

# Workshop manual

## John Deere Diesel engines Powertech 4.5L and 6.8L Level 11 Fuel systems with Denso HPCR



# *POWERTECH*<sup>®</sup> 4.5L & 6.8L Diesel Engines

## Level 11 Electronic Fuel System With Denso HPCR

### TECHNICAL MANUAL *POWERTECH*<sup>®</sup> 4.5 L & 6.8 L Diesel Engines—Level 11 Electronic Fuel System with Denso HPCR

CTM220 21JAN04 (ENGLISH)

For complete service information also see:

*POWERTECH*<sup>®</sup> 4.5 L and 6.8 L Diesel

Engines—Base Engine . . . . . CTM104

Alternators and Starter Motors . . . . . CTM77

OEM Engine Accessories . . . . . CTM67 (English Only)

John Deere Power Systems

LITHO IN U.S.A.

# Introduction

## Forward

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

This manual (CTM220) covers only Level 11 Electronic Fuel System with the Denso High Pressure Common Rail (HPCR). It is one of six volumes on 4.5 L and 6.8 L engines. The following five companion manuals cover the base engine, mechanical fuel system, and other electronic control systems. Each manual covers repair, operation, and diagnostics.

- CTM104—Base Engine
- CTM170—Level 4 Electronic Fuel System with Bosch VP44 Pump
- CTM207—Mechanical Fuel Systems
- CTM284—Level 1 Electronic Fuel System with Delphi (Lucas) DP201 Pump
- CTM331—Level 12 Electronic Fuel System with Stanadyne DE 10 Pump

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

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

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



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

Use this component technical manual in conjunction with the machine technical manual. An application

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

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

Before beginning repair on an engine, clean the engine.

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

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

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

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

# Contents

## SECTION 01—General

- Group 000—Safety
- Group 001—Engine Identification
- Group 002—Fuels, Lubricants, and Coolant

## SECTION 02—Repair and Adjustments

- Group 090—Electronic Fuel System Repair and Adjustments
- Group 110—Electronic Engine Control Repair and Adjustment

## SECTION 03—Theory Of Operation

- Group 130—Electronic Fuel System Operation
- Group 140—Electronic Control System Operation

## SECTION 04—Diagnostics

- Group 150—Observable Diagnostics and Tests
- Group 160—Trouble Code Diagnostics and Tests

## SECTION 05—Tools

- Group 170—Electronic Fuel/Control System Repair Tools and Other Materials
- Group 180—Diagnostic Service Tools

## SECTION 06—Specifications

- Group 200—Repair Specifications
- Group 210—Diagnostic Specifications

01

02

03

04

05

06

INDX

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A John Deere ILLUSTRATION® Manual

*Contents*

01

02

03

04

05

06

INDX

# Section 01 General

## Contents

	Page
<b>Group 000—Safety</b> .....	01-000-1
<b>Group 001—Engine Identification</b>	
Engine Model Designation .....	01-001-1
Engine Serial Number Plate Information .....	01-001-2
OEM Engine Option Code Label .....	01-001-3
Information Relative to Emissions	
Regulations .....	01-001-3
Engine Application Charts .....	01-001-4
<b>Group 002—Fuels, Lubricants, and Coolant</b>	
Lubricants and Coolant .....	01-002-1
Diesel Fuel .....	01-002-1
Bio-Diesel Fuel .....	01-002-2
Dieselscan Fuel Analysis .....	01-002-2
Lubricity of Diesel Fuel .....	01-002-3

*Contents*

01



### Handle Fluids Safely—Avoid Fires

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

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

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

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



TS227 -JUN-23AUG88

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

### Handle Starting Fluid Safely

Starting fluid is highly flammable.

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

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

Do not incinerate or puncture a starting fluid container.



TS1356 -JUN-18MAR92

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

### Service Cooling System Safely

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

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



TS281 -JUN-23AUG88

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

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## Prevent Battery Explosions

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

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

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



TS204 -UN-23AUG88

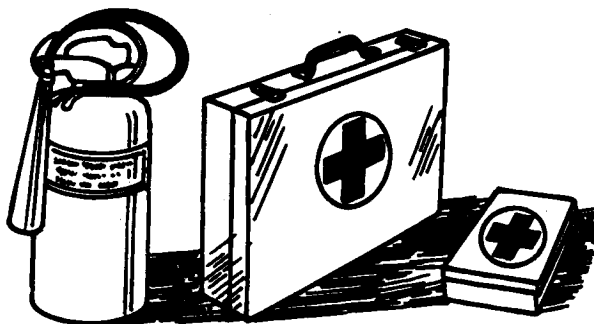
DX,SPARKS -19-03MAR93-1/1

## Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 -UN-23AUG88

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

## Handling Batteries Safely

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

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

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

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

Avoid the hazard by:

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

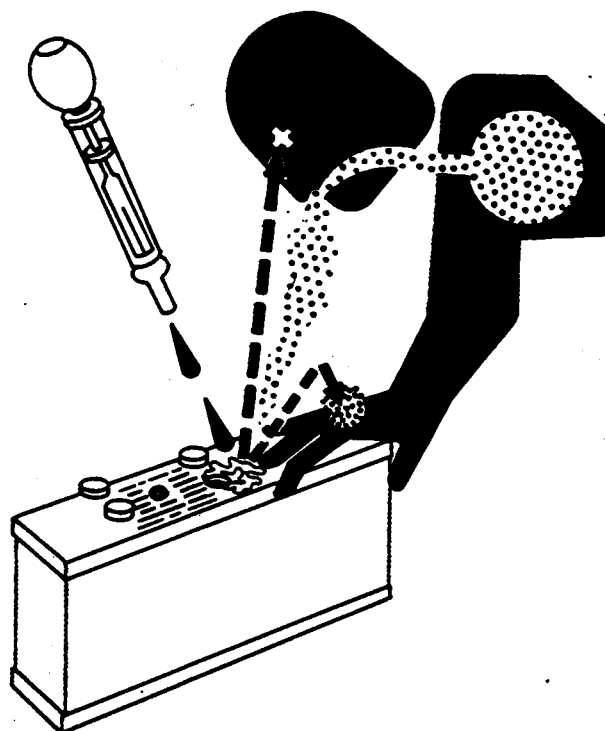
If you spill acid on yourself:

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

If acid is swallowed:

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

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



TS204 -UN-23AUG88

TS203 -UN-23AUG88

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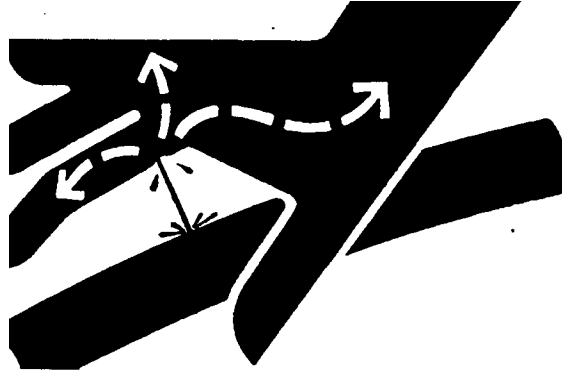
## Avoid High-Pressure Fluids

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

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

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

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



X9811 -UN-23AUG88

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

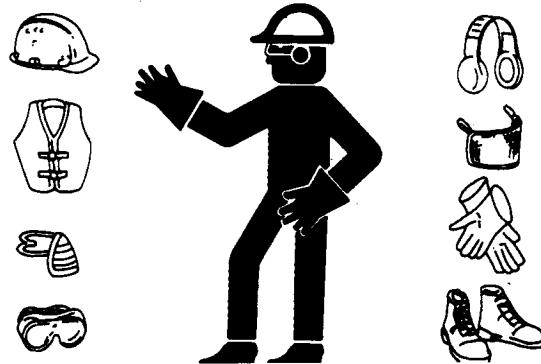
## Wear Protective Clothing

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

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

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

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



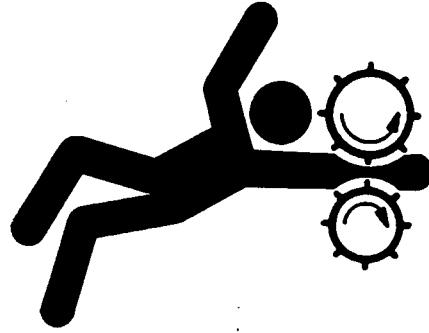
TS206 -UN-23AUG88

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

### Service Machines Safely

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

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



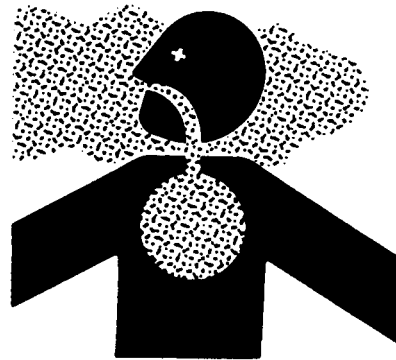
DX,LOOSE -19-04JUN90-1/1

TS228 -JUN-23AUG88

### 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



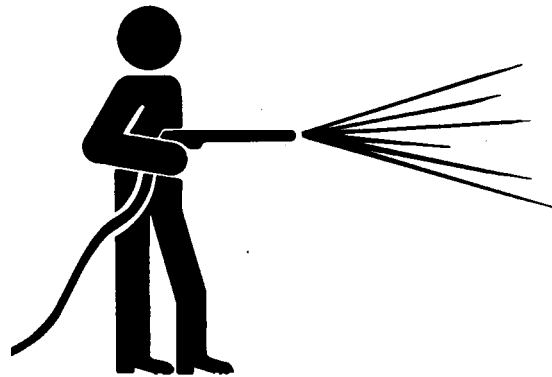
DX,AIR -19-17FEB99-1/1

TS220 -JUN-23AUG88

### 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.



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

T6642EJ -JUN-18OCT88

## Remove Paint Before Welding or Heating

Avoid potentially toxic fumes and dust.

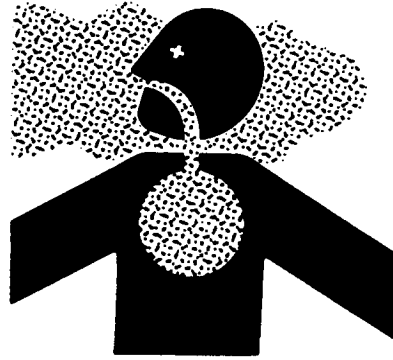
Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

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

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

Dispose of paint and solvent properly.



TS220 -UN-23AUG88

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

## Avoid Heating Near Pressurized Fluid Lines

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



TS953 -UN-15MAY90

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

## Illuminate Work Area Safely

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



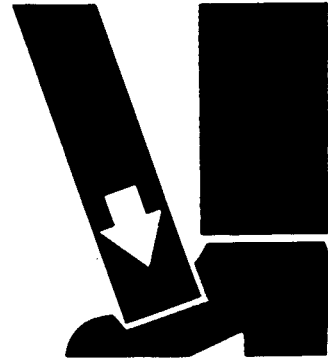
TS223 -UN-23AUG88

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

### Use Proper Lifting Equipment

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

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



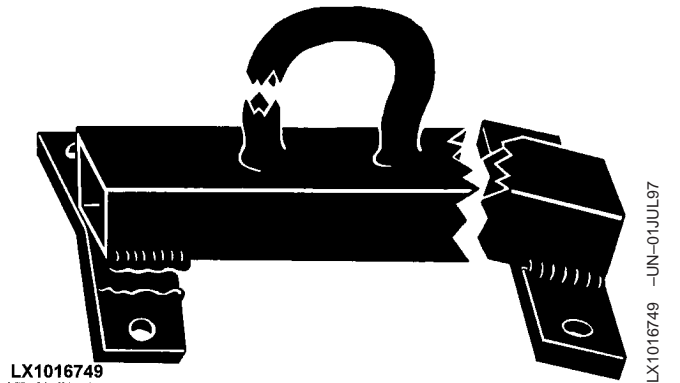
TS226 -JUN-23AUG88

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

### Construct Dealer-Made Tools Safely

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

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



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Construct Dealer-Made Tools Safely

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## Practice Safe Maintenance

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

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

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

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

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

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



TS218 -UN-23AUG88

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

## Use Proper Tools

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

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.



TS779 -UN-08NOV89

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



### Dispose of Waste Properly

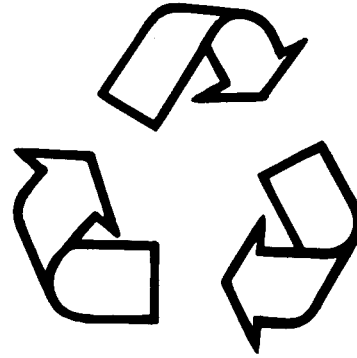
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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

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

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

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



TS1133 -UN-26NOV90

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

### Live With Safety

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



TS231 -19-07OCT88

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



## Engine Model Designation

### John Deere Engine Model—4045 and 6068 Engines

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

#### 4045TF275 Engine

4 ..... Number of cylinders  
 4.5 ..... Liter displacement  
 T ..... Aspiration code  
 F ..... User code  
 275 ..... *POWERTECH*<sup>®</sup> application code

#### Aspiration Code

D ..... Naturally aspirated  
 T ..... Turbocharged, no aftercooling  
 A ..... Turbocharged and Air-to-Coolant Aftercooled  
 H ..... Turbocharged and Air-to-Air Aftercooled

#### User Factory Code

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

#### Application Code

001, etc. .... See ENGINE APPLICATION CHARTS, later in this Group

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## Engine Serial Number Plate Information

**IMPORTANT:** The engine serial number plate (A) can be easily destroyed. Before “hot tank” cleaning the block, remove the plate.

### Engine Serial Number (B)

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:

#### CD4045T000000

CD ..... Factory producing engine  
4045T ..... Engine model designation  
000000 ..... Sequential serial number

#### Factory Code (Engine Manufacturer)

T0 ..... Dubuque, Iowa  
CD ..... Saran, France  
PE ..... Torreon, Mexico  
J0 ..... Rosario, Argentina

#### Engine Model Designation

4045T ..... Definition explained previously. See ENGINE MODEL DESIGNATION earlier in this group.

#### Sequential Number

000000 ..... 6-digit sequential serial number

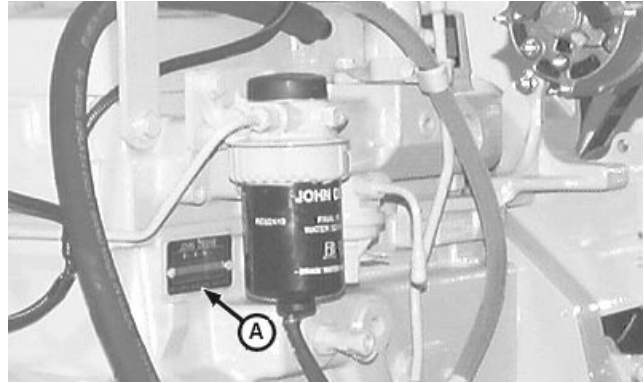
### Engine Application Data (C)

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

### Coefficient of Absorption (D) — (Saran-Built Engines Only)

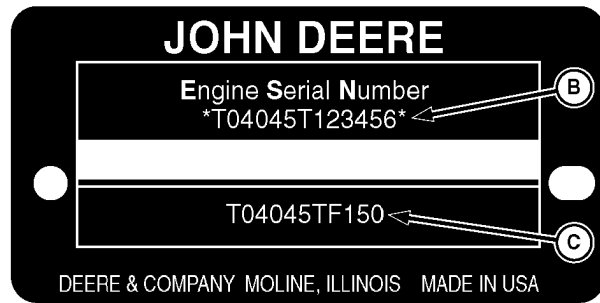
The second line of information on the Saran serial number plate also contains the coefficient of absorption value for smoke emissions.

- A—Engine Serial Number Plate
- B—Engine Serial Number
- C—Engine Application Data
- D—Coefficient of Absorption (Saran Engines Only)



Engine Serial Number Plate

RG11816 -UN-15NOV01



Dubuque Engine Serial Number Plate

RG9060 -UN-16MAR98



Saran Engine Serial Number Plate

RG11949 -UN-07NOV01



Torreon Engine Serial Number Plate

RG11948 -UN-06NOV01

## OEM Engine Option Code Label

An option code label is secured to the top of the valve cover and identifies the factory installed options on each OEM engine to ensure correct parts acquisition.

Always provide option code information and engine base code when ordering repair parts. A listing of option codes is given in parts catalogs and operator's manuals.

*NOTE: Before "hot tank" cleaning, ensure that option codes are recorded elsewhere.*



RG12027 -UN-03DEC01

RG40854,0000006 -19-10APR02-1/1

## Information Relative to Emissions Regulations

Depending on the final destination, engines can meet the emissions regulations according to the US Environmental Protection Agency (EPA), California Air Resources Board (CARB) and for Europe, the Directive 97/68/EC relating the measures against the emissions of particles and gaseous pollutant from internal combustion engines. Such engines are called "CERTIFIED" and receive an emission label stuck on the engine.

The regulations prohibit tampering with the emission-related components listed below which would render that component inoperative or to make any adjustment on the engine beyond published specifications. It is also illegal to install a part or

component where the principle effect of that component is to bypass, defeat, or render inoperative any engine component or device which would affect the engine's conformance to the emission regulations. **To summarize, it is illegal to do anything except return the engine to its original published specifications.**

List of emission-related components:

- Fuel injection system
- Intake manifold
- Turbocharger
- Charge air cooling system
- Piston

RG40854,0000007 -19-10APR02-1/1

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## Engine Application Charts

### JOHN DEERE AGRICULTURAL EQUIPMENT

Machine Model	Engine Model
<b>Waterloo - Tractors</b>	
7220 Tractor	PE6068HRW61
7320 Tractor	PE6068HRW61
7420 Tractor	PE6068HRW62
7520 Tractor	PE6068HRW62
7720 Tractor	
7820 Tractor	PE6068HRW54 PE6068HRW56

<b>Mannheim - Tractors</b>	
6120	
6220	
6420 Tractor Premium (NA/RII)	CD4045HL473
64XX Tractor Premium (RII) IVT, 40K/50K	CD4045HL474
6520 Tractor Premium (NA/RII)	CD6068HL470
6520L Tractor Premium (NA)	CD4045HL475
6620 Tractor Premium (NA/RII)	CD6068HL471
6820 Tractor Premium (RII)	CD6068HL472
6920 Tractor Premium (RII)	CD6068HL473
69XX Tractor Premium (RII) IVT, 40K/50K	CD6068HL474

<b>Moline - Combines</b>	
9550LP Combine	T06068HH054
9550HP Combine	T06068HH055
9965 Amadas Peanut Combine	PE6068HH057

<b>Zweibrucken - Combines</b>	
9560/9560HM Combine	CD6068HZ070

### JOHN DEERE CONSTRUCTION AND FORESTRY EQUIPMENT

Machine Model	Engine Model
<b>Davenport</b>	
624 Loader	PE6068HDW57
670 Motor Grader	PE6068HDW61
672 Motor Grader	PE6068HDW61

### JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)

PE4045HF475  
CD4045HF475  
PE6068HF475  
CD6068HF475

## Lubricants and Coolant

*NOTE: Refer to Section 01, Group 002 of CTM104 Base Engine Manual for information on lubricants and coolants.*

RG40854,000000A -19-10APR02-1/1

## Diesel Fuel

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

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

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

### 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.**

RG40854,000000B -19-10APR02-1/1

## 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

RG40854,000000C -19-10APR02-1/1

## 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.

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DX,FUEL6 -19-06DEC00-1/1



## Lubricity of Diesel Fuel

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

Diesel fuels for highway use in the United States and Canada require sulfur content less than 0.05% (500 ppm).

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

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

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

Fuel lubricity should pass a minimum load level of 3100 gram as measured by the ASTM D6078 or maximum scar diameter of 0.45 mm as measured by ASTM D6079.

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

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

RG40854,000000D -19-10APR02-1/1



# Repair and Adjustments

## Contents

Page	Page
<b>Group 090—Electronic Fuel System Repair and Adjustments</b>	
Fuel System - General Information . . . . .	02-090-1
Relieve Fuel System Pressure . . . . .	02-090-1
Remove and Install Pre-Filter/Water Bowl Base . . . . .	02-090-2
Replace Pre-Filter Element . . . . .	02-090-4
Remove and Install Final Fuel Filter/Water Bowl Base . . . . .	02-090-6
Replace Final Fuel Filter Element . . . . .	02-090-8
Remove Fuel Transfer Pump . . . . .	02-090-9
Install Fuel Transfer Pump . . . . .	02-090-10
Remove and Install High Pressure Fuel Pump . . . . .	02-090-11
Remove and Install High Pressure Fuel Pump Inlet Filter . . . . .	02-090-13
Remove and Install High Pressure Common Rail . . . . .	02-090-14
Remove and Install Flow Dampers . . . . .	02-090-16
Remove and Install Pressure Limiter . . . . .	02-090-18
Remove Electronic Injectors (EIs) . . . . .	02-090-20
Clean Electronic Injector (EI) Bore . . . . .	02-090-21
Clean Electronic Injector (EI) Orifice . . . . .	02-090-21
Clean Electronic Injector (EI) Body . . . . .	02-090-21
Inspect Electronic Injector (EI) Body . . . . .	02-090-21
Install Electronic Injectors (EIs) . . . . .	02-090-22
Remove and Install Leak-off Lines . . . . .	02-090-25
<b>Group 110—Electronic Engine Control Repair and Adjustment</b>	
Engine Control Unit (ECU) . . . . .	02-110-1
Fuel System Sensors . . . . .	02-110-2
Remove and Install Engine Coolant Temperature (ECT) Sensor . . . . .	02-110-2
Remove and Install Fuel Temperature Sensor . . . . .	02-110-3
Remove and Install Manifold Air Temperature (MAT) Sensor . . . . .	02-110-3
Remove and Install Oil Pressure Sensor . . . . .	02-110-4
Remove and Install Fuel Rail Pressure Sensor . . . . .	02-110-5
Remove and Install Crank Position Sensor . . . . .	02-110-6
Remove and Install Pump Position Sensor . . . . .	02-110-6
Remove and Install Glow Plugs . . . . .	02-110-7
Connectors . . . . .	02-110-8
Use Electrical Insulating Compound . . . . .	02-110-8
Using High-Pressure Washer . . . . .	02-110-9
Repair WEATHERPACK™ Connector . . . . .	02-110-10
Remove Blade Terminals from Connector Body . . . . .	02-110-13
Repair (Pull Type) METRI-PACK™ Connectors . . . . .	02-110-14
Repair (Push Type) METRI-PACK™ Connectors . . . . .	02-110-16
Repair DEUTSCH™ Connectors . . . . .	02-110-19
Repair AMP Connector . . . . .	02-110-22
Repair SUMITOMO™ Connectors . . . . .	02-110-24
Repair YAZAKI™ Connectors . . . . .	02-110-26



## Fuel System - General Information

The Level 11 Engine Control Unit (ECU) is used to control the High Pressure Common Rail (HPCR) fuel system. The HPCR fuel system includes the high pressure fuel pump, high pressure common rail, and electronic injectors.

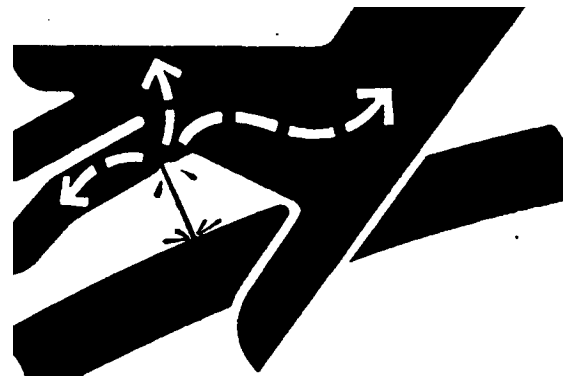
Electronic injectors cannot be tested for opening pressure, as they are controlled electronically.

The electronic injectors can not be serviced. If any part of the component fails, the entire injector must be replaced.

RG40854,000000E -19-10APR02-1/1

## Relieve Fuel System Pressure

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



High Pressure Fluids

X9811 -UN-23AUG88

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

Any time the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system. See BLEED THE FUEL SYSTEM in Section 04, Group 150 in this manual.

RG40854,000000F -19-10APR02-1/1

## Remove and Install Pre-Filter/Water Bowl Base

**NOTE:** For Combine and 6020 Tractors, refer to Vehicle manual for pre-filter information.

**NOTE:** Water bowl attachments are an optional component for pre-filters.

1. Thoroughly clean pre-filter/water bowl assembly and surrounding area to keep from getting dirt and debris into fuel system.
2. Connect a fuel line to filter drain (if equipped) on bottom of filter and drain all fuel from the system.
3. Remove pre-filter element (A) and water bowl (B).

**NOTE:** Fuel lines may be connected to different inlet and outlet ports depending on engine application.

4. Disconnect fuel lines from fuel inlet (C) and fuel outlet (D).
5. If applicable, disconnect fuel transfer pump connector and water in fuel sensor connector.
6. Remove filter base cap screws (E) and pre-filter base (F).

**NOTE:** Mounting bracket does not need to be removed.

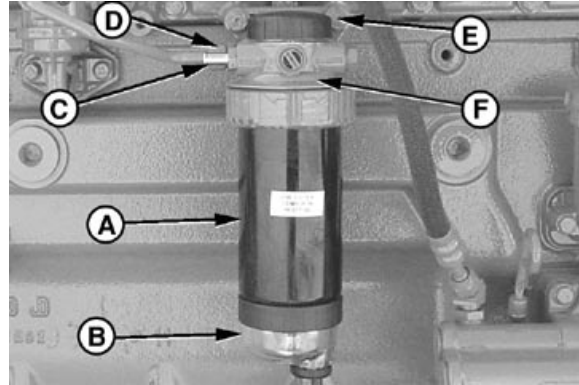
7. Replace parts as necessary.

**NOTE:** The specifications below refer to OEM engines ONLY. For other applications, see Vehicle Manual for pre-filter specifications.

8. If mounting bracket is removed, install on engine. Install filter base on mounting bracket. Tighten cap screws to specification.

### Specification

Pre-filter Mounting	
Bracket-to-Cylinder Head Cap	
Screws—Torque .....	73 N•m (53.8 lb-ft)
Pre-filter Fuel Filter	
Base-to-Bracket Cap Screws—	
Torque .....	50 N•m (36.9 lb-ft)



Pre-filter (OEM engines)

- A—Pre-filter Element
- B—Water Bowl
- C—Fuel Inlet
- D—Fuel Outlet
- E—Pre-filter Base Capscrews (one on opposite side)
- F—Pre-filter Base

RG12451A -UN-14JUN02

9. Install water bowl and pre-filter element. See REPLACE PRE-FILTER ELEMENT later in this Group.

10. Connect fuel lines to fuel inlet and fuel outlet and tighten to specification.

**Specification**

Pre-filter Fuel Filter Inlet Line—

Torque ..... 9 N•m (6.6 lb-ft)

Pre-filter Outlet Line—Torque ..... 9 N•m (6.6 lb-ft)

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

RG40854,000010A -19-22MAY02-2/2

02  
090  
3

## Replace Pre-Filter Element

*NOTE: For Combine and 6020 Tractors, refer to Vehicle manual for pre-filter information.*

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

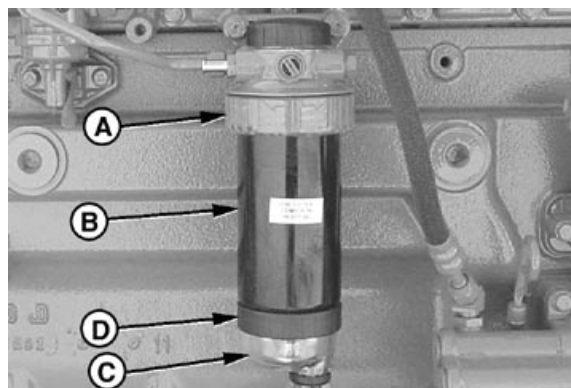
1. Thoroughly clean fuel filter/water bowl assembly and surrounding area, if not previously done.
2. Connect a fuel line to filter drain adapter and drain all fuel from filter/water bowl.

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

3. Firmly grasp the retaining ring and loosen it 1/4 turn. Remove retaining ring with filter element (B) and water bowl (C) (if equipped).
4. Inspect filter mounting base for cleanliness. Clean as required.
5. Remove water bowl, if equipped. Drain and clean bowl. Dry with compressed air.
6. Install water bowl, if equipped, onto new filter element. Tighten adapter (D) securely.
7. Thoroughly inspect filter base seal ring. Replace as needed.

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

8. Install new filter element onto mounting base and position element using a slight rocking motion. Be sure element is properly indexed on mounting base.
9. Install retaining ring onto mounting base and tighten about 1/3 turn until ring "snaps" into the detent. DO NOT overtighten the retaining ring.
10. Bleed fuel system. See BLEED THE FUEL SYSTEM in Section 04, Group 150 later in this manual.



Pre-filter (OEM engines)

- A—Retaining Ring
- B—Pre-filter Element
- C—Water Bowl
- D—Adapter

RG12451B -UN-14JUN02



11. If applicable, connect water in fuel sensor connector.

RG40854,000010D -19-31MAY02-2/2

02  
090  
5

## Remove and Install Final Fuel Filter/Water Bowl Base

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

Final fuel filters can be equipped with a water bowl and/or hand primer on machines equipped with only one filter.

Final fuel filter may be equipped with a water bowl.

1. Thoroughly clean fuel filter/water bowl assembly and surrounding area to keep from getting dirt and debris into fuel system.
2. Connect a fuel line to filter drain and drain all fuel from system.
3. Remove final fuel filter element (A). See REPLACE FINAL FUEL FILTER ELEMENT later in this Group.

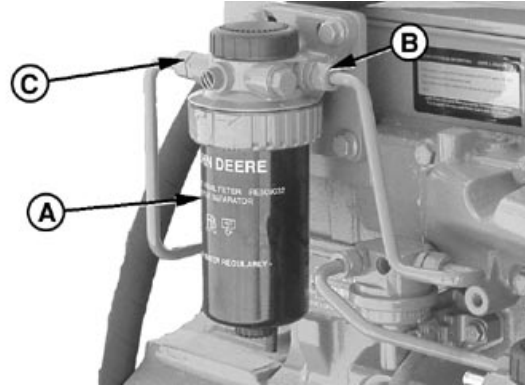
**NOTE:** Fuel lines may be connected to different filter inlet and outlet ports depending on engine application.

4. Disconnect fuel lines from fuel inlet (B), air bleed valve fitting (D) (if applicable), and fuel outlet (C).
5. Remove cap screws and final fuel filter base. Remove final filter.
6. Replace parts as necessary.
7. Install filter base on engine cylinder head. Tighten cap screws to specifications.

### Specification

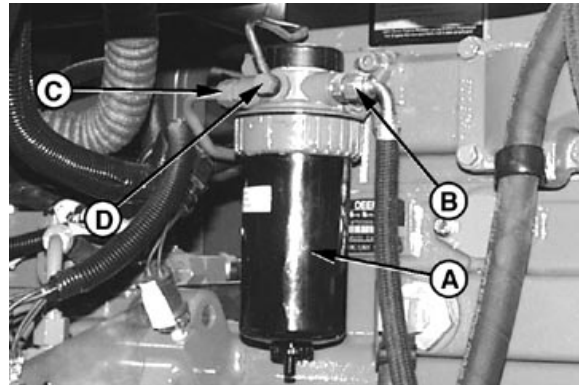
Final Fuel Filter	
Base-to-Bracket—Torque.....	50 N•m (36.9 lb-ft)
Final Fuel Filter Bracket to	
Cylinder Head—Torque.....	73 N•m (53.4 lb-ft)

8. Install water bowl and fuel filter element. See REPLACE FINAL FUEL FILTER ELEMENT later in this Group.
9. Connect fuel lines to fuel inlet, air bleed valve banjo fitting (if applicable), and fuel outlet and tighten to specification.



Final Fuel Filter (OEM engines)

RG12452A -UN-14JUN02



Final Fuel Filter (Combine engines)

RG12345A -UN-22JUL02



Final Fuel Filter (6020 Tractor engines)

RG12344B -UN-19JUL02

- A—Final Fuel Filter Element
- B—Fuel Inlet
- C—Fuel Outlet
- D—Air Bleed Valve Fitting

02  
090  
6

**Specification**

Final Fuel Filter Inlet Line—  
Torque ..... 9 N•m (6.6 lb-ft)  
Final Fuel Filter Outlet Line—  
Torque ..... 9 N•m (6.6 lb-ft)  
Air Bleed Valve Fitting (Combine  
engines)—Torque ..... 20 N•m (14.8 lb-ft)

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

RG40854,000010E -19-31MAY02-2/2

02  
090  
7

## Replace Final Fuel Filter Element

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

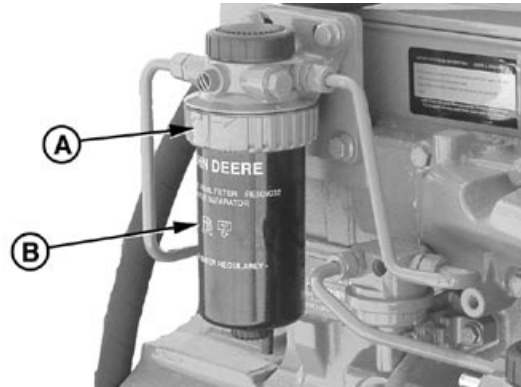
1. Thoroughly clean fuel filter/water bowl assembly and surrounding area, if not previously done.
2. Connect a fuel line to filter drain adapter and drain all fuel from filter/water bowl.

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

3. Firmly grasp the retaining ring and loosen it 1/4 turn. Remove retaining ring with filter element (B) and water bowl (if equipped).
4. Inspect filter mounting base for cleanliness. Clean as required.
5. Remove water bowl, if equipped. Drain and clean bowl. Dry with compressed air.
6. Install water bowl, if equipped, onto new filter element.
7. Thoroughly inspect filter base seal ring. Replace as needed.

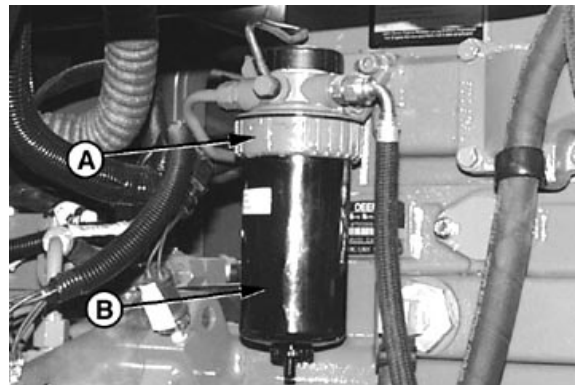
**NOTE:** The fuel filter must be indexed properly and the key on canister must be oriented in slot of mounting base for correct installation.

8. Install new filter element onto mounting base and position element using a slight rocking motion. Be sure element is properly indexed on mounting base.
9. Install retaining ring onto mounting base and tighten about 1/3 turn until ring "snaps" into the detent. DO NOT overtighten the retaining ring.
10. Bleed fuel system. See BLEED THE FUEL SYSTEM in Section 04, Group 150 later in this manual.
11. If applicable, connect water in fuel sensor connector.



Final Fuel Filter (OEM engines)

RG12452B -UN-14JUN02



Final Fuel Filter (Combine engines)

RG12345B -UN-22JUL02



Final Fuel Filter (6020 Tractor engines)

RG12344A -UN-19JUL02

A—Retaining Ring  
B—Final Fuel Filter Element

02  
090  
8

## Remove Fuel Transfer Pump

**NOTE:** For Combine and 6020 Tractors, refer to Vehicle manual for transfer pump information.

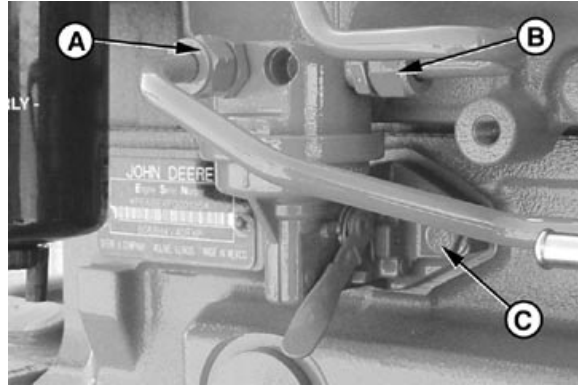
**IMPORTANT:** A backup wrench must always be used when disconnecting fittings or fuel lines from supply pump to avoid damage to fittings.

1. Disconnect fuel inlet line (A) and outlet line (B) and cap connections on fuel transfer pump and fuel lines to keep debris out of fuel system.
2. Remove cap screws (C) and remove fuel transfer pump assembly from cylinder block.

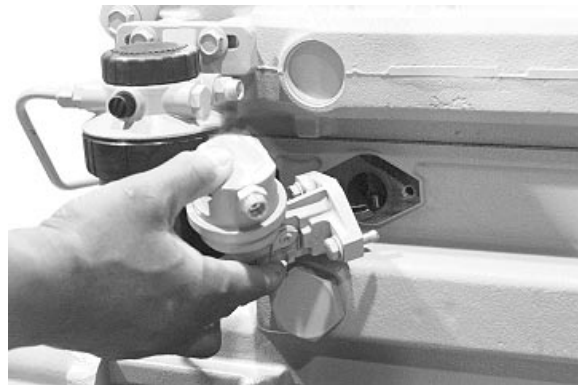
**NOTE:** The fuel transfer pump is driven by a push rod (D) that rides on an eccentric camshaft lobe. The cylinder head must be removed to remove this push rod.

3. Cover opening on cylinder block to prevent dirt from entering the engine.
4. Inspect face of pump lever for wear. If lever face is worn flat or concave, replace pump.

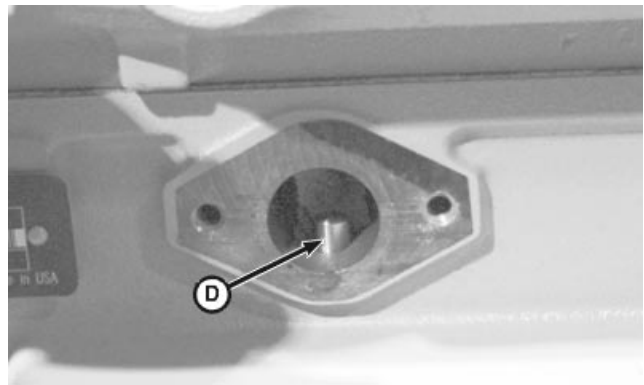
- A—Transfer Pump Inlet from Pre-Filter
- B—Transfer Pump Outlet to Final Fuel Filter
- C—Cap Screws
- D—Push Rod



Mechanical Fuel Transfer Pump Supply Lines



Remove Mechanical Fuel Transfer Pump



Mechanical Fuel Transfer Pump Push Rod

RG40854,000011F -19-10JUN02-1/1

### Install Fuel Transfer Pump

*NOTE: For Combine and 6020 Tractors, refer to Vehicle manual for transfer pump information.*

**IMPORTANT:** Apply LOCTITE 242 to threads of supply pump mounting cap screws (C) and fuel line fittings when reinstalling supply pump. **DO NOT** allow sealant to get into fuel system.

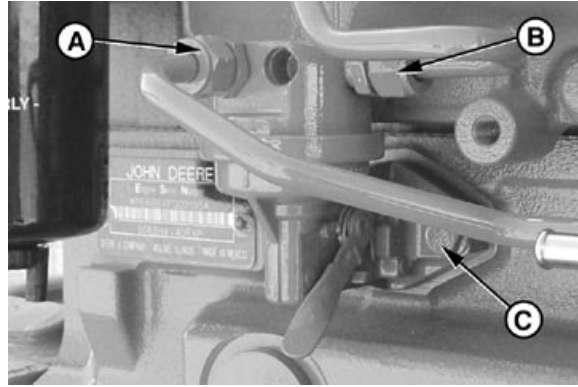
1. Install the fuel transfer pump to cylinder block with pumping lever resting on top of push rod, using a new O-ring. Tighten cap screws (C) to specifications.

**Specification**

Fuel Transfer Pump Cap  
 Screws—Torque..... 30 N•m (22 lb-ft)

**IMPORTANT:** ALWAYS use a backup wrench when installing fittings and/or fuel lines onto supply pump to avoid damage to fittings.

2. Connect supply pump inlet line (A) and outlet line (B) and tighten securely.
3. Bleed fuel system. See BLEED THE FUEL SYSTEM in this Group.



Fuel Transfer Pump Lines

A—Fuel Transfer Pump Inlet from Pre-filter  
 B—Fuel Transfer Pump Outlet to Final Fuel Filter  
 C—Cap Screws

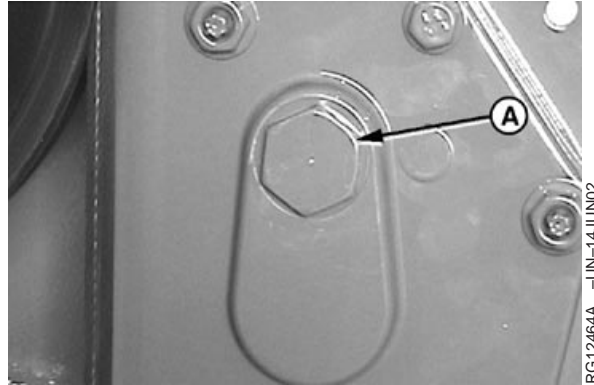
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02  
090  
10

## Remove and Install High Pressure Fuel Pump

### Remove High Pressure Fuel Pump

1. Rotate engine with JDG820 Flywheel Turning Tool until JDE81-4 Timing Pin engages timing hole in flywheel. Engine should be at No.1 "TDC-Compression".
2. Verify engine is at No.1 "TDC-Compression". Remove screw (A) for window on injection pump gear. A marked line on the gear (B) should be visible through the window.



High pressure pump window screw

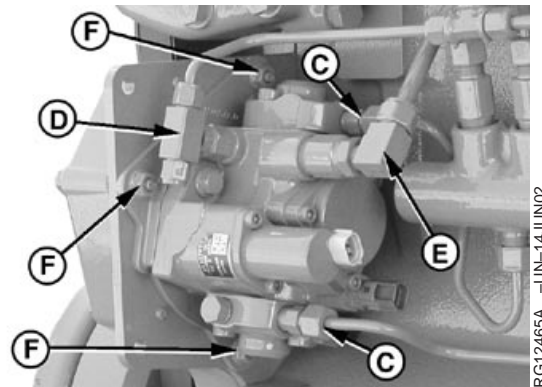
**NOTE:** If line is not visible, engine may be at No. 6 "TDC-Compression". Rotate engine one full revolution in running direction until JDE81-4 Timing Pin engages in flywheel again.

3. Remove high pressure fuel lines (C).
4. Remove fuel leak-off lines surrounding the high pressure fuel pump (D).
5. Disconnect low pressure fuel supply line from the fuel supply inlet (E) on the high pressure fuel pump.
6. Remove 3 capscrews (E) from fuel pump adapter plate
7. Carefully remove high pressure fuel pump from front cover.



High pressure pump gear timing mark

- A—High Pressure Pump Gear Window Screw
- B—High Pressure Pump Gear Timing Mark
- C—High Pressure Fuel Outlets
- D—Leak-Off Line Connection T-Fitting At Pump
- E—Fuel Supply Inlet
- F—Adapter Plate Capscrews



High pressure pump

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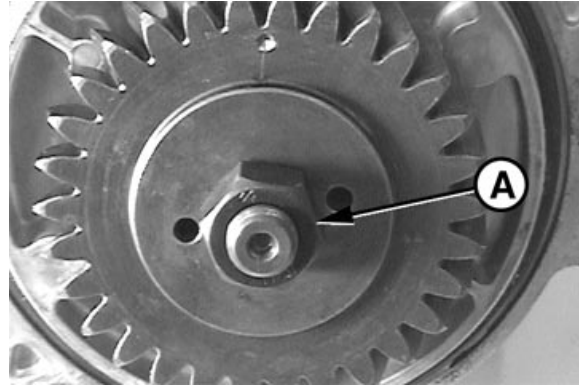
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**Install High Pressure Fuel Pump**

1. If gear has been removed, remove oily residues from pump driveshaft and torque high pressure pump gear nut (A) to pump driveshaft using specification below.

**Specification**

High Pressure Pump Gear Nut—  
Torque ..... 68 N•m (50.1 lb-ft)



High Pressure Pump Gear

RG12460A -UN-14JUN02

2. If adapter plate (F) has been removed from high pressure pump, torque the pump to the adapter plate using the specification below.

**Specification**

High Pressure Pump to Adapter  
Plate—Torque..... 40 N•m (29.5 lb-ft)

3. Install high pressure pump. Align timing mark (B) on pump gear in window. Once mark is vertical with respect to pump, torque adapter plate cap screws to specification.

**Specification**

Adapter Plate to Front Cover—  
Torque ..... 40 N•m (29.5 lb-ft)



High pressure pump gear timing mark

RG12463A -UN-14JUN02

4. Install high pressure fuel lines (C) between High Pressure Common Rail and High Pressure Pump. Torque fittings to specification.

**Specification**

High Pressure Fuel Lines -  
Injection Pump Fitting—Torque..... 27 N•m (19.9 lb-ft)  
High Pressure Fuel Lines - High  
Pressure Common Rail Fitting—  
Torque ..... 27 N•m (19.9 lb-ft)

5. Install high pressure fuel pump leak off line (D). Torque to specification.

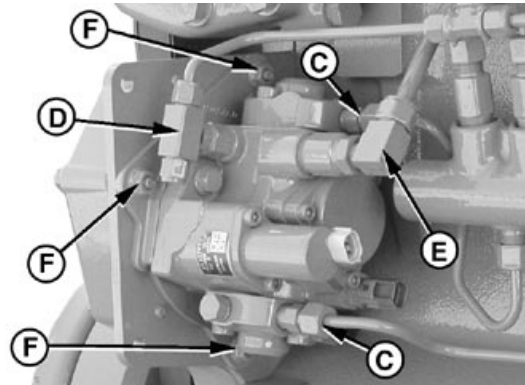
**Specification**

High Pressure Fuel Pump  
Leak-off Line Fitting—Torque..... 6 N•m (4.4 lb-ft)

6. Install fuel supply line (E). Torque to specification.

**Specification**

Fuel Supply Line Fitting—Torque ..... 9 N•m (6.6 lb-ft)



High Pressure Pump

RG12465A -UN-14JUN02

- A—High Pressure Pump Gear Nut
- B—High Pressure Pump Gear Timing Mark
- C—High Pressure Fuel Lines
- D—High Pressure Fuel Pump Leak Off Connector
- E—Fuel Supply Line
- F—Adapter Plate



**Specification**

Fuel Supply Line Fitting—Torque ..... 9 N•m (6.6 lb-ft)

RG40854,0000111 -19-31MAY02-3/3

02  
090  
13

**Remove and Install High Pressure Fuel Pump Inlet Filter**

1. Remove high pressure fuel pump from engine. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP from Section 02, Group 090 of this manual.
2. Cap delivery valve holders on pump to prevent entering of foreign material.
3. Clean housing surface around inlet filter plug.
4. Remove inlet filter plug (A) and filter using a hexagonal wrench.

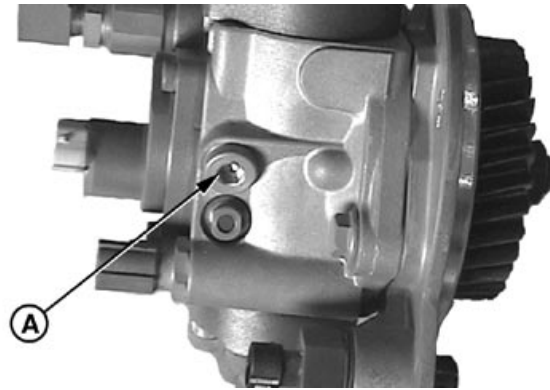
*NOTE: Keep foreign material free from replacement components.*

5. Install new filter, o-ring, plug, and gasket. Tighen plug to specification.

**Specification**

High Pressure Fuel Pump Inlet  
Filter Plug—Torque ..... 18 N•m (13.3 lb-ft)

6. Install high pressure fuel pump. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP in Section 02, Group 090 of this manual.



RG12541A -UN-19JUL02

**A—High Pressure Fuel Pump Inlet Filter Plug**

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## Remove and Install High Pressure Common Rail

### Remove High Pressure Common Rail

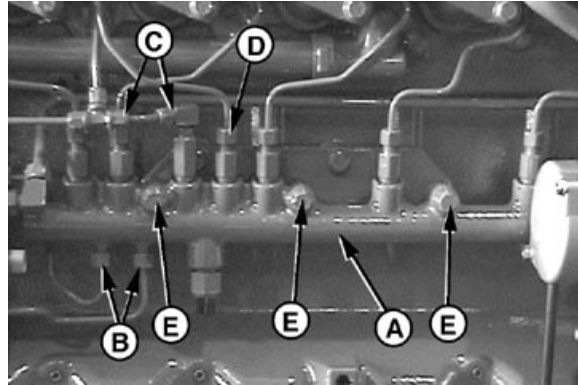


**CAUTION:** Let the engine sit for 5 minutes to allow rail pressure to lower. Be careful of hot turbocharger when

1. Disconnect HPCR leak-off line fitting (C) above the pressure regulating valve.
2. Remove high pressure rail fuel inlet lines (B)
3. Remove HPCR delivery lines (D) to the Electronic Injectors (EIs).

*NOTE: It might be helpful to number the lines per cylinder for easier installation.*

4. Remove HPCR (A) after HPCR cap screws (E) are removed from HPCR bracket.



A—High Pressure Common Rail (HPCR)  
B—High Pressure Rail Fuel Inlet Lines  
C—HPCR Leak-off Line Fitting  
D—HPCR Delivery Line Fitting  
E—HPCR Capscrew

RG12469A -UN-18JUN02

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RG40854,0000113 -19-31MAY02-1/2

**Install High Pressure Common Rail (HPCR)**

1. If HPCR bracket was removed from engine, torque cap screws to specification.

**Specification**

High Pressure Common Rail  
Bracket to Engine—Torque..... 52 N•m (38.4 lb-ft)

2. Install HPCR (A). Torque HPCR cap screws (E) to specification.

**Specification**

High Pressure Common Rail to  
Bracket—Torque..... 52 N•m (38.4 lb-ft)

3. Install HPCR delivery lines (D). Torque fittings to specification.

**Specification**

High Pressure Common Rail -  
Delivery Lines to Electronic  
Injectors—Torque ..... 27 N•m (19.9 lb-ft)

4. Install high pressure rail fuel inlet lines (B). Torque fittings to specification.

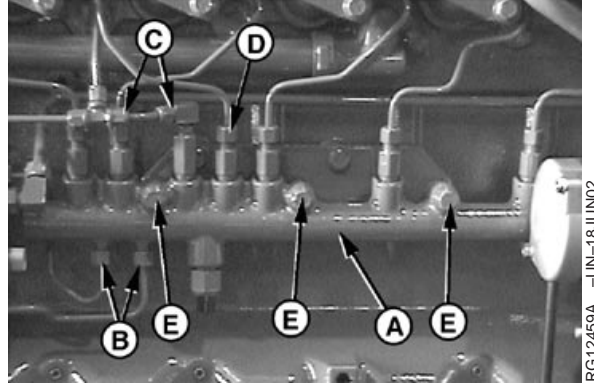
**Specification**

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

5. Install HPCR leak-off line fittings (C). Torque fitting to specification.

**Specification**

High Pressure Common Rail  
Leak-off Line Fitting—Torque..... 6 N•m (4.4 lb-ft)



A—High Pressure Common Rail (HPCR)  
B—High Pressure Rail Fuel Inlet Line Fitting  
C—HPCR Leak-off Line Fitting  
D—HPCR Delivery Line Fitting  
E—HPCR Capscrew

RG12469A -JUN-18JUN02

RG40854,0000113 -19-31MAY02-2/2

## Remove and Install Flow Dampers

### Remove Flow Dampers

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

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

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

2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the faulty flow damper.
3. Remove clamp that secures fuel line to faulty flow damper.

