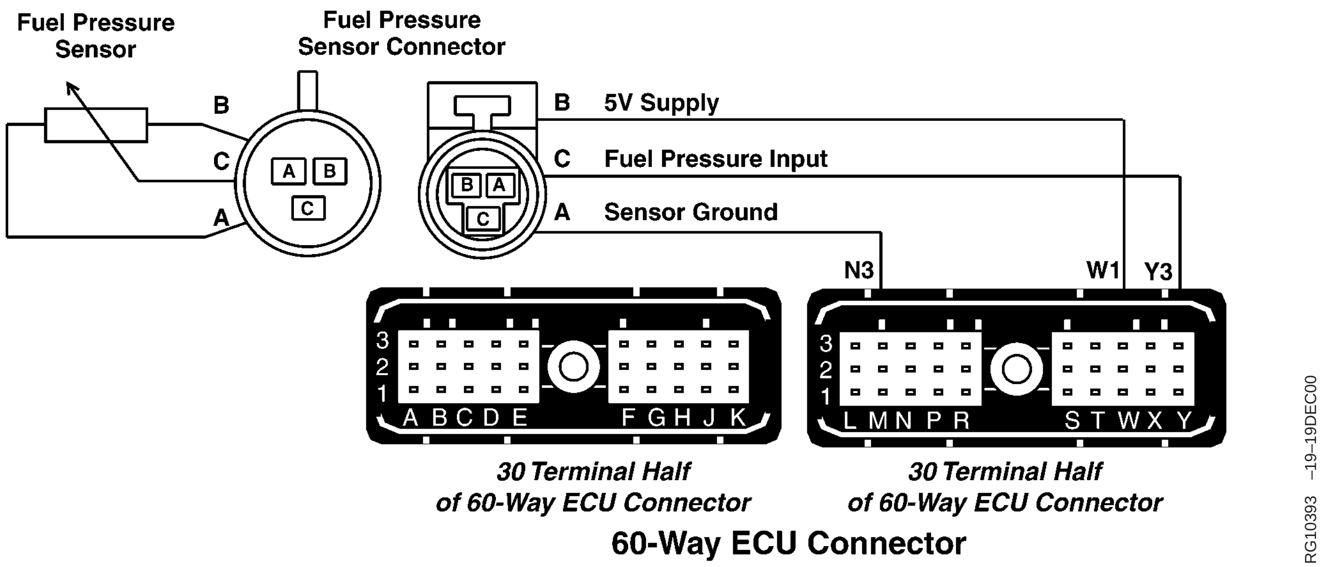
❸ **Fuel Pressure Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000094.04 FUEL SUPPLY PRESSURE INPUT VOLTAGE LOW supporting information* 1. Ignition OFF 2. Disconnect fuel pressure sensor connector 3. Install a jumper wire between terminal B and terminal C in fuel pressure sensor harness connector 4. Ignition ON, engine OFF 5. Read the fuel pressure voltage parameter in the diagnostic software *NOTE: For OEM applications, the high fuel pressure input voltage specification is 4.7V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.7 V:** GO TO ❹ **4.7 V or greater:** Faulty fuel pressure sensor connection OR Faulty fuel pressure sensor – – –1/1

❹ **Fuel Pressure 5 V Supply Test**	*NOTE: For wiring and theory of operation information, see DTC 000094.04 FUEL SUPPLY PRESSURE INPUT VOLTAGE LOW supporting information* 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between fuel pressure sensor 5 V supply terminal (Terminal B) in sensor harness connector and a good chassis ground	**4.0 - 6.0 V:** Open in fuel pressure sensor input circuit OR Short to ground in fuel pressure sensor input circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in fuel pressure sensor 5 V supply circuit OR Short to ground in fuel pressure sensor 5 V supply circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

000094.16 — Fuel Supply Pressure Moderately High



NOTE: *Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

Fuel Pressure Sensor

- The fuel pressure sensor uses a pressure transducer to measure the fuel pressure before the transfer pump. It is located in a fuel manifold behind the fuel filter. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel sensor information, see MEASURING PRESSURE in Section 03, Group 140.

DTC 000094.16 will set if:

- The ECU senses a fuel pressure above the warning value set point in the ECU. The warning value set point is dependent of engine speed.

If DTC 000094.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  – With Shutdown Feature: No shutdown available for this code.
  – 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 of this manual.

DPSG,RG40854,303 –19–15APR02–1/1

000094.16 — Fuel Supply Pressure Moderately High

The ECU senses a fuel pressure above the warning value set point in the ECU.

OUO1004,0000C8F –19–15APR02–1/1

000094.16 Fuel Supply Pressure Moderately High Diagnostic Procedure

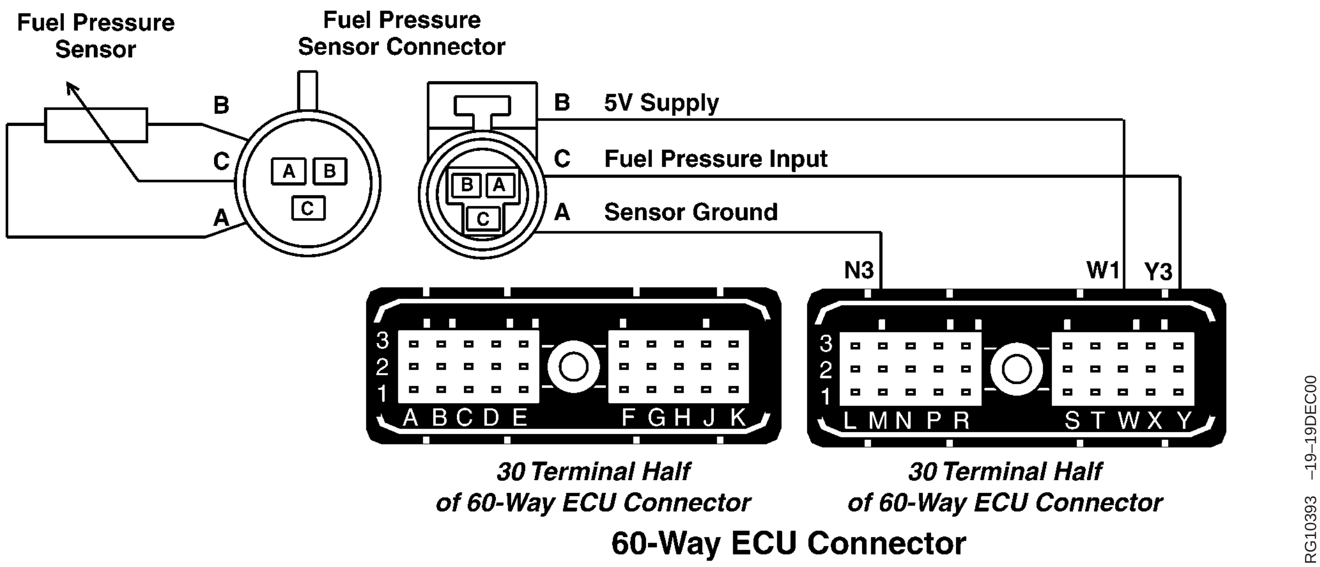
– – –1/1

➊ **Connection 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 000094.16 FUEL SUPPLY PRESSURE MODERATELY HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector and the fuel pressure sensor connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ➋ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Fuel Supply Pressure Test**	*NOTE: For wiring and theory of operation information, see DTC 000094.16 FUEL SUPPLY PRESSURE MODERATELY HIGH supporting information* 1. Connect a 0-1000 kPa (0-150 psi) gauge to the quick connect after removing the dust cap and cleaning the quick connect. 2. Start engine and check fuel pressure at idle and at rated speed. 3. If engine won't start, check fuel pressure while cranking. See CHECK SINGLE RAIL FUEL SUPPLY PRESSURE in Group 150.	**Above 410-480 kPa (60-70 psi) @ idle; 500-600 kPa (70-90 psi) @ rated speed:** Faulty high pressure regulating valve **Below 410-555 kPa (60-80 psi) @ idle; 480-620 kPa (70-90 psi) @ rated speed:** Plugged 100 micron internal housing screen **410-555 kPa (60-80 psi) @ idle; 480-620 kPa (70-90 psi) @ rated speed:** Verify that fuel pressure sensor 5 V supply, input, and ground circuits are OK. If fuel pressure sensor circuits are OK, replace fuel pressure sensor and retest – – –1/1

000094.18 — Fuel Supply Pressure Moderately Low



NOTE: Wiring schematic shows OEM engine applications only. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Fuel Pressure Sensor

- The fuel pressure sensor uses a pressure transducer to measure the fuel pressure before the transfer pump. It is located in a fuel manifold behind the fuel filter. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel sensor information, see MEASURING PRESSURE in Section 03, Group 140.

DTC 000094.18 will set if:

- The fuel pressure goes below the moderately low fuel pressure specification at a given engine speed.
  - For OEM applications, the extremely low fuel pressure specification is 300 kPa (43.5 psi) (3 bar) at any engine speed.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the moderately low fuel pressure specification.

If DTC 000094.18 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of 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 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 of this manual.

DPSG,RG40854,304 –19–15APR02–1/1

000094.18 — Fuel Supply Pressure Moderately Low

The fuel pressure goes below the moderately low fuel pressure specification at a given engine speed.

OUO1004,0000C90 –19–15APR02–1/1

000094.18 Fuel Supply Pressure Moderately Low Diagnostic Procedure

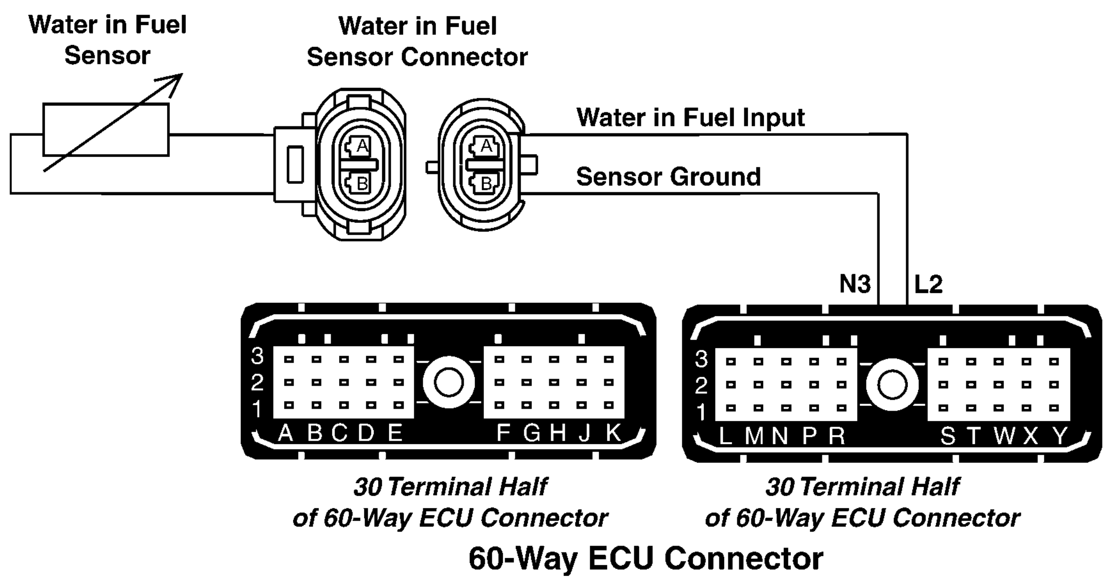
– – –1/1

❶ **DTC 000094.18 - Preliminary Test**	Before using this diagnostic procedure, check for the following that could cause or be mistaken as low fuel pressure: 1. If fuel system has been recently opened (filter changed, line removed etc.), check affected o-rings on fitting and filter for air leaks. 2. If no leaks detected, perform fuel system bleed procedure. See BLEED SINGLE RAIL FUEL SYSTEM in Group 150 and retest. 3. Check fuel quantity 4. Check for ruptured fuel line	**No problem found:** GO TO ❷ **Problem found:** Repair and retest. – – –1/1

❷ **Connection 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 000094.18 FUEL SUPPLY PRESSURE MODERATELY LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector and the fuel pressure sensor connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s) – – –1/1

❸ **Fuel Supply Pressure Test**	*NOTE: For wiring and theory of operation information, see DTC 000094.18 FUEL SUPPLY PRESSURE MODERATELY LOW supporting information* 1. Connect a 0-1000 kPa (0-150 psi) gauge to the quick connect after removing the dust cap and cleaning the quick connect. 2. Start engine and check fuel pressure at idle and at rated speed. If engine won’t start, check fuel pressure while cranking. See CHECK SINGLE RAIL FUEL SUPPLY PRESSURE in Group 150. **Fuel Pressure Specifications:** • Cranking: 135-175 kPa (20-25 psi) • Idle: 410-555 kPa (60-80 psi) • Rated speed: 480-620 kPa (70-90 psi)	**Fuel pressure below specification for any condition:** Check fuel system for low supply pressure. See CHECK SINGLE RAIL FUEL SUPPLY PRESSURE in Group 150. **Fuel Pressure within specification for ALL conditions:** Verify that fuel pressure sensor 5 V supply, input, and ground circuits are OK. If fuel pressure sensor circuits are OK, replace fuel pressure sensor and retest. – – –1/1

000097.00 — Water in Fuel Continuously Detected



04
160
,146

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, the water in fuel sensor will read a lower voltage when water is present than when it is not present. For further WIF sensor information, see WATER IN FUEL SENSOR in Section 03, Group 140.

DTC 000097.00 will set if:

- The WIF 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 PROTECTION in Section 03, Group 140 of 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 of this manual.

DPSG,RG40854,305 –19–15APR02–1/1

000097.00 — Water in Fuel Continuously Detected

The WIF is above a predetermined quantity for an extended period of time.

OUO1004,0000C91 –19–15APR02–1/1

000097.00 Water in Fuel Continuously Detected Diagnostic Procedure

– – –1/1

❶ **Moisture Buildup Test**	1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition OFF 3. Drain sediment bowl on the bottom of the primary fuel filter until all the water is out 4. Ignition ON, engine OFF 5. Start ECU communication software 6. Operate engine in normal use 7. Read DTCs using DST or SERVICE ADVISOR™.	**000097.00 reoccurs:** GO TO ❷ **000097.00 doesn't reoccur:** Problem is was most likely caused by moisture build up over time. Monitor the sediment bowl for moisture periodically, drain as needed.

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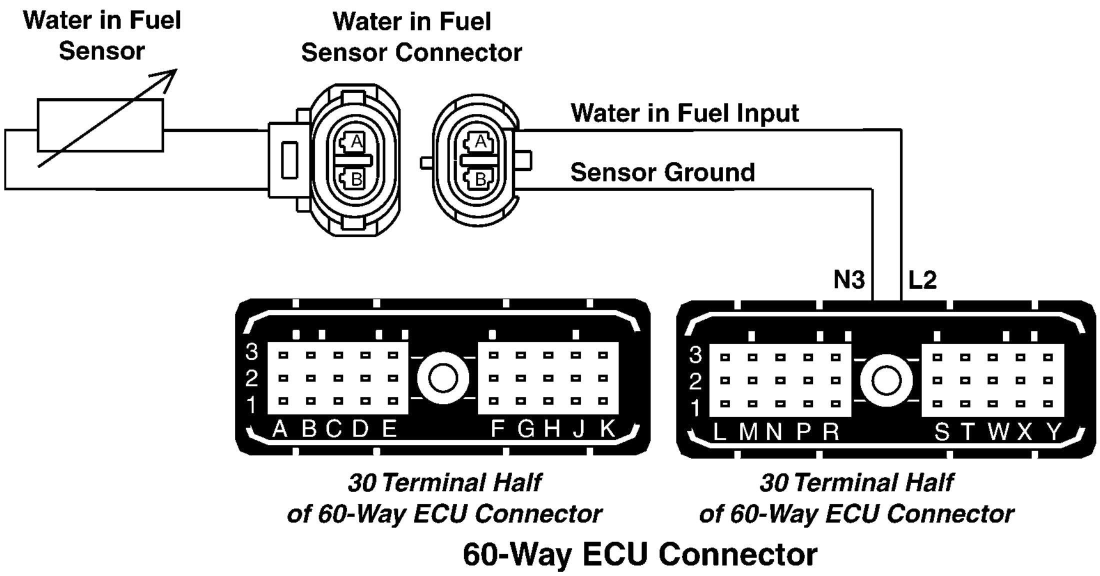
❷ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information.* Perform a preliminary inspection of the 60-way ECU connector and the water in fuel sensor connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❸ **Water in Fuel (WIF) Circuit and Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information* Check the following items that can cause water in the fuel: • Poor fuel quality or water in fuel storage tank • Loose fuel tank cap • Missing or damaged fuel tank cap seal • Excessive condensation build up in fuel tank • Loose or damaged fuel filter or sediment bowl	**Cause of water in fuel located:** Repair problem, drain sediment bowl, and retest **No cause of water in fuel located:** Verify that WIF sensor input and ground circuits are OK. If WIF sensor circuits are OK, replace WIF sensor and retest – – –1/1

000097.03 — Water in Fuel Signal Voltage High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, the water in fuel sensor will read a lower voltage when water is present than when it is not present. For further WIF sensor information, see WATER IN FUEL SENSOR in Section 03, Group 140.

DTC 000097.03 will set if:

- The water in fuel input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for water in fuel.
  – For OEM applications, the water in fuel input voltage specification is 4.8 volts.
  – For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high water in fuel voltage specification.

If DTC 000097.03 sets, the following will occur:

- ECU's WIF engine protection feature disabled.

DPSG,RG40854,306 –19–15APR02–1/1

000097.03 — Water in Fuel Signal Voltage High

The water in fuel input voltage exceeds the sensor's high voltage specification.

OUO1004,0000C92 –19–15APR02–1/1

000097.03 Water in Fuel Signal Voltage High Diagnostic Procedure

– – –1/1

❶ **Connection 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 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the water in fuel sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine OFF 7. Read DTCs	**000097.03 reoccurs:** GO TO ❸ **000097.03 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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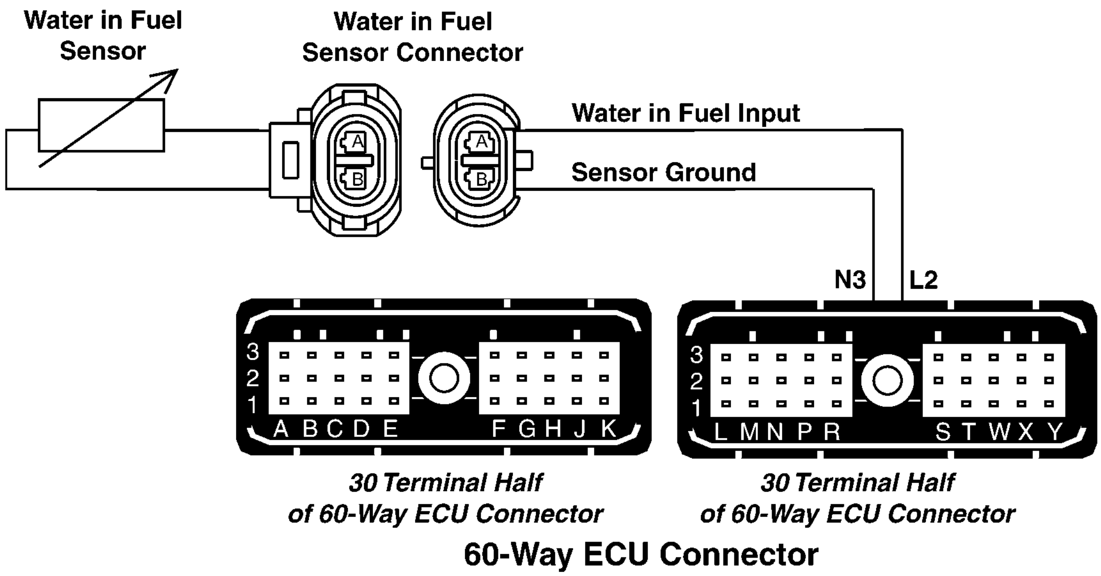
❸ **Water in Fuel (WIF) Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect WIF sensor connector 3. Install a jumper wire between both terminals in the WIF sensor harness connector 4. Make note of all DTCs, then clear all DTCs 5. Ignition ON, engine OFF 6. Read DTCs	**000097.03 reoccurs:** GO TO ❹ **000097.04 occurs:** Faulty WIF sensor connector OR Faulty WIF sensor – – –1/1

❹ **Water in Fuel (WIF) Input Open Test**	*NOTE: For wiring and theory of operation information, see DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Remove jumper wire between both terminals 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between WIF sensor harness connector input terminal and a good chassis ground	**4.0 - 6.0 V:** Open in WIF sensor ground circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in WIF sensor input circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

000097.04 — Water in Fuel Signal Voltage Low



NOTE: *Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, the water in fuel sensor will read a lower voltage when water is present than when it is not present. For further WIF sensor information, see WATER IN FUEL SENSOR in Section 03, Group 140.

DTC 000097.04 will set if:

- The water in fuel input voltage goes below the sensor's low voltage specification.
  - For OEM engine applications, the low water in fuel input voltage specification is 0.1 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low water in fuel input voltage specification.

If DTC 000097.04 sets, the following will occur:

- ECU's WIF engine protection feature disabled.

DPSG,RG40854,307 –19–16APR02–1/1

000097.04 — Water in Fuel Signal Voltage Low

The water in fuel input voltage goes below the sensor's low voltage specification.

OUO1004,0000C93 –19–16APR02–1/1

000097.04 Water in Fuel Signal Voltage Low Diagnostic Procedure

– – –1/1

❶ **Connection 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 000097.04 WATER IN FUEL SIGNAL VOLTAGE LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the water in fuel sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

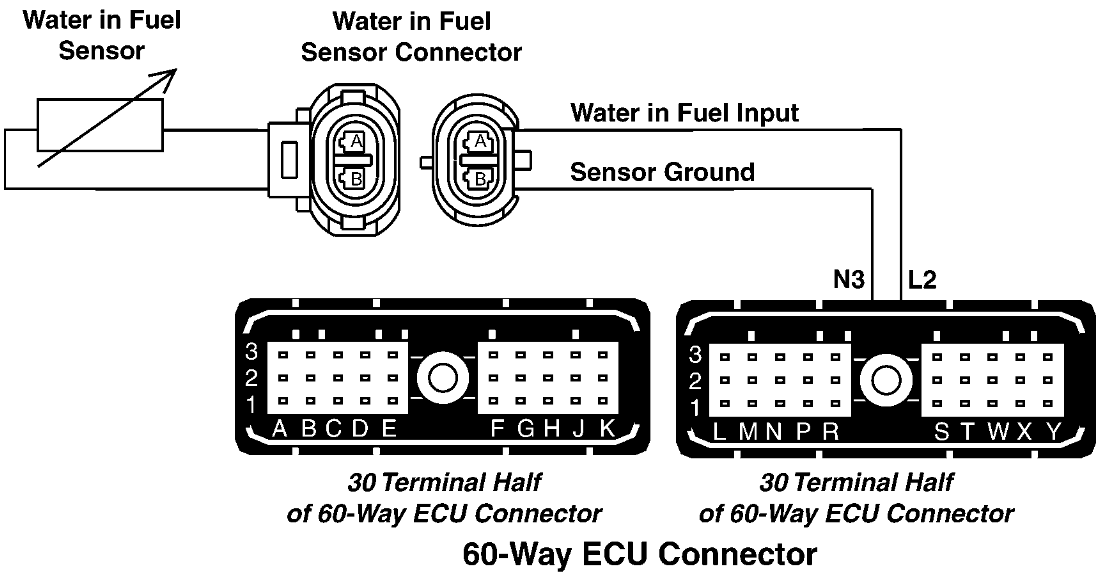
– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000097.04 WATER IN FUEL SIGNAL VOLTAGE LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine OFF 7. Read DTCs	**000097.04 reoccurs:** GO TO ❸ **000097.04 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

– – –1/1

❸ **Water in Fuel (WIF) Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000097.04 WATER IN FUEL SIGNAL VOLTAGE LOW supporting information* 1. Ignition OFF 2. Disconnect WIF sensor connector 3. Make note of all DTCs, then clear all DTCs 4. Ignition ON 5. Read DTCs	**000097.04 reoccurs:** Short to ground in WIF sensor input circuit OR Faulty ECU **000097.03 occurs:** Faulty WIF sensor – – –1/1

000097.16 — Water in Fuel Detected



RG10394 –19–19DEC00

NOTE: *Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, water in fuel sensor will read a lower voltage when water is present than when it is not present. For further WIF sensor information, see WATER IN FUEL 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 PROTECTION in Section 03, Group 140 of this manual.
  – With Shutdown Feature: No shutdown available for this code.
  – 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 of this manual.

DPSG,RG40854,308 –19–16APR02–1/1

000097.16 — Water in Fuel Detected

The WIF is above a predetermined quantity at any given time.

OUO1004,0000C94 –19–16APR02–1/1

000097.16 Water in Fuel Detected Diagnostic Procedure

– – –1/1

❶ **Moisture Buildup Test**	1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition OFF 3. Drain sediment bowl on the bottom of the primary fuel filter until all the water is out 4. Ignition ON, engine OFF 5. Start ECU communication software 6. Operate engine in normal use 7. Read DTCs using DST or SERVICE ADVISOR™.	**000097.16 reoccurs:** GO TO ❷ **000097.16 doesn't reoccur:** Problem is was most likely caused by moisture build up over time Monitor the sediment bowl for moisture periodically, drain as needed

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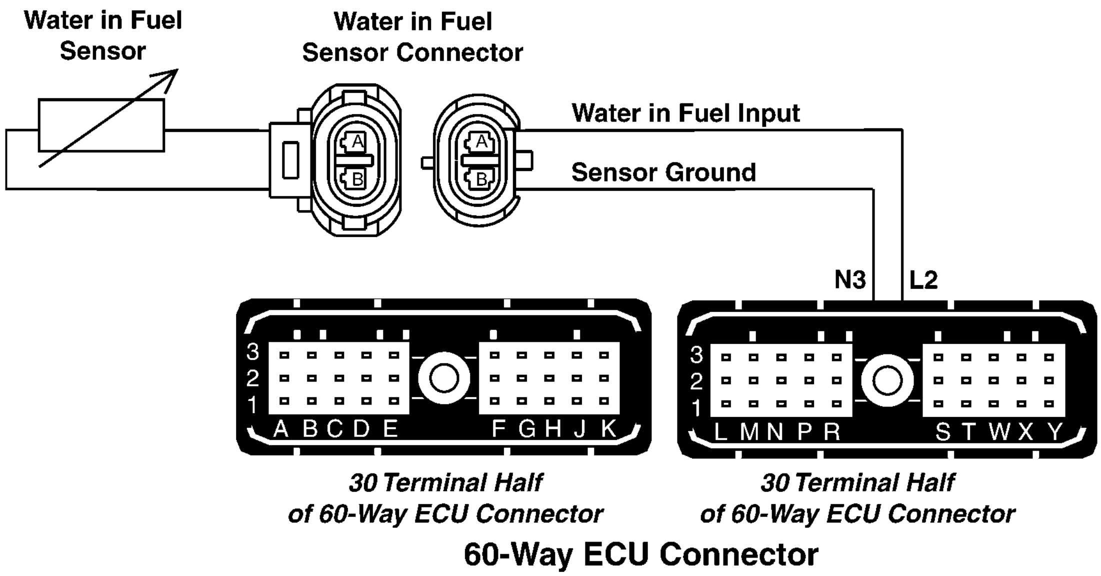
❷ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000097.16 WATER IN FUEL DETECTED supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the water in fuel sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❸ **Water in Fuel (WIF) Circuit and Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000097.16 WATER IN FUEL DETECTED supporting information* Check the following items that can cause water in the fuel: • Poor fuel quality or water in fuel storage tank • Loose fuel tank cap • Missing or damaged fuel tank cap seal • Excessive condensation build up in fuel tank • Loose or damaged fuel filter or sediment bowl	**Cause of water in fuel located:** Repair problem, drain sediment bowl, and retest **No cause of water in fuel located:** Verify that WIF sensor input and ground circuits are OK. If WIF sensor circuits are OK, replace WIF sensor and retest – – –1/1

000097.31 — Water in Fuel Detected



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, the water in fuel sensor will read a lower voltage when water is present than when it is not present. For further WIF sensor information, see WATER IN FUEL SENSOR in Section 03, Group 140.

DTC 000097.31 will set if:

- The WIF is above a predetermined quantity at a given time.

If DTC 000097.31 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: No shutdown available for this code.
  - 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 of this manual.

DPSG,RG40854,309 –19–16APR02–1/1

000097.31 — Water in Fuel Detected

The WIF is above a predetermined quantity at a given time.

OUO1004,0000C95 –19–16APR02–1/1

000097.31 Water in Fuel Detected Diagnostic Procedure

– – –1/1

❶ **Moisture Buildup Test**	1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition OFF 3. Drain sediment bowl on the bottom of the primary fuel filter until all the water is out 4. Ignition ON, engine OFF 5. Start ECU communication software 6. Operate engine in normal use 7. Read DTCs using DST or SERVICE ADVISOR™.	**000097.31 reoccurs:** GO TO ❷ **000097.31 doesn't reoccur:** Problem is was most likely caused by moisture build up over time Monitor the sediment bowl for moisture periodically, drain as needed

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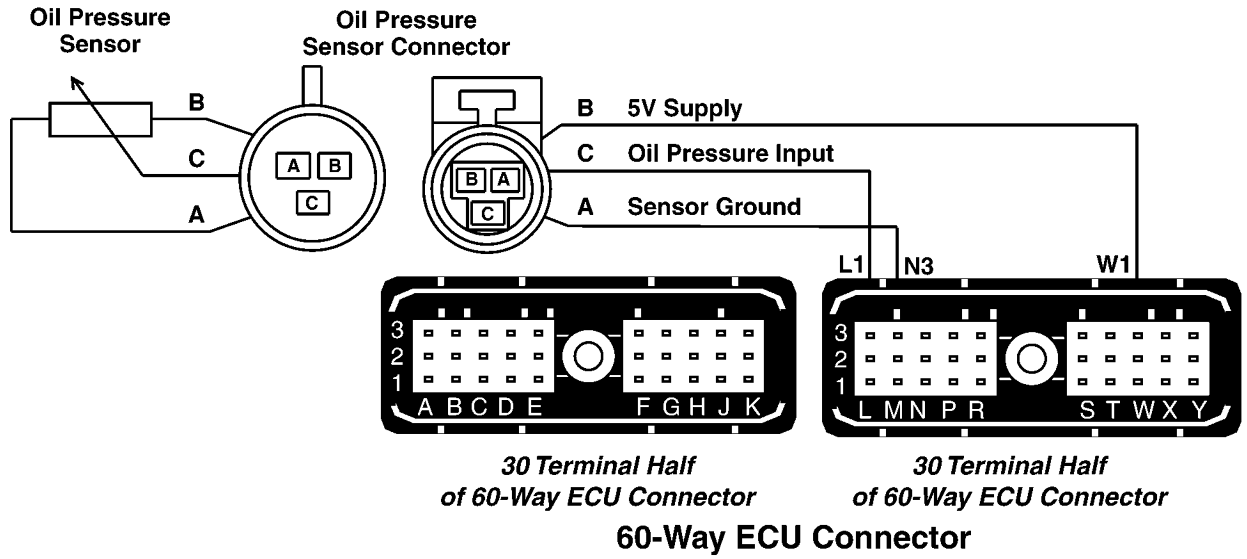
❷ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000097.31 WATER IN FUEL DETECTED supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the water in fuel sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❸ **Water in Fuel (WIF) Circuit and Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000097.31 WATER IN FUEL DETECTED supporting information* Check the following items that can cause water in the fuel: • Poor fuel quality or water in fuel storage tank • Loose fuel tank cap • Missing or damaged fuel tank cap seal • Excessive condensation build up in fuel tank • Loose or damaged fuel filter or sediment bowl	**Cause of water in fuel located:** Repair problem, drain sediment bowl, and retest **No cause of water in fuel located:** Verify that WIF sensor input and ground circuits are OK. If WIF sensor circuits are OK, replace WIF sensor and retest – – –1/1

000100.01 — Engine Oil Pressure Extremely Low



NOTE: *Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil galley 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 000100.01 will set if:

- 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.

If DTC 000100.01 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of 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 of this manual.

DPSG,RG40854,310 –19–16APR02–1/1

000100.01 — Engine Oil Pressure Extremely Low

The ECU senses an oil pressure below the shutdown value set point in the ECU.

OUO1004,0000C96 –19–16APR02–1/1

000100.01 Engine Oil Pressure Extremely Low Diagnostic Procedure

– – –1/1

❶ Connection 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 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the oil pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ Oil Pressure Test	*NOTE: For wiring and theory of operation information, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information.* Under the conditions where DTC 000100.01 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in CTM100, Section 04, Group 150.	**Oil pressure below specification:** Low oil pressure problem. See L3 - ENGINE OIL PRESSURE LOW in CTM100, Section 04, Group 150. **Oil pressure within specification:** Verify that oil pressure sensor 5 V supply, input, and ground circuits are OK. If oil pressure sensor circuits are OK, replace oil pressure sensor and retest

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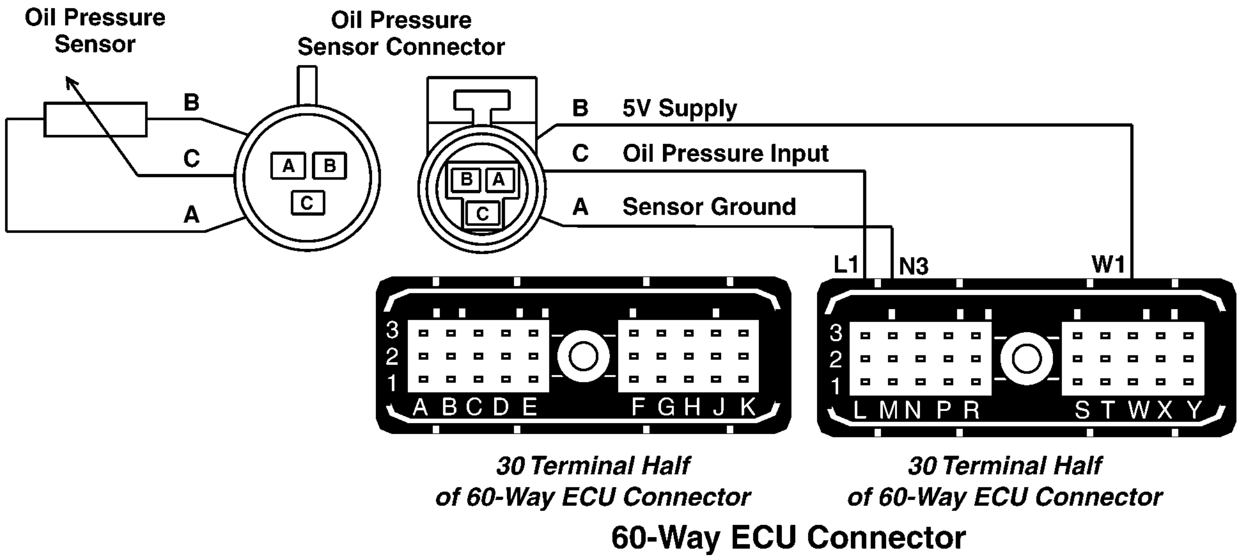
000100.03 — Engine Oil Pressure Input Voltage High



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160
,168

NOTE: *Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil galley 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 000100.03 will set if:

- The oil pressure input voltage exceeds the sensor's high voltage specification. This voltage corresponds to a pressure that is higher than what is physically possible for oil pressure.
  - For OEM engine applications, the high oil pressure input voltage specification is 4.5 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high oil pressure input voltage specification.

If DTC 000100.03 sets, the following will occur:

- ECU's low oil pressure engine protection feature disabled.

DPSG,RG40854,311 –19–16APR02–1/1

000100.03 — Engine Oil Pressure Input Voltage High

The oil pressure input voltage exceeds the sensor's high voltage specification.

OUO1004,0000C97 –19–16APR02–1/1

000100.03 Engine Oil Pressure Input Voltage High Diagnostic Procedure

– – –1/1

❶ **Connection 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 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the oil pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Ignition ON, engine running allowing engine to warm up. 5. Read the oil pressure voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the high oil pressure input voltage specification is 4.5V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.5 V or greater:** GO TO ❸ **Below 4.5 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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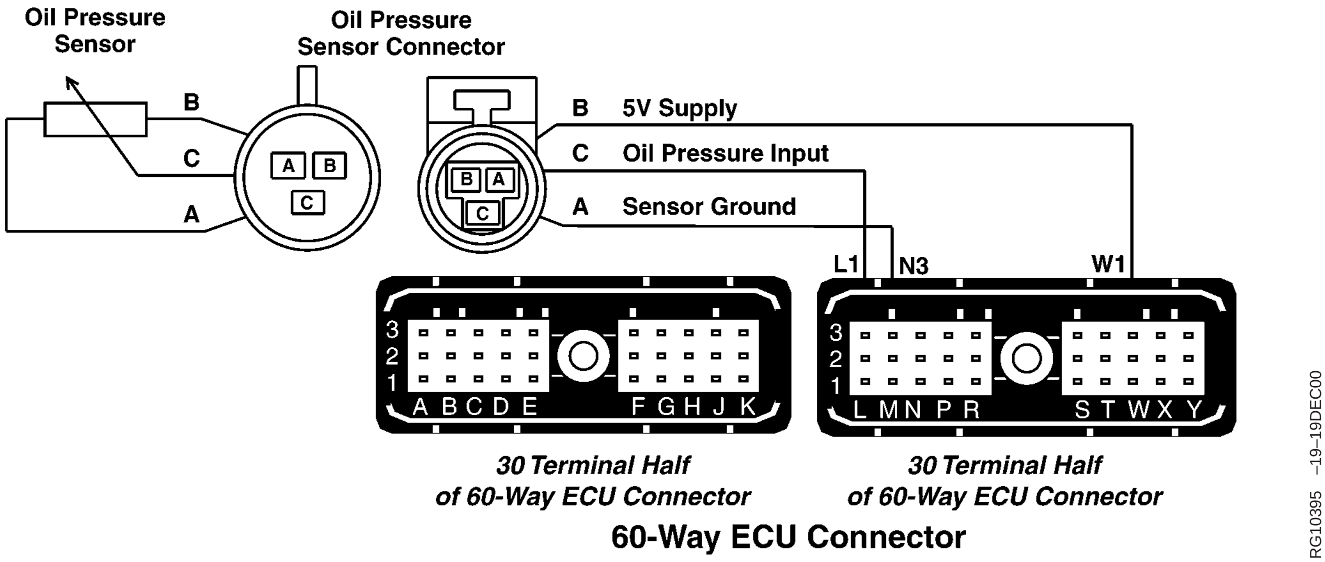
❸ **Oil Pressure Input Shorted Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect oil pressure sensor connector 3. Ignition ON, engine OFF 4. Read the oil pressure voltage parameter *NOTE: For OEM applications, the low oil pressure input voltage specification is 0.3V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 0.3 V:** GO TO ❹ **0.3 V or greater:** Short to voltage in oil pressure sensor input circuit OR Faulty ECU – – –1/1

❹ **Oil Pressure Ground Circuit Open Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.* Probe oil pressure sensor ground (Terminal A) in sensor harness connector with a test light connected to battery voltage	**Light ON:** Faulty oil pressure sensor OR Faulty ECU connection OR Faulty ECU **Light OFF:** Open in oil pressure sensor ground circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

000100.04 — Engine Oil Pressure Input Voltage Low



NOTE: *Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil galley 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 000100.04 will set if:

- The oil pressure input voltage goes below the sensor's low voltage specification. This voltage corresponds to a pressure that is lower than what is physically possible for oil pressure.
  - For OEM engine applications, the low oil pressure input voltage specification is 0.3 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low oil pressure input voltage specification.

If DTC 000100.04 sets, the following will occur:

- ECU's low oil pressure engine protection feature disabled.

DPSG,RG40854,312 –19–16APR02–1/1

000100.04 — Engine Oil Pressure Input Voltage Low

The oil pressure input voltage goes below the sensor's low voltage specification.

OUO1004,0000C98 –19–16APR02–1/1

000100.04 Engine Oil Pressure Input Voltage Low Diagnostic Procedure

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❶ **Connection 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 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the oil pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Ignition ON, engine running allowing engine to warm up. 5. Read the oil pressure voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the low oil pressure input voltage specification is 0.3V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or less:** GO TO ❸ **Above 0.3 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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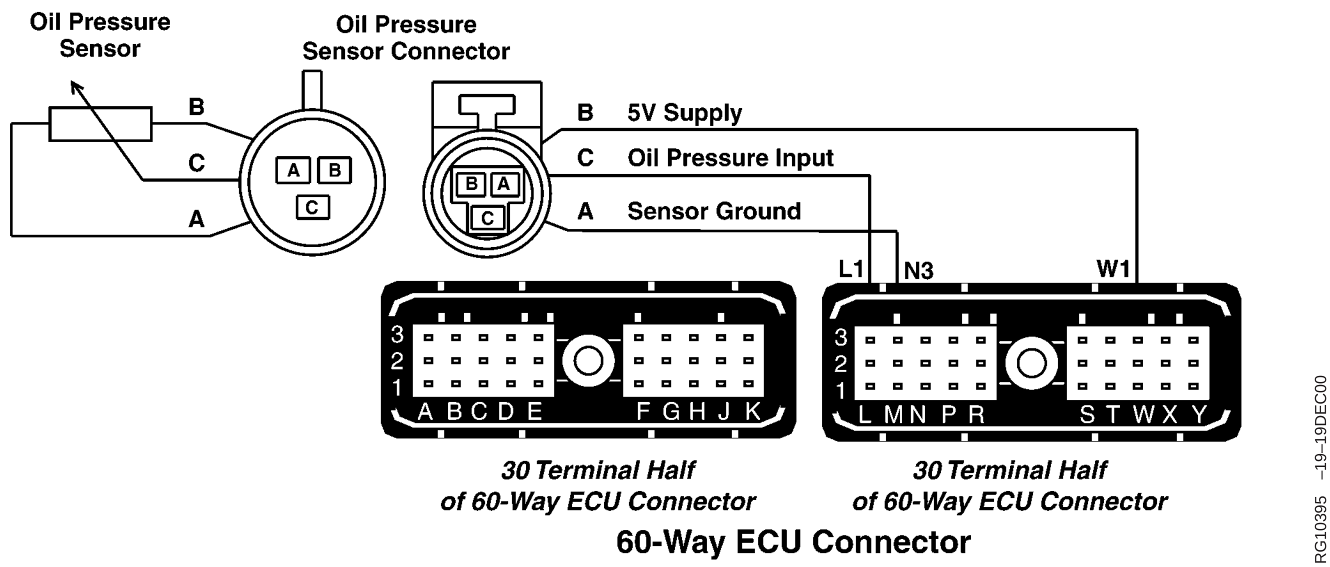
❸ **Oil Pressure Sensor and Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect oil pressure sensor connector 3. Install a jumper wire between oil pressure sensor 5 V supply and the oil pressure input terminal in sensor harness connector 4. Ignition ON, engine OFF 5. Read the oil pressure voltage parameter *NOTE: For OEM applications, the high oil pressure input voltage specification is 4.5V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.5 V:** GO TO ❹ **4.5 V or greater:** Faulty oil pressure sensor connection OR Faulty oil pressure sensor – – –1/1
❹ **Oil Pressure 5 V Supply Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between the 5 V supply (terminal B) of the oil pressure sensor harness connector and a good chassis ground	**4.0 - 6.0 V:** Open in oil pressure sensor input circuit OR Short to ground in oil pressure sensor input circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in oil pressure sensor 5 V supply circuit OR Short to ground in oil pressure sensor 5 V supply circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

000100.18 — Engine Oil Pressure Moderately Low



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil galley 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 PROTECTION in Section 03, Group 140 of this manual.
  – With Shutdown Feature: No shutdown available for this code.
  – 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 of this manual.

DPSG,RG40854,313 –19–16APR02–1/1

000100.18 — Engine Oil Pressure Moderately Low

The ECU senses an oil pressure below the warning value set point in the ECU.

OUO1004,0000C99 –19–16APR02–1/1

000100.18 Engine Oil Pressure Moderately Low Diagnostic Procedure

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❶ **Connection 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 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the oil pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Oil Pressure Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information.* Under the conditions where DTC 000100.01 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in CTM100, Section 04, Group 150.	**Oil pressure below specification:** Low oil pressure problem. See L3 - ENGINE OIL PRESSURE LOW in CTM100, Section 04, Group 150. **Oil pressure within specification:** Verify that oil pressure sensor 5 V supply, input, and ground circuits are OK. If oil pressure sensor circuits are OK, replace oil pressure sensor and retest

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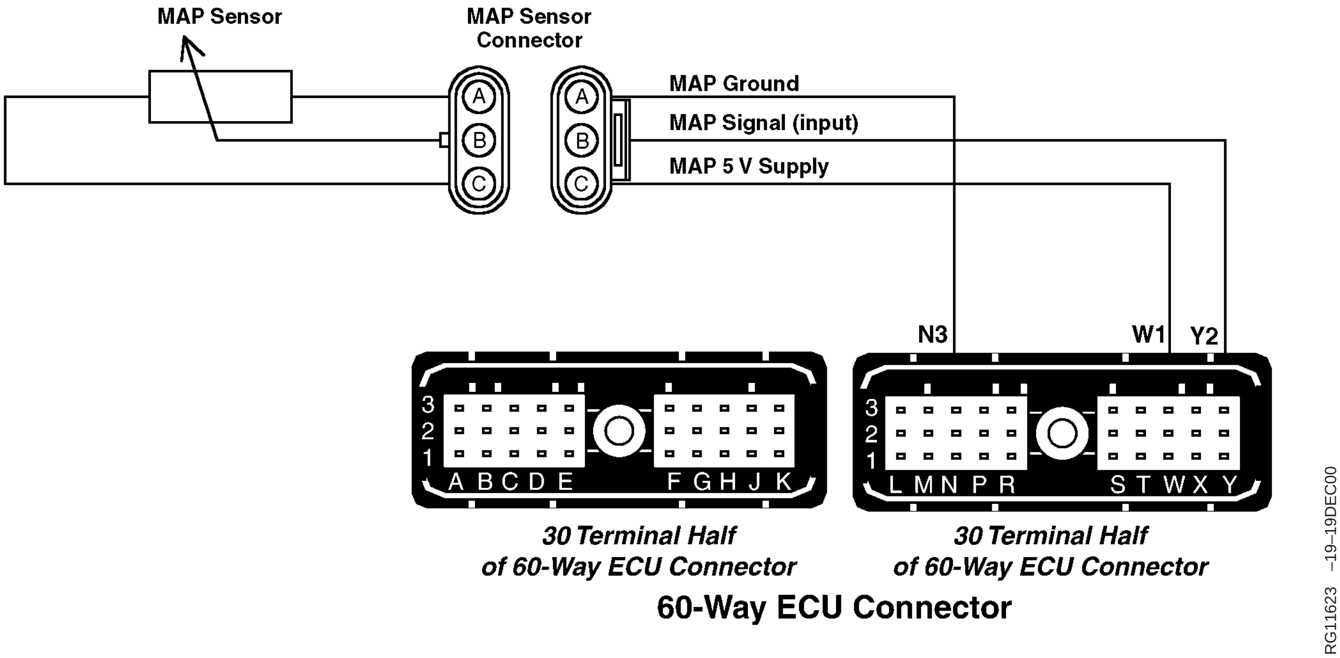
000102.03 — Manifold Air Pressure Input Voltage High



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,178

NOTE: *Wiring schematic shows Loader applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

MAP (Manifold Air Pressure) Sensor

The MAP sensor is a pressure transducer connected to intake manifold air pressure. It is used to measure the air pressure in the intake manifold. The MAP input voltage varies as intake manifold pressure varies. As pressure increases, input voltage to the ECU increases. The ECU uses the MAP sensor input in conjunction with the MAT sensor input to determine engine air flow.

DTC 000102.03 will set if:

- The manifold air pressure input voltage exceeds the sensor's high voltage specification. This voltage corresponds to a pressure that is higher than what is physically possible for manifold air pressure.
  - For OEM engine applications, the high manifold air pressure input voltage specification is 4.7 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high oil pressure input voltage specification.

If DTC 000102.03 sets, the following will occur:

- The ECU will not apply engine protection.

RG40854,0000002 –19–16APR02–1/1

000102.03 — Manifold Air Pressure Input Voltage High

The manifold air pressure input voltage exceeds the sensor's high voltage specification.

OUO1004,0000C9A –19–16APR02–1/1

000102.03 Manifold Air Pressure Input Voltage High Diagnostic Procedure

– – –1/1

❶ **DTC 000102.03 - Preliminary Check**	If engine idle is rough or unstable due to a suspected engine mechanical problem, correct the condition before continuing to use this diagnostic procedure	**Engine mechanical condition OK:** GO TO ❷

– – –1/1

❷ **Connection 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 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the manifold air pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❸ **Intermittent Fault Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Engine running 5. Read DTCs using DST or SERVICE ADVISOR™. 6. Make notes of any DTCs, then clear all DTCs 7. Ignition ON, engine idling 8. Read DTCs	**000102.03 reoccurs:** GO TO ❹ **000102.03 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

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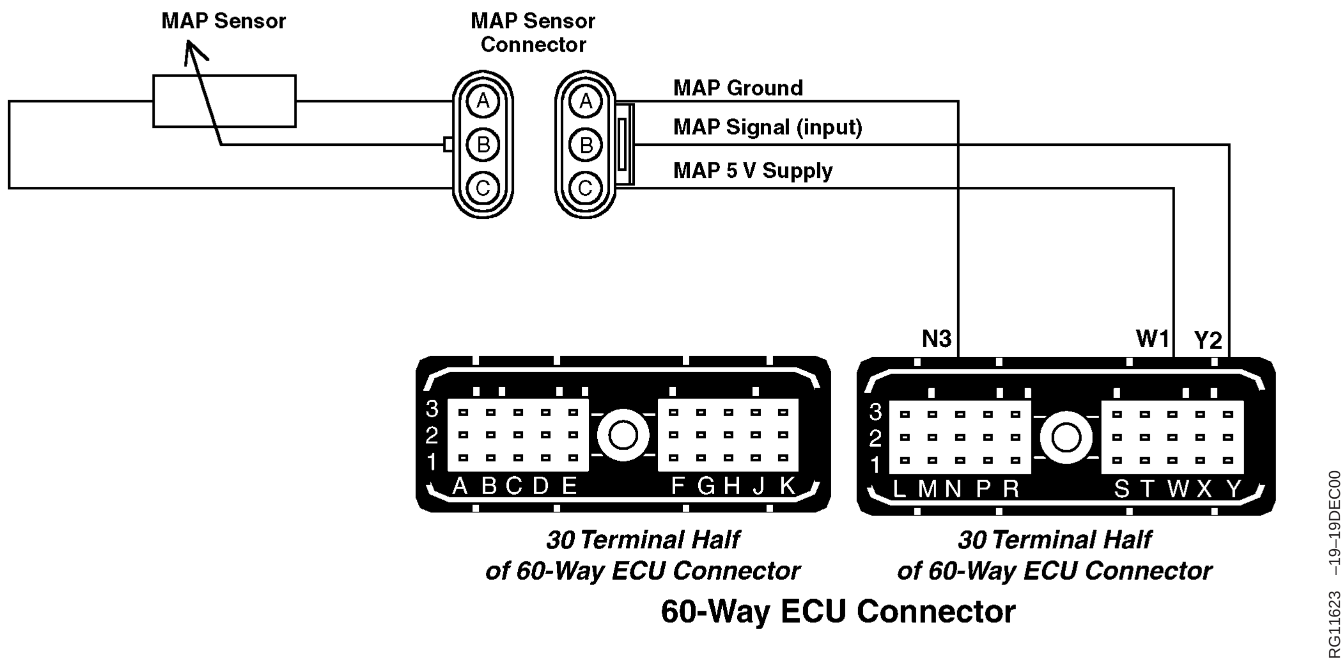
❹ **MAP Input Shorted Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect MAP sensor connector 3. Ignition ON, engine running 4. Read DTCs	**000102.04 occurs:** GO TO ❺ **000102.03 reoccurs:** Short to voltage in MAP input circuit OR Faulty ECU

– – –1/1

❺ **MAP Ground Circuit Open Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000102.03 MANIFOLD AIR PRESSURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Probe MAP ground (terminal A) in harness sensor connector with a test light connected to battery voltage	**Light ON:** Plugged or leaking MAP sensor air supply OR Faulty ECU connection OR Faulty MAP sensor **Light OFF:** Open in MAP ground circuit

– – –1/1

000102.04 — Manifold Air Pressure Input Voltage Low



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160
,182

NOTE: Wiring schematic shows Loader applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

MAP (Manifold Air Pressure) Sensor

The MAP sensor is a pressure transducer connected to intake manifold air pressure. It is used to measure the air pressure in the intake manifold. The MAP input voltage varies as intake manifold pressure varies. As pressure increases, input voltage to the ECU increases. The ECU uses the MAP sensor input in conjunction with the MAT sensor input to determine engine air flow.

DTC 000102.04 will set if:

- The manifold air pressure input voltage goes below the sensor's low voltage specification. This voltage corresponds to a pressure that is lower than what is physically possible for manifold air pressure.
  – For OEM engine applications, the low manifold air pressure input voltage specification is 0.3 volts.
  – For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low oil pressure input voltage specification.

If DTC 000102.04 sets, the following will occur:

- The ECU will not apply engine protection.

RG40854,0000003 –19–16APR02–1/1

000102.04 — Manifold Air Pressure Input Voltage Low

The manifold air pressure input voltage goes below the sensor's low voltage specification.

OUO1004,0000C9B –19–16APR02–1/1

000102.04 Manifold Air Pressure Input Voltage Low Diagnostic Procedure

– – –1/1

❶ **Connection 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 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the manifold air pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Engine running 5. Read DTCs using DST or SERVICE ADVISOR™. 6. Make notes of any DTCs, then clear all DTCs 7. Ignition ON, engine idling 8. Read DTCs	**000102.04 reoccurs:** GO TO ❸ **000102.04 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

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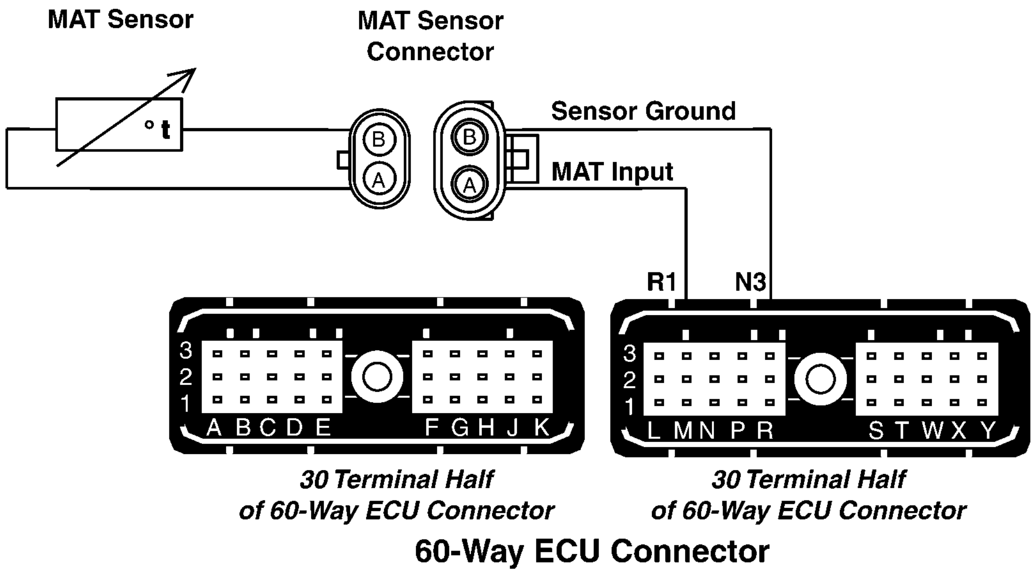
❸ **MAP Wiring Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect MAP sensor connector 3. Install a jumper wire between MAP 5 V supply (terminal C) and MAP input (terminal B) in harness sensor connector 4. Ignition ON, engine OFF 5. Read DTCs	**000102.04 reoccurs:** GO TO ❹ **000102.03 occurs:** Faulty MAP sensor connection OR Faulty MAP sensor – – –1/1

❹ **MAP 5 V Supply Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000102.04 MANIFOLD AIR PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between MAP ground (terminal A) and MAP 5 V supply (terminal C) in harness sensor connector	**4.0 - 6.0 V:** Open in MAP input circuit OR Short to ground in MAP input circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in MAP 5 V supply circuit OR Short to ground in MAP 5 V supply circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

000105.03 — Manifold Air Temperature Input Voltage High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

MAT (Manifold Air Temperature) 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. The ECU uses the MAT sensor input in conjunction with the MAP sensor input to determine engine air flow. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000105.03 will set if:

- The manifold air temperature input voltage exceeds the sensor's high voltage specification. This voltage corresponds to a temperature that is lower than what is physically possible for manifold air temperature.
  – For OEM engine applications, the high manifold air temperature input voltage specification is 4.8 volts.
  – For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high manifold air temperature input voltage specification.

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 –19–16APR02–1/1

000105.03 — Manifold Air Temperature Input Voltage High

The manifold air temperature input voltage exceeds the sensor's high voltage specification.

OUO1004,0000C9C –19–16APR02–1/1

000105.03 Manifold Air Temperature Input Voltage High Diagnostic Procedure

– – –1/1

❶ **Connection 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 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the manifold air temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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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. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON; engine OFF 3. Start ECU communication software 4. Ignition ON, engine OFF or running allowing engine to warm 5. Read the manifold air temperature voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the high manifold air temperature input voltage specification is 4.8V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.8 V or greater:** GO TO ❸ **Below 4.8 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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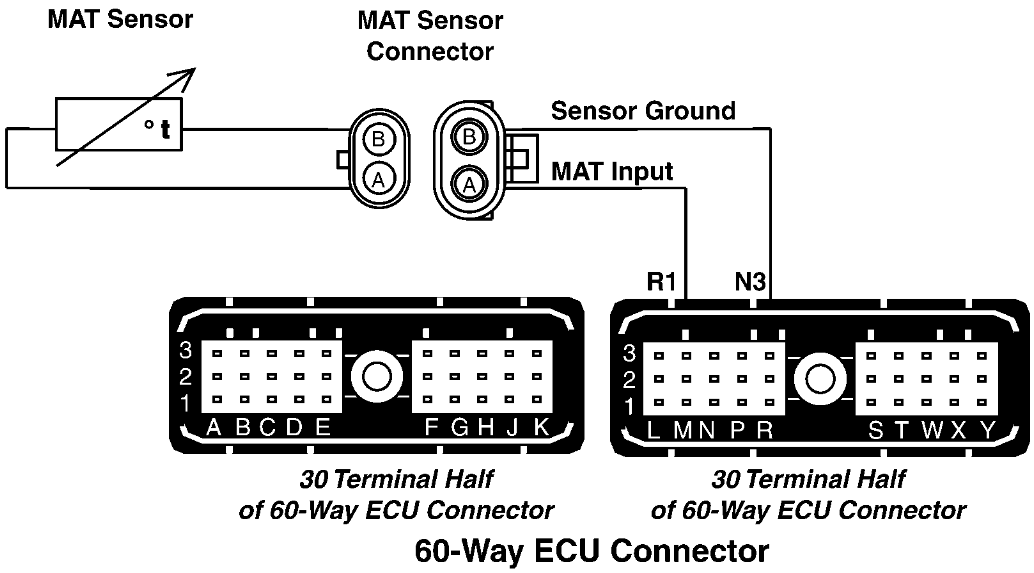
❸ **Manifold Air Temperature (MAT) Sensor and Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect MAT sensor connector 3. Install a jumper wire between both terminals in the MAT sensor harness connector 4. Ignition ON, engine OFF 5. Read the manifold air temperature voltage parameter *NOTE: For OEM applications, the low manifold air temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Greater than 0.1 V:** GO TO ❹ **0.1 V or less:** Faulty MAT sensor connector OR Faulty MAT sensor – – –1/1
❹ **Manifold Air Temperature (MAT) Sensor Open Ground Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Remove jumper wire between both terminals 2. Install jumper wire between MAT sensor harness connector input terminal and a good chassis ground 3. Read the manifold air temperature voltage parameter	**Greater than 0.1 V:** Open in MAT sensor input circuit OR Faulty ECU connection OR Faulty ECU **0.1 V or less:** Open in MAT sensor ground circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

000105.04 — Manifold Air Temperature Input Voltage Low



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

MAT (Manifold Air Temperature) 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. The ECU uses the MAT sensor input in conjunction with the MAP sensor input to determine engine air flow. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000105.04 will set if:

- The manifold air temperature input voltage goes below the sensor's low voltage specification. This voltage corresponds to a temperature that is higher than what is physically possible for manifold air temperature.
  – For OEM engine applications, the low manifold air temperature input voltage specification is 0.1 volts.
  – For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low manifold air temperature input voltage specification.

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 –19–16APR02–1/1

000105.04 — Manifold Air Temperature Input Voltage Low

The manifold air temperature input voltage goes below the sensor's low voltage specification.

OUO1004,0000C9D –19–16APR02–1/1

000105.04 Manifold Air Temperature Input Voltage Low Diagnostic Procedure

– – –1/1

❶ **Connection 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 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the manifold air temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

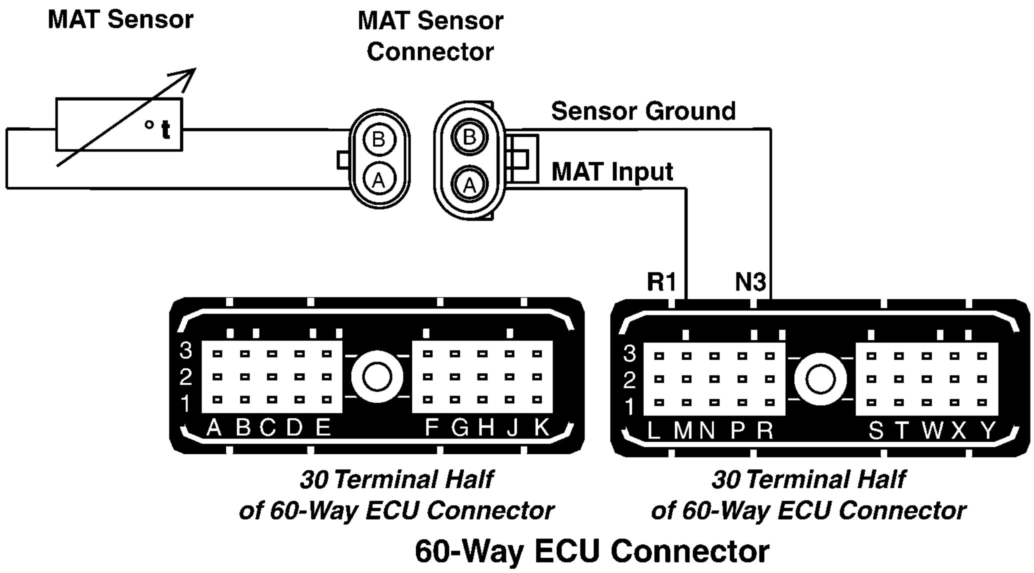
– – –1/1

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. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON; engine OFF 3. Start ECU communication software 4. Ignition ON, engine OFF or running allowing engine to warm 5. Read the manifold air temperature voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the low manifold air temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATIONS SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.1 V or less:** GO TO ❸ **Above 0.1 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

– – –1/1

❸ **Manifold Air Temperature (MAT) Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect MAT sensor connector 3. Ignition ON 4. Read the manifold air temperature voltage parameter. *NOTE: For OEM applications, the high manifold air temperature input voltage specification is 4.8V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.8 V:** Short to ground in MAT sensor input circuit OR Faulty ECU **4.8 V or greater:** Faulty MAT sensor – – –1/1

000105.16 — Manifold Air Temperature Moderately High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

MAT (Manifold Air Temperature) 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. The ECU uses the MAT sensor input in conjunction with the MAP sensor input to determine engine air flow. 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 above the warning value set point in the ECU.
  – For OEM applications, the moderately high manifold air temperature is 90°C (194°F).
  – For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the moderately high manifold air temperature specification.

If DTC 000105.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  – With Shutdown Feature: No shutdown available for this code.
  – 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 of this manual.

DPSG,RG40854,174 –19–16APR02–1/1

000105.16 — Manifold Air Temperature Moderately High

The ECU senses a manifold air temperature above the warning value set point in the ECU.

OUO1004,0000C9E –19–16APR02–1/1

000105.16 Manifold Air Temperature Moderately High Diagnostic Procedure

– – –1/1

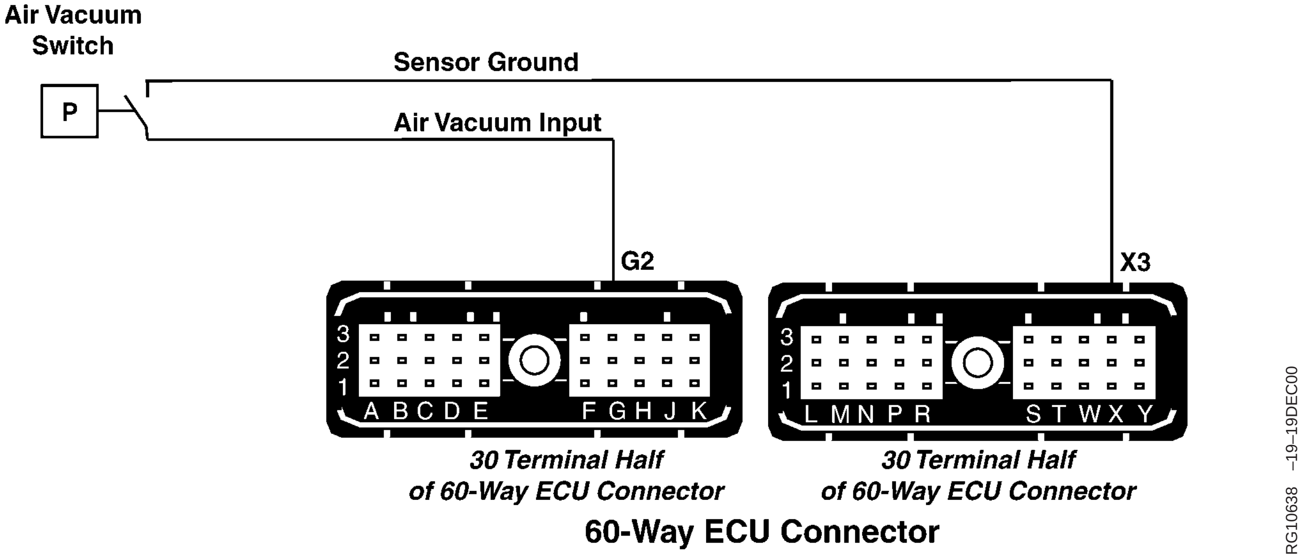
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the manifold air temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Failures Causing High Manifold Air Temperature (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 temp • Restricted, dirty, or damaged charge air cooler • Loose cooling fan belt • Malfunctioning cooling fan • Restricted or damaged intake air piping • Damaged cooling fan shroud	**Cause of high MAT located:** Repair problem and retest. **No cause of high MAT temp located:** Verify that MAT sensor input and ground circuits are OK. If MAT sensor circuits are OK, replace MAT sensor and retest

– – –1/1

000107.00 — Air Filter Restriction High



NOTE: Wiring schematic shows Combine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Air Vacuum Switch

- The air vacuum switch is located on the clean side of the air filter. Higher air pressure causes the contacts on the air vacuum switch to close.

DTC 000107.00 will set if:

- The ECU senses a high air pressure from the air vacuum switch.

If DTC 000107.00 sets, the following will occur:

- Engine may run rough or not run at full power.
- Engine may have black exhaust smoke.

RG40854,0000027 –19–16APR02–1/1

000107.00 — Air Filter Restriction High

The ECU senses a high air pressure from the air vacuum switch.

RG40854,0000028 –19–16APR02–1/1

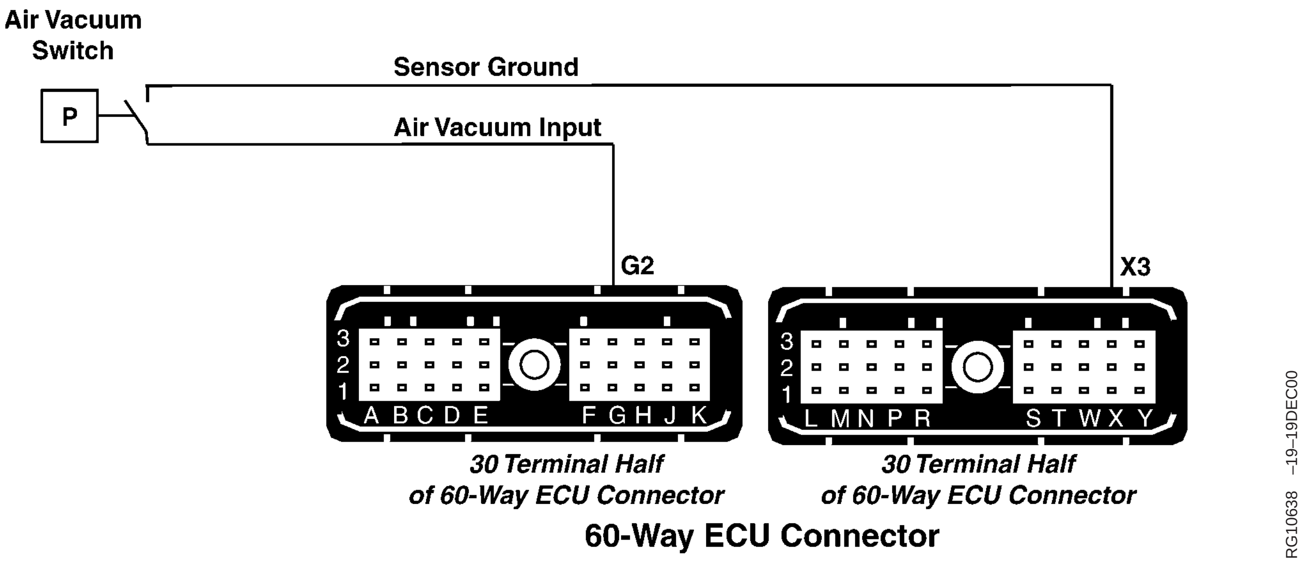
000107.00 Air Filter Restriction High Diagnostic Procedure

04
160
,197

– – –1/1

❶ **Connection 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 HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the air vacuum switch connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) – – –1/1
❷ **Air Intake Restriction Test**	*NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER RESTRICTION HIGH supporting information.* Under the conditions where DTC 000107.00 occurs, inspect air intake system on suction side of turbo. Looking specifically at the air filter element and for any source of blockage of the air intake system. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in CTM100, Section 04, Group 150.	**Restriction found in intake system:** Replace, repair, or clean components as needed. **No problem found with intake system:** Verify that air vacuum input and ground circuits are OK. If air vacuum switch circuits are OK, replace air vacuum switch and retest – – –1/1

000107.31 — Air Filter Restriction High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Air Vacuum Switch

- The air vacuum switch is located on the clean side of the air filter. Higher air pressure causes the contacts on the air vacuum switch to close.

DTC 000107.31 will set if:

- The ECU senses a high air pressure from the air vacuum switch.

If DTC 000107.31 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: No shutdown available for this code.
  - 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 of this manual.
- Engine may run rough or not run at full power.
- Engine may have black exhaust smoke.

DPSG,RG40854,315 –19–16APR02–1/1

000107.31 — Air Filter Restriction High

The ECU senses a high air pressure from the air vacuum switch.

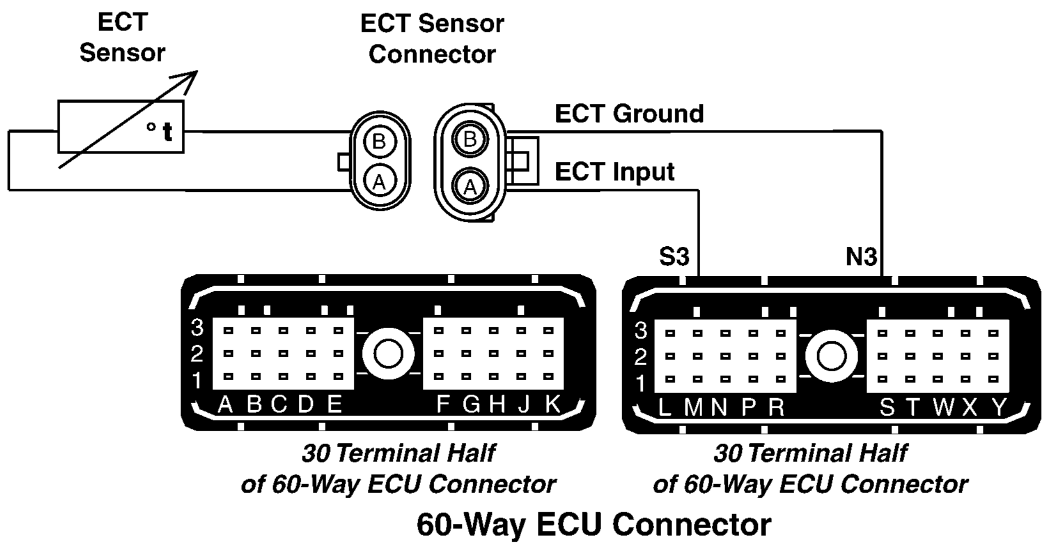
OUO1004,0000C9F –19–16APR02–1/1

000107.31 Air Filter Restriction High Diagnostic Procedure

– – –1/1

❶ **Connection 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 000107.31 AIR FILTER RESTRICTION HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the air vacuum switch connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) – – –1/1
❷ **Air Intake Restriction Test**	*NOTE: For wiring and theory of operation information, see DTC 000107.31 AIR FILTER RESTRICTION HIGH supporting information.* Under the conditions where DTC 000107.31 occurs, inspect air intake system on suction side of turbo. Looking specifically at the air filter element and for any source of blockage of the air intake system. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in CTM100, Section 04, Group 150.	**Restriction found in intake system:** Replace, repair, or clean components as needed. **No problem found with intake system:** Verify that air vacuum input and ground circuits are OK. If air vacuum switch circuits are OK, replace air vacuum switch and retest – – –1/1

000110.00 — Engine Coolant Temperature High Most Severe



04
160
,200

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

ECT (Engine Coolant Temperature) 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 engine coolant temperature above the warning value set point in the ECU.
  – For OEM applications, the most severe engine coolant temperature is 108°C (226°F).
  – For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the moderately high manifold air temperature specification.

If DTC 000110.00 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of 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 of this manual.

DPSG,RG40854,175 –19–16APR02–1/1

000110.00 — Engine Coolant Temperature High Most Severe

The ECU senses a engine coolant temperature above the warning value set point in the ECU.

OUO1004,0000CA0 –19–16APR02–1/1

000110.00 Engine Coolant Temperature High Most Severe Diagnostic Procedure

– – –1/1

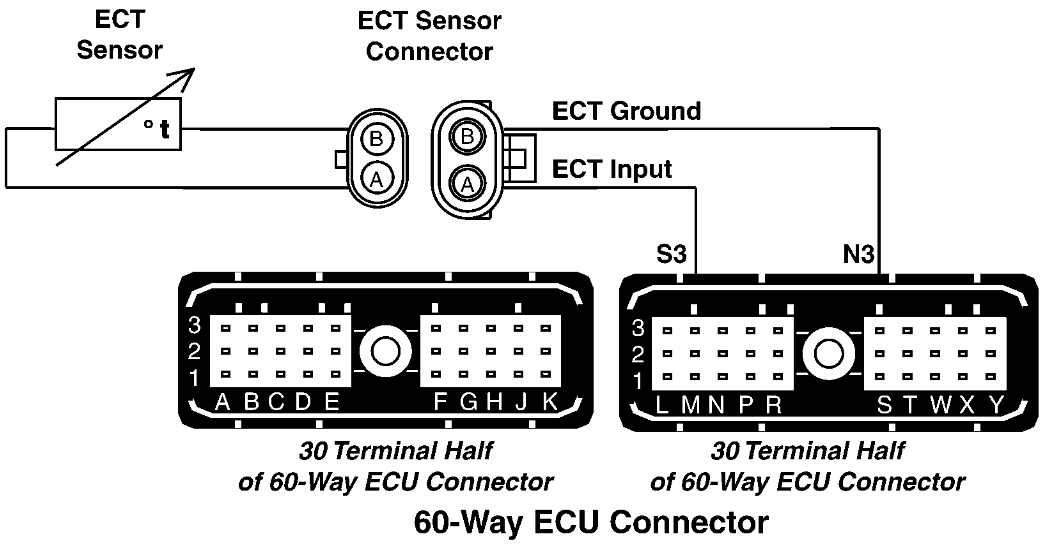
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.00 ENGINE COOLANT TEMPERATURE HIGH MOST SEVERE supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the engine coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **ECT Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.00 ENGINE COOLANT TEMPERATURE HIGH MOST SEVERE supporting information.* Under the conditions where DTC 000110.00 occurs, using a temperature gauge, verify that ECT is above the ECT high most severe specification. *NOTE: For OEM engine applications, the ECT high most severe specification is 108°C (226°F). For the ECT high most severe specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**ECT above high most severe specification:** Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in CTM100, Section 04, Group 150. **ECT significantly less than high most severe specification:** Verify that ECT sensor input and ground circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest.

– – –1/1

000110.03 — Engine Coolant Temperature Input Voltage High



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

ECT (Engine Coolant Temperature) 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 000110.03 will set if:

- The engine coolant temperature input voltage exceeds the sensor's high voltage specification. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant temperature.
  – For OEM engine applications, the engine coolant temperature input voltage specification is 4.9 volts.
  – For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high engine coolant temperature input voltage specification.

If DTC 000110.03 sets, the following will occur:

- The ECU will use a default "limp-home" ECT value of 90°C (194°F).
- ECU's high coolant temperature engine protection feature disabled.

DPSG,RG40854,176 –19–16APR02–1/1

000110.03 — Engine Coolant Temperature Input Voltage High

he engine coolant temperature input voltage exceeds the sensor's high voltage specification.

OUO1004,0000CA1 –19–16APR02–1/1

000110.03 Engine Coolant Temperature Input Voltage High Diagnostic Procedure

04
160
,203

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❶ **Connection 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 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the engine coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

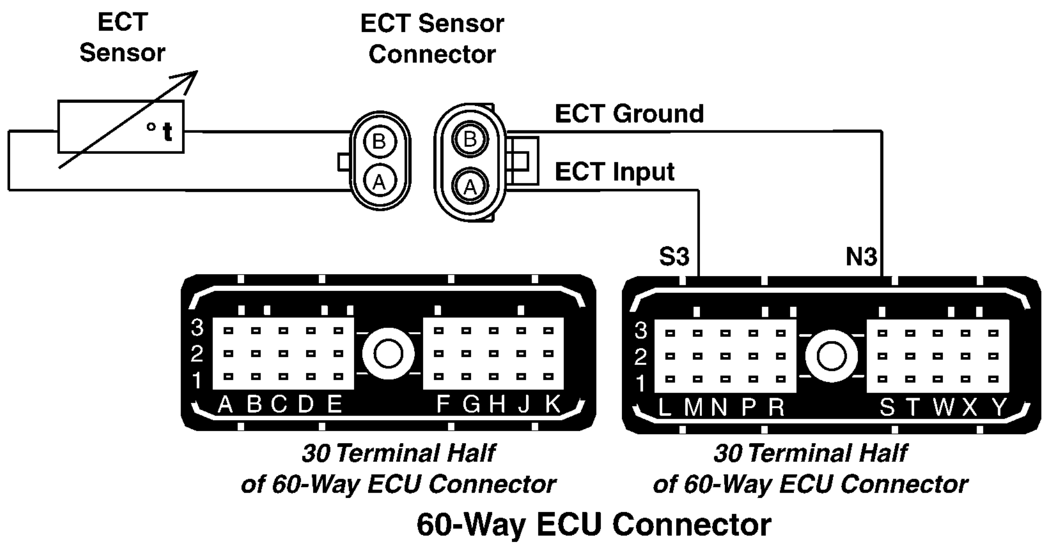
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON; engine OFF 3. Start ECU communication software 4. Ignition ON, engine OFF or running allowing engine to warm 5. Read the engine coolant temperature voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the high engine coolant temperature input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.9 V or greater:** GO TO ❸ **Below 4.9 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

– – –1/1

❸ **ECT Sensor and Connector 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 ECT sensor connector 3. Install a jumper wire between both terminals in the ECT sensor harness connector 4. Ignition ON, engine OFF 5. Read the engine coolant temperature voltage parameter *NOTE: For OEM applications, the low engine coolant temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Greater than 0.1 V:** GO TO ❹ **0.1 V or less:** Faulty ECT sensor connector OR Faulty ECT sensor – – –1/1

❹ **ECT Open Ground Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Remove jumper wire between both terminals 2. Install jumper wire between ECT sensor harness connector input terminal and a good chassis ground 3. Read the engine coolant temperature voltage parameter *NOTE: For OEM applications, the low engine coolant temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Greater than 0.1 V:** Open in ECT input sensor circuit OR Faulty ECU connection OR Faulty ECU **0.1 V or less:** Open in ECT sensor ground circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

000110.04 — Engine Coolant Temperature Input Voltage Low



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

ECT (Engine Coolant Temperature) 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 000110.04 will set if:

- The engine coolant temperature input voltage goes below the sensor's low voltage specification. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant temperature.
  - For OEM engine applications, the low engine coolant temperature input voltage specification is 0.1 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low engine coolant temperature input voltage specification.

If DTC 000110.04 sets, the following will occur:

- The ECU uses a default "limp-home" ECT value of 90°C (194°F).
- ECU's high coolant temperature engine protection feature disabled.

DPSG,RG40854,177 –19–16APR02–1/1

000110.04 — Engine Coolant Temperature Input Voltage Low

The engine coolant temperature input voltage goes below the sensor's low voltage specification.

OUO1004,0000CA2 –19–16APR02–1/1

000110.04 Engine Coolant Temperature Input Voltage Low Diagnostic Procedure

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❶ **Connection 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 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the engine coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s)

– – –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. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON; engine OFF 3. Start ECU communication software 4. Ignition ON, engine OFF or running allowing engine to warm 5. Read the engine coolant temperature voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the low engine coolant temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.1 V or less:** GO TO ❸ **Above 0.1 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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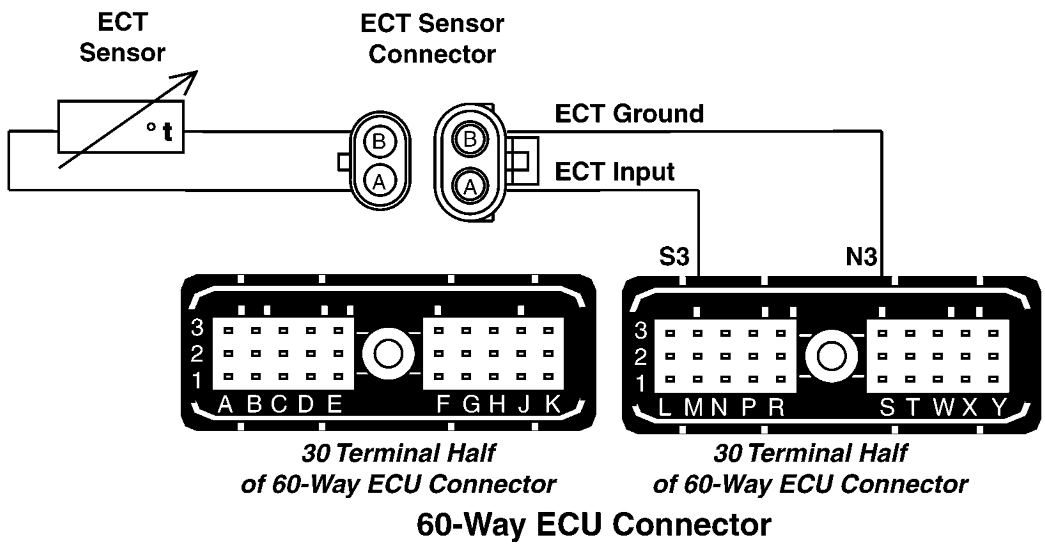
❸ **ECT Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect ECT sensor connector 3. Ignition ON 4. Read the engine coolant temperature voltage parameter *NOTE: For OEM applications, the high engine coolant temperature input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.9 V:** Short to ground in ECT sensor input circuit OR Faulty ECU **4.9 V or greater:** Faulty ECT sensor – – –1/1

000110.15 — Engine Coolant Temperature High Least Severe



RG10397 –19–19DEC00

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

ECT (Engine Coolant Temperature) 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 the warning value set point in the ECU.
  – For OEM applications, the ECT high least severe specification is 100°C (212°F).
  – For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the ECT high least severe specification.

If DTC 000110.15 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  – With Shutdown Feature: No shutdown available for this code.
  – 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 of this manual.

DPSG,RG40854,178 –19–16APR02–1/1

000110.15 — Engine Coolant Temperature High Least Severe

The ECU senses engine coolant temperature above the warning value set point in the ECU.

OUO1004,0000CA3 –19–16APR02–1/1

000110.15 Engine Coolant Temperature High Least Severe Diagnostic Procedure

– – –1/1

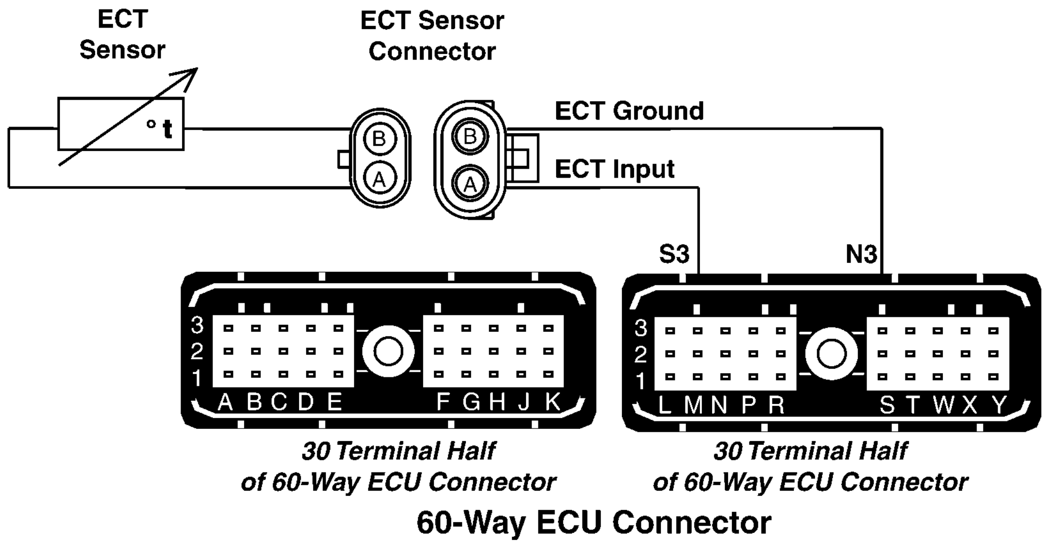
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.15 ENGINE COOLANT TEMPERATURE MODERATELY HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the engine coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **ECT Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.15 ENGINE COOLANT TEMPERATURE MODERATELY HIGH supporting information.* Under the conditions where DTC 000110.15 occurs, using a temperature gauge, verify that ECT is above the ECT high least severe specification. *NOTE: For OEM engine applications, the ECT high least severe specification is 100°C (212°F). For the ECU high least severe specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**ECT above high least severe specification:** Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in CTM100, Section 04, Group 150. **ECT significantly less than high least severe specification:** Verify that ECT sensor input and ground circuits are OK If ECT sensor circuits are OK, replace ECT sensor and retest

– – –1/1

000110.16 Engine Coolant Temperature High Moderately Severe



RG10397 –19–19DEC00

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

ECT (Engine Coolant Temperature) 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 an engine coolant temperature above the warning value set point in the ECU.
  - For OEM applications, the ECT high moderately severe specification is 104°C (219°F).
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the ECT high moderately severe specification.

If DTC 000110.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: No shutdown available for this code.
  - 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 of this manual.

DPSG,RG40854,175 –19–16APR02–1/1

000110.16 — Engine Coolant Temperature High Moderately Severe

The ECU senses an engine coolant temperature above the warning value set point in the ECU.

OUO1004,0000CA0 –19–16APR02–1/1

000110.16 Engine Coolant Temperature High Moderately Severe Diagnostic Procedure

– – –1/1

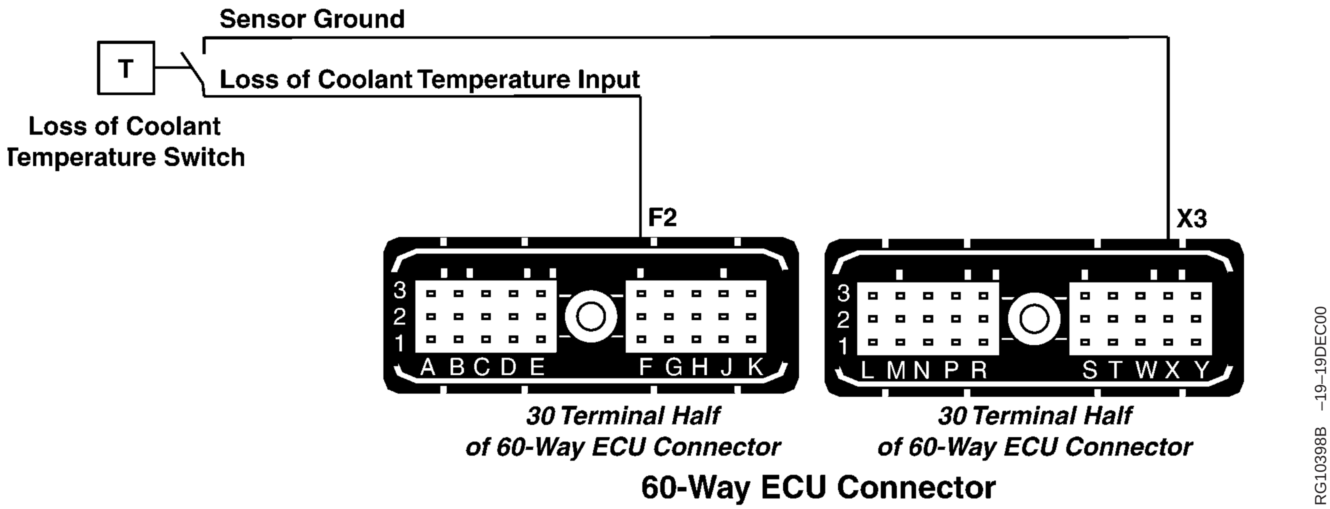
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.16 ENGINE COOLANT TEMPERATURE HIGH MODERATELY SEVERE supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the engine coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **ECT Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.16 ENGINE COOLANT TEMPERATURE HIGH MODERATELY SEVERE supporting information.* Under the conditions where DTC 000110.16 occurs, using a temperature gauge, verify that ECT is above the ECT high moderately severe specification. *NOTE: For OEM engine applications, the ECT high moderately severe specification is 104°C (219°F). For the ECU high moderately severe specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**ECT above high moderately severe specification:** Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in CTM100, Section 04, Group 150. **ECT significantly less than high moderately severe specification:** Verify that ECT sensor input and ground circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest.

– – –1/1

000111.01 — Engine Coolant Level Low



04
160
,214

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Loss of Coolant Temperature Switch

- The loss of coolant temperature switch is a normally open temperature sensitive switch. When engine coolant is at the proper level, the temperature sensitive end of the switch is submerged in coolant, and the switch contacts will be open. If coolant level drops, the switch will no longer be submerged causing the temperature of the switch to raise beyond the point that causes the switch contacts to close. This causes the ECU to sense continuity to ground through the external shutdown/derate input terminal.

DTC 000111.01 will set if:

- The loss of coolant temperature switch contacts close causing the ECU to sense continuity to ground through the external shutdown/derate input terminal.

If DTC 000111.01 sets, the following occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of 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 of this manual.

DPSG,RG40854,179 –19–16APR02–1/1

000111.01 — Engine Coolant Level Low

The loss of coolant temperature switch contacts close causing the ECU to sense continuity to ground through the external shutdown/derate input terminal.