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

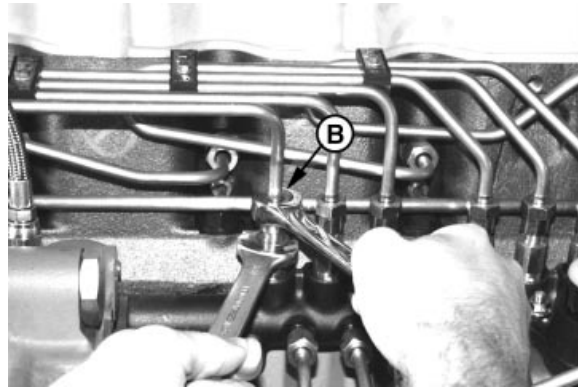
4. Using a backup wrench on flow damper, loosen fuel line fitting (A) from the faulty flow damper.

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

5. Loosen fuel line fitting on EI inlet connector. The line does not need to be removed.
6. Remove flow damper keeping internal components together (B).

**IMPORTANT:** Make sure magnet is clean before using.

7. Remove orifice plate (D) from inside flow damper bore on high pressure common rail using a magnet (C).
8. Replace complete flow damper as an assembly.



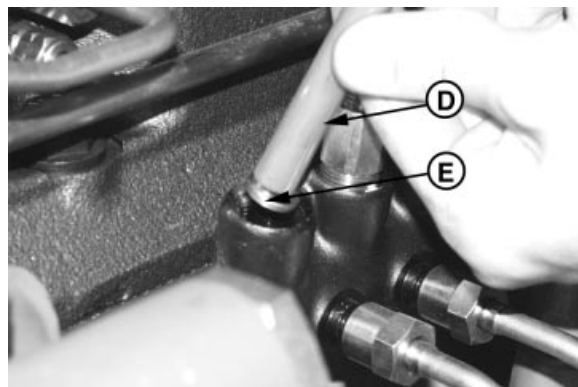
Fuel Fitting

RG11759A -UN-26JUL01



Flow Damper Internal Components

RG11760A -UN-26JUL01



Removing Orifice Plate

RG11761A -UN-26JUL01

- A—Fuel Fitting
- B—Internal Components
- C—Magnet
- D—Orifice Plate

Continued on next page

RG40854,0000112 -19-31MAY02-1/2

**Install Flow Dampers**

1. Insert new orifice plate (A) inside bore on high pressure common rail.
2. Holding spring (C) and piston (B) inside flow damper body (D), install new flow damper on high pressure common rail. Tighten flow damper to specification.

**Specification**

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

3. Connect high pressure injection line to High Pressure Common Rail using a backup wrench. Tighten to specification.

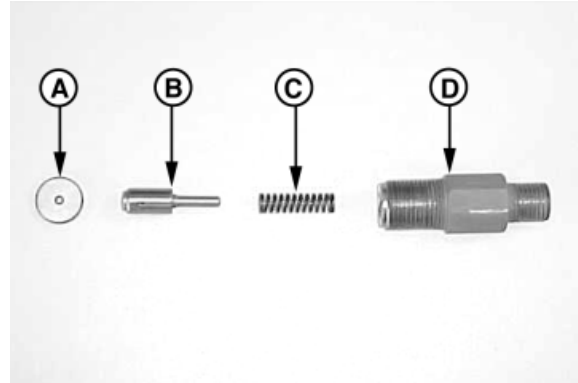
**Specification**

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

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

**Specification**

High Pressure Rail Delivery Fuel  
Line - Fitting at Side Feed Tube  
Retaining Nut—Torque..... 27 N•m (20 lb-ft)



Flow Damper Exploded View

- A—Orifice Plate
- B—Piston
- C—Spring
- D—Flow Damper Body

RG11845A -JUN-31AUG01

02  
090  
17

RG40854.0000112 -19-31MAY02-2/2

## Remove and Install Pressure Limiter

### Remove Pressure Limiter

**CAUTION:** Fuel in the high pressure common rail is under extremely high pressure. Do NOT start this procedure until the engine has been turned OFF for at least 5 minutes.

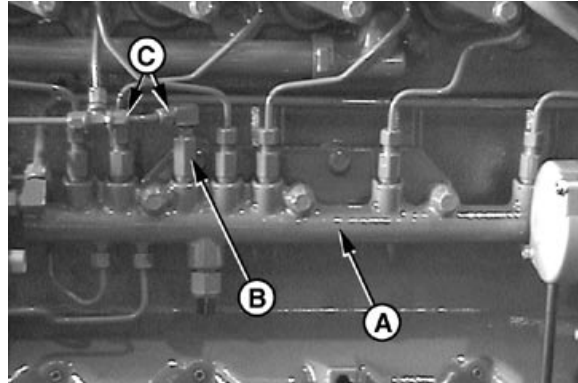
1. By letting the engine sit for at least 5 minutes, fuel pressure in the HPCR (A) will be relieved.

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

2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure limiter.
3. Disconnect HPCR leak-off line fitting (C) from pressure limiter (B) using a backup wrench on the pressure limiter. Remove leakoff line.

**IMPORTANT:** Clean magnet prior to removing pressure limiter.

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



High Pressure Common Rail (HPCR)

A—High Pressure Common Rail (HPCR)  
 B—High Pressure Limiter  
 C—HPCR Leak-off Line Fitting

RG12459B -UN-18JUN02

Continued on next page

RG40854,0000114 -19-03JUN02-1/2

### Install Pressure Limiter

1. Install pressure limiter (B) into HPCR (A). Tighten to specification.

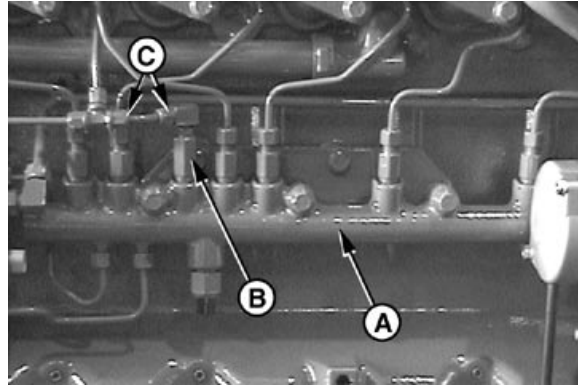
**Specification**

Pressure Limiter—Torque ..... 176.5 N•m (130 lb-ft)

2. Connect HPCR leak-off line fitting (D) to pressure limiter using a backup wrench. Tighten fitting to specification.

**Specification**

High Pressure Common Rail  
Leak-off Line Fitting—Torque..... 6 N•m (11 lb-ft)



High Pressure Common Rail (HPCR)

- A—High Pressure Common Rail (HPCR)
- B—High Pressure Limiter
- C—HPCR Leak-off Line

RG12459B -JUN-18JUN02

02  
090  
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RG40854,0000114 -19-03JUN02-2/2

## Remove Electronic Injectors (EIs)

1. Remove heat shield (A) from rocker arm cover.
2. Remove rocker arm cover with vent tube.

**NOTE:** *Rocker arm cover gasket is reusable if no visible damage is detected. Do not store cover resting on gasket surface.*

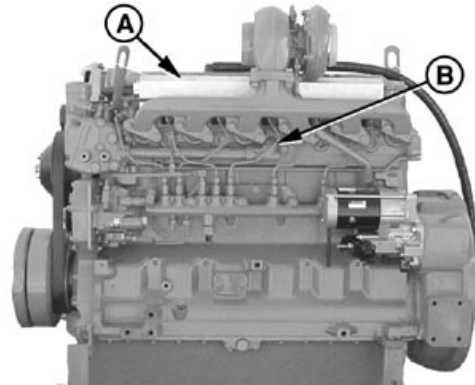
3. Disconnect High Pressure Common Rail (HPCR) delivery line (B) of the electronic injector (E) to be removed.
4. Remove wires from EI studs (G) of EI to be removed.
5. Loosen side feed tube retaining nut (C) and EI hold down clamp cap screw.
6. Remove side feed tube (D) and electronic injector hold down clamp (F)
7. Using the injector removal tool JDG1652 (H), remove EI from the cylinder head.

**IMPORTANT:** When removing the Electronic Injector (EI), do not twist the top of the EI. This will cause the EI calibration to be changed.

8. Gripping EI body by hand, remove EI(s).

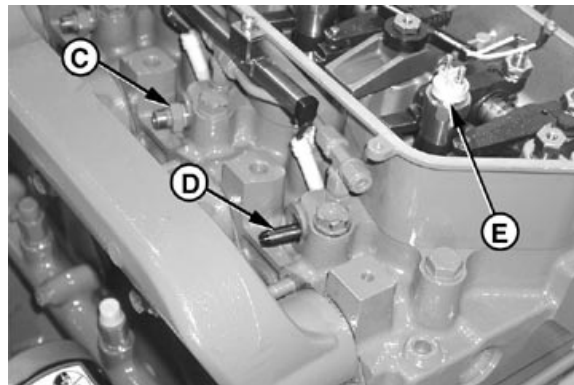
**IMPORTANT:** Immediately cover electronic injector bore using cap from JDG998 to prevent dirt from entering the fuel system when removing electronic injectors.

**IMPORTANT:** Injector needs to be stored in a clean location.



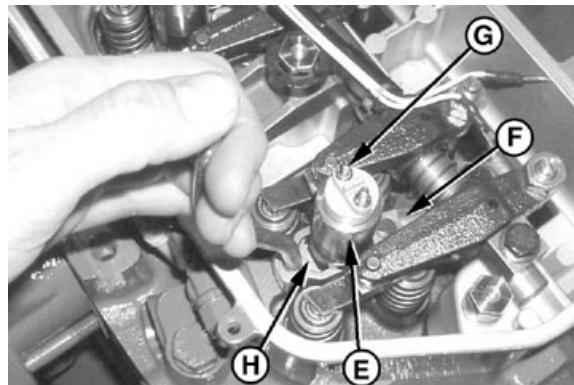
Remove Heat Shield and Rocker Arm Cover

RG12471A -UN-14JUN02



Side Feed Tube Removal

RG12468A -UN-14JUN02



Electronic Injector Removal

RG12469A -UN-14JUN02

- A—Heat Shield
- B—HPCR Delivery Line
- C—Side Feed Tube Retaining Nut
- D—Side Feed Tube
- E—Electronic Injector (EI)
- F—EI Hold Down Clamp
- G—EI Stud
- H—EI Removal Tool (JDG1652)

02  
090  
20



### Clean Electronic Injector (EI) Bore

1. Clean light deposits out of electronic injector bore using an electric drill and D17030BR Thread Cleaning brush.
2. Work brush up and down several times to clean bore.

RG40854,0000118 -19-03JUN02-1/1

02  
090  
21

### Clean Electronic Injector (EI) Orifice

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

RG40854,0000117 -19-03JUN02-1/1

### Clean Electronic Injector (EI) Body

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

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

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

RG40854,0000116 -19-03JUN02-1/1

### Inspect Electronic Injector (EI) Body

1. Inspect electronic injector body to see that it is not scratched or scored.
2. If electronic injector is scratched or scored, replace electronic injector.

RG40854,0000115 -19-03JUN02-1/1

## Install Electronic Injectors (EIs)

**NOTE:** Clean injector prior to installing injectors.  
Also, the injector washer must be replaced.

1. Place washer (B) in the bottom of the injector sleeve.

**IMPORTANT:** Do not get oils in high pressure fuel passage or sealing surfaces.

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

2. If EI is being re-installed, o-rings on the EI(s) (A) must be replaced. Lubricate o-ring with amojell (petroleum jelly) clean oil or equivalent.
3. Slide the forked legs of the EI hold down clamp (H) around the flat part of the EI. Orient the EI conical bore (C) in the side of the EI away from the clamp.
4. Carefully insert the EI and clamp assembly into the bore until it "pops" into place. The EI position mark (D) needs to face towards the side feed tube (E).

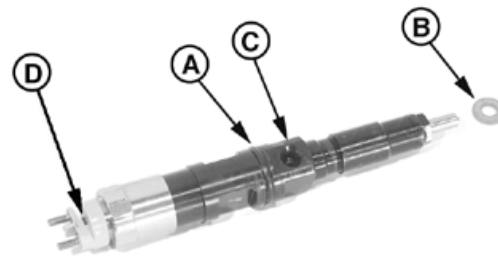
**IMPORTANT:** Do not get oils in high pressure fuel passage or sealing surfaces.

5. If side feed tube is being re-installed, o-rings on side feed tube must be replaced. Lubricate o-ring with amojell (petroleum jelly) clean oil or equivalent.

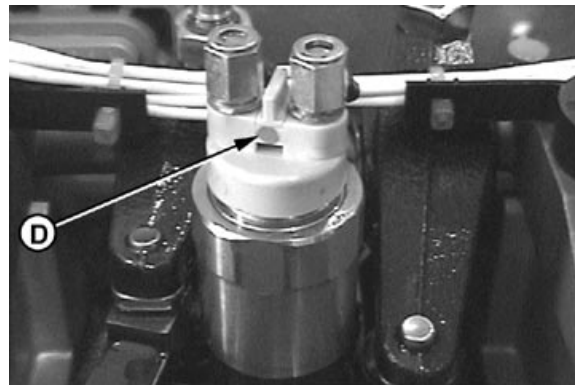
**IMPORTANT:** Do not get oils in high pressure fuel passage or sealing surfaces.

6. Lubricate side feed tube retaining nut (G) o-ring with amojell (petroleum jelly) clean oil or equivalent.

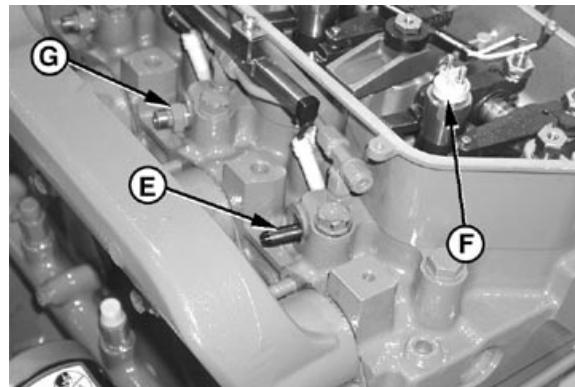
- A—O-ring
- B—Washer
- C—EI Conical Bore
- D—EI Position Mark
- E—Side Feed Tube
- F—Electronic Injector (EI)
- G—Side Feed Tube Retaining Nut
- H—EI Hold Down Clamp and Cap Screw



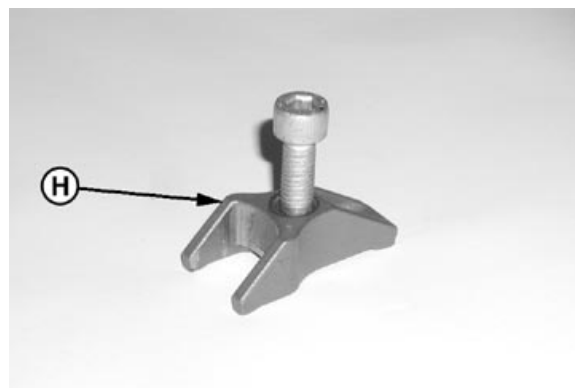
Electronic Injector



Injector Position Mark



Side Feed Tube Installation



Injector Hold Down Clamp and Cap Screw

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RG40854,000011A -19-03JUN02-1/3

02  
090  
22

RG12470A -UN-14JUN02

RG12467A -UN-14JUN02

RG12468B -UN-14JUN02

RG12466A -UN-19JUL02

7. Install the side feed tube (E) with the small end toward the EI (F).

8. Tighten EI hold down clamp tight to seat.

9. Torque side feed tube retaining nut to specification.

**Specification**

First Torque - Side Feed Tube  
Retaining Nut—Torque..... 5 N•m (3.7 lb-ft)

10. Torque cap screw of EI hold down clamp to specification.

**Specification**

EI Hold Down Clamp—Torque..... 47 N•m (34.7 lb-ft)

11. Torque side feed tube retaining nut to specification.

**Specification**

Second Torque - Side Feed Tube  
Retaining Nut—Torque..... 35 N•m (25.8 lb-ft)

12. Connect High Pressure Common Rail (HPCR) delivery line(s) to side feed tube retaining nut and HPCR. Torque to specification.

**Specification**

HPCR Delivery Line Fitting—  
Torque ..... 27 N•m (19.9 lb-ft)

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

13. Apply LOCTITE® 222 Small Thread Locker (TY24311) to injector studs.

14. Install EI wiring and retaining nuts to EI studs and tighten to specification.

**Specification**

Injector Solenoid Wire Retaining  
Nut—Torque ..... 2 N•m (1.5 lb-ft) (18 lb-in.)

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15. Install rocker arm cover with vent tube. See INSTALL  
ROCKER ARM COVER in Section 02, Group 021 of  
CTM 104.

16. Install heat shield. Torque cap screws to  
specifications.

**Specification**

Heat Shield Cylinder Head Cap	
Screws—Torque .....	60 N•m (44 lb-ft)
Heat Shield Rocker Arm Carrier	
Cap Screws—Torque .....	10 N•m (7.4 lb-ft)

RG40854,000011A -19-03JUN02-3/3

02  
090  
24

## Remove and Install Leak-off Lines

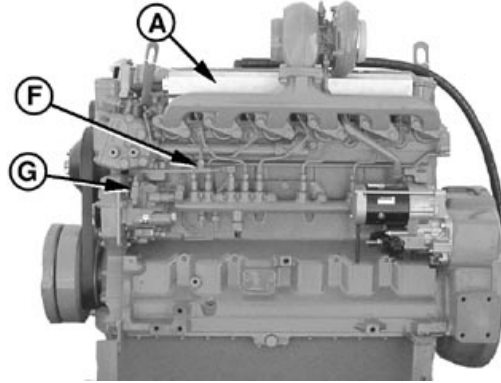
### Remove Leak-off Lines

1. Remove heat shield (A) from rocker arm cover.
2. Remove glow plug harness rail (B) (3 allenhead screws)

**NOTE:** Do not remove rocker arm carrier for leak-off line removal installation.. Although it is easier to install the leak-off T-fittings, it is not required to remove the rocker arm carrier.

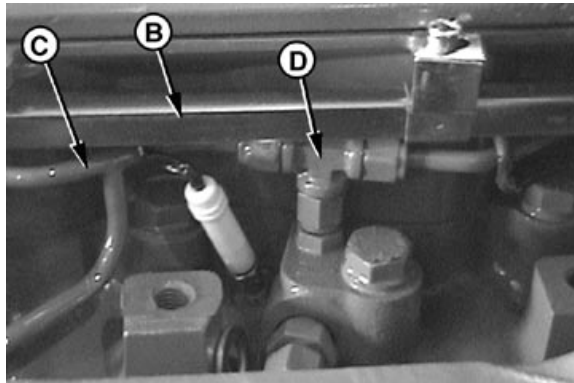
3. Remove necessary leak-off lines, T-fittings, and leak-off fittings.

- A—Heat Shield
- B—Glow Plug Harness Rail
- C—Injector Leak-off Line
- D—Injector Leak-off Line T-fitting
- E—Injector Leak-off fitting
- F—Rail Leak-off Line T-fitting
- G—Pump Leak-off Line T-fitting



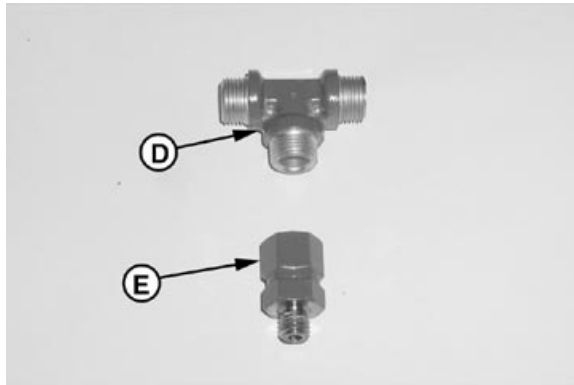
Remove Heat Shield

RG12471B -UN-14JUN02



Injector Leak-off Lines

RG12466A -UN-14JUN02



Injector T-fitting and Leak-off Fitting

RG12457A -UN-19JUL02

Continued on next page

RG40854,000011B -19-03JUN02-1/2

**Installation of Leak-off Lines**

1. If injector leak-off fitting (F) has been removed, apply LOCTITE® 222 Small Thread Locker (TY24311) on the fitting threads, and torque injector leak-off fitting to specification.

**Specification**

Injector Leak-off Fitting—Torque..... 18 N•m (13.3 lb-ft)

2. If injector leak-off T-fittings (E) have been removed, tighten until snug and orient correctly.

**NOTE:** Leak off T-line (I) to pump and rail is located between cylinder 2 and 3.

3. Connect all leak-off lines between injector leak-off T-fittings (E), HPCR leak-off T-fitting (G), and pump leak-off line T-fitting (H). Torque to specification.

**Specification**

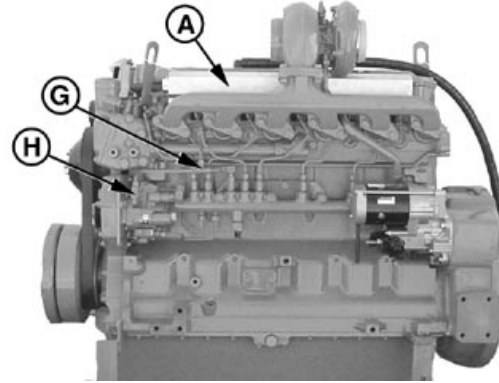
High Pressure Common Rail  
Leak-off Line Fitting—Torque..... 6 N•m (11 lb-ft)

4. Install glow plug harness rail (B). Torque screws to specification.
5. Connect glow plugs (C) to glow plug harness.
6. Install heat shield (A). Torque cap screws to specification.

**Specification**

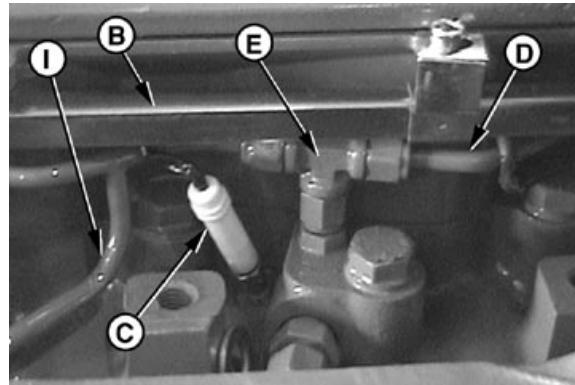
Heat Shield Cylinder Head Cap  
Screws—Torque..... 60 N•m (44 lb-ft)  
Heat Shield Rocker Arm Carrier  
Cap Screws—Torque..... 10 N•m (7.4 lb-ft)

- A—Heat Shield
- B—Glow Plug Harness Rail
- C—Glow Plug
- D—Injector Leak-off Line
- E—Injector Leak-off Line T-fitting
- F—Injector Leak-off fitting
- G—HPCR Leak-off Line T-fitting
- H—Pump Leak-off Line T-fitting
- I—Leak-off T-line from Injectors



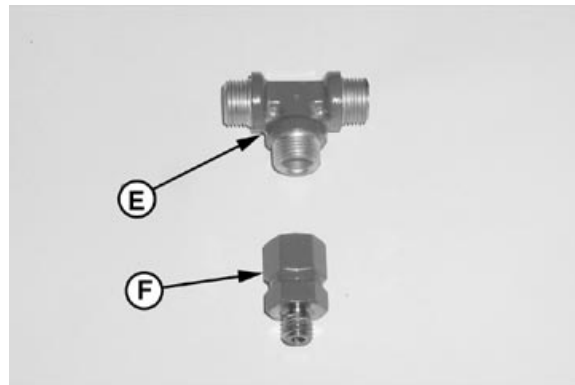
Engine Side View

RG12471D -UN-24JUL02



Injector Leak-off Lines

RG12456C -UN-25JUL02



Injector T-fitting and Leak-off fitting

RG12457B -UN-24JUL02

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02  
090  
26

## Engine Control Unit (ECU)

**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. Also disconnect module connector at injector pump.
3. Connect welder ground close to welding point and make sure ECU and other electrical components are not in the ground path.

*NOTE: For diagnosis and testing of the electronic engine control and sensors, refer to Group 150.*

**IMPORTANT: DO NOT OPEN ENGINE CONTROL UNIT.**

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

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

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

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



Engine Control Unit (ECU)

RG11822 -JUN-20AUG01

02  
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## Fuel System Sensors

The Pump Control Valve (PCV) is not serviceable. If the PCV fails, the high pressure fuel pump must be replaced. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP in Section 02, Group 090 earlier in this manual.

RG40854,00000D4 -19-20MAY02-1/1

## Remove and Install Engine Coolant Temperature (ECT) Sensor

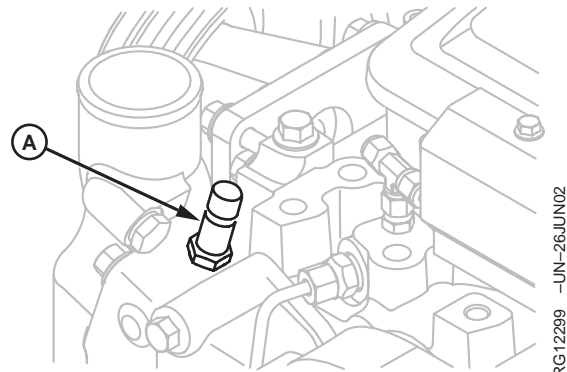
**NOTE:** For an expanded component location drawing, see *ELECTRONIC CONTROL SYSTEM OVERVIEW* in Section 03, Group 140 of this manual.

1. Disconnect ECT sensor (A) wiring connector and remove sensor.
2. Coat sensor O-ring with JDT405 High Temperature Grease and install sensor in thermostat housing. Tighten to specifications.

### Specification

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

3. Install sensor wiring connector.



Engine Coolant Temperature Sensor

A—Engine Coolant Temperature Sensor

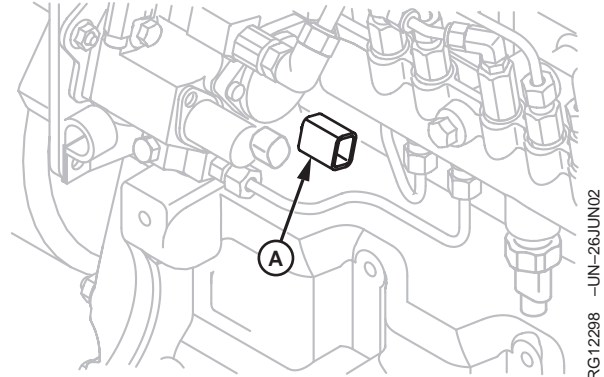
RG40854,00000D5 -19-20MAY02-1/1



## Remove and Install Fuel Temperature Sensor

**NOTE:** For an expanded component location drawing, see *ELECTRONIC CONTROL SYSTEM OVERVIEW* in Section 03, Group 140 of this manual.

1. Disconnect fuel temperature sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.
3. Reconnect sensor wiring connection.



Fuel Temperature Sensor

A—Fuel Temperature Sensor

### Specification

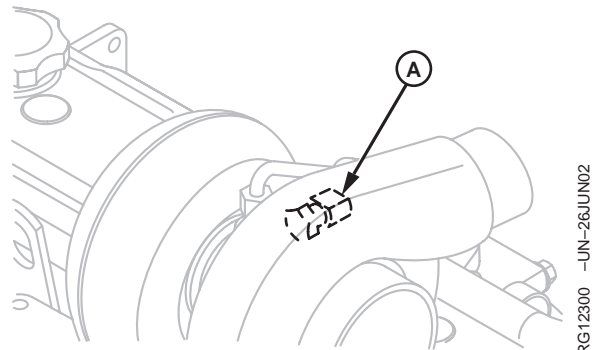
Fuel Temperature Sensor—  
Torque ..... 10 N•m (7 lb-ft)

RG40854,00000D6 -19-20MAY02-1/1

## Remove and Install Manifold Air Temperature (MAT) Sensor

**NOTE:** For an expanded component location drawing, see *ELECTRONIC CONTROL SYSTEM OVERVIEW* in Section 03, Group 140 of this manual.

1. Disconnect MAT sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.
3. Reconnect sensor wiring connection.



Manifold Air Temperature Sensor

A—Manifold Air Temperature Sensor

### Specification

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

RG40854,00000D7 -19-20MAY02-1/1

## Remove and Install Oil Pressure Sensor

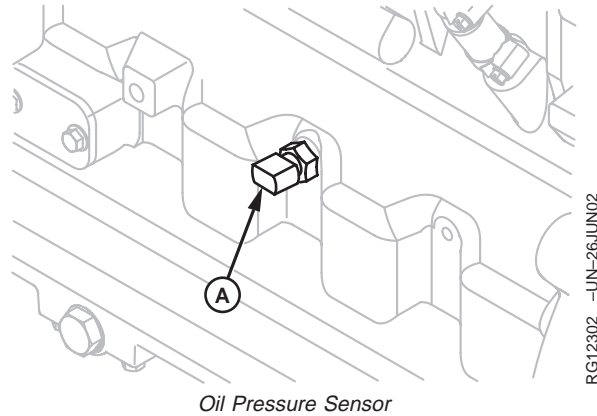
**NOTE:** For an expanded component location drawing, see *ELECTRONIC CONTROL SYSTEM OVERVIEW* in Section 03, Group 140 of this manual.

1. Disconnect oil pressure sensor (A) wiring connection and remove sensor.
2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.

### Specification

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

3. Reconnect oil pressure sensor wiring connection.



A—Oil Pressure Sensor

## Remove and Install Fuel Rail Pressure Sensor

**NOTE:** For an expanded component location drawing, see **ELECTRONIC CONTROL SYSTEM OVERVIEW** in Section 03, Group 140 of this manual.

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

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

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

2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the fuel rail pressure sensor.
3. Disconnect fuel rail pressure sensor wiring connection and remove sensor (A).

**NOTE:** Sensor should not be reused once it has been removed from the fuel rail.

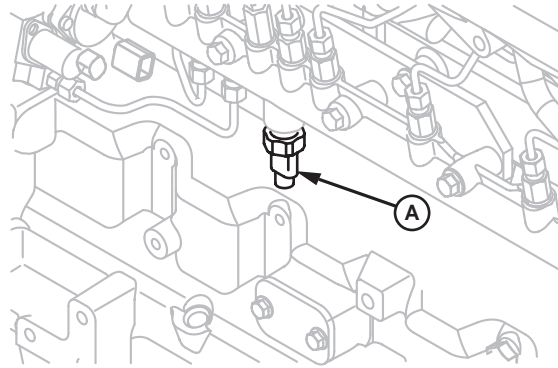
**IMPORTANT:** Do not get any grease on tip of sensor.

4. Coat new sensor threads with JDT405 High Temperature Grease.
5. Verify that sensor is clean from all debris and install new sensor. Tighten to specification.

### Specification

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

6. Reconnect sensor wiring connection.
7. Bleed the fuel system. See **BLEED THE FUEL SYSTEM** in Section 04, Group 150 later in this manual.



Fuel Rail Pressure Sensor

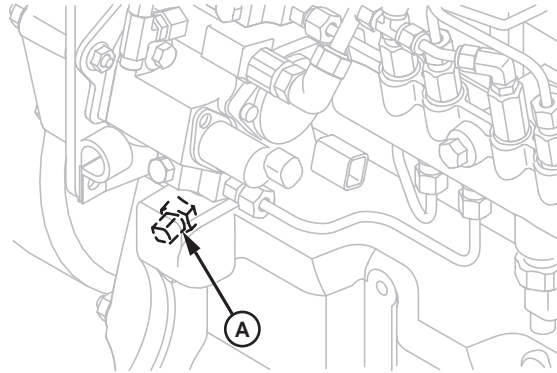
RG12301 -JUN-26JUN02

02  
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## Remove and Install Crank Position Sensor

**NOTE:** For an expanded component location drawing, see *ELECTRONIC CONTROL SYSTEM OVERVIEW* in Section 03, Group 140 of this manual.

1. Disconnect crankshaft position sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.
3. Reconnect sensor wiring connection.



Crankshaft Position Sensor

A—Crankshaft Position Sensor

RG12306 -UN-26JUN02

### Specification

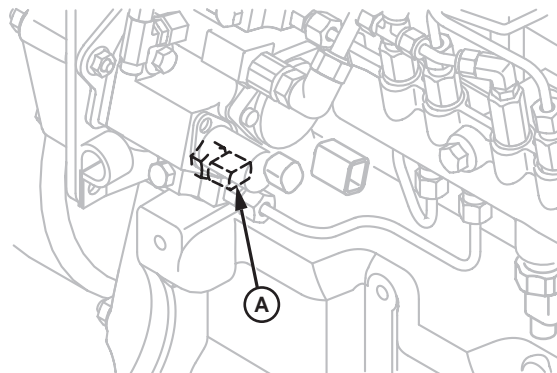
Crankshaft Position Sensor—  
Torque ..... 14 N•m (10 lb-ft)

RG40854,00000DB -19-20MAY02-1/1

## Remove and Install Pump Position Sensor

**NOTE:** For an expanded component location drawing, see *ELECTRONIC CONTROL SYSTEM OVERVIEW* in Section 03, Group 140 of this manual.

1. Disconnect pump position sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.
3. Reconnect sensor wiring connection.



Pump Position Sensor

RG12305 -UN-26JUN02

### Specification

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

RG40854,00000DC -19-20MAY02-1/1

## Remove and Install Glow Plugs

### Removal of Glow Plugs

1. Remove heat shield from rocker arm cover.
2. Disconnect glow plug (C) from glow plug harness rail (B).
3. Remove glow plug(s)

### Installation of Glow Plugs

1. Install glow plug(s). Torque to specification.

#### Specification

Glow Plug—Torque ..... 15 N•m (11 lb-ft)

2. Connect glow plug harness connector to glow plug.

3. Install heat shield. Torque cap screws to specification.

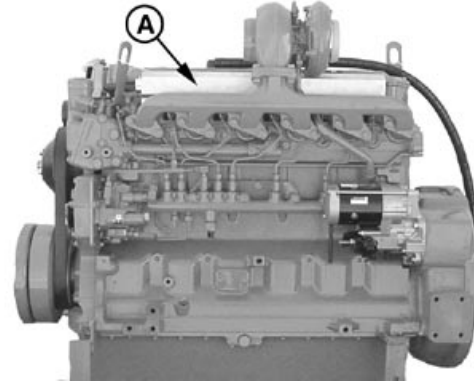
#### Specification

Heat Shield Cylinder Head Cap

Screws—Torque ..... 60 N•m (44 lb-ft)

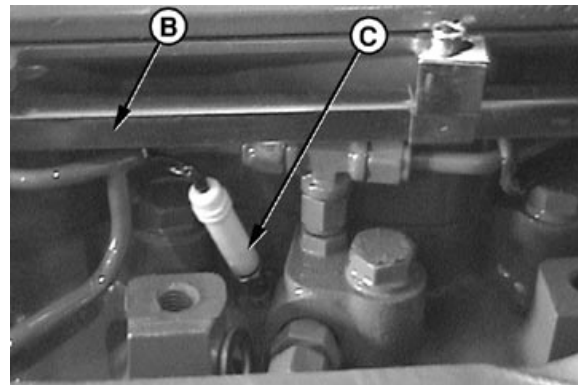
Heat Shield Rocker Arm Carrier

Cap Screws—Torque ..... 10 N•m (7.4 lb-ft)



Heat Shield Removal

RG12471C -UN-14JUN02



Glow Plug Location

RG12456B -UN-14JUN02

- A—Heat Shield
- B—Glow Plug Harness Rail
- C—Glow Plug

RG40854,000011D -19-03JUN02-1/1

## Connectors

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

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

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

RG40854,00000D2 -19-20MAY02-1/1

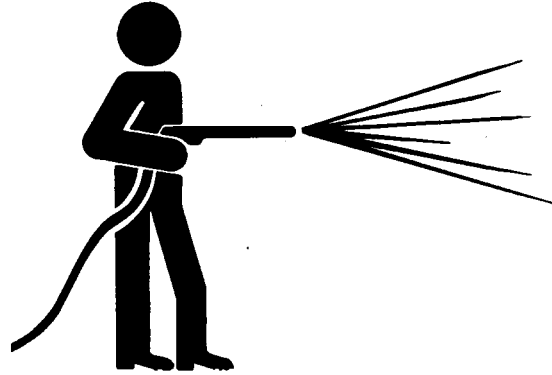
## Use Electrical Insulating Compound

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.

RG40854,00000D1 -19-20MAY02-1/1

## Using High-Pressure Washer

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



*Using High-Pressure Washer*

T6642EJ -JUN-18OCT88

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RG40854,00000D0 -19-20MAY02-1/1

## 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<sup>1</sup> 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<sup>2</sup>, 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<sup>2</sup>, strip 6 mm (1/4 in.) insulation from end of wire.



TS0128 -UN-23AUG88

*WEATHERPACK is a trademark of Packard Electric*

<sup>1</sup> Included in JT07195B Electrical Repair Kit

<sup>2</sup> Included in JDG155 Electrical Repair Tool Kit

Continued on next page

RG40854,00000CF -19-20MAY02-1/4



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 -JUN-23AUG88

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RG40854,00000CF -19-20MAY02-2/4

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 -JUN-02NOV94

WEATHER PACK is a trademark of Packard Electric

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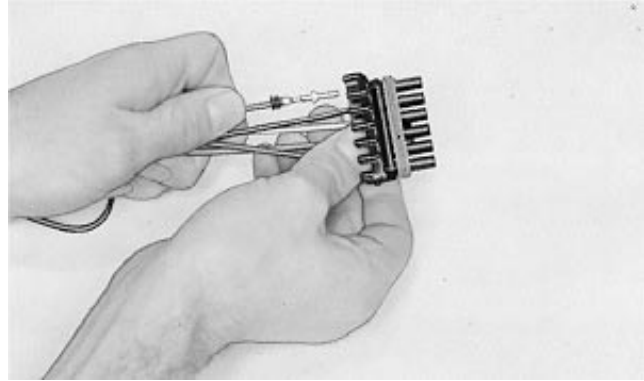
9. Insert terminal into connector. Terminal should click when it is fully seated. Make sure the wire is inserted into the correct connector cavity.

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

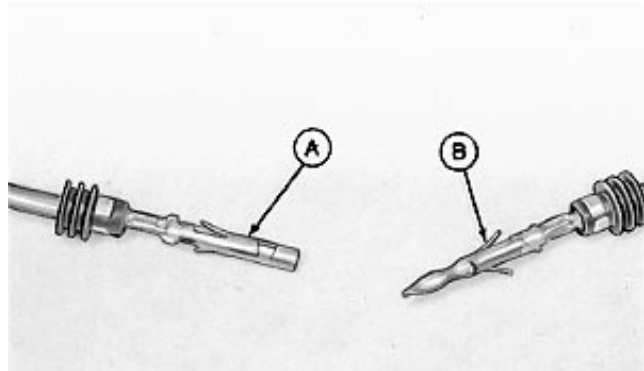
*NOTE:* Connector bodies are "keyed" for correct terminals. Be sure terminals are correctly aligned.

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

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



TS0130 -UN-23AUG88



TS0139 -UN-02DEC88

A—Sleeve  
B—Pin

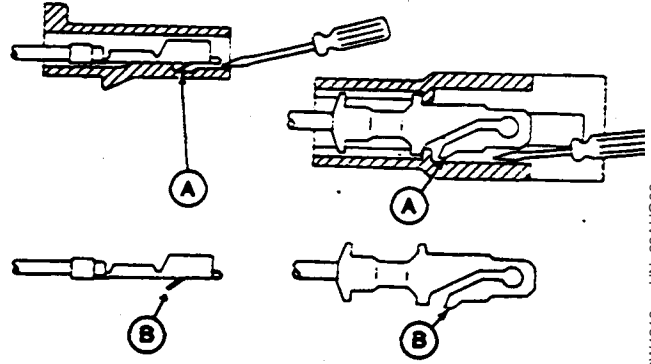
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## Remove Blade Terminals from Connector Body

**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<sup>1</sup> 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

<sup>1</sup>Included in JT07195B Electrical Repair Kit

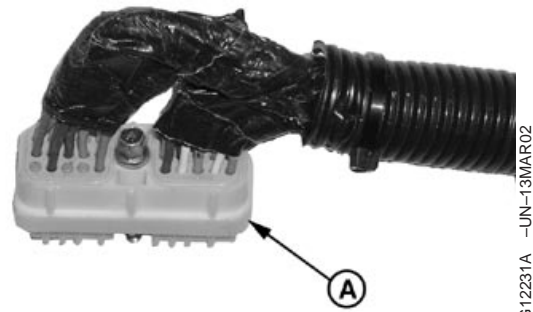
## Repair (Pull Type) METRI-PACK™ Connectors

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

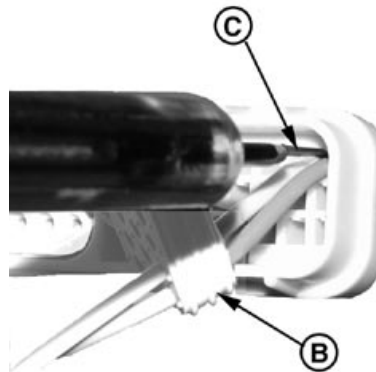
**IMPORTANT:** Make sure no damage to the seal occurs or water and contaminants will corrode terminals.

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

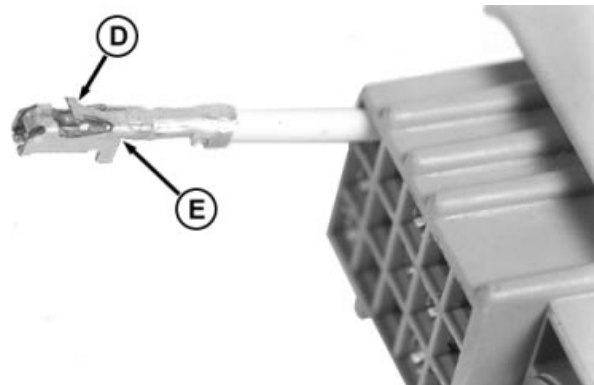
5. Using JDG776 Terminal Extraction Tool (C), angle the tip so it slides along the top edge of the connector. Make sure the extraction tool is centered in the connector cavity and push the tool in until resistance is felt.
6. With extraction tool inserted into the connector, gently rotate tool clockwise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



RG12231A -UN-13MAR02



RG12232A -UN-13MAR02



RW16935A -UN-05AUG98

- A—Connector
- B—Connector Seal
- C—JDG777 Terminal Extraction Tool
- D—Terminal Locking Tang
- E—Terminal

METRI-PACK is a trademark of Delphi Packard Electric Systems

<sup>1</sup> Included JT07195B Electrical Repair Kit

9. Using JDG145 Universal Electrical Pliers<sup>1</sup>, 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<sup>1</sup>, 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.

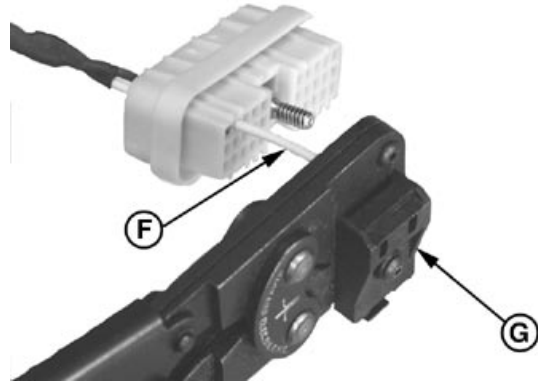
13. Make sure terminal locking tang (D) on new terminal is in outward position. Pull wire back into connector cavity until terminal locks.

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

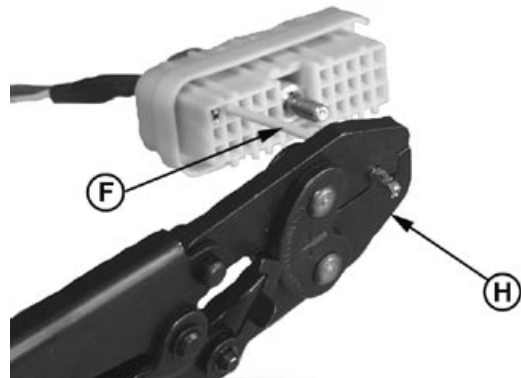
14. Push on the wire to make sure terminal is locked into the connector.

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

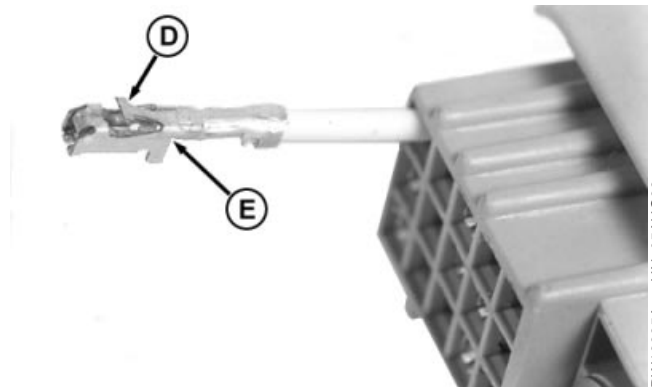
16. Retape the wires and add the required tie bands to the harness.



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

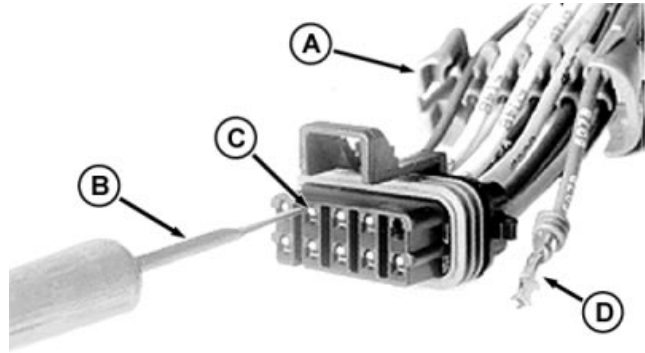
<sup>1</sup>Included in JDG155 Electrical Repair Tool Kit

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

1. Disconnect the METRI-PACK connector. Remove the tie bands and tape.
2. Remove secondary lock (A).
3. Identify wire color/number to the connector cavity. Make sure each wire goes back to the correct cavity location.
4. Insert JDG776 or JDG777 Terminal Extraction Tool<sup>1</sup> (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<sup>2</sup>, cut off wire directly behind the terminal.
7. Using JDG145 Universal Electrical Pliers<sup>2</sup> strip 6 mm (1/4 in.) insulation from end of wire.
8. Select correct size of seal. Slide the seal over the wire insulation with the smaller diameter side facing the end of the wire. Small diameter side of seal should line up with the outer edge of the insulation.



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

RW77137 -UN-08DEC98

TS0136 -UN-23AUG88

METRI-PACK is a trademark of Delphi Packard Electric Systems

<sup>1</sup>Included in JT07195B Electrical Repair Kit

<sup>2</sup>Included in JDG155 Electrical Repair Tool Kit

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**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.

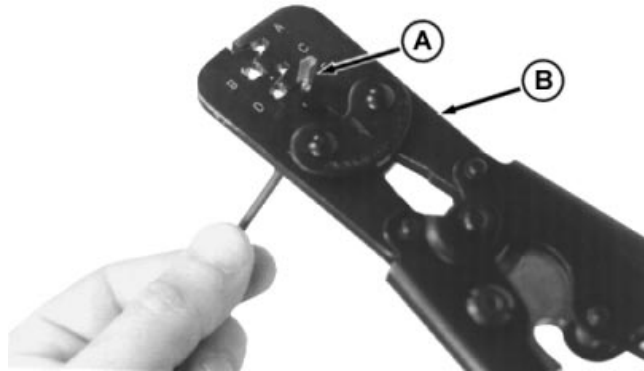
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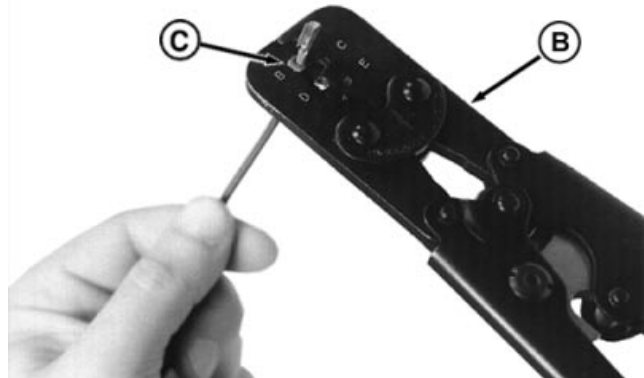
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10. Crimp contact (A) on wire with a "W" type crimp using JDG865 Crimping Tool (B).
11. Crimp cable seal (C) on contact using JDG865 Crimping Tool (B).
12. Make sure locking tang (D) on the new terminal is in the outward position.
13. Push terminal into the correct connector cavity until terminal locks.
14. Gently pull on wire to verify terminal is locked into the connector.
15. Place the secondary lock back on the connector.
16. Retape the wires and add the required tie bands to the harness.

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



RW77139 -UN-07DEC98



RW77138A -UN-15MAR02



RW77140A -UN-15MAR02

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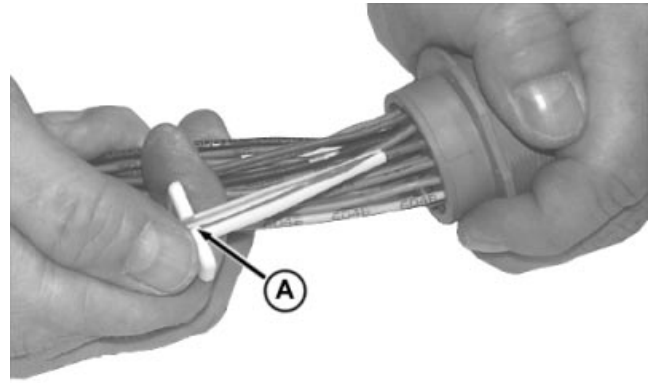


## Repair DEUTSCH™ Connectors

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<sup>1</sup>
  - JDG362 Extractor Tool - 16—18 Gauge Wire<sup>1</sup>
  - JDG363 Extractor Tool - 20 Gauge Wire<sup>2</sup>
  - JDG785 Extractor Tool - 6-8 Gauge Wire<sup>3</sup>
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<sup>4</sup> cut off wire directly behind the terminal.
9. Using JDG145 Universal Electrical Pliers<sup>4</sup>, strip 6 mm (1/4 in.) insulation from end of wire.