OUO1004,0000CA4 –19–16APR02–1/1

000111.01 Engine Coolant Level Low Diagnostic Procedure

– – –1/1

❶ **Coolant Level Test**	**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 strop to relieve pressure before removing completely.** Check coolant level.	**Coolant level OK:** GO TO ❷ **Coolant level low:** Determine cause of low coolant level Repair problem and retest

– – –1/1

❷ **Connection 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 000111.01 ENGINE COOLANT LEVEL LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the loss of coolant switch connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s)

– – –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. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Engine running 5. Read DTCs using DST or SERVICE ADVISOR™. 6. Make note of all active DTCs, then clear all DTCs 7. Engine running 8. Read DTCs	**000111.01 reoccurs:** GO TO ❹ **000111.01 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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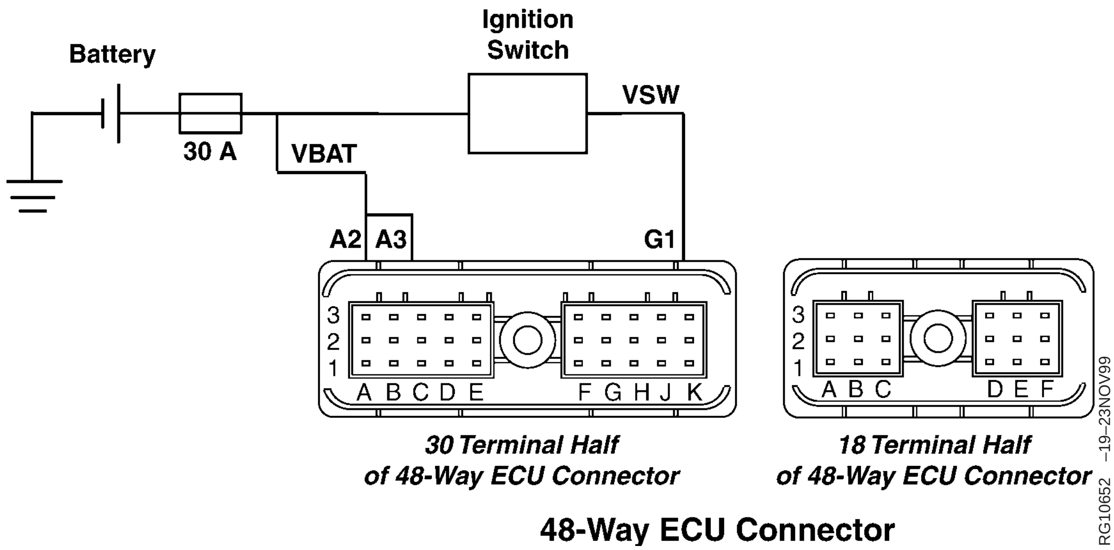
❹ **Loss of Coolant Temperature Switch Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information.* 1. Ignition OFF 2. Disconnect loss of coolant temperature switch connector 3. Ignition ON 4. Read DTCs 5. Make note of all DTCs, then clear all DTCs 6. Read DTCs	**000111.01 reoccurs:** Short to ground in loss of coolant temperature switch input circuit. **000111.01 doesn't reoccur:** Faulty loss of coolant temperature switch.

– – –1/1

000158.17 — ECU Power Down Error



NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

DTC 000158.17 will set if:

- ECU is unable to complete proper power down procedures after detecting a key off condition.

If DTC 000158.17 sets, the following will occur:

- Vehicle battery may be drained.

DPSG,RG40854,210 –19–16APR02–1/1

000158.17 — ECU Power Down Error

ECU is unable to complete proper power down procedures after detecting a key off condition.

OUO1004,0000CA5 –19–16APR02–1/1

000158.17 ECU Power Down Diagnostic Procedure

– – –1/1

❶ **Connection 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 000158.17 ECU POWER DOWN ERROR supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the ignition power circuit, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make a note of any DTCs, then clear all DTCs 6. Cycle ignition OFF for 10 seconds, then back ON 7. Read DTCs	**000158.17 reoccurs:** GO TO ❸ **000158.17 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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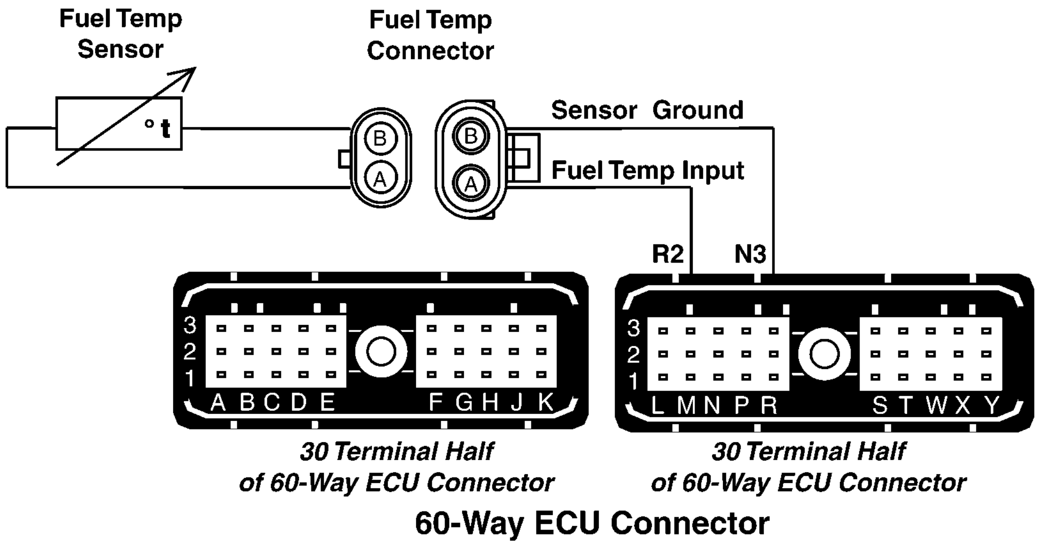
❸ **Wiring Test**	*NOTE: For theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.* 1. Ignition OFF 2. Disconnect 30-terminal half of the 48-way ECU connector 3. Using a multimeter measure voltage between a good ground and terminal G1 of the 30-terminal half of the 48-way ECU connector.	**Measurements above 3.0 V:** Faulty ignition switch circuit OR ECU key-on power supply wires shorted to voltage OR Faulty ignition switch **Measurements below 3.0 V:** Faulty ECU connection OR Faulty ECU – – –1/1

000174.03 — Fuel Temperature Input Voltage High



RG10399 –19–19DEC00

NOTE: *Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the fuel manifold. 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; 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.

DTC 000174.03 will set if:

- The fuel temperature input voltage exceeds the sensor's high voltage specification. This voltage corresponds to a temperature that is lower than what is physically possible for fuel temperature.
  – For OEM engine applications, the high fuel temperature input voltage specification is 4.9 volts.
  – For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high fuel temperature input voltage specification.

If DTC 000174.03 sets, the following will occur:

- The ECU will use a default "limp-home" value of 90°C (194°F).

DPSG,RG40854,211 –19–16APR02–1/1

000174.03 — Fuel Temperature Input Voltage High

The fuel temperature input voltage exceeds the sensor's high voltage specification.

OUO1004,0000CA6 –19–16APR02–1/1

000174.03 Fuel Temperature Input Voltage High Diagnostic Procedure

– – –1/1

❶ **Connection 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 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the fuel temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

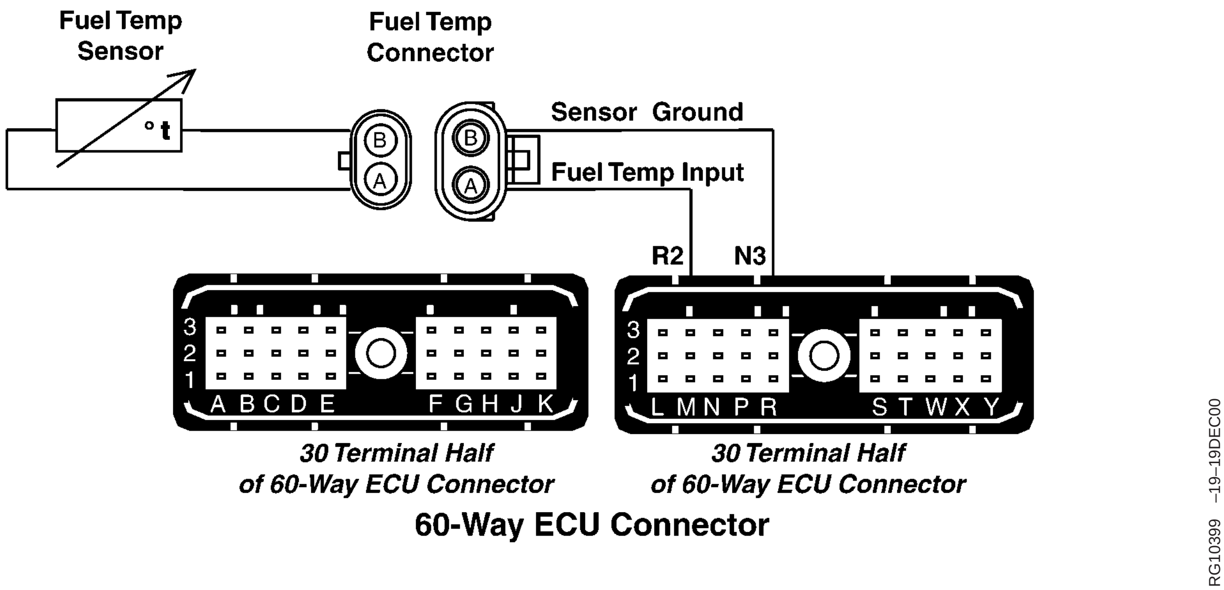
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Warm engine 5. Read the fuel temperature voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the high fuel temperature input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.9 V or greater:** GO TO ❸ **Below 4.9 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

– – –1/1

❸ **Fuel Temperature Sensor and Connector 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 fuel temperature sensor connector 3. Install a jumper wire between both terminals in the fuel temp sensor harness connector 4. Ignition ON, engine OFF 5. Read the fuel temperature voltage parameter *NOTE: For OEM applications, the low fuel temperature input voltage specification is 0.3V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Greater than 0.3 V:** GO TO ❹ **0.3 V or less:** Faulty fuel temperature sensor connector OR Faulty temperature sensor – – –1/1

❹ **Fuel Temperature Open in Ground Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Remove jumper wire between both terminals 2. Install jumper wire between fuel temp sensor harness connector input terminal and a good chassis ground 3. Read the fuel temperature voltage parameter *NOTE: For OEM applications, the low fuel temperature input voltage specification is 0.3V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Greater than 0.3 V:** Open in fuel temp sensor input circuit OR Faulty ECU connection OR Faulty ECU **0.3 V or less:** Open in fuel temp sensor ground circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

000174.04 — Fuel Temperature Input Voltage Low



NOTE: *Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the fuel manifold. 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; 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.

DTC 000174.04 will set if:

- The fuel temperature input voltage goes below the sensor's low voltage specification. This voltage corresponds to a temperatrue that is higher than what is physically possible fuel temperature.
  - For OEM engine applications, the low fuel temperature input voltage specification is 0.3 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low fuel temperature input voltage specification.

If DTC 000174.04 sets, the following will occur:

- The ECU will use a default "limp-home" value of 90°C (194°F).

DPSG,RG40854,212 –19–16APR02–1/1

000174.04 — Fuel Temperature Input Voltage Low

The fuel temperature input voltage goes below the sensor's low voltage specification.

OUO1004,0000CA7 –19–16APR02–1/1

000174.04 Fuel Temperature Input Voltage Low Diagnostic Procedure

– – –1/1

❶ **Connection 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 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the fuel temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –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. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Warm engine 5. Read the fuel temperature voltage parameter using DST or SERVICE ADVISOR™. *NOTE: For OEM applications, the low fuel temperature input voltage specification is 0.3V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or less:** GO TO ❸ **Above 0.3 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

– – –1/1

❸ **Fuel Temperature Sensor 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 fuel temperature sensor connector 3. Ignition ON 4. Read the fuel temperature voltage parameter *NOTE: For OEM applications, the high fuel temperature input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.9 V:** Short to ground in fuel temperature sensor input circuit OR Faulty ECU **4.9 V or greater:** Faulty fuel temperature sensor – – –1/1

000177.09 — Transmission Oil Temperature Invalid

The ECU receives an erratic transmission oil temperature over CAN from the RCU.

CAN (Controller Area Network) Transmission Oil Temperature

- The ECU receives engine coolant temperature information over CAN (Controller Area Network) from the RCU (Reverser Control Unit). The RCU measures transmission oil temperature with a temperature sensor and sends the measured temperature as a message to the ECU over CAN. The ECU in turn monitors this temperature and executes an default value for temperature to protect the transmission in case of an overheat condition.

DTC 000177.09 will set if:

- The ECU receives an erratic transmission oil temperature over CAN from the RCU.

If DTC 000177.09 sets, the following will occur:

- The ECU defaults the transmission oil temperature to a high value.
- The cooling fan runs in an attempt to prevent an overheat condition.

If DTC 000177.09 sets:

- If DTC SPN 110 FMI 0, DTC SPN 110 FMI 16, or DTC 000111.01 occur, diagnose those codes first. Determine cause of high coolant temperature.
  - ***On 8.1 L engines***, see C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).
- If trouble codes on the RCU occur, diagnose those trouble codes.

RG40854,0000002 –19–18NOV02–1/1

000523.09 — Gear Selection Invalid

The ECU does not receive vehicle gear selection information or it is invalid.

Gear Selection

- The SPFH (Self Propelled Forage Harvester) controller transmits the vehicle gear selection 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:

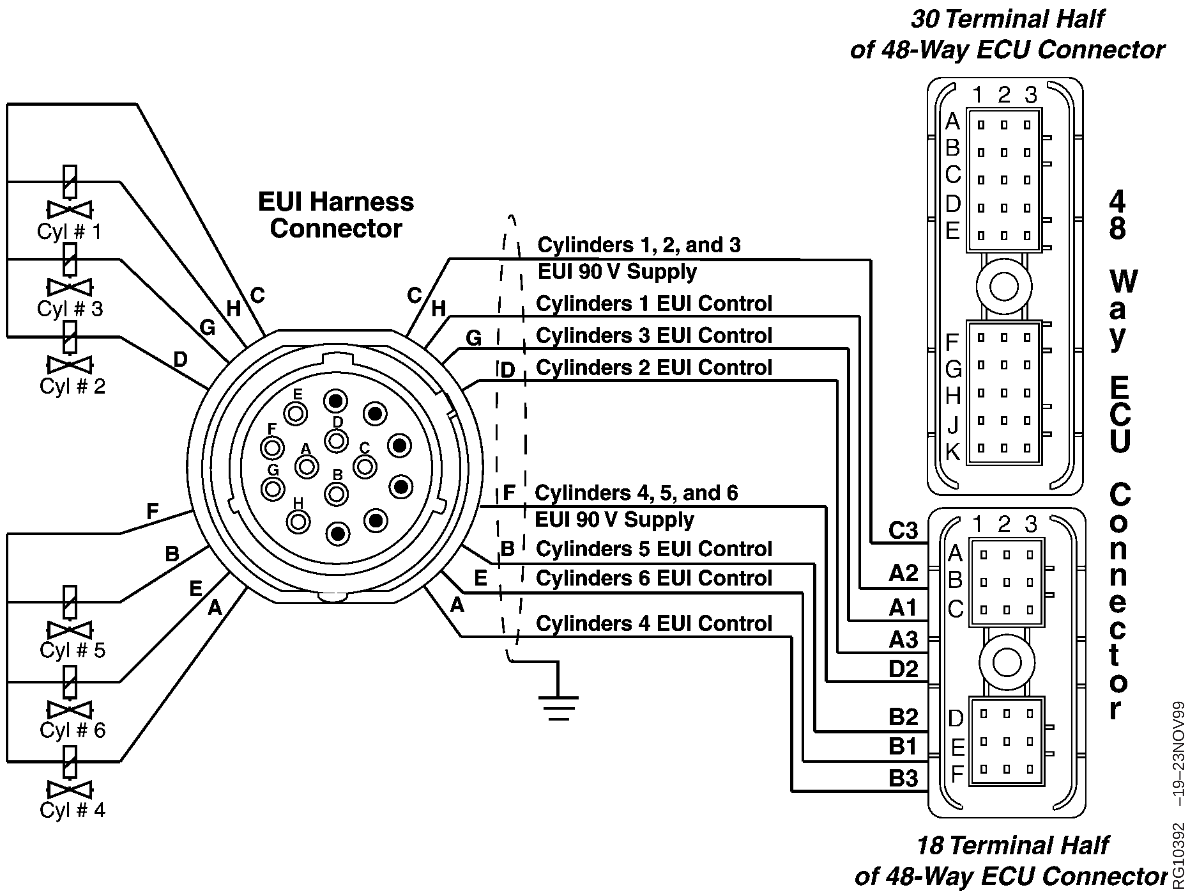
- The ECU limits engine speed to 1650 rpm in transport mode.
- DTC 000639.13 may also be present. If 000639.13 is present, diagnose it first.

If DTC 000523.09 sets:

- Using the DST or SERVICE ADVISOR™, monitor DTCs on the active code display parameter. If DTC 000639.13 also occurs, see LEVEL 6 ECU - DTC 000639.13 CAN BUS ERROR DIAGNOSTIC PROCEDURE 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.
- If no other stored or active CAN or vehicle related DTCs are found, replace ECU and retest.

RG40854,0000003 –19–18NOV02–1/1

000611.03 — Injector Wiring Shorted To Power Source



EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUI's for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI 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 –19–16APR02–1/1

000611.03 — Injector Wiring Shorted To Power Source

The ECU detects that injector wiring is shorted to a power source.

OUO1004,0000CA8 –19–16APR02–1/1

000611.03 Injector Wiring Shorted To Power Source Diagnostic Procedure

– – –1/1

❶ **Connection 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 000611.03 INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.* Perform a preliminary inspection of the 60-way and 48-way ECU connectors, the EUI harness connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	**IMPORTANT: Other DTCs may be set with SPN 611 FMI 3. Follow this chart first, make repairs as directed.** *NOTE: For wiring and theory of operation information, see DTC 000611.03 INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000611.03 reoccurs:** GO TO ❸ **000611.03 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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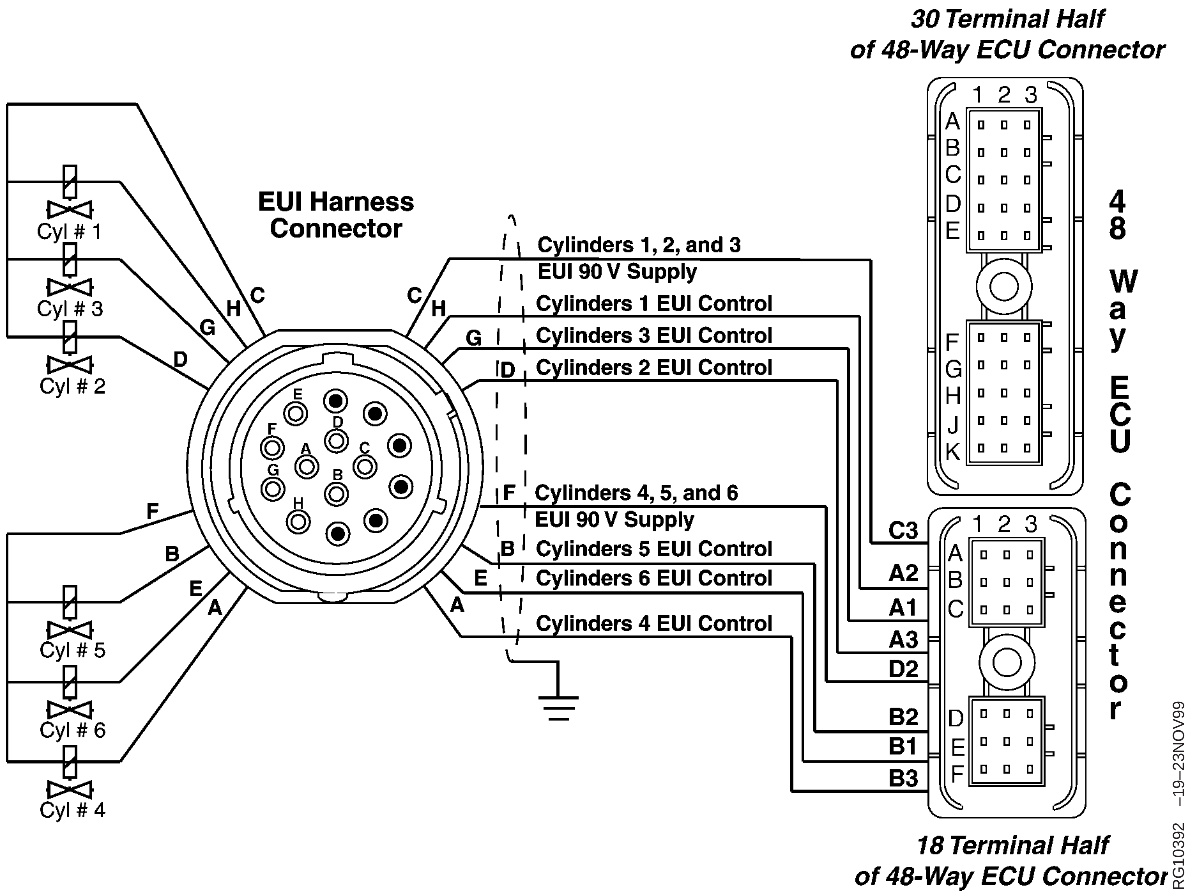
❸ **Engine Operation Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.03 INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.* 1. Ignition ON, engine running 2. Run engine at high idle 3. Observe engine performance for: • Exhaust smoke • Engine misfire • High-idle speed	**Engine has white-gray smoke, a maximum engine speed of @ 900 RPM, and a lack of response:** GO TO ❺ **Engine has a misfire, little to no smoke, and goes to or near maximum engine speed:** GO TO ❹ – – –1/1
❹ **Short in EUI Control Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.03 INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.* 1. Perform Cylinder Cutout Test. See ENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST 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. These will be the cylinders referred to in the following steps.* 2. Make note of the cylinder that changes the running of the engine the least during the Cylinder Cutout Test 3. Ignition OFF 4. Disconnect 48 and 60-way ECU connectors 5. Disconnect EUI wiring harness connector at rear of cylinder head 6. Using a multimeter, measure resistance between the control terminal of the EUI identified in the Cylinder Cutout Test at the harness end of the 18-terminal half of the 48-way ECU connector ***and*** all the terminals in both of the 48 and 60-way ECU connectors	**All measurements greater than 20,000 ohms:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **One or more measurements less than 20,000 ohms:** Short in EUI control circuit – – –1/1
❺ **Short in 90 V Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.03 INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.* 1. Ignition OFF 2. Disconnect 48 and 60-way ECU connectors 3. Disconnect EUI wiring harness connector at rear of cylinder head 4. Using a multimeter, measure resistance between: • The EUI 90 V terminal C3 in the harness end of the 18 terminal half of the 48-way ECU connector ***and*** all the terminals in both the 48 and 60-way connectors • The EUI 90 V terminal D2 in the harness end of the 18 terminal half of the 48-way ECU connector ***and*** all the terminals in both the 48 and 60-way connectors	**All measurements greater than 20,000 ohms:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **One or more measurements less than 20,000 ohms:** Short in EUI 90 V circuit – – –1/1

000611.04 — Injector Wiring Shorted To Ground



EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI 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 –19–16APR02–1/1

000611.04 — Injector Wiring Shorted To Ground

The ECU detects that injector wiring is shorted to ground.

OUO1004,0000CA9 –19–16APR02–1/1

000611.04 Injector Wiring Shorted To Ground Diagnostic Procedure

– – –1/1

❶ **Connection 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 000611.04 INJECTOR WIRING SHORTED TO GROUND supporting information.* Perform a preliminary inspection of the 60-way and 48-way ECU connectors, the EUI connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	**IMPORTANT: Other DTCs may be set with SPN 611 FMI 4. Follow this chart first, make repairs as directed.** *NOTE: For wiring and theory of operation information, see DTC 000611.04 INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running at high idle or cranking for 15 seconds 7. Read DTCs	**000611.04 reoccurs:** GO TO ❸ **000611.04 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

– – –1/1

❸ **Engine Operation Check**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 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 ❼ **Engine runs rough and has excessive black smoke:** GO TO ❹ – – –1/1

❹ **Short in EUI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Perform Cylinder Cutout Test as described in ENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST in this Group. *NOTE: The results of the Cylinder Cutout Test will show at least one cylinder that improves the engine operation and clears the black smoke. This cylinder will be the one referred as the "failed cylinder" in the rest of the diagnostics of the EUI and wiring.* 2. Ignition OFF 3. Disconnect 48 and 60-way ECU connectors 4. Disconnect EUI wiring harness connector at rear of cylinder head 5. Using a multimeter, measure resistance between the EUI control terminal of the "failed cylinder" in the harness end of the 18-terminal half of the 48-way ECU connector and: • All other terminals in the 48 and 60-way ECU connectors • A good chassis ground	**All measurements greater than 20,000 ohms:** GO TO ❺ **Any measurement less than 20,000 ohms:** Short in ECU wiring harness – – –1/1

❺ **ECU and EUI Wiring Connection Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Ignition OFF 2. EUI wiring harness connector at rear of cylinder head disconnected 3. Using a multimeter, measure resistance between the EUI control terminal of the "failed cylinder" on the cylinder head side of the EUI wiring harness ***and*** a good ground	**Any measurement less than 20,000 ohms:** GO TO ❻ **All measurements greater than 20,000 ohms:** Faulty ECU connection OR Faulty EUI wiring connection OR Faulty ECU – – –1/1

❻ **EUI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Ignition OFF 2. Remove rocker cover 3. Disconnect all electrical connections from the EUI of the "failed cylinder" 4. Using a multimeter, measure resistance between: • One terminal on an EUI ***and*** the EUI body • The other terminal on the EUI ***and*** the EUI body	**Any measurement less than 20,000 ohms:** Faulty EUI(s) **All measurements greater than 20,000 ohms:** Faulty EUI wiring harness – – –1/1

❼ **Short in ECU Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Ignition OFF 2. Disconnect 48 and 60-way ECU connectors 3. Disconnect EUI wiring harness connector at rear of cylinder head 4. Using a multimeter, measure resistance between: • Terminal C3 in the harness end of the 18 terminal half of the 48-way ECU connector ***and*** all other terminals in the 48 and 60-way ECU connectors and a good chassis ground • Terminal D2 in the harness end of the 18 terminal half of the 48-way ECU connector ***and*** all other terminals in the 48 and 60-way ECU connector and a good chassis ground	**All measurements greater than 20,000 ohms:** GO TO ❽ **Any measurement less than 20,000 ohms:** Short in ECU wiring harness – – –1/1

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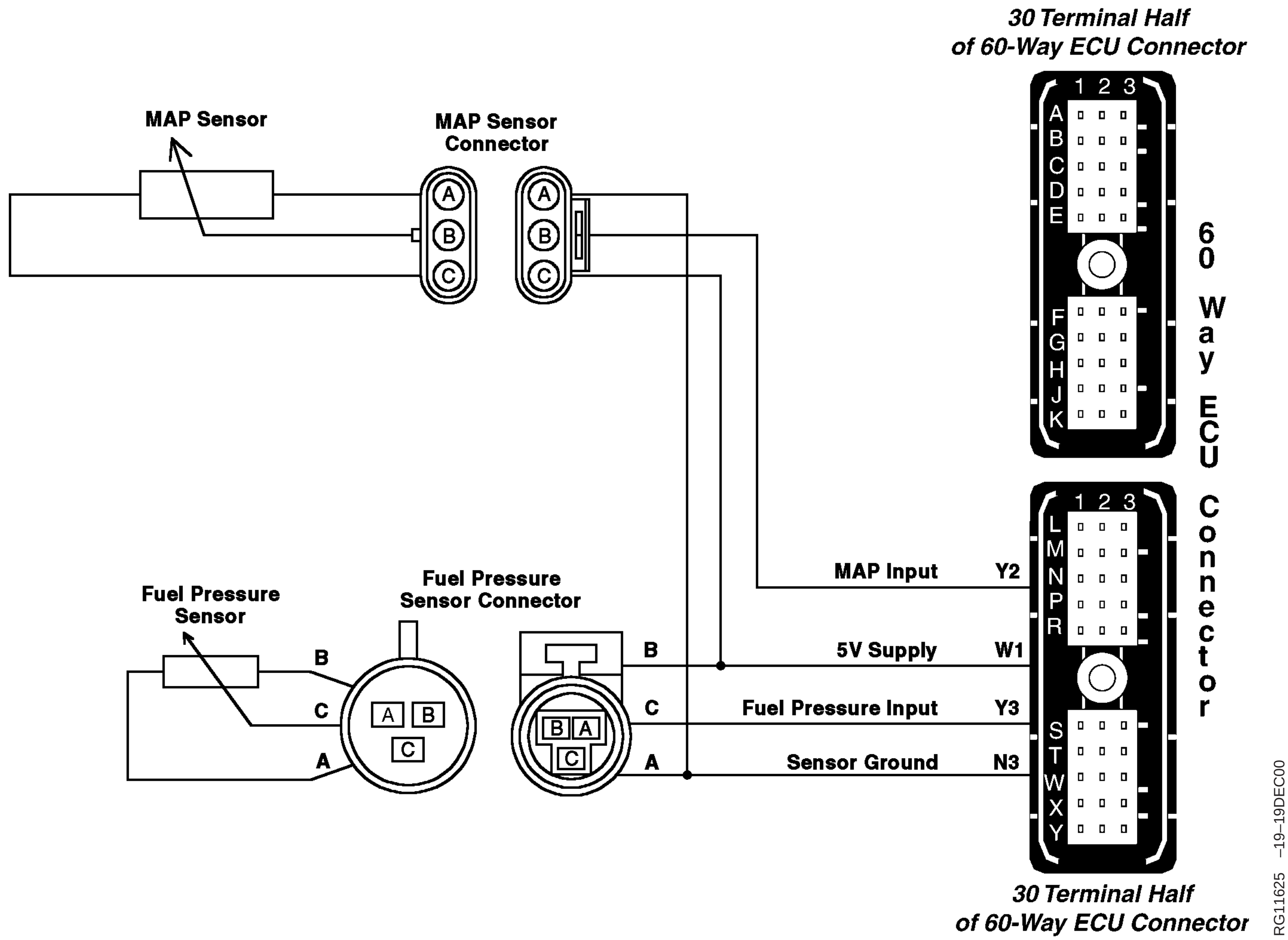
,239

❽ **ECU and EUI Wiring Connection Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Ignition OFF 2. EUI wiring harness connector at rear of cylinder head disconnected 3. Using a multimeter, measure resistance between: • Terminal C in the cylinder head side of the EUI wiring harness ***and*** a good ground • Terminal F in the cylinder head side of the EUI wiring harness ***and*** a good ground	**Any measurement less than 20,000 ohms:** GO TO ❾ **All measurements greater than 20,000 ohms:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU – – –1/1

❾ **EUI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000611.04 INJECTOR WIRING SHORTED TO GROUND supporting information.* 1. Ignition OFF 2. Remove rocker cover 3. Disconnect all electrical connections from the 6 EUIs 4. Using a multimeter, measure resistance between: • One terminal on an EUI ***and*** the EUI body • The other terminal on the EUI ***and*** the EUI body 5. Perform the above measurements on all 6 EUIs	**Measurements greater than 20,000 ohms:** Faulty EUI wiring harness **Any measurement less than 20,000 ohms:** Faulty EUI(s) – – –1/1

000620.03 — Sensor Supply Voltage High



NOTE: Wiring schematic shows Loader applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on the 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.

DTC 000620.03 will set if:

- The ECU detects a voltage that is higher than the expected 5 volts.

If DTC 000620.03 sets, the following will occur:

- The ECU will use default values for the sensors on this circuit.

RG40854,0000013 –19–16APR02–1/1

000620.03 — Sensor Supply Voltage High

The ECU detects a voltage above specification on the ECU 5 volt sensor supply circuit.

OUO1004,0000CAA –19–16APR02–1/1

000620.03 Sensor Supply Voltage High Diagnostic Procedure

– – –1/1

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❶ **Connection 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 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the 60-way and 48-way ECU connectors. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make note of all active DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000620.03 reoccurs:** GO TO ❸ **000620.03 cleared and doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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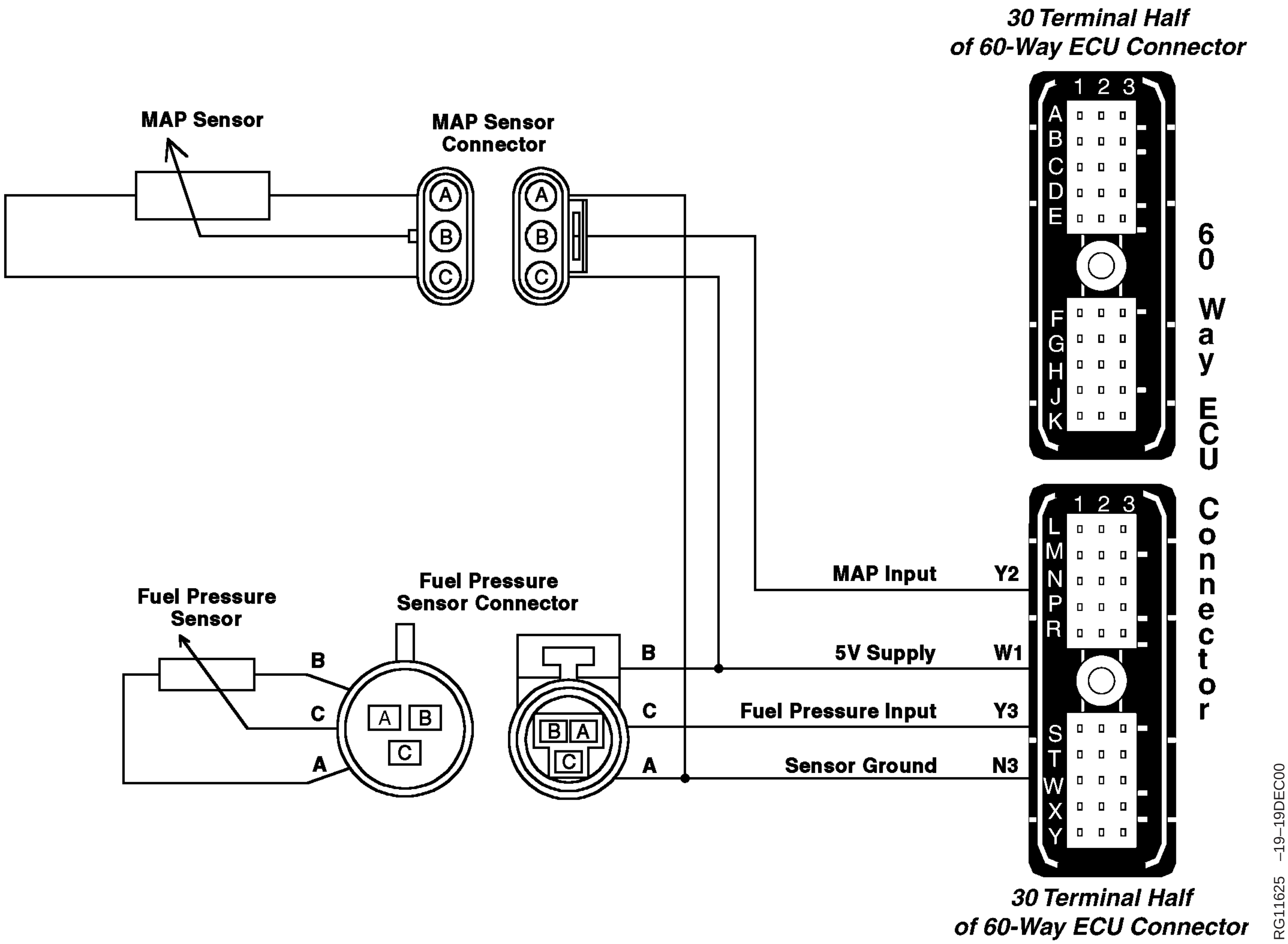
❸ **Sensor 5 V Supply Voltage Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect 60-way ECU connector 3. Ignition ON 4. Using a multimeter, measure voltage between terminal W1 in the harness end of the 60-way ECU connector ***and*** a good ground	**0.5 volts or less:** GO TO ❹ **Greater than 0.5 volts:** Short to power in sensor 5 volt supply circuit – – –1/1

❹ **Sensor 5 V Supply Short to Battery Voltage Supply Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Measure resistance between terminal W1 of the 60-way ECU connector ***and*** terminal G1 of the 48-way ECU connector.	**Greater than 10,000 ohms:** Faulty ECU connection OR Faulty ECU **10,000 ohms or less:** Sensor 5 volt supply circuit shorted to ECU battery voltage supply circuit – – –1/1

000620.04 — Sensor Supply Voltage Low



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NOTE: Wiring schematic shows Loader applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on the 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.

DTC 000620.04 will set if:

- The ECU detects a voltage that is lower than the expected 5 volts.

If DTC 000620.04 sets, the following will occur:

- The ECU will use default values for the sensors on this circuit.

RG40854,0000014 –19–16APR02–1/1

000620.04 — Sensor Supply Voltage Low

The ECU detects a voltage below specification on the ECU 5 volt sensor supply circuit.

OUO1004,0000CAB –19–16APR02–1/1

000620.04 Sensor Supply Voltage Low Diagnostic Procedure

– – –1/1

❶ **Connection 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 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* Perform a preliminary inspection of the 60-way and 48-way ECU connectors. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition OFF 3. Disconnect the sensors supplied voltage by ECU terminal W1 of the 60-way ECU connector. 4. Start ECU communication software 5. Ignition ON, engine OFF 6. Read DTCs using DST or SERVICE ADVISOR™. 7. Make note of all active DTCs, then clear all DTCs 8. Ignition ON, engine running 9. Read DTCs	**000620.04 reoccurs:** GO TO ❹ **000620.04 cleared and doesn't reoccur:** GO TO ❸

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❸ **Sensor Shorted Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information* 1. Reconnect the disconnected sensors one at a time 2. Read DTCs after each sensor is connected.	**000620.04 reoccurs:** Sensor that caused DTC 000620.04 to reoccur is shorted. Replace sensor and retest **000620.04 cleared and doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❹ **Sensor Supply Short to Ground Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information* 1. Ignition OFF 2. Disconnect 30-way ECU connector 3. Using a multimeter, measure resistance between terminal W1 of the 60-way ECU connector and: • Terminal B1 of the 48-way ECU connector • Terminal B3 of the 48-way ECU connector	**Greater than 10,000 ohms:** Faulty ECU connection OR Faulty ECU **10,000 ohms or less:** Sensor 5 volt supply circuit shorted to ECU ground circuit OR Sensor 5 volt supply circuit shorted to sensor ground circuit

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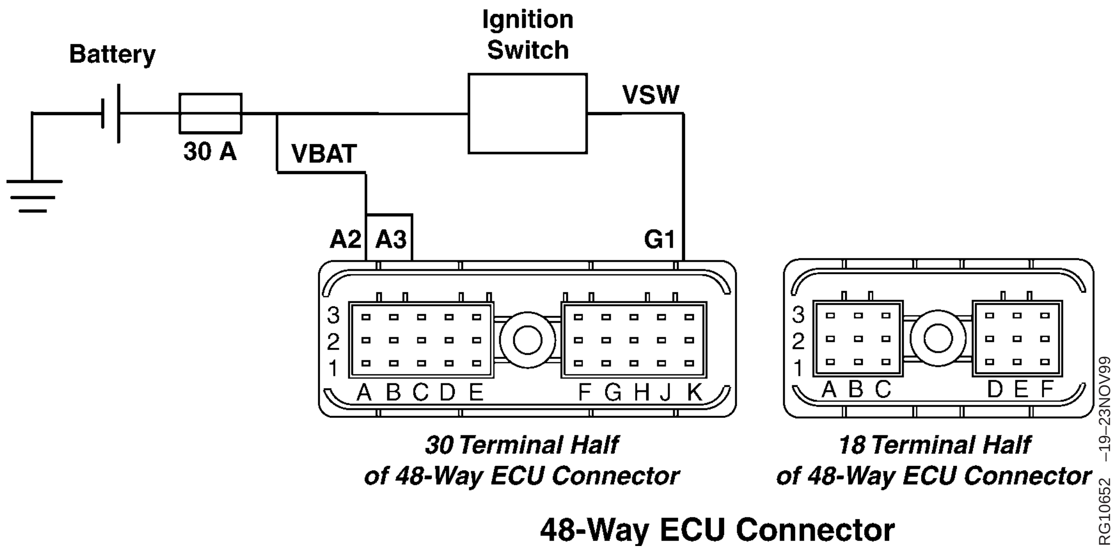
000627.01 — Injector Supply Voltage Problem



DTC 000627.01 will set if:

- The ECU detects an injector voltage supply problem.

If DTC 000627.01 sets, the following will occur:

- The EUIs will not work properly.

DPSG,RG40854,215 –19–16APR02–1/1

000627.01 — Injector Supply Voltage Problem

The ECU detects an injector voltage supply problem.

OUO1004,0000CAC –19–16APR02–1/1

000627.01 Injector Supply Voltage Problem Diagnostic Procedure

– – –1/1

❶ **Connection 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 000627.01 INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.* Perform a preliminary inspection of the 48-way ECU connector and all ECU grounds. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000627.01 INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™. 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000627.01 reoccurs:** GO TO ❸ **000627.01 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **ECU Test**	*NOTE: For wiring and theory of operation information, see DTC 000627.01 INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.* 1. Ignition OFF 2. Disconnect 30-terminal half of the 48-way ECU connector 3. Using a multimeter, measure voltage between a good chassis ground and: • Terminal A2 of the 30-terminal half of the 48-way ECU connector • Terminal A3 of the 30-terminal half of the 48-way ECU connector	**Voltages are substantially less than battery voltage, depending on your system:** GO TO ❹ **Voltages are at or near battery voltage:** Faulty ECU connection OR Faulty ECU – – –1/1

❹ **Battery or Charging System Test**	*NOTE: For wiring and theory of operation information, see DTC 000627.01 INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.* Using a multimeter, measure battery voltage at the battery terminals.	**Voltage is OK for the system being diagnosed:** Faulty ECU power supply fuse OR Faulty ECU connection OR Open or short in ECU power circuit **Voltage is substantially less than battery voltage:** Faulty battery or charging system. – – –1/1

000629.12 — ECU Error

The ECU detects an internal problem.

DTC 000629.12 will set if:

- The ECU detects an internal problem.

If DTC 000629.12 sets, the following will occur:

- Engine will not start or run.

RG40854,000000A –19–16APR02–1/1

000629.12 ECU Error Diagnostic Procedure

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,254

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❶ **Intermittent Fault Test**	*NOTE: For theory of operation information, see DTC 000629.12 ECU ERROR supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine OFF 7. Read DTCs using DST or SERVICE ADVISOR™.	**000629.12 reoccurs:** Faulty ECU **000629.12 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

– – –1/1

000629.13 — ECU Error

The ECU detects an internal problem.

DTC 000629.13 will set if:

- The ECU detects an internal problem.

If DTC 000629.12 or 000629.13 sets, the following will occur:

- Engine will not start or run.

DPSG,RG40854,216 –19–16APR02–1/1

000629.12 or 000629.13 ECU Error Diagnostic Procedure

– – –1/1

❶ **Intermittent Fault Test**	*NOTE: For theory of operation information, see DTC 000629.13 ECU ERROR supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON, engine OFF 7. using DST or SERVICE ADVISOR™.	**000629.13 reoccurs:** Faulty ECU **000629.13 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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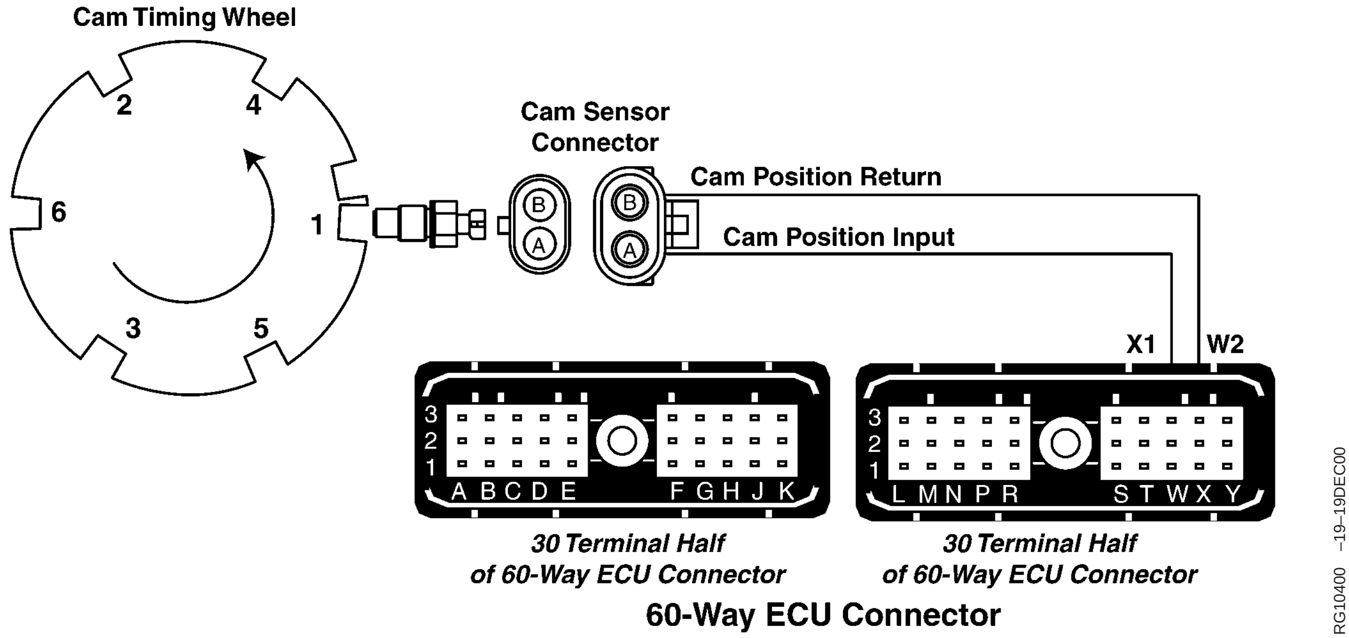
000636.02 — Cam Position Input Noise



Camshaft Position Sensor

- The Cam position sensor is an inductive type pickup sensor that detects 7 notches on the camshaft timing wheel. 6 of the 7 notches correspond to a cylinder; the 7th notch allows the ECU to identify cylinder number 1. Using the Cam position input, the ECU is able to determine when a cylinder is at the end of the compression stroke. The ECU uses the crank position input to determine engine speed and precise piston position in relation to TDC. Based on this information, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC 000636.02 will set if:

- The ECU detects excessive noise (extra pulses) on the cam position input.

If DTC 000636.02 sets, the following will occur:

- If a crank position sensor trouble code accompanies DTC SPN 636 FMI 2, the engine will die and won’t restart until at least one of the two codes is repaired.
- ECU will use only the crank position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,217 –19–16APR02–1/1

000636.02 — Cam Position Input Noise

The ECU detects excessive noise (extra pulses) on the cam position input.

OUO1004,0000CAD –19–16APR02–1/1

000636.02 Cam Position Input Noise Diagnostic Procedure

– – –1/1

❶ **Connection 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 000636.02 CAM POSITION INPUT NOISE supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the cam position sensor, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.02 CAM POSITION INPUT NOISE supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Warm engine 3. Ignition ON, engine OFF 4. Start ECU communication software 5. Read DTCs using DST or SERVICE ADVISOR™. 6. Make note of all DTCs, then clear all DTCs 7. Ignition ON, engine running 8. Read DTCs	**000636.02 reoccurs:** GO TO ❸ **000636.02 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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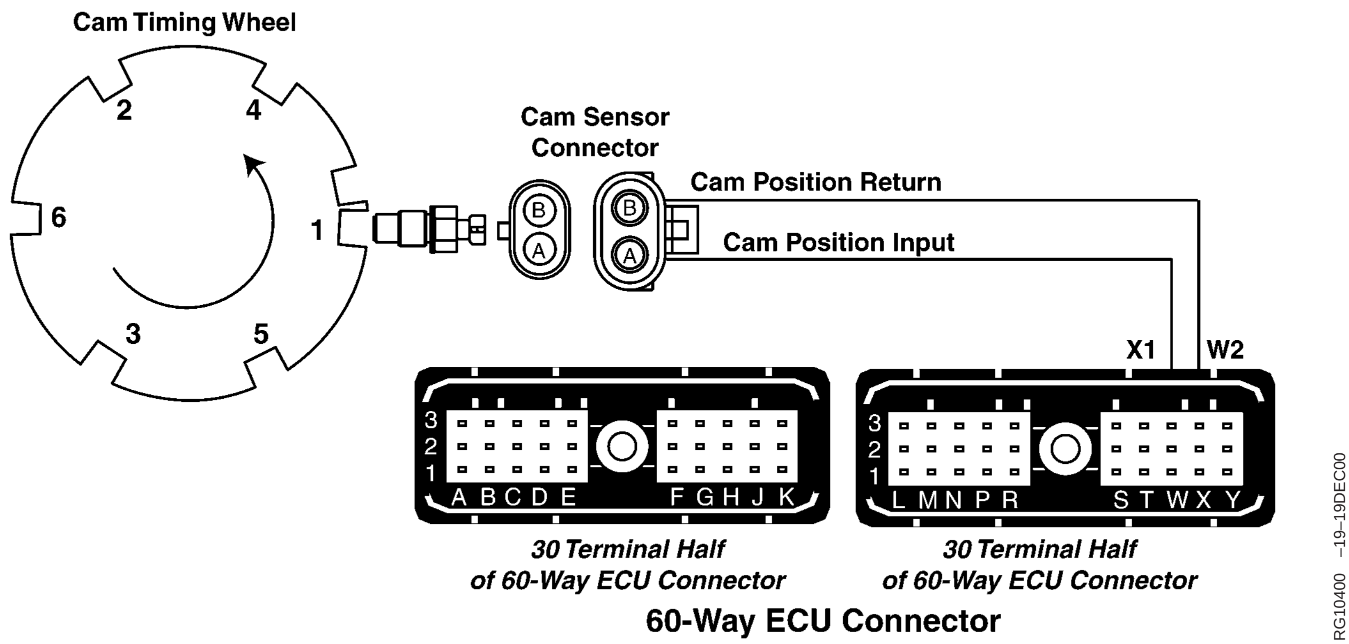
❸ **Noise Detection Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.02 CAM POSITION INPUT NOISE supporting information.* 1. 000636.02 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical 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 cam sensor and ECU connectors 2. Other possible causes of SPN 636 FMI 2: • Electromagnetic interference (EMI) from an incorrectly installed 2-way radio • Interference from some radar source • Possible burrs on the camshaft notches, should be clean, square edges	– – –1/1

000636.08 — Cam Position Input Missing



Camshaft Position Sensor

- The cam position sensor is an inductive type pickup sensor that detects 7 notches on the camshaft timing wheel. 6 of the 7 notches correspond to a cylinder; the 7th notch allows the ECU to identify cylinder number 1. Using the cam position input, the ECU is able to determine when a cylinder is at the end of the compression stroke. The ECU uses the crank position input to determine engine speed and precise piston position in relation to TDC. Based on this information, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC 000636.08 will set if:

- The ECU does not detect the cam position input.

If DTC 000636.08 sets, the following will occur:

- If a crank position sensor trouble code accompanies DTC SPN 636 FMI 8, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the crank position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,218 –19–16APR02–1/1

000636.08 — Cam Position Input Missing

The ECU does not detect the cam position input.

OUO1004,0000CAE –19–16APR02–1/1

000636.08 Cam Position Input Missing Diagnostic Procedure

– – –1/1

❶ **Connection 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 000636.08 CAM POSITION INPUT MISSING supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the cam position sensor, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 CAM POSITION INPUT MISSING supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Read DTCs using DST or SERVICE ADVISOR™. 4. Make notes of any DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs	**000636.08 reoccurs:** GO TO ❸ **000636.08 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

– – –1/1

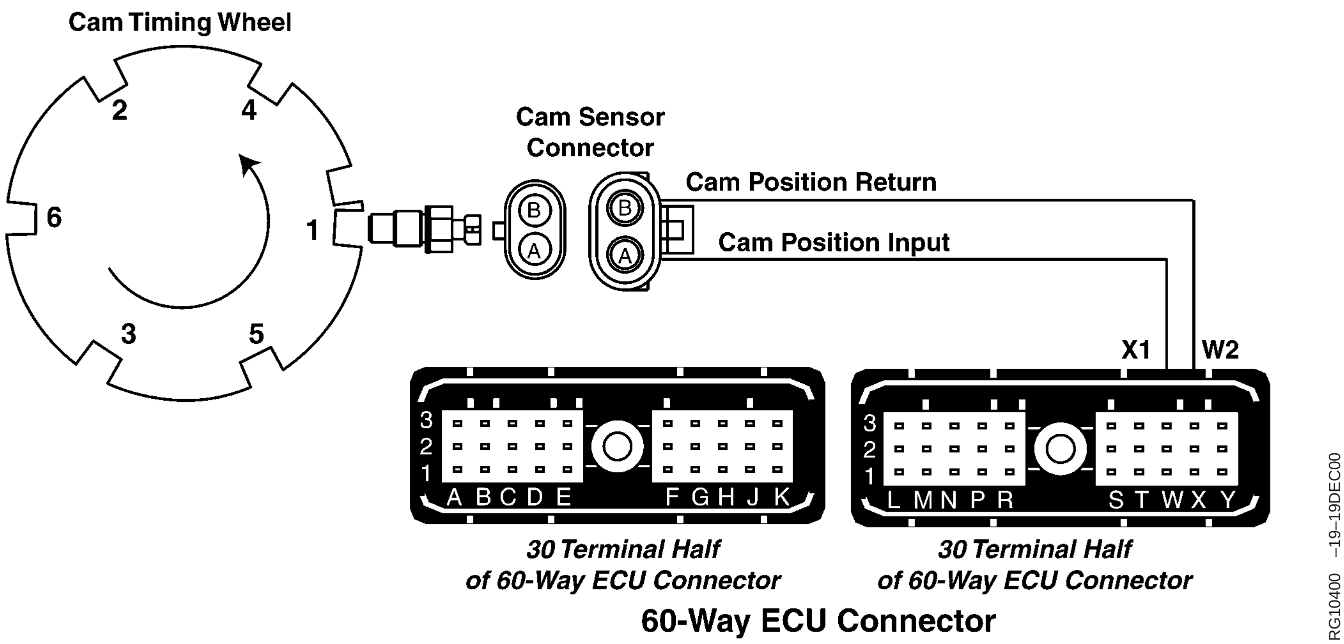
❸ **Cam Position Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 CAM POSITION INPUT MISSING supporting information.* 1. Ignition OFF 2. Disconnect cam position sensor connector 3. Using a multimeter, measure resistance between both terminals of the cam position sensor	**Between 2500 and 3500 ohms:** GO TO ❸ **Below 2500 ohms or above 3500 ohms:** Faulty cam position sensor – – –1/1

❹ **Open in Cam Position Input and Return Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 CAM POSITION INPUT MISSING supporting information.* 1. Disconnect the cam position sensor connector 2. Disconnect 60-way ECU connector 3. Using a multimeter, measure resistance between: • Terminal A of the cam position sensor harness connector ***and*** terminal X1 in the harness end of the 60-way ECU connector • Terminal B of the cam position sensor harness connector ***and*** terminal W2 in the harness end of the 60-way ECU connector	**Both measurements 5 ohms or less:** GO TO ❹ **Either measurement greater than 5 ohms:** Open in cam position sensor input wire OR Open in cam position sensor return wire OR Terminals A and B in the cam position sensor harness connector possibly inverted – – –1/1

❺ **Cam Position Sensor Input Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 CAM POSITION INPUT MISSING supporting information.* 1. Ignition OFF 2. Cam position sensor connector and ECU connector still disconnected 3. Cam position sensor connector and ECU connector still disconnected 4. Using a multimeter measure resistance between terminal X1 in the harness end of the ECU connector and: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2,000 ohms:** GO TO ❺ **Any measurement less than 2,000 ohms:** Faulty cam position sensor input wiring harness – – –1/1

❻ **Cam Position Sensor Return Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.08 CAM POSITION INPUT MISSING supporting information.* 1. Ignition OFF 2. Cam position sensor connector and ECU connector still disconnected 3. Using a multimeter measure resistance between terminal W2 in the harness end of the ECU connector and: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2,000 ohms:** Faulty cam position sensor connector OR Damaged cam position sensor OR Faulty ECU connector OR Faulty ECU **Any measurement less than 2,000 ohms:** Faulty cam position sensor return wiring harness – – –1/1

000636.10 — Cam Position Input Pattern Error



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Camshaft Position Sensor

- The cam position sensor is an inductive type pickup sensor that detects 7 notches on the camshaft timing wheel. 6 of the 7 notches correspond to a cylinder; the 7th notch allows the ECU to identify cylinder number 1. Using the cam position input, the ECU is able to determine when a cylinder is at the end of the compression stroke. The ECU uses the crank position input to determine engine speed and precise piston position in relation to TDC. Based on this information, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC 000636.10 will set if:

- The ECU detects an improper pattern on the cam position input.

If DTC 000636.10 sets, the following will occur:

- If a crank position sensor trouble code accompanies DTC SPN 636 FMI 10, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the crank position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,219 –19–16APR02–1/1

000636.10 — Cam Position Input Pattern Error

The ECU detects an improper pattern on the cam position input.

OUO1004,0000CAF –19–16APR02–1/1

000636.10 Cam Position Input Pattern Error Diagnostic Procedure

– – –1/1

❶ **Connection 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 000636.10 CAM POSITION INPUT PATTERN ERROR supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the cam position sensor, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 CAM POSITION INPUT PATTERN ERROR supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000636.10 reoccurs:** GO TO ❸ **000636.10 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Cam Position Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 CAM POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Disconnect cam position sensor connector 3. Using a multimeter, measure resistance between both terminals of the cam position sensor	**Between 2,500 and 3,500 ohms:** GO TO ❹ **Below 2,500 ohms or above 3,500 ohms:** Faulty cam position sensor – – –1/1

❹ **Open Cam Position Input and Return Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 CAM POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Disconnect cam position sensor connector 3. Disconnect 60-way ECU connector 4. Using a multimeter, measure resistance between: • Terminal A of the cam position sensor harness connector ***and*** terminal X1 in the harness end of the 60-way ECU connector • Terminal B of the cam position sensor harness connector ***and*** terminal W2 in the harness end of the 60-way ECU connector	**Both measurements 5 ohms or less:** GO TO ❺ **Either measurement greater than 5 ohms:** Open in cam position sensor input wire OR Open in cam position sensor return wire OR Terminals A and B in the cam position sensor harness connector possibly inverted – – –1/1

❺ **Cam Position Input Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 CAM POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Cam position sensor connector and 60-way ECU connector still disconnected 3. Using a multimeter measure resistance between terminal X1 in the harness end of the 60-way ECU connector and: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2,000 ohms:** GO TO ❻ **Any measurement less than 2,000 ohms:** Faulty cam position sensor input wiring harness – – –1/1

❻ **Cam Position Return Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 CAM POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Cam position sensor connector and 60-way ECU connector still disconnected 3. Using a multimeter measure resistance between terminal W2 in the harness end of the 60-way ECU connector and: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2,000 ohms:** GO TO ❼ **Any measurement less than 2,000 ohms:** Faulty cam position sensor return wiring harness – – –1/1

❼ **Cam Sensor and Cam Timing Wheel Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 CAM POSITION INPUT PATTERN ERROR supporting information.* 1. Remove cam sensor from cylinder head 2. Inspect sensor for cracks, corrosion, or any foreign material on the end of the sensor 3. Remove the rocker arm cover 4. Inspect the camshaft timing notches for burrs or chips	**All components OK:** GO TO ❽ **Faulty component found:** Repair or replace component as needed – – –1/1

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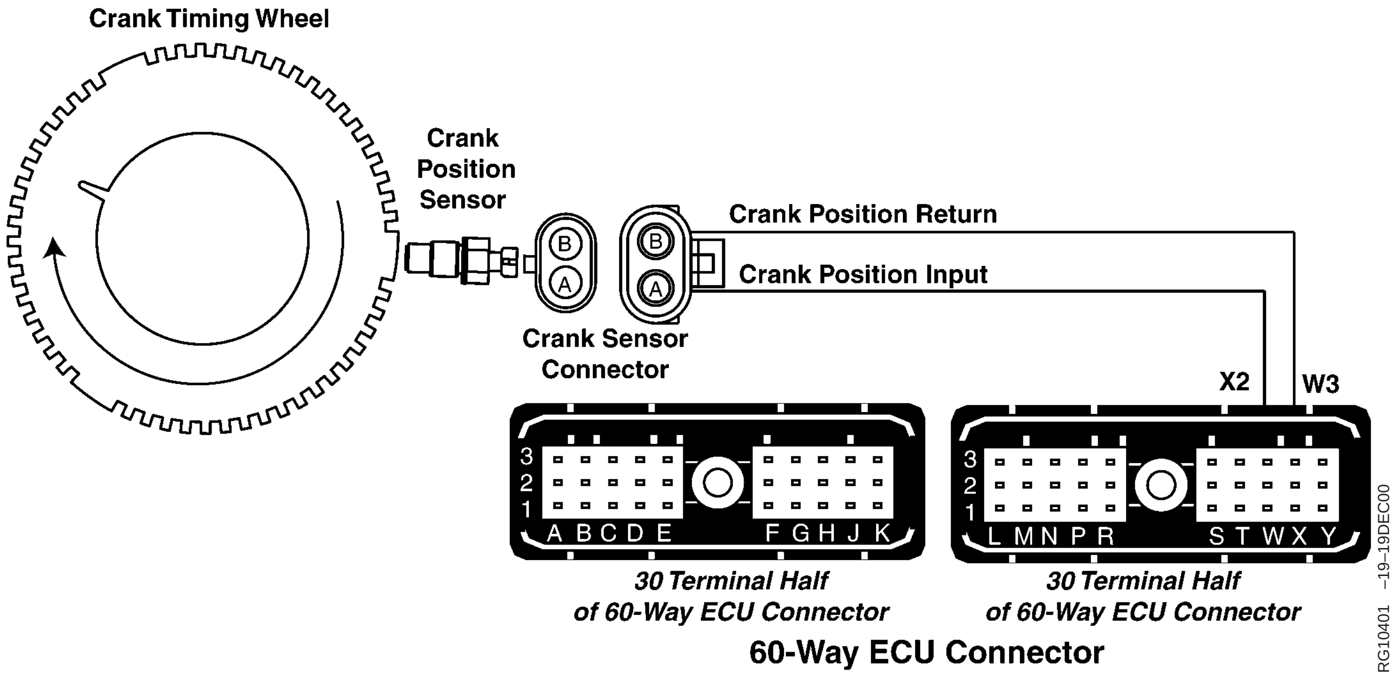
❽ **Cam and Crank Timing Test**	*NOTE: For wiring and theory of operation information, see DTC 000636.10 CAM POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Check camshaft-to-crankshaft timing. See CHECK CAMSHAFT-TO-CRANKSHAFT TIMING in CTM100, Section 02, Group 050.	**Crank timing pin engages in slot:** Faulty cam sensor connector OR Faulty ECU connector OR Faulty ECU **Crank timing pin won't engage slot:** Adjust timing between cam and crank. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in Section 02, Group 050 of CTM100. – – –1/1

000637.02 — Crank Position Input Noise



Crank Position Sensor

- The crank position sensor is an inductive type pickup sensor that detects notches on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the cam position sensor input to determine piston position in relation to the firing order. Based on information from the crank and cam position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC 000637.02 will set if:

- The ECU detects excessive noise (extra pulses) on the crank position input.

If DTC 000637.02 sets, the following will occur:

- If a cam position sensor trouble code accompanies DTC SPN 637 FMI 2, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the cam position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,220 –19–30JUN99–1/1

000637.02 — Crank Position Input Noise

The ECU detects excessive noise (extra pulses) on the crank position input.

OUO1004,0000CB0 –19–16APR02–1/1

000637.02 Crank Position Input Noise Diagnostic Procedure

– – –1/1

❶ **Connection 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 000637.02 CRANK POSITION INPUT NOISE supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the crank position sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANK POSITION INPUT NOISE supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Warm engine 3. Ignition ON, engine OFF 4. Start ECU communication software 5. Read DTCs using DST or SERVICE ADVISOR™ 6. Make notes of any DTCs, then clear all DTCs 7. Ignition ON, engine running 8. Read DTCs	**000637.02 reoccurs:** GO TO ❸ **000637.02 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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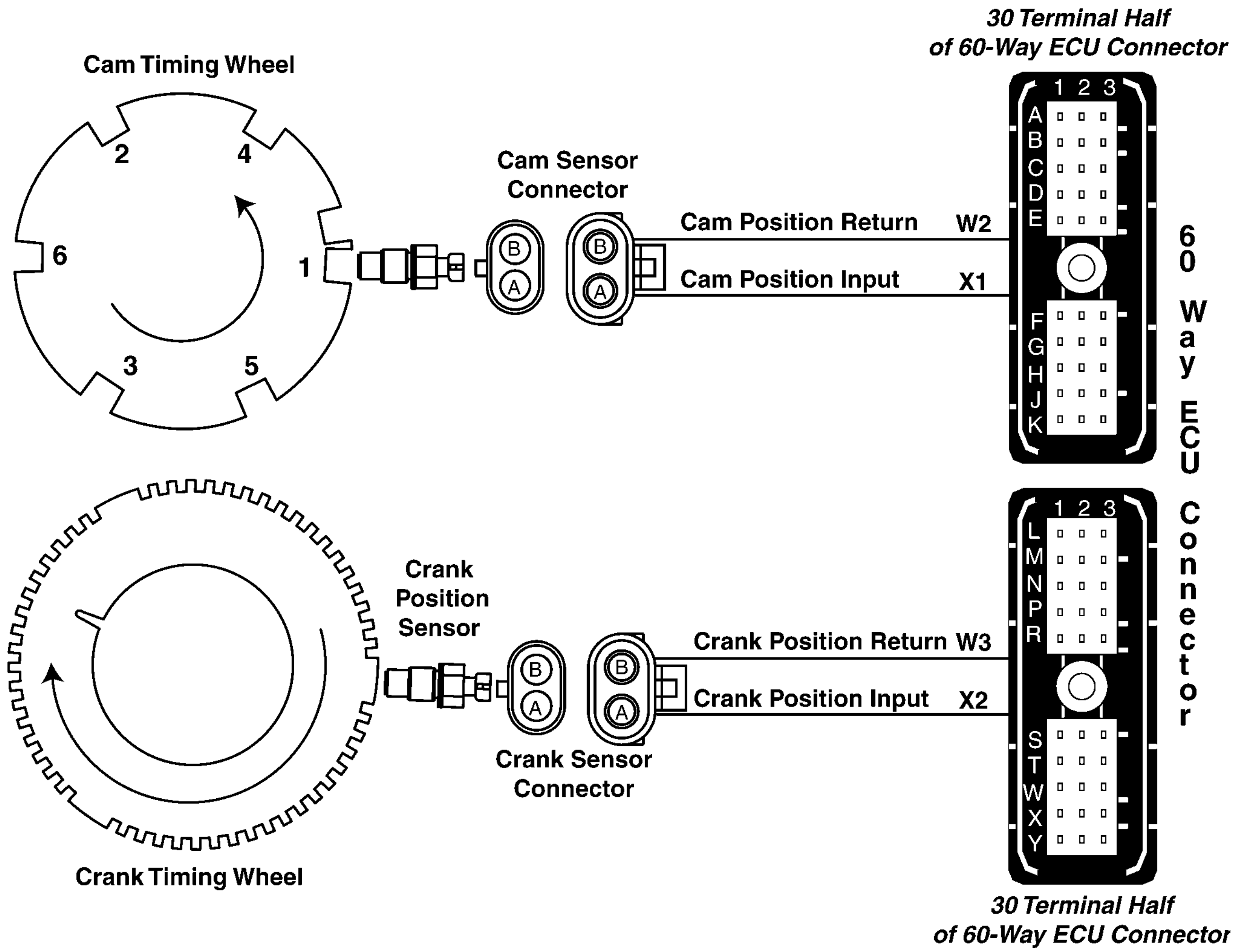
❸ **Noise Detection Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANK POSITION INPUT NOISE supporting information.* 1. 000637.02 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical 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 crank sensor wiring • Check wiring for proper pin location in the crank sensor and ECU connectors 2. Other possible causes of SPN 637 FMI 2: • Electromagnetic interference (EMI) from an incorrectly installed 2-way radio • Interference from some radar source • Possible broken teeth on the crankshaft timing ring	– – –1/1

000637.07 — Crank Position/Cam Position Out of Sync



RG10639 –19–20DEC00

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Camshaft and Crankshaft Position Sensors

- The cam and crank position sensors are both inductive type pickup sensors that detect notches on the cam and crank timing wheels. The ECU uses the crank position input to determine engine speed and precise piston position in relation to TDC. Using the cam position 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 EUIs accordingly. A known relationship between the cam position sensor signal and the crank position sensor signal allows the ECU to recognize when one signal is not in sync with the other.

DTC 000637.07 will set if:

- The ECU detects that the cam and crank 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 crank position sensor will allow the engine to start.
- If the engine continues to run, it will develop low power.

DPSG,RG40854,316 –19–21NOV00–1/1

000637.07 — Crank Position/Cam Position Out of Sync

The ECU detects that the cam and crank inputs are not in sync with each other.

OUO1004,0000CB1 –19–16APR02–1/1

000637.07 Crank Position/Cam Position Out of Sync Diagnostic Procedure

– – –1/1

❶ **Connection 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 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the crank position sensor connector, cam position sensor connector, and any connectors in between them and the ECU connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000637.07 reoccurs:** GO TO ❸ **000637.07 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Cam to Crank Timing Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Ignition OFF 2. Remove rocker arm cover *NOTE: Rocker arm cover gasket is reusable if no visible damage is detected. Do not store cover resting on gasket surface.* 3. Check cam to crank timing. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in CTM100, Section 02, Group 050.	**Crank timing pin engages in slot:** GO TO ❹ **Crank timing pin won't engage in slot:** Adjust timing between cam and crank. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in CTM100, Section 02, Group 050. – – –1/1

❹ **Crank and Cam Timing Wheel and Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Ignition OFF 2. Remove cam and crank timing pins 3. Inspect crank timing wheel and cam timing wheel for broken teeth, nicks burrs, or other damage 4. Remove cam and crank sensors from cylinder head and timing gear cover 5. Inspect cam and crank position sensors for cracks, debris, or other damage.	**All components OK:** GO TO ❺ **Faulty component found:** Replace faulty component and retest. – – –1/1

❺ **Crankshaft Position Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector 3. Using a multimeter, measure resistance between both terminal of the crank position sensor	**Measurement between 2500 and 3500 ohms:** GO TO ❻ **Measurement below 2500 ohms or above 3500 ohms:** Faulty crankshaft position sensor – – –1/1

❻ **Camshaft Position Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Ignition OFF 2. Disconnect cam position sensor connector 3. Using a multimeter, measure resistance between both terminals of the cam position sensor	**Measurement between 2500 and 3500 ohms:** GO TO ❼ **Measurement below 2500 ohms or above 3500 ohms:** Faulty camshaft position sensor – – –1/1

❼ **Open in Crank Position Sensor Input and Return Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector 3. Disconnect 60-way ECU connector 4. Using a multimeter, measure resistance between: • Terminal A of the crank position sensor harness connector ***and*** terminal X2 in the harness end of the 60-way ECU connector. • Terminal B of the crank position sensor harness connector ***and*** terminal W3 in the harness end of the 60-way ECU connector.	**Both measurements 5 ohms or less:** GO TO ❽ **Either measurement greater than 5 ohms:** Open in crank position sensor input wire OR Open in crank position sensor return wire OR Terminals A and B in the crank position sensor harness connector possibly inverted – – –1/1

❽ **Crank Position Sensor Input Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Ignition OFF 2. Crank position sensor connector and 60-way ECU connector still disconnected 3. Using a multimeter measure resistance between terminal X2 in the harness end of the 60-way ECU connector and: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2000 ohms:** GO TO ❾ **Any measurement less than 2000 ohms:** Faulty crank position sensor input wiring harness – – –1/1

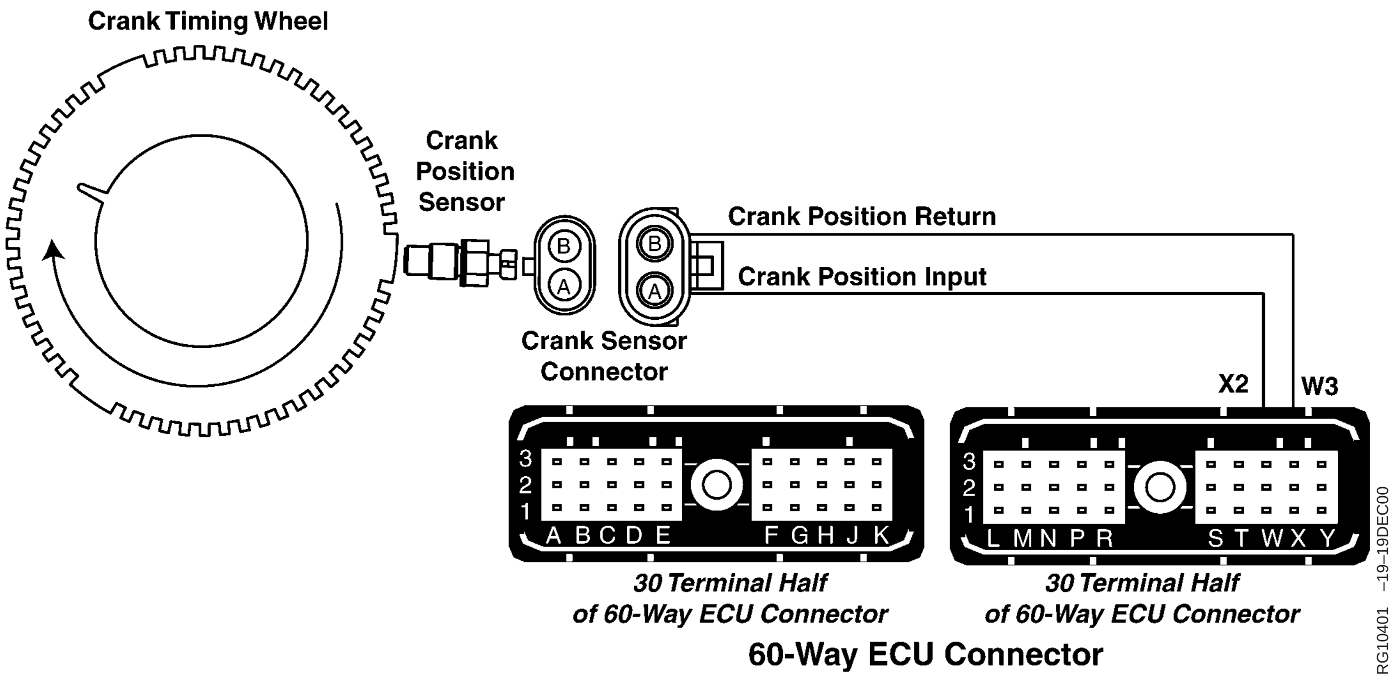
❾ **Crank Position Sensor Return Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Ignition OFF 2. Crank position sensor connector and 60-way ECU connector still disconnected 3. Using a multimeter measure resistance between terminal W3 in the harness end of the 60-way ECU connector and: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2000 ohms:** GO TO ❿ **Any measurement less than 2000 ohms:** Faulty crank position sensor return wiring harness – – –1/1

10 Open in Cam Position Input and Return Wire Test	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Ignition OFF 2. Disconnect cam position sensor connector 3. Disconnect 60-way ECU connector 4. Using a multimeter, measure resistance between: • Terminal A of the cam position sensor harness connector ***and*** terminal X1 in the harness end of the 60-way ECU connector • Terminal B of the cam position sensor harness connector ***and*** terminal W2 in the harness end of the 60-way ECU connector	**Both measurements 5 ohms or less:** GO TO 11 **Either measurement greater than 5 ohms:** Open in cam position sensor input wire OR Open in cam position sensor return wire OR Terminals A and B in the cam position sensor harness connector possibly inverted – – –1/1

11 Cam Position Sensor Input Wiring Harness Test	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Ignition OFF 2. Cam position sensor connector and 60-way ECU connector still disconnected 3. Using a multimeter measure resistance between terminal X1 in the harness end of the 60-way ECU connector and: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2000 ohms:** GO TO 12 **Any measurement less than 2000 ohms:** Faulty cam position sensor input wiring harness – – –1/1

12 Cam Position Sensor Return Wiring Harness Test	*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/CAM POSITION OUT OF SYNC supporting information.* 1. Ignition OFF 2. Cam position sensor connector and 60-way ECU connector still disconnected 3. Using a multimeter measure resistance between terminal W2 in the harness end of the 60-way ECU connector and: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2000 ohms:** Faulty crank sensor connector OR Faulty cam sensor connector OR Faulty ECU connector OR Faulty ECU **Any measurement less than 2000 ohms:** Faulty cam position sensor return wiring harness – – –1/1

000637.08 — Crank Position Input Missing



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Crank Position Sensor

- The crank position sensor is an inductive type pickup sensor that detects notches on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the cam position sensor input to determine piston position in relation to the firing order. Based on information from the crank and cam position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC 000637.08 will set if:

- The ECU does not detect the crank position input.

If DTC 000637.08 sets, the following will occur:

- If a cam position sensor trouble code accompanies DTC SPN 637 FMI 8, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the cam position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,221 –19–16APR02–1/1

000637.08 — Crank Position Input Missing

The ECU does not detect the crank position input.

OUO1004,0000CB2 –19–16APR02–1/1

000637.08 Crank Position Input Missing Diagnostic Procedure

– – –1/1

❶ **Connection 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 000637.08 CRANK POSITION INPUT MISSING supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the crank position sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Warm engine 3. Ignition ON, engine OFF 4. Start ECU communication software 5. Read DTCs using DST or SERVICE ADVISOR™ 6. Make notes of any DTCs, then clear all DTCs 7. Ignition ON, engine running 8. Read DTCs	**000637.08 reoccurs:** GO TO ❸ **000637.08 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Crank Sensor Observable Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.* 1. Ignition OFF 2. Remove crank position sensor from timing gear cover 3. Inspect sensor tip for damage, such as cracks or debris	**No signs of damage:** GO TO ❹ **Damage to sensor:** Determine and repair the cause of damage to sensor Replace sensor and retest – – –1/1

❹ **Crank Sensor Depth Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.* Check depth of crank sensor. See CHECK CRANKSHAFT POSITION SENSOR DEPTH in CTM100, Section 04 Group 150.	**Depth OK:** GO TO ❺ **Depth out of specification:** Repair as needed. – – –1/1

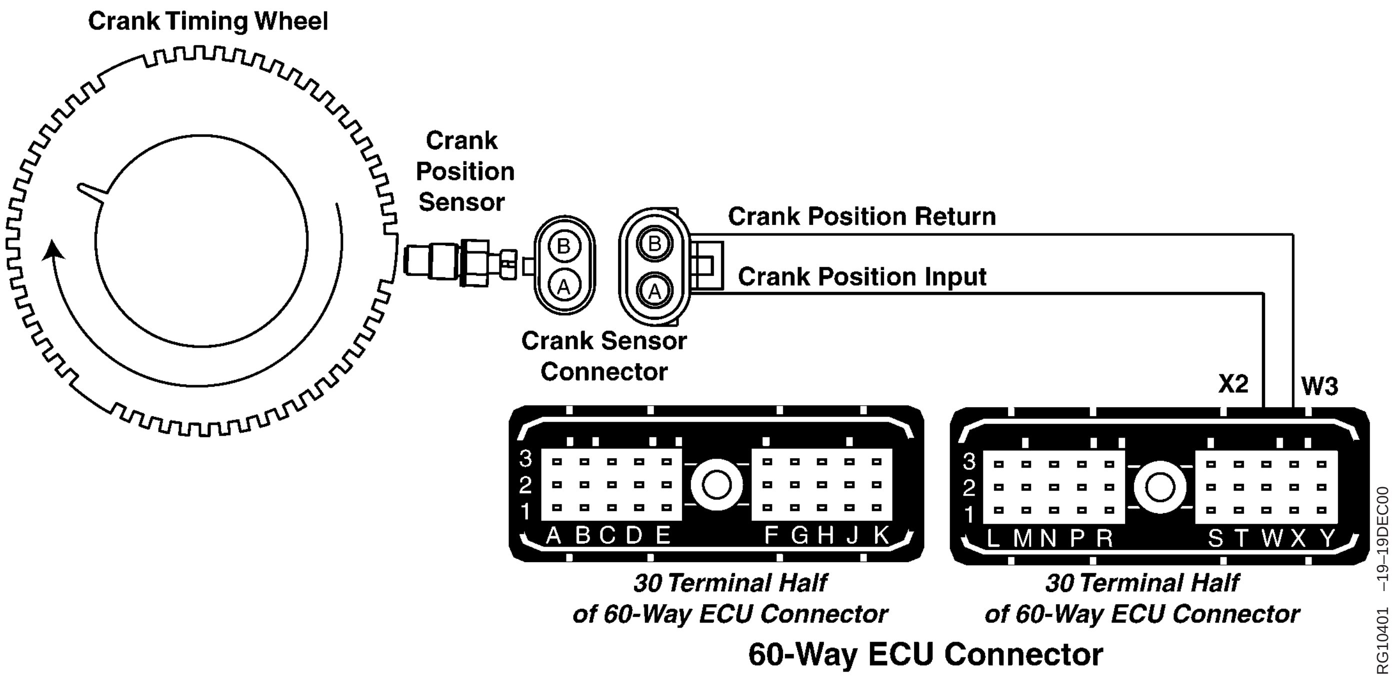
❺ **Crank Position Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector 3. Using a multimeter, measure resistance between both terminals of the crank position sensor	**Measurement between 2500 and 3500 ohms:** GO TO ❻ **Measurement below 2500 ohms or above 3500 ohms:** Faulty crank position sensor. – – –1/1

❻ **Open in Crank Position Sensor Input and Return Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector 3. Disconnect 60-way ECU connector 4. Using a multimeter, measure resistance between: • Terminal A of the crank position sensor harness connector ***and*** terminal X2 in the harness end of the 60-way ECU connector • Terminal B of the crank position sensor harness connector ***and*** terminal W3 in the harness end of the 60-way ECU connector	**Both measurements 5 ohms or less:** GO TO ❼ **Either measurement greater than 5 ohms:** Open in crank position sensor input wire OR Open in crank position sensor return wire OR Terminals A and B in the crank position sensor harness connector possibly inverted – – –1/1

❼ **Crank Position Sensor Input Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.* 1. Ignition OFF 2. Crank position sensor connector and 60-way ECU connector still disconnected 3. Using a multimeter measure resistance between terminal X2 in the harness end of the 60-way ECU connector and: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2000 ohms:** GO TO ❽ **Any measurement less than 2000 ohms:** Faulty crank position sensor input wiring harness – – –1/1

❽ **Crank Position Sensor Return Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.* 1. Ignition OFF 2. Crank position sensor connector and 60-way ECU connector still disconnected 3. Using a multimeter measure resistance between terminal W3 in the harness end of the 60-way ECU connector and: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2000 ohms:** Faulty crank position sensor connector OR Damaged crank position sensor OR Faulty ECU connector OR Faulty ECU **Any measurement less than 2000 ohms:** Faulty crank position sensor return wiring harness – – –1/1

000637.10 — Crank Position Input Pattern Error



Crank Position Sensor

- The crank position sensor is an inductive type pickup sensor that detects notches on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the cam position sensor input to determine piston position in relation to the firing order. Based on information from the crank and cam position sensors, the ECU calculates the cam position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC 000637.10 will set if:

- The ECU detects an improper pattern on the crank position input.

If DTC 000637.10 sets, the following will occur:

- If a cam position sensor trouble code accompanies DTC SPN 637 FMI 10, the engine will die and won’t restart until at least one of the two codes is repaired.
- ECU will use only the cam position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,222 –19–21NOV00–1/1

000637.10 — Crank Position Input Pattern Error

The ECU detects an improper pattern on the crank position input.

OUO1004,0000CB3 –19–16APR02–1/1

000637.10 Crank Position Input Pattern Error Diagnostic Procedure

– – –1/1

❶ **Connection 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 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the crank position sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000637.10 reoccurs:** GO TO ❸ **000637.10 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Crank Position Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector 3. Using a multimeter, measure resistance between both terminals of the crank position sensor	**Measurement between 2500 and 3500 ohms:** GO TO ❹ **Measurement below 2500 ohms or above 3500 ohms:** Faulty crank position sensor – – –1/1

❹ **Crank Position Wiring Open Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector Disconnect 60-way ECU connector 3. Using a multimeter, measure resistance between: • Terminal A of the crank position sensor harness connector ***and*** terminal X2 in the harness end of the 60-way ECU connector. • Terminal B of the crank position sensor harness connector ***and*** terminal W3 in the harness end of the 60-way ECU connector.	**Both measurements 5 ohms or less:** GO TO ❺ **Either measurement greater than 5 ohms:** Open in crank position sensor input wire OR Open in crank position sensor return wire OR Terminals A and B in the crank position sensor harness connector possibly inverted – – –1/1

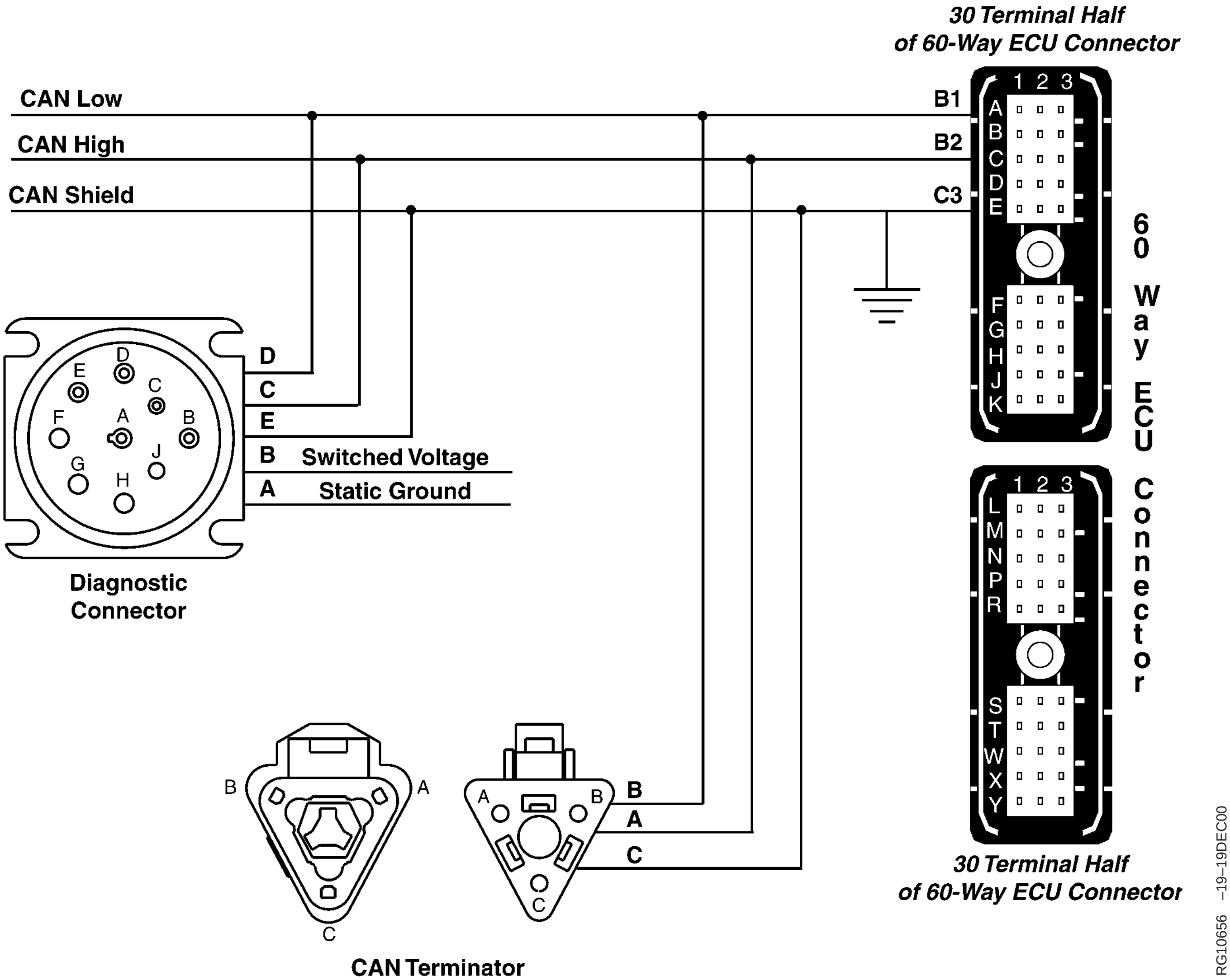
❺ **Crank Position Sensor Return Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector 3. Disconnect 60-way ECU connector 4. Using a multimeter, measure resistance between: • Terminal A of the crank position sensor harness connector ***and*** terminal X2 in the harness end of the 60-way ECU connector. • Terminal B of the crank position sensor harness connector ***and*** terminal W3 in the harness end of the 60-way ECU connector.	**All measurements greater than 2000 ohms:** GO TO ❻ **Any measurement less than 2000 ohms:** Faulty crank position sensor return wiring harness – – –1/1

❻ **Crank Sensor Observable Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* *NOTE: Do not remove the timing cover to perform this inspection.* 1. Remove crank sensor from timing gear cover 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 timing wheel	**All components OK:** GO TO ❼ **Fault found in a component:** Repair or replace component as needed. – – –1/1

❼ **Crank Sensor Depth Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* Check depth of the crank sensor. See CHECK CRANKSHAFT POSITION SENSOR DEPTH in CTM100, Section 04, Group 150	**Depth OK:** GO TO ❽ **Depth out of specification:** Repair as needed. – – –1/1

❽ **Cam to Crank Timing Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Check cam to crank timing. See CHECK CAMSHAFT-TO-CRANKSHAFT TIMING in CTM100, Section 02, Group 050.	**Crank timing pin engages in slot:** Faulty crank sensor connector OR Faulty ECU connector OR Faulty ECU **Crank timing pin won't engage slot:** Adjust timing between cam and crank. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in Section 02, Group 050 of CTM100 – – –1/1

000639.13 — CAN Error



Controller Area Network (CAN)

- CAN is the network in which the individual controllers on a machine communicate with each other. The number of controllers communicating on CAN depends on the application. On some applications, the ECU is the only controller on CAN; on other applications, there are many controllers on CAN.

DTC 000639.13 will set if:

- The ECU detects a problem communicating on CAN.

If DTC 000639.13 sets, the following will occur:

- Depending on the application, engine operation may or may not be affected.

RG40854,0000015 –19–16APR02–1/1

000639.13 — CAN Error

The ECU detects a problem communicating on CAN.