A—Handle

RW77142 -UN-07DEC98

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*DEUTSCH is a trademark of Deutsch Company*

<sup>1</sup>Included in JT07195B Electrical Repair Tool Kit and JDG359 DEUTSCH Electrical Repair Kit

<sup>2</sup>Included in JDG359 DEUTSCH Electrical Repair Kit

<sup>3</sup>Included in JT07195B Electrical Repair Tool Kit

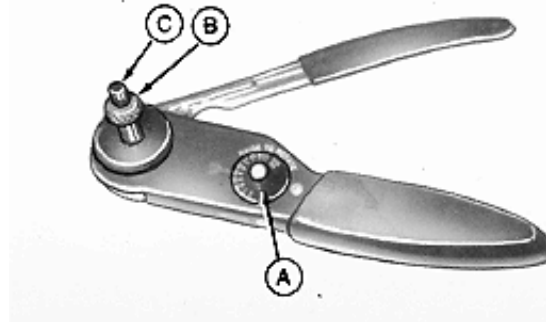
<sup>4</sup>Included in JDG155 Electrical Repair Tool Kit

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RG40854.00000CB -19-20MAY02-1/4

10. Adjust selector (A) on JDG360 Crimping Tool<sup>1</sup> for correct wire size .
11. Loosen lock nut (B) and turn adjusting screw (C) in until screw stops.

A—Selector  
B—Lock Nut  
C—Adjusting Screw



TS117 -UN-23AUG88

<sup>1</sup>Included in JDG359 Electrical Repair Kit

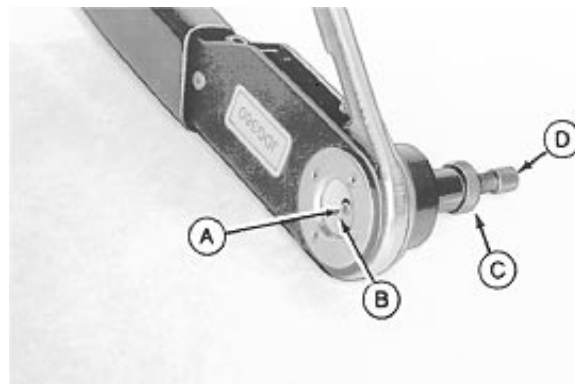
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12. Insert terminal (A) and turn adjusting screw (D) until terminal is flush with cover (B).

**IMPORTANT: Select correct size terminal to fit connector body.**

13. Tighten lock nut (C).

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



TS0134 -UN-23AUG88

Continued on next page

RG40854,00000CB -19-20MAY02-3/4

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.

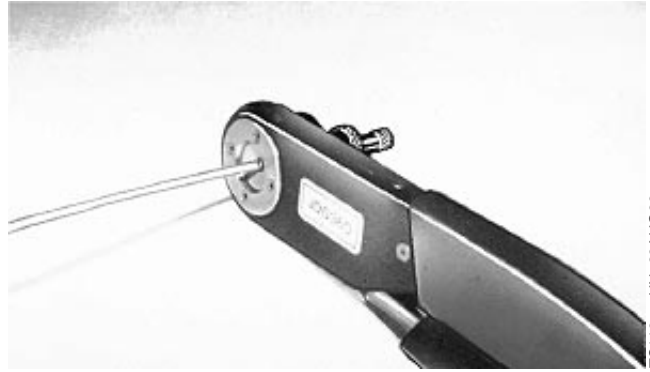
**IMPORTANT: If all wire strands are not crimped into terminal, cut off wire at terminal and repeat terminal installation procedures.**

*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 -JUN-23AUG88



TS0135 -JUN-23AUG88

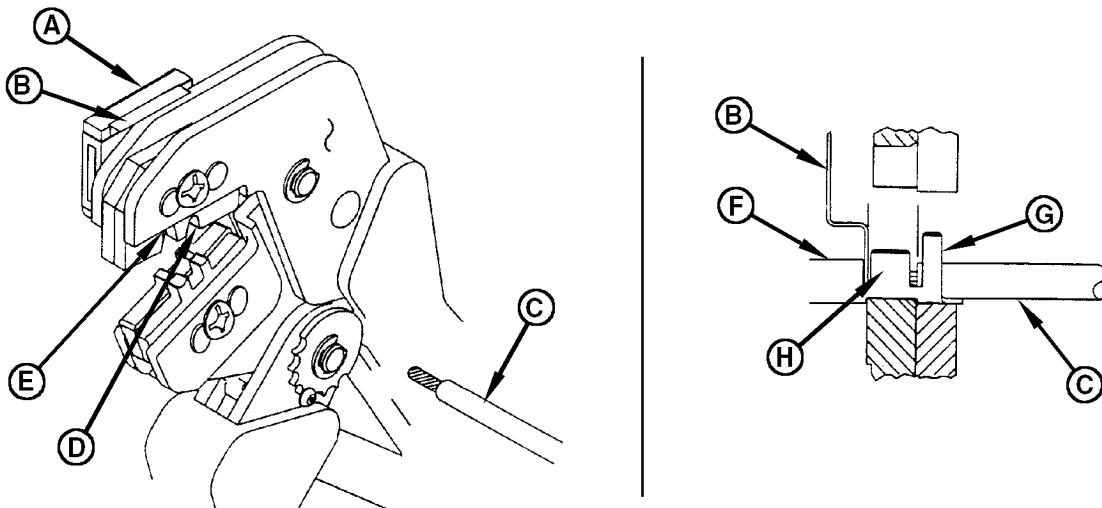


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## Repair AMP Connector



Using AMP Crimping Tool

A—Locator Assembly  
B—Locator

C—Wire  
D—Crimping Slot

E—Crimping Slot  
F—Terminal

G—Insulation Barrel  
H—Wire Barrel

1. Disconnect AMP connector. Remove the tie bands and tape.
2. Identify wire color/number to the connector cavity. Make sure the each wire goes back into the correct cavity location.
3. Press JDG1369 Terminal Extraction Tool into face of connector and remove wire and terminal from back of connector.

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

4. Strip new wire to length indicated in tool instructions. Do not nick or cut wire strands.
5. Hold JDG708 AMP Crimping Tool so that the back (wire side) is facing you. Squeeze tool handles together and allow them to open fully.

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

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

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

7. Position the terminal so that the open "U" of the wire and insulation barrels (H and G) face the top of the tool. Place the terminal up into the nest so that the movable locator (B) drops into the slot in the terminal as shown. Butt the front end of the wire barrel (H) against the movable locator.
8. Hold the terminal (F) in position and squeeze the tool handles together until ratchet engages sufficiently to hold the terminal in position. DO NOT deform insulation barrel or wire barrel.
9. Insert stripped wire (C) into terminal insulation and wire barrels until it is butted against the wire stop.

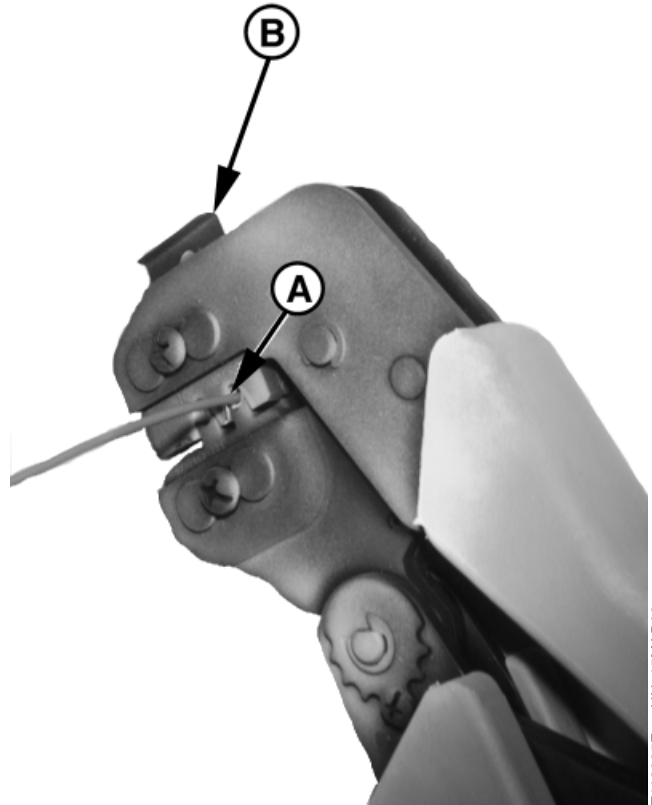
RG10742 -UN-31MAY00

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

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

11. Install wire in correct connector cavity.
12. Retape the wires and add the required tie bands to the harness.

**A—Wire and Terminal**  
**B—Locator**



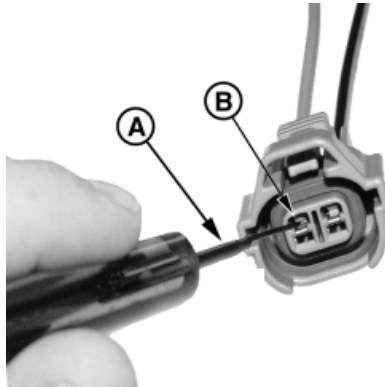
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## Repair SUMITOMO™ Connectors

1. Disconnect the SUMITOMO™ connector. Remove the tie bands and tape.
2. Identify wire color/number location with the connector cavity. Make sure each wire goes back to the correct cavity location.
3. Insert JDG777 Terminal Extraction Tool<sup>1</sup> (A) into connector body socket pushing the terminal locking tab upward (B).
4. Gently pull wire from the back of the connector. Then remove the extraction tool.
5. Remove old contact from wire using JDG145 Universal Electrical Pliers<sup>2</sup>.
6. Using JDG145 Universal Electrical Pliers<sup>2</sup>, strip 6 mm (1/4 in.) insulation from end of wire.
7. Select the correct seal. Slide the seal over the wire insulation with the smaller diameter side facing the end of the wire. Small diameter side of seal should line up with the outer edge of the insulation.



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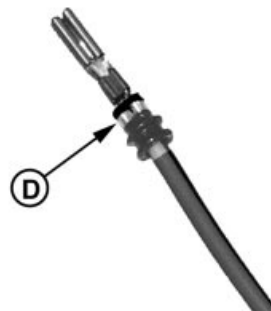
**IMPORTANT: The seal must fit snug over the cable insulation, without a gap between the cable seal and the insulation.**

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

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



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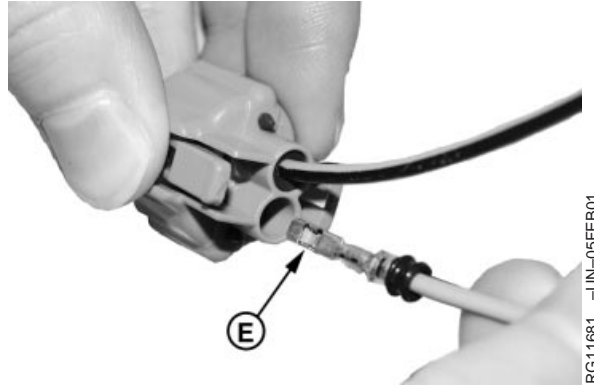


RG11680 -UN-05FEB01

<sup>1</sup>Included in JT07195B Electrical Repair Tool Kit.

<sup>2</sup>Included in JDG155 Electrical Repair Tool Kit.

9. Make sure the terminal is positioned correctly (E) for the locking tang inside the connector.
10. Push terminal into correct connector cavity until terminal locks.
11. Gently pull on wire to verify terminal is locked into the connector.
12. Retape the wires and add the required tie bands to the harness.



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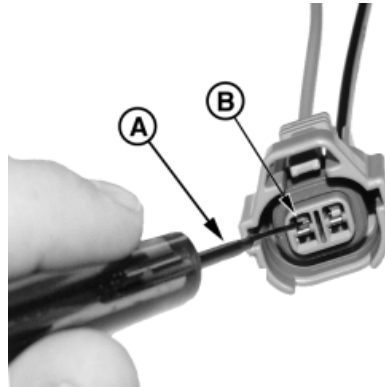
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**E—Terminal Orientation**

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## Repair YAZAKI™ Connectors

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



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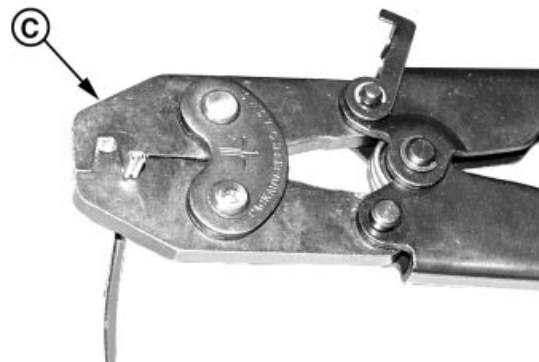


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**IMPORTANT: The seal must fit snug over the cable insulation, without a gap between the cable seal and the insulation.**

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

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



RG11678 -UN-05FEB01



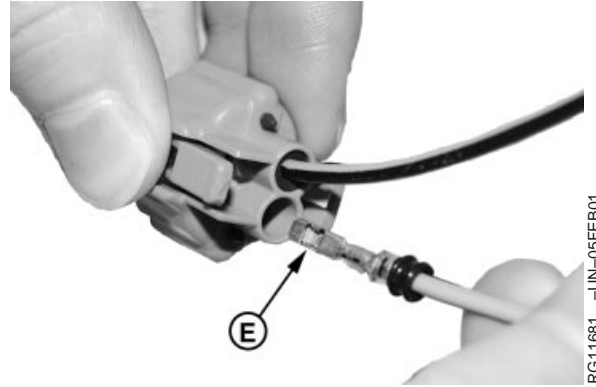
RG11680 -UN-05FEB01

<sup>1</sup>Included in JT07195B Electrical Repair Tool Kit.

<sup>2</sup>Included in JDG155 Electrical Repair Tool Kit.



9. Make sure the terminal is positioned correctly (E) for the locking tang inside the connector.
10. Push terminal into correct connector cavity until terminal locks.
11. Gently pull on wire to verify terminal is locked into the connector.
12. Retape the wires and add the required tie bands to the harness.



RG11681 -JUN-05FEB01

02  
110  
27

**E—Terminal Orientation**

RG40854,00000C8 -19-20MAY02-2/2



# Section 03 Theory Of Operation

## Contents

### Page

#### Group 130—Electronic Fuel System Operation

About This Group . . . . .	03-130-1
Fuel System Operation . . . . .	03-130-2
Pre-filter Operation . . . . .	03-130-3
Fuel Transfer Pump Operation . . . . .	03-130-4
Final Fuel Filter Operation . . . . .	03-130-5
High Pressure Fuel Pump Operation . . . . .	03-130-6
High Pressure Common Rail (HPCR) Operation . . . . .	03-130-7
Electronic Injector (EI) Operation . . . . .	03-130-8

#### Group 140—Electronic Control System Operation

About This Group . . . . .	03-140-1
Electronic Control System Terminology . . . . .	03-140-2
Electronic Control System Operation . . . . .	03-140-3
Electronic Control System Overview . . . . .	03-140-4
Monitoring Engine Parameters . . . . .	03-140-5
Measuring Temperature . . . . .	03-140-5
Measuring Pressure . . . . .	03-140-8
Measuring Throttle Position . . . . .	03-140-10
Measuring Engine Speed . . . . .	03-140-13
Pump Control Valve (PCV) . . . . .	03-140-14
Water in Fuel (WIF) Sensor . . . . .	03-140-14
Electronic Injector (EI) Wiring Harness Connector . . . . .	03-140-15
Engine Control Unit (ECU) . . . . .	03-140-16
Controlled Area Network (CAN) . . . . .	03-140-18
Glow Plug Operation . . . . .	03-140-18
Cruise Control Operation . . . . .	03-140-19
Engine Protection . . . . .	03-140-20
Derate Programs . . . . .	03-140-20
Multiple Torque Curve Selection . . . . .	03-140-21
Governor Droop Mode Selection . . . . .	03-140-21
Engine Control Unit (ECU) Self-Diagnosis . . . . .	03-140-22



## About This Group

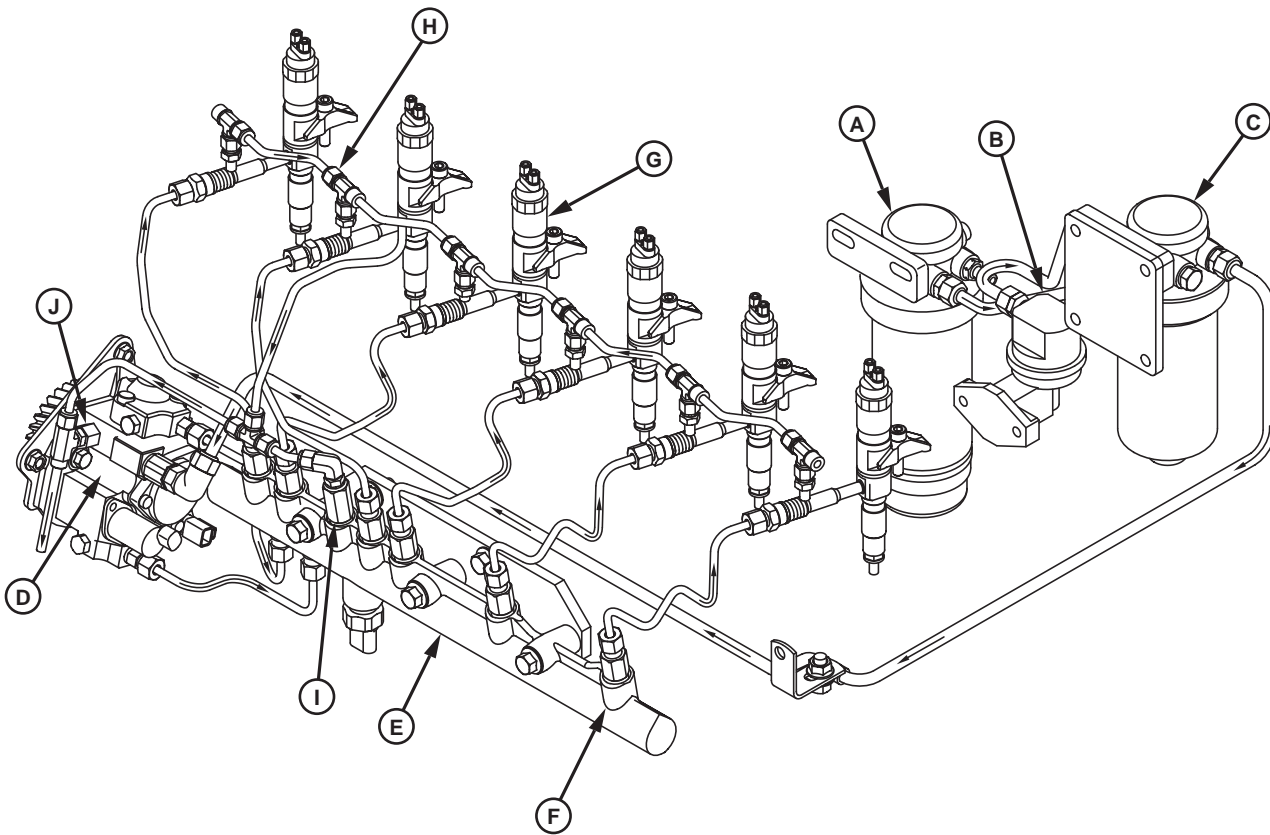
In this group, the fuel system information is described in the following categories:

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

RG40854,0000123 -19-17JUN02-1/1

03  
130  
1

### Fuel System Operation



A—Pre-Filter  
B—Fuel Transfer Pump  
C—Final Filter

D—High Pressure Fuel Pump  
E—High Pressure Common Rail (HPCR)

F—Flow Damper  
G—Electronic Injector (EI)  
H—Fuel Leak-off Line

I—Pressure Limiter  
J—Overflow Orifice

RG12290 -UN-22JUL02

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RG40854.0000122 -19-17JUN02-1/2

Fuel is drawn from the fuel tank and pre-filter by the fuel transfer pump. It travels from the transfer pump through the final fuel filter (C) to the high pressure fuel pump (D). The type and location of the pre-filter and fuel transfer pump vary by application. On OEM applications, a mechanically-controlled fuel transfer pump (B) draws fuel from the vented fuel tank through the pre-filter (A). On Combine applications, the electronic transfer pump is mounted to the pre-filter and both are remotely mounted. On 6020 Tractor applications, an electronic transfer pump is mounted below the High Pressure Common Rail (HPCR) on the vehicle chassis. The pre-filter and final filter on tractor applications are mounted to the engine in front of the HPCR.

The high pressure fuel pump raises the pressure of the fuel to the required pressure for injection. This high pressure fuel is routed into the HPCR (E) which evenly

distributes fuel to all of the Electronic Injectors (EIs) (G). The HPCR uses flow dampers (F) to regulate a constant pressure to the EIs. If excess fuel pressure develops in the HPCR, the pressure limiter (I) opens and routes the fuel through the fuel return line (H) back to the fuel tank. Excess fuel in the high pressure fuel pump exits the overflow orifice (J) and is routed back to tank through the fuel leak-off line (H).

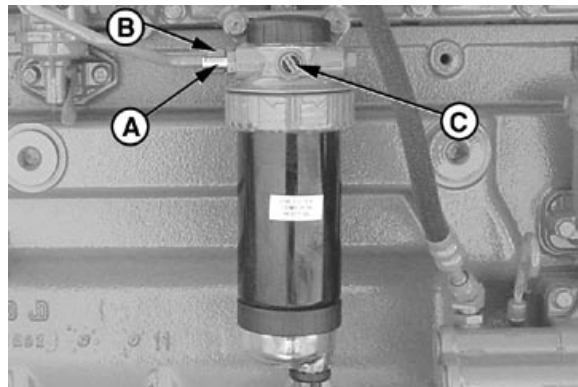
The Engine Control Unit (ECU) sends a signal to the EI. This controls the volume of fuel, the timing of delivery, and the rate of delivery for each EI. Once the fuel enters the EI, the high pressure overcomes the nozzle valve allowing fuel to spray into each cylinder. Excess fuel from the nozzles routes through the fuel return line and back to the fuel tank. On some applications, this fuel goes through a fuel cooler before returning to the fuel tank.

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### Pre-filter Operation

The pre-filter located on the suction side of the transfer pump. Fuel is routed from the vented fuel tank directly to the pre-filter inlet (A). The pre-filter screens particles out of the fuel system before exiting the pre-filter outlet (B). On Combine applications, an electronic transfer pump is mounted to the top of the pre-filter base. On 6020 Tractor applications, the pre-filter is mounted to a bracket in front of the high pressure common rail.

- A—Pre-filter Inlet
- B—Pre-filter Outlet
- C—Bleed Screw



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## Fuel Transfer Pump Operation

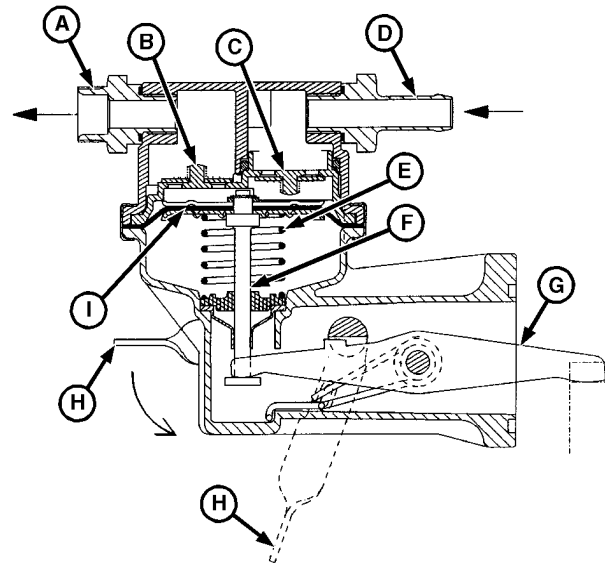
### Mechanical Fuel Transfer Pump

The mechanical fuel transfer pump uses an eccentric lobe on the engine camshaft to operate lever (G) on supply pump to pressurize fuel system. Fuel flows from the fuel tank at gravity pressure to the inlet side (D) of the diaphragm-type pump.

As lever (G) rides on the high side of the camshaft lobe, rod (F) pulls diaphragm (I) down. Suction pressure opens the inlet check valve (C) and fuel is drawn into the pump.

As the camshaft lobe rotates to the low side, return spring (E) forces diaphragm (I) upward. The resulting fuel pressure closes inlet check valve (C) and opens outlet check valve (B), delivering fuel through outlet (A) to the injection pump.

Hand primer lever (H) is provided for manually forcing fuel through the system to bleed air from the fuel filter, lines, etc.



Mechanical Fuel Transfer Pump

- A—Fuel Outlet
- B—Outlet Check Valve
- C—Inlet Check Valve
- D—Fuel Inlet
- E—Return Spring
- F—Rod
- G—Lever
- H—Hand Primer Lever
- I—Diaphragm

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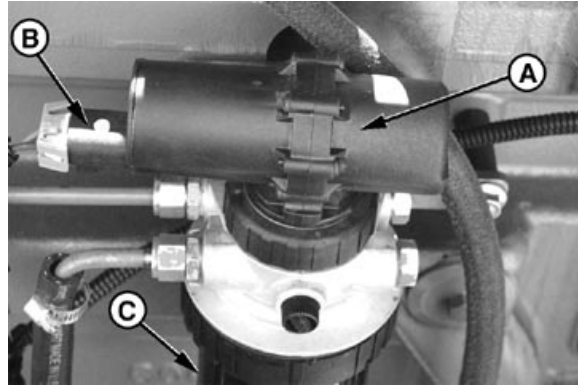
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### Electronic Fuel Transfer Pump

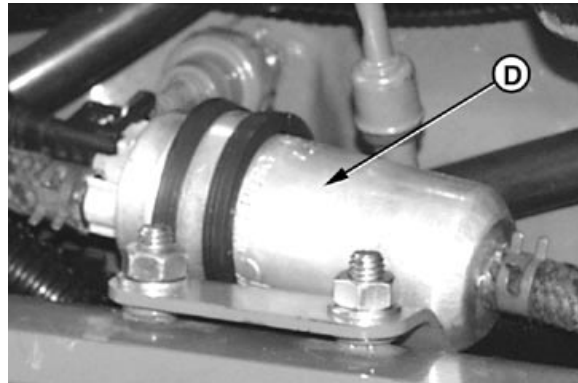
Both Combines and 6020 Tractors use electronic fuel transfer pumps. The fuel transfer pump (A) used on Combines is mounted directly above the pre-filter (C). It is controlled by the ECU through wiring in the transfer pump connector (B). The fuel transfer pump (D) used on 6020 Tractors is mounted to the chassis near the engine. It runs on switched voltage and is not controlled through the ECU.

- A—Electronic Fuel Transfer Pump (Combines)
- B—Transfer Pump Connector
- C—Pre-filter
- D—Electronic Fuel Transfer Pump (6020 Tractors)



Electronic Fuel Transfer Pump (Combines)

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Electronic Fuel Transfer Pump (6020 Tractors)

RG12542A -UN-22JUL02

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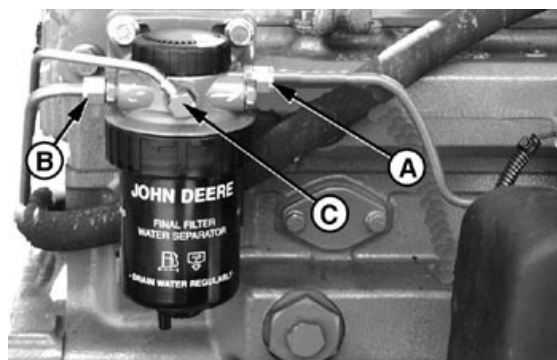
### Final Fuel Filter Operation

Fuel enters the final filter at the fuel inlet (A), flows through the filter element, and exits through the outlet (B) to the high pressure fuel pump. On OEM and 6020 Tractor applications, a bleed screw (C) can be used on the base of the filter to purge air out of the system. On Combine applications, an air/bleed valve (D) is provided to remove air or excess fuel. It has a fuel line that connects to the fuel injector leak-off line.

- A—Final Fuel Filter Inlet
- B—Final Fuel Filter Outlet
- C—Bleed Screw
- D—Air/Bleed Valve



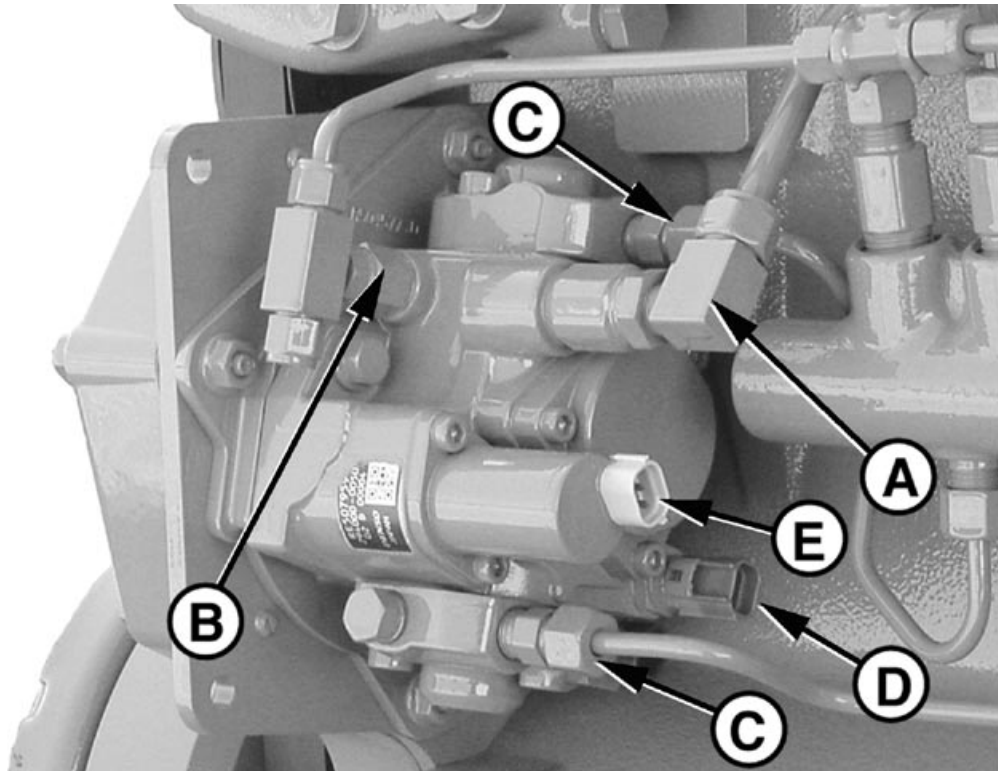
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RG12454C -UN-18JUN02

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## High Pressure Fuel Pump Operation



RG12465B -UN-18JUN02

A—Fuel Inlet  
B—Overflow Orifice

C—Fuel Outlets

D—Fuel Temperature Sensor

E—Pump Control Valve (PCV)  
Solenoid

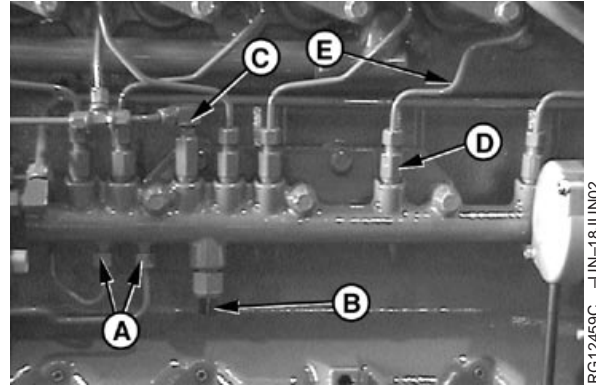
The 4045 and 6068 high pressure common rail engine uses the Denso HP3 high pressure fuel pump. Filtered fuel enters the high pressure pump through the fuel inlet (A). Once fuel passes through the inlet, it goes through a fuel inlet filter and continues through an internal transfer pump. Fuel is then routed either to lubricate the pump crankcase or to the Pump Control Valve (E). For more information on the PCV Solenoid, see PUMP CONTROL VALVE (PCV) in Group 140 of

this manual. There is one chamber on the top of the pump and another chamber on the bottom of the pump. Fuel in each chamber is pressurized when the pump camshaft rotates. Excess fuel leaves the pump through the overflow orifice (B), so it can return to the fuel tank. A fuel temperature sensor (D) is included on the pump to measure the temperature of the pump housing.

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## High Pressure Common Rail (HPCR) Operation

High pressure fuel is delivered to the high pressure common rail (HPCR) through two high pressure pump delivery lines (A). The high pressure common rail delivery lines (E) transport the fuel to the Electronic Injectors (EIs). The fuel rail pressure sensor (B) detects the fuel pressure inside the rail. The Engine Control Unit (ECU) uses this sensor to monitor the fuel pressure to determine the timing of the pump control valve on the high pressure fuel pump. For more information on the fuel rail pressure sensor, see MEASURING PRESSURE in Group 140 later in this manual. If an abnormally high pressure is generated within the HPCR, the pressure limiter (C) is used to release the excess pressure and drain fuel back to the tank. The flow dampers (D) are used to control the maximum fuel flow to the EIs and prevent damage if the EI should fail or if a high pressure leak develops by shutting off fuel flow to the failed EI.



- A—High Pressure Pump Delivery Lines
- B—Fuel Rail Pressure Sensor
- C—Pressure Limiter
- D—Flow Damper
- E—High Pressure Common Rail Delivery Lines

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## Electronic Injector (EI) Operation

The electronic injectors (EIs) are located inside the engine's cylinder head and are electronically controlled by the ECU. The amount of fuel delivered to the

cylinder is in direct proportion with the length of time current is supplied to the two-way electromagnetic valve (TWV) on each EI.

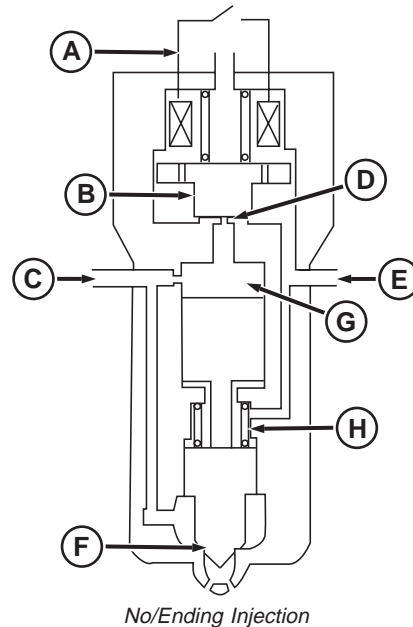
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### EI - No Injection

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

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



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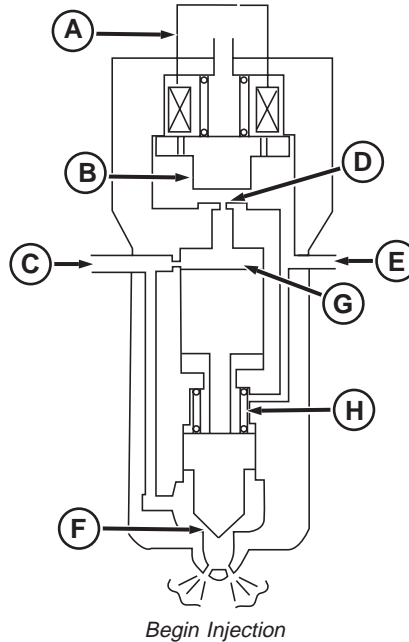
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### EI - Begin Injection

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

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



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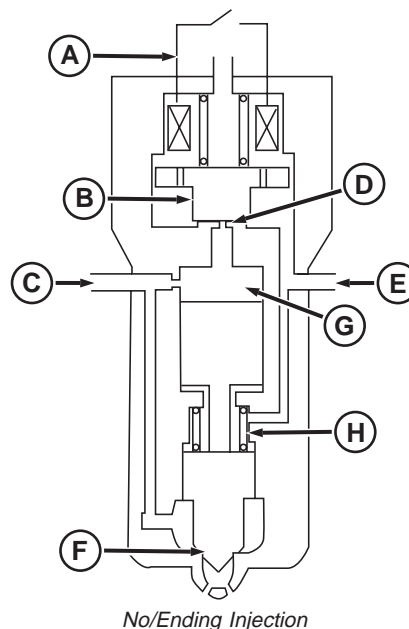
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### EI - Ending Injection

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

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



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### About This Group

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

- Electronic Control System Terminology
- Electronic Control System Operation
- Electronic Control System Overview
- Monitoring Engine Parameters
- Measuring Temperature
  - ECT (Engine Coolant Temperature) Sensor
  - Fuel Temperature Sensor
  - MAT Manifold Air Temperature Sensor
- Measuring Pressure
  - Fuel Rail Pressure Sensor
  - Oil Pressure Sensor
- Measuring Throttle Position
- Measuring Engine Speed
  - Crank Position Sensor
  - Pump Position Sensor
- Pump Control Valve (PCV)
- Electronic Injector (EI) Wiring Harness Connector
- Engine Control Unit (ECU)
- Glow Plug Operation
- Cruise Control Operation
- Engine Protection
- Derate Programs
- Multiple Torque Curve Selection
- Governor Droop Mode Selection
- Engine Control Unit (ECU) Self Diagnosis

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1

## Electronic Control System Terminology

<b>Actuator</b>	A device controlled by the ECU to perform a certain function.
<b>Analog</b>	Signal which has a continuous range of possible voltages. Usually 0 to 5 volts or 0 to 12 volts.
<b>Boost</b>	Pressurized air in the intake manifold.
<b>CAN</b>	Controller Area Network. The network on vehicles that allows communication between controllers.
<b>Digital</b>	A signal which consists of only two-volt levels — usually 0 volts and +5 volts.
<b>DST</b>	Diagnostic Scan Tool. This is a diagnostic software that is used to read engine parameters, check DTCs, and run special tests. The DST consists of an Windows ('95, '98, 2000) or NT compatible computer and a hardware kit available from John Deere Distribution Service Center (DSC): JDIS121 - ECU Communication Hardware Kit. The software is available to download from your John Deere home page.
<b>DTC</b>	Diagnostic Trouble Code. This is a code that is stored in the ECU's memory when it detects a problem in the electronic control system. There are two types of codes: Active and Stored.
<b>ECT</b>	Engine Coolant Temperature (sensor). Measure the temperature of the engine coolant.
<b>ECU</b>	Engine Control Unit. Computer that controls the fuel, air, and ignition systems on the engine.
<b>EI</b>	Electronic Injector. The EI is an electronic injector that is controller by the ECU. The ECU controls the start of injection and the amount of fuel injected by energizing and de-energizing the two-way valve on the injectors. See ELECTRONIC INJECTOR (EI) OPERATION in Group 130 for details.
<b>FMI</b>	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).
<b>J1939</b>	The Society of Automotive Engineers (SAE) standard for communication between the electronic controllers on heavy-duty vehicles, both on- and off-highway.
<b>MAT</b>	Manifold Air Temperature (sensor). Measures the temperature of the air in the intake manifold. See MEASURING TEMPERATURE later in this group for details.
<b>PCV</b>	Pump Control Valve. Opens the valve directing fuel from the high pressure fuel pump to the HPCR.
<b>PROM</b>	Programmable, Read-Only Memory. A computer chip that contains the calibration information for the engine control system.
<b>PWM</b>	Pulse Width Modulation. A digital electronic signal (not analog) which consists of a pulse generated at a fixed frequency. When an actuator is controlled by a PWM signal, the on-time of the signal is increased or decreased (modulated) to increase or decrease the output of the actuator.
<b>RAM</b>	Random Access Memory. The RAM is the portion of the computer memory within the ECU that changes as the engine is running and is stored while engine is off.
<b>Sensor</b>	Device used by the ECU to monitor various engine parameters.
<b>SPN</b>	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).



<b>TPS</b>	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.
<b>TWV</b>	Two-Way Valve. The TWV is energized to raise the outer valve allowing fuel to be injected into the cylinder.
<b>WIF</b>	Water In Fuel (sensor). The WIF sensor sends a signal to the ECU when water is detected in the fuel.

RG40854,00000E0 -19-20MAY02-2/2

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140  
3

## Electronic Control System Operation

### Engine Starting Mode

When the key is turned to the "ON" position, a switched power voltage is sent to the Electronic Control Unit (ECU). This energizes the ECU and allows it to "boot-up" and ready itself for engine start.

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

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

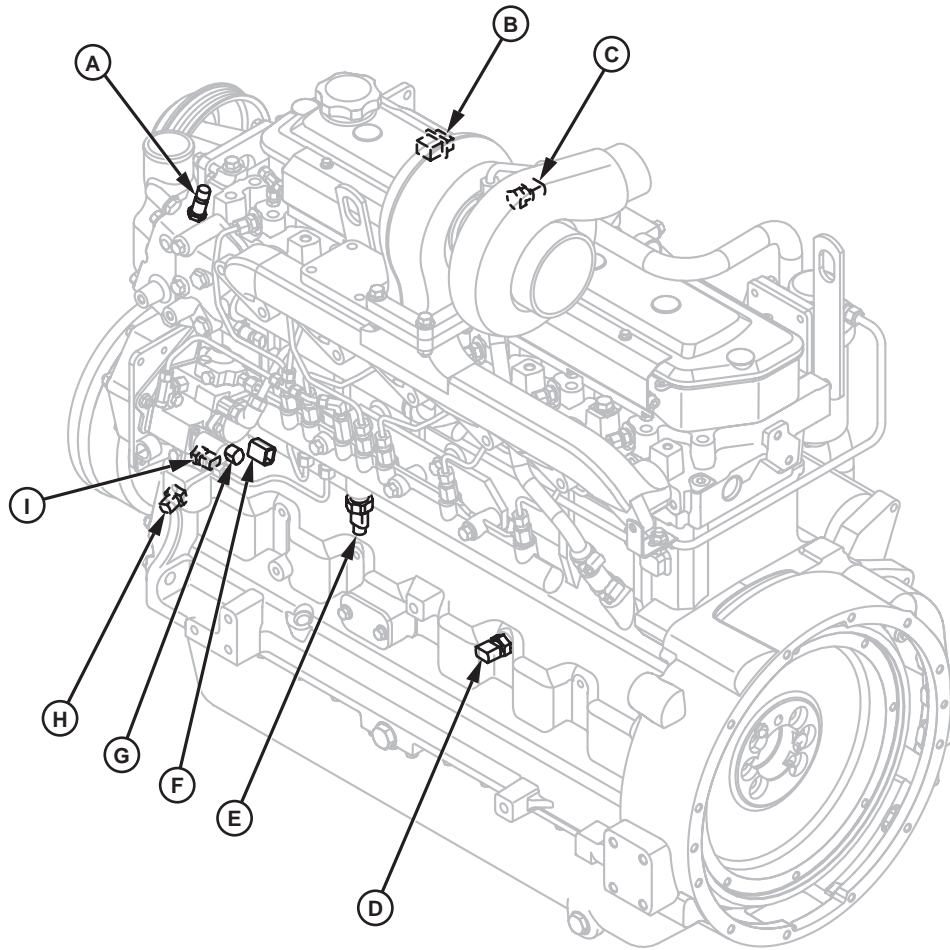
To provide cold temperature enrichment, the amount of fuel injected is based on the temperature measured by the Engine Coolant Temperature (ECT) sensor. At this point, the engine will start and the ECU will go into the running mode.

### Engine Running Mode

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

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## Electronic Control System Overview



RG12297 -UN-24JUN02

Electronic Control System Overview

A—Engine Coolant Temperature (ECT) Sensor  
B—Electronic Injector (EI) Wiring Harness Connector

C—Manifold Air Temperature (MAT) Sensor  
D—Oil Pressure Sensor

E—Fuel Rail Pressure Sensor  
F—Fuel Temperature Sensor  
G—Pump Control Valve (PCV)

H—Crank Position Sensor  
I—Pump Position Sensor

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

The electronic control system serves as an engine governor by controlling the Electronic Injectors (EIs) so that fuel is delivered according to a given set engine conditions, precise amounts, and at 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

RG40854,00000E2 -19-12JUN03-1/1

## Monitoring Engine Parameters

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

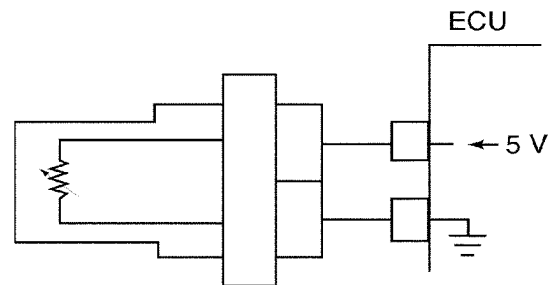
- Engine Coolant Temperature (ECT)
- Fuel Temperature
- Manifold Air Temperature (MAT)
- Fuel Rail Pressure
- Oil Pressure
- Crank Position
- Pump Position

RG40854,00000E3 -19-20MAY02-1/1

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## Measuring Temperature

The Engine Coolant Temperature (ECT), the Fuel Temperature, and the Manifold Air Temperature (MAT) sensor are thermistors (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. Temperature switches close when a specific temperature is reached.



Temperature Sensor Schematic

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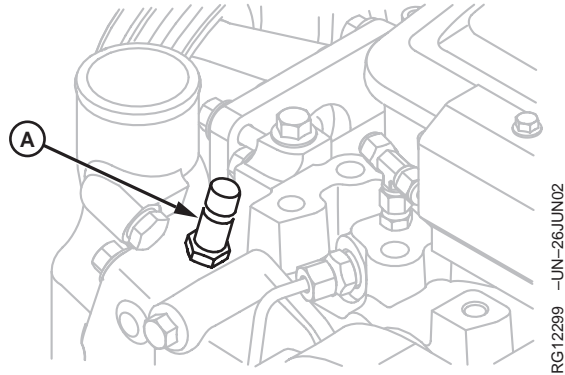
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RG40854,00000E4 -19-20MAY02-1/4

### ECT (Engine Coolant Temperature) Sensor

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

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



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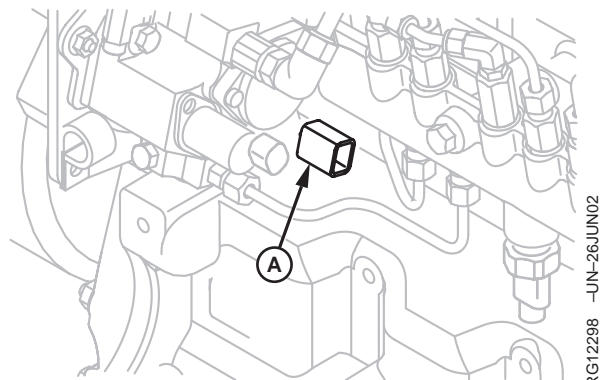
A—Engine Coolant Temperature (ECT) Sensor

RG40854,00000E4 -19-20MAY02-2/4

### Fuel Temperature Sensor

The fuel temperature sensor (A) is located on the base of the final fuel filter. The ECU uses this sensor input to calculate fuel density and adjust fuel delivery accordingly. The ECU also uses the fuel temperature sensor for engine protection purposes. For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

A—Fuel Temperature Sensor



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Fuel Temperature Sensor

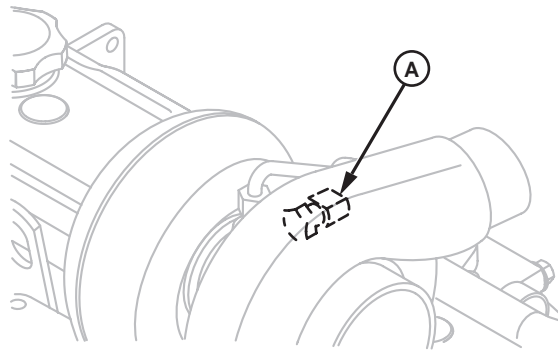
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### MAT (Manifold Air Temperature) Sensor

The MAT sensor (A) is located on the bottom of the intake manifold. The MAT sensor measures intake air temperature to help the ECU calculate for correct fueling. This is an optional sensor that is not included on all applications. The ECU also monitors manifold air temperature for engine protection purposes. For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

**A—Manifold Air Temperature (MAT) Sensor**



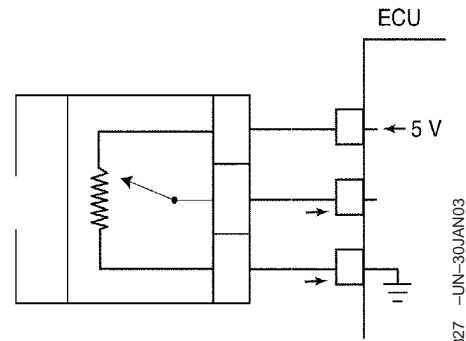
Manifold Air Temperature (MAT) Sensor

RG12300 -JUN-26JUN02

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## Measuring Pressure

The system's pressure sensors are 3 wire 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. Pressure switches close when a specific pressure is reached.



Pressure Sensor Schematic

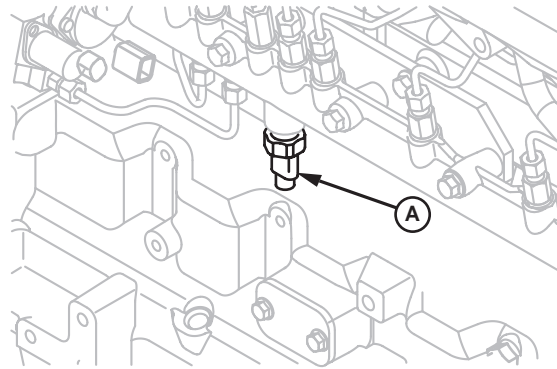
RG12827 -JUN-30JAN03

RG40854,00000E5 -19-20MAY02-1/3

## Fuel Rail Pressure Sensor

The fuel rail pressure sensor (A) is located on the HPCR. The ECU monitors fuel pressure to control the amount and timing of fuel transferred from the high pressure fuel pump to the HPCR.

A—Fuel Rail Pressure Sensor



Fuel Rail Pressure Sensor

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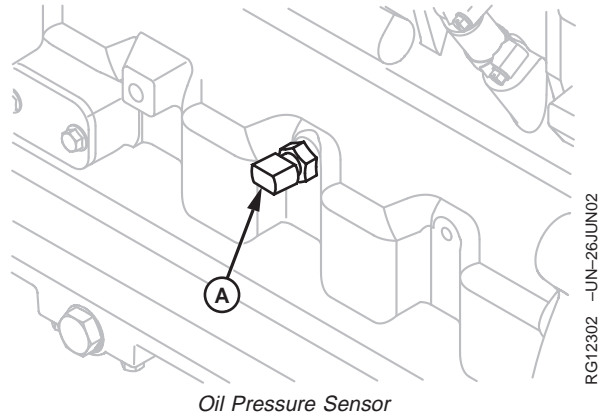
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RG40854,00000E5 -19-20MAY02-2/3

### Oil Pressure Sensor

The oil pressure sensor (A) is an optional sensor that is located in the main engine galley of the block. The ECU monitors oil pressure for engine protection purposes. For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

A—Oil Pressure Sensor



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## Measuring Throttle Position

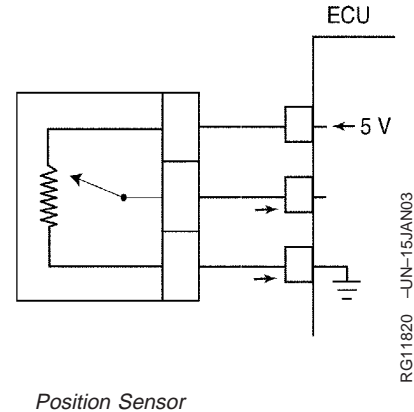
The 4.5L & 6.8L engines have the option of operating with an analog throttle position sensor output signal,

multi-state throttle, or a CAN throttle. On some applications, multiple throttles are used.