RG40854,000006F –19–16APR02–1/1

000639.13 CAN Error Diagnostic Procedure

– – –1/1

❶ **Connection 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 000639.13 CAN ERROR supporting information.* Perform a preliminary inspection of the 60-way ECU connector, other controller connections, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For theory of operation information, see DTC 000639.13 CAN ERROR supporting information* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**DTC 000639.13 reoccurs:** GO TO ❸ **DTC 000639.13 cleared:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

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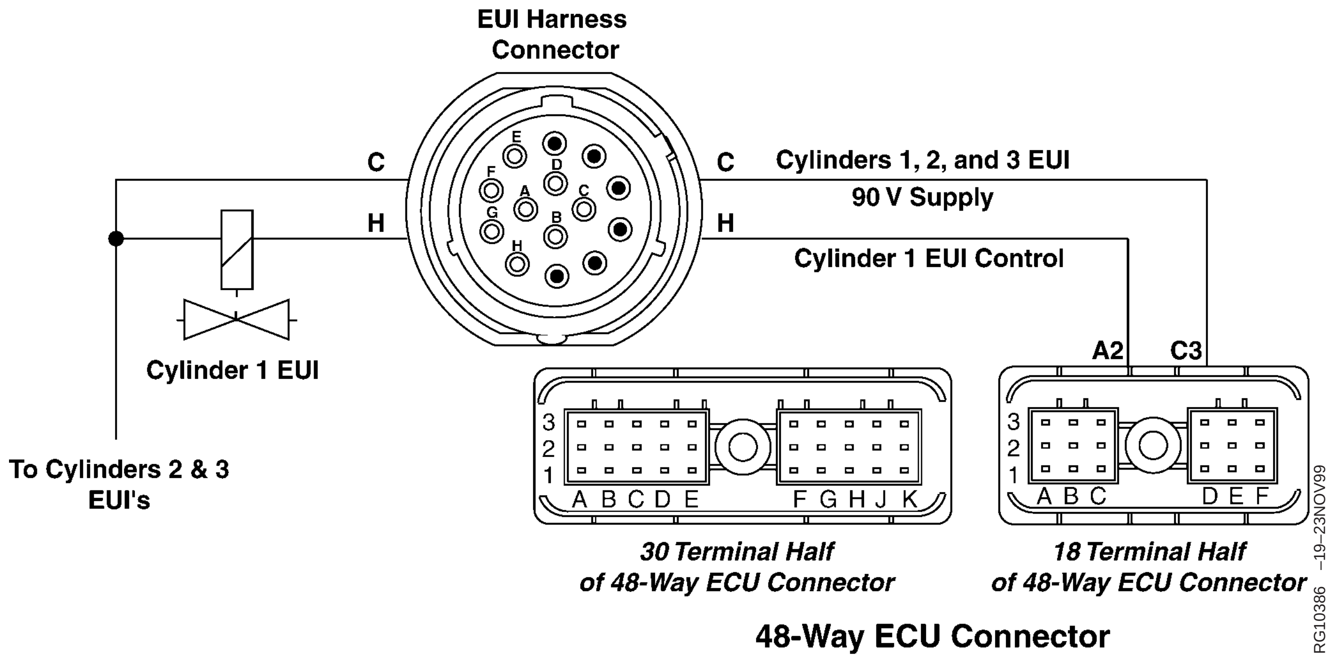
❸ **Check Other Controllers For CAN Related DTCs**	If application has other machine controllers communicating on the CAN bus, check those controllers•for CAN related DTCs	**No CAN related DTCs found on other controllers:** GO TO ❹ **Did find CAN related DTCs on other controllers:** Refer to machine manual to diagnose and repair the cause of DTC, then determine if DTC 000639.13 reoccurs – – –1/1

❹ **CAN Resistance Test**	*NOTE: For theory of operation information, see DTC 000639.13 CAN ERROR supporting information* 1. Ignition OFF 2. Disconnect 60-way ECU•connector 3. Using a multimeter, measure resistance between•terminals B1 ***and*** B2 in the harness end of the 60-way ECU connector	**Between 55 - 65 ohms:** Faulty 60-way ECU connector OR Faulty ECU **Less than 55 or greater than 65 ohms:** Open or short in CAN communication circuit – – –1/1

000651.05 — Cylinder #1 EUI Circuit Open



EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000651.05 will set if:

- The ECU detects an open in the Cylinder #1 EUI circuit.

If DTC 000651.05 sets, the following will occur:

- Cylinder #1 EUI will not fire.

DPSG,RG40854,223 –19–16APR02–1/1

000651.05 — Cylinder #1 EUI Circuit Open

The ECU detects an open in the Cylinder #1 EUI circuit.

OUO1004,0000CB4 –19–16APR02–1/1

000651.05 Cylinder #1 EUI Circuit Open Diagnostic Procedure

– – –1/1

❶ **Connection 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 000651.05 CYLINDER #1 EUI CIRCUIT OPEN supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or 000627.01 are active, repair those DTCs first.** *NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EUI CIRCUIT OPEN supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000651.05 reoccurs:** GO TO ❸ **000651.05 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

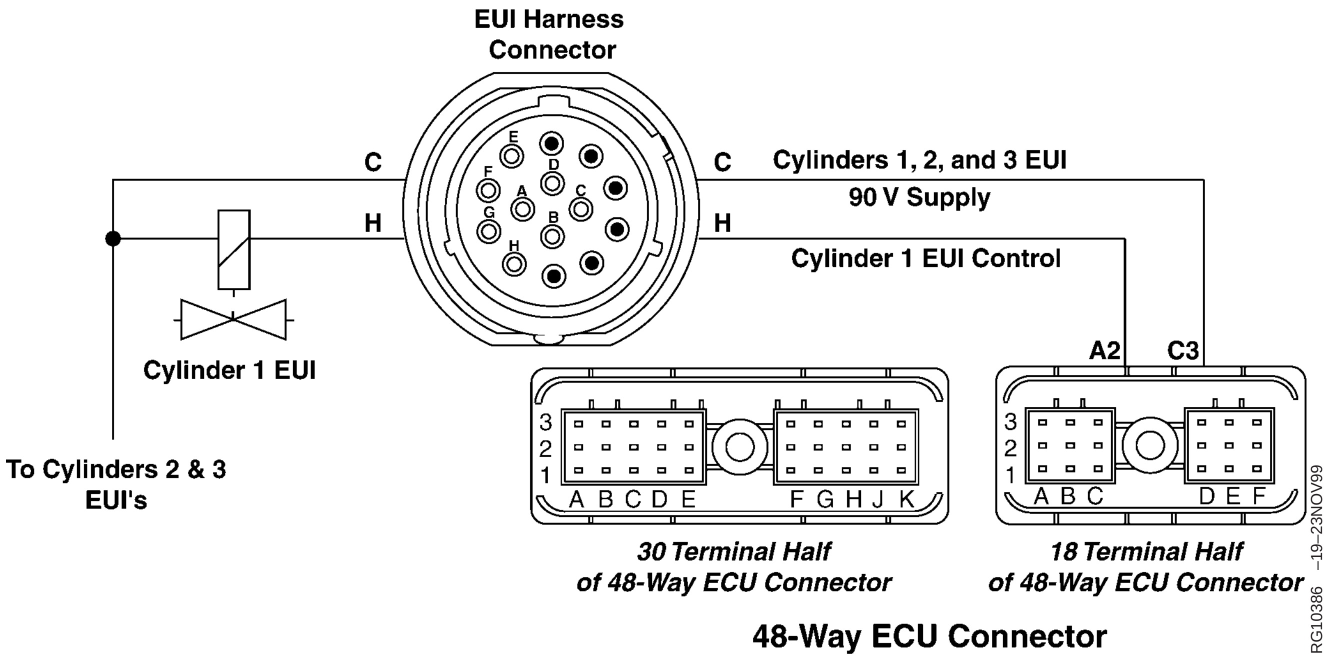
– – –1/1

❸ **Open Wire in 90V Supply or EUI Control Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EUI CIRCUIT OPEN supporting information.* 1. Ignition OFF ⚠ **CAUTION: Possible strong electric shock hazard if engine is cranking or running.** 2. Disconnect EUI wiring harness connector at rear of cylinder head Disconnect 18-terminal half of 48-way ECU connector 3. Using a multimeter, measure resistance between: • Terminal H in the harness end of the EUI wiring harness connector ***and*** terminal A2 in the harness end of the ECU connector. • Terminal C in the harness end of the EUI wiring harness connector ***and*** terminal C3 in the harness end of the ECU connector.	**Both measurements 5 ohms or less:** GO TO ❹ **Measurement between H to A2 greater than 5 ohms:** Open in wire between terminal H and A2. **Measurement between C to C3 greater than 5 ohms:** Open in wire between terminal C and C3. – – –1/1

❹ **Cylinder 1 EUI Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EUI CIRCUIT OPEN supporting information.* 1. Remove rocker arm cover 2. Disconnect electrical connections to cylinder 1 EUI and a known good EUI 3. Using a multimeter measure resistance between: • The two terminals on cylinder 1 EUI • The two terminals on the known good EUI 4. Compare the measurements between the two EUIs *NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typically, EUI resistance should be 1.0-1.8 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 1 EUI – – –1/1

❺ **EUI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EUI CIRCUIT OPEN supporting information.* 1. Ignition OFF 2. Cylinder 1 EUI wires disconnected from EUI 3. Disconnect EUI wiring harness connector from rear of cylinder head 4. Using a multimeter, measure resistance between: • One of the cylinder 1 EUI harness eyelet ***and*** the corresponding terminal at the connector on the rear of the cylinder head (either C or H, the EUI's are not polarity sensitive) • The other cylinder 1 EUI harness eyelet ***and*** the other corresponding terminal at the connector on the rear of the cylinder head	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EUI harness in head – – –1/1

000651.06 — Cylinder #1 EUI Circuit Shorted



EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000651.06 will set if:

- The ECU detects a short in the Cylinder #1 EUI circuit.

If DTC 000651.06 sets, the following will occur:

- Cylinder #1 EUI will not fire.

DPSG,RG40854,224 –19–16APR02–1/1

000651.06 — Cylinder #1 EUI Circuit Shorted

The ECU detects a short in the Cylinder #1 EUI circuit.

OUO1004,0000CB5 –19–16APR02–1/1

000651.06 Cylinder #1 EUI Circuit Shorted Diagnostic Procedure

– – –1/1

❶ **Connection 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 000651.06 CYLINDER #1 EUI CIRCUIT SHORTED supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR 000627.01 are active, repair those DTCs first.** *NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EUI CIRCUIT SHORTED supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000651.06 reoccurs:** GO TO ❸ **000651.06 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ Short in EUI Wiring Harness Test	*NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF **CAUTION: Possible strong electric shock hazard if engine is cranking or running.** 2. Disconnect 18-terminal half of 48-way ECU connector 3. Disconnect EUI wiring harness connector at rear of cylinder head 4. Using a multimeter, measure resistance between terminal H in the harness end of the EUI wiring connector and: • Terminal C in the harness end of the EUI wiring connector • Terminal F in the harness end of the EUI wiring connector	**Both measurements greater than 20,000 ohms:** GO TO ❹ **Either measurement less than 20,000 ohms:** Short in ECU wiring harness. – – –1/1

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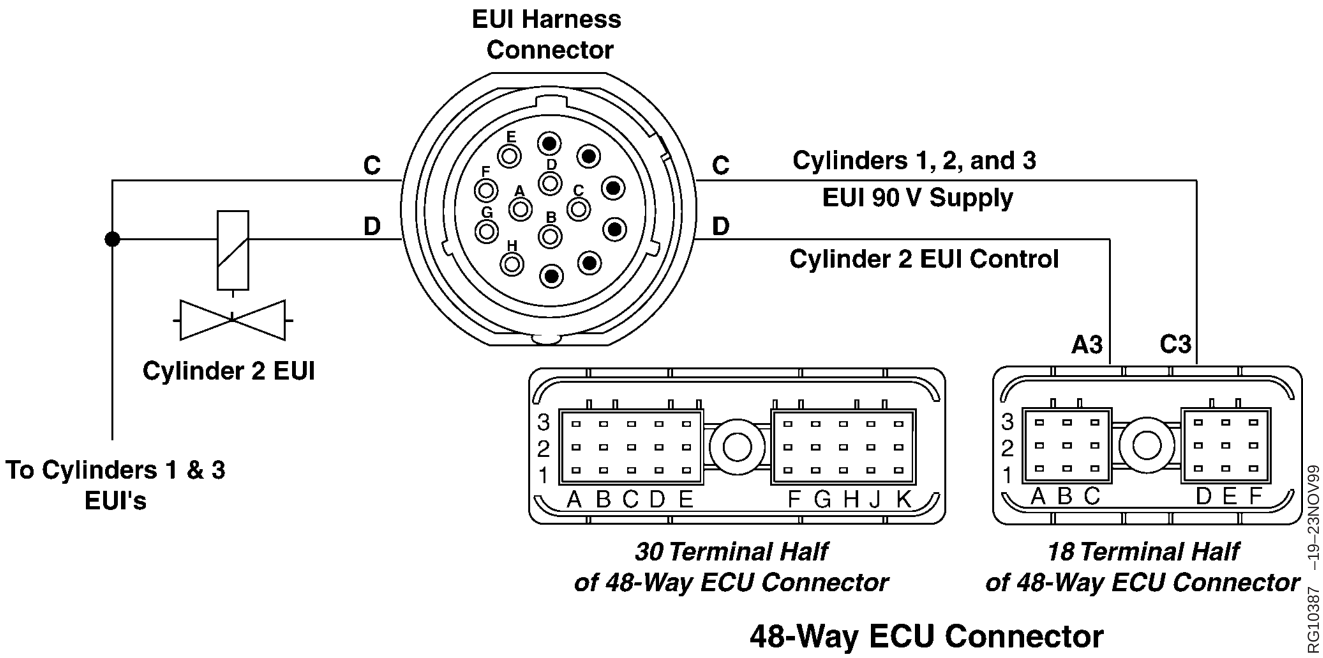
160
,296

❹ Cylinder 1 EUI Test	*NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EUI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover 2. Disconnect electrical connections to cylinder 1 EUI and a known good EUI 3. Using a multimeter measure resistance between: • The two terminals on cylinder 1 EUI • The two terminals on the known good EUI 4. Compare the measurements between the two EUIs *NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typical EUI resistance should be 1.0-1.8 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 1 EUI – – –1/1

❺ EUI Wiring Harness in Cylinder Head Test Cylinder 1 EUI Test	*NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF 2. Keep cylinder 1 EUI wires disconnected from EUI 3. Keep EUI wiring harness connector at rear of cylinder head disconnected 4. Using a multimeter, measure resistance between both of cylinder 1 EUI harness eyelets.	**Greater than 20,000 ohms:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Less than 20,000 ohms:** Faulty EUI wiring harness – – –1/1

000652.05 — Cylinder #2 EUI Circuit Open



IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000652.05 will set if:

- The ECU detects an open in the Cylinder #2 EUI circuit.

If DTC 000652.05 sets, the following will occur:

- Cylinder #2 EUI will not fire.

DPSG,RG40854,225 –19–30JUN99–1/1

000652.05 — Cylinder #2 EUI Circuit Open

The ECU detects an open in the Cylinder #2 EUI circuit.

OUO1004,0000CB6 –19–16APR02–1/1

000652.05 Cylinder #2 EUI Circuit Open Diagnostic Procedure

04
160
,299

– – –1/1

❶ **Connection 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 000652.05 CYLINDER #2 EUI CIRCUIT OPEN supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or 000627.01 are active, repair those DTCs first.** *NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EUI CIRCUIT OPEN supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000652.05 reoccurs:** GO TO ❸ **000652.05 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **744 Loader Serial Number Check**	*NOTE: This check is only required for 744 Loaders. For other applications, GO TO ❹.* **744 Loader Serial Numbers:** • **(—573732):** GO TO ❹ • **(573733—581927):** See Step 4 in LEVEL 6 ECU - DTC 000655.05 CYLINDER #5 EUI CIRCUIT OPEN DIAGNOSTIC PROCEDURE later in this Group. *NOTE: The ECU displays the wrong DTC for these vehicles with the above serial number range. Follow the link shown above to diagnose the correct DTC.* • **581927—:** GO TO ❹	 – – –1/1

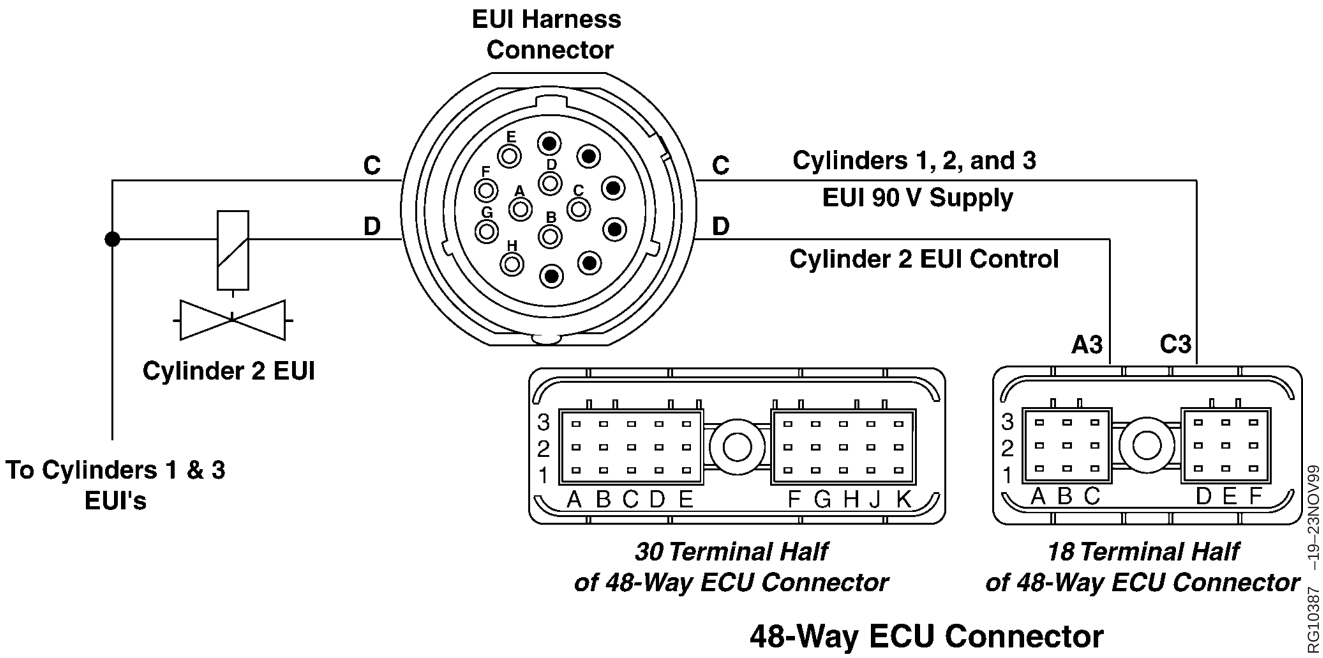
04 160 ,300

❹ **Open Wire in 90V Supply or EUI Control Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EUI CIRCUIT OPEN supporting information.* 1. Ignition OFF 2. Possible strong electric shock hazard if engine is cranking or running 3. Disconnect EUI wiring harness connector at rear of cylinder head Disconnect 18-terminal half of 48-way ECU connector 4. Using a multimeter, measure resistance between: • Terminal D in the harness end of the EUI wiring harness connector ***and*** terminal A3 in the harness end of the ECU connector • Terminal C in the harness end of the EUI wiring harness connector ***and*** terminal C3 in the harness end of the ECU connector	**Both measurements 5 ohms or less:** GO TO ❺ **Measurement between D to A3 greater than 5 ohms:** Open in wire between terminal D and A3 **Measurement between C to C3 greater than 5 ohms:** Open in wire between terminal C and C3 – – –1/1

❺ **Cylinder 2 EUI Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EUI CIRCUIT OPEN supporting information.* 1. Remove rocker arm cover 2. Disconnect electrical connections to cylinder 2 EUI and a known good EUI 3. Using a multimeter measure resistance between: • The two terminals on cylinder 2 EUI • The two terminals on the known good EUI 4. Compare the measurements between the two EUIs *NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, EUI resistance should be 1.0-1.8 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❻ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 2 EUI – – –1/1

❻ **EUI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EUI CIRCUIT OPEN supporting information.* 1. Ignition OFF 2. Cylinder 2 EUI wires disconnected from EUI 3. Disconnect EUI wiring harness connector from rear of cylinder head 4. Using a multimeter, measure resistance between: • One of the cylinder 2 EUI harness eyelet ***and*** the corresponding terminal at the connector on the rear of the cylinder head (either C or D, the EUI's are not polarity sensitive) • The other cylinder 2 EUI harness eyelet ***and*** the other corresponding terminal at the connector on the rear of the cylinder head	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EUI harness in head – – –1/1

000652.06 — Cylinder #2 EUI Circuit Shorted



EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000652.06 will set if:

- The ECU detects a short in the Cylinder #2 EUI circuit.

If DTC 000652.06 sets, the following will occur:

- Cylinder #2 EUI will not fire.

DPSG,RG40854,226 –19–16APR02–1/1

000652.06 — Cylinder #2 EUI Circuit Shorted

The ECU detects a short in the Cylinder #2 EUI circuit.

OUO1004,0000CB7 –19–16APR02–1/1

000652.06 Cylinder #2 EUI Circuit Shorted Diagnostic Procedure

– – –1/1

❶ **Connection 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 000652.06 CYLINDER #2 EUI CIRCUIT SHORTED supporting information supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR 000627.01 are active, repair those DTCs first.** *NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EUI CIRCUIT SHORTED supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000652.06 reoccurs:** GO TO ❸ **000652.06 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ 744 Loader Serial Number Check

NOTE: This check is only required for 744 Loaders. For other applications, GO TO ❹.

744 Loader Serial Numbers:

- **(—573732):** GO TO ❹
- **(573733—581927):** See Step 4 in LEVEL 6 ECU - DTC 000655.06 CYLINDER #5 EUI CIRCUIT SHORTED DIAGNOSTIC PROCEDURE later in this Group.
  NOTE: The ECU displays the wrong DTC for these vehicles with the above serial number range. Follow the link shown above to diagnose the correct DTC.
- **581927—:** GO TO ❹

– – –1/1

❹ Short in EUI Wiring Harness Test

NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EUI CIRCUIT SHORTED supporting information.

1. Ignition OFF

CAUTION: Possible strong electric shock hazard if engine is cranking or running

2. Disconnect 18-terminal half of 48-way ECU connector
3. Disconnect EUI wiring harness connector at rear of cylinder head
4. Using a multimeter, measure resistance between terminal D in the harness end of the EUI wiring connector and:
   - Terminal C in the harness end of the EUI wiring connector
   - Terminal F in the harness end of the EUI wiring connector

Both measurements greater than 20,000 ohms:
GO TO ❺

Either measurement less than 20,000 ohms:
Short in ECU wiring harness

– – –1/1

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❺ Cylinder 2 EUI Test

NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EUI CIRCUIT SHORTED supporting information.

1. Remove rocker arm cover
2. Disconnect electrical connections to cylinder 2 EUI and a known good EUI
3. Using a multimeter measure resistance between:
   - The two terminals on cylinder 2 EUI
   - The two terminals on the known good EUI
4. Compare the measurements between the two EUIs

   NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typical EUI resistance should be 1.0-1.8 ohms.

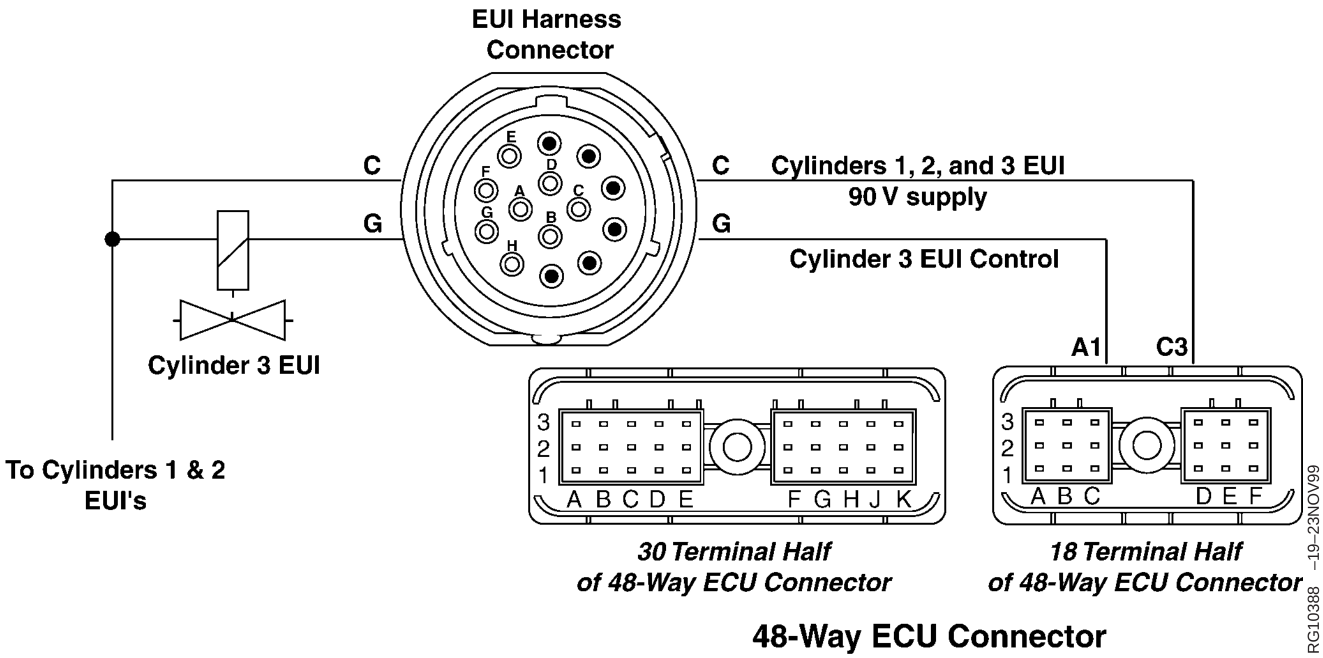
Difference between measurements 0.2 ohms or less:
GO TO ❻

Difference between measurements greater than 0.2 ohms:
Faulty cylinder 2 EUI

– – –1/1

❻ **EUI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF 2. Keep cylinder 2 EUI wires disconnected from EUI 3. Keep EUI wiring harness connector at rear of cylinder head disconnected 4. Using a multimeter, measure the resistance between both of cylinder 2 EUI harness eyelets.	**Greater than 20,000 ohms:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Less than 20,000 ohms:** Faulty EUI wiring harness – – –1/1

000653.05 — Cylinder #3 EUI Circuit Open



EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000653.05 will set if:

- The ECU detects an open in the Cylinder #3 EUI circuit.

If DTC 000653.05 sets, the following will occur:

- Cylinder #3 EUI will not fire.

DPSG,RG40854,227 –19–16APR02–1/1

000653.05 — Cylinder #3 EUI Circuit Open

The ECU detects an open in the Cylinder #3 EUI circuit.

OUO1004,0000CB8 –19–16APR02–1/1

000653.05 Cylinder #3 EUI Circuit Open Diagnostic Procedure

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❶ **Connection 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 000653.05 CYLINDER #3 EUI CIRCUIT OPEN supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or 000627.01 are active, repair those DTCs first** *NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EUI CIRCUIT OPEN supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000653.05 reoccurs:** GO TO ❸ **000653.05 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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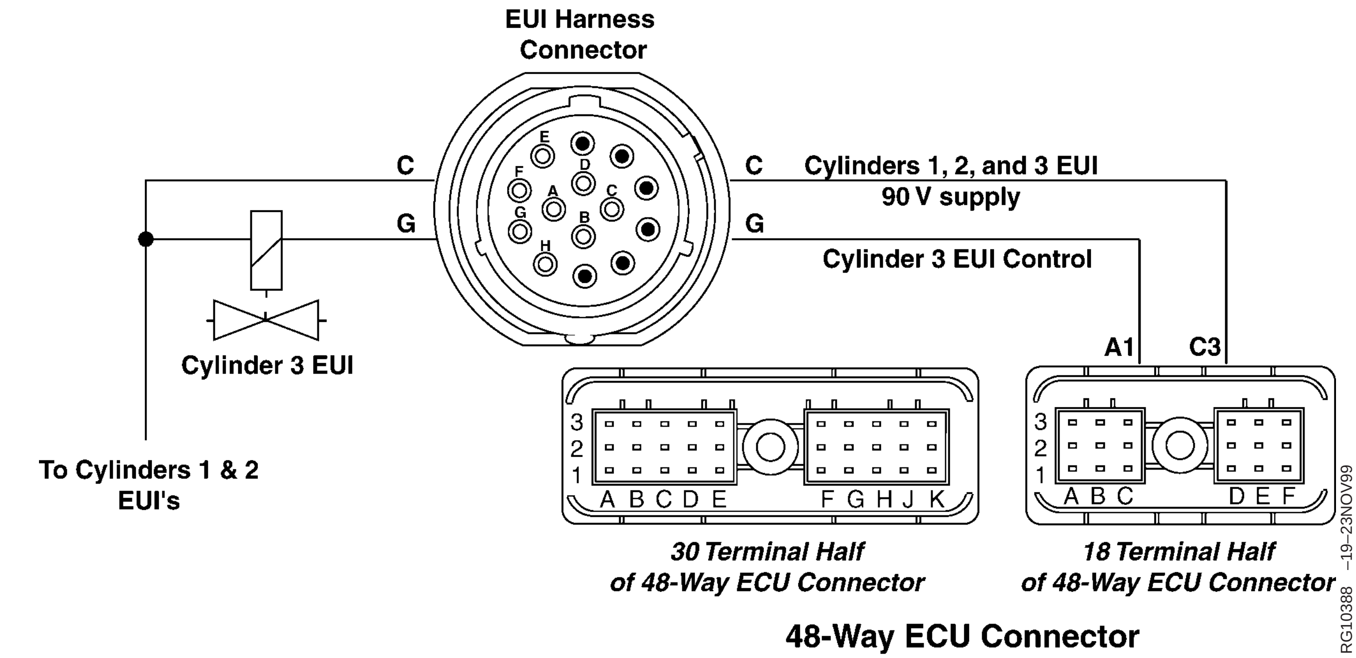
❸ **Open Wire in 90V Supply or EUI Control Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EUI CIRCUIT OPEN supporting information.* 1. Ignition OFF **CAUTION: Possible strong electric shock hazard if engine is cranking or running** 2. Disconnect EUI wiring harness connector at rear of cylinder head 3. Disconnect 18-terminal half of 48-way ECU connector 4. Using a multimeter, measure resistance between: • Terminal G in the harness end of the EUI wiring harness connector ***and*** terminal A1 in the harness end of the ECU connector • Terminal C in the harness end of the EUI wiring harness connector ***and*** terminal C3 in the harness end of the ECU connector	**Both measurements 5 ohms or less:** GO TO ❹ **Measurement between G to A1 greater than 5 ohms:** Open in wire between terminal G and A1. **Measurement between C to C3 greater than 5 ohms:** Open in wire between terminal C and C3. – – –1/1

❹ **Cylinder 3 EUI Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EUI CIRCUIT OPEN supporting information.* 1. Remove rocker arm cover 2. Disconnect electrical connections to cylinder 3 EUI and a known good EUI 3. Using a multimeter measure resistance between: • The two terminals on cylinder 3 EUI • The two terminals on the known good EUI 4. Compare the measurements between the two EUIs *NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, EUI resistance should be 1.0-1.8 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 3 EUI – – –1/1

❺ **EUI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EUI CIRCUIT OPEN supporting information.* 1. Ignition OFF 2. Cylinder 3 EUI wires disconnected from EUI 3. Disconnect EUI wiring harness connector from rear of cylinder head 4. Using a multimeter, measure resistance between: • One of the cylinder 3 EUI harness eyelet ***and*** the corresponding terminal at the connector on the rear of the cylinder head (either C or G, the EUI's are not polarity sensitive) • The other cylinder 3 EUI harness eyelet ***and*** the other corresponding terminal at the connector on the rear of the cylinder head	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EUI harness in head – – –1/1

000653.06 — Cylinder #3 EUI Circuit Shorted



EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000653.06 will set if:

- The ECU detects a short in the Cylinder #3 EUI circuit.

If DTC 000653.06 sets, the following will occur:

- Cylinder #3 EUI will not fire.

DPSG,RG40854,228 –19–16APR02–1/1

000653.06 — Cylinder #3 EUI Circuit Shorted

The ECU detects a short in the Cylinder #3 EUI circuit.

OUO1004,0000CB9 –19–16APR02–1/1

000653.06 Cylinder #3 EUI Circuit Shorted Diagnostic Procedure

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❶ **Connection 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 000653.06 CYLINDER #3 EUI CIRCUIT SHORTED supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR 000627.01 are active, repair those DTCs first.** *NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EUI CIRCUIT SHORTED supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000653.06 reoccurs:** GO TO ❸ **000653.06 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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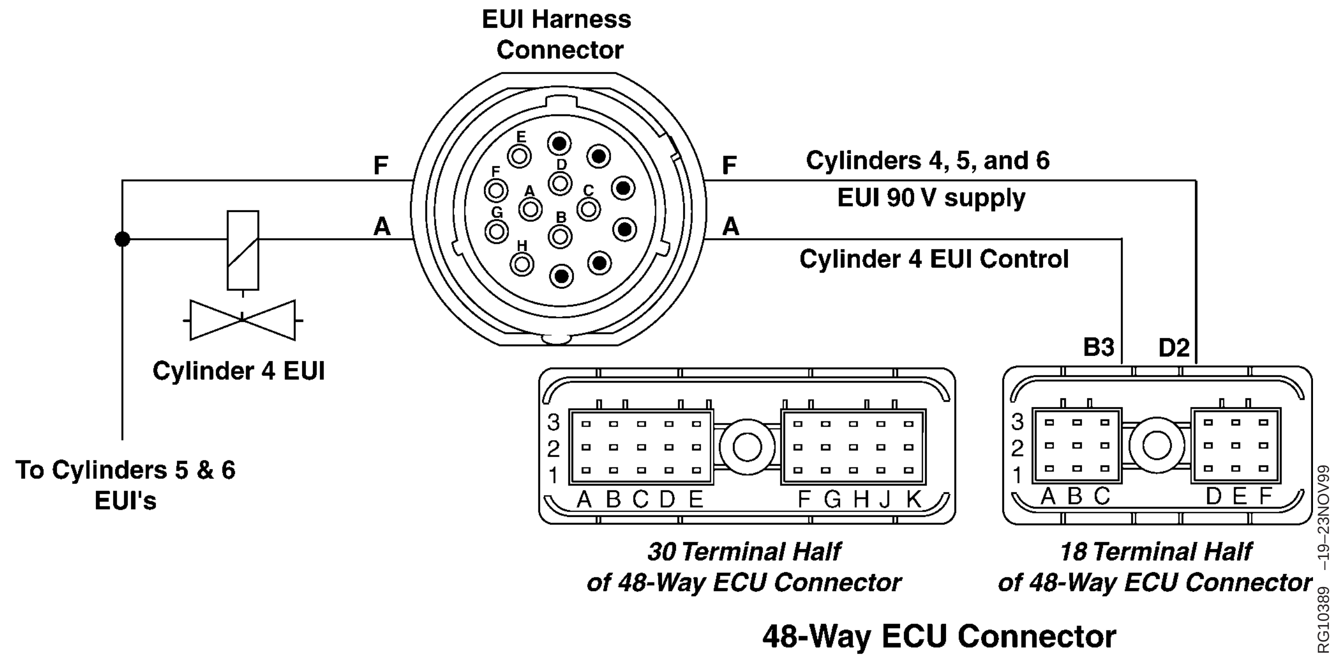
❸ **Short in EUI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF **CAUTION: Possible strong electric shock hazard if engine is cranking or running** 2. Disconnect 18-terminal half of 48-way ECU connector 3. Disconnect EUI wiring harness connector at rear of cylinder head 4. Using a multimeter, measure resistance between terminal G in the harness end of the EUI wiring connector and: • Terminal C in the harness end of the EUI wiring connector • Terminal F in the harness end of the EUI wiring connector	**Both measurements greater than 20,000 ohms:** GO TO ❹ **Either measurement less than 20,000 ohms:** Short in ECU wiring harness – – –1/1

❹ **Cylinder 3 EUI Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EUI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover 2. Disconnect electrical connections to cylinder 3 EUI and a known good EUI 3. Using a multimeter measure resistance between: • The two terminals on cylinder 3 EUI • The two terminals on the known good EUI 4. Compare the measurements between the two EUIs *NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EUI resistance should be 1.0-1.8 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❺ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 3 EUI – – –1/1

❺ **EUI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF 2. Keep cylinder 3 EUI wires disconnected from EUI 3. Keep EUI wiring harness connector at rear of cylinder head disconnected 4. Using a multimeter, measure resistance between both of cylinder 3 EUI harness eyelets	**Greater than 20,000 ohms:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Less than 20,000 ohms:** Faulty EUI wiring harness – – –1/1

000654.05 — Cylinder #4 EUI Circuit Open



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EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000654.05 will set if:

- The ECU detects an open in the Cylinder #4 EUI circuit.

If DTC 000654.05 sets, the following will occur:

- Cylinder #4 EUI will not fire.

DPSG,RG40854,229 –19–16APR02–1/1

000654.05 — Cylinder #4 EUI Circuit Open

The ECU detects an open in the Cylinder #4 EUI circuit.

OUO1004,0000CBA –19–16APR02–1/1

000654.05 Cylinder #4 EUI Circuit Open Diagnostic Procedure

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❶ **Connection 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 000654.05 CYLINDER #4 EUI CIRCUIT OPEN supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or 000627.01 are active, repair those DTCs first.** *NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EUI CIRCUIT OPEN supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000654.05 reoccurs:** GO TO ❸ **000654.05 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ 744 Loader Serial Number Check

NOTE: This check is only required for 744 Loaders. For other applications,GO TO ❹.

744 Loader Serial Numbers:

- **(—573732):** GO TO ❹
- **(573733—581927):** See Step 4 in LEVEL 6 ECU - DTC 000656.05 CYLINDER #6 EUI CIRCUIT OPEN DIAGNOSTIC PROCEDURE later in this Group.
  NOTE: The ECU displays the wrong DTC for these vehicles with the above serial number range. Follow the link shown above to diagnose the correct DTC.
- **581927—:** GO TO ❹

– – –1/1

❹ Open Wire in 90V Supply or EUI Control Wire Test

NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EUI CIRCUIT OPEN supporting information.

1. Ignition OFF

CAUTION: Possible strong electric shock hazard if the engine is cranking or running

2. Disconnect EUI wiring harness connector at rear of cylinder head
3. Disconnect 18-terminal half of 48-way ECU connector
4. Using a multimeter, measure resistance between:
   - Terminal A in the harness end of the EUI wiring harness connector ***and*** terminal B3 in the harness end of the ECU connector
   - Terminal F in the harness end of the EUI wiring harness connector ***and*** terminal D2 in the harness end of the ECU connector

Both measurements 5 ohms or less:
GO TO ❺

Measurement between A to B3 greater than 5 ohms:
Open in wire between terminal A and B3

Measurement between F to D2 greater than 5 ohms:
Open in wire between terminal F and D2

– – –1/1

❺ Cylinder 4 EUI Test

NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EUI CIRCUIT OPEN supporting information.

1. Remove rocker arm cover
2. Disconnect electrical connections to cylinder 4 EUI and a known good EUI
3. Using a multimeter measure resistance between:
   - The two terminals on cylinder 4 EUI
   - The two terminals on the known good EUI
4. Compare the measurements between the two EUIs

   NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, EUI resistance should be 1.0-1.8 ohms.

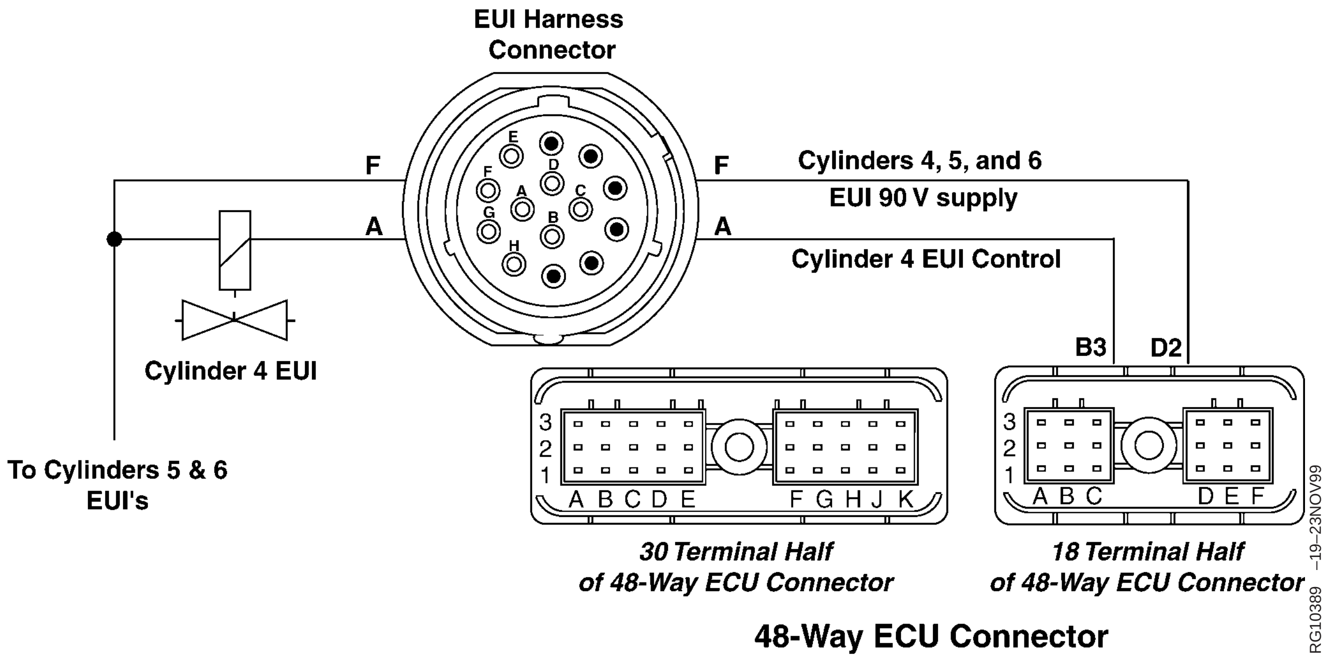
Difference between measurements 0.2 ohms or less:
GO TO ❻

Difference between measurements greater than 0.2 ohms:
Faulty cylinder 4 EUI

– – –1/1

❻ **EUI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EUI CIRCUIT OPEN supporting information.* 1. Ignition OFF 2. Cylinder 4 EUI wires disconnected from EUI 3. Disconnect EUI wiring harness connector from rear of cylinder head 4. Using a multimeter, measure resistance between: • One of the cylinder 4 EUI harness eyelet ***and*** the corresponding terminal at the connector on the rear of the cylinder head (either F or A, the EUI's are not polarity sensitive) • The other cylinder 4 EUI harness eyelet ***and*** the other corresponding terminal at the connector on the rear of the cylinder head	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EUI harness in head – – –1/1

000654.06 — Cylinder #4 EUI Circuit Shorted



EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000654.06 will set if:

- The ECU detects a short in the Cylinder #4 EUI circuit.

If DTC 000654.06 sets, the following will occur:

- Cylinder #4 EUI will not fire.

DPSG,RG40854,230 –19–16APR02–1/1

000654.06 — Cylinder #4 EUI Circuit Shorted

The ECU detects a short in the Cylinder #4 EUI circuit.

OUO1004,0000CBB –19–16APR02–1/1

000654.06 Cylinder #4 EUI Circuit Shorted Diagnostic Procedure

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❶ **Connection 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 000654.06 CYLINDER #4 EUI CIRCUIT SHORTED supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR 000627.01 are active, repair those DTCs first** *NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EUI CIRCUIT SHORTED supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000654.06 reoccurs:** GO TO ❸ **000654.06 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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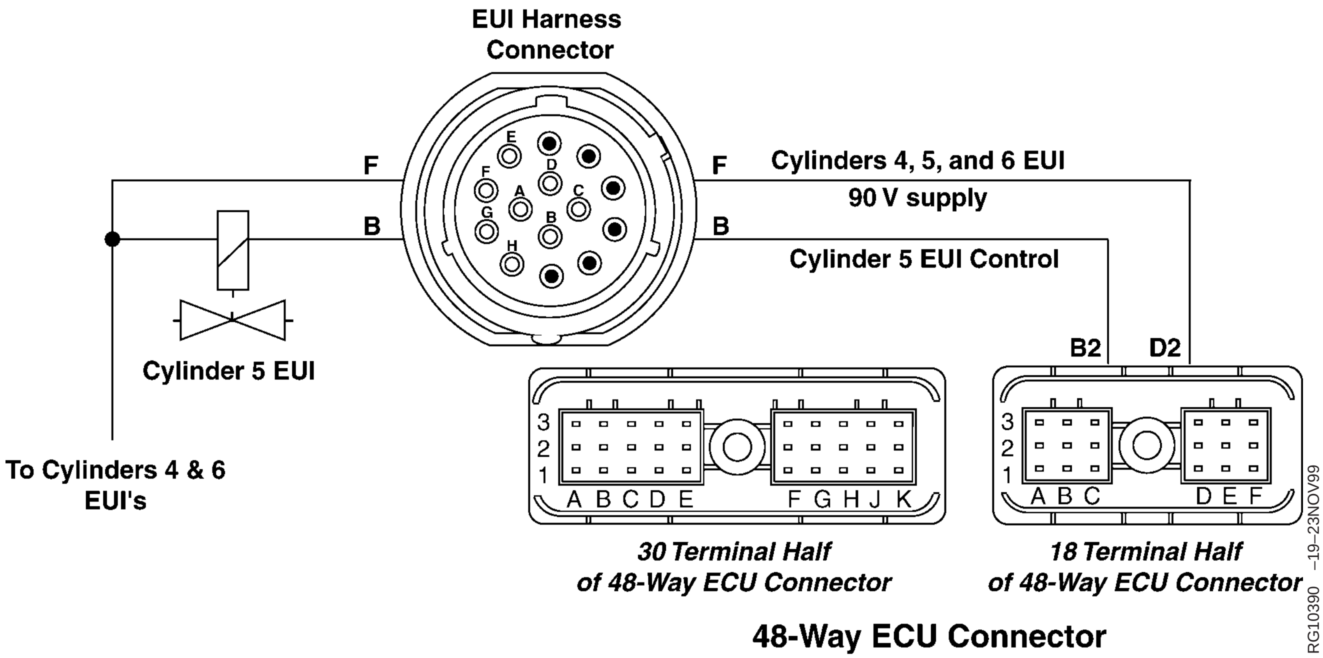
❸ 744 Loader Serial Number Check	*NOTE: This check is only required for 744 Loaders. For other applications GO TO ❸.* **744 Loader Serial Numbers:** • **(—573732):** GO TO ❹ • **(573733—581927):** See Step 4 in LEVEL 6 ECU - DTC 000656.06 CYLINDER #6 EUI CIRCUIT SHORTED DIAGNOSTIC PROCEDURE later in this Group. *NOTE: The ECU displays the wrong DTC for these vehicles with the above serial number range. Follow the link shown above to diagnose the correct DTC.* • **581927—:** GO TO ❹	– – –1/1

❹ Short in EUI Wiring Harness Test	*NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF **CAUTION: Possible strong electric shock hazard if engine is cranking or running** 2. Disconnect 18-terminal half of 48-way ECU connector 3. Disconnect EUI wiring harness connector at rear of cylinder head 4. Using a multimeter, measure resistance between terminal A in the harness end of the EUI wiring connector and: • Terminal C in the harness end of the EUI wiring connector • Terminal F in the harness end of the EUI wiring connector	**Both measurements greater than 20,000 ohms:** GO TO ❺ **Either measurement less than 20,000 ohms:** Short in ECU wiring harness – – –1/1

❺ Cylinder 4 EUI Test	*NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EUI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover 2. Disconnect electrical connections to cylinder 4 EUI and a known good EUI 3. Using a multimeter measure resistance between: • The two terminals on cylinder 4 EUI • The two terminals on the known good EUI 4. Compare the measurements between the two EUIs *NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EUI resistance should be 1.0-1.8 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❻ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 4 EUI – – –1/1

❻ **EUI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF 2. Keep cylinder 4 EUI wires disconnected from EUI 3. Keep EUI wiring harness connector at rear of cylinder head disconnected 4. Using a multimeter, measure resistance between both of cylinder 4 EUI harness eyelets	**Greater than 20,000 ohms:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Less than 20,000 ohms:** Faulty EUI wiring harness – – –1/1

000655.05 — Cylinder #5 EUI Circuit Open



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EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000655.05 will set if:

- The ECU detects an open in the Cylinder #5 EUI circuit.