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### 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 volts 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 -JUN-15JAN03

RG40854,00000E7 -19-20MAY02-2/7

### 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.

See Dual State, Tri-State,  
or Ramp Throttle  
Schematics for  
Multi-State Switch/Wiring  
Information

*Multi-state Throttle Schematic*

RG12348 -19-06MAY02

Continued on next page

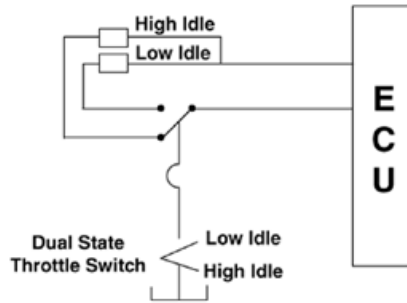
RG40854,00000E7 -19-20MAY02-3/7

03  
140  
10



### 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.



Dual State Throttle

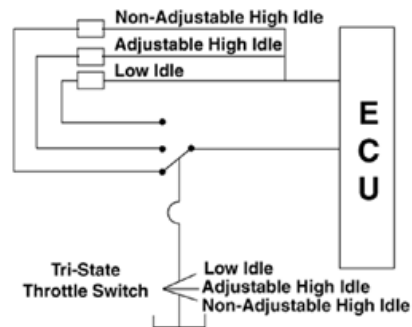
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RG40854,00000E7 -19-20MAY02-4/7

### 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 application. 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.



Tri-State Throttle

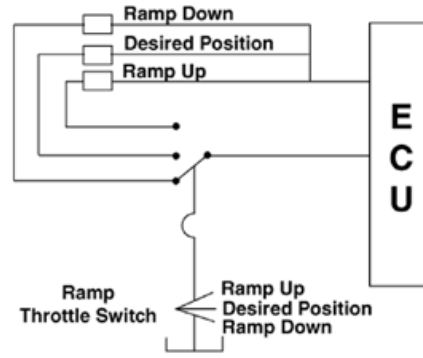
RG12285 -19-26APR02

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RG40854,00000E7 -19-20MAY02-5/7

### 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.



Ramp Throttle

RG12286 -19-26APR02

RG40854,00000E7 -19-20MAY02-6/7

### CAN Throttle

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



CAN Throttle Schematic

RG12349 -19-06MAY02

RG40854,00000E7 -19-20MAY02-7/7

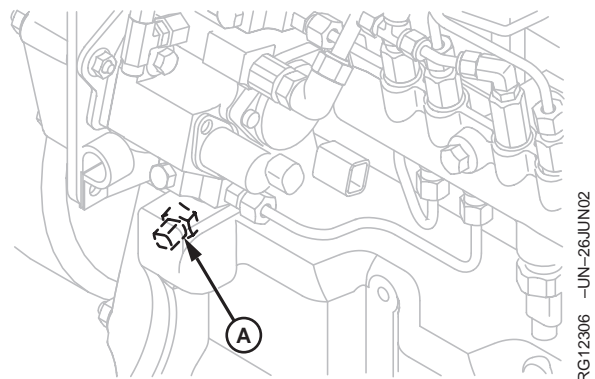
## Measuring Engine Speed

Both the crank position sensor and the pump position sensor operate by detecting notches on their corresponding gears. When a notch on the timing wheel is directly under the sensor, a voltage is induced. The ECU monitors this voltage to determine the location of the timing wheel.

### Crank Position Sensor

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

A—Crank Position Sensor

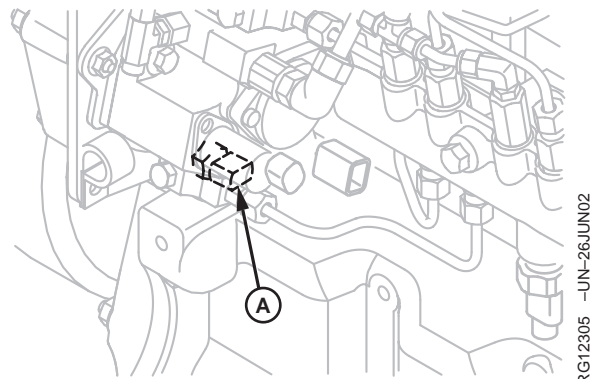


Crank Position Sensor

### Pump Position Sensor

The pump position sensor (A) is located on the side of the high pressure fuel pump. It is an inductive type pickup sensor that detects notches on the auxiliary gear of the high pressure fuel pump camshaft. The auxiliary gear is composed of 6 evenly spaced notches with one additional notch offset to tell the ECU that cylinder #1 is approaching Top-Dead-Center.

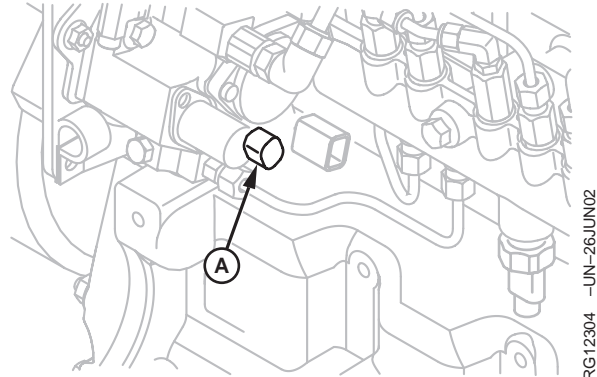
A—Pump Position Sensor



Pump Position Sensor

### Pump Control Valve (PCV)

The Pump Control Valve (A) are located on the high pressure fuel pump. The ECU sends an electronic signal to the PCV to regulate the delivery of fuel to the High Pressure Common Rail (HPCR). When the PCV is energized, fuel is allowed discharge from the fuel outlet on the high pressure fuel pump to the HPCR.



Pump Control Valve (PCV)

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RG40854,00000EA -19-20MAY02-1/1

### Water in Fuel (WIF) Sensor

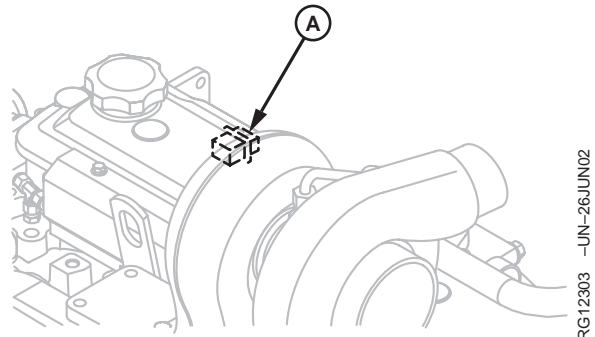
When water is detected in the fuel, a signal is sent to the ECU. The WIF sensor uses the resistance of fuel and water in the fuel system along with the principle that water is a better conductor than fuel. If water is present, the voltage will be lower. The ECU monitors this for engine protection purposes. For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

RG41221,00000A8 -19-12JUN03-1/1

## Electronic Injector (EI) Wiring Harness Connector

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

**A—EI Wiring Harness Connector**



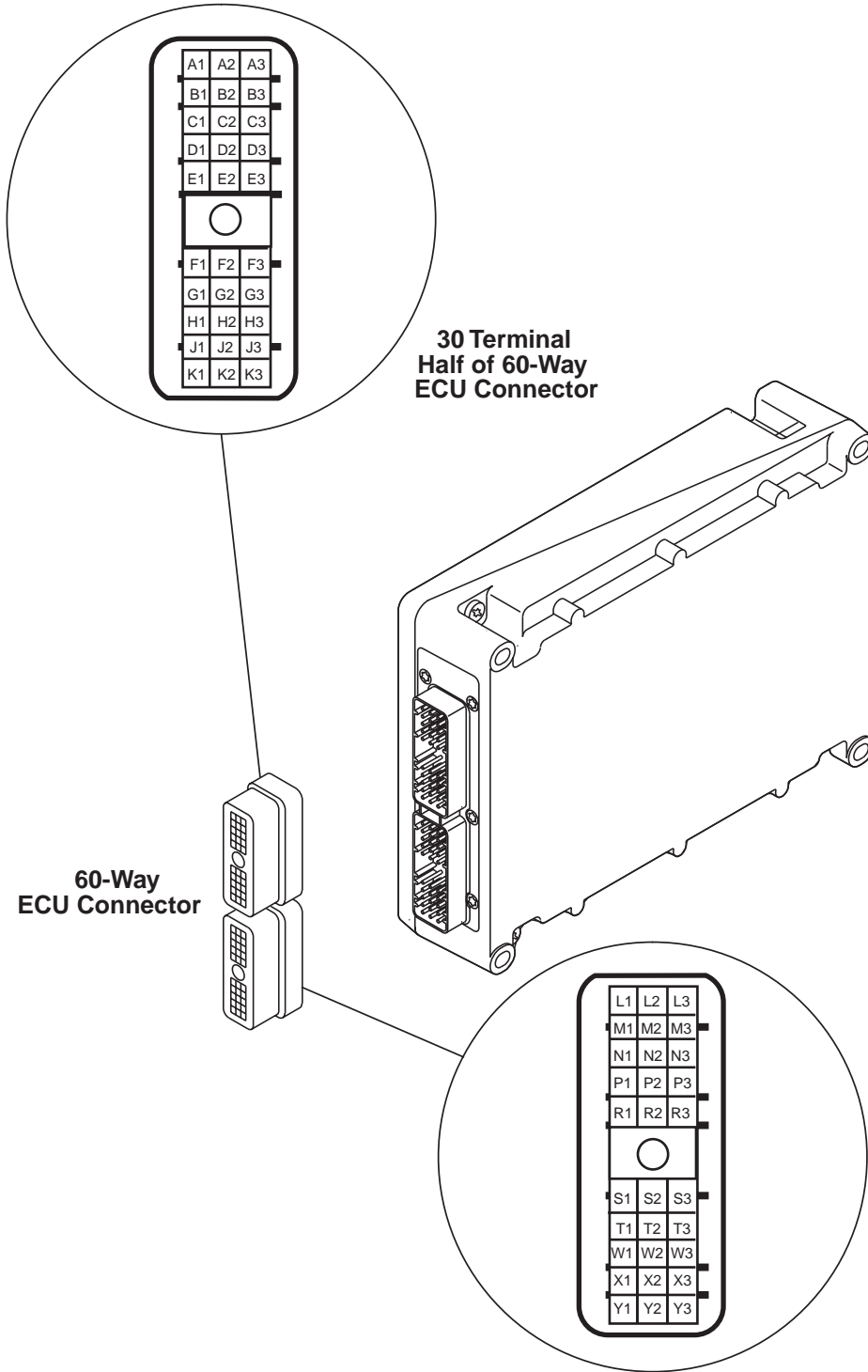
*EI Wiring Harness Connector*

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RG40854,00000EB -19-20MAY02-1/1

Engine Control Unit (ECU)



60-Way ECU Connector

30 Terminal Half of 60-Way ECU Connector

30 Terminal Half of 60-Way ECU Connector

John Deere Level 11 ECU

RG11390 -19-17NOV00

Continued on next page

RG40854,00000EC -19-20MAY02-1/2

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

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

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

The ECU is composed of the following subsystems:

#### **Analog/Digital Converters**

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

#### **Central Processing Unit (CPU)**

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

in controlling injection fuel quantity and injection timing. The CPU communicates its desired fuel quantity and timing to the high pressure fuel pump and EIs and it controls the self diagnostic system.

#### **Memory**

The ECU contains 3 different types of memory:

— Random Access Memory - RAM

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

— Read Only Memory - ROM

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

— Electrical Erasable Programmable Read Only Memory - EEPROM

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

## Controlled Area Network (CAN)

Controlled 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.

application, information like throttle position, application requested derates and or engine protection, displaying diagnostic fault codes on vehicle displays, ect.

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

Just about any type of information can be communicated over the CAN Bus. Depending on the

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## Glow Plug Operation

The glow plug heaters are used to increase intake manifold air temperature to improve cold starting. When the operator turns the key from "OFF" to "ON", the ECU calculates the fuel temperature, determines if the temperature is below the set point, turns on the "Wait to Start" light on the dash, and energizes the glow plug relay. The glow plug relay will in turn energize the glow plugs located above each cylinder. The ECU will keep the glow plugs energized for an amount of time that is determined by the measured temperatures. When the ECU has determined that the preheat time is adequate, it will turn off the "Wait to Start" light and de-energize the glow plug relay. If the

operator turns the ignition from "ON" to "START" at this time, the engine will crank and start.

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

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

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## Cruise Control Operation

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

The cruise control has the normal functions of:

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

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

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## Engine Protection

Engine protection is necessary to prevent damage to an engine. There are three different engine protection programs available in Engine Control Units (ECUs):

- **No Protection** — The ECU does not have the software to derate or shut the engine down. It is the responsibility of the operator to react to warning light(s) on their application. Derating or shutting the engine down may be necessary depending on the Diagnostic Trouble Code (DTC) that is set. Refer to the operator's manual to identify this information for a given application.
- **Engine Protection WITHOUT Shutdown** — The ECU has the capability to derate an engine. It is the responsibility of the operator to react to warning light(s) on their application to identify if it is necessary to shut the engine down. Refer to the operator's manual to retrieve this information for a given application.
- **Engine Protection with Shutdown** — The ECU will derate the engine for given DTCs. If a DTC that

requires shutdown is set, the ECU will severely derate the engine and shut the engine down 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.

There are two levels of engine protection:

### 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.

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## 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

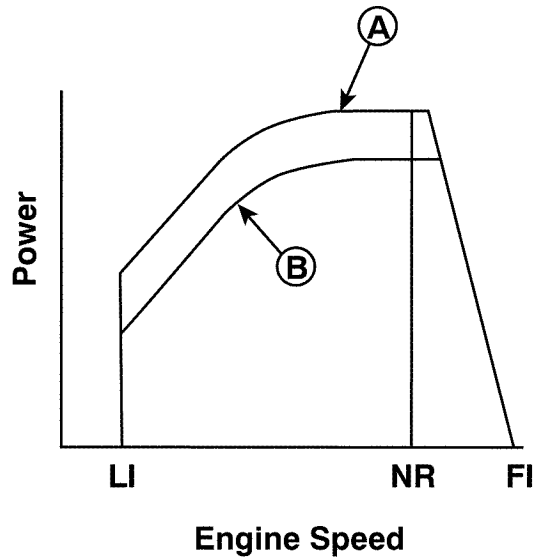
fuel derate. See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for derate specifications per application.

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## Multiple Torque Curve Selection

The ECU has the ability to limit the maximum fuel quantity through Electronic Injectors (EIs) 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 for torque curve selection specifications.



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

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## Governor Droop Mode Selection

The electronic control system provides all-speed governing. The Engine Control Unit (ECU) controls the engine speed based on the analog throttle input.

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 for governor droop mode specifications.

RG40854.00000F3 -19-20MAY02-1/1

## 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 6 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 11 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, 000110.03 will be displayed as 000110.03.

### 2-DIGIT/3-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 Group 160 of this manual.

### WARNING LAMP

On some applications, there is a warning lamp (also referred to as the "Wait Lamp" ) that is used when a code becomes active. When a code is active, this lamp will either blink or stay on solid. A solid light indicates that the ECU is taking extreme measures to protect the engine. A blinking light indicates that the ECU has detected a fault and engine performance may be affected.

#### **CLEARING STORED DTCs**

Stored DTCs can be cleared through the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™. Refer to the vehicle machine manual or see CLEARING STORED DTCS ON DIAGNOSTIC GAUGE in Group 160 later in this manual to determine how to clear the code reader.

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RG40854,00000F4 -19-11APR03-2/2

03  
140  
23



# Section 04 Diagnostics

## Contents

	Page		Page
<b>Group 150—Observable Diagnostics and Tests</b>			
About This Group . . . . .	04-150-1	A2 - Glow Plug Check Diagnostic	
E1 - Engine Cranks/Won't Start. . . . .	04-150-2	Procedure . . . . .	04-150-44
E1 - Engine Cranks/Won't Start Diagnostic		Check Fuel Supply Quality . . . . .	04-150-47
Procedure . . . . .	04-150-2	Test for Air in Fuel . . . . .	04-150-49
E2 - Engine Misfires/Runs Irregularly . . . . .	04-150-5	Check Fuel Supply Pressure. . . . .	04-150-50
E2 - Engine Misfires/Runs Irregularly		Check for Restricted Fuel Leak-off Line . . . . .	04-150-51
Diagnostic Procedure. . . . .	04-150-5	Bleed the Fuel System . . . . .	04-150-53
E3 - Engine Does Not Develop Full Power . . . . .	04-150-9	Check and Adjust High Pressure Fuel Pump	
E3 - Engine Does Not Develop Full Power		Static Timing . . . . .	04-150-56
Diagnostic Procedure. . . . .	04-150-9	<b>Group 160—Trouble Code Diagnostics and Tests</b>	
E4 - Engine Emits Excessive White		About This Group . . . . .	04-160-1
Exhaust Smoke . . . . .	04-150-14	Electrical Concepts . . . . .	04-160-2
E4 - Engine Emits Excessive White		Using a Digital Multimeter . . . . .	04-160-2
Exhaust Smoke Diagnostic Procedure . . . . .	04-150-14	Electrical Circuit Malfunctions . . . . .	04-160-3
E5 - Engine Emits Excessive Black Or Gray		Troubleshooting Circuit Malfunctions. . . . .	04-160-6
Exhaust Smoke . . . . .	04-150-17	Connecting to Diagnostic Scan Tool (DST) or	
E5 - Engine Emits Excessive Black Or		SERVICE ADVISOR™ . . . . .	04-160-10
Gray Exhaust Smoke Diagnostic		Blinking DTCs . . . . .	04-160-12
Procedure . . . . .	04-150-17	Engine Configuration Data Parameters on	
E6 - Engine Will Not Crank . . . . .	04-150-19	Diagnostic Gauge . . . . .	04-160-13
E7 - Engine Idles Poorly . . . . .	04-150-19	Viewing Active DTCs on Diagnostic	
E8 - Abnormal Engine Noise. . . . .	04-150-20	Gauge . . . . .	04-160-15
E9 - Analog Throttle (A) Does Not		Viewing Stored DTCs on Diagnostic	
Respond . . . . .	04-150-22	Gauge . . . . .	04-160-15
E10 - Analog Throttle (B) Does Not		Clearing Stored DTCs on Diagnostic	
Respond . . . . .	04-150-22	Gauge . . . . .	04-160-16
F1 - Fuel Supply System Check . . . . .	04-150-24	Data Parameter Description . . . . .	04-160-18
F1 - Fuel Supply System Check Diagnostic		Engine Test Instructions—Cylinder Misfire	
Procedure . . . . .	04-150-24	Test . . . . .	04-160-22
F2 - Excessive Fuel Consumption. . . . .	04-150-29	Engine Test Instructions—Compression	
F3 - Fuel in Oil . . . . .	04-150-29	Test . . . . .	04-160-23
D1 - ECU Does Not Communicate with		Engine Test Instructions— Cylinder Cutout	
DST or SERVICE ADVISOR™ . . . . .	04-150-30	Test . . . . .	04-160-24
. . . . .	04-150-31	Engine Test Instructions— Tractor Torque	
D1 - ECU Does Not Communicate With		Curve Change Test . . . . .	04-160-25
DST or SERVICE ADVISOR™ Diagnostic		Reprogramming Engine Control Unit	
Procedure . . . . .	04-150-31	(ECU) . . . . .	04-160-26
D2 - Diagnostic Gauge Does Not		Downloading Payload File For DST. . . . .	04-160-27
Communicate With ECU . . . . .	04-150-36	Reprogramming Engine Control Unit (ECU)	
. . . . .	04-150-37	With DST. . . . .	04-160-32
D2 - Diagnostic Gauge Does Not		Downloading Payload File For SERVICE	
Communicate With ECU Diagnostic		ADVISOR™ . . . . .	04-160-37
Procedure . . . . .	04-150-37		
A2 - Glow Plug Check. . . . .	04-150-42		

Continued on next page

Contents

	Page		Page
Reprogramming Engine Control Unit (ECU) With SERVICE ADVISOR™	04-160-45	000091.03 — Throttle Voltage High	04-160-97
Diagnostic Trouble Codes (DTCs)	04-160-49	000091.04 — Throttle Voltage Low	04-160-98
Listing of Diagnostic Trouble Codes (DTCs) on ECU	04-160-50	000091.09 — Throttle Invalid	04-160-98
Diagnostic Procedure	04-160-54	000091.14 — Throttle Voltage Out of Range	04-160-99
Intermittent Fault Diagnostics	04-160-55	000094.03 — Fuel Rail Pressure Input Voltage High	04-160-100
T1 - Multi-state Throttle Input High	04-160-56		04-160-101
	04-160-57	000094.03 Fuel Rail Pressure Input Voltage High Diagnostic Procedure	04-160-101
T1 - Multi-State Throttle Input High Diagnostic Procedure	04-160-57	000094.04 Fuel Rail Pressure Input Voltage Low	04-160-104
T2 - Multi-state Throttle Input Low	04-160-60		04-160-105
	04-160-61	000094.04 Fuel Rail Pressure Input Voltage Low Diagnostic Procedure	04-160-105
T2 - Multi-State Throttle Input Low Diagnostic Procedure	04-160-61	000094.10 — Fuel Rail Pressure Loss Detected	04-160-108
T3 - Analog Throttle (A) Input High	04-160-64		04-160-109
	04-160-65	000094.10 Fuel Rail Pressure Loss Detected Diagnostic Procedure	04-160-109
T3 - Analog Throttle (A) Input High Diagnostic Procedure	04-160-65	000094.13 — Fuel Rail Pressure Higher Than Expected	04-160-112
T4 - Analog Throttle (A) Input Low	04-160-68		04-160-113
	04-160-69	000094.13 Fuel Rail Pressure Higher Than Expected Diagnostic Procedure	04-160-113
T4 - Analog Throttle (A) Input Low Diagnostic Procedure	04-160-69	000094.17 — Fuel Rail Pressure Not Developed	04-160-116
T5 - Analog Throttle (B) Input High	04-160-72		04-160-117
	04-160-73	000094.17 Fuel Rail Pressure Not Developed Diagnostic Procedure	04-160-117
T5 - Analog Throttle (B) Input High Diagnostic Procedure	04-160-73	000097.00 — Water in Fuel Continuously Detected	04-160-120
T6 - Analog Throttle (B) Input Low	04-160-76		04-160-121
	04-160-77	000097.00 Water In Fuel Continuously Detected Diagnostic Procedure	04-160-121
T6 - Analog Throttle (B) Input Low Diagnostic Procedure	04-160-77	000097.03 — Water in Fuel Signal Voltage High	04-160-123
T7 - CAN Throttle Invalid	04-160-80		04-160-124
	04-160-81	000097.03 Water in Fuel Signal Voltage High Diagnostic Procedure	04-160-124
T7 - CAN Throttle Invalid Diagnostic Procedure	04-160-81	000097.04 — Water in Fuel Signal Voltage Low	04-160-126
T17 - Analog Throttle (C) Input High	04-160-84		04-160-127
	04-160-85	000097.04 Water in Fuel Signal Voltage Low Diagnostic Procedure	04-160-127
T17 - Analog Throttle (C) Input High Diagnostic Procedure	04-160-85	000097.16 — Water in Fuel Detected	04-160-130
T18 - Analog Throttle (C) Input Low	04-160-88		04-160-131
	04-160-89	000097.16 Water In Fuel Detected Diagnostic Procedure	04-160-131
T18 - Analog Throttle (C) Input Low Diagnostic Procedure	04-160-89	000100.01 — Engine Oil Pressure Extremely Low	04-160-134
T22 - Analog Throttle (A) Input Voltage Out of Range	04-160-91		
000028.03 — Throttle Voltage High	04-160-92		
000028.04 — Throttle Voltage Low	04-160-92		
000029.03 — Throttle Voltage High	04-160-93		
000029.04 — Throttle Voltage Low	04-160-93		
000084.31 — Vehicle Speed Mismatch	04-160-94		
	04-160-95		
000084.31 Vehicle Speed Mismatch Diagnostic Procedure	04-160-95		

Continued on next page



Contents

Page	Page		
000100.01 Engine Oil Pressure Extremely Low Diagnostic Procedure . . . . .	04-160-136	000110.03 Engine Coolant Temperature Input Voltage High Diagnostic Procedure . . . . .	04-160-169
000100.03 — Engine Oil Pressure Input Voltage High . . . . .	04-160-138	000110.04 — Engine Coolant Temperature Input Voltage Low . . . . .	04-160-172
000100.03 Engine Oil Pressure Input Voltage High Diagnostic Procedure . . . . .	04-160-139	000110.04 Engine Coolant Temperature Input Voltage Low Diagnostic Procedure . . . . .	04-160-173
000100.04 — Engine Oil Pressure Input Voltage Low . . . . .	04-160-142	000110.15 — Engine Coolant Temperature High Least Severe . . . . .	04-160-176
000100.04 Oil Pressure Input Voltage Low Diagnostic Procedure . . . . .	04-160-144	000110.15 Engine Coolant Temperature High Least Severe Diagnostic Procedure . . . . .	04-160-177
000100.18 — Engine Oil Pressure Moderately Low . . . . .	04-160-148	000110.16 — Engine Coolant Temperature Moderately High . . . . .	04-160-178
000100.18 Engine Oil Pressure Moderately Low Diagnostic Procedure . . . . .	04-160-149	000110.16 Engine Coolant Temperature Moderately High Diagnostic Procedure . . . . .	04-160-179
000105.00 — Manifold Air Temperature Extremely High . . . . .	04-160-150	000111.01 — Engine Coolant Level Low . . . . .	04-160-180
000105.00 Manifold Air Temperature Extremely High Diagnostic Procedure . . . . .	04-160-151	000111.01 Engine Coolant Level Low Diagnostic Procedure . . . . .	04-160-181
000105.03 — Manifold Air Temperature Input Voltage High . . . . .	04-160-152	000158.17 — ECU Power Down Error . . . . .	04-160-184
000105.03 Manifold Air Temperature Input Voltage High Diagnostic Procedure . . . . .	04-160-153	000158.17 ECU Power Down Error Diagnostic Procedure . . . . .	04-160-185
000105.04 — Manifold Air Temperature Input Voltage Low . . . . .	04-160-156	000160.02 — Wheel Speed Input Noise . . . . .	04-160-188
000105.04 Manifold Air Temperature Input Voltage Low Diagnostic Procedure . . . . .	04-160-157	000160.02 Wheel Speed Input Noise Diagnostic Procedure . . . . .	04-160-189
000105.16 — Manifold Air Temperature Moderately High . . . . .	04-160-160	000174.00 — Fuel Temperature High Most Severe . . . . .	04-160-192
000105.16 Manifold Air Temperature Moderately High Diagnostic Procedure . . . . .	04-160-161	000174.00 Fuel Temperature High Most Severe Diagnostic Procedure . . . . .	04-160-193
000107.00 — Air Filter Differential Pressure . . . . .	04-160-162	000174.03 — Fuel Temperature Input Voltage High . . . . .	04-160-196
000107.00 Air Filter Differential Pressure Diagnostic Procedure . . . . .	04-160-163	000174.03 Fuel Temperature Input Voltage High Diagnostic Procedure . . . . .	04-160-197
000110.00 — Engine Coolant Temperature Extremely High . . . . .	04-160-166	000174.04 — Fuel Temperature Input Voltage Low . . . . .	04-160-200
000110.00 Engine Coolant Temperature Extremely High Diagnostic Procedure . . . . .	04-160-167	000174.04 Fuel Temperature Input Voltage Low Diagnostic Procedure . . . . .	04-160-201
000110.03 — Engine Coolant Temperature Input Voltage High . . . . .	04-160-168	000174.16 — Fuel Temperature High Moderately Severe . . . . .	04-160-204
000110.03 Engine Coolant Temperature Input Voltage High Diagnostic Procedure . . . . .	04-160-169		04-160-205

Continued on next page

Contents

	Page		Page
000174.16 Fuel Temperature High Moderately Severe Diagnostic Procedure . . . . .	04-160-205	000636.08 Pump Position Sensor Input Missing Diagnostic Procedure . . . . .	04-160-243
000189.00 — Engine Speed Derate . . . . .	04-160-207	000636.10 — Pump Position Sensor Input Pattern Error . . . . .	04-160-246
000190.00 — Engine Overspeed Extreme . . . . .	04-160-208	000636.10 Pump Position Sensor Input Pattern Error Diagnostic Procedure . . . . .	04-160-247
000190.16 — Engine Overspeed Moderate . . . . .	04-160-209	000637.02 — Crank Position Input Noise . . . . .	04-160-250
000237.02 — Vehicle Identification Number Invalid . . . . .	04-160-210	000637.02 Crank Position Input Noise Diagnostic Procedure . . . . .	04-160-251
000237.13 — Vehicle Identification Option Code Invalid . . . . .	04-160-211	000637.07 — Crank Position/Pump Position Timing Moderately Out of Sync . . . . .	04-160-254
000237.31 — Vehicle Model Number Invalid . . . . .	04-160-212	000637.07 Crank Position/Pump Position Timing Moderately Out of Sync Diagnostic Procedure . . . . .	04-160-256
000611.03 — Electronic Injector Wiring Shorted To Power Source . . . . .	04-160-214	000637.08 — Crank Position Input Missing . . . . .	04-160-260
000611.03 Electronic Injector Wiring Shorted To Power Source Diagnostic Procedure . . . . .	04-160-216	000637.08 Crank Position Input Missing Diagnostic Procedure . . . . .	04-160-261
000611.04 — Electronic Injector Wiring Shorted To Ground . . . . .	04-160-218	000637.10 — Crank Position Input Pattern Error . . . . .	04-160-264
000611.04 Electronic Injector Wiring Shorted To Ground Diagnostic Procedure . . . . .	04-160-220	000637.10 Crank Position Input Pattern Error Diagnostic Procedure . . . . .	04-160-265
000620.03 — Sensor Supply 2 Voltage High . . . . .	04-160-224	000639.13 — CAN Bus Error . . . . .	04-160-268
000620.03 Sensor Supply 2 Voltage High Diagnostic Procedure . . . . .	04-160-225	000639.13 CAN Bus Error Diagnostic Procedure . . . . .	04-160-269
000620.04 — Sensor Supply 2 Voltage Low . . . . .	04-160-228	000651.05 — Cylinder #1 EI Circuit Open . . . . .	04-160-272
000620.04 Sensor Supply 2 Voltage Low Diagnostic Procedure . . . . .	04-160-229	000651.05 Cylinder #1 EI Circuit Open Diagnostic Procedure . . . . .	04-160-274
000627.01 — Electronic Injector Supply Voltage Problem . . . . .	04-160-232	000651.06 — Cylinder #1 EI Circuit Shorted . . . . .	04-160-278
000627.01 Electronic Injector Supply Voltage Problem Diagnostic Procedure . . . . .	04-160-233	000651.06 Cylinder #1 EI Circuit Shorted Diagnostic Procedure . . . . .	04-160-280
000629.13 — ECU Error . . . . .	04-160-236	000651.07 — Cylinder #1 EI Mechanical Failure . . . . .	04-160-282
000629.13 ECU Error Diagnostic Procedure . . . . .	04-160-236	000651.07 Cylinder #1 EI Mechanical Failure Diagnostic Procedure . . . . .	04-160-284
000636.02 — Pump Position Sensor Input Noise . . . . .	04-160-238	000652.05 — Cylinder #2 EI Circuit Open . . . . .	04-160-286
000636.02 Pump Position Sensor Input Noise Diagnostic Procedure . . . . .	04-160-239		04-160-288
000636.08 — Pump Position Sensor Input Missing . . . . .	04-160-242		
	04-160-243		

Continued on next page

Contents

	Page		Page
000652.05 Cylinder #2 EI Circuit Open		000655.07 — Cylinder #5 EI Mechanical	
Diagnostic Procedure . . . . .	04-160-288	Failure . . . . .	04-160-342
000652.06 — Cylinder #2 EI Circuit		. . . . .	04-160-343
Shorted . . . . .	04-160-292	000655.07 Cylinder #5 EI Mechanical Failure	
. . . . .	04-160-294	Diagnostic Procedure . . . . .	04-160-343
000652.06 Cylinder #2 EI Circuit Shorted		000656.05 — Cylinder #6 EI Circuit	
Diagnostic Procedure . . . . .	04-160-294	Open . . . . .	04-160-346
000652.07 — Cylinder #2 EI Mechanical		. . . . .	04-160-347
Failure . . . . .	04-160-298	000656.05 Cylinder #6 EI Circuit Open	
. . . . .	04-160-300	Diagnostic Procedure . . . . .	04-160-347
000652.07 Cylinder #2 EI Mechanical Failure		000656.06 — Cylinder #6 EI Circuit	
Diagnostic Procedure . . . . .	04-160-300	Shorted . . . . .	04-160-350
000653.05 — Cylinder #3 EI Circuit		. . . . .	04-160-351
Open . . . . .	04-160-302	000656.06 Cylinder #6 EI Circuit Shorted	
. . . . .	04-160-304	Diagnostic Procedure . . . . .	04-160-351
000653.05 Cylinder #3 EI Circuit Open		000656.07 — Cylinder #6 EI Mechanical	
Diagnostic Procedure . . . . .	04-160-304	Failure . . . . .	04-160-354
000653.06 — Cylinder #3 EI Circuit		. . . . .	04-160-355
Shorted . . . . .	04-160-308	000656.07 Cylinder #6 EI Mechanical Failure	
. . . . .	04-160-310	Diagnostic Procedure . . . . .	04-160-355
000653.06 Cylinder #3 EI Circuit Shorted		000676.03 — Glow Plug Relay Voltage	
Diagnostic Procedure . . . . .	04-160-310	High . . . . .	04-160-358
000653.07 — Cylinder #3 EI Mechanical		. . . . .	04-160-359
Failure . . . . .	04-160-314	000676.03 Glow Plug Relay Voltage High	
. . . . .	04-160-316	Diagnostic Procedure . . . . .	04-160-359
000653.07 Cylinder #3 EI Mechanical Failure		000676.05 — Glow Plug Relay Voltage	
Diagnostic Procedure . . . . .	04-160-316	Low . . . . .	04-160-362
000654.05 — Cylinder #4 EI Circuit		. . . . .	04-160-363
Open . . . . .	04-160-318	000676.05 Glow Plug Relay Voltage Low	
. . . . .	04-160-320	Diagnostic Procedure . . . . .	04-160-363
000654.05 Cylinder #4 EI Circuit Open		000898.09 — Vehicle Speed or Torque	
Diagnostic Procedure . . . . .	04-160-320	Message Invalid . . . . .	04-160-365
000654.06 — Cylinder #4 EI Circuit		000970.31 — Engine Shutdown - Auxiliary	
Shorted . . . . .	04-160-324	Request . . . . .	04-160-366
. . . . .	04-160-326	000971.31 — External Fuel Derate Switch	
000654.06 Cylinder #4 EI Circuit Shorted		Active . . . . .	04-160-367
Diagnostic Procedure . . . . .	04-160-326	001069.09 — Tire Size Invalid . . . . .	04-160-368
000654.07 — Cylinder #4 EI Mechanical		001069.09 Tire Size Invalid Diagnostic	
Failure . . . . .	04-160-330	Procedure . . . . .	04-160-369
. . . . .	04-160-332	001069.31 — Tire Size Error . . . . .	04-160-372
000654.07 Cylinder #4 EI Mechanical Failure		. . . . .	04-160-373
Diagnostic Procedure . . . . .	04-160-332	001069.31 Tire Size Error Diagnostic	
000655.05 — Cylinder #5 EI Circuit		Procedure . . . . .	04-160-373
Open . . . . .	04-160-334	001079.03 — Sensor Supply 1 Voltage	
. . . . .	04-160-335	High . . . . .	04-160-374
000655.05 Cylinder #5 EI Circuit Open		. . . . .	04-160-375
Diagnostic Procedure . . . . .	04-160-335	001079.03 Sensor Supply 1 Voltage High	
000655.06 — Cylinder #5 EI Circuit		Diagnostic Procedure . . . . .	04-160-375
Shorted . . . . .	04-160-338	001079.04 — Sensor Supply 1 Voltage	
. . . . .	04-160-339	Low . . . . .	04-160-378
000655.06 Cylinder #5 EI Circuit Shorted		. . . . .	04-160-379
Diagnostic Procedure . . . . .	04-160-339		

Continued on next page

Contents

	Page		Page
001079.04 Sensor Supply 1 Voltage Low Diagnostic Procedure . . . . .	04-160-379	001639.18 Fan Speed Lower Than Expected Diagnostic Procedure . . . . .	04-160-419
001080.03 — Fuel Rail Pressure Sensor Supply Voltage High . . . . .	04-160-382	002000.13 — Security Violation . . . . .	04-160-422
. . . . .	04-160-383	002005.09 — ACU Signal Missing . . . . .	04-160-423
001080.03 Fuel Rail Pressure Sensor Supply Voltage High Diagnostic Procedure . . . . .	04-160-383	002049.09 — CAB Signal Missing . . . . .	04-160-424
001080.04 — Fuel Rail Pressure Sensor Supply Voltage Low . . . . .	04-160-386	002071.09 — CCU Signal Missing . . . . .	04-160-425
. . . . .	04-160-387		
001080.04 Fuel Rail Pressure Sensor Supply Voltage Low Diagnostic Procedure . . . . .	04-160-387		
001109.31 — Engine Protection Shutdown Warning . . . . .	04-160-390		
001110.31 — Engine Protection Shutdown . . . . .	04-160-391		
001347.03 — Pump Control Valve Current High . . . . .	04-160-392		
. . . . .	04-160-393		
001347.03 Pump Control Valve Current High Diagnostic Procedure . . . . .	04-160-393		
001347.05 — Pump Control Valve Current Mismatch . . . . .	04-160-396		
. . . . .	04-160-397		
001347.05 Pump Control Valve Current Mismatch Diagnostic Procedure . . . . .	04-160-397		
001347.07 — Fuel Rail Pressure Control Error . . . . .	04-160-400		
. . . . .	04-160-401		
001347.07 Fuel Rail Pressure Control Error Diagnostic Procedure . . . . .	04-160-401		
001347.10 — Pump Control Valve Fuel Flow Not Detected . . . . .	04-160-404		
001347.10 Pump Control Valve Fuel Flow Not Detected Diagnostic Procedure . . . . .	04-160-405		
001568.02 — Torque Curve Selection Invalid . . . . .	04-160-408		
001569.31 — Fuel Derate . . . . .	04-160-409		
001639.01 — Fan Speed Input Missing . . . . .	04-160-410		
. . . . .	04-160-411		
001639.01 Fan Speed Input Missing Diagnostic Procedure . . . . .	04-160-411		
001639.16 — Fan Speed Higher Than Expected . . . . .	04-160-414		
. . . . .	04-160-415		
001639.16 Fan Speed Higher Than Expected Diagnostic Procedure . . . . .	04-160-415		
001639.18 — Fan Speed Lower Than Expected . . . . .	04-160-418		
. . . . .	04-160-419		

## About This Group

This section of the manual contains necessary information for observable diagnostics and fuel-related test procedures. Use this information in conjunction with the 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104). Group 150 is divided into two areas: diagnosing malfunctions and test procedures. The diagnosing malfunctions area is further divided into the following headings, containing the following observable symptoms:

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

*NOTE: To diagnose observable symptoms on engines with a mechanical fuel system, see 4.5L & 6.8L Diesel Engines Mechanical Fuel Systems Manual (CTM 207).*

- 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
- E9 - Analog Throttle (A) Will Not Respond
- E10 - Analog Throttle (B) Will Not Respond
  
- F1 - Fuel supply system check

- F2 - Excessive fuel consumption
- F3 - Fuel in oil
  
- D1 - ECU Does Not Communicate With DST or SERVICE ADVISOR™
- D2 - Diagnostic Gauge Does Not Communicate With ECU
  
- A2 - Glow Plug Check

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

- Fuel System Testing Procedures:
  - Check Fuel Supply Quality
  - Test for Air in Fuel
  - Check Fuel Supply Pressure
  - Check for Restricted Fuel Leak-off Line
  - Bleed the Fuel System
  - Check and Adjust High Pressure Fuel Pump Static Timing

## E1 - Engine Cranks/Won't Start

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### E1 - Engine Cranks/Won't Start Diagnostic Procedure

*NOTE: This procedure applies to engines with John Deere Engine Control Units (ECUs). This procedure should be used if engine cranking speed is OK, but engine will not start, or only starts after prolonged cranking. If engine will not crank, determine problem in the starting/charging system.*

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<p><b>1 E1- Preliminary Check</b></p>	<p>Before using this diagnostic chart:</p> <ol style="list-style-type: none"> <li>1. Ensure that fuel quality and quantity are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.</li> <li>2. Ensure that engine cranking speed is OK. See TEST ENGINE CRANKING SPEED in Section 04, Group 150 of 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</li> <li>3. Ensure that oil viscosity is correct. See DIESEL ENGINE OIL—TIER II ENGINES in Section 01, Group 02 of 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</li> </ol>	<p><b>No problems found:</b> GO TO <b>2</b></p> <p><b>Problems found:</b> Repair and retest.</p>
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<p><b>2 Active DTC Test</b></p>	<ol style="list-style-type: none"> <li>1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR in Group 160 later in this manual.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU communication software</li> <li>4. Crank engine for 15 seconds.</li> <li>5. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>No active DTCs present:</b> GO TO <b>3</b></p> <p><b>Active DTC(s) present:</b> Diagnose active DTCs first. If any of the DTCs have a SPN of 636 or 637, go to those first.</p> <p><b>Can not communicate with ECU:</b> See D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR DIAGNOSTIC PROCEDURE later in this Group.</p>
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Observable Diagnostics and Tests

<p><b>③ Pump Position and Crank Indicator Test</b></p>	<ol style="list-style-type: none"> <li>1. Start cranking engine.</li> <li>2. While cranking, use the DST or SERVICE ADVISOR™ to observe pump position status, pump position sensor input noise indicator, crank position input noise indicator, and crank position status. See DATA PARAMETER DESCRIPTION in Section 04, Group 160 of this manual for an explanation of the Pump Position/Crank Position parameters.</li> </ol>	<p><b>No pump position or crank noise and pump position and crank status reached 15:</b> GO TO <b>④</b></p> <p><b>Pump position or crank noise and pump position or crank status does not reach 15:</b> Inspect vehicle for possible failures that can cause either of these conditions: Bad electrical connections, damaged sensor, damaged high pressure fuel pump camshaft or crankshaft timing ring, EMI from improperly installed radio equipment, or other electronic devices. Repair and retest.</p>
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<p><b>④ Pilot Injection Test</b></p>	<ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF</li> <li>2. Read engine coolant temperature.</li> <li>3. Ignition ON, engine cranking</li> <li>4. Read pilot injection</li> </ol>	<p><b>Pilot Injection reads ON or N/A:</b> GO TO <b>⑤</b></p> <p><b>Pilot Injection reads OFF:</b> Pilot Injection should be ON if the ECT is below 10°C (50°F). If Pilot Injection is OFF under this condition, determine problem in the ECT sensor circuit.</p>
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<p><b>⑤ Glow Plug Check</b></p>	<ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF.</li> <li>2. Read fuel temperature</li> </ol>	<p><b>Fuel temperature above 0°C (32°F):</b> GO TO <b>⑥</b></p> <p><b>Fuel temperature at or below 0°C (32°F):</b> See A2 - GLOW PLUG CHECK DIAGNOSTIC PROCEDURE later in this Group.</p>
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*Observable Diagnostics and Tests*

<p><b>6 Fuel Supply System Test</b></p>	<p>Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.</p>	<p><b>No fuel supply system problems:</b> GO TO <b>7</b></p> <p><b>Fuel supply system problem found:</b> Repair and retest.</p> <p style="text-align: right;">---1/1</p>
<p><b>7 EI Cap Screw and EI Harness and Connector Test</b></p>	<ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove rocker arm cover.</li> </ol> <p><i>NOTE: Rocker arm cover gasket is reusable if no visible damages is detected. Do NOT store cover on gasket surface.</i></p> <ol style="list-style-type: none"> <li>3. Check EI rocker arms and valve rocker arm operation.</li> </ol> <p><i>NOTE: Verify that hold down clamps are positioned correctly.</i></p> <ol style="list-style-type: none"> <li>4. Check that the hold down clamp cap screws on all EIs are tightened and torque turned to specification. See INSTALL ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual.</li> <li>5. Inspect EI harness and EI harness connector for damage.</li> <li>6. When diagnostics are completed, reassemble the rocker arm cover and tighten to specifications.</li> </ol>	<p><b>All components operating correctly:</b> GO TO <b>8</b></p> <p><b>Faulty component found:</b> Repair faulty component and retest.</p> <p style="text-align: right;">---1/1</p>
<p><b>8 Pump Position Timing Check</b></p>	<p>Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING later in this Group.</p>	<p><b>Pump position timing OK:</b> Replace ECU and retest.</p> <p><b>Pump position timing out of sync:</b> Adjust timing and retest.</p> <p style="text-align: right;">---1/1</p>

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## E2 - Engine Misfires/Runs Irregularly

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

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<p><b>❶ E2 - Preliminary Check</b></p>	<p>Before using this diagnostic procedure, check the following that could cause or be mistaken as miss/rough running:</p> <ol style="list-style-type: none"> <li>1. Intake manifold air leaks.</li> <li>2. Engine mechanical problems.</li> <li>3. Transmission problems.</li> <li>4. Engine Accessories such as A/C cycling on and off.</li> <li>5. Electromagnetic interference (EMI) from improperly installed radios, etc.</li> </ol>	<p><b>No problems found:</b> GO TO <b>❷</b></p> <p><b>Problem found:</b> Repair and retest.</p>
<p><b>❷ Active DTC Test</b></p>	<ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU communication software</li> <li>4. Ignition ON, engine idling</li> <li>5. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>No active DTCs:</b> GO TO <b>❸</b></p> <p><b>Active DTC(s) present:</b> Diagnose active DTCs first. If any of the DTCs have an SPN of 636 or 637, diagnose those first.</p>
<p><i>SERVICE ADVISOR is a trademark of Deere &amp; Company</i></p>		
<p><b>❸ Engine Performance Check</b></p>	<ol style="list-style-type: none"> <li>1. Ignition ON, engine idling</li> <li>2. Observe engine performance</li> </ol>	<p><b>Not running rough:</b> GO TO <b>❹</b></p> <p><b>Running rough:</b> GO TO <b>❻</b></p>

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Observable Diagnostics and Tests

<b>4 Recreate Conditions</b>	Operate engine under conditions where the miss/rough running complaint occurs.	<b>Not running rough:</b> No problem found. Verify complaint and try to reproduce conditions of miss/rough running complaint.  <b>Running rough:</b> GO TO <b>5</b>
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<b>5 Active DTC Test With Engine Running Rough</b>	Read DTCs using the DST or Service ADVISOR while engine is operating under conditions where the miss/rough running complaint occurs.	<b>No active DTCs:</b> GO TO <b>6</b>  <b>Active DTCs present:</b> Diagnose active DTCs first. If any of the DTCs have an SPN 636 or 637, diagnose those first.
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6

Observable Diagnostics and Tests

<p><b>6 Compression and Misfire Test</b></p>	<ol style="list-style-type: none"> <li>Using the DST or Service ADVISOR, perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 of this manual.</li> <li>Make note of the results.</li> <li>Using the DST or Service ADVISOR, perform the Misfire Test. For instructions, see ENGINE TEST INSTRUCTIONS - MISFIRE TEST in Section 04, Group 160 of this manual.</li> <li>Make note of the results.</li> </ol>	<p><b>All cylinders scored within 10% of each other on both tests: GO TO 7</b></p> <p><b>One or more cylinders scored 10% or more lower than the rest of the cylinders on the Compression Test and DIFFERENT cylinder(s) scored 10% or more lower on the Misfire Test: GO TO 8</b></p> <p><b>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 9</b></p> <p><b>All cylinders scored within 10% of each other on the Compression Test and one or more cylinders scored 10% or more lower than other cylinders on the Misfire Test: Replace the EI(s) of the cylinder(s) that tested low on the Misfire Test.</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>7 Fuel Supply System Test</b></p>	<p>Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.</p>	<p><b>No fuel supply system problems: GO TO 10</b></p> <p><b>Fuel supply system problem found: Repair and retest.</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>8 Inconclusive Test Results</b></p>	<p>These types of results indicate either the Misfire Test or Compression Test could not operate correctly. Further engine diagnostics should be performed to determine if the engine misfire is caused by a faulty EI or by a compression problem.</p>	<p style="text-align: right;">-- -1/1</p>

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Observable Diagnostics and Tests

<p><b>9 Low Compression Pressure Check</b></p>	<p>Determine the cause of low compression pressure on the low scoring cylinders.</p>	<p>---1/1</p>
<p><b>10 Valve Clearance Test</b></p>	<p>Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</p>	<p><b>Valve clearance on all valves within specification:</b> GO TO <b>11</b></p> <p><b>Valve clearance on one or more valves out of specification:</b> Adjust valve clearance.</p> <p>---1/1</p>
<p><b>11 EI Cap Screw and EI Harness and Connector Test</b></p>	<ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove rocker arm cover.  <i>NOTE: Rocker arm cover gasket is reusable if no visible damages is detected. Do NOT store cover on gasket surface.</i></li> <li>3. Check EI rocker arms and valve rocker arm operation.  <i>NOTE: Verify that hold down clamps are positioned correctly.</i></li> <li>4. Check that the hold down clamp cap screws on all EIs are tightened and torque turned to specification. See INSTALL ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual.</li> <li>5. Inspect EI harness and EI harness connector for damage.</li> <li>6. When diagnostics are completed, reassemble the rocker arm cover and tighten to specifications.</li> </ol>	<p><b>All components operating correctly:</b> GO TO <b>12</b></p> <p><b>Faulty component found:</b> Repair faulty component and retest.</p> <p>---1/1</p>
<p><b>12 Verification Check</b></p>	<ol style="list-style-type: none"> <li>1. Ensure there are no engine mechanical problems.</li> <li>2. Ensure there is not something drawing excessive engine power.</li> <li>3. If none of the above problems are found, see E3 - ENGINE DOES NOT DEVELOP FULL POWER DIAGNOSTIC PROCEDURE in this Group.</li> </ol>	<p>---1/1</p>

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## E3 - Engine Does Not Develop Full Power

RG40854,00000C6 -19-15MAY02-1/1

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

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<p><b>❶ E3 - Preliminary Check</b></p>	<p>Before using this diagnostic procedure, check the following that could cause or be mistaken as low power:</p> <ol style="list-style-type: none"> <li>1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.</li> <li>2. Check for plugged air and fuel filters.</li> <li>3. Check for transmission problems.</li> <li>4. Check for engine mechanical problems.</li> <li>5. Check for excessive load on the engine.</li> <li>6. Check for unbalanced ballast.</li> </ol>	<p><b>Problems found:</b> GO TO <b>❷</b></p> <p><b>No problems found:</b> Repair and retest.</p>
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<p><b>❷ Active DTC Test</b></p>	<p><i>NOTE: Some DTCs may cause the ECU to derate the engine, which would cause low power.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU communication software</li> <li>4. Ignition ON, engine idling</li> <li>5. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>No active DTCs:</b> GO TO <b>❸</b></p> <p><b>Active DTC(s) present:</b> Diagnose active DTCs first.</p>
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Observable Diagnostics and Tests

<p><b>③ Exhaust Emission Check</b></p>	<ol style="list-style-type: none"> <li>1. Operate engine at full load rated speed.</li> <li>2. Under these conditions, determine type of exhaust emitted.</li> </ol>	<p><b>Small amount or no exhaust smoke:</b> GO TO <b>④</b></p> <p><b>Heavy white exhaust smoke:</b> See E4 - ENGINE EMITS EXCESSIVE WHITE EXHAUST SMOKE DIAGNOSTIC PROCEDURE later in this Group.</p> <p><b>Heavy black or gray exhaust smoke:</b> See E5 - ENGINE EMITS EXCESSIVE BLACK OR GRAY EXHAUST SMOKE DIAGNOSTIC PROCEDURE later in this Group.</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>④ Torque Curve Selection Check</b></p>	<p><i>NOTE: This check is not required for applications that either do not select multiple torque curves or use torque curve selection over the Controller Area Network (CAN). For these applications, GO TO ⑤</i></p> <ol style="list-style-type: none"> <li>1. Recreate the conditions of the low power complaint.</li> <li>2. Read the torque curve number.</li> <li>3. Compare the torque curve parameter to the appropriate torque curve chart. The ECU has the ability to operate on multiple torque curves selected by certain operating conditions. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual and refer to the corresponding torque curve for your application.</li> </ol>	<p><b>Torque curve number displayed is correct for the operating conditions of the low power complaint:</b> GO TO <b>⑤</b></p> <p><b>Torque curve number displayed is NOT correct for the operating conditions of the low power complaint:</b> Refer to machine manual to determine components that could prevent the correct torque curve from being selected. OR Investigate torque curve selection problems including checking for open, short, and grounded circuits in the torque curve selection wiring.</p> <p style="text-align: right;">-- -1/1</p>
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Observable Diagnostics and Tests

<p><b>5 Governor Droop Selection Mode Check</b></p>	<p><i>NOTE: This check is not required for applications that either do not select different droop modes or use droop mode selection over the Controller Area Network (CAN). For these applications, GO TO 6</i></p> <ol style="list-style-type: none"> <li>1. Operate engine and attempt to recreate the low power condition.</li> <li>2. Read the desired speed governor curve and the maximum speed governor curve .</li> <li>3. Compare governor selection to the appropriate governor mode chart. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual and refer to the corresponding maximum speed and desired speed governor curves for your application.</li> </ol>	<p><b>Governor droop mode is correct:</b> GO TO <b>6</b></p> <p><b>Governor droop mode is incorrect:</b> Refer to machine manual to determine components that could prevent the correct governor droop from being selected. OR Investigate droop mode selection problems including checking for open, short, and grounded circuits in the droop mode selection wiring.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>6 Compression and Misfire Test</b></p>	<ol style="list-style-type: none"> <li>1. Using the DST or Service ADVISOR, perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 of this manual.</li> <li>2. Make note of the results.</li> <li>3. Using the DST or Service ADVISOR, perform the Misfire Test. For instructions, see ENGINE TEST INSTRUCTIONS - MISFIRE TEST in Section 04, Group 160 of this manual.</li> <li>4. Make note of the results.</li> </ol>	<p><b>All cylinders scored within 10% of each other:</b> GO TO <b>7</b></p> <p><b>One or more cylinders scored 10% or more lower than other cylinders:</b> See E2 - ENGINE MISFIRE/RUNS IRREGULARLY DIAGNOSTIC PROCEDURE earlier in this Group.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>7 Throttle Test</b></p>	<ol style="list-style-type: none"> <li>1. Operate engine at full load rated speed.</li> <li>2. At these operating conditions, read throttle position data parameter.</li> </ol>	<p><b>97% or above:</b> GO TO <b>8</b></p> <p><b>Below 97%:</b> Refer to your machine manual and perform the throttle calibration procedure; then retest.</p> <p style="text-align: right;">-- -1/1</p>

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*Observable Diagnostics and Tests*

<p><b>8 Turbocharger Boost Pressure Check</b></p>	<p>Check Turbo Boost pressure. See MEASURE INTAKE MANIFOLD PRESSURE (TURBOCHARGER BOOST/POWER CHECK) in Section 04, Group 150 of 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM104).</p>	<p><b>Intake manifold pressure in range or above compared to boost specifications:</b> See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.</p> <p><b>Intake manifold pressure below range compared to boost specifications:</b> GO TO 9</p> <p style="text-align: right;">---1/1</p>
<p><b>9 Turbocharger Failure Check</b></p>	<p>Check the following that could cause reduces boost pressure:</p> <ul style="list-style-type: none"> <li>• Restricted air cleaner</li> <li>• Intake air leak</li> <li>• Exhaust air leak</li> <li>• Restriction in exhaust</li> <li>• Faulty turbocharger. See TURBOCHARGER INSPECTION in Section 02, Group 080 in 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</li> </ul>	<p><b>None of the problems found:</b> GO TO 10</p> <p><b>Above problem found:</b> Repair problem and retest.</p> <p style="text-align: right;">---1/1</p>
<p><b>10 Fuel Supply System Test</b></p>	<p>Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.</p>	<p><b>No fuel supply system problems:</b> GO TO 11</p> <p><b>Fuel supply system problem found:</b> Repair and retest.</p> <p style="text-align: right;">---1/1</p>

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Observable Diagnostics and Tests

<p><b>11 EI Cap Screw and EI Harness and Connector Test</b></p>	<ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove rocker arm cover.</li> </ol> <p><i>NOTE: Rocker arm cover gasket is reusable if no visible damages is detected. Do NOT store cover on gasket surface.</i></p> <ol style="list-style-type: none"> <li>3. Check EI rocker arms and valve rocker arm operation.</li> </ol> <p><i>NOTE: Verify that hold down clamps are positioned correctly.</i></p> <ol style="list-style-type: none"> <li>4. Check that the hold down clamp cap screws on all EIs are tightened and torque turned to specification. See INSTALL ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual.</li> <li>5. Inspect EI harness and EI harness connector for damage.</li> </ol>	<p><b>All components operating correctly:</b> GO TO <b>12</b></p> <p><b>Faulty component found:</b> Repair faulty component and retest.</p>
<p><b>12 Valve Clearance Check</b></p>	<p>Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</p>	<p><b>Valve clearance on one or more valves out of specification:</b> GO TO <b>13</b></p> <p><b>Valve clearance on all valves within specification:</b> Faulty high pressure fuel pump OR Faulty ECU.</p>
<p><b>13 Adjust Valve Clearance</b></p>	<p>Adjust valve clearance. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</p>	<p><b>Low power complaint is no longer present.</b></p> <p><b>If problem still exist:</b> Faulty high pressure fuel pump OR Faulty ECU</p>

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## E4 - Engine Emits Excessive White Exhaust Smoke

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### E4 - Engine Emits Excessive White Exhaust Smoke Diagnostic Procedure

*NOTE: This procedure should be used if the engine emits excessive white exhaust smoke. This type of smoke causes a burning sensation to the eyes. If engine emits a less heavy, bluish exhaust smoke, see 4.5L/6.8L - L1 - EXCESSIVE OIL CONSUMPTION in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104)*

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#### ① E4 - Preliminary Procedure

1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.
2. Ensure engine coolant temperature is not extremely low.

**Problem not found:**  
GO TO ②

**Problem found:**  
Repair and retest.

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#### ② Head Gasket Test

Check for failed head gasket. See CHECK FOR HEAD GASKET FAILURES in Section 04, Group 150 of 4.5L and 6.8L Diesel Engines Base Engine Manual (CTM 104).

**No signs of head gasket failure.**  
GO TO ③

**Signs of head gasket failure are found:**  
See HEAD GASKET INSPECTION AND REPAIR SEQUENCE in Group 021 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

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Observable Diagnostics and Tests

<p><b>3 Compression Test</b></p>	<p>Perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 of this manual.</p>	<p><b>All cylinders scored within 10% of each other:</b> GO TO <b>4</b></p> <p><b>One or more cylinders scored 10% or more lower than other cylinders:</b> See E2 - ENGINE MISFIRE/RUNS IRREGULARLY DIAGNOSTIC PROCEDURE earlier in this Group.</p>
<p><b>4 Fuel Pressure Check</b></p>	<ol style="list-style-type: none"> <li>1. Read fuel rail pressure (actual) when engine is idling using the DST or Service ADVISOR.</li> <li>2. Check fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE later in this Group.</li> </ol>	<p><b>Both pressures within specification:</b> GO TO <b>5</b></p> <p><b>Either pressure below specification:</b> See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.</p>
<p><b>5 Valve Clearance Check</b></p>	<p>Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</p>	<p><b>Valve clearance on one or more valves out of specification:</b> GO TO <b>6</b></p> <p><b>Valve clearance on all valves within specification:</b> Ensure there are no engine mechanical problems. If no other problems are found, see E3 - ENGINE DOES NOT DEVELOP FULL POWER DIAGNOSTIC PROCEDURE earlier in this Group.</p>

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*Observable Diagnostics and Tests*

**⑥ Adjust Valve Clearance**

Adjust valve clearance. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 86).

**White exhaust smoke is no longer present.**

**If problem still exist:**  
Faulty high pressure fuel pump  
OR  
Faulty ECU

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## E5 - Engine Emits Excessive Black Or Gray Exhaust Smoke

RG40854,00000B3 -19-08MAY02-1/1

### 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, bluish exhaust smoke, see 4.5L/6.8L - L1 - EXCESSIVE OIL CONSUMPTION in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).*

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17

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<p><b>① E5 - Preliminary Check</b></p>	<p>Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. Ensure engine is not excessively loaded Ensure air filter is not restricted or plugged.</p>	<p><b>Problem not found:</b> GO TO <b>②</b></p> <p><b>Problem found:</b> Repair and retest</p> <p>-- 1/1</p>
<p><b>② Intake and Exhaust Restriction and Air Leak Test</b></p>	<p>Check for intake and exhaust restrictions and air leaks. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS and CHECK FOR EXHAUST AIR LEAKS (TURBOCHARGED ENGINES) in Section 04, Group 150 of 4.5L &amp; 6.8L Diesel Engines Base Engine Manual (CTM 104)</p>	<p><b>No restrictions or leaks found:</b> GO TO <b>③</b></p> <p><b>Restrictions or leaks found:</b> Repair or replace components as necessary.</p> <p>-- 1/1</p>
<p><b>③ Turbocharger Failure Test</b></p>	<p>Check for turbocharger failure. See TURBOCHARGER INSPECTION in Section 02, Group 080 in 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</p>	<p><b>No turbocharger failure found:</b> GO TO <b>④</b></p> <p><b>Turbocharger failure found:</b> Follow appropriate repair procedure in Section 02, Group 080 of 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</p> <p>-- 1/1</p>

*Observable Diagnostics and Tests*

<p><b>④ Valve Clearance Check</b></p>	<p>Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</p>	<p><b>Valve clearance on all valves within specification:</b> GO TO ⑥</p> <p><b>Valve clearance on one or more valves out of specification:</b> GO TO ⑤</p> <p style="text-align: right;">---1/1</p>
<p><b>⑤ Adjust Valve Clearance</b></p>	<p>Adjust valve clearance. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L &amp; 6.8L Diesel Engine Base Engine Manual (CTM 104).</p>	<p><b>Black or gray exhaust smoke is no longer present.</b></p> <p><b>Adjusted valve clearance and black or gray exhaust smoke is still present:</b> GO TO ⑥</p> <p style="text-align: right;">---1/1</p>
<p><b>⑥ Pump Position Timing Check</b></p>	<p>Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING later in this Group.</p>	<p><b>Timing is OK:</b> Ensure there are no engine mechanical problems. If no other problems are found, continue diagnosing by going to diagnostic chart E3 - ENGINE DOES NOT DEVELOP FULL POWER DIAGNOSTIC PROCEDURE earlier in this Group.</p> <p><b>Timing out of sync:</b> Adjust timing and retest.</p> <p style="text-align: right;">---1/1</p>

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18

## E6 - Engine Will Not Crank

Symptom	Problem	Solution
<b>E6 - Engine Will Not Crank</b>	Weak battery	Replace battery.
	Corroded or loose battery connections	Clean battery terminals and connections.
	Defective main switch or start safety switch	Repair switch as required.
	Starter solenoid defective	Replace solenoid.
	Starter defective	Replace starter.
	Start circuit defective	Check wiring, fuses, and relays.
	Engine is seized up	Check by rotating engine by hand.

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19

## E7 - Engine Idles Poorly

Symptom	Problem	Solution
<b>E7 - Engine Idles Poorly</b>	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 SPECIFICATIONS in Section 06, Group 200 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).
	Electronic control system problem or basic engine problem	See E2 - ENGINE MISFIRE/RUNS IRREGULARLY DIAGNOSTIC PROCEDURE earlier in this Group.

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## E8 - Abnormal Engine Noise

Symptom	Problem	Solution
<b>E8 - Abnormal Engine Noise</b>	Worn main or connecting rod bearings	Determine bearing clearance. See CYLINDER BLOCK, LINERS, PISTONS, AND RODS SPECIFICATIONS in Group 200 or CRANKSHAFT, MAIN BEARINGS, AND FLYWHEEL SPECIFICATIONS in Section 06, Group 200 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).
	Excessive crankshaft end play	Check crankshaft end play. See CHECK CRANKSHAFT END PLAY in Section 06, Group 040 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).
	Loose main bearing caps	Check bearing clearance; replace bearings and bearing cap screws as required. See CRANKSHAFT, MAIN BEARINGS, AND FLYWHEEL SPECIFICATIONS in Group 200 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).
	Worn connecting rod bushings and piston pins	Inspect piston pins and bushings. See INSPECT PISTON PINS AND BUSHINGS in Section 02, Group 030 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).
	Scored pistons	Inspect pistons. See INSPECT PISTON PINS AND BUSHINGS in Section 02, Group 030 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).

Continued on next page

RG40854,00000B6 -19-08MAY02-1/2



Observable Diagnostics and Tests

Symptom	Problem	Solution
	Worn timing gears or excess back lash	Check timing gear back lash. See and MEASURE CAMSHAFT END PLAY and MEASURE TIMING GEAR BACKLASH in Section 02, Group 050 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).
	Excessive valve clearance	Check and adjust valve clearance. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104).
	Worn camshaft	Inspect camshaft. See VISUALLY INSPECT CAMSHAFT in Section 02, Group 050 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).
	Worn rocker arm shaft(s)	Inspect rocker arm shafts. See DISASSEMBLE AND INSPECT ROCKER ARM SHAFT ASSEMBLY in Section 02, Group 021 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).
	Insufficient engine lubrication	See L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).
	Turbocharger noise	See TURBOCHARGER INSPECTION in Section 02, Group 080 in 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104).

04  
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21

RG40854,00000B6 -19-08MAY02-2/2

## E9 - Analog Throttle (A) Does Not Respond

*NOTE: This procedure is necessary for OEM applications only. For other applications, check for Diagnostic Trouble Codes (DTCs) and follow the corresponding procedure.*

Symptom	Problem	Solution
<b>E9 - Analog Throttle (A) Does Not Respond</b>	Active DTC Check	Read DTCs on DST or SERVICE ADVISOR™. Go to the diagnostic procedure for the corresponding DTC.
	Analog Throttle (A) Check	See T4 - ANALOG THROTTLE (A) INPUT LOW DIAGNOSTIC PROCEDURE in Group 160 of this manual.

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## E10 - Analog Throttle (B) Does Not Respond

*NOTE: This procedure is necessary for OEM applications only. For other applications, check for Diagnostic Trouble Codes (DTCs) and follow the corresponding procedure.*

Symptom	Problem	Solution
<b>E10 - Analog Throttle (B) Does Not Respond</b>	Active DTC Check	Read DTCs on DST or SERVICE ADVISOR™. Go to the diagnostic procedure for the corresponding DTC.
	Analog Throttle (B) Check	See T6 - ANALOG THROTTLE (B) INPUT LOW DIAGNOSTIC PROCEDURE in Group 160 of this manual.

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22



## F1 - Fuel Supply System Check

RG40854,00000C7 -19-16MAY02-1/1

### F1 - Fuel Supply System Check Diagnostic Procedure

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#### 1 F1 - Preliminary Check

*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.*

1. If fuel system has been recently opened (filter changed, line removed etc.) perform fuel system bleed procedure. See BLEED THE FUEL SYSTEM later in this Group and retest.
2. Check for ruptured fuel lines.
3. Check for restricted vent in fuel tank.
4. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.

**No problem found:**  
GO TO 2

**Problem found:**  
Repair and retest

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#### 2 Active DTC Test

*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.*

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 Section 04, Group 160 earlier in this manual.
2. Ignition ON, engine OFF
3. Start the ECU diagnostic software
4. Ignition ON, engine OFF or running
5. Read DTCs using DST or SERVICE ADVISOR™.

**No active DTCs present:**  
GO TO 3

**Active DTC(s) present:**  
Diagnose active DTCs first.  
If any of the DTCs have a SPN 636 or 637, go to those first.

**Can not communicate with ECU:**  
See D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR DIAGNOSTIC PROCEDURE later in this Group.

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#### 3 Engine Start Test

*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.*

Ignition ON, engine cranking

**Engine starts:**  
GO TO 12

**Engine cranks but won't start:**  
GO TO 4

---1/1

Observable Diagnostics and Tests

<p><b>4 Air in Fuel Check</b></p>	<p><i>NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.</i></p> <p>Check for air in the fuel. See TEST FOR AIR IN FUEL later in this Group.</p>	<p><b>No air found in fuel system:</b> GO TO <b>5</b></p> <p><b>Air found in fuel system:</b> Bleed the fuel system. See BLEED THE FUEL SYSTEM later in this Group.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>5 Cranking Fuel Rail Pressure Test</b></p>	<p><i>NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine cranking</li> <li>2. Using the ECU diagnostic software, read fuel rail pressure - actual</li> </ol>	<p><b>Consistently below 20 MPa (200 bar) (2900 psi):</b> GO TO <b>6</b></p> <p><b>Consistently above 20 MPa (200 bar) (2900 psi):</b> No fuel system problem is apparent. See E1-ENGINE CRANKS/WON'T START DIAGNOSTIC PROCEDURE earlier in this Group.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>6 Fuel Pressure at Final Fuel Filter Check</b></p>	<p><i>NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Connect proper pressure gauge from Universal Pressure Kit JT05412 to diagnostic port on final fuel filter base.</li> <li>3. Ignition ON, engine cranking</li> <li>4. Using gauge, read pressure</li> </ol>	<p><b>Consistently at or below 30 kPa (0.3 bar) (4.4 psi):</b> GO TO <b>7</b></p> <p><b>Consistently above 30 kPa (0.3 bar) (4.4 psi):</b> GO TO <b>10</b></p> <p style="text-align: right;">-- -1/1</p>

04  
150  
25

Observable Diagnostics and Tests

<p><b>7 Final Fuel Filter Check</b></p>	<p><i>NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.</i></p> <p>Replace the final fuel filter element and recheck fuel pressure at the rail and the final fuel filter. See REPLACE FINAL FUEL FILTER ELEMENT in Section 02, Group 090 earlier in this manual.</p>	<p><b>Fuel pressure still below specification:</b> GO TO <b>8</b></p> <p><b>Fuel pressure in specification:</b> Problem fixed.</p> <p style="text-align: right;">---1/1</p>
<p><b>8 Pre-filter Check</b></p>	<p><i>NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.</i></p> <p>Replace the pre-filter element and recheck fuel pressure at the rail and the final fuel filter. See REPLACE PRE-FILTER ELEMENT in Section 02, Group 090 earlier in this manual.</p>	<p><b>Fuel pressure still below specification:</b> GO TO <b>9</b></p> <p><b>Fuel pressure in specification:</b> Problem fixed.</p> <p style="text-align: right;">---1/1</p>
<p><b>9 Fuel Line Check</b></p>	<p><i>NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.</i></p> <p>Check for a partially restricted fuel line between the following:</p> <ul style="list-style-type: none"> <li>• Fuel tank and pre-filter</li> <li>• Pre-filter and transfer pump inlet</li> <li>• Transfer pump outlet and final fuel filter inlet</li> </ul>	<p><b>No restrictions found:</b> GO TO <b>10</b></p> <p><b>Restriction(s) found:</b> Repair fuel line and retest.</p> <p style="text-align: right;">---1/1</p>
<p><b>10 Fuel Line Check</b></p>	<p><i>NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.</i></p> <p>Check for a partially restricted fuel line between the final fuel filter outlet and the high pressure fuel pump inlet</p>	<p><b>No restrictions found:</b> GO TO <b>11</b></p> <p><b>Restriction(s) found:</b> Repair fuel line and retest.</p> <p style="text-align: right;">---1/1</p>

04  
150  
26

Observable Diagnostics and Tests

<p><b>11 High Pressure Fuel Pump Inlet Filter Check</b></p>	<p><i>NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove high pressure fuel pump from engine. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP in Section 02, Group 090 of this manual.</li> <li>3. Remove high pressure fuel pump inlet filter and replace. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP INLET FILTER in Section 02, Group 090 of this manual.</li> <li>4. Install high pressure fuel pump. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP in Section 02, Group 090 of this manual.</li> <li>5. Try to start engine</li> </ol>	<p><b>No fuel flows through check valve:</b> Faulty check valve. Replace check valve and bleed the fuel system. See BLEED THE FUEL SYSTEM later in this Group. Retest</p> <p><b>Fuel flow through check valve present:</b> Faulty high pressure fuel pump. Replace and retest</p> <p style="text-align: right;">-- -1/1</p>
<p><b>12 Fuel Rail Pressure Test</b></p>	<p><i>NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine running at low idle</li> <li>2. Using the ECU diagnostic software, read fuel rail pressure - actual with engine at low idle</li> </ol>	<p><b>Rail pressure consistently below 35 MPa (350 bar) (5076 psi):</b> GO TO <b>13</b></p> <p><b>Rail pressure consistently at or above 35 MPa (350 bar) (5076 psi):</b> No fuel system problem found.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>13 Fuel Pressure at Final Fuel Filter Check</b></p>	<p><i>NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Connect proper pressure gauge from Universal Pressure Kit JT05412 to diagnostic port on final fuel filter base.</li> <li>3. Ignition ON, engine running at low idle</li> <li>4. Using gauge, read pressure</li> </ol>	<p><b>Consistently at or below 40 kPa (0.4 bar) (5.8 psi):</b> GO TO <b>15</b></p> <p><b>Consistently above 40 kPa (0.4 bar) (5.8 psi):</b> GO TO <b>14</b></p> <p style="text-align: right;">-- -1/1</p>

04  
150  
27

Observable Diagnostics and Tests

**14 Pressure Limiter Test**

*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.*



**CAUTION:** Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

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

1. Before removing fuel line from pressure limiter, turn engine OFF and let sit for at least 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail.
2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure limiter.
3. Disconnect fuel return line fitting at the fuel leak-off line from the pressure limiter valve. Do NOT remove the pressure limiter valve.
4. Run a clear line from a suitable container for diesel fuel to the pressure limiter valve
5. Ignition ON, engine running.
6. Check fuel flow at pressure limiter valve.

**Minimal or no fuel present:**  
GO TO **15**

**Fuel flow is present:**  
Faulty pressure limiter valve. Replace pressure limiter and retest. See REMOVE AND INSTALL PRESSURE LIMITER in Section 02, Group 090 earlier in this manual.

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**15 Final Fuel Filter Check**

*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.*

Replace the final fuel filter element and recheck fuel pressure at the rail and the final fuel filter. See REPLACE FINAL FUEL FILTER ELEMENT in Section 02, Group 090 earlier in this manual.

**Fuel pressure in specification:**  
Problem fixed.

**Fuel pressure still below specification:**  
Faulty high pressure fuel pump  
OR  
Faulty ECU

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04  
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28



## F2 - Excessive Fuel Consumption

Symptom	Problem	Solution
<b>F2 - Excessive Fuel Consumption</b>	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.

04  
150  
29

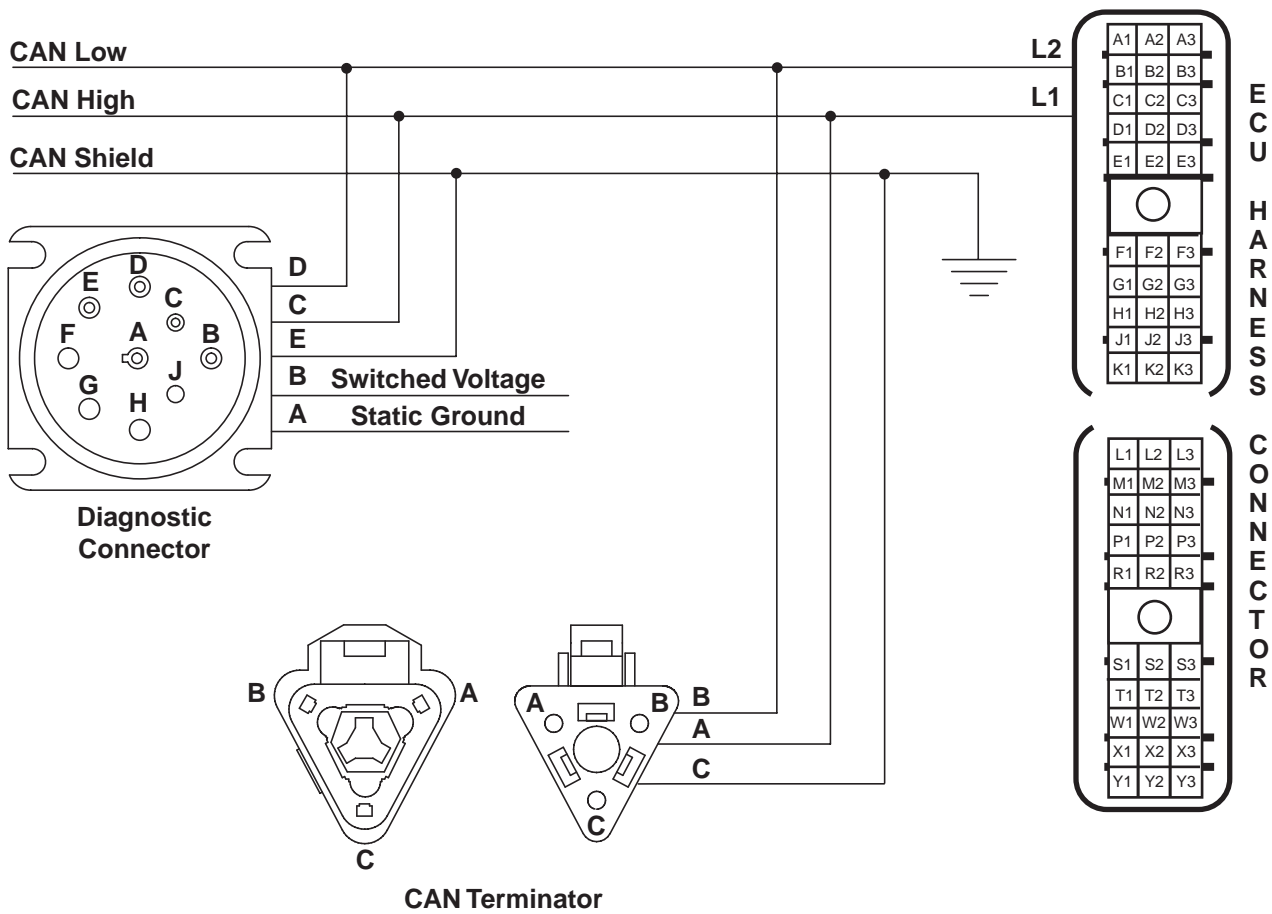
RG40854,00000B7 -19-08MAY02-1/1

## F3 - Fuel in Oil

Symptom	Problem	Solution
<b>F3 - Fuel in Oil</b>	Faulty high pressure fuel pump front seal	Replace front seal.

RG40854,00000B9 -19-08MAY02-1/1

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



RG11336 -19-17NOV00

This diagnostic procedure should be used if communication between the Diagnostic Scan Tool

(DST) and the Engine Control Unit (ECU) cannot be established.

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RG40854,00000BA -19-08MAY02-1/1

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

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RG40854.00000BC -19-08MAY02-1/1

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

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors, the diagnostic connector, CAN terminator connector, and any connectors between them looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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31

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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Make sure all communication cables are properly connected</li> <li>3. Ignition ON, engine OFF</li> <li>4. Start the ECU communication software</li> </ol>	<p><b>Can not communicate with ECU:</b> GO TO <b>❸</b></p> <p><b>Communicates with ECU:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Observable Diagnostics and Tests

<p><b>3 Sensor Voltage Test</b></p>	<p><i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect any one of the following: <ul style="list-style-type: none"> <li>• Fuel temperature sensor</li> <li>• MAT sensor</li> <li>• ECT sensor</li> </ul> </li> </ol> <p>For sensor location, see ELECTRONIC CONTROL SYSTEM OVERVIEW in Section 03, Group 140 of this manual.</p> <ol style="list-style-type: none"> <li>3. Ignition ON</li> <li>4. Using a multimeter, measure the voltage between both terminals of the selected sensor harness connector.</li> </ol>	<p><b>4.5 volts or above:</b> GO TO <b>5</b></p> <p><b>Below 4.5 volts:</b> GO TO <b>4</b></p>
<p><b>4 Power Supply Test</b></p>	<p><i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both 30-way ECU connectors.</li> <li>3. Ignition ON</li> <li>4. Using a multimeter, measure the voltage between a good chassis ground and terminal E3 in the harness end of the ECU connector.</li> </ol>	<p><b>10.0 volts or above:</b> Faulty ECU power wiring OR Faulty ECU.</p> <p><b>Below 10.0 volts:</b> Faulty ECU power fuse OR Key-on signal wire shorted to ground OR Faulty ignition switch OR Faulty key-on power fuse.</p>
<p><b>5 PDM Power Light Test</b></p>	<p><i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON</li> <li>2. Note power light on the Parallel Data Module (PDM).</li> </ol>	<p><b>Power light is Green:</b> GO TO <b>8</b></p> <p><b>Power light is OFF:</b> GO TO <b>6</b></p>
<p><b>6 Open in Diagnostic Connector Ground Wire Test</b></p>	<p><i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect the diagnostic cable from the diagnostic connector on main harness.</li> <li>3. Using a multimeter, measure the voltage between the ground terminal and the power terminal (terminals A and B) in the diagnostic connector on the main harness.</li> </ol>	<p><b>Substantially less than battery voltage:</b> GO TO <b>7</b></p> <p><b>Light OFF:</b> Faulty diagnostic cable between diagnostic connector and PDM OR Faulty Parallel Data Module (PDM)</p>

04  
150  
32

*Observable Diagnostics and Tests*

<p><b>7 Harness Power and Ground Wire Test</b></p>	<p><i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect the diagnostic cable from the diagnostic connector on the main harness.</li> <li>3. Probe terminal A in the diagnostic connector with test light connected to battery voltage.</li> </ol>	<p><b>Light ON:</b> Faulty diagnostic connector OR Open or short to ground in diagnostic connector power wire.</p> <p><b>Light OFF:</b> Faulty diagnostic connector OR Open in diagnostic connector ground wire.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>8 Open in Harness Circuit Test</b></p>	<p><i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both 30-way ECU connectors and diagnostic cable from the diagnostic connector</li> <li>3. Using a multimeter, measure resistance on the harness end of both connectors between: <ul style="list-style-type: none"> <li>• Terminal D in the diagnostic connector and terminal L2 in the ECU connector.</li> <li>• Terminal C in the diagnostic connector and terminal L1 in the ECU connector.</li> </ul> </li> </ol>	<p><b>All measurements 5 ohms or less:</b> GO TO <b>8</b></p> <p><b>One or more measurements greater than 5 ohms:</b> Open in harness circuit OR Connector terminals in wrong position.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>9 CAN Resistance Check</b></p>	<p><i>NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. ECU and diagnostic connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminals C and D in the harness end of the diagnostic connector.</li> </ol>	<p><b>Between 45 - 75 ohms:</b> GO TO <b>9</b></p> <p><b>Less than 45 ohms or greater than 75 ohms:</b> Faulty or missing CAN terminator connector(s). OR Open or short in CAN wiring harness</p> <p style="text-align: right;">-- -1/1</p>

04  
150  
33

Observable Diagnostics and Tests

**10 CAN High and Low Voltage Test**

*NOTE: For wiring information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information.*

1. Ignition OFF
2. Reconnect both 30-way ECU connectors.
3. Ignition ON
4. Using a multimeter, measure voltage between a good chassis ground and:
  - Terminal C in the diagnostic connector.
  - Terminal D in the diagnostic connector.

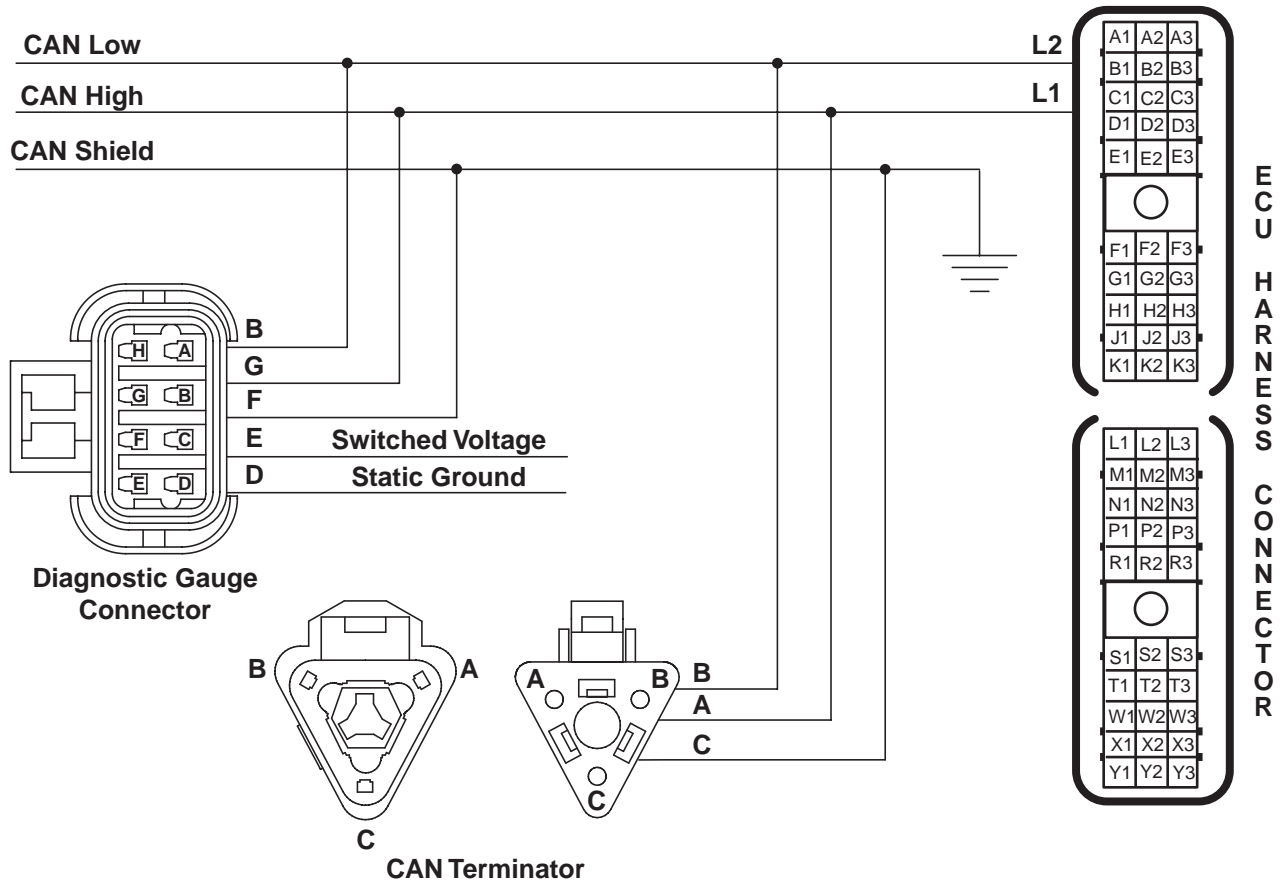
**Both measurements between 1.5 - 3.5 volts:**  
Faulty ECU/Cab Harness connection  
OR  
Faulty diagnostic cable  
OR  
Faulty diagnostic connector  
OR  
Faulty Parallel Port Data Module (PDM)  
OR  
Faulty diagnostic software/computer configuration  
OR  
Faulty ECU

**Either measurement less than 1.5 volts or greater than 3.5 volts:**  
CAN wiring shorted to ground or voltage  
OR  
Faulty ECU

04  
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34



## D2 - Diagnostic Gauge Does Not Communicate With ECU



RG11649 -19-23JAN01

### Internal Diagnostic Gauge Errors

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

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

RG40854,00000BD -19-17DEC02-1/1

04  
150  
36



**D2 - Diagnostic Gauge Does Not Communicate With ECU**

RG40854.00000BE -19-08MAY02-1/1

**D2 - Diagnostic Gauge Does Not Communicate With ECU Diagnostic Procedure**

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors, the diagnostic connector, CAN terminator connector, and any connectors between them looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Ignition ON</li> </ol>	<p><b>Error or no power found in diagnostic gauge:</b> GO TO <b>❸</b></p> <p><b>No error found and power present in diagnostic gauge:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>

04  
150  
37

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Observable Diagnostics and Tests

<p><b>3 Sensor Voltage Test</b></p>	<p><i>NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect any of the following: <ul style="list-style-type: none"> <li>Fuel temperature sensor</li> <li>MAT sensor</li> <li>ECT sensor</li> </ul> </li> <li>Ignition ON</li> <li>Using a multimeter, measure the voltage between both terminals of the selected sensor harness connector.</li> </ol>	<p><b>4.5 V or above:</b> GO TO <b>5</b></p> <p><b>Below 4.5 V:</b> GO TO <b>4</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>4 Power Supply Test</b></p>	<p><i>NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect both 30 way ECU connectors.</li> <li>Ignition ON</li> <li>Using a multimeter, measure the voltage between a good ground and terminal E3 in the harness end of the ECU connector.</li> </ol>	<p><b>10.0 V or above:</b> Faulty ECU power wiring OR Faulty ECU</p> <p><b>Below 10.0 V:</b> Key-on signal wire open or short to ground OR Faulty ignition switch OR Faulty ECU power fuse</p> <p style="text-align: right;">-- -1/1</p>
<p><b>5 Diagnostic Gauge Power Test</b></p>	<p><i>NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition ON</li> <li>View diagnostic gauge</li> </ol>	<p><b>Gauge has power:</b> GO TO <b>8</b></p> <p><b>Gauge does not have power:</b> GO TO <b>6</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>6 Open in Diagnostic Gauge Connector Ground Wire Test</b></p>	<p><i>NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect the diagnostic gauge from the diagnostic connector.</li> <li>Using a multimeter, measure voltage between the switched voltage terminal and the ground terminal (terminals D and E) of the harness end of the diagnostic gauge connector.</li> </ol>	<p><b>Substantially less than battery voltage:</b> GO TO <b>7</b></p> <p><b>At or near battery voltage:</b> Faulty diagnostic connector OR Faulty diagnostic cable OR Faulty Parallel Port Data Module (PDM)</p> <p style="text-align: right;">-- -1/1</p>

04  
150  
38

*Observable Diagnostics and Tests*

<p><b>7 Open in Diagnostic Gauge Connector Power Wire Test</b></p>	<p><i>NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect the diagnostic gauge connector.</li> <li>3. Probe terminal D in the diagnostic gauge connector with a test light connected to battery voltage.</li> </ol>	<p><b>Light ON:</b> Open or short to ground in diagnostic gauge power wire.</p> <p><b>Light OFF:</b> Open in diagnostic gauge connector ground wire.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>8 Open in Harness Circuit Test</b></p>	<p><i>NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both 30-way ECU connectors and the diagnostic cable from the diagnostic connector.</li> <li>3. Using a multimeter, measure resistance on the harness end of both connectors between: <ul style="list-style-type: none"> <li>• Terminal B in the diagnostic gauge connector and terminal L2 in the ECU connector.</li> <li>• Terminal G in the diagnostic gauge connector and terminal L1 in the ECU connector.</li> </ul> </li> </ol>	<p><b>All measurements 5 ohms or less:</b> GO TO ③</p> <p><b>One or more measurements greater than 5 ohms:</b> Open in harness circuit OR Connector terminals in wrong position</p> <p style="text-align: right;">-- -1/1</p>
<p><b>9 CAN Resistance Test</b></p>	<p><i>NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Both 30-way ECU and diagnostic connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminals B and G in the harness end of the diagnostic connector.</li> </ol>	<p><b>Between 45-75 ohms:</b> GO TO ⑨</p> <p><b>Less than 45 or greater than 75 ohms:</b> Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness</p> <p style="text-align: right;">-- -1/1</p>

04  
150  
39

Observable Diagnostics and Tests

**10 CAN High and Low Voltage Test**

*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.*

1. Ignition OFF
2. Reconnect both 30-way ECU connectors.
3. Ignition ON
4. Using a multimeter, measure voltage between a good chassis ground and:
  - Terminal B in the diagnostic gauge connector
  - Terminal G in the diagnostic gauge connector

**Both measurements between 1.5 - 3.5 V:**  
Faulty ECU connection  
OR  
Faulty diagnostic gauge connection  
OR  
Faulty diagnostic software/computer configuration  
OR  
Faulty ECU

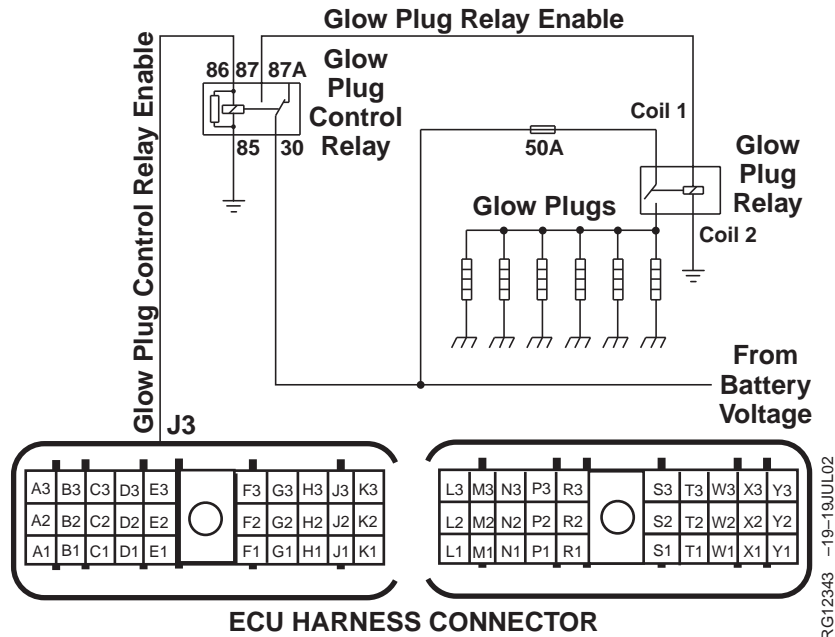
**Either measurement less than 1.5 V or greater than 3.5 V:**  
CAN wiring shorted to ground or power  
OR  
Faulty ECU

--1/1

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## A2 - Glow Plug Check



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### Glow Plugs

Glow plugs are located above each cylinder's combustion chamber. Its function is to heat the intake air during cold starting conditions. Its operation time is dependent on the fuel temperature that the ECU detects at key-on. The table below explains this relationship.

The ECU sends battery voltage out of terminal J3 to power the glow plug relay when fuel temperature is below the required specification. The glow plug relay

allows battery voltage to power the glow plugs. On OEM applications, there is a glow plug control relay that controls the activation of the glow plug relay. When the ECU stops sending voltage out of terminal J3, the relay(s) deactivate effectively taking power away from the glow plugs.

Either a monitor or a wait lamp indicates to the operator when the engine should be started after pre-heating is performed by the glow plugs. On applications that use a lamp, the lamp is ON to signal to the operator to wait to start the engine. To ensure full utilization of the glow plugs, the operator should wait until the light goes out before starting the engine. Anytime the engine cranks but does not start, a key-off/key-on cycle will be required before preheating is allowed again. A table is included on the following page. See A2 - GLOW PLUG CHECK in this Group.

RG40854.0000150 -19-17JUL02-1/1

## A2 - Glow Plug Check

*NOTE: The air heater indicator light is the same light that trouble codes are displayed on. If the light stays on past 30 seconds, check for trouble codes or a short to ground in the air heater indicator light wire.*

Glow Plug Operating Conditions - Combines -Glow Plug Operation - Combines		
Fuel Temperature	Preheat Time	Reheat Time
-30°C (-22°F)	15 seconds	10 seconds
-25°C (-13°F)	15 seconds	10 seconds
-20°C (-4°F)	11 seconds	10 seconds
-15°C (5°F)	7 seconds	10 seconds
-10°C (14°F)	4.5 seconds	10 seconds
-5°C (23°F)	2.2 seconds	10 seconds
0°C (32°F)	0 seconds	0 seconds

Glow Plug Operating Conditions - Loaders -Glow Plug Operation - Loaders		
Fuel Temperature	Preheat Time	Reheat Time
-30°C (-22°F)	15 seconds	30 seconds
-25°C (-13°F)	15 seconds	30 seconds
-20°C (-4°F)	11 seconds	20 seconds
-15°C (5°F)	7 seconds	10 seconds
-10°C (14°F)	4.5 seconds	10 seconds
-5°C (23°F)	2.2 seconds	10 seconds
0°C (32°F)	0 seconds	0 seconds

Glow Plug Operating Conditions - Motor Graders -Glow Plug Operation - Motor Graders		
Fuel Temperature	Preheat Time	Reheat Time
-30°C (-22°F)	15 seconds	30 seconds
-25°C (-13°F)	15 seconds	30 seconds
-20°C (-4°F)	11 seconds	20 seconds
-15°C (5°F)	7 seconds	10 seconds
-10°C (14°F)	4.5 seconds	10 seconds
-5°C (23°F)	2.2 seconds	10 seconds
0°C (32°F)	0 seconds	0 seconds

Glow Plug Operating Conditions - OEM -Glow Plug Operation - OEM		
Fuel Temperature	Preheat Time	Reheat Time
-30°C (-22°F)	15 seconds	30 seconds
-25°C (-13°F)	15 seconds	30 seconds
-20°C (-4°F)	11 seconds	20 seconds
-15°C (5°F)	7 seconds	10 seconds
-10°C (14°F)	4.5 seconds	10 seconds
-5°C (23°F)	2.2 seconds	10 seconds
0°C (32°F)	0 seconds	0 seconds

Glow Plug Operating Conditions - Tractors - 6020 Series -Glow Plug Operation - Tractors - 6020 Series		
Fuel Temperature	Preheat Time	Reheat Time
-30°C (-22°F)	15 seconds	30 seconds
-25°C (-13°F)	15 seconds	30 seconds
-20°C (-4°F)	11 seconds	20 seconds
-15°C (5°F)	7 seconds	10 seconds
-10°C (14°F)	4.5 seconds	10 seconds
-5°C (23°F)	2.2 seconds	10 seconds
0°C (32°F)	0 seconds	0 seconds

Glow Plug Operating Conditions - Tractors - 7720/7820 Series -Glow Plug Operation - Tractors - 7720/7820 Series		
Fuel Temperature	Preheat Time	Reheat Time
-30°C (-22°F)	15 seconds	10 seconds
-25°C (-13°F)	15 seconds	10 seconds
-20°C (-4°F)	11 seconds	10 seconds
-15°C (5°F)	7 seconds	10 seconds
-10°C (14°F)	4.5 seconds	10 seconds
-5°C (23°F)	2.2 seconds	10 seconds
0°C (32°F)	0 seconds	0 seconds

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## A2 - Glow Plug Check

RG40854.0000152 -19-18JUL02-1/1

### A2 - Glow Plug Check Diagnostic Procedure

---1/1

#### ① 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 A2 - GLOW PLUG CHECK supporting information.*

Perform a preliminary inspection of the ECU connectors, glow plug relay connector(s), glow plug connectors, and any connectors between them looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

---1/1

#### ② Air Heater Indicator Light Check

*NOTE: For wiring and theory of operation information, see A2 - GLOW PLUG CHECK supporting information*

1. Ignition ON, engine OFF
2. Verify that the air heater indicator light or monitor message is working

**Light or monitor works:**  
GO TO ③

**Light or monitor does not work:**  
Faulty air heater indicator light wiring  
OR  
Faulty air heater indicator light

---1/1

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44



## Observable Diagnostics and Tests

<p><b>3 Active DTC Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see A2 - GLOW PLUG CHECK supporting information</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU Communication Software</li> <li>4. Ignition ON, engine OFF</li> <li>5. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>No active DTC(s) present:</b> GO TO <b>4</b></p> <p><b>Active DTC(s) present:</b> Go to appropriate diagnostic procedure</p>
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SERVICE ADVISOR is a trademark of Deere & Company -- -1/1

<p><b>4 Fuel Temperature Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see A2 - GLOW PLUG CHECK CHECK supporting information</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF</li> <li>2. Read the fuel temperature parameter</li> </ol>	<p><b>Below 0°C (32°F):</b> GO TO <b>5</b></p> <p><b>At or above 0°C (32°F):</b> No glow plug-related problem found</p> <p style="text-align: right; font-size: x-small;">-- -1/1</p>
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<p><b>5 Voltage at Air Heater Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see A2 - GLOW PLUG CHECK CHECK supporting information</i></p> <p><i>NOTE: For 6020 Tractor and Combine applications, GO TO 6</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect all glow plug connectors</li> <li>3. Using a multimeter, measure the voltage between each glow plug connector and a good chassis ground while turning ignition ON (engine OFF).</li> </ol> <p><i>NOTE: Voltage must be read as ignition is turned ON</i></p>	<p><b>At or near battery voltage:</b> GO TO <b>6</b></p> <p><b>No voltage detected:</b> GO TO <b>7</b></p> <p style="text-align: right; font-size: x-small;">-- -1/1</p>
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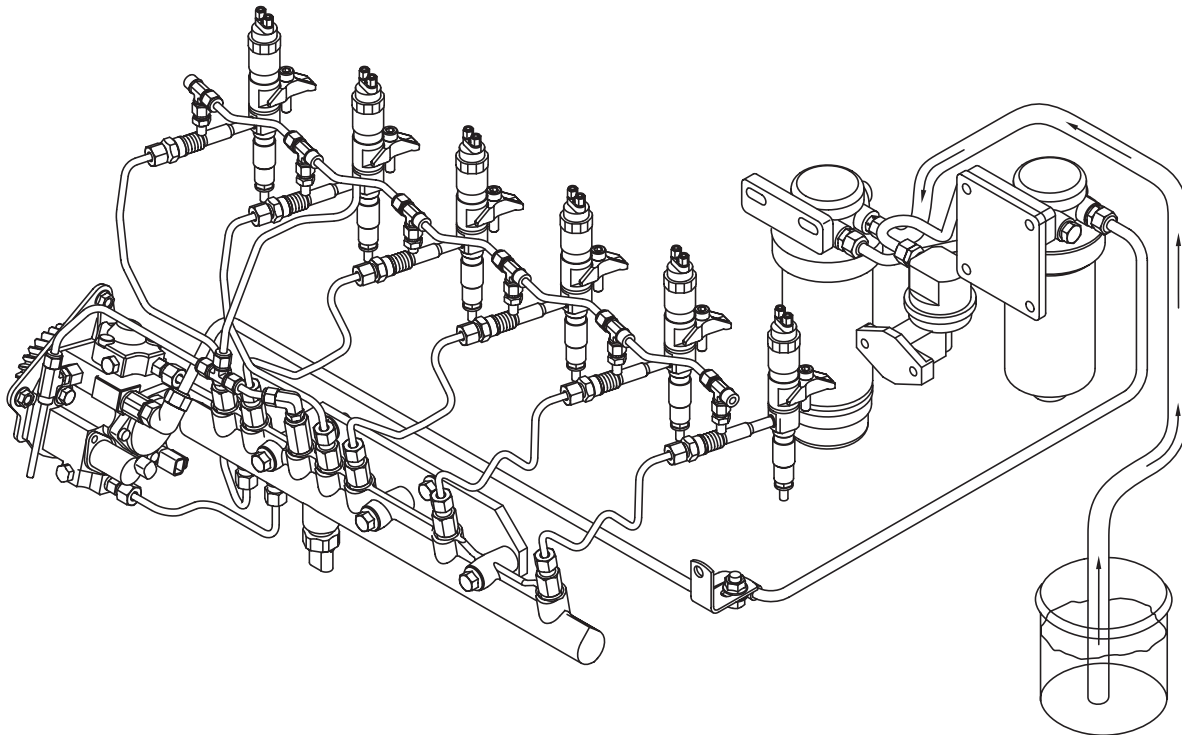
<p><b>6 Glow Plugs Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see A2 - GLOW PLUG CHECK supporting information</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove glow plugs from engine.</li> <li>3. Using a multimeter, check the continuity of the glow plug(s)</li> </ol>	<p><b>Good continuity through glow plug(s):</b> No glow plug related problem found</p> <p><b>Poor continuity through glow plug(s):</b> Faulty glow plug(s)</p> <p style="text-align: right; font-size: x-small;">-- -1/1</p>
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Observable Diagnostics and Tests

<p><b>7 Glow Plug Control Relay Enable Wire Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see A2 - GLOW PLUG CHECK supporting information</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect glow plug control relay enable wire at terminal 86 of the glow plug control relay.</li> </ol> <p><i>NOTE: Check will not work if fuel temperature is above 0°C (32°F).</i></p> <ol style="list-style-type: none"> <li>3. Using a multimeter, measure the voltage between the glow plug control relay enable wire at terminal 86 of the glow plug control relay and a good chassis ground while turning ignition ON (engine OFF).</li> </ol> <p><i>NOTE: Voltage must be read as ignition is turned ON</i></p>	<p><b>At or near battery voltage:</b> GO TO ⑧</p> <p><b>Substantially less than battery voltage:</b> Faulty glow plug control relay enable wire OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>
<p><b>8 Glow Plug Relay Enable Wire Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see A2 - GLOW PLUG CHECK supporting information</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect glow plug relay enable wire at glow plug relay</li> </ol> <p><i>NOTE: Check will not work if fuel temperature is above 0°C (32°F).</i></p> <ol style="list-style-type: none"> <li>3. Using a multimeter, measure the voltage between glow plug relay enable wire at glow plug relay and a good chassis ground while turning ignition ON (engine OFF).</li> </ol> <p><i>NOTE: Voltage must be read as ignition is turned ON</i></p>	<p><b>At or near battery voltage:</b> Faulty battery voltage wire to glow plug relay OR Faulty glow plug relay ground OR Faulty glow plug harness wiring (between glow plug relay and glow plugs) OR Faulty glow plug relay</p> <p><b>Substantially less than battery voltage:</b> Faulty glow plug relay enable wire OR Faulty glow plug control relay ground OR Faulty battery voltage wire to glow plug control relay OR Faulty glow plug control relay</p> <p style="text-align: right;">-- -1/1</p>

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## Check Fuel Supply Quality



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RG12308 -JUN-24JUN02

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

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

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

1. Check prefilter (if equipped) and final fuel filter for serviceability. If filter is equipped with a water bowl, empty and clean water bowl.
2. Start engine and operate under load, observing engine performance.
3. Ignition OFF, engine off

Continued on next page

RG40854.00000BF -19-08MAY02-1/2

*Observable Diagnostics and Tests*

4. Disconnect fuel line from inlet side of prefilter (if equipped) or inlet side of final filter on engines without prefilter.
5. Connect a hose to inlet port.
6. Submerge hose in a container of clean, good quality fuel meeting engine specifications.