If DTC 000655.05 sets, the following will occur:

- Cylinder #5 EUI will not fire.

DPSG,RG40854,231 –19–30JUN99–1/1

000655.05 — Cylinder #5 EUI Circuit Open

The ECU detects an open in the Cylinder #5 EUI circuit.

OUO1004,0000CBC –19–16APR02–1/1

000655.05 Cylinder #5 EUI Circuit Open Diagnostic Procedure

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❶ **Connection 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 000655.05 CYLINDER #5 EUI CIRCUIT OPEN supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or 000627.01 are active, repair those DTCs first.** *NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EUI CIRCUIT OPEN supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000655.05 reoccurs:** GO TO ❸ **000655.05 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ 744 Loader Serial Number Check

NOTE: This check is only required for 744 Loaders. For other applications, GO TO ❹.

744 Loader Serial Numbers:

- **(—573732):** GO TO ❹
- **(573733—581927):** See Step 4 in LEVEL 6 ECU - DTC 000652.05 CYLINDER #2 EUI CIRCUIT OPEN DIAGNOSTIC PROCEDURE later in this Group.
  NOTE: The ECU displays the wrong DTC for these vehicles with the above serial number range. Follow the link shown above to diagnose the correct DTC.
- **581927—:** GO TO ❹

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❹ Open Wire in 90V Supply or EUI Control Wire Test

NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EUI CIRCUIT OPEN supporting information.

1. Ignition OFF

CAUTION: Possible strong electric shock hazard if engine is cranking or running

2. Disconnect EUI wiring harness connector at rear of cylinder head
3. Disconnect 18-terminal half of 48-way ECU connector
4. Using a multimeter, measure resistance between:
   - Terminal B in the harness end of the EUI wiring harness connector ***and*** terminal B2 in the harness end of the ECU connector
   - Terminal F in the harness end of the EUI wiring harness connector ***and*** terminal D2 in the harness end of the ECU connector

Both measurements 5.0 ohms or less:
GO TO ❺

Measurement between B to B2 greater than 5 ohms:
Open in wire between terminal B and B2

Measurement between F to D2 greater than 5 ohms:
Open in wire between terminal F and D2

– – –1/1

❺ Cylinder 5 EUI Test

NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EUI CIRCUIT OPEN supporting information.

1. Remove rocker arm cover
2. Disconnect electrical connections to cylinder 5 EUI and a known good EUI
3. Using a multimeter measure resistance between:
   - The two terminals on cylinder 5 EUI
   - The two terminals on the know good EUI
4. Compare the measurements between the two EUIs

   NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, EUI resistance should be 1.0-1.8 ohms.

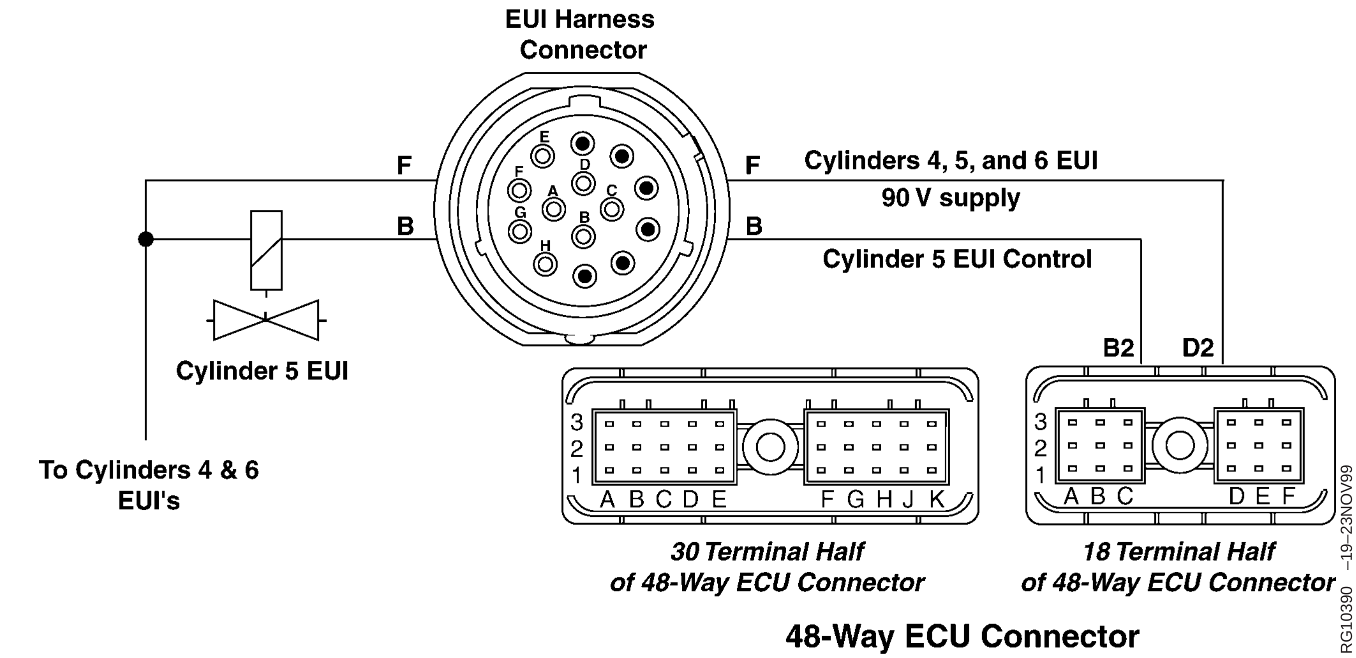
Difference between measurements 0.2 ohms or less:
GO TO ❻

Difference between measurements greater than 0.2 ohms:
Faulty cylinder 5 EUI

– – –1/1

❻ **EUI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EUI CIRCUIT OPEN supporting information.* 1. Ignition OFF 2. Cylinder 5 EUI wires disconnected from EUI 3. Disconnect EUI wiring harness connector from rear of cylinder head 4. Using a multimeter, measure resistance between: • One of the cylinder 5 EUI harness eyelet ***and*** the corresponding terminal at the connector on the rear of the cylinder head (either F or B, the EUI's are not polarity sensitive) • The other cylinder 5 EUI harness eyelet ***and*** the other corresponding terminal at the connector on the rear of the cylinder head	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EUI harness in head – – –1/1

000655.06 — Cylinder #5 EUI Circuit Shorted



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EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000655.06 will set if:

- The ECU detects a short in the Cylinder #5 EUI circuit.

If DTC 000655.06 sets, the following will occur:

- Cylinder #5 EUI will not fire.

DPSG,RG40854,232 –19–16APR02–1/1

000655.06 — Cylinder #5 EUI Circuit Shorted

The ECU detects a short in the Cylinder #5 EUI circuit.

OUO1004,0000CBD –19–16APR02–1/1

000655.06 Cylinder #5 EUI Circuit Shorted Diagnostic Procedure

– – –1/1

❶ **Connection 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 000655.06 CYLINDER #5 EUI CIRCUIT SHORTED supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR 000627.01 are active, repair those DTCs first.** *NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EUI CIRCUIT SHORTED supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000655.06 reoccurs:** GO TO ❸ **000655.06 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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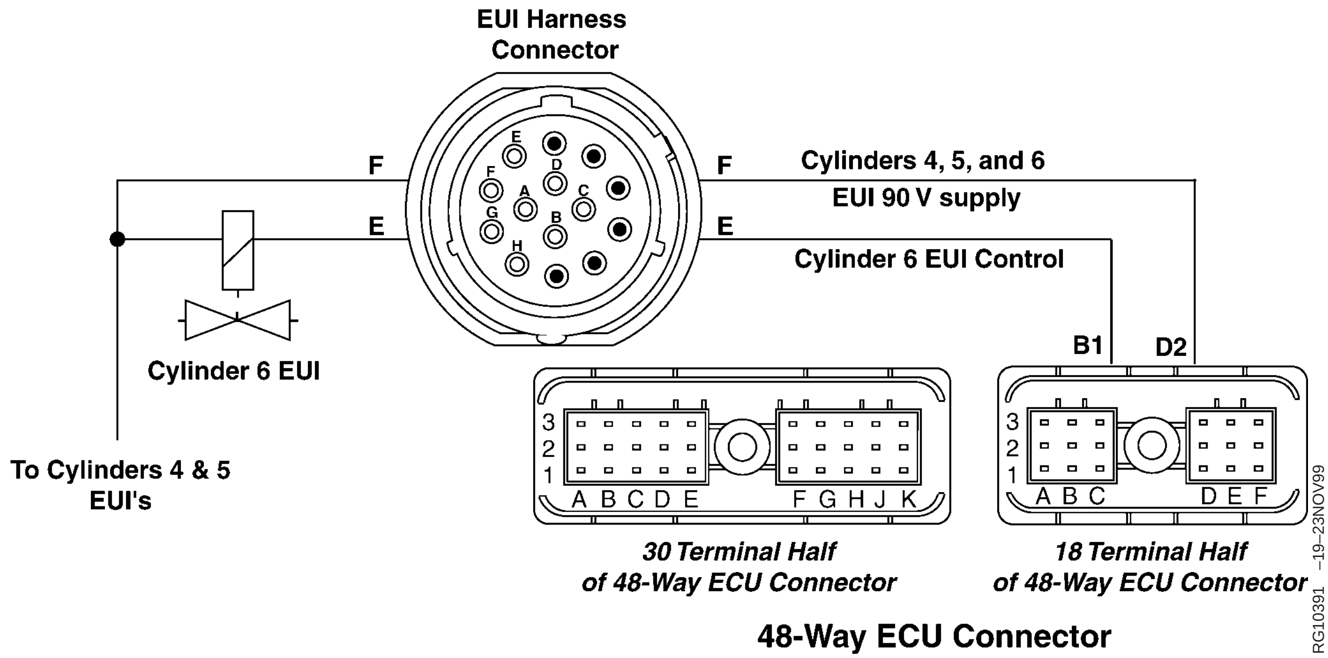
❸ **744 Loader Serial Number Check**	*NOTE: This check is only required for 744 Loaders. For other applications, GO TO ❹.* **744 Loader Serial Numbers:** • **(—573732):** GO TO ❹ • **(573733—581927):** See Step 4 in LEVEL 6 ECU - DTC 000652.06 CYLINDER #2 EUI CIRCUIT SHORTED DIAGNOSTIC PROCEDURE earlier in this Group. *NOTE: The ECU displays the wrong DTC for these vehicles with the above serial number range. Follow the link shown above to diagnose the correct DTC.* • **581927—:** GO TO ❹	– – –1/1
❹ **Short in EUI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF **CAUTION: Possible strong electric shock hazard if engine is cranking or running** 2. Disconnect 18-terminal half of 48-way ECU connector 3. Disconnect EUI wiring harness connector at rear of cylinder head 4. Using a multimeter, measure resistance between terminal B in the harness end of the EUI wiring connector and: • Terminal C in the harness end of the EUI wiring connector • Terminal F in the harness end of the EUI wiring connector	**Both measurements greater than 20,000 ohms:** GO TO ❺ **Either measurement less than 20,000 ohms:** Short in ECU wiring harness – – –1/1
❺ **Cylinder 5 EUI Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EUI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover 2. Disconnect electrical connections to cylinder 5 EUI and a known good EUI 3. Using a multimeter measure resistance between: • The two terminals on cylinder 5 EUI • The two terminals on the known good EUI 4. Compare the measurements between the two EUIs *NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EUI resistance should be 1.0-1.8 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❻ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 5 EUI – – –1/1

❻ **EUI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF 2. Keep cylinder 5 EUI wires disconnected from EUI 3. Keep EUI wiring harness connector at rear of cylinder head disconnected 4. Using a multimeter, measure resistance between both of cylinder 5 EUI harness eyelets	**Greater than 20,000 ohms:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Less than 20,000 ohms:** Faulty EUI wiring harness – – –1/1

000656.05 — Cylinder #6 EUI Circuit Open



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EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000656.05 will set if:

- The ECU detects an open in the Cylinder #6 EUI circuit.

If DTC 000656.05 sets, the following will occur:

- Cylinder #6 EUI will not fire.

DPSG,RG40854,233 –19–16APR02–1/1

000656.05 — Cylinder #6 EUI Circuit Open

The ECU detects an open in the Cylinder #6 EUI circuit.

OUO1004,0000CBE –19–16APR02–1/1

000656.05 Cylinder #6 EUI Circuit Open Diagnostic Procedure

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❶ **Connection 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 000656.05 CYLINDER #6 EUI CIRCUIT OPEN supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or 000627.01 are active, repair those DTCs first** *NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EUI CIRCUIT OPEN supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000656.05 reoccurs:** GO TO ❸ **000656.05 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **744 Loader Serial Number Check**	*NOTE: This check is only required for 744 Loaders. For other applications, GO TO ❹.* **744 Loader Serial Numbers:** • **(—573732):** GO TO ❹ • **(573733—581927):** See Step 4 in LEVEL 6 ECU - DTC 000654.05 CYLINDER #4 EUI CIRCUIT OPEN DIAGNOSTIC PROCEDURE earlier in this Group. *NOTE: The ECU displays the wrong DTC for these vehicles with the above serial number range. Follow the link shown above to diagnose the correct DTC.* • **581927—:** GO TO ❹	– – –1/1

❹ **Open Wire in 90V Supply or EUI Control Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EUI CIRCUIT OPEN supporting information.* 1. Ignition OFF **CAUTION: Possible strong electric shock hazard if engine is cranking or running** 2. Disconnect EUI wiring harness connector at rear of cylinder head 3. Disconnect 18-terminal half of 48-way ECU connector 4. Using a multimeter, measure resistance between: • Terminal E in the harness end of the EUI wiring harness connector ***and*** terminal B1 in the harness end of the ECU connector • Terminal F in the harness end of the EUI wiring harness connector ***and*** terminal D2 in the harness end of the ECU connector	**Both measurements 5 ohms or less:** GO TO ❺ **Measurement between E to B1 greater than 5 ohms:** Open in wire between terminal E and B1 **Measurement between F to D2 greater than 5 ohms:** Open in wire between terminal F and D2 – – –1/1

❺ **Cylinder 6 EUI Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EUI CIRCUIT OPEN supporting information.* 1. Remove rocker arm cover 2. Disconnect electrical connections to cylinder 6 EUI and a known good EUI 3. Using a multimeter measure resistance between: • The two terminals on cylinder 6 EUI • The two terminals on the know good EUI 4. Compare the measurements between the two EUIs *NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically EUI resistance should be 1.0-1.8 ohms.*	**Difference between measurements 0.2 ohms or less:** GO TO ❻ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 6 EUI – – –1/1

❻ **EUI Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EUI CIRCUIT OPEN supporting information.* 1. Ignition OFF 2. Cylinder 6 EUI wires disconnected from EUI 3. Disconnect EUI wiring harness connector from rear of cylinder head 4. Using a multimeter, measure resistance between: • One of the cylinder 6 EUI harness eyelet ***and*** the corresponding terminal at the connector on the rear of the cylinder head (either F or E, the EUI's are not polarity sensitive) • The other cylinder 6 EUI harness eyelet ***and*** the other corresponding terminal at the connector on the rear of the cylinder head	**Both measurements 2.0 ohms or less:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Either measurements greater than 2.0 ohms:** Faulty EUI harness in head – – –1/1

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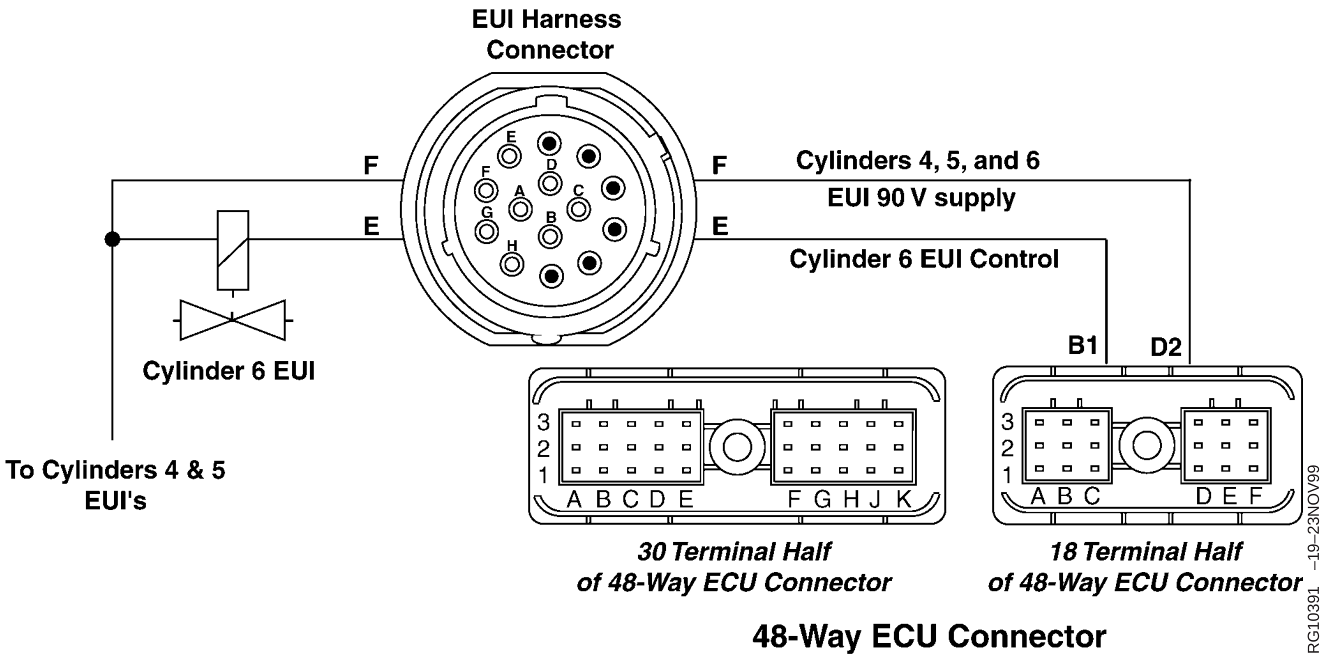
000656.06 — Cylinder #6 EUI Circuit Shorted



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EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC 000656.06 will set if:

- The ECU detects a short in the Cylinder #6 EUI circuit.

If DTC 000656.06 sets, the following will occur:

- Cylinder #6 EUI will not fire.

DPSG,RG40854,234 –19–16APR02–1/1

000656.06 — Cylinder #6 EUI Circuit Shorted

The ECU detects a short in the Cylinder #6 EUI circuit.

OUO1004,0000CBF –19–16APR02–1/1

000656.06 Cylinder #6 EUI Circuit Shorted Diagnostic Procedure

– – –1/1

❶ **Connection 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 000656.06 CYLINDER #6 EUI CIRCUIT SHORTED supporting information.* Perform a preliminary inspection of the 48-way ECU connector, the EUI harness connector (located at the back of the cylinder head), and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	**IMPORTANT: If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR 000627.01 are active, repair those DTCs first** *NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EUI CIRCUIT SHORTED supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO CONNECTING TODIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000656.06 reoccurs:** GO TO ❸ **000656.06 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **744 Loader Serial Number Check**	*NOTE: This check is only required for 744 Loaders. For other applications,GO TO ❹.* **744 Loader Serial Numbers:** • **(—573732):** GO TO ❹ • **(573733—581927):** See Step 4 in LEVEL 6 ECU - DTC 000654.06 CYLINDER #4 EUI CIRCUIT SHORTED DIAGNOSTIC PROCEDURE earlier in this Group. *NOTE: The ECU displays the wrong DTC for these vehicles with the above serial number range. Follow the link shown above to diagnose the correct DTC.* • **581927—:** GO TO ❹	

– – –1/1

❹ **Short in EUI Wiring Harness Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF **CAUTION: Possible strong electric shock hazard if engine is cranking or running** 2. Disconnect 18-terminal half of 48-way ECU connector 3. Disconnect EUI wiring harness connector at rear of cylinder head 4. Using a multimeter, measure resistance between terminal E in the harness end of the EUI wiring connector and: • Terminal C in the harness end of the EUI wiring connector • Terminal F in the harness end of the EUI wiring connector	**Both measurements greater than 20,000 ohms:** GO TO ❺ **Either measurement less than 20,000 ohms:** Short in ECU wiring harness – – –1/1

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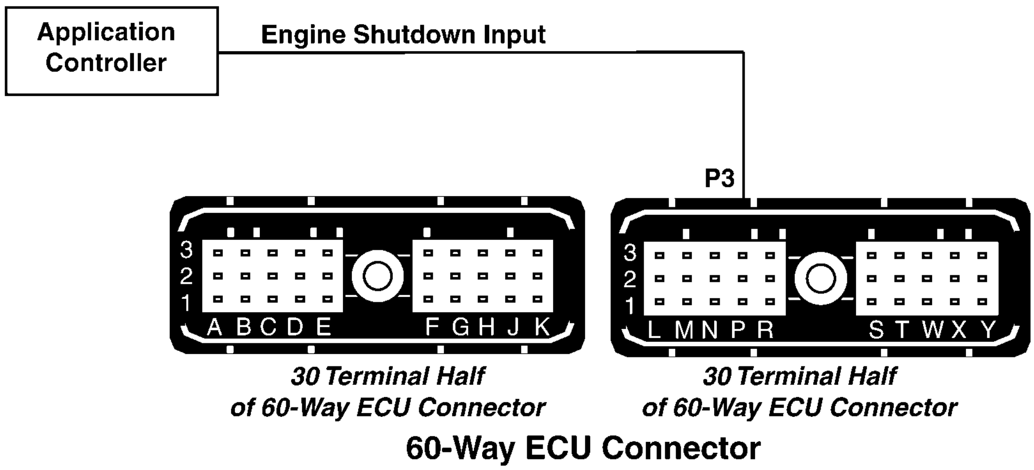
❺ **Cylinder 6 EUI Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EUI CIRCUIT SHORTED supporting information.* 1. Remove rocker arm cover 2. Disconnect electrical connections to cylinder 6 EUI and a known good EUI 3. Using a multimeter measure resistance between: • The two terminals on cylinder 6 EUI • The two terminals on the known good EUI 4. Compare the measurements between the two EUIs *NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EUI resistance should be 1.0-1.8 ohms*	**Difference between measurements 0.2 ohms or less:** GO TO ❻ **Difference between measurements greater than 0.2 ohms:** Faulty cylinder 6 EUI – – –1/1

❻ **EUI Wiring Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EUI CIRCUIT SHORTED supporting information.* 1. Ignition OFF 2. Keep cylinder 6 EUI wires disconnected from EUI 3. Keep EUI wiring harness connector at rear of cylinder head disconnected 4. Using a multimeter, measure resistance between both of cylinder 6 EUI harness eyelets	**Greater than 20,000 ohms:** Faulty ECU connection OR Faulty EUI wiring harness connection OR Faulty ECU **Less than 20,000 ohms:** Faulty EUI wiring harness – – –1/1

000970.02 — Auxiliary Engine Shutdown Switch Signal Invalid



RG10663 –19–19DEC00

NOTE: *Wiring schematic shows Tractor applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

DTC 000970.02 will set if:

- The ECU reads an input voltage from the application’s controller to be less than 0.5 volts or greater than 2.5 volts.

If DTC 000970.02 sets, the following will occur:

- The ECU will shut the engine down.

DPSG,RG40854,317 –19–16APR02–1/1

000970.02 — Auxiliary Engine Shutdown Switch Signal Invalid

The ECU reads an input voltage from the application's controller that is out of specification.

OUO1004,0000CC0 –19–16APR02–1/1

000970.02 Auxiliary Engine Shutdown Switch Signal Invalid Diagnostic Procedure

– – –1/1

❶ **Connection 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 000970.02 AUXILIARY ENGINE SHUTDOWN SWITCH SIGNAL INVALID supporting information.* Perform a preliminary inspection of the 60-way ECU connector, the auxiliary engine shutdown switch connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000970.02 AUXILIARY ENGINE SHUTDOWN SWITCH SIGNAL INVALID supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using DST or SERVICE ADVISOR™ 5. Make notes of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs	**000970.02 reoccurs:** GO TO ❸ **000970.02 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Other Controller DTC Test**	*NOTE: For wiring and theory of operation information, see DTC 000970.02 AUXILIARY ENGINE SHUTDOWN SWITCH SIGNAL INVALID supporting information.* Check another controller for related DTCs. *NOTE: Auxiliary shutdown signal originates from another controller.*	**Controller reports no related DTCs:** GO TO ❹ **Controller has related DTCs:** Refer to diagnostic procedures for controller. Repair cause of DTC and retest. – – –1/1

❹ **Controller Test**	*NOTE: For wiring and theory of operation information, see DTC 000970.02 AUXILIARY ENGINE SHUTDOWN SWITCH SIGNAL INVALID supporting information.* 1. Ignition OFF 2. Disconnect 60-way ECU connector 3. Ignition ON 4. Using a multimeter, measure voltage between terminal P3 in the harness end of the 60-way ECU connector ***and*** a good chassis ground	**Less than 0.5 V or greater than 2.5V:** GO TO ❺ **Between 0.5 V and 2.5V:** Wrong ECU for the vehicle OR Faulty ECU connector OR Faulty ECU OR Faulty auxiliary shutdown signal source controller – – –1/1

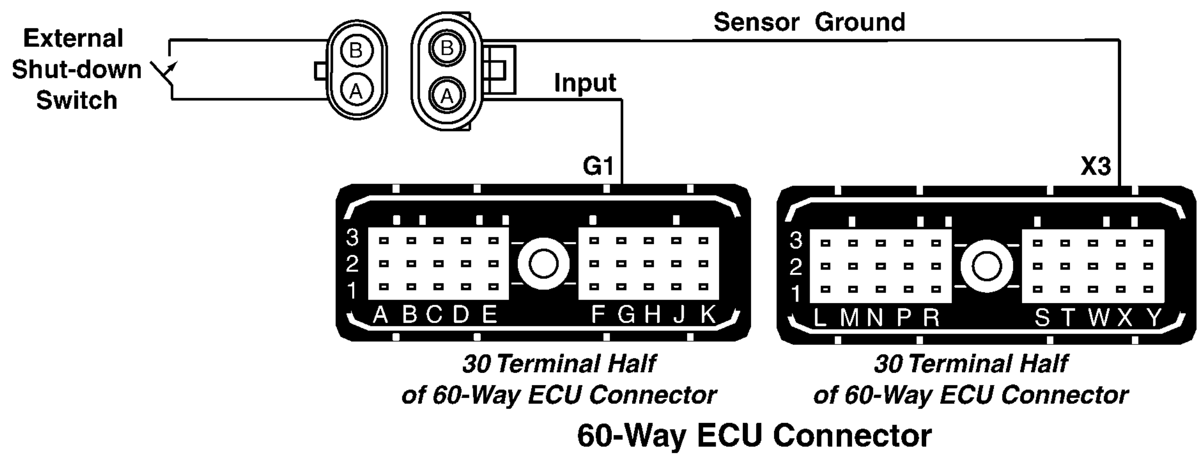
❺ **Open in Auxiliary Shutdown Signal Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000970.02 AUXILIARY ENGINE SHUTDOWN SWITCH SIGNAL INVALID supporting information.* 1. Ignition OFF 2. 60-way ECU connector still disconnected 3. Obtain wiring information for this application and determine the source of the auxiliary shutdown signal 4. Disconnect the connector that outputs the shutdown signal 5. Using a multimeter, measure the resistance between terminal P3 of the 60-way ECU connector ***and*** the originating shutdown signal terminal	**5 ohms or less:** GO TO ❻ **Greater than 5 ohms:** Open in auxiliary shutdown signal circuit – – –1/1

❻ **Short in Auxiliary Shutdown Signal Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000970.02 AUXILIARY ENGINE SHUTDOWN SWITCH SIGNAL INVALID supporting information.* 1. Ignition OFF 2. Using a multimeter measure resistance between terminal P3 in the harness end of the 60-way ECU connector and: • All other terminals in that connector • A good chassis ground	**All measurements greater than 2000 ohms:** Faulty signal source controller wiring OR Faulty auxiliary shutdown controller connector OR Faulty auxiliary shutdown signal source controller **Any measurement less than 2000 ohms:** Short in auxiliary shutdown signal circuit – – –1/1

000970.31 — Auxiliary Engine Shutdown Switch Active

The ECU does not read an input voltage on the auxiliary engine shutdown input.

DPSG,RG40854,318 –19–16APR02–1/2



RG10653 –19–19DEC00

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: *Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

Auxiliary Engine Shutdown Switch

- On OEM applications, the engine shutdown switch is a normally open switch. When the property being measured exceeds a certain value, the switch will close. When the switch is closed, the voltage is grounded, which will cause the ECU to shutdown the engine.

DTC 000970.31 will set if:

- The ECU does not read an input voltage on the auxiliary engine shutdown input.

If DTC 000970.31 sets, the following will occur:

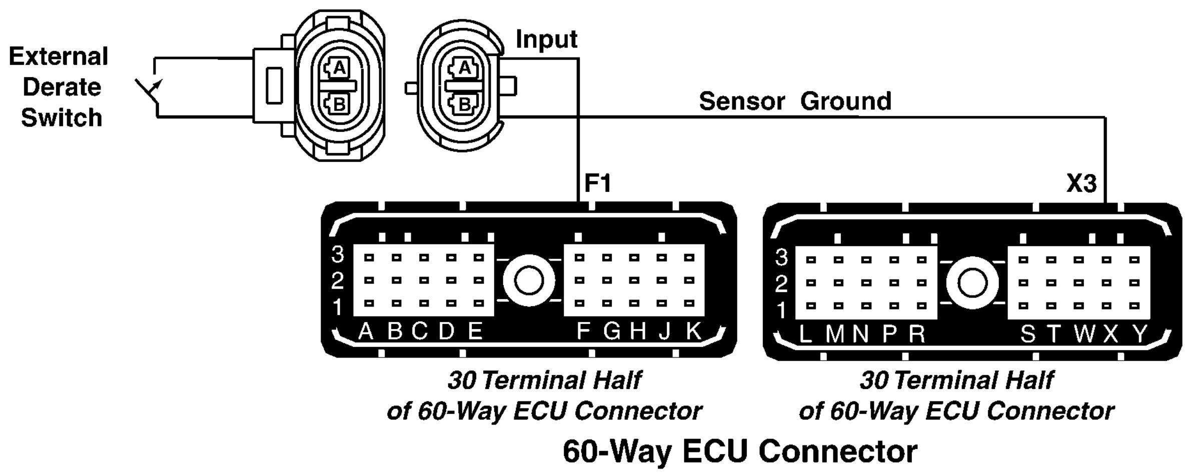
- The ECU will shut the engine down.

DPSG,RG40854,318 –19–16APR02–2/2

000971.31 — External Fuel Derate Switch Active

The ECU does not read an input voltage from external switch.

DPSG,RG40854,319 –19–16APR02–1/2



RG10654 –19–19DEC00

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: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

External Fuel Derate Switch

On OEM applications, the external derate switch is a normally open switch. When property being measured exceeds a certain value, the switch will close. When the switch is closed, the voltage is grounded, which will cause the ECU to derate the engine.

DTC 000971.31 will set if:

- The ECU does not read an input voltage from external switch.

If DTC 000971.31 sets, the following will occur:

- The ECU will derate the engine. The amount of derate is dependent on the application.

DPSG,RG40854,319 –19–16APR02–2/2

001109.31 — Engine Shutdown Warning

The ECU will shut the engine down to protect the engine from damage.

Engine Shutdown Warning:

This code informs the operator that the ECU will shut the engine down because it has detected a condition such as 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 within 30 seconds. Prior to shutdown, the engine will be derated.

DTC 001109.31 will set if:

- The ECU detects low fuel pressure.
- The ECU detects water in fuel for an extended period of time.
- The ECU detects low oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects a high loss of coolant temperature.

If DTC 001109.31 sets, the following will occur:

- If the ECU has engine protection with shutdown, it will derate (according to relating DTC) the engine for 30 seconds and will shut the engine down.

If DTC 1109 FMI 31 sets:

- If DTC 000094.01 is active, see DTC 000094.01 FUEL SUPPLY PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000097.00 is active, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000100.01 is active, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000110.00 is active, see DTC 000110.00 ENGINE COOLANT TEMPERATURE HIGH MOST SEVERE DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000111.01 is active, see DTC 000111.01 ENGINE COOLANT LEVEL LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.

DPSG,RG40854,487 –19–16APR02–1/1

001110.31 — Engine Shutdown

The ECU shut the engine down to protect the engine from damage.

Engine Shutdown:

This code informs the operator that the ECU shut the engine down because it has detected a condition such as 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 fuel pressure.
- The ECU detects water in fuel for an extended period of time.
- The ECU detects low oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects a high loss of coolant temperature.

If DTC 001110.31 sets, the following will occur:

- The ECU will have shut the engine down.

If DTC 1110 FMI 31 sets:

- If DTC 000094.01 is active, see DTC 000094.01 FUEL SUPPLY PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000097.00 is active, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000100.01 is active, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000110.00 is active, see DTC 000110.00 ENGINE COOLANT TEMPERATURE HIGH MOST SEVERE DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000111.01 is active, see DTC 000111.01 ENGINE COOLANT LEVEL LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.

DPSG,RG40854,488 –19–22JUN01–1/1

001569.31 — Fuel Derate

The ECU has commanded a fuel derate for engine protection.

Fuel Derate

The fuel derate trouble code is information to the operator that the ECU has detected a condition such as low fuel pressure, high fuel pressure, water in fuel, low oil pressure, high manifold air temperature, high air filter restriction, high engine coolant temperature, or low coolant level, and is derating the engine by limiting the maximum amount of fuel available to the engine.

DTC 001569.31 will set if:

- The ECU detects low or high fuel supply pressure
- The ECU detects water in fuel.
- The ECU detects low oil pressure.
- The ECU detects high manifold air temperature.
- The ECU detects a restriction in the air filter.
- The ECU detects a high engine coolant temperature.
- The ECU detects a high loss of coolant temperature.

If DTC 001569.31 sets, the following will occur:

- The ECU will limit the amount of fuel available to the engine in an attempt to protect the engine.

If DTC 001569.31 sets:

- If DTC 000094.01 or DTC 000094.16 or DTC 000094.18 is active, see one of the following procedures earlier in this Group of the manual:
  - DTC 000094.01 FUEL SUPPLY PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE
  - DTC 000094.16 FUEL SUPPLY PRESSURE MODERATELY HIGH DIAGNOSTIC PROCEDURE
  - DTC 000094.18 FUEL SUPPLY PRESSURE MODERATELY LOW DIAGNOSTIC PROCEDURE
- If DTC 000097.00 or DTC 000097.16 or DTC 000097.31 is active, see one of the following procedures earlier in this Group of the manual:
  - DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED DIAGNOSTIC PROCEDURE
  - DTC 000097.16 WATER IN FUEL DETECTED DIAGNOSTIC PROCEDURE
  - DTC 000097.31 WATER IN FUEL DETECTED DIAGNOSTIC PROCEDURE
- If DTC 000100.01 or DTC 000100.18 is active, see one of the following procedures earlier in this Group of the manual:
  - DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE
  - DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW DIAGNOSTIC PROCEDURE
- If DTC 000105.16 is active, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000107.31 is active, see DTC 000107.31 AIR FILTER RESTRICTION HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC SPN 110 FMI 0, DTC SPN 110 FMI 15, or DTC 000110.16 is active, see one of the following procedures earlier in this Group of the manual:
  - DTC 000110.00 ENGINE COOLANT TEMPERATURE HIGH MOST SEVERE DIAGNOSTIC PROCEDURE
  - DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE DIAGNOSTIC PROCEDURE
  - DTC 000110.16 ENGINE COOLANT TEMPERATURE HIGH MODERATELY SEVERE DIAGNOSTIC PROCEDURE
- If DTC 000111.01 is active, see DTC 000111.01 ENGINE COOLANT LEVEL LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.

DPSG,RG40854,320 –19–16APR02–1/1

002000.13 — Security Violation

The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

Security Violation

- When the ignition is first turned on, all of the controllers on the machine communicate with each other to make sure that all controllers are correct for the particular machine.

DTC 002000.13 will set if:

- The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

If DTC 002000.13 sets, the following will occur:

- The ECU will allow the engine to start, but will only allow low idle engine speed.

If DTC 002000.13 sets:

- If one of the controllers on the machine has just been replaced, make sure the correct controller was installed.
- If all controllers on the machine are the correct part numbers, check to see if any of the controllers have active or stored CAN related DTCs. If they do, go to the appropriate diagnostic procedure.

RG40854,000000B –19–16APR02–1/1

Section 05
Tools

Contents

Fuel System Essential Tools

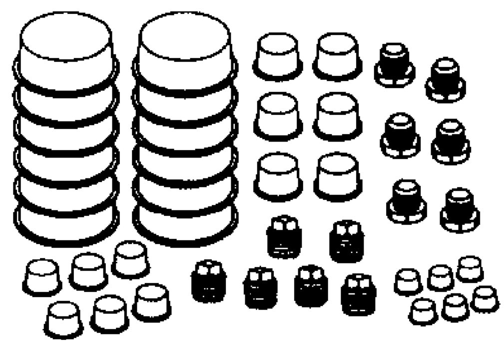
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

SERVICEGARD is a trademark of Deere & Company

OUO1004,0000BDF –19–03NOV00–1/4

Fuel System Cap Plug Kit JDG998

Use to protect the fuel system from dirt and debris when disconnecting fuel system components during routine maintenance and service.

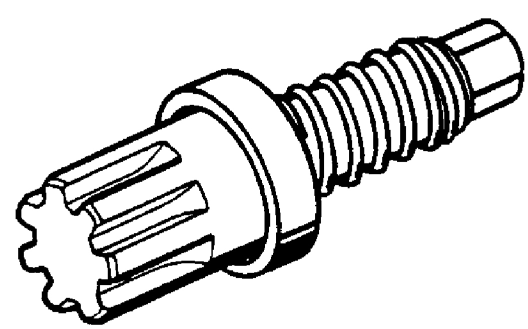

RG8518 –UN–09OCT02

JDG998

OUO1004,0000BDF –19–03NOV00–2/4

Flywheel Turning Tool JDG820

Use to rotate engine flywheel to find cylinder No. 1 and No. 6 “Top Dead Center” when adjusting electronic unit injector (EUI) preload. Use with JDG971 Timing Pins.

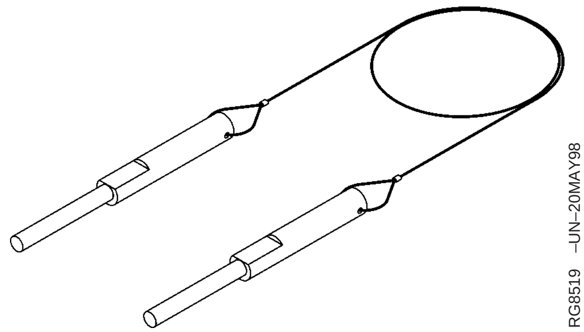

RG7056
RG7056 –UN–05DEC97

JDG820

Continued on next page
OUO1004,0000BDF –19–03NOV00–3/4

Cam/Crankshaft Timing Lock Pins JDG971

Set of two. Used to lock camshaft and crankshaft at “Top Dead Center” during timing gear backlash adjustment. Use on crankshaft only for valve clearance adjustments. Set consists of two 313796 Lock Pins.



JDG971

OUO1004,0000BDF –19–03NOV00–4/4

Fuel System Service Equipment and Tools

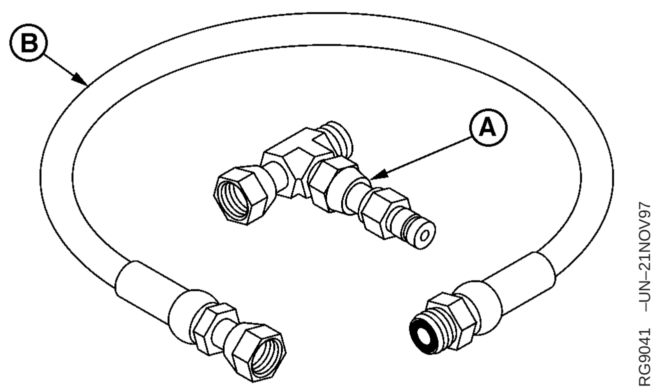
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

SERVICEGARD is a trademark of Deere & Company

OUO1004,0000BE0 –19–03NOV00–1/2

Fuel Supply System Test Kit JT03513

Fuel Pressure Test Fitting is used with JT05472 Universal Pressure Test Kit to measure fuel transfer pump pressure. Fuel Air Detection Line is used to determine if air is present in fuel system. Kit consists of: JT03509 Fuel Pressure Test Fitting (A) and JT03513-1 Fuel Air Detection Line (B).



JT03513

OUO1004,0000BE0 –19–03NOV00–2/2

Fuel System Other Material

Number	Name	Use
T43512 (U.S.) TY9473 (Canadian) 242 (LOCTITE®)	Thread Lock and Sealer (Medium Strength)	Apply to fuel filter check valve and elbow (filter header end). Apply to EUI hold-down clamp cap screws on dual rail fuel systems. Apply to **used** EUI hold-down clamp cap screws on single rail fuel systems.
AR54749 (U.S.)	Soap Lubricant	Apply to fuel supply pump mounting bracket O-ring.
TY24311 (U.S.) CXTY24311 (Canadian) 222 (LOCTITE®)	Thread Lock and Sealer (Low Strength)	Electronic unit injector wiring connector stud nuts.

05
170
3

OUO1004,0000BE1 –19–03NOV00–1/1

Electronic Control System Essential Tools

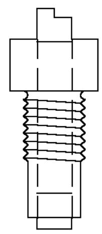
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

SERVICEGARD is a trademark of Deere & Company

OUO1004,0000BDB –19–03NOV00–1/17

Depth Checking Tool JDG1334

Used to check depth of crankshaft position sensor in timing gear cover.


RG10381 –UN–21OCT99

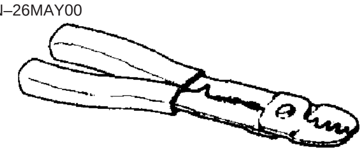
JDG1334

OUO1004,0000BDB –19–03NOV00–2/17

RG10739 –UN–26MAY00

Crimping Pliers JDG144

Used to crimp wire terminal ends for METRI-PACK™ connectors.



JDG144

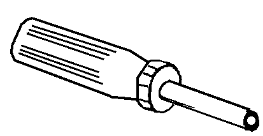
METRI-PACK is a trademark of Delphi Packard Electric Systems

OUO1004,0000BDB –19–03NOV00–3/17

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

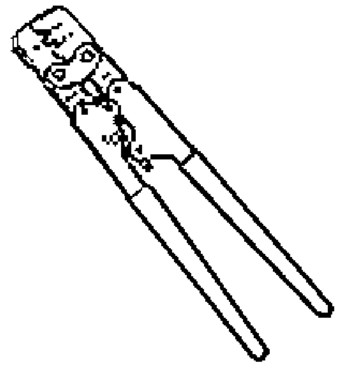
[1]Included in Technician's Electrical Repair Kit - JT07195B

Continued on next page

OUO1004,0000BDB –19–03NOV00–4/17

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.



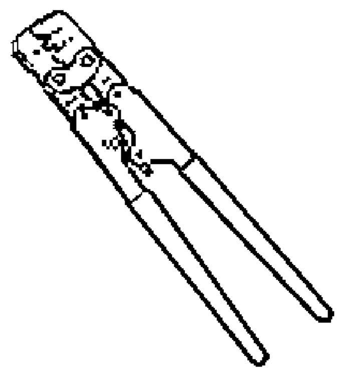
RW25542A –UN–07MAR02

WEATHER PACK is a trademark of Packard Electric

OUO1004,0000BDB –19–03NOV00–5/17

METRI-PACK™ Crimping Tool JDG865

Used to crimp METRI-PACK™ male and female terminals on 14-20 gauge wires.



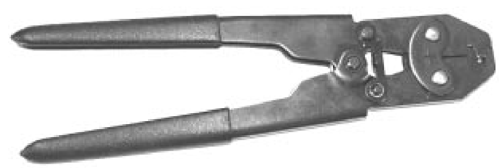
RW25542A –UN–07MAR02

METRI-PACK is a trademark of Packard Electric Inc.

OUO1004,0000BDB –19–03NOV00–6/17

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.



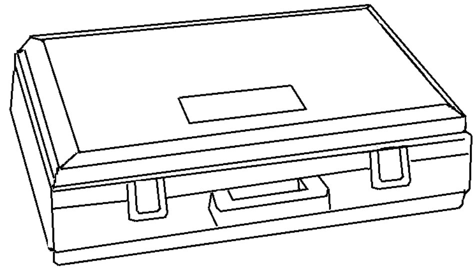
RG11679 –UN–05FEB01

Continued on next page

OUO1004,0000BDB –19–03NOV00–7/17

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, and **JDG785** - Deutsch 6-8 gauge terminal extraction/insertion tool.

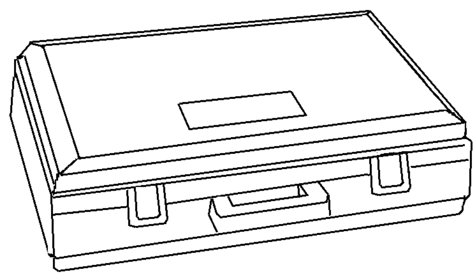


RW25558 –UN–29AUG96

OUO1004,0000BDB –19–03NOV00–8/17

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, **JDG146** - Carrying Case, and **JDG785** - Deutsch 6-8 gauge terminal extraction/insertion tool.