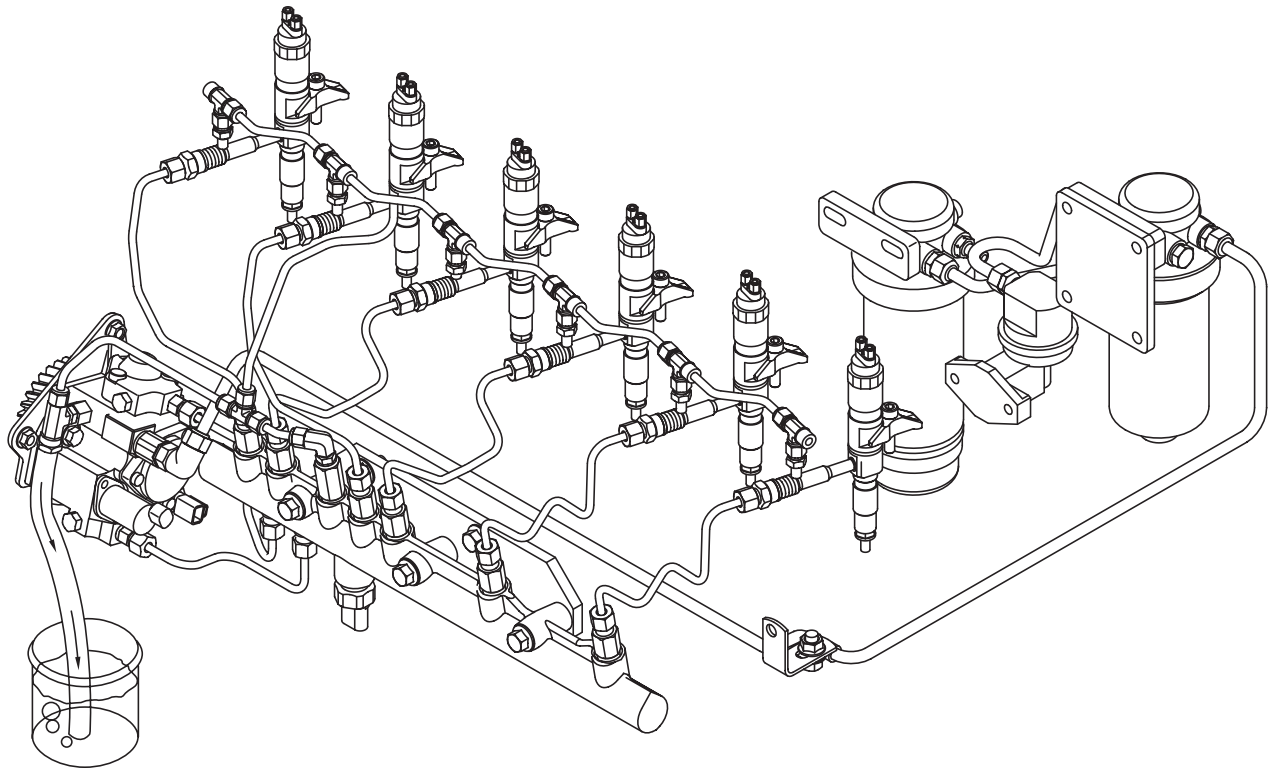
7. Operate engine under load and observe performance.

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

RG40854,00000BF -19-08MAY02-2/2

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48

## Test for Air in Fuel



**NOTE:** If engine cranks but won't start, see **BLEED THE FUEL SYSTEM** later in this Group.

Air in the fuel system will make the engine hard to start, run rough, misfire, or produce low power. Additionally, it can cause excessive smoke and knocking.

Whenever the fuel system is opened for repair, it must be bled to remove any air that has entered the system.

1. Disconnect hose from end of fuel leakoff line assembly. Connect a clear plastic hose to end of leakoff line assembly and place opposite end of hose in a suitable container filled with fuel as shown.
2. Operate engine and check for air bubbles in container. If bubbles are present, bleed the fuel system and repeat test. See **BLEED THE FUEL SYSTEM** later in this Group.
3. If bubbles are still present, check the following:

04  
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49

RG12309 -JUN-24JUN02

Continued on next page

RG40854.00000C0 -19-08MAY02-1/2

- Check for loose fuel fitting from the suction side of the fuel supply pump to the fuel tank including all lines and filter.
- Check fuel tank suction tube (if equipped) and welded joints for cracks and holes.

Perform any necessary repairs, bleed the fuel system, and repeat test.

RG40854,00000C0 -19-08MAY02-2/2

### Check Fuel Supply Pressure

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

1. Connect proper pressure gauge from Universal Pressure Kit JT05412 to the final fuel filter outlet plug (A).
2. Start engine and run at low idle. Fuel transfer pump should maintain minimum output pressure shown in specification.

#### Specification

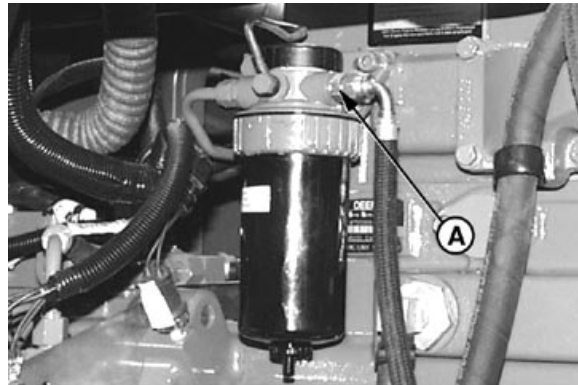
Fuel Transfer Pump Pressure—	
Pressure - Cranking .....	30 kPa (0.3 bar) (4.4 psi)
Pressure - Low Idle .....	40 kPa (0.4 bar) (5.8 psi)

A—Final Fuel Filter Outlet



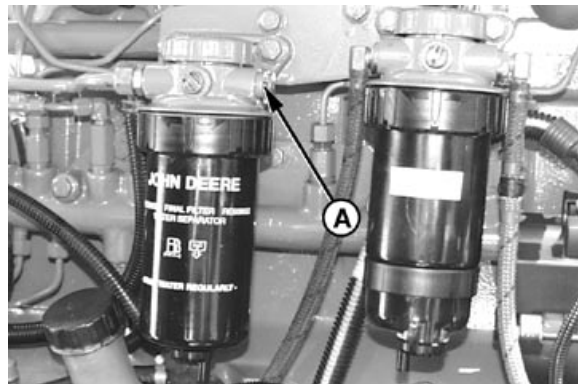
Final Fuel Filter (OEM engines)

RG12452C -UN-23JUL02



Final Fuel Filter (Combine engines)

RG12345C -UN-23JUL02



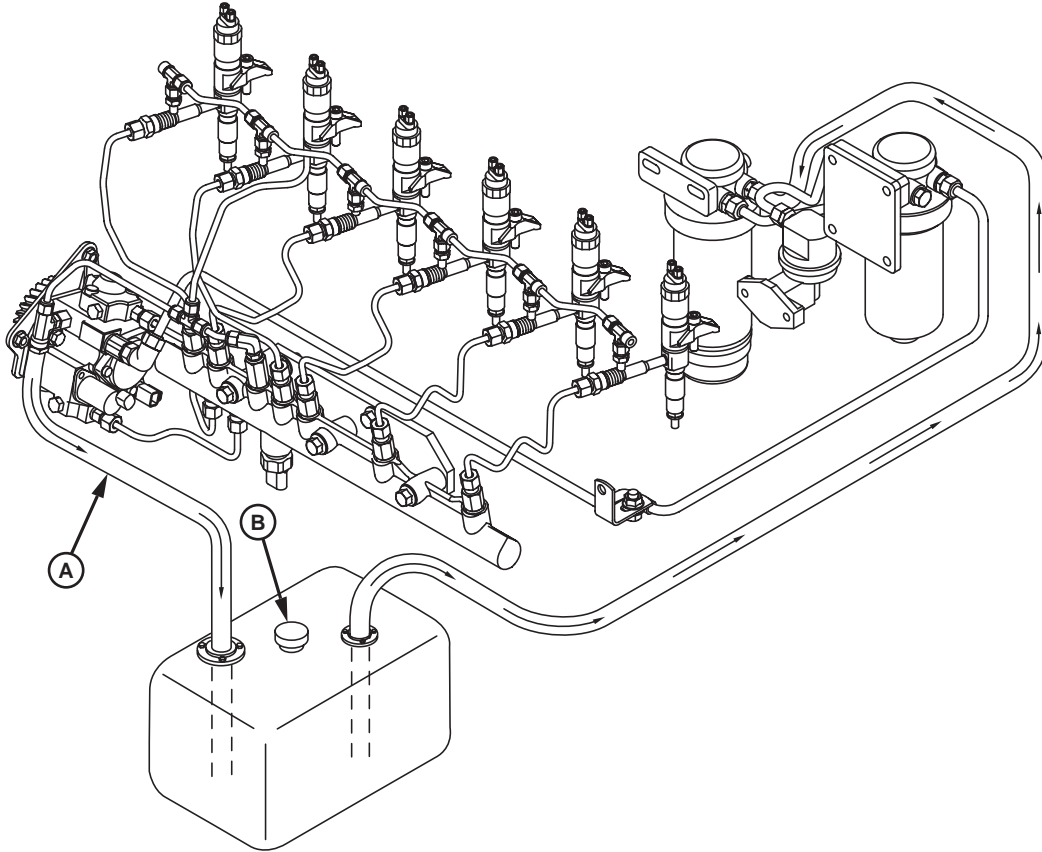
Final Fuel Filter (6020 Tractors)

RG12344C -UN-23JUL02

RG40854,00000C1 -19-08MAY02-1/1

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### Check for Restricted Fuel Leak-off Line



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51

A—Fuel Leak-off Line

B—Fuel Tank Cap

This check will help determine if the fuel leak-off line is restricted.

1. Disconnect fuel leak-off line (A) from the fuel leakoff line at the engine.

RG12311 -JUN-24JUN02

Continued on next page

RG40854.00000C2 -19-08MAY02-1/2

2. Remove fuel tank cap (B).
3. Force compressed air through the fuel leak-off line while listening at the fuel tank filler neck.



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

4. If the leak-off line is not restricted, the compressed air bubbling into the fuel tank should be audible through the tank filler neck.
5. If no air bubbling through the tank is audible, completely check fuel leak-off line for any possible restrictions.

RG40854\_00000C2 -19-08MAY02-2/2



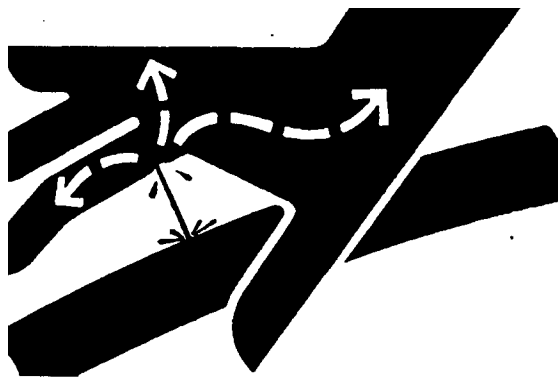
## Bleed the Fuel System



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

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

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



High Pressure Fluids

X9811 -UN-23AUG88

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53

Continued on next page

RG40854,00000C3 -19-08MAY02-1/4

**IMPORTANT: Do not crack any fuel lines to bleed the fuel system. This fuel system is sensitive to fuel contamination.**

**Bleed Procedure (OEM Engines)**

1. Loosen the air bleed vent screw (A) two full turns by hand on the final fuel filter base.
2. Operate fuel transfer pump primer lever, or primer button on fuel filter base (if equipped), until fuel flows out of bleed vent screw.
3. Tighten bleed vent screw securely. Continue operating primer until pumping action is not felt.
4. Start engine and check for leaks. If engine will not start, repeat, step 1-4.



A—Bleed Vent Screw

RG12220 -UN-24MAY02

RG40854,00000C3 -19-08MAY02-2/4

04  
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54

**Bleed Procedure (Combines)**

The bleed is automatically performed by the air bleed valve in the final fuel filter. The fuel line joined to the air bleed valve connects to the fuel leakoff line. The system allows air to continually escape when the key is ON.

1. Ignition ON

*NOTE: The electronic transfer pump on Combines primes the fuel system for 40 seconds when the key is turned ON. It runs continuously after the engine is started.*

2. Allow 40 seconds for the electronic transfer pump to complete priming.
3. If further bleeding is required, turn key OFF. Wait 20 seconds. Turn ignition ON and allow for the system to prime another 40 seconds before checking again.



A—Air Bleed Valve

RG12345D -UN-23JUL02

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RG40854,00000C3 -19-08MAY02-3/4

### Bleed Procedure (6020 Tractors)

1. Open bleed vent screw (A) two full turns by hand on the final fuel filter base.

*NOTE: The electronic transfer pump on 6020 Tractors will always run when the key is ON.*

2. Ignition ON until fuel is free of air bubbles.
3. Ignition OFF
4. Tighten bleed vent screw two full turns.



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**A—Bleed Vent Screw**

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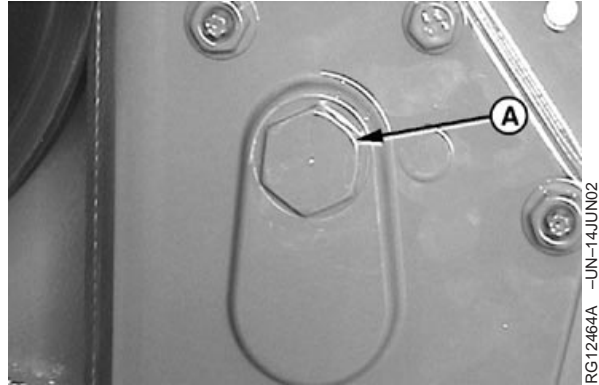
RG40854,00000C3 -19-08MAY02-4/4

## Check and Adjust High Pressure Fuel Pump Static Timing

1. Rotate engine with JDG820 Flywheel Turning Tool until JDE81-4 Timing Pin engages timing hole in flywheel. Engine should be at No.1 "TDC-Compression".
2. Verify engine is at No.1 "TDC-Compression". Remove screw (A) for window on injection pump gear. A marked line on the gear (B) should be visible through the window.

**NOTE:** *If line is not visible, engine may be at No. 6 "TDC-Compression". Rotate engine one full revolution in running direction until JDE81-4 Timing Pin engages in flywheel again.*

**A—High Pressure Pump Gear Window Screw**  
**B—High Pressure Pump Gear Timing Mark**



High pressure pump window screw



High pressure pump gear timing mark

RG40854,00000C5 -19-08MAY02-1/1

04  
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56

## About This Group

This group of the manual contains necessary information to diagnose the electronic control system. Use this information in conjunction with 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104)

See the 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104) for:

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

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

To help diagnose electronic control system problems, see APPLICATION SPECIFICATIONS in Section 06,

Group 210 of this manual. It contains useful information, such as system wiring schematic and ECU terminal identification.

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

*NOTE: Instruction 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.*

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1

RG40854,00000F5 -19-20MAY02-1/1

## 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

04  
160  
2

RG40854,00000F6 -19-20MAY02-1/1

## Using a Digital Multimeter

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

Instructions for measuring voltages take the following form:

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

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

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

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



Digital Multimeter

RG11126 -UN-19JUN00

RG40854,00000F7 -19-20MAY02-1/1

## Electrical Circuit Malfunctions

### Circuit Malfunctions

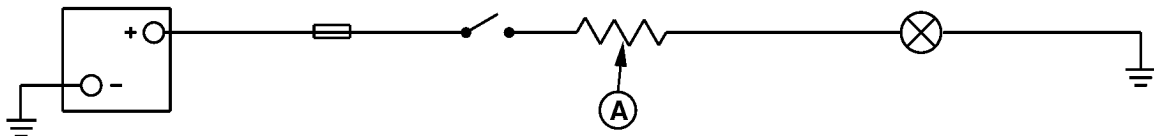
There are four major circuit malfunctions. They are:

1. High-resistance circuit
2. Open circuit
3. Grounded circuit
4. Shorted circuit

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RG40854,00000F8 -19-20MAY02-1/6

RG9891 -UN-06JAN99



High Resistance Circuit

A—Unwanted Resistance

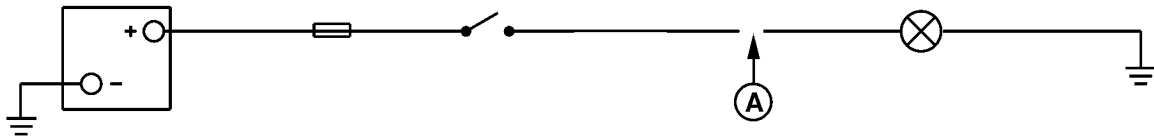
### Definition of Circuit Malfunctions

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

#### 1. High Resistance Circuit:

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RG9892 -UN-06JAN99



Open Circuit

A—Break or Separation in Circuit

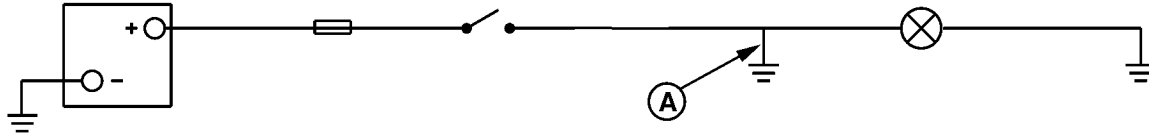
#### 2. Open Circuit:

A circuit having a break or a separation (A) that prevent current from flowing in the circuit.

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RG9893 -UN-06JAN99



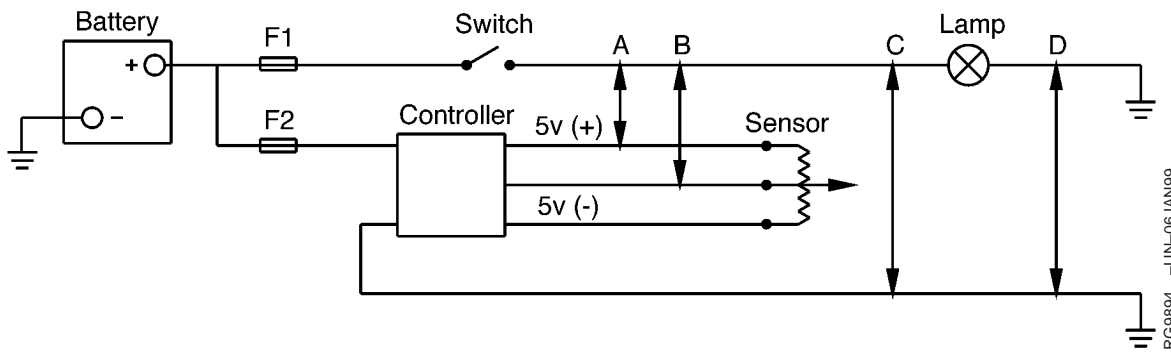
Grounded Circuit

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.

RG40854,00000F8 -19-20MAY02-4/6



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.*

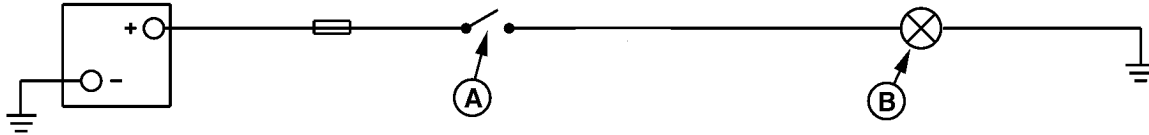
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4



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.

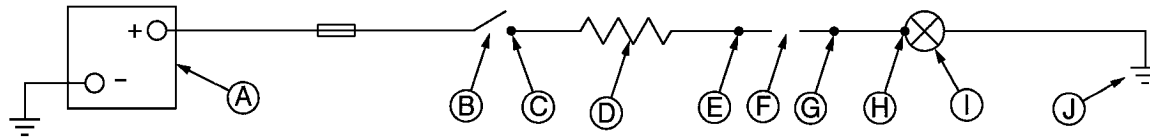
**Reason:** Oxidation of the terminals created “High Resistance” and a voltage drop that prevents the proper amount of current flow to the component. Disconnecting and reconnecting the connector, removed some oxidation and reestablished good continuity through the connector.

04  
160  
5

RG40854,00000F8 -19-20MAY02-6/6

## Troubleshooting Circuit Malfunctions

RG9896 -UN-06JAN99



Troubleshooting Circuit Malfunctions

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

### 1. High Resistance Circuit:

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

proper voltage at a location easily accessible between (C) and (H).

- If voltage is low, move toward the voltage source (A) to locate the point of voltage drop.
- If voltage is correct, move toward the load (I) and ground terminal (J) to locate the voltage drop.

### 2. Open Circuit:

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

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

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

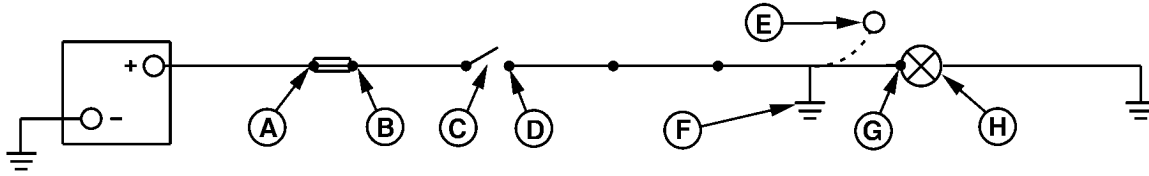
- Repair the circuit as required.
- Perform an operational check-out on the component after completing the repair.

- With the controlling switch (B) closed (on) and the load (I) connected into the circuit, check for

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RG40854,00000F9 -19-20MAY02-1/4

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.

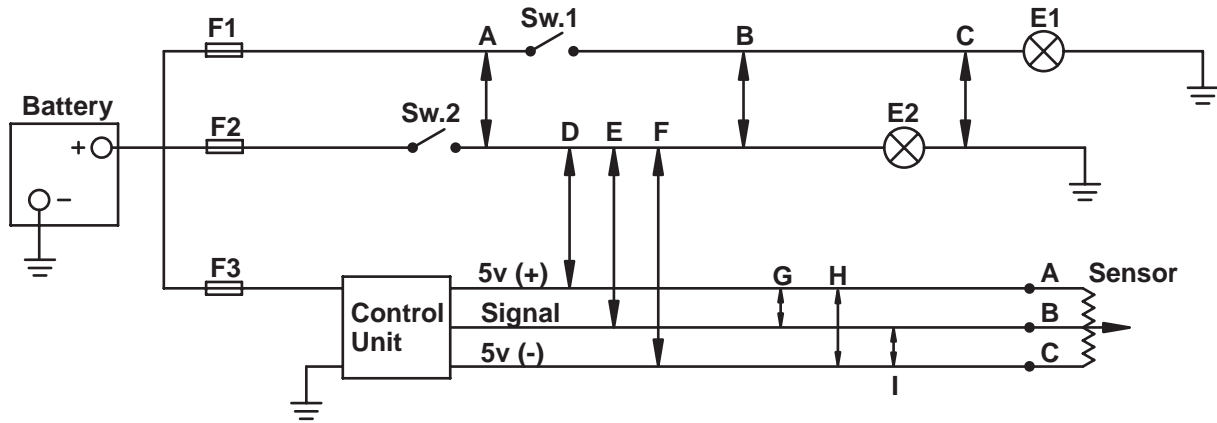
*NOTE: The example is grounded between (D) and (E) at (F).*

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

04  
160  
7

Continued on next page

RG40854,00000F9 -19-20MAY02-2/4



RG11399 -UN-29NOV00

#### 4. Shorted Circuit:

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

1. Battery wire from fuse (F1) is shorted at (A) to another battery wire after switch (Sw.2).
  - Result: Lamp (E1) is on all of the time.
2. Battery wire from fuse (F1) is shorted at (B) to another battery wire after switches (Sw.1 & 2).
  - Result: Both lamps (E1 & E2) operate on either switch (Sw. 1 or 2).
3. Battery wire from fuse (F1) is shorted at (C) to a ground wire.
  - Result: Fuse (F1) opens after closing switch (Sw. 1)
4. Battery wire from switch (Sw. 2) is shorted at (D) to a regulated voltage wire.
  - Result: The sensor signal voltage is distorted.<sup>1</sup>
5. Battery wire from switch (Sw. 2) is shorted at (E) to the sensor signal voltage wire.
  - Result: The sensor signal is distorted.<sup>1</sup>
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.<sup>1</sup>
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.<sup>1</sup>
  9. Sensor voltage wire is shorted at (I) to the sensor ground wire.
    - Result: The sensor signal is distorted.<sup>1</sup>

#### 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.

<sup>1</sup>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.

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

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

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

f. Alternate Method to Check for Shorted Circuit.

With the components disconnected at each end of the suspected circuits, turn the key switch on.

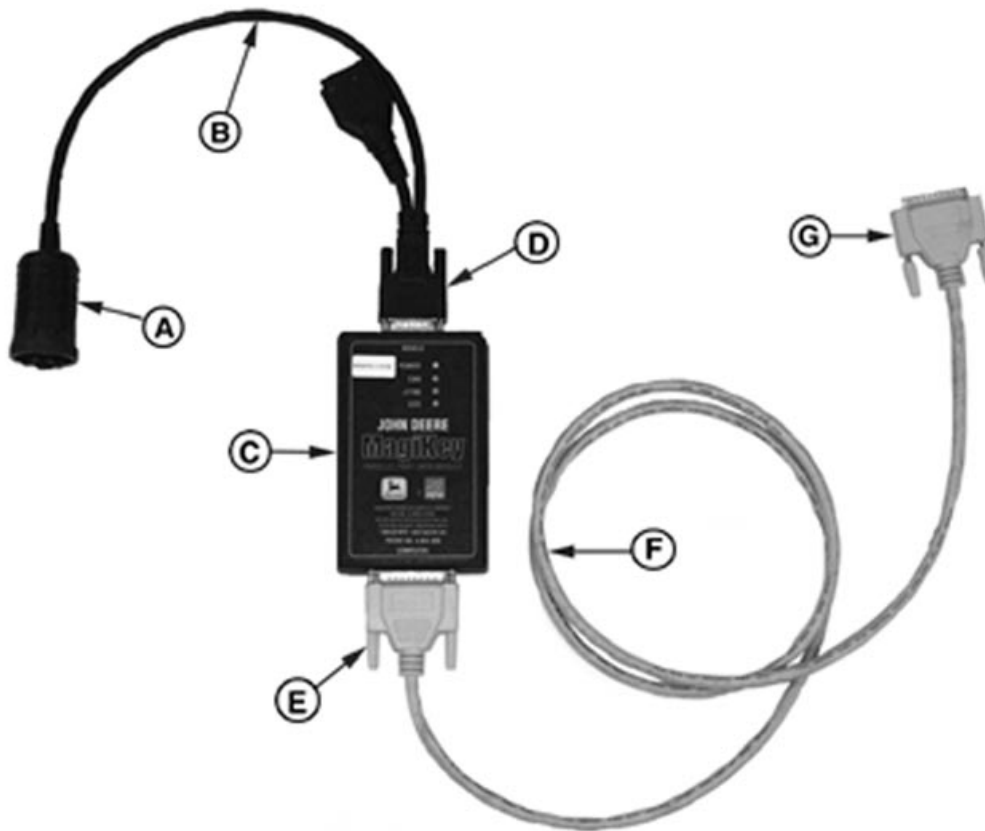
Connect one meter lead to a good frame ground. With the other meter probe, touch each of the suspected circuits one at a time. If there is a voltage reading, the circuit is shorted to another voltage wire. Repair the circuit.

g. Repair the "Shorted Circuit" as follows:

- Wires not in a loom: Wrap individual wires with electrical tape or replace the damaged wire and band as required.
- Wires in a loom: If hot spots exist in shorted area of the harness, replace the harness. If hot spots are not noticeable, install a new wire of proper gauge between the last two connections. Use tie bands to secure the wire to outside of the harness.

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

## Connecting to Diagnostic Scan Tool (DST) or SERVICE ADVISOR™



Connecting to the DST or SERVICE ADVISOR™

A—Diagnostic Connector Mate    C—MagiKey    E—25 Pin MagiKey Connector    G—PC Connector  
 B—John Deere Controller Cable    D—26 Pin MagiKey Connector    F—PC Cable

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.

RG11737A -UN-18MAY01

7. Start the diagnostic software and select the appropriate application.
8. Connect to the application. The CAN light on the MagiKey should illuminate red when the connection to the ECU is made.
9. If DST or SERVICE ADVISOR™ does not connect see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR DIAGNOSTIC PROCEDURE in 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.



Power Adapter

RG12277 -JUN-22APR02

04  
160  
11

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RG40854,00000FA -19-20MAY02-2/2

## Blinking DTCs

On OEM applications that have a Fault Lamp, the ECU has the ability to display DTCs using blinking sequence of the fault lamp. To retrieve DTCs from the ECU using the “blink code” method:

*NOTE: The ECU blinks the codes in 2-digit codes only. In order to convert the codes to SPN/FMI codes, see LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) ON ECU later in this Group.*

1. Turn the ignition switch “ON”.
2. Hold Override Shutdown Switch for a few seconds
3. The Fault Lamp will begin to flash a code number. For example, flash three times...short pause...flash two times...long pause. This example is code 32.
4. The ECU begins the flashing sequence by flashing a code 32, this indicates the start of blinking active codes. If there are any active DTCs, the ECU will flash it's 2-digit number. If there is more than one active DTC, the ECU will flash each code in numerical order. If there are no active DTCs, the Fault Lamp will flash a code 88.

5. Following the active codes, the Fault Lamp will flash a code 33, this indicates the start of blinking stored codes. If there are any stored DTCs, the Fault Lamp will flash it's 2-digit number. If there is more than one stored DTC, the ECU will flash each code in numerical order. If there are no stored DTCs, the Fault Lamp will flash a code 88.
6. Once complete, the above sequence will be repeated.
7. When complete, turn ignition “OFF”

As an example, if an engine had an active DTC 18 and stored DTC 53, the flashing sequence would be:

- flash three times...short pause
- flash two times...long pause
- flash one time...short pause
- flash eight times...long pause
- flash three times...short pause
- flash three times...long pause
- flash five times...short pause
- flash three times

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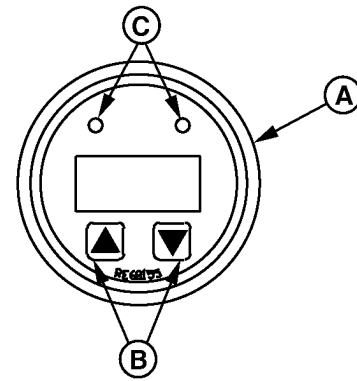
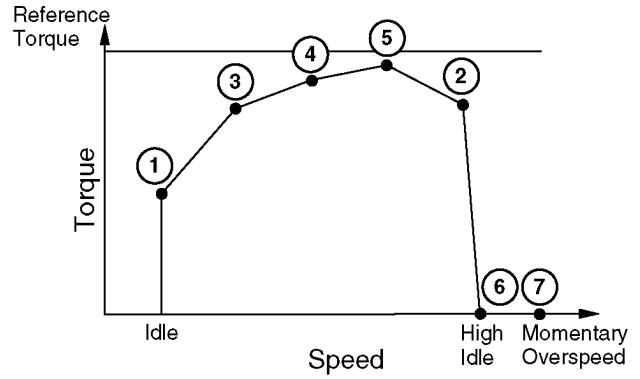


## Engine Configuration Data Parameters on Diagnostic Gauge

### Accessing Engine Configuration Data Parameters:

1. Scroll through the main menu of engine parameters by pressing **either** the right or the left touch switch
2. Select "E-Config" sub-menu by **simultaneously** pressing the right and the left touch switch.
3. Scroll through the "E-Config" sub-menu to view Engine Configuration Parameters by pressing **either** the right or the left touch switch until desired parameter is found. The numbers next to the parameters correspond to the number on the graph.
4. In order to exit "E-Config" sub-menu, **simultaneously** press the right and left touch switch

A—Diagnostic Gauge  
 B—Touch Switches  
 C—Lights



RG11647 -19-19JAN01

04  
160  
13

RG10031 -JUN-28OCT99

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RG40854,00000FB -19-20MAY02-1/2

## Trouble Code Diagnostics and Tests

### Engine Configuration Parameter Description

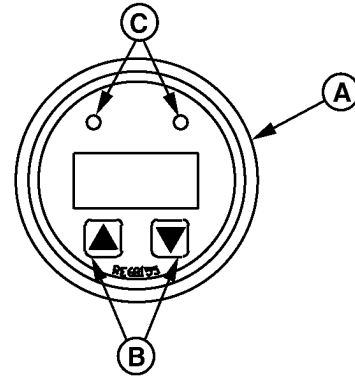
Parameter Displayed on Diagnostic Gauge	Units	Description
Speed 1	RPM	Stationary low idle speed of engine which includes influences due to engine temperature and other stationary changes. This is point 1 on the engine configuration map.
Torque 1	%	Torque 1 equals the desired torque of the ECU divided 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 does not change if a difference engine torque map becomes valid.
Speed 7	RPM	The maximum engine speed above point 6 allowed by the engine control during a momentary high idle override. This duration is limited by the maximum momentary override time limit.
Time Limit	sec	The maximum time limit allowed to override the engine's high idle speed.
Lo Limit	RPM	The minimum engine speed that the engine will allow when operating in a speed control/limit mode
Hi Limit	RPM	The maximum engine speed that the engine will allow when operating in a speed control/limit mode.
Low Limit	%	The minimum engine torque that the engine will allow when operating in a torque control/limit mode.
Hi Limit	%	The maximum engine torque that the engine will allow when operating in a torque control/limit mode.

RG40854.00000FB -19-20MAY02-2/2

## 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 "SvcCodes" sub-menu by **simultaneously** pressing the right and the left touch switch.
3. Scroll through the "Svc 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 "SvcCodes" sub menu, **simultaneously** press the right and left touch switch



A—Diagnostic Gauge  
B—Touch Switches  
C—Lights

RG10031 -JUN-28OCT99

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RG40854,00000FC -19-20MAY02-1/1

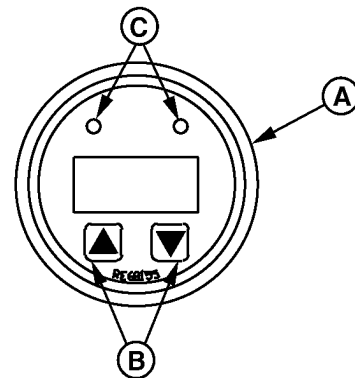
## Viewing Stored DTCs on Diagnostic Gauge

### 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

RG10031 -JUN-28OCT99

RG40854,00000FD -19-20MAY02-1/1

## Clearing Stored DTCs on Diagnostic Gauge

### Clearing Stored Diagnostic Trouble Codes (DTCs):

1. Scroll through the main menu of engine parameters by pressing **either** the right or the left touch switch
2. Select "DM2Codes" sub-menu by **simultaneously** pressing the right and the left touch switch.
3. Scroll through the "DM2Codes" sub-menu to view stored DTCs by pressing **either** the right or the left touch switch until all codes are found.

**NOTE:** If "No Data" is on the gauge, there are no stored codes.

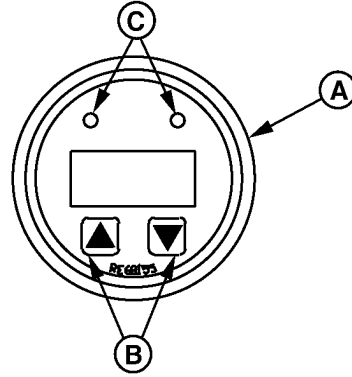
4. In order to clear codes, **simultaneously** press the right and left switch for at least 8 seconds

**NOTE:** If the switches are held for less than 8 seconds, the sub menu will be exited.

5. If display reads "\*\*\*\*\*", press the right switch for at least 8 seconds.

**NOTE:** If the switch is held for less than 8 seconds, the sub menu will be exited.

6. If the display reads "\*\*Send\* \*\*DM3 \*\*", the codes are now cleared. In order to exit "DM2Codes" sub menu, **simultaneously** press the right and left touch switch



A—Diagnostic Gauge  
B—Touch Switches  
C—Lights

RG10031 -UN-28OCT99

04  
160  
16

RG40854,00000FE -19-20MAY02-1/1



## Data Parameter Description

Following is a list of the data parameters that can be read on the Diagnostic Scan Tool (DST) or SERVICE ADVISOR™. The DST consists of a Windows ('95 or '98 or 2000) or NT compatible computer and JDIS121

- ECU Communication Hardware Kit available from John Deere. Included in the list below is a brief description of each parameter, the range of possible readings, and each parameter's unit of measurement.

Parameter	Units	Description
Analog Throttle (A) Input Voltage	volts	Voltage from analog throttle (A) position sensor (potentiometer) on non-OEM applications.
Analog Throttle (A) Input Voltage (OEM)	volts	Voltage from analog throttle (A) position sensor (potentiometer) on OEM applications ONLY.
Analog Throttle (B) Input Voltage	volts	Voltage from analog throttle (B) position sensor (potentiometer) on non-OEM applications.
Analog Throttle (B) Input Voltage (OEM)	volts	Voltage from analog throttle (B) position sensor (potentiometer) on OEM applications ONLY.
Analog Throttle (C) Input Voltage	volts	Voltage from analog throttle (A) position sensor (potentiometer) on non-OEM applications.
Battery Voltage	volts	Switched battery voltage may vary depending on application.
Commanded Power	kW (HP)	ECU calculates horsepower based on engine fueling.
Commanded Torque	Nm (lb-ft)	ECU calculates torque based on engine fueling.
Crank Position Improper Pattern Indicator	%	A "0" reading means that there is NO improper pattern. Between 0—100, the crank pattern becomes progressively more improper. When 100 is reached, a trouble code is thrown.
Crank Position Input Noise Indicator	%	A "0" reading means that there is NO noise. Between 0—100, crank noise becomes progressively worse. When 100 is reached, a trouble code is thrown.
Crank Position Sensor Speed	rpm	The speed of the crank timing wheel.
Crank Position Status	N/A <sup>a</sup>	When status is 15, the ECU is receiving ALL of the signal. When the status is below 15, it means that the ECU is not receiving all of the signal.
Cruise Accelerate Switch	N/A <sup>a</sup>	The cruise accelerate function has been activated. This should increase the speed at which cruise is set.

<sup>a</sup>N/A = Not Applicable

## Trouble Code Diagnostics and Tests

Parameter	Units	Description
Cruise Brake Switch	N/A <sup>a</sup>	The cruise brake function has been activated. This will cancel the cruise when the brake is applied until operator resumes operation.
Cruise Clutch Switch	N/A <sup>a</sup>	The cruise clutch function has been activated. This will cancel the cruise when the clutch is applied until operator resumes operation.
Cruise Coast Switch	N/A <sup>a</sup>	The cruise coast function has been activated. This should decrease the speed at which cruise is set.
Cruise Resume Switch	N/A <sup>a</sup>	The cruise resume function has been activated. This will reset the cruise to the speed at which cruise was at prior to using the brake or clutch..
Cruise Set Switch	N/A <sup>a</sup>	The cruise set function has been activated. This should lock the current engine speed in when switch is activated.
Desired Speed Governor Curve	N/A <sup>a</sup>	The mode selected is dependent on the application. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.
ECU Boot Block Part Number	N/A <sup>a</sup>	Part number for the Engine Control Unit (ECU) boot block.
ECU Configuration File Part Number	N/A <sup>a</sup>	Part number for the configuration file in the ECU.
ECU EOL Data Part Number	N/A <sup>a</sup>	Part number for the data programmed into the ECU at the end of the assembly line. EOL = End of Line
ECU Part Number	N/A <sup>a</sup>	Part number for the Engine Control Unit (ECU) hardware.
ECU Serial Number	N/A <sup>a</sup>	Serial number for the Engine Control Unit (ECU).
ECU Software Assembly Part Number	N/A <sup>a</sup>	Part number for the Engine Control Unit (ECU) software assembly.
ECU Software Part Number	N/A <sup>a</sup>	Part number for the Engine Control Unit (ECU) operating software.
Engine Coolant Temperature	°C (°F)	Engine Coolant Temperature value. <i>NOTE: If there is an active fault for the ECT circuit, the ECT value displayed will be the "limp-home" value.</i>
Engine Coolant Temperature Input Voltage	volts	Engine Coolant Temperature Sensor input voltage to the ECU
Engine Hourmeter	hr -min- -sec	Total hours the ECU has run on an engine.
Engine Load at Current Speed	%	Percentage of load on the engine at a given speed.
Engine Model Number	N/A <sup>a</sup>	The model number for the engine.
Engine Oil Pressure	kPa (psi)	Engine Oil Pressure value
Engine Oil Pressure Input Voltage	volts	Engine Oil Pressure Sensor input voltage to the ECU.
Engine Oil Temperature	°C (°F)	Engine Oil Temperature value.
Engine Serial Number	N/A <sup>a</sup>	Serial number for the engine.
Engine Speed	rpm	The speed that the crank sensor detects the crank timing wheel to be moving at.
Fuel Mode	N/A <sup>a</sup>	This code explains the operation mode of the engine.
Fuel Rail Pressure - Actual	MPa (psi)	On the high pressure common rail fuel system applications, the ECU monitors fuel pressure in the actual state. This pressure is displayed in absolute pressure.

<sup>a</sup>N/A = Not Applicable

04  
160  
19

Continued on next page

RG40854,0000129 -19-19JUN02-2/4

## Trouble Code Diagnostics and Tests

Parameter	Units	Description
Fuel Rail Pressure - Desired	MPa (psi)	On the high pressure common rail fuel system applications, the ECU monitors fuel pressure in the desired state. This pressure is displayed in absolute pressure.
Fuel Rail Pressure Sensor Supply Voltage	volts	Voltage that the ECU supplies the Fuel Rail Pressure Sensor.
Fuel System Part Number	N/A <sup>a</sup>	The part number for the fuel system used on the engine.
Fuel System Serial Number	N/A <sup>a</sup>	The serial number for the fuel system used on the engine.
Fuel Temperature	°C (°F)	Fuel temperature value. <i>NOTE: If there is an active fault for the fuel temperature circuit, the fuel temperature value displayed will be the "limp-home" value.</i>
Fuel Temperature Input Voltage	volts	Fuel Temperature Sensor input voltage to the ECU.
Fuel Usage Rate	L/h (gal/h)	Total amount of fuel the ECU has commanded the EIs to deliver during the total hours shown by the Engine Hour Meter parameter.
Glow Plug Status	On/Off	The glow plugs have power to run for a specified amount of time dependent on fuel temperature. For more information, see GLOW PLUG OPERATION in Section 03, Group 140 of this manual.
Glow Plug Time Remaining	sec	The glow plugs have power to run for a specified amount of time dependent on fuel temperature. For more information, see GLOW PLUG OPERATION in Section 03, Group 140 of this manual.
Inject Start Time	microsec	If value of zero appears, one or more of the injectors are not firing.
Manifold Absolute Pressure	kPa (psi)	Manifold Air Pressure value (boost pressure). <i>NOTE: If there is an active fault for the MAP circuit, the MAP value displayed will be the "limp-home" value.</i>
Manifold Air Temperature	°C (°F)	Manifold Air Temperature value. <i>NOTE: If there is an active fault for the MAP circuit, the MAP value displayed will be the "limp-home" value.</i>
Manifold Air Temperature Input Voltage	volts	Manifold Air Temperature Sensor input voltage to the ECU.
Maximum Speed Governor Curve	NA	The mode selected is dependent on the application. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.
Option Assembly Part Number	N/A <sup>a</sup>	Part number that describes all of the options on the entire vehicle. This includes the Performance Option Part Number and the Vehicle Option Part Number.
Performance Option Part Number	N/A <sup>a</sup>	These are the engine performance specific options relate to power and torque.
Pilot Injection	N/A <sup>a</sup>	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.
Pump Position Sensor Improper Pattern Indicator	%	A "0" reading means that there is NO improper pattern. Between 0—100, the pump position pattern becomes progressively more improper. When 100 is reached, a trouble code is thrown.
Pump Position Sensor Input Noise Indicator	%	A "0" reading means that there is NO noise. Between 0—100, pump position noise becomes progressively worse. When 100 is reached, a trouble code is thrown.
Pump Position Sensor Speed	rpm	The speed of the pump position timing wheel.
<sup>a</sup> N/A = Not Applicable		

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RG40854.0000129 -19-19JUN02-3/4



## Trouble Code Diagnostics and Tests

Parameter	Units	Description
Pump Position Sensor Status	N/A <sup>a</sup>	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.
Sensor Supply 1 Voltage	volts	Voltage that the ECU supplies sensors.
Sensor Supply 2 Voltage	volts	Voltage that the ECU supplies the analog throttle (A).
Throttle Position	%	Percent of the throttle being used.
Throttle Supply Voltage	volts	Voltage that the ECU supplies the throttle.
Throttle Type	N/A <sup>a</sup>	Level 11 Electronic Fuel Systems operate with several different types of throttles. Throttle Type displays the type being used on this application.
Torque Curve Number	N/A <sup>a</sup>	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. For definition of the possible torque curves, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.
Transfer Pump Control Status	On/Off	The transfer pump is given its voltage from the ECU. The pump primes for 40 seconds at key ON. During operation, the status is always on.
Transfer Pump Duty Cycle	sec	The transfer pump is given its voltage from the ECU. The pump primes for 40 seconds at key ON. During operation, the status is always on.
Vehicle Option Part Number	N/A <sup>a</sup>	These are the vehicle specific options for the engine like fuel derates, shutdowns, sensor thresholds, ect.
Vehicle Serial Number	N/A <sup>a</sup>	The serial number of the vehicle that this engine is located in.
Vehicle Speed - Calculated	km/h (mi/hr)	Vehicle speed calculated by ECU from wheel speed PWM signal.
Vehicle Speed - CAN	km/h (mi/hr)	Vehicle speed ECU detects over CAN.
<sup>a</sup> N/A = Not Applicable		

04  
160  
21

RG40854,0000129 -19-19JUN02-4/4

## 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 cylinders.

The Cylinder Misfire Test cannot determine if an engine is delivering low power. The test results are only a guide to help determine if there is a problem in a cylinder. The results alone should not be used as a conclusive reason for replacing the injection pump or nozzles. Other information such as the results of a Compression Test, Cylinder Cutout Test, and other engine diagnostic procedures should be used to accurately determine the source of an engine problem.

### Before executing the Cylinder Misfire Test

- Warm engine to normal operating temperature
- Repair the cause of any Diagnostic Trouble Codes (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. Follow instruction given by the diagnostic software. The software will instruct that the throttle lever be moved from low idle position to wide open throttle position, then back to low idle position 6 times.

*NOTE: For OEM genset applications that use a tri-state throttle, use the low idle position and the center switch position to run this test.*

*NOTE: For OEM genset applications that use an analog throttle, slowly adjust throttle in higher rpm direction until engine speeds increases. When speed increases, turn back to low idle position. If throttle is adjusted too fast, test may not function correctly.*

The diagnostic software will inform the test operator if the test was not successfully completed. If the test was successfully completed, the results will be displayed on the screen.

Results shown will represent each cylinders' 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.

## 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 Section 06, 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 activating the high pressure solenoid valve in the injection pump), then measure the time it takes the piston of each cylinder to accelerate through and past TDC. A piston that accelerated faster than the rest would indicate that cylinder has lower compression than the other cylinders.

The Compression Test cannot determine the true compression pressure of any cylinder, it can only compare each cylinder to the average. The test results are only a guide to help determine if a cylinder has lower compression. The results alone should not be used as a conclusive reason for performing any major engine work. Other information such as the results of the Cylinder Misfire Test, Cylinder Cutout Test, and other engine diagnostic procedures should be used to accurately determine the source of an engine problem.

### Before executing the Compression Test

- Warm engine to normal operating temperature
- Repair the cause of any Diagnostic Trouble Codes (DTCs)

*NOTE: The ECU will not allow the test to run if there are any active DTCs.*

- Ensure that the battery and starter are in good working condition

### Performing the Compression Test

1. Engine OFF.
2. Select Compression Test on the DST or SERVICE ADVISOR™.
3. Follow instruction given by the diagnostic software. The software will instruct that the engine be cranked for up to 15 seconds. Typically, it should take less than 5 seconds. The DST or SERVICE ADVISOR™ should be observed carefully for instructions during the test.

The diagnostic software will inform the test operator if the test was not successfully completed. If the test was successfully completed, the results will be displayed on the screen.

Results shown will represent each cylinders' compression as a percentage in relation to the average of all cylinders. If any cylinder is more than 10% below the rest, that indicates the cylinder's compression is lower than the rest.

*NOTE: 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.

## 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 Section 04, 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. 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 the injection pump or nozzles. Other information such as the results of a Compression Test and other engine diagnostic procedures should be used to accurately determine the source of the engine problem.

### Before executing the Cylinder Cutout Test

- Warm engine to normal operating temperature
- Repair the cause of any Diagnostic Trouble Codes (DTCs)

*NOTE: The ECU will not allow the test to run if there are any active DTCs.*

- Ensure that the battery and starter are in good working condition

### Performing the Cylinder Cutout Test

1. Engine idling or under the conditions that the problem occurred.
2. Select Cylinder Cutout Test on the DST or SERVICE ADVISOR™.
3. Follow instructions given by the DST or SERVICE ADVISOR™.
4. Select the cylinder(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 temperature.
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.*

## Engine Test Instructions— Tractor Torque Curve Change Test

Torque curve adjustment may be necessary for tractors while operating on a dynamometer. This test allows the user to select the highest torque curve available on the tractor in order to simulate the max power. Torque curve adjustment can only be accomplished with the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR in Section 04, Group 160 later in this manual.

### Performing the Torque Curve Dynamometer Adjustment

1. Ignition ON, engine off.
2. Select Tractor Torque Curve Change Test on the DST or SERVICE ADVISOR™.
3. Select the option that corresponds to the desired operation.
  1. Normal operation
  2. Dynamometer setup

04  
160  
25

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RG41221,000011C -19-11APR03-1/1

## **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 to reprogram ECUs using Diagnostic Scan Tool (DST). See REPROGRAMMING ENGINE CONTROL UNIT USING DST later in this Group.

04  
160  
26

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RG41221,0000092 -19-04NOV02-1/1

## 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).

04  
160  
27

RG41221,0000097 -19-04NOV02-1/11



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.

Continued on next page

RG41221,0000097 -19-04NOV02-2/11

Menu	Description	Action
HELP	The ECU Software Delivery System (SDS) is designed to support remote programming of ECUs. To download an ECU payload, click on the Download button.	Download <input checked="" type="checkbox"/>
LOG OFF		
SDS HOME	A valid license is required to program an ECU. To validate an existing license or get a new license, click the License button.	License <input checked="" type="checkbox"/>



RG12629 -19-19SEP02

Obtaining Valid License

Menu	Description
HELP	License information required for programming an ECU is being validated. Please wait...
LOG OFF	
SDS HOME	

RG12630 -19-19SEP02

Validating License

**NOTE:** Steps 3 - 5 only need to be completed the first time this instruction is performed.

permissions. Click on "License"(B). A screen will appear while validating license.

3. A license file is required for each computer that will reprogram ECUs. Download the license file to gain

RG41221,0000097 -19-04NOV02-3/11



RG12613 -19-20SEP02

Grant Always Screen

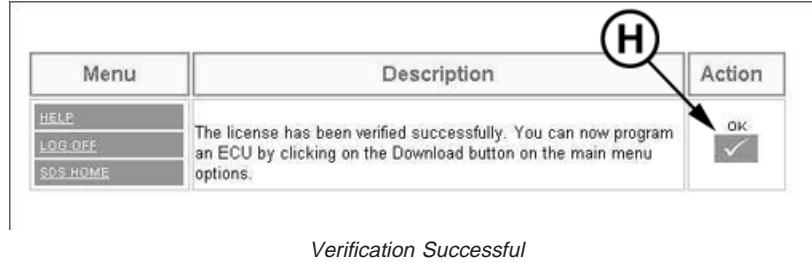
4. Click on "Grant Always" (G).

Continued on next page

RG41221,0000097 -19-04NOV02-4/11

04  
160  
28



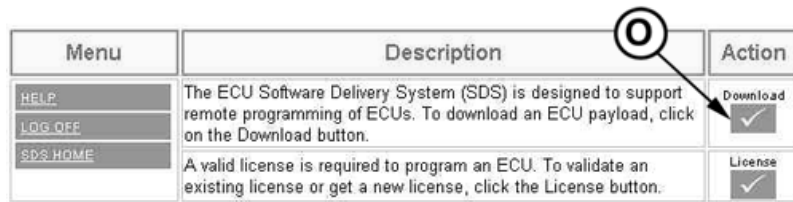


RG12631 -19-19SEP02

Verification Successful

5. Click "OK" (H) when license verification has completed.

RG41221.0000097 -19-04NOV02-5/11

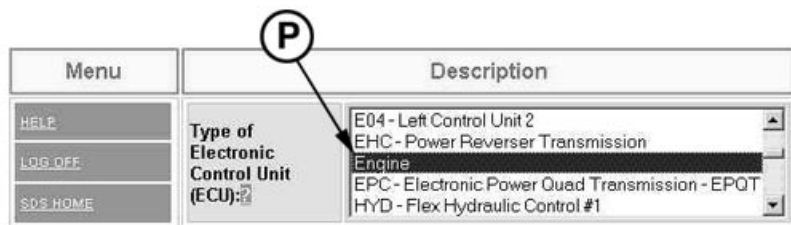


RG12579 -19-06SEP02

04  
160  
29

6. Click on "Download" button (O). A screen will appear as the system verifies that a valid license file is present.

RG41221.0000097 -19-04NOV02-6/11



RG12632 -19-19SEP02

Selecting Engine for ECU Type

7. Scroll down and click on "Engine" (P).

Continued on next page

RG41221.0000097 -19-04NOV02-7/11

Menu	Description		Action
HELP	Engine Serial Number: <input type="text"/>	(e.g. RG6081H144792)	Download <input type="checkbox"/>
LOG OFF	Replacing the ECU? <input type="checkbox"/>	<input type="checkbox"/> Yes	
SDS HOME	(if so, enter the new, replacement ECU serial number e.g. 110112)		

RG12618 -19-18SEP02

Enter Engine Serial Number (ESN)

8. Click once in the ESN text box (Q) so the cursor is in the box. Type in the ESN into the text field. If you are replacing the current ECU, GO TO 9. If you are

reprogramming the existing ECU, click "Download" (R) and GO TO 11.

RG41221,0000097 -19-04NOV02-8/11

Menu	Description		Action
HELP	Engine Serial Number: <input type="text"/>	RG6081H200029	Download <input type="checkbox"/>
LOG OFF	Replacing the ECU? <input checked="" type="checkbox"/>	<input type="checkbox"/> Yes	
SDS HOME	(if so, enter the new, replacement ECU serial number e.g. 110112)		

RG12701A -19-14OCT02

Replacing ECU

9. If the current machine is being replaced, check the "Replacing the ECU" box (E).

current ECU, the software will tie the engine serial number to the new ECU serial number.

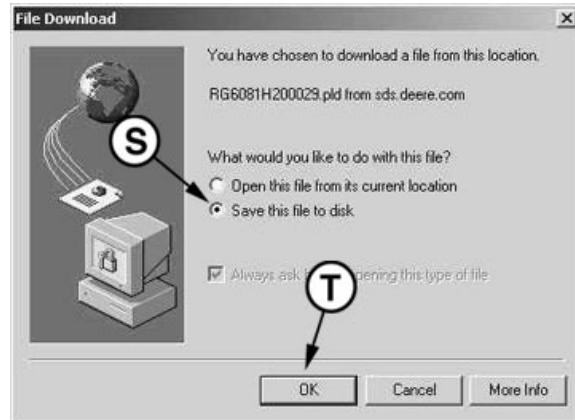
**NOTE:** Sometimes the original ECU will not be available for reprogramming. When a new ECU is being programmed to replace the

10. Enter in the new ECU's serial number (F) located on the ECU label and click "Download".

Continued on next page

RG41221,0000097 -19-04NOV02-9/11

11. In the "File Download" window ensure that the "Save this file to disk" button (S) is selected and click "OK" (T).

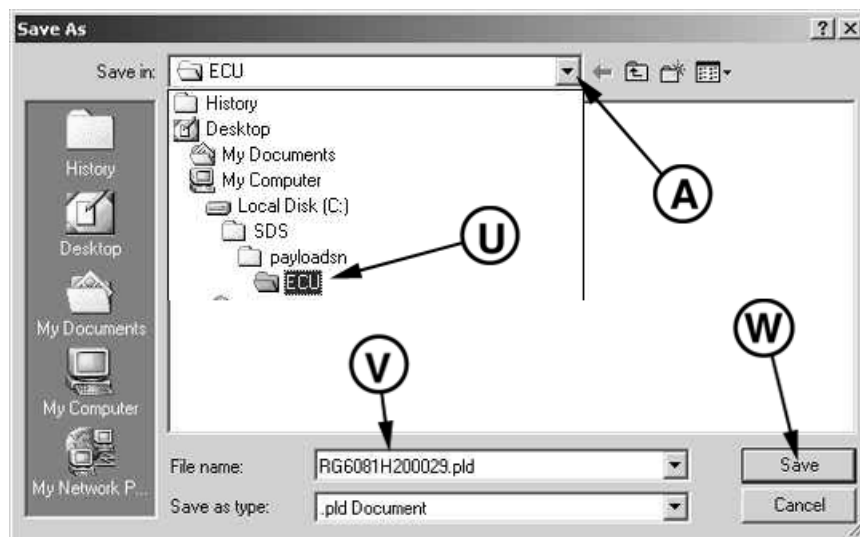


File Download

RG12619 -19-18SEP02

04  
160  
31

RG41221,0000097 -19-04NOV02-10/11



Save As Window

RG12620 -19-18SEP02

12. The "Save As" window will appear. The file must be saved in "C:\SDS\PAYLOADS\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

RG12621 -19-18SEP02

RG41221,0000097 -19-04NOV02-11/11

## Reprogramming Engine Control Unit (ECU) With DST

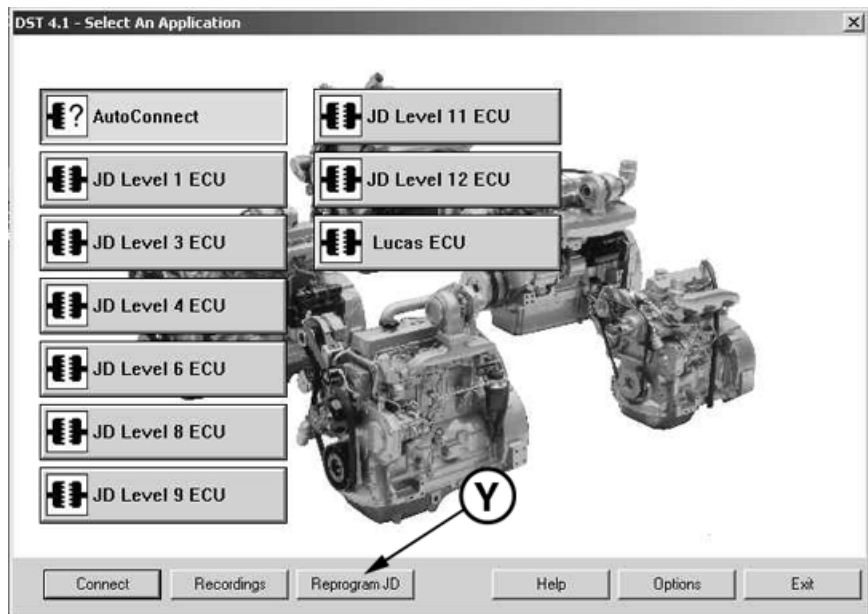
**IMPORTANT:** Diagnostic Scan Tool (DST) Version 4.1 or later must be installed prior to performing the following instructions.

2. Ignition ON, engine OFF.
3. Connect computer with DST to the Diagnostic Connector on the engine.

*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.

RG41221,0000098 -19-04NOV02-1/9



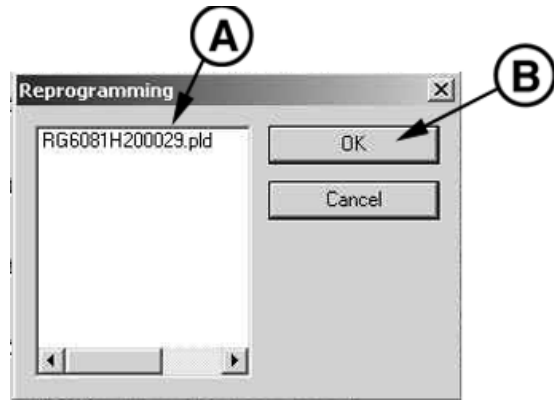
DST Main Screen

4. Start the DST software. Click on "Reprogram JD" (Y).

Continued on next page

RG41221,0000098 -19-04NOV02-2/9

5. Click on the proper payload (A) and click OK (B).



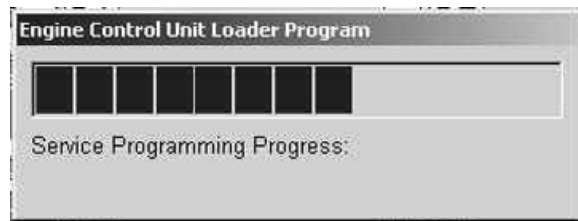
Selecting Payload file for Reprogramming

RG12623 -19-18SEP02

04  
160  
33

RG41221,0000098 -19-04NOV02-3/9

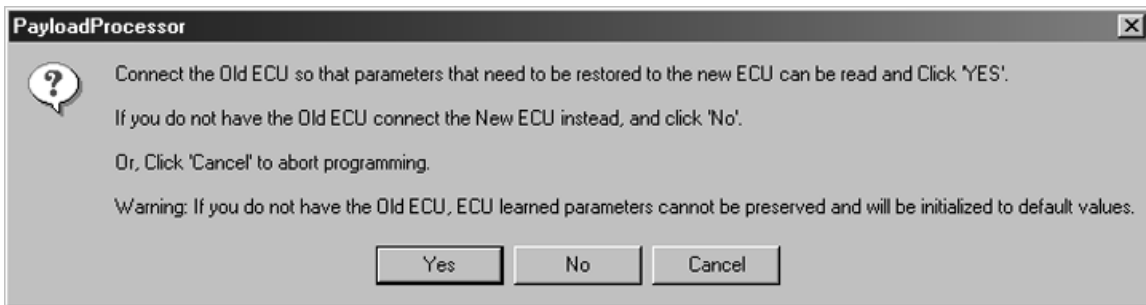
6. A progress bar will appear while reprogramming the ECU. If the engine is equipped with warning alarms, these may come on while in process of reprogramming and should be ignored.



Status Bar

RG12624 -19-18SEP02

RG41221,0000098 -19-04NOV02-4/9



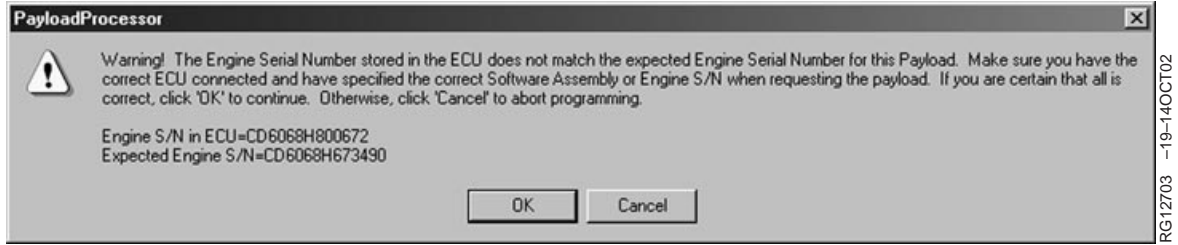
RG12702 -19-11OCT02

7. If the ECU is being replaced, the above message will appear. If you have the old ECU, connect to it

and click YES. If the old ECU is not available, click NO.

Continued on next page

RG41221,0000098 -19-04NOV02-5/9



8. If the ECU is being replaced, the software will notice that the engine serial number does not match the ECU serial number. This message lets

the user know that the ECU expects a different engine serial number to match its ECU serial number. Click "OK" to continue.

RG41221,0000098 -19-04NOV02-6/9

9. When reprogramming the ECU has been successfully completed, the Payload Processor window will appear. Click "OK".



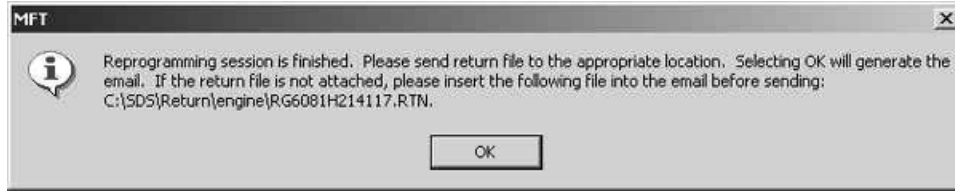
*Payload Processor Completed*

Continued on next page

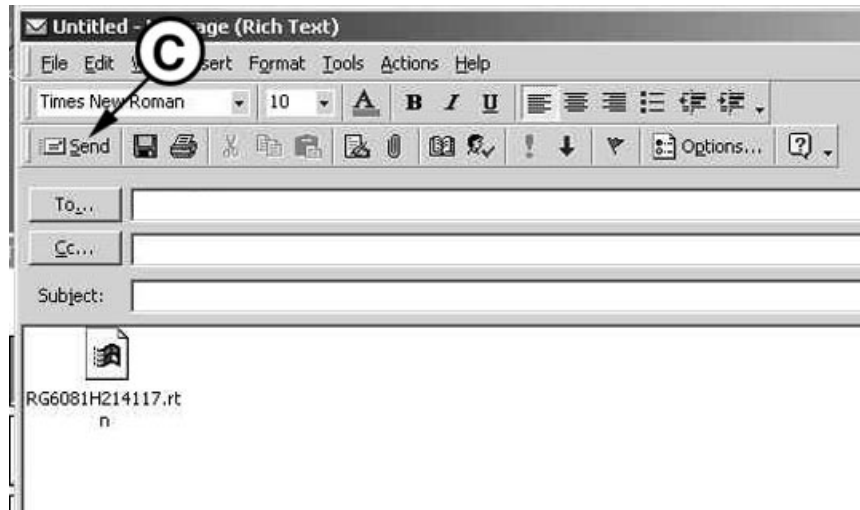
RG41221,0000098 -19-04NOV02-7/9

04  
160  
34

RG12626 -19-18SEP02



Return File Message



Automatic E-mail Generated

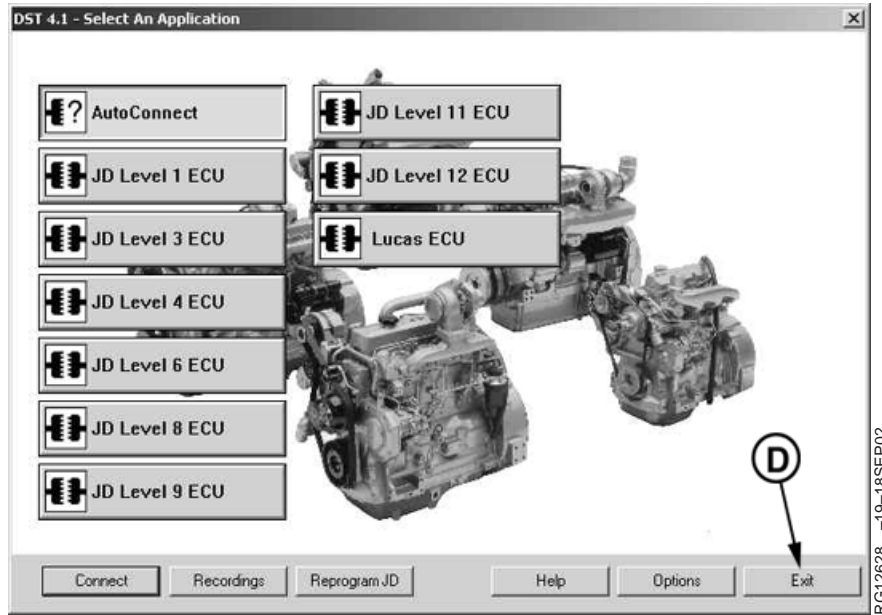
04  
160  
35

10. A return file is created when reprogramming an ECU is completed. The MFT window will appear showing the return file to send back. Click "OK". This will automatically generate an E-mail

message with the proper E-mail address. Click "Send" (C). The next time the mail application is connected to the mail server the message will be sent.

Continued on next page

RG41221.0000098 -19-04NOV02-8/9



Exit DST Software

11. Once the E-mail has been successfully sent, click "Exit" (D) to close DST.

12. Disconnect computer from diagnostic connector and start engine to ensure proper operation.

RG41221,0000098 -19-04NOV02-9/9

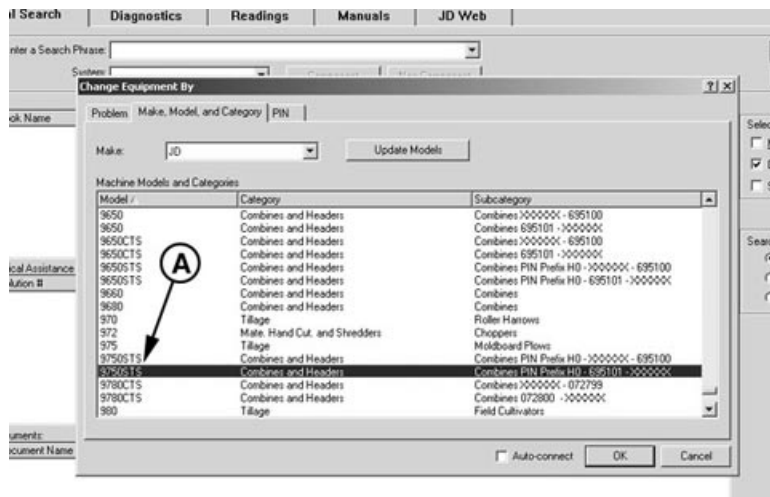


## Downloading Payload File For SERVICE ADVISOR™

**NOTE:** An Internet connection will be needed for steps 1 - 15.      1. Start SERVICE ADVISOR™

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RG41221.000094 -19-04NOV02-1/16



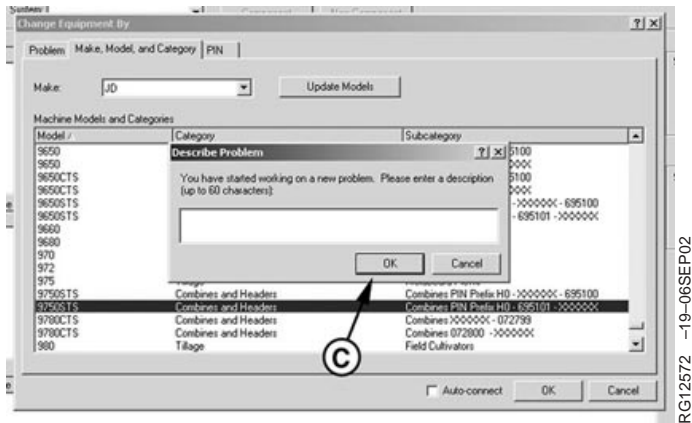
04  
160  
37

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

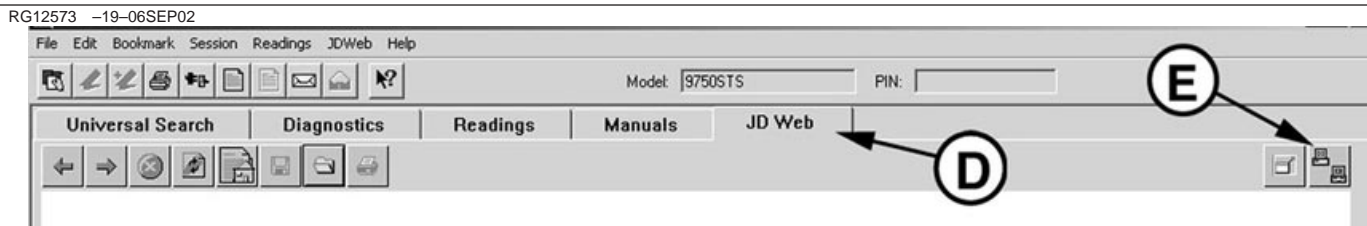
RG41221.000094 -19-04NOV02-2/16

## Trouble Code Diagnostics and Tests



3. Describe Problem window will appear, click OK (C).

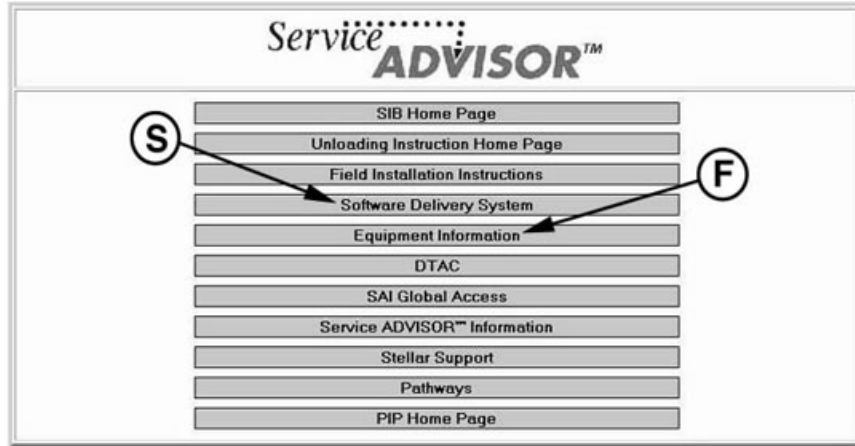
RG41221,0000094 -19-04NOV02-3/16



4. Click on "JD Web" tab (D). In the upper right hand corner click on "Connect to Network" button (E). Select network connection type and click OK.

Continued on next page

RG41221,0000094 -19-04NOV02-4/16



RG12574 -19-06SEP02

*NOTE: Menu options may vary on the SERVICE ADVISOR™ menu.*

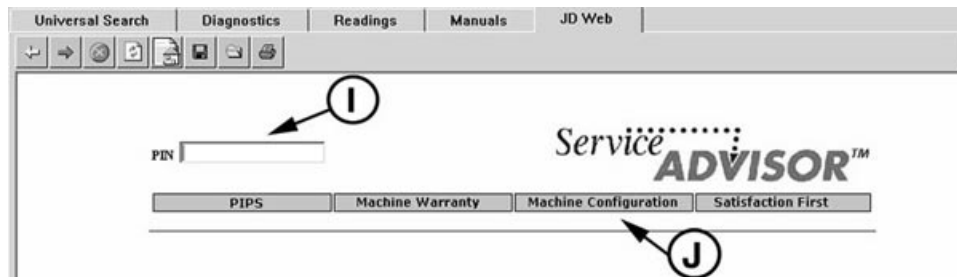
to step 10. With the PIN number only available click on "Equipment Information" (F) button.

5. If the Engine Serial number (ESN) is available click on "Software Delivery System" button (S) and skip

04  
160  
39

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RG41221,0000094 -19-04NOV02-5/16



RG12575 -19-06SEP02

6. Enter PIN number (I) if not already filled in, and select "Machine Configuration" (J). Equipment detail

information for this vehicle will appear on the screen.

Continued on next page

RG41221,0000094 -19-04NOV02-6/16

Major Components Row(s) returned: 11

Status	Serial Number	Component	Install Date (YYYY-MM-DD)
O	CEGB3TT103875	GEAR BOX	2001-12-17
O	CETM3HU106470	TRANS	2001-12-17
O	HOGW001133562	MOIST	2001-12-17
O	PCGT02C261227	RCVR	2001-12-17
O	PCGU02E101415	DSPLAY	2001-12-17
O	PCGV02D114500	MAP	2001-12-17
O	RG6081H201772	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

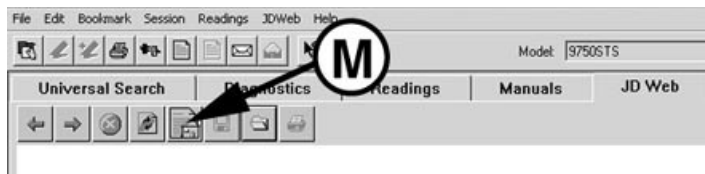
RG12576 -19-06SEP02

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.

RG41221,0000094 -19-04NOV02-7/16

RG12577 -19-06SEP02

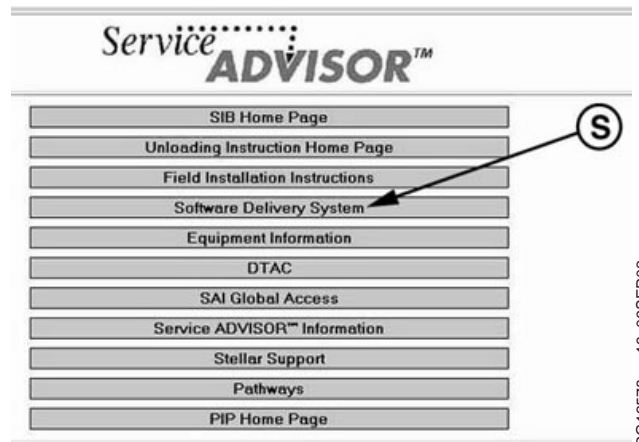


8. Click on the "Home" button (M) within SERVICE ADVISOR™ to go back to the menu.

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RG41221,0000094 -19-04NOV02-8/16

9. Click on "Software Delivery System" button (S). Login if necessary.



RG12578 -19-06SEP02

Continued on next page

RG41221,0000094 -19-04NOV02-9/16

SDS - Software Delivery System

Menu	Description	Action
HELP	The ECU Software Delivery System (SDS) is designed to support remote programming of ECUs. To download an ECU payload, click on the Download button.	Download <input checked="" type="checkbox"/>
LOG OFF		
SDS HOME	A valid license is required to program an ECU. To validate an existing license or get a new license, click the License button.	License <input checked="" type="checkbox"/>
Service ADVISOR™		

**B**

RG12612 -19-06SEP02

Obtaining Valid License

SDS - Software Delivery System

Menu	Description
HELP	License information required for programming an ECU is being validated. Please wait...
LOG OFF	
SDS HOME	
Service ADVISOR™	

RG12614 -19-06SEP02

Validating License

SDS - Software Delivery System

Menu	Description	Action
HELP	The ECU Software Delivery System (SDS) is designed to support remote programming of ECUs. To download an ECU payload, click on the Download button.	Download <input checked="" type="checkbox"/>
LOG OFF		
SDS HOME		
Service ADVISOR™		

**O**

RG12616 -19-06SEP02

Figure B

**NOTE:** Steps 10 - 12 only need to be completed the first time this instruction is performed.

10. A license file is required for each computer that will reprogram ECUs. Download the license file to

gain permissions. Click on "License" (B). A screen will appear while validating license. If the screen appears as "Figure O" allowing the option to download only, then skip to Step 13.

Continued on next page

RG41221,0000094 -19-04NOV02-10/16

04  
160  
41

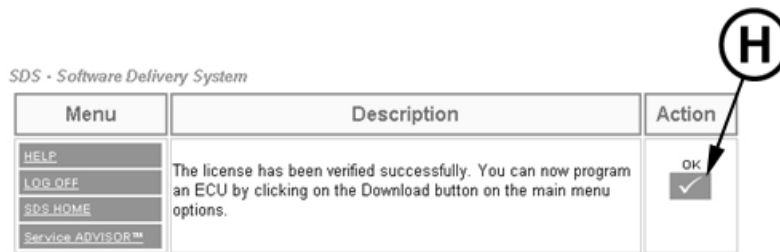


RG12613 -19-20SEP02

11. Click on "Grant Always" (G).

04  
160  
42

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

Menu	Description	Action
HELP	The ECU Software Delivery System (SDS) is designed to support remote programming of ECUs. To download an ECU payload, click on the Download button.	Download <input checked="" type="checkbox"/>
LOG OFF		
SDS HOME	A valid license is required to program an ECU. To validate an existing license or get a new license, click the License button.	License <input checked="" type="checkbox"/>

RG12579 -19-06SEP02

- Click on "Download" button (O). A screen will appear as the system verifies that a valid license file is present.

04  
160  
43

RG41221.0000094 -19-04NOV02-13/16

SDS - Software Delivery System

Menu	Description
HELP	Type of Electronic Control Unit (ECU): CAS - Active Seat for EPQ transmission E04 - Left Hand Armrest Control EHC - Power Reverser Transmission Engine EPC - Electronic Power Quad Transmission - EPQT
LOG OFF	
SDS HOME	
Service ADVISOR?	

RG12580 -19-06SEP02

- Scroll down and click on "Engine" (P).

RG41221.0000094 -19-04NOV02-14/16

SDS - Software Delivery System

Menu	Description	Action
HELP	Engine Serial Number: Replacing the ECU? (if so, enter the new, replacement ECU serial number e.g. 110112)	Download <input checked="" type="checkbox"/>

RG12581 -19-06SEP02

- Click once in the ESN text box (Q) so the cursor is in the box. Type in the ESN or Right click and select "Paste" to copy the ESN into the text field.

If you are replacing the ECU, go to step 16. If you reprogramming the existing ECU, click "Download" (R) and go to step 18.

Continued on next page

RG41221.0000094 -19-04NOV02-15/16

Menu	Description		Action
HELP	Engine Serial Number:?	RG6081H200029	Download <input checked="" type="checkbox"/>
LOG OFF	Replacing the ECU??	<input checked="" type="checkbox"/>	
SDS HOME	(if so, enter the new, replacement ECU serial number e.g. 110112)	110112	

RG12701A -19-14OCT02

Replacing ECU

16. If the current machine is being replaced, check the "Replacing the ECU" box (E).

**IMPORTANT: Service ADVISOR™ software must be closed and reopened prior to programming the ECU.**

*NOTE: Sometimes the original ECU will not be available for reprogramming. When a new ECU is being programmed to replace the current ECU, the software will tie the engine serial number to the new ECU serial number.*

18. After downloading the ECU payload to the computer, exit SERVICE ADVISOR™

17. Enter in the new ECU's serial number (F) located on the ECU label and click "Download".

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160  
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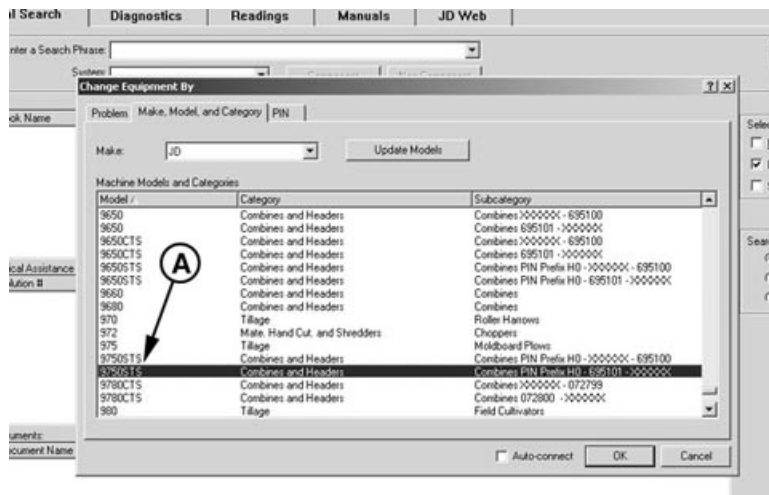
## Reprogramming Engine Control Unit (ECU) With SERVICE ADVISOR™

**IMPORTANT: Ignition ON, engine OFF.**

Connect computer with SERVICE ADVISOR™ to the Diagnostic Connector in the cab or on the engine.

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RG41221.000099 -19-04NOV02-1/8



04  
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**NOTE:** Internet connection is not required to program an engine control unit.

known select the PIN tab and enter PIN number. Click OK.

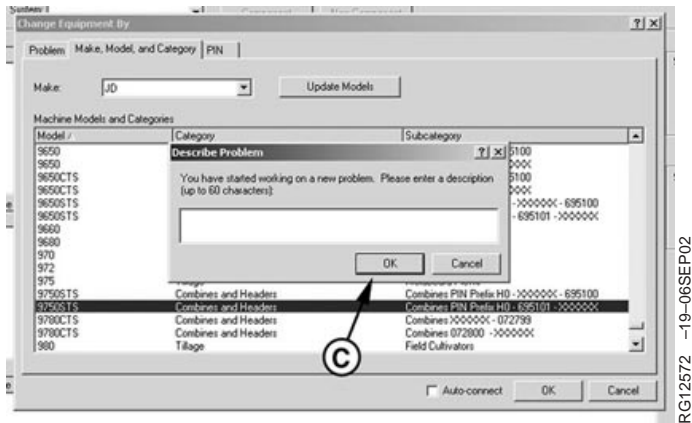
1. Start SERVICE ADVISOR™. Select vehicle model (A) with the proper serial number range or if PIN is

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RG41221.000099 -19-04NOV02-2/8

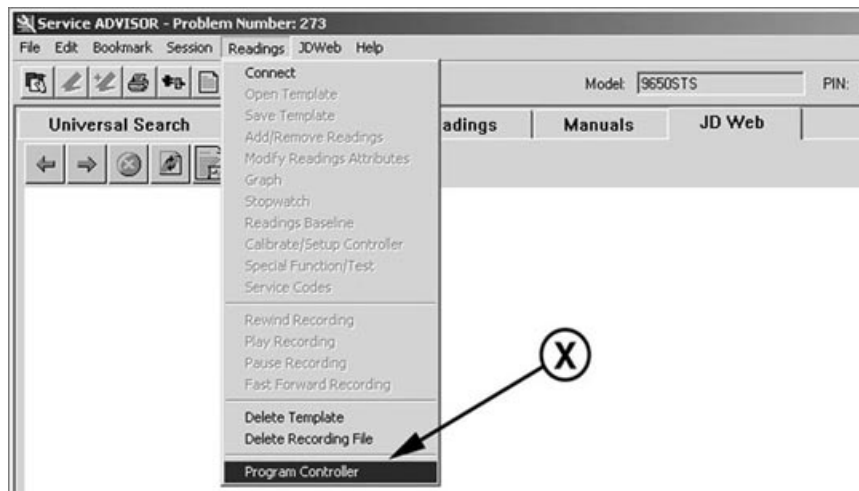
## Trouble Code Diagnostics and Tests



2. Describe Problem window will appear, click OK (C).

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160  
46

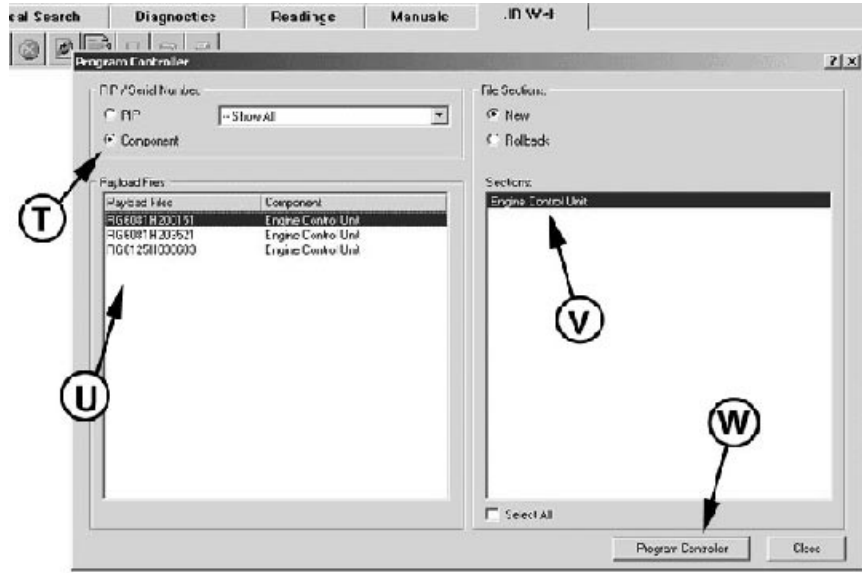
RG41221,0000099 -19-04NOV02-3/8



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

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47

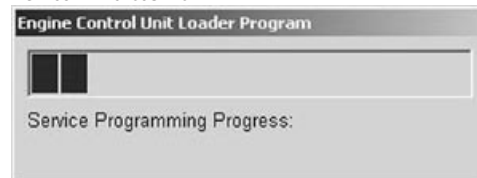
4. Select radio button for "Component" (T). Select the proper payload file for engine ECU (U).

5. Click once on "Engine Control Unit" (V) and click on "Program Controller" (W).

RG41221,0000099 -19-04NOV02-5/8

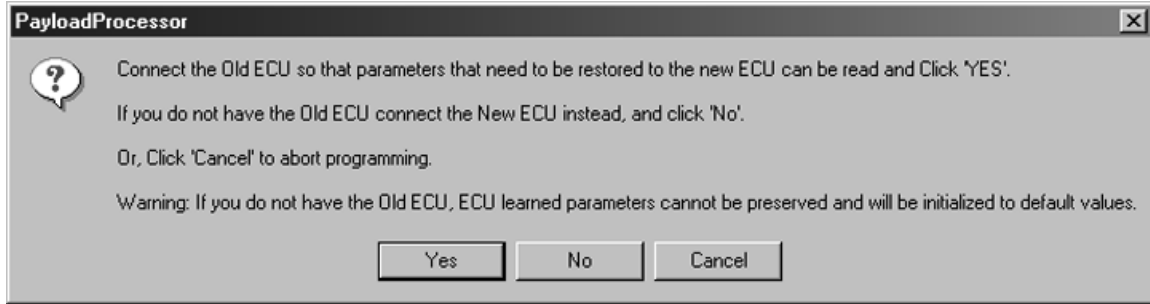
6. A progress bar will appear while reprogramming the ECU. The engine warning light may come on and a warning may sound while in process of reprogramming and should be ignored.

RG12584 -19-06SEP02



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RG41221,0000099 -19-04NOV02-6/8

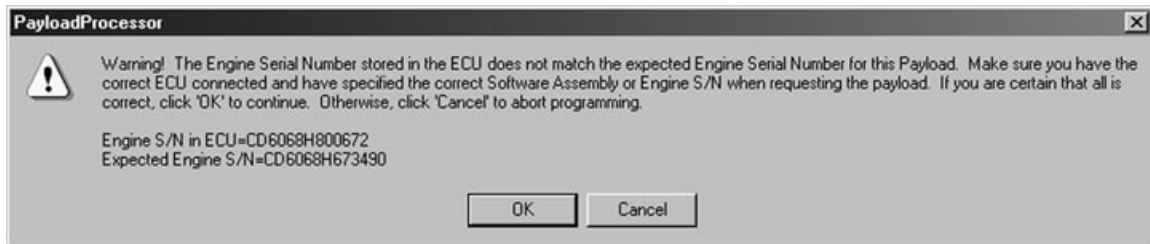


7. If the ECU is being replaced, the above message will appear. If you have the old ECU, connect to it

and click YES. If the old ECU is not available, click NO.

04  
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48

RG41221,0000099 -19-04NOV02-7/8



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 11 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, 000110.03 will be displayed as 000110.03.

### 2-DIGIT CODES

Some applications may not display engine codes as an SPN/FMI. In most of these cases, the code is displayed as a 2-digit code. Some applications may

require the blinking of codes. For information on how to blink codes, see BLINKING DTCS in this Group. 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 Group 160 of this manual.

### WARNING LAMP

On some applications, there is a warning lamp that is used when a code becomes active. When a code is active, this lamp will either blink or stay on solid. Typically, a solid light indicates that the ECU is taking extreme measures to protect the engine, and a blinking light indicates that the ECU has detected a fault and engine performance may be affected. Refer to Operator's Manual for a given application for more detailed information.

### CLEARING STORED DTCS

Stored DTCs can be cleared through the OEM instrument panel, through the DST or SERVICE ADVISOR™. For more information on clearing DTCs using the diagnostic code reader on the instrument panel, see CLEARING STORED DTCS ON DIAGNOSTIC GAUGE earlier in this Group.