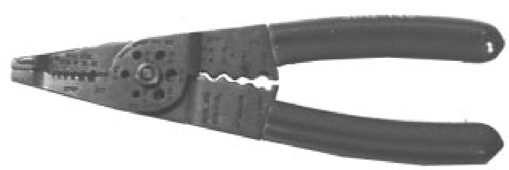


RW25558 –UN–29AUG96

OUO1004,0000BDB –19–03NOV00–9/17

Electrician's Pliers[1] JDG145

Used to cut, strip, and splice wires.



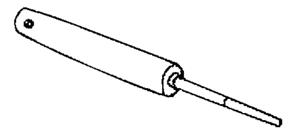
RG11686 –UN–13FEB01

[1]*Included in Technician's Electrical Repair Kit - JDG155*

Continued on next page OUO1004,0000BDB –19–03NOV00–10/17

RW25541 –UN–20AUG96

METRI-PACK™ Extractor (Wide)[1] JDG776



Used to remove terminals from 56-Series, 280-Series, and 630-Series METRI-PACK™ connectors.

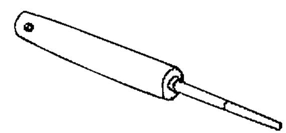
METRI-PACK is a trademark of Packard Electric Inc.

[1]Included in Technician's Electrical Repair Kit - JT07195B

OUO1004,0000BDB –19–03NOV00–11/17

RW25541 –UN–20AUG96

METRI-PACK™ Extractor (Narrow)[1]. JDG777



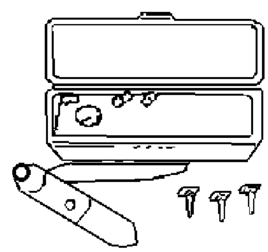
Used to remove terminals from 150-Series METRI-PACK™, SUMITOMO, and YAZAKI connectors.

METRI-PACK is a trademark of Packard Electric Inc.

[1]Included in Technician's Electrical Repair Kit - JT07195B

OUO1004,0000BDB –19–03NOV00–12/17

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), and **JDG363** - Deutsch 20-24 gauge terminal extraction/insertion tool (set of 2)

DEUTSCH is a trademark of Deutsch Co.

Continued on next page

OUO1004,0000BDB –19–03NOV00–13/17

12—14 Gauge Extractor (Set of Two)[1]. JDG361

Used to remove terminals on 12-14 gauge wires in DEUTSCH connectors.

Deutsch Extraction Tool

[1]Included in DEUTSCH Electrical Repair Kit - JDG359

OUO1004,0000BDB –19–03NOV00–14/17

16—18 Gauge Extractor (Set of Two)[1]. JDG362

Used to remove terminals on 16-18 gauge wires in DEUTSCH connectors.

Deutsch Extraction Tool

[1]Included in DEUTSCH Electrical Repair Kit - JDG359

Continued on next page

OUO1004,0000BDB –19–03NOV00–15/17

20—24 Gauge Extractor (Set of Two)[1] JDG363

Used to remove terminals on 20-24 gauge wires in DEUTSCH connectors.

RG12278 –UN–22APR02

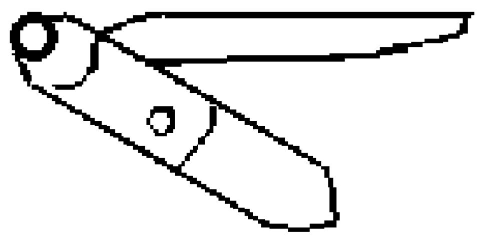
Deutsch Extraction Tool

[1]Included in DEUTSCH Electrical Repair Kit - JDG359

OUO1004,0000BDB –19–03NOV00–16/17

Crimping Tool[1] JDG360

Used to crimp DEUTSCH closed barrel terminals on 12-24 gauge wires.



RG12235 –UN–15MAR02

[1]Included in DEUTSCH Electrical Repair Kit - JDG359

OUO1004,0000BDB –19–03NOV00–17/17

Electronic Control System Service Equipment and Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

SERVICEGARD is a trademark of Deere & Company

OUO1004,0000C32 –19–13DEC00–1/2

Electrician's Pliers JDG145

Remove terminals and strip wires on METRI-PACK™ connectors.

METRI-PACK is a trademark of Delphi Packard Electric Systems

OUO1004,0000C32 –19–13DEC00–2/2

Electronic Control System Other Material

Number	Name	Use
JDT405 (U.S.)	High Temperature Grease	Sensor O-rings.
TY9375 (U.S.) TY9480 (Canadian) 592 (LOCTITE®)	Pipe Sealant with TEFLON®	Apply to threads of oil pressure sensor.
AT66865 (U.S.)	Lubricant	Insulate electrical connectors

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

OUO1004,0000BDD –19–03NOV00–1/1

Engine Diagnostics and Testing Procedure Tools

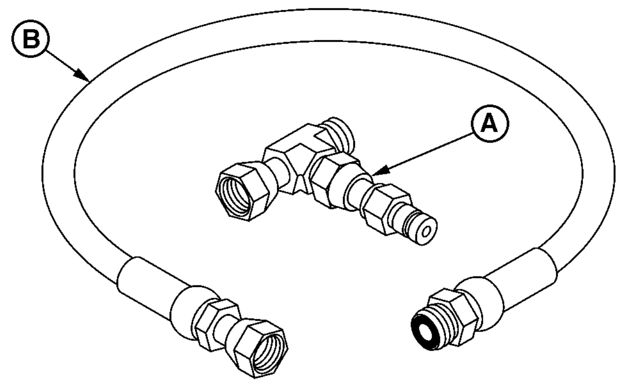
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or in the European Microfiche Tool Catalog (MTC) unless otherwise noted.

SERVICEGARD is a trademark of Deere & Company.

RG,RG34710,1605 –19–30SEP97–1/5

Fuel Supply System Test Kit JT03513

Fuel Pressure Test Fitting is used with JT05472 Universal Pressure Test Kit to measure fuel transfer pump pressure. Fuel Air Detection Line is used to determine if air is present in fuel system. Kit consists of: JT03509 Fuel Pressure Test Fitting (A) and JT03513-1 Fuel Air Detection Line (B).



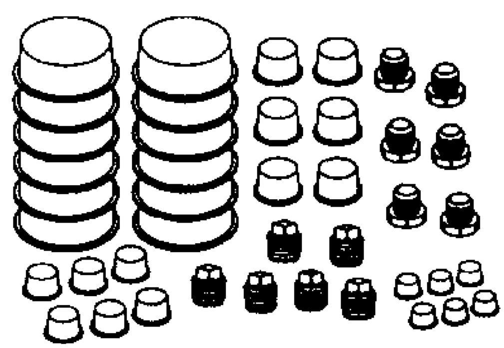
RG9041 –UN–21NOV97

JT03513

RG,RG34710,1605 –19–30SEP97–2/5

Fuel System Cap Plug Kit JDG998

Used to protect the fuel system from dirt and debris when disconnecting fuel system components during fuel transfer pump pressure check.



RG8518 –UN–09OCT02

JDG998

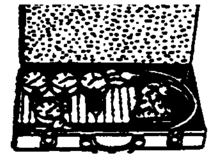
Continued on next page

RG,RG34710,1605 –19–30SEP97–3/5

Universal Pressure Test Kit JT05412

Used for testing engine oil pressure, intake manifold pressure (turbo boost), and fuel transfer pump pressure.

RG5162 –UN–23AUG88

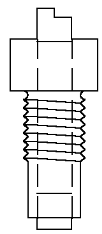


JT05412

RG,RG34710,1605 –19–30SEP97–4/5

Depth Checking Tool JDG1334

Used to check depth of crankshaft position sensor in timing gear cover.



RG10381 –UN–21OCT99

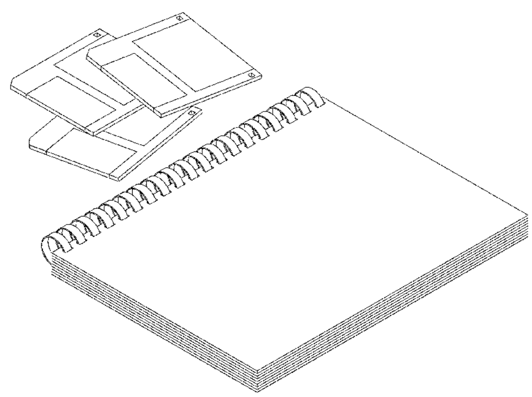
JDG1334

RG,RG34710,1605 –19–30SEP97–5/5

Electronic Control System Diagnostic Tools

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

RG,RG34710,111 –19–22JUN01–1/8

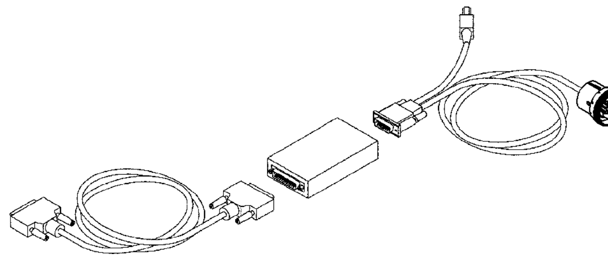
NOTE: Available from John Deere Distribution Service Center (DSC). **United States and Canadian Agricultural dealers DO NOT ORDER without first contacting your Branch or TAM.**

Continued on next page

RG,RG34710,111 –19–22JUN01–2/8

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.

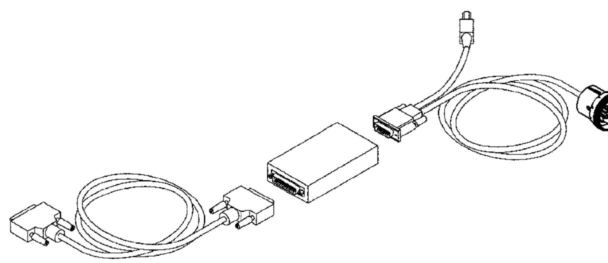


RG11747 –UN–09JUL01

RG,RG34710,111 –19–22JUN01–3/8

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

RG,RG34710,111 –19–22JUN01–4/8

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.

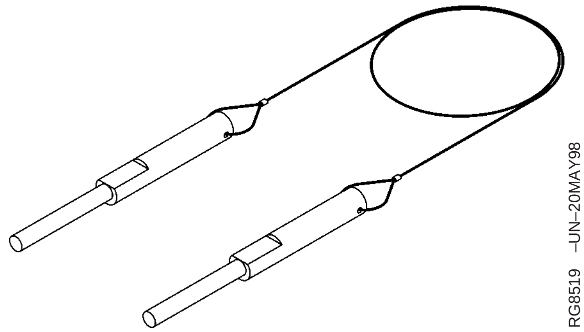
RG11126 –UN–19JUN00

Continued on next page

RG,RG34710,111 –19–22JUN01–5/8

Cam/Crankshaft Timing Lock Pins (2) JDG971

Used to verify cam/crank gear train is correctly timed. Use with JDG820.

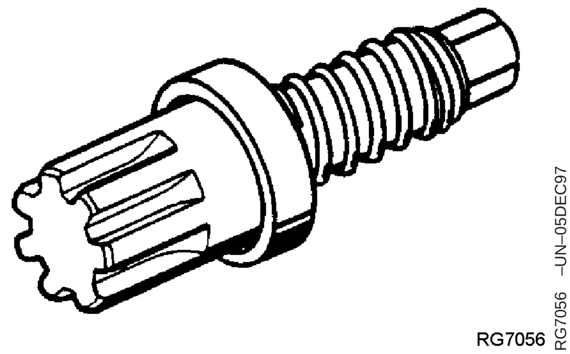


JDG971

RG,RG34710,111 –19–22JUN01–6/8

Flywheel Turning Tool JDG820

Used to rotate flywheel on engine, with 129-tooth flywheel ring gear and a 29.9 mm (1.18 in.) I.D. flywheel housing guide bore diameter, to verify cam/crank gear train is correctly timed. JDE81-1 may be used also if JDG820 is not available. Use with JDG971 Timing Pins.

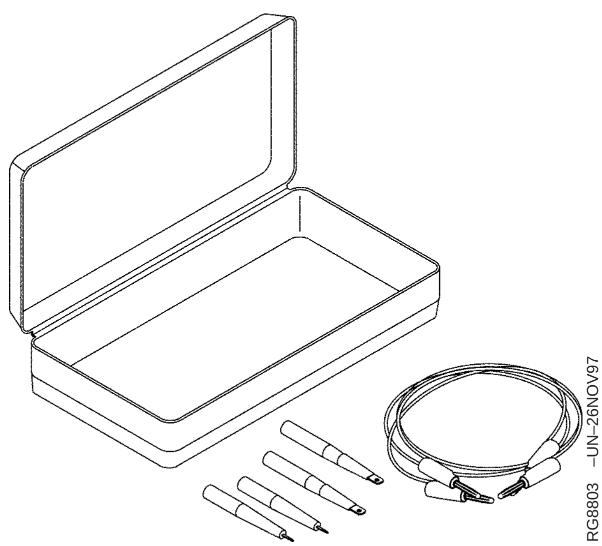


JDG820

RG,RG34710,111 –19–22JUN01–7/8

Connector Adapter Test Kit JT07328

Used with JT07306 Digital Multimeter to make voltage and resistance measurements in control system wiring harness connectors. Can also be used to test terminals for proper fit.



JT07328

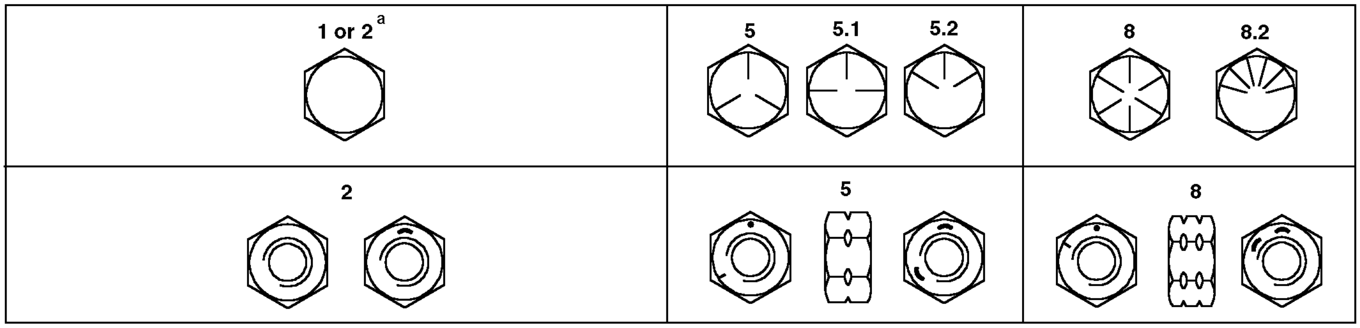
RG,RG34710,111 –19–22JUN01–8/8

Section 06
Specifications

Contents

06

Unified Inch Bolt and Cap Screw Torque Values



TORQ1A –UN–27SEP99

Top, SAE Grade and Head Markings; Bottom, SAE Grade and Nut Markings

	Grade 1 (No Mark)		Grade 2[a] (No Mark)		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
Size	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**
1/4	3.8 (2.8)	4.7 (3.5)	6 (4.4)	7.5 (5.5)	9.5 (7)	12 (9)	13.5 (10)	17 (12.5)
5/16	7.7 (5.7)	9.8 (7.2)	12 (9)	15.5 (11.5)	19.5 (14.5)	25 (18.5)	28 (20.5)	35 (26)
3/8	13.5 (10)	17.5 (13)	22 (16)	27.5 (20)	35 (26)	44 (32.5)	49 (36)	63 (46)
7/16	22 (16)	28 (20.5)	35 (26)	44 (32.5)	56 (41)	70 (52)	80 (59)	100 (74)
1/2	34 (25)	42 (31)	53 (39)	67 (49)	85 (63)	110 (80)	120 (88)	155 (115)
9/16	48 (35.5)	60 (45)	76 (56)	95 (70)	125 (92)	155 (115)	175 (130)	220 (165)
5/8	67 (49)	85 (63)	105 (77)	135 (100)	170 (125)	215 (160)	240 (175)	305 (225)
3/4	120 (88)	150 (110)	190 (140)	240 (175)	300 (220)	380 (280)	425 (315)	540 (400)
7/8	190 (140)	240 (175)	190 (140)	240 (175)	490 (360)	615 (455)	690 (510)	870 (640)
1	285 (210)	360 (265)	285 (210)	360 (265)	730 (540)	920 (680)	1030 (760)	1300 (960)
1-1/8	400 (300)	510 (375)	400 (300)	510 (375)	910 (670)	1150 (850)	1450 (1075)	1850 (1350)
1-1/4	570 (420)	725 (535)	570 (420)	725 (535)	1280 (945)	1630 (1200)	2050 (1500)	2600 (1920)
1-3/8	750 (550)	950 (700)	750 (550)	950 (700)	1700 (1250)	2140 (1580)	2700 (2000)	3400 (2500)
1-1/2	990 (730)	1250 (930)	990 (730)	1250 (930)	2250 (1650)	2850 (2100)	3600 (2650)	4550 (3350)

[a] Grade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

[b] "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

[c] "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

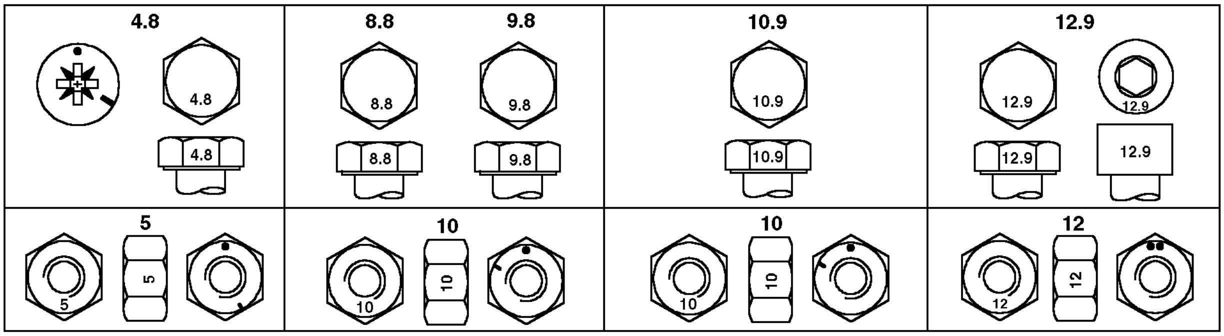
Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

DX,TORQ1 –19–01OCT99–1/1

Metric Bolt and Cap Screw Torque Values



TORQ2 –UN–07SEP99

Top, Property Class and Head Markings; Bottom, Property Class and Nut Markings

	Class 4.8		Class 8.8 or 9.8		Class 10.9		Class 12.9	
Size	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**
M6	4.7 (3.5)	6 (4.4)	9 (6.6)	11.5 (8.5)	13 (9.5)	16.5 (12.2)	15.5 (11.5)	19.5 (14.5)
M8	11.5 (8.5)	14.5 (10.7)	22 (16)	28 (20.5)	32 (23.5)	40 (29.5)	37 (27.5)	47 (35)
M10	23 (17)	29 (21)	43 (32)	55 (40)	63 (46)	80 (59)	75 (55)	95 (70)
M12	40 (29.5)	50 (37)	75 (55)	95 (70)	110 (80)	140 (105)	130 (95)	165 (120)
M14	63 (46)	80 (59)	120 (88)	150 (110)	175 (130)	220 (165)	205 (150)	260 (190)
M16	100 (74)	125 (92)	190 (140)	240 (175)	275 (200)	350 (255)	320 (235)	400 (300)
M18	135 (100)	170 (125)	265 (195)	330 (245)	375 (275)	475 (350)	440 (325)	560 (410)
M20	190 (140)	245 (180)	375 (275)	475 (350)	530 (390)	675 (500)	625 (460)	790 (580)
M22	265 (195)	330 (245)	510 (375)	650 (480)	725 (535)	920 (680)	850 (625)	1080 (800)
M24	330 (245)	425 (315)	650 (480)	820 (600)	920 (680)	1150 (850)	1080 (800)	1350 (1000)
M27	490 (360)	625 (460)	950 (700)	1200 (885)	1350 (1000)	1700 (1250)	1580 (1160)	2000 (1475)
M30	660 (490)	850 (625)	1290 (950)	1630 (1200)	1850 (1350)	2300 (1700)	2140 (1580)	2700 (2000)
M33	900 (665)	1150 (850)	1750 (1300)	2200 (1625)	2500 (1850)	3150 (2325)	2900 (2150)	3700 (2730)
M36	1150 (850)	1450 (1075)	2250 (1650)	2850 (2100)	3200 (2350)	4050 (3000)	3750 (2770)	4750 (3500)

[a] *"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.*

[b] *"Dry" means plain or zinc plated without any lubrication.*

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

DX,TORQ2 –19–01OCT99–1/1

General OEM Engine Specifications

ITEM	UNIT OF MEASURE	6105AF	6105HF	6125AF	6125HF (— 29999)	6125HF (30000—)
Number of Cylinders	——	6	6	6	6	6
Fuel	——	Diesel	Diesel	Diesel	Diesel	Diesel
Stroke	mm (in.)	138 (5.43)	138 (5.43)	165 (6.50)	165 (6.50)	165 (6.50)
Bore	mm (in.)	127 (5.00)	127 (5.00)	127 (5.00)	127 (5.00)	127 (5.00)
Displacement	L (cu in.)	10.5 (640)	10.5 (640)	12.5 (766)	12.5 (766)	12.5 (766)
Compression Ratio	——	16:1	16:1	16:1	16:1	17:1
Physical Dimensions: Width	mm (in.)	741 (29.2)	808 (31.8)	741 (29.2)	808 (31.8)	808 (31.8)
Height	mm (in.)	1224 (48.2)	1239 (48.8)	1224 (48.2)	1239 (48.8)	1239 (48.8)
Length	mm (in.)	1326 (52.2)	1326 (52.2)	1326 (52.2)	1326 (52.2)	1326 (52.2)
Basic Dry Weight	kg (lb)	1211 (2665)	1200 (2640)	1216 (2675)	1205 (2650)	1205 (2650)

RG,RG34710,7615 –19–30OCT00–1/1

Dual Rail Fuel System Specifications

Item	Measurement	Specification
Fuel Filter Header-to-Bracket	Torque	50 N•m (37 lb-ft)
Fuel Filter Bracket-to-Head	Torque	35 N•m (26 lb-ft)
Fuel Filter Bracket-to-Block	Torque	65 N•m (48 lb-ft)
Fuel Filter-to-Air Intake	Torque	25 N•m (18 lb-ft)
Primary Fuel Filter Header Plugs	Torque	47 N•m (35 lb-ft)
Fuel Line-to-Fuel Filter/Air Purge Valve	Torque	24 N•m (18 lb-ft)
Air Purge Valve Diagnostic Port Fitting	Torque	24 N•m (18 lb-ft)
Fuel Filter Check Valve to Fuel Filter Header or Elbow on Header	Torque	46 N•m (34 lb-ft)
Elbow, Fuel Filter Check Valve-to-Filter Header	Torque	46 N•m (34 lb-ft)
Fuel Line-to-Fuel Filter Check Valve	Torque	24 N•m (18 lb-ft)
Surge Tank Fuel Line Adapter (Top)	Torque	46 N•m (34 lb-ft)
Surge Tank Fuel Line Adapter (Bottom)	Torque	39 N•m (29 lb-ft)
Surge Tank Mounting Bracket-to-Cylinder Head Cap Screws	Torque	130 N•m (95 lb-ft)
Surge Tank-to-Mounting Bracket Cap Screws	Torque	50 N•m (37 lb-ft)
Surge Tank Fuel Lines	Torque	24 N•m (18 lb-ft)
Fuel Supply Pump and Camshaft Drive Coupler Set Screws	Torque	4 N•m (3 lb-ft)
Fuel Supply Pump Mounting Bracket Cap Screws	Torque	50 N•m (37 lb-ft)
Fuel Supply Pump-to-Bracket	Torque	25 N•m (18 lb-ft)

Continued on next page
OUO1004,0000BE2 –19–03NOV00–1/2

Item	Measurement	Specification
Fuel Line ORFS Fittings	Torque	24 N•m (18 lb-ft)
Dual Rail Fuel Manifold-to-Head	Torque	35 N•m (26 lb-ft)
Fuel Lines-to-Fuel Manifold	Torque	24 N•m (18 lb-ft)
Fuel Return Check Valve (On Manifold)	Torque	33 N•m (24 lb-ft)
Electronic Unit Injector Hold-Down Clamp Cap Screws	Initial Torque	20 N•m (15 lb-ft)
Electronic Unit Injector Hold-Down Clamp Cap Screws	Final Torque-Turn	90—100°
Electronic Unit Injector Wiring Harness Connector Nuts	Torque	2 N•m (1.75 lb-ft) (18 lb-in.)
Fuel Line Clamps	Torque	5 N•m (4 lb-ft)
Electronic Unit Injector Harness-to-Shaft Clamps	Torque	35 N•m (26 lb-ft)
Electronic Unit Injector Wiring Connector Bracket-to-Head	Torque	25 N•m (18 lb-ft)
Electronic Unit Injector Adjusting Screw Lock Nut	Torque	65 N•m (48 lb-ft)
Timing Pin Plug in Cylinder Block	Torque	33 N•m (24 lb-ft)
Fuel Filter Outlet Line	Torque	24 N•m (18 lb-ft)

OUO1004,0000BE2 –19–03NOV00–2/2

Single Rail Fuel System Specifications

Item	Measurement	Specification
Fuel Filter Assembly		
Fuel Line ORFS Fittings	Torque	24 N•m (18 lb-ft)
Fitting (Fuel Return from Rail)	Torque	33 N•m (24 lb-ft)
Fuel Pressure Sensor	Torque	14 N•m (124 lb-in.)
Fitting (Fuel Pressure Sensor)	Torque	14 N•m (124 lb-in.)
Fitting (Fuel Return to Tank)	Torque	33 N•m (24 lb-ft)
Fitting (Fuel Outlet to Supply Pump)	Torque	33 N•m (24 lb-ft)
Fitting (Fuel Inlet from Tank)	Torque	33 N•m (24 lb-ft)
Fuel Primer	Torque	14 N•m (124 lb-in.)
Fuel Primer-to-Fuel Filter Housing Adapter (Single Rail Fuel System)	Torque	11 N•m (97 lb-in.)
Fuel Temperature Sensor	Torque	14 N•m (124 lb-in.)
Check Valve and Fitting	Torque	33 N•m (24 lb-ft)
Diagnostic Test Port and Fitting	Torque	14 N•m (124 lb-in.)
Filter Housing Plugs	Torque	7 N•m (62 lb-in.)
Filter Cap	Torque	11 N•m (100 lb-in.)
Water Separator Bowl	Torque	6 N•m (55 lb-in.)
Fuel Filter Return Tube (Inside Filter Housing)	Torque	20 N•m (15 lb-ft)
Fuel Filter Assembly-to-Bracket Cap Screws	Torque	50 N•m (37 lb-ft)
Fuel Filter Bracket-to-Cylinder Block Cap Screws	Torque	65 N•m (48 lb-ft)

Continued on next page
OUO1004,0000C3B –19–18DEC00–1/2

Item	Measurement	Specification
Low Pressure Regulating Valve-to-Filter Housing	Torque	18 N•m (13 lb-ft)
High Pressure Regulating Valve-to-Filter Housing	Torque	14 N•m (124 lb-in.)
100 Micron Internal Filter Housing Screen	Torque	5 N•m (44 lb-in.)
Fuel Filter Check Valve to Fuel Filter Housing	Torque	33 N•m (24 lb-ft)
Fuel Supply Pump and Camshaft Drive Coupler Set Screws	Torque	4 N•m (3 lb-ft)
Fuel Supply Pump Mounting Bracket Cap Screws	Torque	50 N•m (37 lb-ft)
Fuel Supply Pump-to-Bracket	Torque	25 N•m (18 lb-ft)
Fuel Line ORFS Fittings	Torque	24 N•m (18 lb-ft)
Electronic Unit Injector Hold-Down Clamp Cap Screws	Initial Torque	20 N•m (15 lb-ft)
Electronic Unit Injector Hold-Down Clamp Cap Screws	Final Torque-Turn	90—100°
Electronic Unit Injector Wiring Harness Connector Nuts	Torque	2 N•m (18 lb-in.)
Fuel Line Clamps	Torque	5 N•m (44 lb-in.)
Electronic Unit Injector Harness-to-Shaft Clamps	Torque	35 N•m (26 lb-ft)
Electronic Unit Injector Wiring Connector Bracket-to-Rear of Head	Torque	25 N•m (18 lb-ft)
Electronic Unit Injector Adjusting Screw Lock Nut	Torque	65 N•m (48 lb-ft)
Timing Pin Plug in Cylinder Block	Torque	33 N•m (24 lb-ft)

OUO1004,0000C3B –19–18DEC00–2/2

Electronic Engine Control System Specifications

Item	Measurement	Specification
ECU Mounting Bracket-to-Cylinder Block Lower Cap Screws	Torque	68 N•m (55 lb-ft)
ECU Mounting Bracket-to-Cylinder Block Upper Front Cap Screw	Torque	110 N•m (81 lb-ft)
Coolant Temperature Sensor	Torque	10 N•m (7.5 lb-ft)
Fuel Temperature Sensor-to-Fuel Manifold (Dual Rail Fuel System)	Torque	10 N•m (7.5 lb-ft)
Fuel Temperature Sensor-to-Fuel Filter Housing (Single Rail Fuel System)	Torque	14 N•m (10 lb-ft)
Fuel Pressure Sensor-to-Fuel Filter Housing (Single Rail Fuel System)	Torque	14 N•m (10 lb-ft)
Water-in-Fuel Sensor-to-Water Separator Bowl (Single Rail Fuel System)	Torque	14 N•m (10 lb-ft)
Engine Oil Pressure Sensor	Torque	9 N•m (80 lb-in.)
Engine Oil Pressure Sensor Adapter-to-Filter Housing	Torque	11 N•m (97 lb-in.)
Manifold Air Temperature (MAT) Sensor	Torque	10 N•m (7.5 lb-ft)
Manifold Absolute Pressure (MAP) Sensor	Torque	7 N•m (5 lb-ft)
Camshaft Position Sensor	Torque	14 N•m (10 lb-ft)
Crankshaft Position Sensor Spotface (Mounting Surface)-to-Crankshaft Timing Wheel Tooth	Distance	36.7—38.2 mm (1.44—1.50 in.)
Crankshaft Position Sensor	Torque	14 N•m (10 lb-ft)

OUO1004,0000BDE –19–03NOV00–1/1

Fuel System Diagnostic Specifications

ITEM	SPECIFICATION
Fuel Supply Pressure on a Dual Rail Fuel System	
Normal (Idle)	410–480 kPa (4.1–4.8 bar) (60–70 psi)
Cranking (Minimum 200 rpm)	70–170 kPa (0.7–1.7 bar) (10–25 psi)
Fuel Supply Pressure on a Single Rail Fuel System	
Normal (Idle)	410-555 kPa (4.1—5.5 bar) (60—80 psi)
Cranking (Minimum 200 rpm)	135—175 kPa (1.35—1.75 bar) (20—25 psi)
Rated Speed	480—620 kPa (4.8—6.2 bar) (70—90 psi)
Fuel System O-ring-Face-Seal Fittings on Dual Rail Fuel System:	
Final Filter-to-Fuel Manifold	24 N•m (18 lb-ft)
Transfer Pump-to-Final Filter	24 N•m (18 lb-ft)

RG,RG34710,1609 –19–30SEP97–1/1

Application Specifications

- **Combines**
  - SENSOR SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Excavators**
  - SENSOR SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Forage Harvesters**
  - SENSOR SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Loaders**
  - SENSOR SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.
- **Marine Engines**
  - SENSOR SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM
  - WHEEL HOUSE PANEL ELECTRICAL WIRING DIAGRAM
  - FLY BRIDGE PANEL ELECTRICAL WIRING DIAGRAM
  - VEHICLE WIRING - See Vehicle manual.
- **OEM Engines**
  - SENSOR SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM
  - 10.5L & 12.5L INSTRUMENT PANEL/ENGINE START COMPONENTS ELECTRICAL WIRING DIAGRAM
- **Tractors**
  - SENSOR SPECIFICATIONS
  - TORQUE CURVE SELECTION
  - GOVERNOR MODE SELECTION
  - ECU TERMINAL IDENTIFICATION
  - VEHICLE WIRING - See Vehicle manual.

RG40854,000000C –19–16APR02–1/1

Combines - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Continued on next page RG40854,000000D –19–17APR02–1/2

Sensor Specifications for Combines				
Sensor	**SPN-FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Fuel Pressure	000094.01	Extremely Low Pressure	Below 200 kPa (29 psi) (2 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
	000094.03	High Input Voltage	Above 4.7 volts	Low fuel pressure engine protection is disabled.
	000094.04	Low Input Voltage	Below 0.3 volts	Low fuel pressure engine protection is disabled.
	000094.16	Moderately High Pressure	Above the high fuel pressure warning specification for a given engine speed.	High fuel pressure engine protection is disabled.
	000094.18	Moderately Low Pressure	Below 300 kPa (43.5 psi) (3 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
Water in Fuel	000097.03	High Input Voltage	Above 4.8 volts	Water in fuel engine protection is disabled.
	000097.04	Low Input Voltage	Below 0.1 volts	Water in fuel engine protection is disabled.
Oil Pressure	000100.03	High Input Voltage	Above 4.5 Volts	Low oil pressure engine protection is disabled.
	000100.04	Low Input Voltage	Below 0.3 Volts	Low oil pressure engine protection is disabled.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.8 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 113°C (235°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.16	Moderately Severe Temperature	Exceeds 108°C (226°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	ECU uses default fuel temperature
	000174.04	Low Input Voltage	Below 0.3 Volts	ECU uses default fuel temperature

RG40854,000000D –19–17APR02–2/2

Combines - Torque Curve Selection

Torque Curve Selection for Combines	
Torque Curve on DST or SERVICE ADVISOR™	**Conditions for Torque Curve**
0	Default - error in CAN communication
1	Normal operating conditions
2	Auger ON (times out after three minutes of continuous auger operation)
3	Separator engagement only

SERVICE ADVISOR is a trademark of Deere & Company

RG40854,000000E –19–17APR02–1/1

Combines - Governor Mode Selection

NOTE: Desired Speed Governor and Max. Speed Governor are parameters that are listed in the DST or SERVICE ADVISOR™. A number is located next to each of these parameters. Use the following tables to determine if the correct governor has been selected with respect to the conditions of the application.

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Desired Speed Governor Selection for Combines	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
0	Normal conditions with isochronous governor

Max. Speed Governor Selection for Combines	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
9	Normal when not in 3rd gear drooped governor
10	3rd gear at 1870 rpm with isochronous governor

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Combines - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Switched Battery	A2	N/A[a]
Unswitched Battery	K1	N/A[a]
System Ground	J2	N/A[a]
CAN High	G1	N/A[a]
CAN Low	F1	N/A[a]
5V Sensor Supply	E2	Changes with each sensor
Sensor Ground	D3	Changes with each sensor
Analog Throttle (A) Input	B3	B
Crank Position Input	B2	A
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A

[a]N/A = Not Applicable

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Excavators - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Continued on next page RG40854,0000011 –19–17APR02–1/3

Sensor Specifications for Excavators				
Sensor	**SPN-FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Fuel Pressure	000094.01	Extremely Low Pressure	Below 200 kPa (29 psi) (2 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
	000094.03	High Input Voltage	Above 4.7 volts	Low fuel pressure engine protection is disabled.
	000094.04	Low Input Voltage	Below 0.3 volts	Low fuel pressure engine protection is disabled.
	000094.16	Moderately High Pressure	Above the high fuel pressure warning specification for a given engine speed.	High fuel pressure engine protection is disabled.
	000094.18	Moderately Low Pressure	Below 300 kPa (43.5 psi) (3 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
Water in Fuel	000097.03	High Input Voltage	Above 4.8 volts	Water in fuel engine protection is disabled.
	000097.04	Low Input Voltage	Below 0.1 volts	Water in fuel engine protection is disabled.
Manifold Air Pressure (MAP)	000102.03	High Input Voltage	Above 4.7 Volts	High MAP engine protection is disabled.
	000102.04	Low Input Voltage	Below 0.3 Volts	High MAP engine protection is disabled.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.8 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.15	Moderately Severe Temperature	Exceeds 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 60% of full power.
	000110.16	Moderately Severe Temperature	Exceeds 113°C (235°F)	ECU derates engine 20% per minute until engine runs at 80% of full power.

Continued on next page RG40854,0000011 –19–17APR02–2/3

Sensor Specifications for Excavators				
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	ECU uses default fuel temperature
	000174.04	Low Input Voltage	Below 0.3 Volts	ECU uses default fuel temperature

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Excavators - Torque Curve Selection

Torque Curve Selection for Excavators	
Torque Curve # on DST or SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal operation

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Excavators - Governor Mode Selection

NOTE: Desired Speed Governor and Max. Speed Governor are parameters that are listed in the DST or SERVICE ADVISOR™. A number is located next to each of these parameters. Use the following tables to determine if the correct governor has been selected with respect to the conditions of the application.

Desired Speed Governor Selection for Excavators	
Mode Selected on DST or SERVICE ADVISOR™	**Conditions**
0	Normal droop

Max. Speed Governor Selection for Excavators	
Mode Selected on DST or SERVICE ADVISOR™	**Conditions:**
9	Normal droop

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Excavators - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal#
Switched Battery	A2	N/A[a]
Unswitched Battery	K1	N/A[a]
System Ground	J2	N/A[a]
CAN High	G1	N/A[a]
CAN Low	F1	N/A[a]
5V Sensor Supply	E2	Changes with each sensor
Sensor Ground	D3	Changes with each sensor
Analog Throttle (A) Input	B3	B
Crank Position Input	B2	A
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
Oil Pressure Input	F3	B
Loss of Coolant Temperature	C1	A

[a]N/A = Not Applicable

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Forage Harvesters - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Continued on next page RG40854,0000016 –19–17APR02–1/3

Sensor Specifications for Forage Harvesters				
Sensor	**SPN-FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Fuel Pressure	000094.01	Extremely Low Pressure	Below 200 kPa (29 psi) (2 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
	000094.03	High Input Voltage	Above 4.7 volts	Low fuel pressure engine protection is disabled.
	000094.04	Low Input Voltage	Below 0.3 volts	Low fuel pressure engine protection is disabled.
	000094.16	Moderately High Pressure	Above the high fuel pressure warning specification for a given engine speed.	High fuel pressure engine protection is disabled.
	000094.18	Moderately Low Pressure	Below 300 kPa (43.5 psi) (3 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
Water in Fuel	000097.03	High Input Voltage	Above 4.8 volts	Water in fuel engine protection is disabled.
	000097.04	Low Input Voltage	Below 0.1 volts	Water in fuel engine protection is disabled.
Oil Pressure	000100.01	Extremely Low Pressure	Below an extremely low engine oil pressure. This pressure increases with engine speed.	Low oil pressure engine protection is disabled.
	000100.04	Low Input Voltage	Switch is closed when key ON, engine OFF.	Low oil pressure engine protection is disabled.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.8 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Exceeds 91°C (196°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 113°C (235°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.16	Moderately Severe Temperature	Exceeds 104°C (219°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
Loss of Coolant Switch	000111.01	Engine Coolant Level Low	Switch closes when temperature is extremely high	ECU derates engine 20% per minute until engine runs at 40% of full power.

Continued on next page

Sensor Specifications for Forage Harvesters				
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	ECU uses default fuel temperature
	000174.04	Low Input Voltage	Below 0.3 Volts	ECU uses default fuel temperature

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Forage Harvesters - Torque Curve Selection

Torque Curve Selection for Forage Harvesters	
Torque Curve # on DST or SERVICE ADVISOR™	Conditions for Torque Curve
0	Normal Operation
1	Security Violation Derated Torque Curve.

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Forage Harvesters - Governor Mode Selection

NOTE: Desired Speed Governor and Max. Speed Governor are parameters that are listed in the DST or SERVICE ADVISOR™. A number is located next to each of these parameters. Use the following tables to determine if the correct governor has been selected with respect to the conditions of the application.

Desired Speed Governor Selection for 6750 and 6850 Self-Propelled Forage Harvesters	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
0	Droop for low speeds (mode 0 is selected until 1650 rpm when speed increases and below 1450 rpm when speed is decreases)
1	Droop for high speeds (mode 1 selected at 1650 rpm when speed increases and 1450 rpm when speed decreases)

Max. Speed Governor Selection for 6750 and 6850 Self-Propelled Forage Harvesters	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
9	Normal droop

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Forage Harvesters - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal#
Switched Battery	A2	N/A[a]
Unswitched Battery	K1	N/A[a]
System Ground	J2	N/A[a]
CAN High	G1	N/A[a]
CAN Low	F1	NA
Sensor Ground	D3	Changes with each sensor
Throttle Reference	F3	N/A[a]
Throttle Input	B3	N/A[a]
Throttle Ground	C1	N/A[a]
Crank Position Input	B2	A
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A

[a]N/A = Not Applicable

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Loaders - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Continued on next page RG40854,0000019 –19–17APR02–1/3

Sensor Specifications for Loaders				
Sensor	**SPN-FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Analog Throttle (A)	000091.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000091.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Analog Throttle (B)	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.
Fuel Pressure	000094.01	Extremely Low Pressure	Below 200 kPa (29 psi) (2 bar) at any engine speed.	ECU derates engine 20% per minute until engine runs at 50% of full power.
	000094.03	High Input Voltage	Above 4.7 volts	Low fuel pressure engine protection is disabled.
	000094.04	Low Input Voltage	Below 0.3 volts	Low fuel pressure engine protection is disabled.
	000094.16	Moderately High Pressure	Above the high fuel pressure warning specification for a given engine speed.	High fuel pressure engine protection is disabled.
	000094.18	Moderately Low Pressure	Below 300 kPa (43.5 psi) (3 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
Water in Fuel	000097.03	High Input Voltage	Above 4.8 volts	Water in fuel engine protection is disabled.
	000097.04	Low Input Voltage	Below 0.1 volts	Water in fuel engine protection is disabled.
	000097.31	Detected	Water in fuel detected for a short period of time.	ECU derates engine 20% per minute until engine runs at 50% of full power.
Manifold Air Pressure (MAP)	000102.03	High Input Voltage	Above 4.7 Volts	High MAP engine protection is disabled.
	000102.04	Low Input Voltage	Below 0.3 Volts	High MAP engine protection is disabled.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.8 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

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Sensor Specifications for Loaders				
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 75% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.15	Moderately Severe Temperature	Exceeds 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 95% of full power.
	000110.16	Moderately Severe Temperature	Exceeds 113°C (235°F)	ECU derates engine 2% per minute until engine runs at 90% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	ECU uses default fuel temperature
	000174.04	Low Input Voltage	Below 0.3 Volts	ECU uses default fuel temperature

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Loaders - Torque Curve Selection

Torque Curve Selection for 744H/MH Loaders	
Torque Curve on DST or SERVICE ADVISOR™	**Conditions for Torque Curve**
0	Not a proper torque curve. Used when CAN is used.
1	744H when in Gears 2-4
2	744H/MH when in Gear 1
3	744MH when in Gears 2-4

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Loaders - Governor Mode Selection

NOTE: Desired Speed Governor and Max. Speed Governor are parameters that are listed in the DST or SERVICE ADVISOR™. A number is located next to each of these parameters. Use the following tables to determine if the correct governor has been selected with respect to the conditions of the application.

Desired Speed Governor Selection for 744H/MH and LX 230 Loaders	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
0	Normal droop

Max. Speed Governor Selection for 744H/MH and LX 230 Loaders	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
9	Normal droop

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Loaders - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal#
Switched Battery	A2	N/A[a]
Unswitched Battery	K1	N/A[a]
System Ground	J2	N/A[a]
CAN High	G1	N/A[a]
CAN Low	F1	NA
5V Sensor Supply	E2	Changes with each sensor
Sensor Ground	D3	Changes with each sensor
Analog Throttle (A) Input (1010 Forwarders ONLY)	E1	B
Analog Throttle (B) Input (1010 Forwarders ONLY)	F2	B
Crank Position Input	B2	A
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
Oil Pressure Input	F3	B
[a]N/A = Not Applicable		

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Marine Engines - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Continued on next page RG40854,000001D –19–17APR02–1/3

Sensor Specifications for Marine Engines				
Sensor	**SPN-FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Analog Throttle (A)	000091.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000091.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Analog Throttle (B)	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.
Fuel Pressure	000094.01	Extremely Low Pressure	Below 200 kPa (29 psi) (2 bar) at any engine speed.	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000094.03	High Input Voltage	Above 4.7 volts	Low fuel pressure engine protection is disabled.
	000094.04	Low Input Voltage	Below 0.3 volts	Low fuel pressure engine protection is disabled.
	000094.16	Moderately High Pressure	Above the high fuel pressure warning specification for a given engine speed.	ECU derates engine 2% per minute until engine runs at 80% of full power.
	000094.18	Moderately Low Pressure	Below 300 kPa (43.5 psi) (3 bar) at any engine speed.	ECU derates engine 2% per minute until engine runs at 80% of full power.
Water in Fuel	000097.00	Continuously Detected	Water in fuel detected for a long period of time.	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000097.03	High Input Voltage	Above 4.8 volts	Water in fuel engine protection is disabled.
	000097.04	Low Input Voltage	Below 0.1 volts	Water in fuel engine protection is disabled.
	000097.16	Detected	Water in fuel detected for a short period of time.	ECU derates engine 2% per minute until engine runs at 80% of full power.
Oil Pressure	000100.01	Extremely Low Pressure	Below an extremely low engine oil pressure. This pressure increases with engine speed.	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000100.03	High Input Voltage	Above 4.5 Volts	Low oil pressure engine protection is disabled.
	000100.04	Low Input Voltage	Below 0.3 Volts	Low oil pressure engine protection is disabled.

Continued on next page

Sensor Specifications for Marine Engines				
	000100.18	Moderately Low Pressure	Below a moderately low engine oil pressure. This pressure increases with engine speed.	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 108°C (244°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.16	Moderately Severe Temperature	Exceeds 103°C (217°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	ECU uses default fuel temperature
	000174.04	Low Input Voltage	Below 0.3 Volts	ECU uses default fuel temperature

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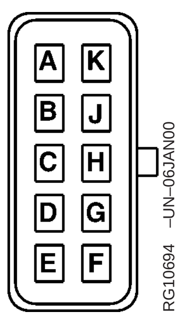
Marine Engines - Torque Curve Selection

Torque Curve Selection for Marine Applications		
Torque Curve on DST or SERVICE ADVISOR™	**Rated Speed**	**Jumper wire on Program Performance Connector:**
0	2100 rpm	No jumper wires installed
1	2000 rpm	Jumper wire installed between terminals C and H only
2	1900 rpm	Jumper wire installed between terminals B and J only
3	1800 rpm	Jumper wire installed between terminals A and K.



Performance Program

Connector

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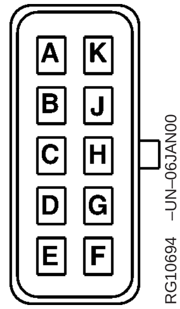
Marine Engines - Governor Mode Selection

NOTE: Desired Speed Governor and Max. Speed Governor are parameters that are listed in the DST or SERVICE ADVISOR™. A number is located next to each of these parameters. Use the following tables to determine if the correct governor has been selected with respect to the conditions of the application.

NOTE: In order for the isochronous governor to be selected, terminals E and F on the performance program connector must be connected by a jumper wire.



Performance Program Connector

Desired Speed Governor Selection for Marine Applications	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
0	Torque curve 0 droop
1	Torque curve 1 droop
2	Torque curve 2 droop
3	Torque curve 3 droop
4	Torque curve 0 with isochronous governor
5	Torque curve 1 with isochronous governor
6	Torque curve 2 with isochronous governor
7	Torque curve 3 with isochronous governor
10	Torque curve 0 with isochronous governor with crank error
11	Torque curve 1 with isochronous governor with crank error
12	Torque curve 2 with isochronous governor with crank error
13	Torque curve 3 with isochronous governor with crank error

Max. Speed Governor Selection for Marine Applications	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
9	Normal droop

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Marine Engines - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor/Switch Connector Terminal#	Circuit #
Switched Battery	G1 of 30-way half of 48-way ECU connector	N/A[a]	012
Unswitched Battery	A2 and A3 of 30-way half of 48-way ECU connector	N/A[a]	022
System Ground	B1 and B3 of 30-way half of 48-way ECU connector	N/A[a]	050
CAN High	B2 of 60-way ECU connector	N/A[a]	904
CAN Low	B1 of 60-way ECU connector	N/A[a]	905
CAN Shield	C3 of 60-way ECU connector	N/A[a]	020
5V Sensor Supply	W1 of 60-way ECU connector	Multiple sensors use this supply	416
Sensor Ground	N3 of 60-way ECU connector	Multiple sensors use this ground.	415
Analog Throttle (A) Input	K1 of the 60-way ECU connector	B	913
Analog Throttle (B) Input	K3 of the 60-way ECU connector	B	923
Analog Throttle 5V Supply	H1 of 60-way ECU connector	Multiple throttles use this supply.	418
Analog Throttle Ground	F3 of 60-way ECU connector	Multiple throttles use this ground.	417
Crank Position Input	X2 of 60-way ECU connector	A	447
Crank Position Return	W3 of 60-way ECU connector	B	448
Cam Position Input	X1 of 60-way ECU connector	A	445
Cam Position Return	W2 of 60-way ECU connector	B	443
Manifold Air Pressure Input	Y2 of 60-way ECU connector	B	465
Oil Pressure Input	L1 of 60-way ECU connector	C	467
Fuel Pressure Input	Y3 of 60-way ECU connector	C	466
Fuel Temperature Input	R2 of 60-way ECU connector	A	428
Engine Coolant Temperature Input	S3 of 60-way ECU connector	A	461
Water in Fuel Input	L2 of 60-way ECU connector	A	453
90V Supply for Cylinders 1, 2, and 3	C3 of 18-way half of 48-way ECU connector	C (EUI harness connector at rear of cylinder head)	491
Cylinder #1 EUI Control	A2 of 18-way half of 48-way ECU connector	H (EUI harness connector at rear of cylinder head)	493
Cylinder #2 EUI Control	A3 of 18-way half of 48-way ECU connector	D (EUI harness connector at rear of cylinder head)	495
[a]N/A = Not Applicable			

Continued on next page

Cylinder #3 EUI Control	A1 of 18-way half of 48-way ECU connector	G (EUI harness connector at rear of cylinder head)	494
90V Supply for Cylinders 4, 5, and 6	D2 of 18-way half of 48-way ECU connector	F (EUI harness connector at rear of cylinder head)	496
Cylinder #4 EUI Control	B3 of 18-way half of 48-way ECU connector	A (EUI harness connector at rear of cylinder head)	499
Cylinder #5 EUI Control	B2 of 18-way half of 48-way ECU connector	B (EUI harness connector at rear of cylinder head)	497
Cylinder #6 EUI Control	B1 of 18-way half of 48-way ECU connector	E (EUI harness connector at rear of cylinder head)	498

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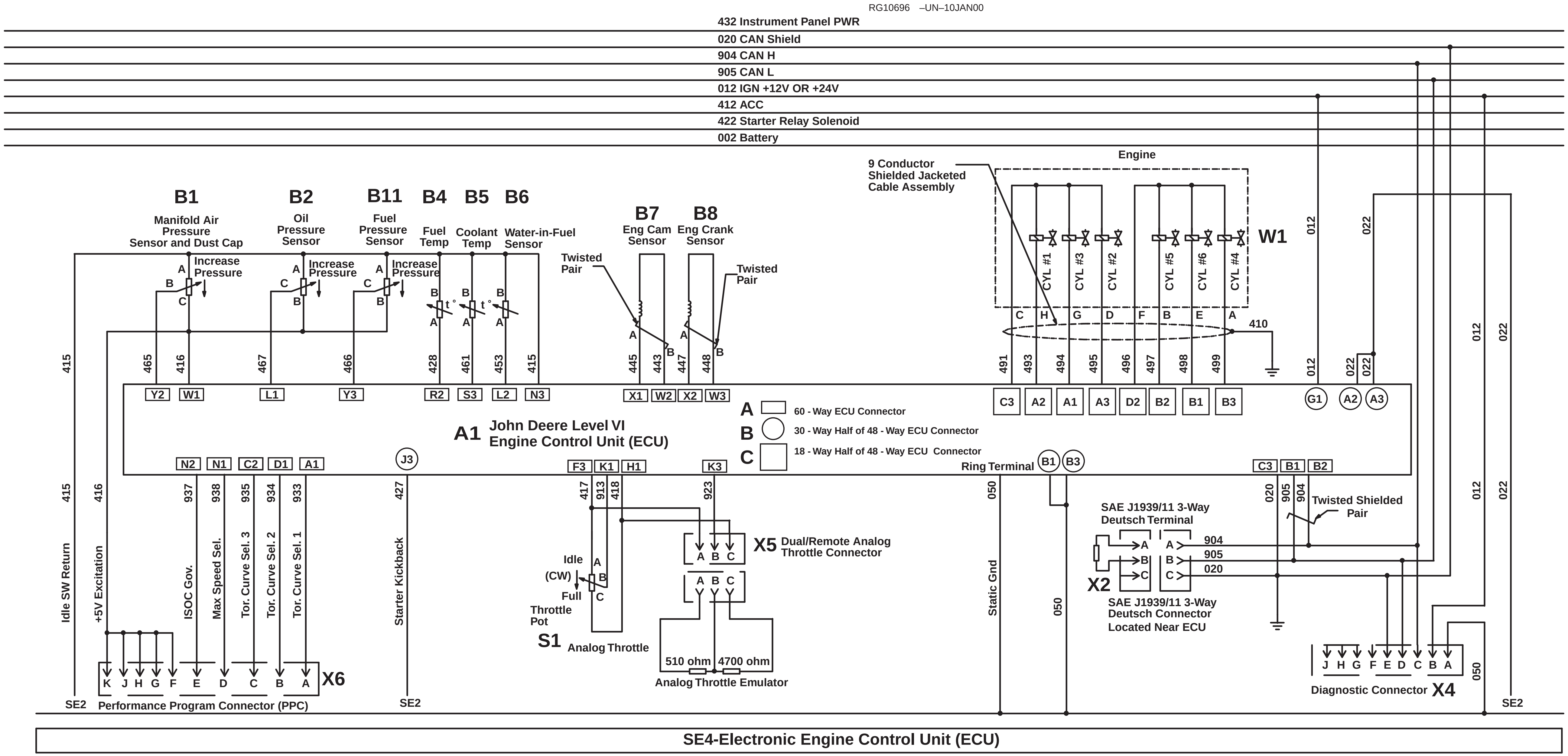
Marine Engines - Electronic Control System Wiring Diagram



A—60-way ECU Connector
B—30-way half of 48-way ECU connector
C—18-way half of 48-way ECU connector
A1—John Deere Level 6 Control Unit (ECU)
B1—Manifold Air Pressure Sensor
B2—Oil Pressure Sensor
B4—Fuel Temperature Sensor
B5—Engine Coolant Sensor
B6—Water in Fuel Sensor
B7—Engine Cam Sensor
B8—Engine Crank Sensor
B10—Fuel Vacuum Switch
B11—Fuel Pressure Sensor
S1—Analog Throttle (A)
W1—Electronic Unit Injectors (6)
X2—CAN Terminator
X4—Diagnostic Connector
X5—Analog Throttle (B)
X6—Performance Program Connector

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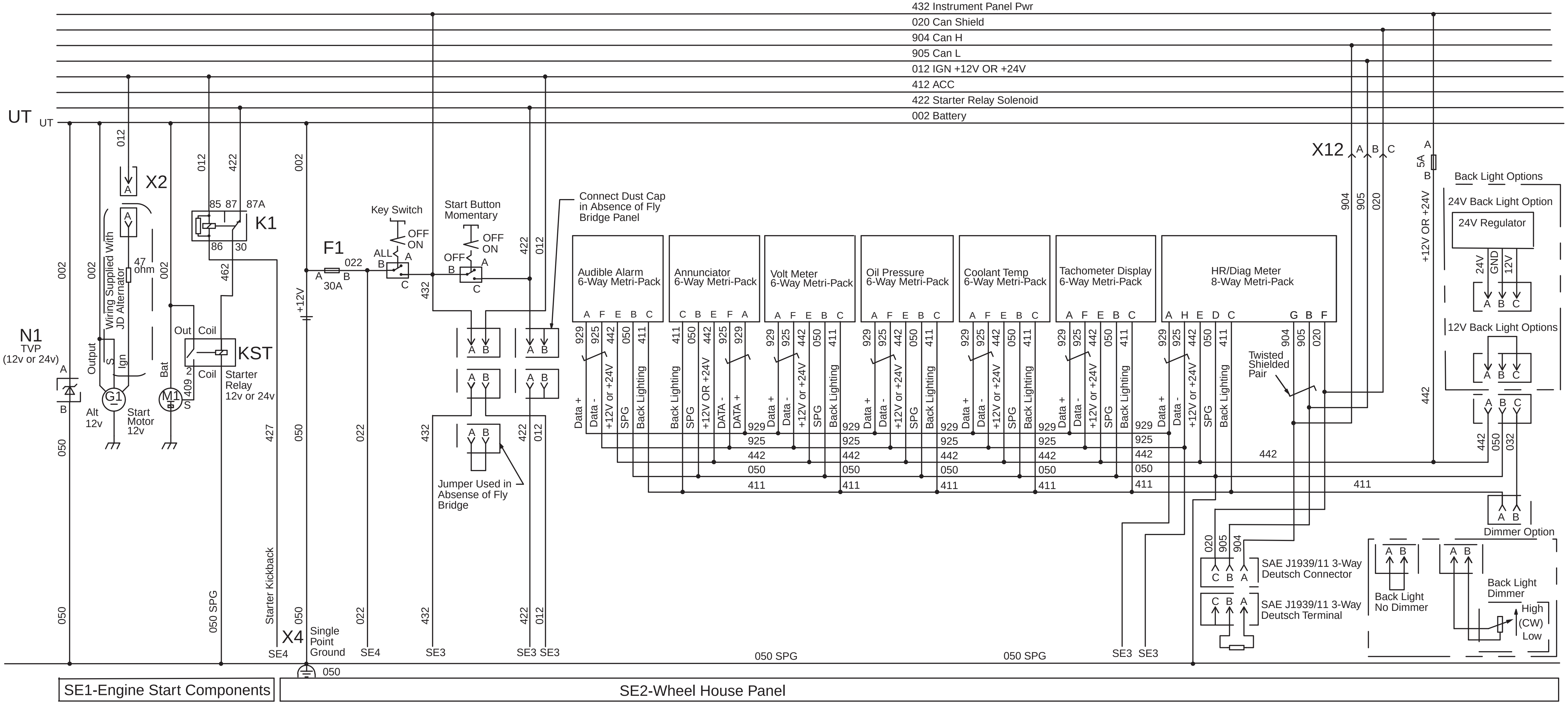
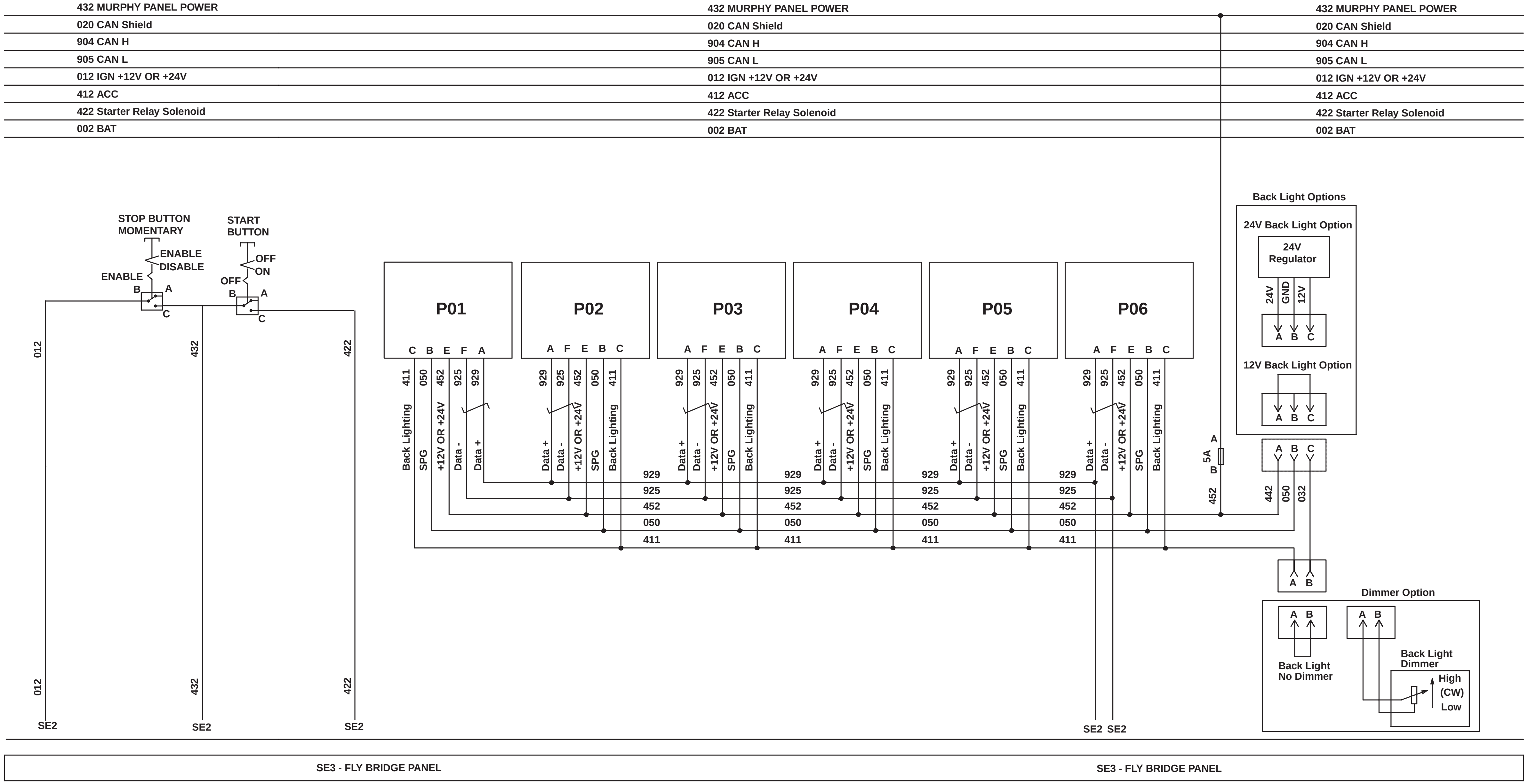
12.5 L Marine Application Wheel House Panel Electrical Wiring Diagram

RG12802 –19–07FEB03



12.5 L Marine Application Fly Bridge Panel Electrical Wiring Diagram

RG12803 –19–07JAN03



RG41221,0000100 –19–06MAR03–1/1

OEM Engines - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Continued on next page RG40854,0000023 –19–17APR02–1/3

Sensor Specifications for OEM Engines				
Sensor	**SPN-FMI**	**Measured Sensor Parameter**	**Out of Range 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.
Analog Throttle (B)	000028.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
Fuel Pressure	000094.01	Extremely Low Pressure	Below 200 kPa (29 psi) (2 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
	000094.03	High Input Voltage	Above 4.7 volts	Low fuel pressure engine protection is disabled.
	000094.04	Low Input Voltage	Below 0.3 volts	Low fuel pressure engine protection is disabled.
	000094.16	Moderately High Pressure	Above the high fuel pressure warning specification for a given engine speed.	High fuel pressure engine protection is disabled.
	000094.18	Moderately Low Pressure	Below 300 kPa (43.5 psi) (3 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
Water in Fuel	000097.00	Continuously Detected	Water in fuel detected for a long period of time.	ECU derates engine 40% per minute until engine runs at 60% of full power.
	000097.03	High Input Voltage	Above 4.8 volts	Water in fuel engine protection is disabled.
	000097.04	Low Input Voltage	Below 0.1 volts	Water in fuel engine protection is disabled.
	000097.16	Detected	Water in fuel detected for a short period of time.	ECU derates engine 2% per minute until engine runs at 80% of full power.
Oil Pressure	000100.01	Extremely Low Pressure	Below an extremely low engine oil pressure. This pressure increases with engine speed.	ECU derates engine 40% per minute until engine runs at 40% of full power.
	000100.03	High Input Voltage	Above 4.5 Volts	Low oil pressure engine protection is disabled.
	000100.04	Low Input Voltage	Below 0.3 Volts	Low oil pressure engine protection is disabled.
	000100.18	Moderately Low Pressure	Below a moderately low engine oil pressure. This pressure increases with engine speed.	ECU derates engine 2% per minute until engine runs at 80% of full power.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.8 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.

Continued on next page

Sensor Specifications for OEM Engines				
	000105.16	Moderately High Temperature	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Air Vacuum Switch	000107.31	Restriction High	Switch closed with high pressure	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.16	Moderately Severe Temperature	Exceeds 110°C (230°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
Loss of Coolant Switch	000111.01	Engine Coolant Level Low	Switch closes when temperature is extremely high	ECU derates engine 40% per minute until engine runs at 40% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	ECU uses default fuel temperature
	000174.04	Low Input Voltage	Below 0.3 Volts	ECU uses default fuel temperature

06
210
38

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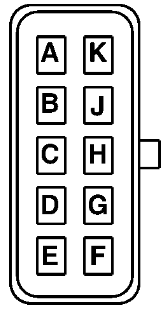
OEM Engines - Torque Curve Selection

Torque Curve Selection for OEM Applications (6105AF001, 6105HF001, 6125AF001, and 6125HF001)		
Torque Curve on DST or SERVICE ADVISOR™	**Engine Speed**	**Jumper wire on Program Performance Connector:**
1	Intermittent power curve #1	No jumper wires installed
2	Intermittent power curve # 1 with “minimum” power bulge (Torque curve 1 times out and torque curve 2 is selected)	No jumper wires installed
3	Derated intermittent power curve #3	Jumper wire installed between terminals B and J only
4	Continuous power curve #2	Jumper wire installed between terminals A and K only
5	Continuous power curve #2 with “minimum” power bulge (Torque curve 4 times out and torque curve 5 is selected)	Jumper wire installed between terminals A and K only
6	Derated continuous power curve #4	Jumper wire installed between terminals B and J and terminals A and K



RG10694 –UN–06JAN00

Performance Program Connector

SERVICE ADVISOR is a trademark of Deere & Company

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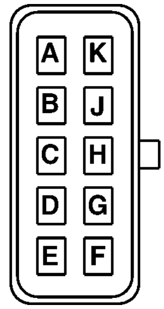
Torque Curve Selection for OEM Engine Applications (6125HF070)		
Torque Curve on DST or SERVICE ADVISOR™	**Engine Speed**	**Jumper wire on Program Performance Connector:**
1	Intermittent power curve #1	No jumper wires installed
2	Intermittent power curve # 1 with "minimum" power bulge (Torque curve 1 times out and torque curve 2 is selected)	No jumper wires installed
3	Continuous power curve #1	Jumper wire installed between terminals A and K only
4	Intermittent power curve #2	Jumper wire installed between terminals B and J only
5	Intermittent power curve #2 with "minimum" power bulge (Torque curve 4 times out and torque curve 5 is selected)	Jumper wire installed between terminals B and J only
6	Continuous power curve #2	Jumper wire installed between terminals B and J and terminals A and K

RG40854,0000022 –19–17APR02–2/2

OEM Engines - Governor Mode Selection

NOTE: Desired Speed Governor and Max. Speed Governor are parameters that are listed in the DST or SERVICE ADVISOR™. A number is located next to each of these parameters. Use the following tables to determine if the correct governor has been selected with respect to the conditions of the application.

NOTE: In order for the isochronous governor to be selected, terminals E and F on the performance program connector must be connected by a jumper wire.



RG10694 –UN–06JAN00

Performance Program Connector

Desired Speed Governor Selection for OEM Applications	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
0	Normal droop
2	Isochronous all speed
5	Cruise control

Max. Speed Governor Selection for OEM Applications	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
9	Drooped high speed governor
10	Isochronous governor at high idle

RG40854,000012B –19–29JAN02–1/1

OEM Engines - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor/Switch Connector Terminal#	Circuit #
Switched Battery	G1 of 30-way half of 48-way ECU connector	N/A[a]	012
Unswitched Battery	A2 and A3 of 30-way half of 48-way ECU connector	N/A[a]	022
System Ground	B1 and B3 of 30-way half of 48-way ECU connector	N/A[a]	050
CAN High	B2 of 60-way ECU connector	N/A[a]	904
CAN Low	B1 of 60-way ECU connector	N/A[a]	905
CAN Shield	C3 of 60-way ECU connector	N/A[a]	020
5V Sensor Supply	W1 of 60-way ECU connector	Multiple sensors use this supply	416
Sensor Ground	N3 of 60-way ECU connector	Multiple sensors use this ground.	414
Analog Throttle (A) Input	K1 of the 60-way ECU connector	B	915
Analog Throttle (B) Input	K3 of the 60-way ECU connector	B	913
Analog Throttle 5V Supply	H1 of 60-way ECU connector	Multiple throttles use this supply.	911
Analog Throttle Ground	F3 of 60-way ECU connector	Multiple throttles use this ground.	914
Multi-state Throttle Input	S1 of 60-way ECU connector	B	947
Multi-state Throttle Ground	N3 of 60-way ECU connector	A	414
Crank Position Input	X2 of 60-way ECU connector	A	447
Crank Position Return	W3 of 60-way ECU connector	B	448
Cam Position Input	X1 of 60-way ECU connector	A	445
Cam Position Return	W2 of 60-way ECU connector	B	443
Manifold Air Pressure Input	Y2 of 60-way ECU connector	B	465
Oil Pressure Input	L1 of 60-way ECU connector	C	467
Fuel Pressure Input	Y3 of 60-way ECU connector	C	466
Fuel Temperature Input	R2 of 60-way ECU connector	A	428
Engine Coolant Temperature Input	S3 of 60-way ECU connector	A	461
Water in Fuel Input	L2 of 60-way ECU connector	A	453
Manifold Air Temperature Input	R1 of 60-way ECU connector	A	463
Loss of Coolant Input	F2 of 60-way ECU connector	A	948
Air Vacuum Input	G2 of 60-way ECU connector	A	479
Override Shutdown Input	G3 of 60-way ECU connector	B	918
[a]N/A = Not Applicable			

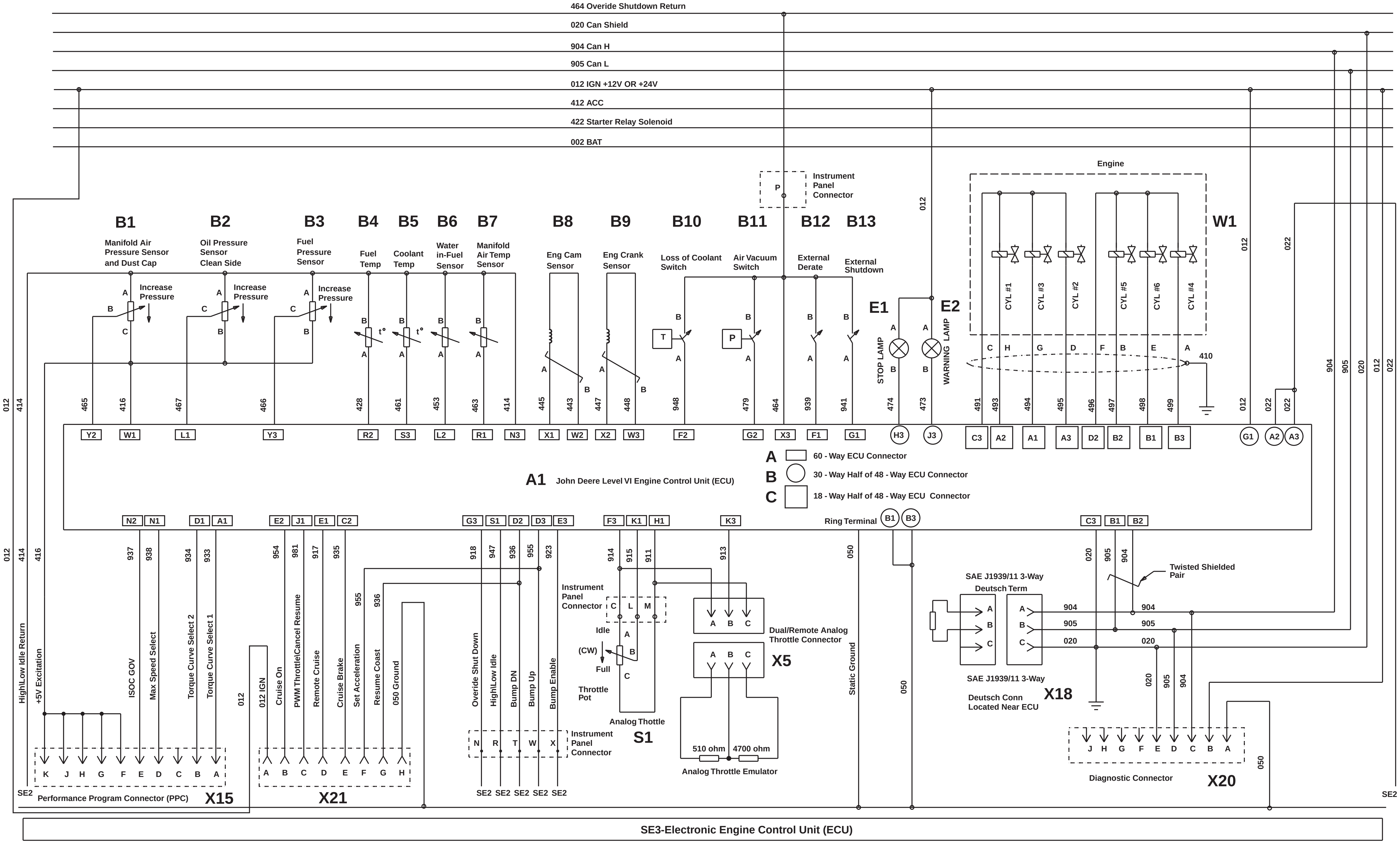
Continued on next page RG40854,000012C –19–29JAN02–1/2

External Derate Input	F1 of 60-way ECU connector	A	939
External Shutdown Input	G1 of 60-way ECU connector	A	941
Switch Ground	X3 of 60-way ECU connector	Multiple switches use this ground.	464
90V Supply for Cylinders 1, 2, and 3	C3 of 18-way half of 48-way ECU connector	C (EUI harness connector at rear of cylinder head)	491
Cylinder #1 EUI Control	A2 of 18-way half of 48-way ECU connector	H (EUI harness connector at rear of cylinder head)	493
Cylinder #2 EUI Control	A3 of 18-way half of 48-way ECU connector	D (EUI harness connector at rear of cylinder head)	495
Cylinder #3 EUI Control	A1 of 18-way half of 48-way ECU connector	G (EUI harness connector at rear of cylinder head)	494
90V Supply for Cylinders 4, 5, and 6	D2 of 18-way half of 48-way ECU connector	F (EUI harness connector at rear of cylinder head)	496
Cylinder #4 EUI Control	B3 of 18-way half of 48-way ECU connector	A (EUI harness connector at rear of cylinder head)	499
Cylinder #5 EUI Control	B2 of 18-way half of 48-way ECU connector	B (EUI harness connector at rear of cylinder head)	497
Cylinder #6 EUI Control	B1 of 18-way half of 48-way ECU connector	E (EUI harness connector at rear of cylinder head)	498
Stop Lamp Ground	H3 of 30-way half of 48-way ECU connector	B	474
Warning Lamp Ground	J3 of 30-way half of 48-way ECU connector	B	473

RG40854,000012C –19–29JAN02–2/2

OEM Engines - Electronic Control System Wiring Diagram

RG10668 –UN–06JAN00



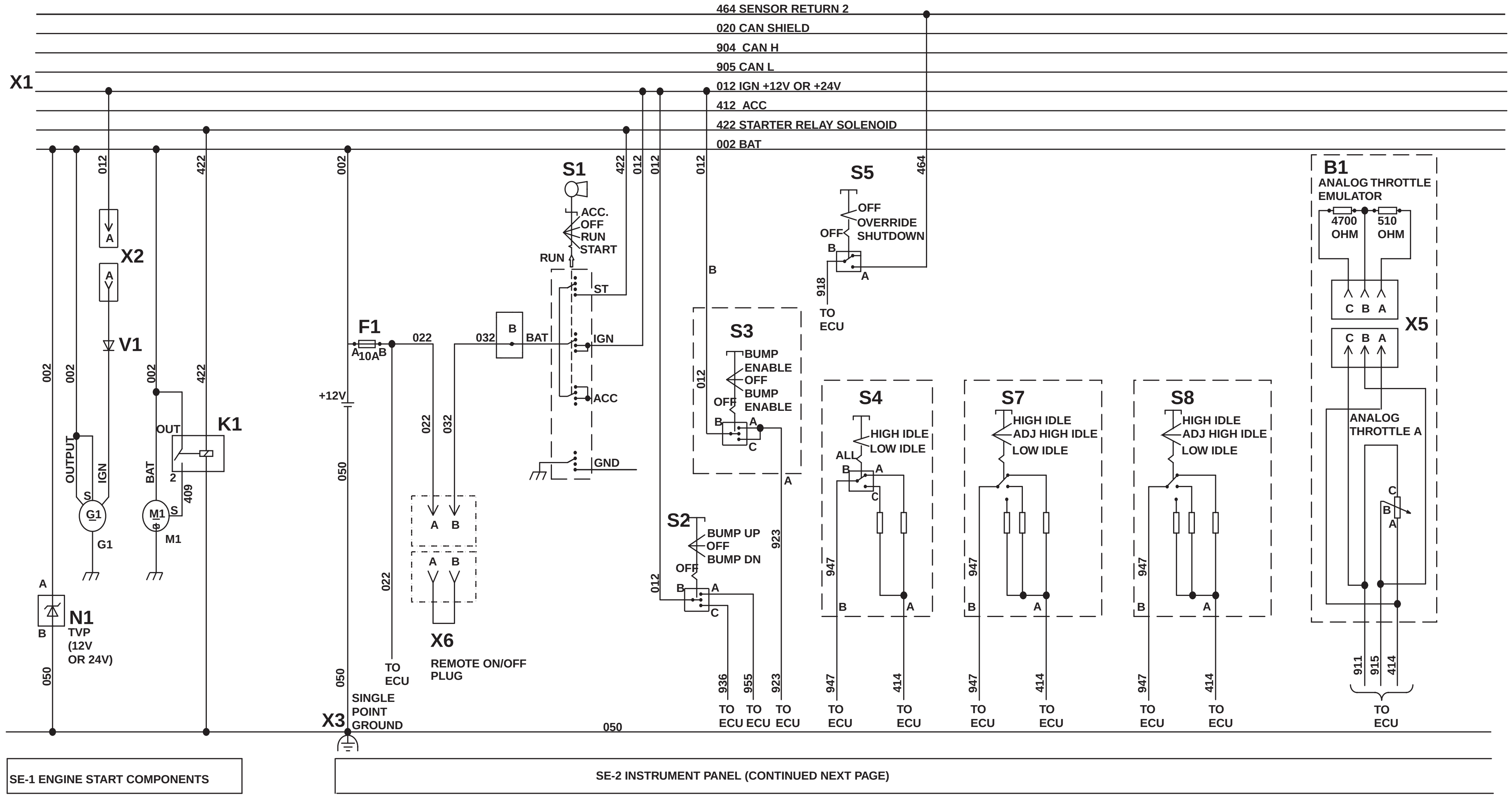
RG40854,0000028 –19–17APR02–1/2

A—60-way ECU Connector
B—30-way half of 48-way ECU connector
C—18-way half of 48-way ECU connector
A1—John Deere Level 6 Engine Control Unit (ECU)
B1—Manifold Air Pressure Sensor
B2—Oil Pressure Sensor
B3—Fuel Pressure Sensor
B4—Fuel Temperature Sensor
B5—Engine Coolant Temperature Sensor
B6—Water in Fuel Sensor
B7—Manifold Air Temperature Sensor
B8—Engine Cam Sensor
B9—Engine Crank Sensor
B10—Loss of Coolant Switch
B11—Air Vacuum Switch
B12—External Derate Switch
B13—External Shutdown Switch
E1—Stop Lamp
E2—Warning Lamp
S1—Analog Throttle (A)
W1—Electronic Unit Injectors (6)
X5—Analog Throttle (B)
X15—Program Performance Connector
X18—CAN Terminator
X20—Diagnostic Connector
X21—Cruise Control Connector

RG40854,0000028 –19–17APR02–2/2

OEM Engines - 10.5L & 12.5L Instrument Panel/Engine Start Components Electrical Wiring Diagram

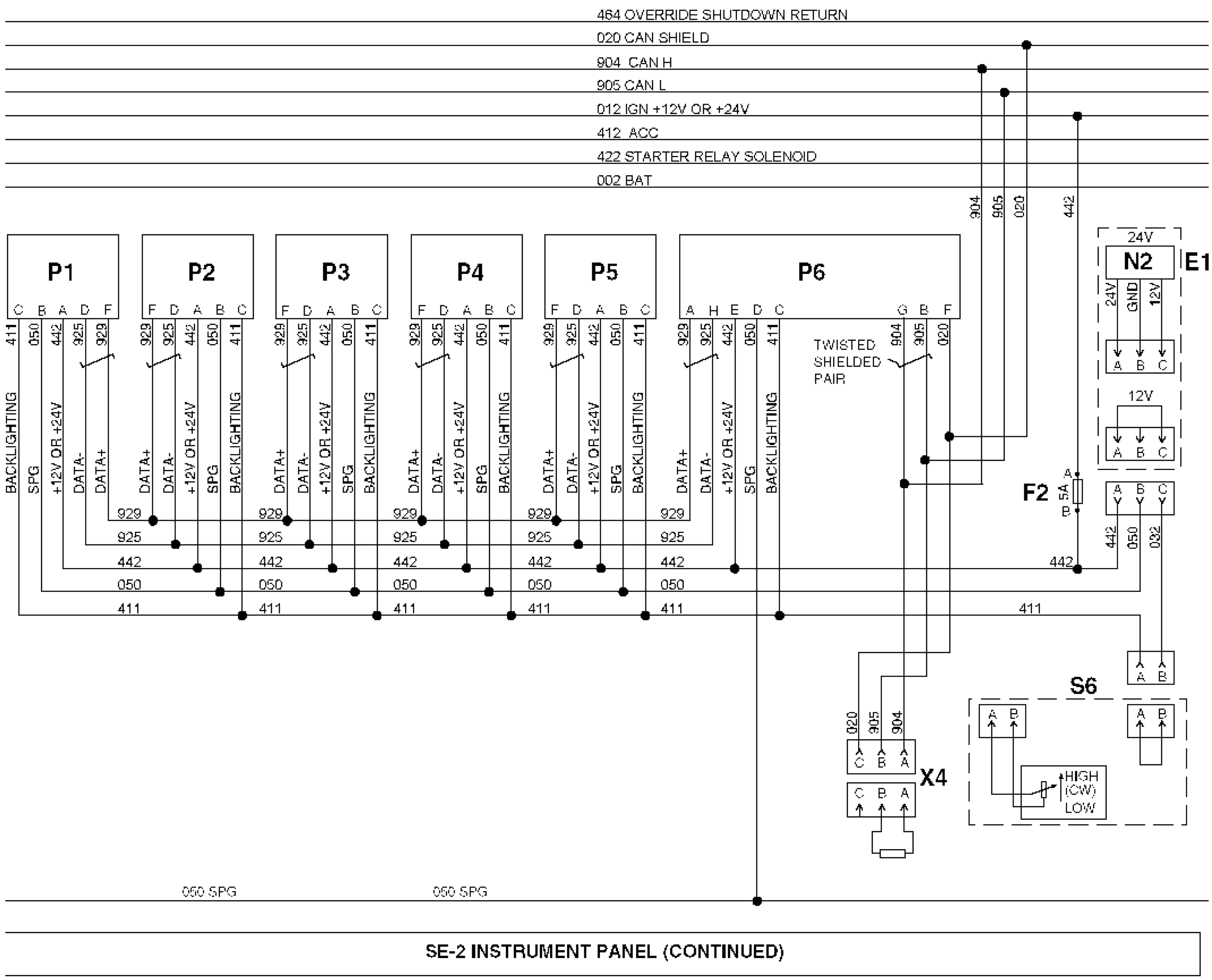
RG12288 –19–23AUG02



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

RG40854,0000029 –19–17APR02–1/1

OEM Engines - 10.5L & 12.5L Instrument Panel/Engine Start Components Electrical Wiring Diagram - Continued



RG10040A –19–13NOV01

B1—Analog Throttle or Emulator
E1—Back Light Regulator (24V) or Plug (12V)
F1—Fuse (30 Amp)
F2—Fuse (5 amp)
G1—Alternator
K1—Starter Relay
M1—Starter Motor
N1—Transient Voltage Protector
N2—Voltage Regulator (for 24V Operation)
P1—Optional Gauge
P2—Optional Gauge
P3—Oil Pressure Gauge
P4—Coolant Temperature Gauge
P5—Tachometer Display
P6—Hourmeter/Diagnostic Meter
R1—Resistor
S1—Ignition Key Switch
S2—Speed Select Switch (Momentary)
S3—Bump Enable Switch (Momentary)
S4—High-Low Speed Switch
S5—Override Shutdown Switch (Momentary)
S6—Dimmer Control or Jumper Plug
X1—Vehicle Harness Connector
X2—Alternator Harness Connector
X3—Single Point Ground
X4—CAN Terminator
X5—Analog Throttle Connector

RG40854,000002A –19–17APR02–1/1

Tractors - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Continued on next page RG40854,0000026 –19–17APR02–1/2

Sensor Specifications for Tractors				
Sensor	**SPN-FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Fuel Pressure	000094.01	Extremely Low Pressure	Below 200 kPa (29 psi) (2 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
	000094.03	High Input Voltage	Above 4.7 volts	Low fuel pressure engine protection is disabled.
	000094.04	Low Input Voltage	Below 0.3 volts	Low fuel pressure engine protection is disabled.
	000094.16	Moderately High Pressure	Above the high fuel pressure warning specification for a given engine speed.	High fuel pressure engine protection is disabled.
	000094.18	Moderately Low Pressure	Below 300 kPa (43.5 psi) (3 bar) at any engine speed.	Low fuel pressure engine protection is disabled.
Water in Fuel	000097.03	High Input Voltage	Above 4.8 volts	Water in fuel engine protection is disabled.
	000097.04	Low Input Voltage	Below 0.1 volts	Water in fuel engine protection is disabled.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.8 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Exceeds 91°C (196°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	9220 - Exceeds 113°C (235°F) 9320, 9420, 9520 - Exceeds 108°C (226°F)	ECU derates engine 20% per minute until engine runs at 40% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.15	Moderately Severe Temperature	9220 - Exceeds 107°C (225°F) 9320, 9420, 9520 - Exceeds 102°C (216°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
	000110.16	Moderately Severe Temperature	9220 - Exceeds 111°C (232°F) 9320, 9420, 9520 - Exceeds 106°C (223°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	ECU uses default fuel temperature
	000174.04	Low Input Voltage	Below 0.3 Volts	ECU uses default fuel temperature

Tractors - Torque Curve Selection

Torque Curve Selection for 9200, 9300, 9400 Wheel Tractors				
Torque Curve using DST or SERVICE ADVISOR™	Torque Curve using On-Board Display	**PST**	**12 Speed MST**	**24 Speed MST**
0	1	When none of the below conditions are met	When none of the below conditions are met	When none of the below conditions are met
1	2	When in gear 3F	When in gear 3F	When in gears A3H or B1L
2	3	3-pt. hitch lowered OR Vehicle speed less than 0.5 mph and PTO engaged	3-pt. hitch lowered OR Vehicle speed less than 0.5 mph and PTO engaged	3-pt. hitch lowered OR Vehicle speed less than 0.5 mph and PTO engaged OR When in gears A1L, A1H, A2L, A2H, A3L, ARL, or ARH
3	4	When in gears 1F, 2F, 1R	Not Used	Not Used

Continued on next page

RG40854,0000024 –19–17APR02–1/2

Torque Curve Selection for 9300/9400 Track Tractors (LTVs)		
Torque Curve on DST or SERVICE ADVISOR™	**Torque Curve using On-Board Display**	**Conditions for Torque Curve**
0	1	When torque curve 1 and 2 (2 and 3 for On-Board Display) conditions are not met
1	2	When in gears A3H or B1L
2	3	When 3-pt. hitch lowered and PTO engaged OR When in gears A1H, A2L, A2H, A3L, ARL, or ARH
3	4	Not Used
4	5	When torque curve 1 and 2 (2 and 3 for On-Board Display) conditions not met AND steering boost is activated
5	6	When in gears A3H or B1L AND steering boost activated.
6	7	When in gears A1L, A1H, A2L, A2H, A3L, ARL, or ARH AND steering boost activated
7	8	Not used

RG40854,0000024 –19–17APR02–2/2

Tractors - Governor Mode Selection

NOTE: Desired Speed Governor and Max. Speed Governor are parameters that are listed in the DST or SERVICE ADVISOR™. A number is located next to each of these parameters. Use the following tables to determine if the correct governor has been selected with respect to the conditions of the application.

Desired Speed Governor Selection for 9200, 9300, 9400 Wheel Tractors and 9300 and 9400 LTVs	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
0	Normal droop
1	Field cruise with isochronous governor
4	Field cruise with crank error

Max. Speed Governor Selection 9200, 9300, 9400 Wheel Tractors and 9300 and 9400 LTVs	
Mode on DST or SERVICE ADVISOR™	**Conditions:**
9	Normal droop (at 2240 rpm, becomes isochronous)
10	PTO or hitch down operation.

RG40854,0000025 –19–17APR02–1/1

Tractors - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor/Switch Connector Terminal#
Switched Battery	G1 of 30-way half of 48-way ECU connector	N/A[a]
Unswitched Battery	A1, A2, and A3 of 30-way half of 48-way ECU connector	N/A[a]
System Ground	B1 and B3 of 30-way half of 48-way ECU connector	N/A[a]
CAN High	B2 of 60-way ECU connector	N/A[a]
CAN Low	B1 of 60-way ECU connector	N/A[a]
5V Sensor Supply	W1 of 60-way ECU connector	Multiple sensors use this supply
Sensor Ground	N3 of 60-way ECU connector	Multiple sensors use this ground.
PWM Throttle Input	J1 of the 60-way ECU connector	Not available
Crank Position Input	X2 of 60-way ECU connector	A
Crank Position Return	W3 of 60-way ECU connector	B
Cam Position Input	X1 of 60-way ECU connector	A
Cam Position Return	W2 of 60-way ECU connector	B
Oil Pressure Input	L1 of 60-way ECU connector	C
Fuel Pressure Input	Y3 of 60-way ECU connector	C
Fuel Temperature Input	R2 of 60-way ECU connector	A
Engine Coolant Temperature Input	S3 of 60-way ECU connector	A
Water in Fuel Input	L2 of 60-way ECU connector	A
Manifold Air Temperature Input	R1 of 60-way ECU connector	A
Loss of Coolant Input	F2 of 60-way ECU connector	A
Air Vacuum Input	G2 of 60-way ECU connector	A
Override Shutdown Input	G3 of 60-way ECU connector	B
External Derate Input	F1 of 60-way ECU connector	A
External Shutdown Input	G1 of 60-way ECU connector	A
Switch Ground	X3 of 60-way ECU connector	Multiple switches use this ground.
90V Supply for Cylinders 1, 2, and 3	C3 of 18-way half of 48-way ECU connector	C (EUI harness connector at rear of cylinder head)
Cylinder #1 EUI Control	A2 of 18-way half of 48-way ECU connector	H (EUI harness connector at rear of cylinder head)
Cylinder #2 EUI Control	A3 of 18-way half of 48-way ECU connector	D (EUI harness connector at rear of cylinder head)
Cylinder #3 EUI Control	A1 of 18-way half of 48-way ECU connector	G (EUI harness connector at rear of cylinder head)
90V Supply for Cylinders 4, 5, and 6	D2 of 18-way half of 48-way ECU connector	F (EUI harness connector at rear of cylinder head)
Cylinder #4 EUI Control	B3 of 18-way half of 48-way ECU connector	A (EUI harness connector at rear of cylinder head)
[a]N/A = Not Applicable		

Continued on next page

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Cylinder #5 EUI Control	B2 of 18-way half of 48-way ECU connector	B (EUI harness connector at rear of cylinder head)
Cylinder #6 EUI Control	B1 of 18-way half of 48-way ECU connector	E (EUI harness connector at rear of cylinder head)
Stop Lamp Ground	H3 of 30-way half of 48-way ECU connector	B
Warning Lamp Ground	J3 of 30-way half of 48-way ECU connector	B

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