## Listing of Diagnostic Trouble Codes (DTCs) on ECU

### Ascending SPN/FMI Codes

SPN	FMI	Description
000028	03	Throttle Volts High
	04	Throttle Volts Low
000029	03	Throttle Volts High
	04	Throttle Volts Low
000084	31	Vehicle Speed Mismatch
000091	03	Throttle Volts High
	04	Throttle Volts Low
	09	Throttle Invalid
	14	Throttle Voltage Out of Range
000094	03	Fuel Rail Pressure Input Voltage High
	04	Fuel Rail Pressure Input Voltage Low
	10	Fuel Rail Pressure Loss Detected
	13	Fuel Rail Pressure Higher Than Expected
	17	Fuel Rail Pressure Not Developed
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
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
000105	00	Manifold Air Temperature Extremely High
	03	Manifold Air Temperature Input Voltage High
	04	Manifold Air Temperature Input Voltage Low
	16	Manifold Air Temperature Moderately High
000107	00	Air Filter Differential Pressure
000110	00	Engine Coolant Temperature Extremely High
	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 Moderately High
000111	01	Engine Coolant Level Low
000158	17	ECU Power Down Error
000160	02	Wheel Speed Input Noise
000174	00	Fuel Temperature High Most Severe
	03	Fuel Temperature Input Voltage High
	04	Fuel Temperature Input Voltage Low
	16	Fuel Temperature High Moderately Severe
	00	Engine Speed Derate
000189	00	Engine Speed Derate
000190	00	Engine Overspeed Extreme
	16	Engine Overspeed Moderate
	02	Vehicle Identification Number Invalid
000237	13	Vehicle Identification Option Code Invalid
	31	Vehicle Model Number Invalid
	03	Electronic Injector Wiring Shorted to Power Source
000611	04	Electronic Injector Wiring Shorted to Ground
	03	Sensor Supply 2 Voltage High
000620	04	Sensor Supply 2 Voltage Low

Continued on next page

RG40854,0000103 -19-20MAY02-1/4

*Trouble Code Diagnostics and Tests*

000627	01	Electronic Injector Supply Voltage Problem
000629	13	ECU Error
000636	02	Pump Position Sensor Input Noise
	08	Pump Position Sensor Input Missing
	10	Pump Position Sensor Input Pattern Error
000637	02	Crank Position Input Noise
	07	Crank Position/Pump Position Timing Moderately Out of Sync
	08	Crank Position Input Missing
	10	Crank Position Input Pattern Error
000639	13	CAN Bus Error
000651	05	Cylinder #1 Electronic Injector Circuit Open
	06	Cylinder #1 Electronic Injector Circuit Shorted
	07	Cylinder #1 Electronic Injector Mechanical Failure
000652	05	Cylinder #2 Electronic Injector Circuit Open
	06	Cylinder #2 Electronic Injector Circuit Shorted
	07	Cylinder #2 Electronic Injector Mechanical Failure
000653	05	Cylinder #3 Electronic Injector Circuit Open
	06	Cylinder #3 Electronic Injector Circuit Shorted
	07	Cylinder #3 Electronic Injector Mechanical Failure
000654	05	Cylinder #4 Electronic Injector Circuit Open
	06	Cylinder #4 Electronic Injector Circuit Shorted
	07	Cylinder #4 Electronic Injector Mechanical Failure
000655	05	Cylinder #5 Electronic Injector Circuit Open
	06	Cylinder #5 Electronic Injector Circuit Shorted
	07	Cylinder #5 Electronic Injector Mechanical Failure
000656	05	Cylinder #6 Electronic Injector Circuit Open
	06	Cylinder #6 Electronic Injector Circuit Shorted
	07	Cylinder #6 Electronic Injector Mechanical Delivery Failure
000676	03	Glow Plug Relay Voltage High
	05	Glow Plug Relay Voltage Low
000898	09	Vehicle Speed or Torque Message Invalid
000970	31	Engine Shutdown - Auxiliary Request
000971	31	External Fuel Derate Switch Active
001069	09	Tire Size Invalid
	31	Tire Size Error
001079	03	Sensor Supply 1 Voltage High
	04	Sensor Supply 1 Voltage Low
001080	03	Fuel Rail Pressure Sensor Supply Voltage High
	04	Fuel Rail Pressure Sensor Supply Voltage Low
001109	31	Engine Protection Shutdown Warning
001110	31	Engine Protection Shutdown
001347	03	Pump Control Valve Current High
	05	Pump Control Valve Current Mismatch
	07	Fuel Rail Pressure Control Error
	10	Pump Control Valve Fuel Flow Not Detected
001568	02	Torque Curve Selection Invalid
001569	31	Fuel Derate
001639	01	Fan Speed Input Missing
	16	Fan Speed Higher Than Expected
	18	Fan Speed Lower Than Expected
002000	13	Security Violation
002005	09	ACU Signal Missing
002049	09	CAB Signal Missing
002071	09	CCU Signal Missing

04  
160  
51

Continued on next page

RG40854.0000103 -19-20MAY02-2/4

Ascending 2-Digit Codes

DTC's Listing in Ascending 2-Digit Codes

2-Digit	SPN	FMI	Definition
11	000091	03	Throttle Volts High
12	000091	04	Throttle Volts Low
13	000029	03	Throttle Volts High
15	000028	03	Throttle Volts High
17	000653	05	Cylinder #3 EI Circuit Open
18	000110	03	Engine Coolant Temperature Input Voltage High
19	000110	04	Engine Coolant Temperature Input Voltage Low
21	000620	03	Sensor Supply 2 Voltage High
22	000620	04	Sensor Supply 2 Voltage Low
23	000100	03	Engine Oil Pressure Input Voltage High
24	000100	04	Engine Oil Pressure Input Voltage Low
25	000105	03	Manifold Air Temperature Input Voltage High
26	000105	04	Manifold Air Temperature Input Voltage Low
27	000094	03	Fuel Rail Pressure Input Voltage High
28	000094	04	Fuel Rail Pressure Input Voltage Low
29	000652	05	Cylinder #2 EI Circuit Open
31	000651	05	Cylinder #1 EI Circuit Open
32	N/A <sup>a</sup>	N/A <sup>a</sup>	When reading blink codes, signifies the start of active codes.
33	N/A <sup>a</sup>	N/A <sup>a</sup>	When reading blink codes, signifies the start of stored codes.
34	000654	05	Cylinder #4 EI Circuit Open
35	000655	05	Cylinder #5 EI Circuit Open
36	000656	06	Cylinder #6 EI Circuit Open
37	000174	03	Fuel Temperature Input Voltage High
38	000174	04	Fuel Temperature Input Voltage Low
39	000637	02	Crank Position Input Noise
	000637	10	Crank Position Input Pattern Error
41	000637	08	Crank Position Input Missing
42	000190	00	Engine Overspeed Extreme
		16	Engine Overspeed Moderate
43	000636	08	Pump Position Input Missing
44	000636	02	Pump Position Input Noise
	000636	10	Pump Position Pattern Error
45	000637	07	Crank/Pump Position Out of Sync
48	001080	04	Fuel Rail Pressure Sensor Supply Voltage High
49	001080	03	Fuel Rail Pressure Sensor Supply Voltage Low
51	001079	03	Sensor Supply 1 Voltage High
52	001079	04	Sensor Supply 1 Voltage Low
54	000158	17	ECU Power Down Error
55	000105	16	Manifold Air Temperature Moderately High
56	000655	07	Cylinder #5 EI Delivery Failure
59	000653	07	Cylinder #3 EI Delivery Failure
61	000110	15	Engine Coolant Temperature High Least Severe
62	000110	16	Engine Coolant Temperature High Moderately Severe
63	000110	00	Engine Coolant Temperature High Most Severe
64	000111	01	Engine Coolant Level Low
65	000651	07	Cylinder #1 EI Delivery Failure
66	000652	07	Cylinder #2 EI Delivery Failure
67	000654	07	Cylinder #4 EI Delivery Failure
68	000656	07	Cylinder #6 EI Delivery Failure

<sup>a</sup>N/A = Not Applicable

04  
160  
52



## Trouble Code Diagnostics and Tests

71	000174	16	Fuel Temperature Moderately High
74	000100	18	Engine Oil Pressure Moderately Low
75	000100	01	Engine Oil Pressure Extremely Low
76	000654	07	Cylinder #4 EI Delivery Failure
77	001347	05	Pump Control Valve Current Mismatch
78	001347	07	Fuel Rail Pressure Control Error
79	001347	03	Pump Control Valve Current High
82	001110	31	Engine Protection Shutdown
83	000970	31	Auxiliary Engine Shutdown Switch Active
84	000971	31	External Fuel Derate Switch Active
85	000094	17	Fuel Rail Pressure Not Developed
86	000094	10	Fuel Rail Pressure Loss Detected
88	N/A <sup>a</sup>	N/A <sup>a</sup>	When reading blink codes, signifies that no fault codes are in buffer.
91	000651	06	Cylinder #1 EI Circuit Shorted
92	000652	06	Cylinder #2 EI Circuit Shorted
93	000653	06	Cylinder #3 EI Circuit Shorted
94	000654	06	Cylinder #4 EI Circuit Shorted
95	000655	06	Cylinder #5 EI Circuit Shorted
96	000656	06	Cylinder #6 EI Circuit Shorted
97	000627	01	Electronic Injector Supply Voltage Problem
98	000611	03	Electronic Injector Wiring Shorted to Power Source
99	000611	04	Electronic Injector Wiring Shorted to Ground

<sup>a</sup>N/A = Not Applicable

04  
160  
53

RG40854,0000103 -19-20MAY02-4/4

## 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 procedure in Section 04, Group 150 of this manual.
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.**

## Intermittent Fault Diagnostics

Intermittent faults are problems that periodically “go away”. A problem such as a loose terminal that intermittently does not 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

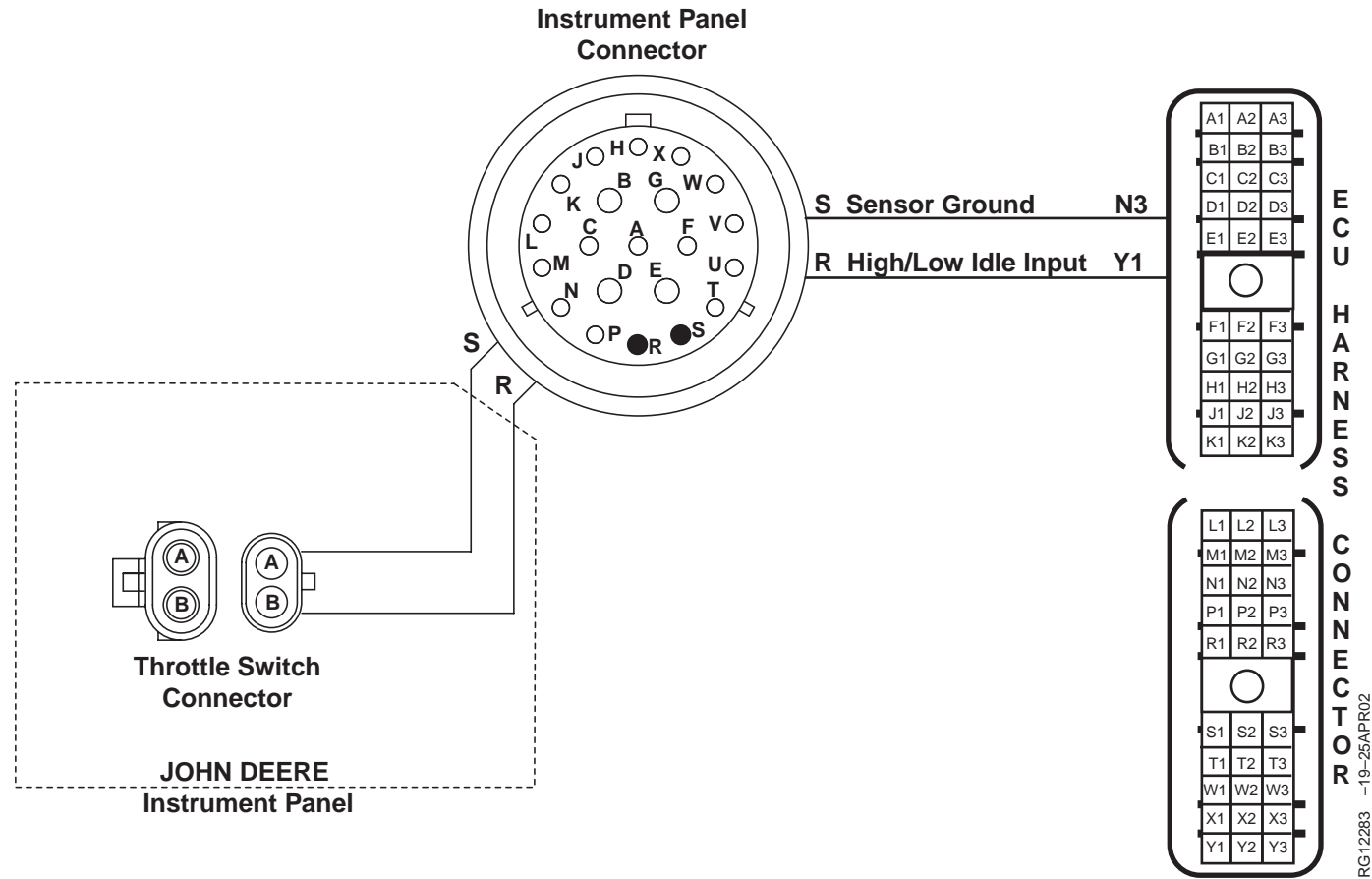
includes a function called Recording. The Recording function permits the recording of data parameter values during a diagnostic session. If a DTC sets during a certain diagnostic session, the parameters can be played back and observed to see what each parameter’s value was when the DTC occurred.

- If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the DST or SERVICE ADVISOR™ to see if the fault resets.
- To check the connection between the harness and a sensor or the harness and the ECU, use JT07328 Connector Adapter Test Kit. Insert the male end of the appropriate test adapter into the female end of the ECU or sensor connector terminal. There should be moderate resistance when the test adapter is inserted into the terminal. If the connection is loose, replace the female terminal.

### Possible Causes of Intermittent Faults:

- Faulty connection between sensor or actuator and harness.
- Faulty contact between terminals in connector.
- Faulty terminal/wire connection.
- Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc. can cause faulty signals to be sent to the ECU.

### T1 - Multi-state Throttle Input High



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160  
56

#### 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. For further multi-state throttle operation information, see MEASURING THROTTLE POSITION in Section 03, Group 140 of this manual.

#### This code will set if:

- The multi-state throttle input voltage exceeds the maximum threshold. The voltage is higher than what is physically possible for the throttle lever to achieve.

#### If this code sets, the following will occur:

- 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.

## T1 - Multi-state Throttle Input High

RG40854,0000004 -19-29APR02-1/1

### T1 - Multi-State Throttle Input High Diagnostic Procedure

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors, the multi-state throttle connector, and any connectors between them looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine OFF</li> <li>6. Move the multi-state switch through all the positions.</li> <li>7. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000091.03 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000091.03 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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*Trouble Code Diagnostics and Tests*

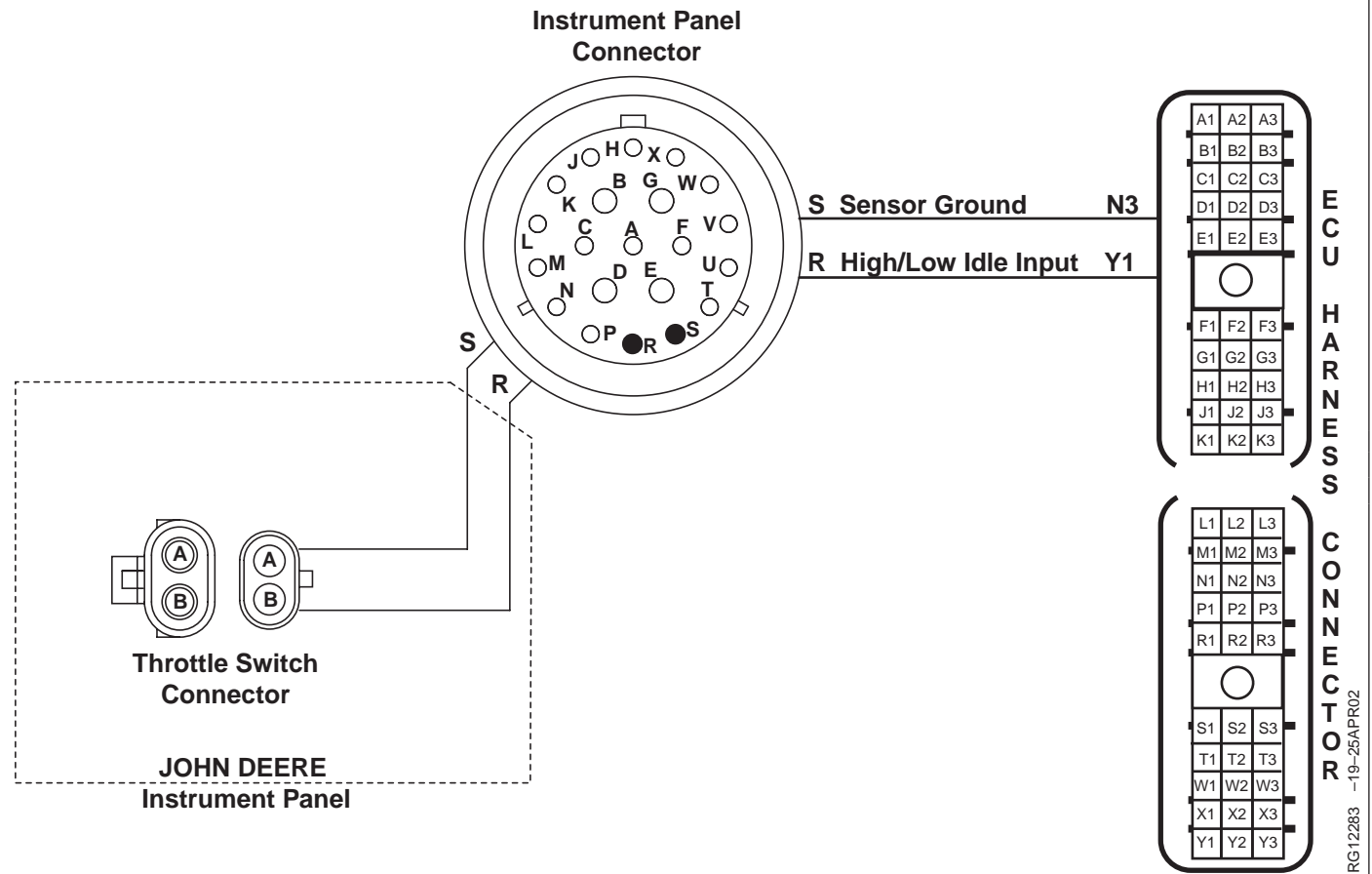
<p><b>③ Throttle Position Input Shorted Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect multi-state throttle switch at two wire connector behind instrument panel.</li> <li>3. Install a jumper wire between both terminals of the switch harness connector.</li> <li>4. Make note of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine OFF</li> <li>6. Using the ECU diagnostic software, read DTCs</li> </ol>	<p><b>000091.03 reoccurs:</b> GO TO ④</p> <p><b>000091.04 occurs:</b> Faulty multi-state throttle switch connector OR Faulty multi-state throttle switch</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>④ Throttle Position Ground Circuit Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove jumper wire.</li> <li>3. Ignition ON, engine OFF</li> <li>4. Using a multimeter, measure voltage between multi-state switch 5 V input terminal (terminal B) and a good chassis ground.</li> </ol>	<p><b>4.0 - 6.0 volts:</b> Open in multi-state switch ground circuit OR Faulty ECU connection OR Faulty ECU</p> <p><b>Below 4.0 volts:</b> Open in multi-state switch 5 V input circuit OR Faulty ECU connection OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>
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58



## T2 - Multi-state Throttle Input Low



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### 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. For further multi-state throttle operation information, see MEASURING THROTTLE POSITION in Section 03, Group 140 of this manual.

### 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.



## T2 - Multi-state Throttle Input Low

RG40854,0000006 -19-29APR02-1/1

### T2 - Multi-State Throttle Input Low Diagnostic Procedure

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors, the multi-state throttle connector, and any connector between them looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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160  
61

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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine OFF</li> <li>6. Move the multi-state switch through all the positions.</li> <li>7. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000091.04 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000091.04 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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Trouble Code Diagnostics and Tests

③ Throttle Position  
Wiring Test

*NOTE: For wiring and theory of operation, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information.*

1. Ignition OFF
2. Disconnect multi-state throttle switch at two wire connector behind instrument panel.
3. Make note of any DTCs, then clear all DTCs
4. Ignition ON, engine OFF
5. Using the ECU diagnostic software, read DTCs

**000091.04 reoccurs:**  
Short to ground in multi-state input circuit  
OR  
Open in multi-state input circuit  
OR  
Faulty ECU

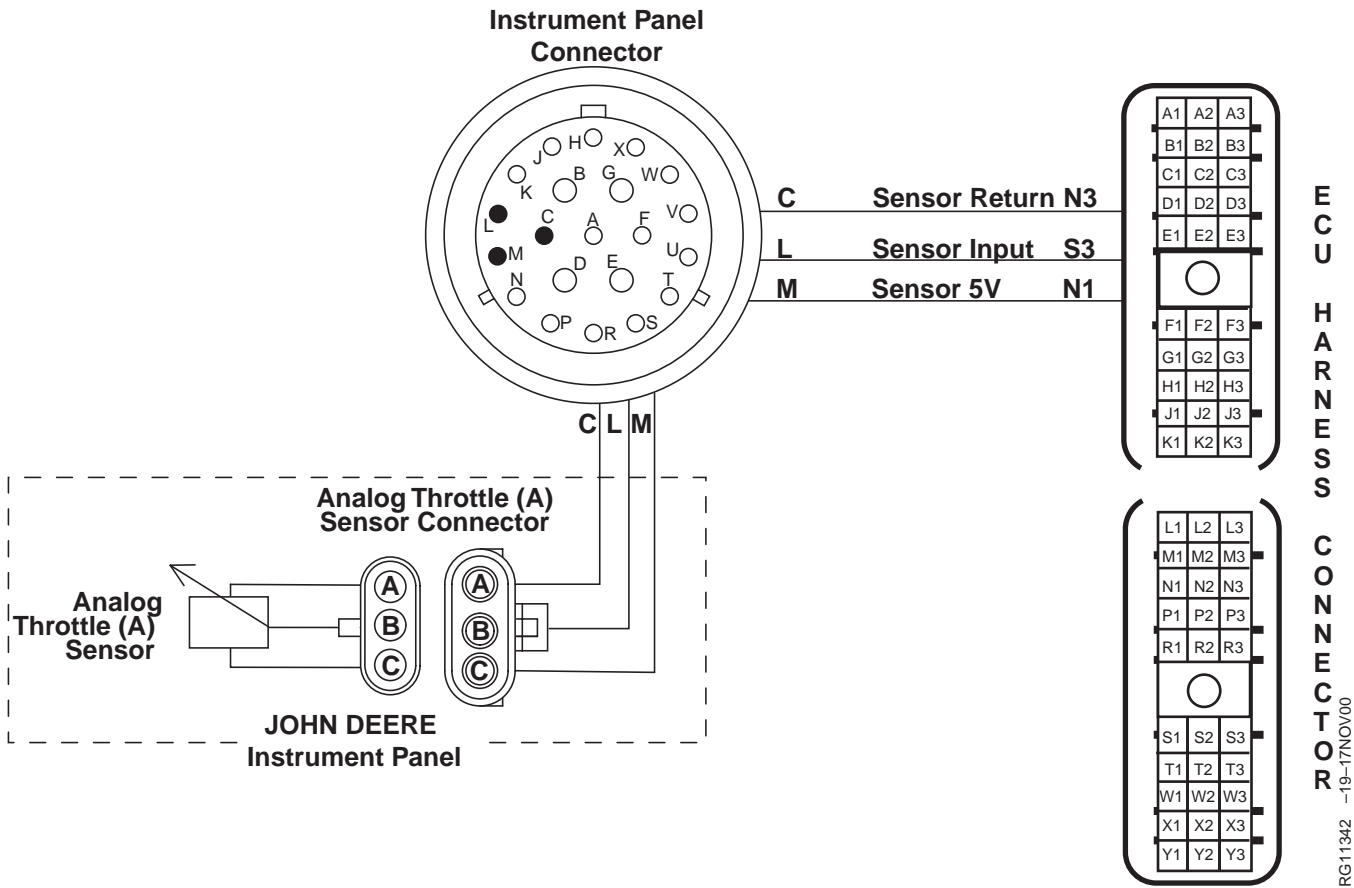
**000091.03 occurs:**  
Faulty multi-state throttle switch connector  
OR  
Faulty multi-state throttle switch.

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04  
160  
62



### T3 - Analog Throttle (A) Input High



**NOTE:** Wiring diagram shows OEM engine applications. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 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. The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

**This code will set if:**

- The analog throttle (A) input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for the throttle lever to achieve.
  - For OEM applications, the high analog throttle (A) input voltage specification is 4.7 volts.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 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.
- 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.

04  
160  
64

## T3 - Analog Throttle (A) Input High

RG40854,0000008 -19-29APR02-1/1

### T3 - Analog Throttle (A) Input High Diagnostic Procedure

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.</i></p> <p>Perform a preliminary inspection ECU connectors, the analog throttle (A) sensor connector, and any connectors between them looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Analog Throttle (A) in the idle position.</li> <li>5. Read the analog throttle (A) input voltage on DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE: For OEM applications, the high analog throttle (A) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>4.7 volts or greater:</b> GO TO <b>❹</b></p> <p><b>Below 4.7 volts:</b> GO TO <b>❸</b></p>
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160  
65

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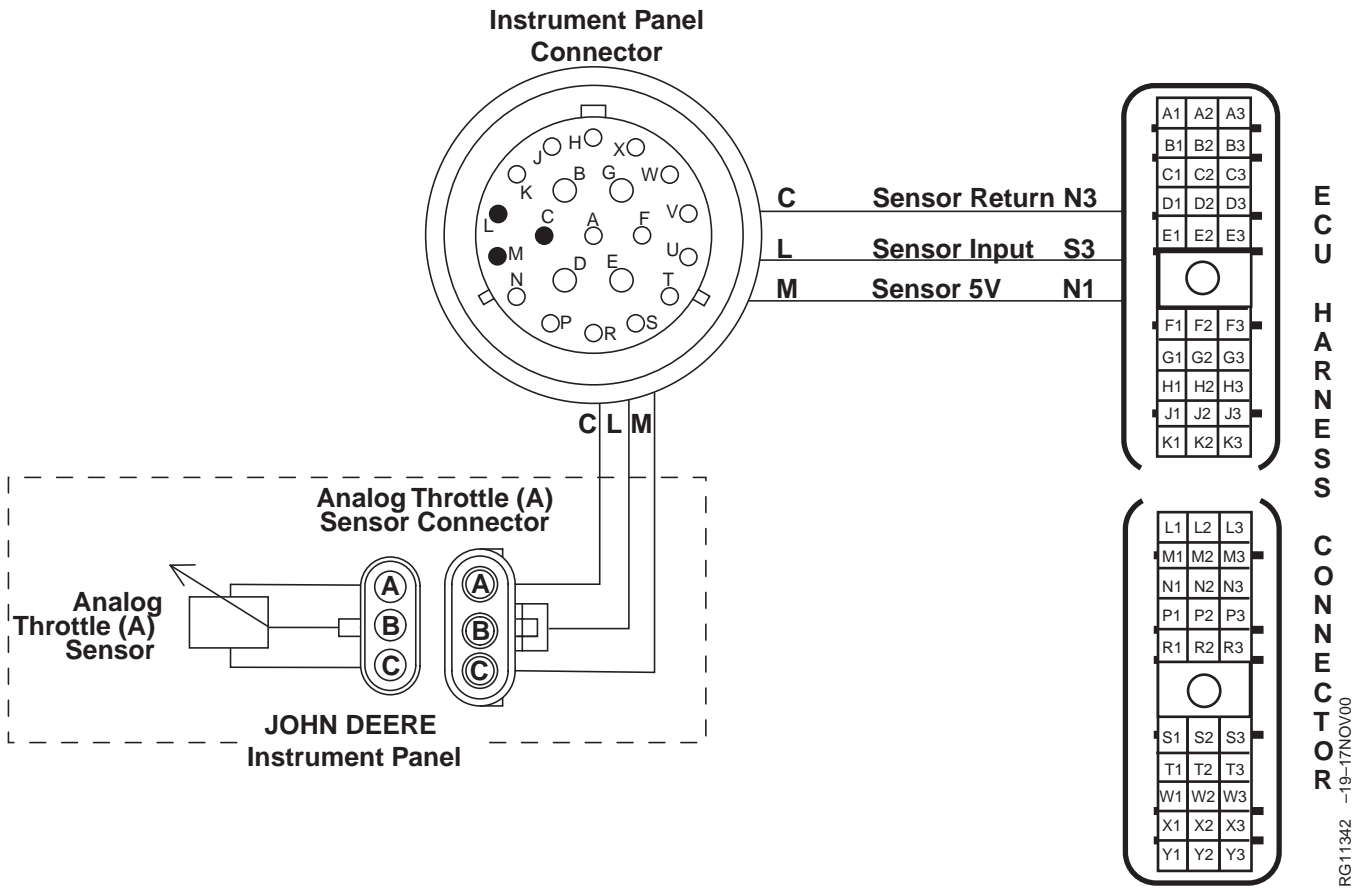
## Trouble Code Diagnostics and Tests

<p><b>③ Throttle Travel Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Slowly operate analog throttle (A) through its full travel.</li> <li>2. Using the ECU diagnostic software, read the analog throttle (A) input voltage</li> </ol> <p><i>NOTE: For OEM applications, the high analog throttle (A) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Goes above 4.7 volts:</b>            Faulty analog throttle (A) sensor connector            OR            Open in analog throttle (A) sensor ground circuit            OR            Faulty analog throttle (A) sensor</p> <p><b>Never goes above 4.7 volts:</b>            Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Throttle Position Input Shorted Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect analog throttle (A) sensor connector behind instrument panel.</li> <li>3. Ignition ON, Engine OFF</li> <li>4. Using the ECU diagnostic software, read the analog throttle (A) input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low analog throttle (A) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>0.3 volts or less:</b>            GO TO ⑤</p> <p><b>Above 0.3 volts:</b>            Short to voltage in analog throttle (A) input circuit            OR            Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Throttle Position Ground Circuit Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Analog throttle (A) sensor connector disconnected.</li> <li>3. Using a test light connected to battery (+), probe the ground terminal (terminal A) in the analog throttle (A) sensor connector on the instrument panel harness.</li> </ol>	<p><b>Light ON:</b>            Faulty analog throttle (A) sensor connector            OR            Faulty analog throttle (A) sensor</p> <p><b>Light OFF:</b>            Open in analog throttle (A) ground circuit</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
66



### T4 - Analog Throttle (A) Input Low



**NOTE:** Wiring diagram shows OEM engine applications. 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. The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

**This code will set if:**

- The analog throttle (A) input voltage drops below the sensor's low voltage specification. The voltage is lower than what is physically possible for the throttle lever to achieve.
  - For OEM applications, the low analog throttle (A) input voltage specification is 0.3 volts.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 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.
- 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.



## T4 - Analog Throttle (A) Input Low

RG40854,000000B -19-29APR02-1/1

### T4 - Analog Throttle (A) Input Low Diagnostic Procedure

-- 1/1

<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors, the analog throttle (A) sensor connector, and any connector between them looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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160  
69

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<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Throttle (A) in the idle position.</li> <li>5. Read the analog throttle (A) input voltage on DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE: For OEM applications, the low analog throttle (A) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>0.3 volts or less:</b> GO TO <b>④</b></p> <p><b>Above 0.3 volts:</b> GO TO <b>③</b></p>
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## Trouble Code Diagnostics and Tests

<p><b>③ Throttle Travel Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Slowly operate analog throttle (A) through its full travel.</li> <li>2. Using the ECU diagnostic software, read the analog throttle (A) input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low analog throttle (A) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Goes below 0.3 volts:</b>            Faulty analog throttle (A) sensor connector            OR            Open in analog throttle (A) sensor ground circuit            OR            Faulty analog throttle (A) sensor</p> <p><b>Never goes above 0.3 volts:</b>            Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Throttle Position Wiring Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect analog throttle (A) sensor connector behind the instrument panel.</li> <li>3. Install a jumper wire between the 5 V Supply terminal and the input terminal (terminals B and C) in the analog throttle (A) sensor connector on the instrument panel harness.</li> <li>4. Ignition ON, engine OFF</li> <li>5. Using the ECU diagnostic software, read the analog throttle (A) input voltage</li> </ol> <p><i>NOTE: For OEM applications, the high analog throttle (A) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Below 4.7 volts:</b>            GO TO ⑤</p> <p><b>4.7 volts or greater:</b>            Faulty analog throttle (A) sensor connector            OR            Faulty analog throttle (A) sensor</p> <p style="text-align: right;">-- -1/1</p>

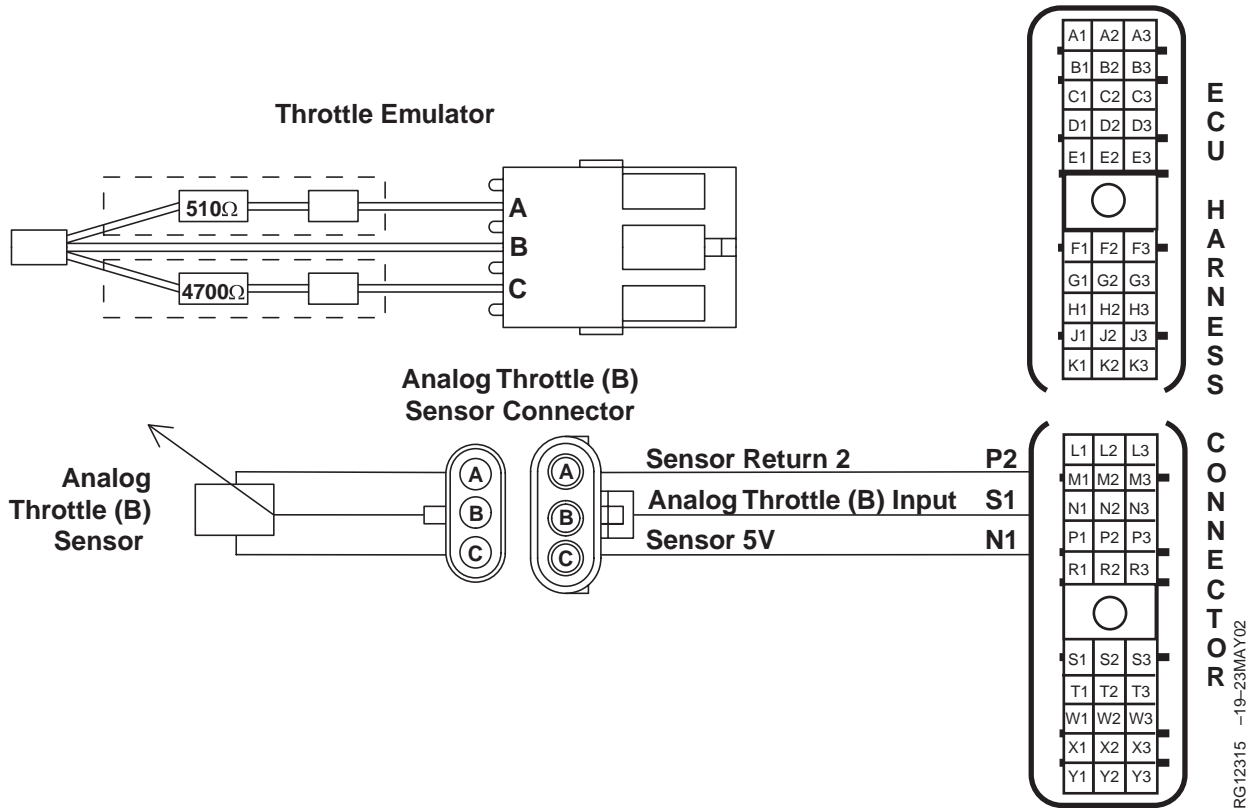
04  
160  
70

Trouble Code Diagnostics and Tests

<p><b>5 Throttle Position 5V Supply Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.</i></p> <ol style="list-style-type: none"><li>1. Ignition OFF</li><li>2. Remove jumper wire.</li><li>3. Ignition ON, engine OFF</li><li>4. Using a multimeter, measure the voltage between the analog throttle (A) ground terminal and the 5 V Supply terminal (terminals A and C) in the analog throttle (A) sensor connector on the engine harness.</li></ol>	<p><b>4.0-6.0 volts:</b> Open in analog throttle (A) input circuit OR Short to ground in analog throttle (A) input circuit OR Faulty ECU connector OR Faulty ECU</p> <p><b>Below 4.0 volts:</b> Open in analog throttle (A) 5 V Supply circuit OR Short to ground in analog throttle (A) 5 V Supply circuit OR Faulty ECU connector OR Faulty ECU</p> <p>-- -1/1</p>
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160  
71

## T5 - Analog Throttle (B) Input High



**NOTE:** Wiring diagram shows OEM engine applications. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 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. The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

**This code will set if:**

- The analog throttle (B) input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for the throttle lever to achieve.
  - For OEM applications, the high analog throttle (B) input voltage specification is 4.7 volts.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 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.
- 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.

## T5 - Analog Throttle (B) Input High

RG40854,000000D -19-29APR02-1/1

### T5 - Analog Throttle (B) Input High Diagnostic Procedure

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.</i></p> <p>Perform a preliminary inspection ECU connectors and the analog throttle (B) sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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04  
160  
73

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<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Analog Throttle (B) in the idle position.</li> <li>5. Read the analog throttle (B) input voltage on DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>4.7 volts or greater:</b> GO TO <b>④</b></p> <p><b>Below 4.7 volts:</b> GO TO <b>③</b></p>
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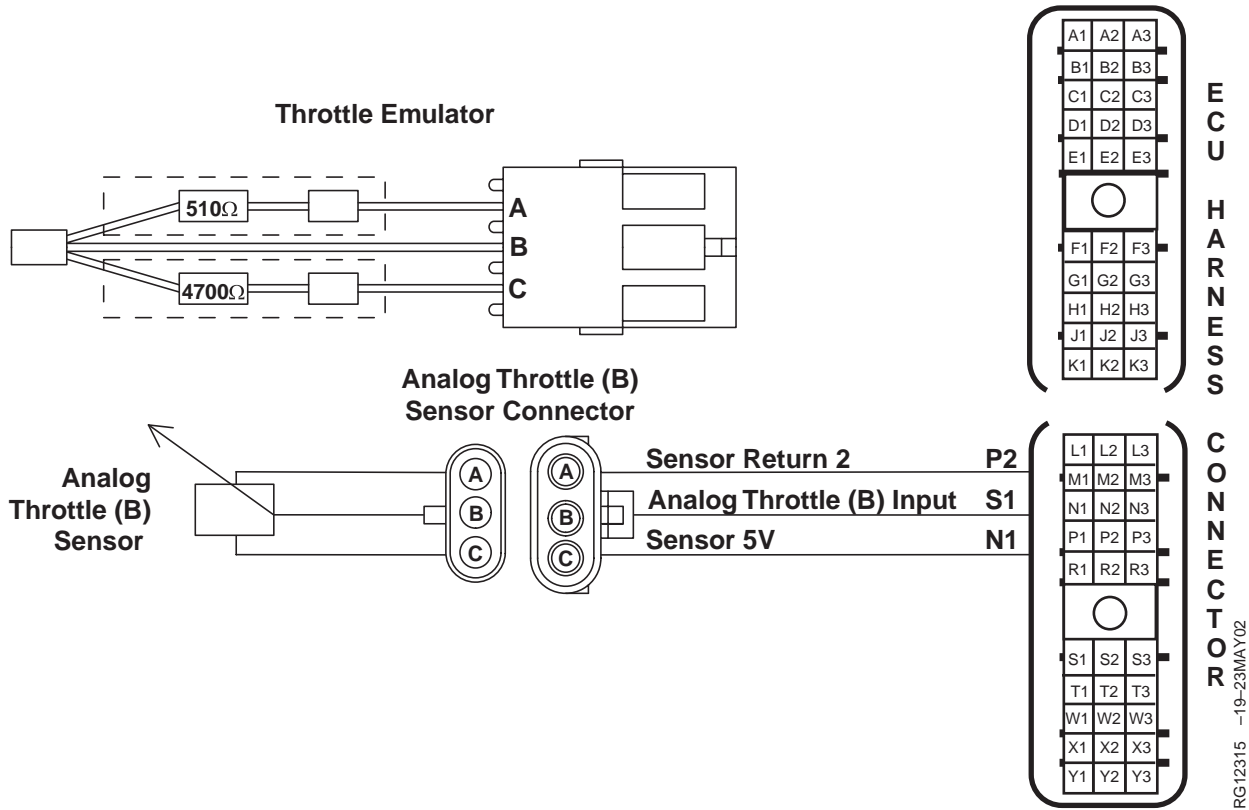
## Trouble Code Diagnostics and Tests

<p><b>③ Throttle Travel Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>Slowly operate analog throttle (B) through its full travel.</li> <li>Using the ECU diagnostic software, read the analog throttle (B) input voltage</li> </ol> <p><i>NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Goes above 4.7 volts:</b>            Faulty analog throttle (B) sensor connector            OR            Open in analog throttle (B) sensor ground circuit            OR            Faulty analog throttle (B) sensor</p> <p><b>Never goes above 4.7 volts:</b>            Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Throttle Position Input Shorted Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect analog throttle (B) sensor connector behind instrument panel.</li> <li>Ignition ON, Engine OFF</li> <li>Using the ECU diagnostic software, read the analog throttle (B) input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low analog throttle (B) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>0.3 volts or less:</b>            GO TO ⑤</p> <p><b>Above 0.3 volts:</b>            Short to voltage in analog throttle (B) input circuit            OR            Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Throttle Position Ground Circuit Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Analog throttle (B) sensor connector disconnected.</li> <li>Using a test light connected to battery (+), probe the ground terminal (terminal A) in the analog throttle (B) sensor connector on the engine harness.</li> </ol>	<p><b>Light ON:</b>            Faulty analog throttle (B) sensor connector            OR            Faulty analog throttle (B) sensor</p> <p><b>Light OFF:</b>            Open in analog throttle (B) ground circuit</p> <p style="text-align: right;">-- -1/1</p>

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160  
74

04  
160  
75

## T6 - Analog Throttle (B) Input Low



**NOTE:** Wiring diagram shows OEM engine applications. For non-OEM engine wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 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. The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

**This code will set if:**

- The analog throttle (B) input voltage drops below the sensor's low voltage specification. The voltage is lower than what is physically possible for the throttle lever to achieve.
  - For OEM applications, the low analog throttle (B) input voltage specification is 0.3 volts.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 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.
- 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.



## T6 - Analog Throttle (B) Input Low

RG40854,000000F -19-29APR02-1/1

### T6 - Analog Throttle (B) Input Low Diagnostic Procedure

-- -1/1

<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors and the analog throttle (B) sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connections:</b> GO TO <b>②</b></p> <p><b>Faulty connections:</b> Repair faulty connection(s).</p>
<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Analog Throttle (B) in the idle position.</li> <li>5. Read the analog throttle (B) input voltage on DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE: For OEM applications, the low analog throttle (B) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>0.3 volts or less:</b> GO TO <b>④</b></p> <p><b>Above 0.3 volts:</b> GO TO <b>③</b></p>
<p><i>SERVICE ADVISOR is a trademark of Deere &amp; Company</i></p>		

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160  
77

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## Trouble Code Diagnostics and Tests

<p><b>③ Throttle Travel Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>Slowly operate analog throttle (B) through its full travel.</li> <li>Using the ECU diagnostic software, read the analog throttle (B) input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low analog throttle (B) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Goes below 0.3 volts:</b>            Faulty analog throttle (B) sensor connector            OR            Open in analog throttle (B) sensor ground circuit            OR            Faulty analog throttle (B) sensor</p> <p><b>Never goes above 0.3 volts:</b>            Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group</p> <p style="text-align: right;">-- -1/1</p>
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160  
78

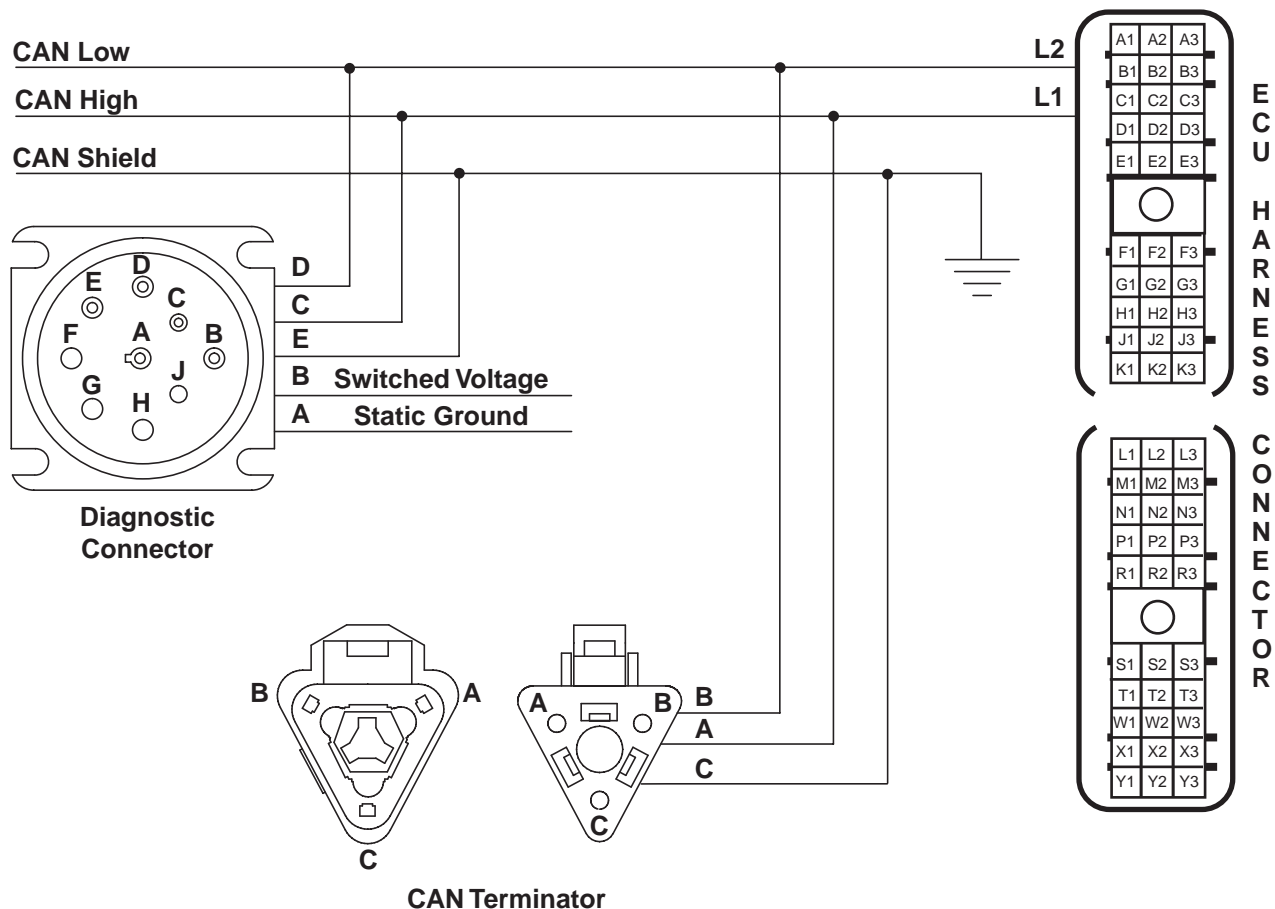
<p><b>④ Throttle Position Wiring Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect analog throttle (B) sensor connector.</li> <li>Install a jumper wire between the 5 V Supply terminal and the input terminal (terminals B and C) in the analog throttle (B) sensor connector on the engine harness.</li> <li>Ignition ON, engine OFF</li> <li>Using the ECU diagnostic software, read the analog throttle (B) input voltage</li> </ol> <p><i>NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Below 4.7 volts:</b>            GO TO ⑤</p> <p><b>4.7 volts or greater:</b>            Faulty analog throttle (B) sensor connector            OR            Faulty analog throttle (B) sensor</p> <p style="text-align: right;">-- -1/1</p>
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Trouble Code Diagnostics and Tests

<p><b>5 Throttle Position 5 V Supply Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.</i></p> <ol style="list-style-type: none"><li>1. Ignition OFF</li><li>2. Remove jumper wire.</li><li>3. Ignition ON, engine OFF</li><li>4. Using a multimeter, measure the voltage between the analog throttle (B) ground terminal and the 5 V supply terminal (terminals A and C) in the analog throttle (B) sensor connector on the engine harness.</li></ol>	<p><b>4.0-6.0 volts:</b> Open in analog throttle (B) input circuit OR Short to ground in analog throttle (B) input circuit OR Faulty ECU connector OR Faulty ECU</p> <p><b>Below 4.0 volts:</b> Open in analog throttle (B) 5 V Supply circuit OR Short to ground in analog throttle (B) 5 V Supply circuit OR Faulty ECU connector OR Faulty ECU</p> <p>-- -1/1</p>
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### T7 - CAN Throttle Invalid



#### CAN (Controller Area Network) Throttle

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

#### This code will set if:

- The ECU either does not receive throttle information over CAN, or the information received is not valid.

#### If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the CAN throttle, and will use the input values from another throttle.
- If the CAN throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,0000010 -19-29APR02-1/1

**T7 - CAN Throttle Invalid**

RG40854,0000011 -19-29APR02-1/1

**T7 - CAN Throttle Invalid Diagnostic Procedure**

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connections:</b> GO TO <b>❷</b></p> <p><b>Faulty connections:</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000091.09 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000091.09 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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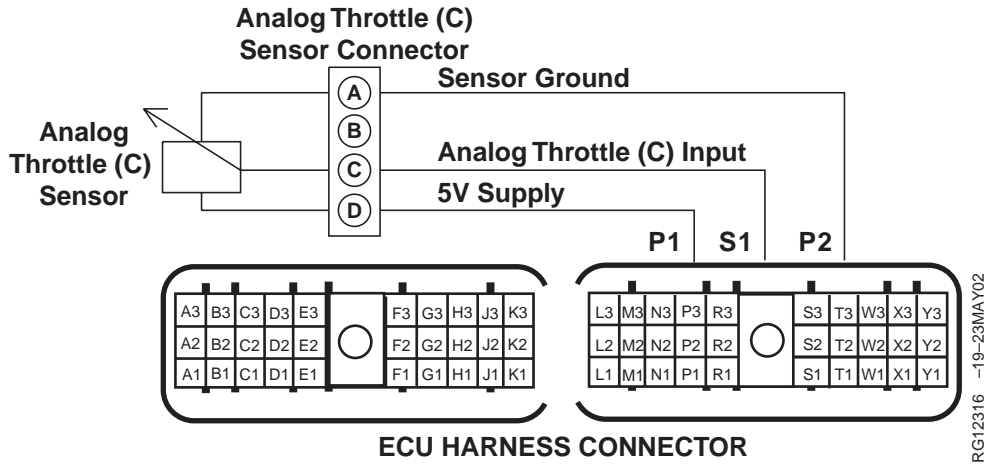
*Trouble Code Diagnostics and Tests*

<p><b>③ Application Related DTCs Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.</i></p> <p>If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs.</p>	<p><b>No CAN related DTCs found on other controllers:</b> GO TO ④</p> <p><b>Found CAN related DTCs found on other controllers:</b> Refer to diagnostic procedure for that controller.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Resistance Between CAN High and Low Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Using a multimeter, measure resistance between terminals C and D in the harness end of the diagnostic connector.</li> </ol>	<p><b>Between 45-75 ohms:</b> GO TO ⑤</p> <p><b>Less than 45 or greater than 75 ohms:</b> Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ CAN Wiring Shorted to Ground or Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Using a multimeter, measure voltage between a good chassis ground and: <ul style="list-style-type: none"> <li>• Terminal C in the diagnostic connector.</li> <li>• Terminal D in the diagnostic connector.</li> </ul> </li> </ol>	<p><b>Both measurements between 1.5 and 3.5 volts:</b> Faulty ECU connector OR Other connector in the CAN system OR Faulty ECU.</p> <p><b>Either measurement less than 1.5 or greater than 3.5 volts:</b> CAN wiring shorted to ground or voltage OR Another controller in the CAN system is faulty OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>

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82



### T17 - Analog Throttle (C) Input High



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84

#### Analog Throttle (C) Position Sensor

- The analog throttle (C) position sensor is a variable resistor (potentiometer) used to measure the position of the cruise throttle for Tractor applications. The throttle input voltage normally varies between 0.75 and 4.25 volts depending on throttle position.

#### This code will set if:

- The analog throttle (C) input voltage exceeds the 4.7 volts. The voltage is higher than what is physically possible for the cruise analog throttle to achieve.

#### If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854.0000013 -19-29APR02-1/1



## T17 - Analog Throttle (C) Input High

RG40854,0000014 -19-29APR02-1/1

### T17 - Analog Throttle (C) Input High Diagnostic Procedure

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors and the analog throttle (C) sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connections:</b> GO TO <b>❷</b></p> <p><b>Faulty connections:</b> Repair faulty connection(s).</p>
<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU communication software</li> <li>4. Throttle (C) in the idle position</li> <li>5. Read the analog throttle (C) voltage parameter on DST or SERVICE ADVISOR™.</li> </ol>	<p><b>4.7 V or greater:</b> GO TO <b>❹</b></p> <p><b>Below 4.7 V:</b> GO TO <b>❸</b></p>
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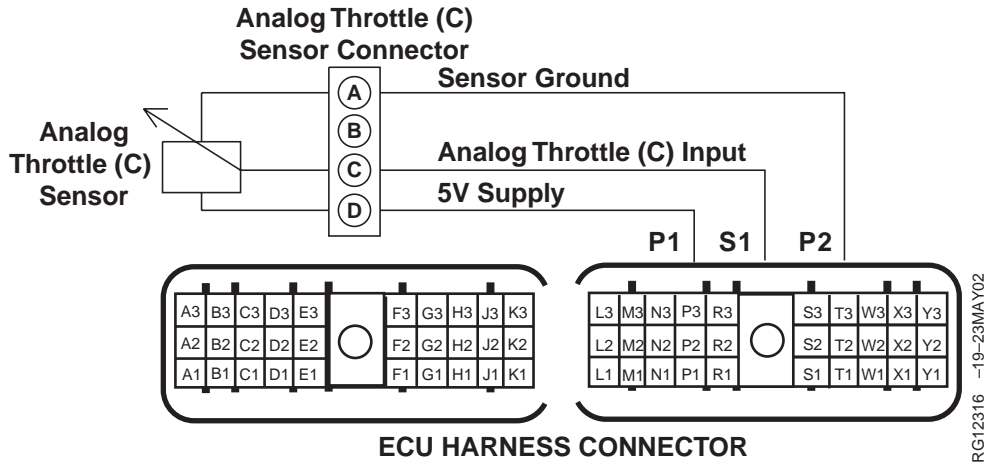
Trouble Code Diagnostics and Tests

<p><b>③ Throttle Travel Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.</i></p> <p>Read the analog throttle (C) voltage parameter while slowly operating the analog throttle (C) through full travel</p>	<p><b>Goes above 4.7 V:</b>            Faulty analog throttle (C) sensor connector            OR            Open in analog throttle (C) sensor ground circuit            OR            Faulty analog throttle (C) sensor</p> <p><b>Never goes above 4.7 V:</b>            Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Throttle Position Input Shorted Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect analog throttle sensor connector</li> <li>3. Ignition ON, engine OFF</li> <li>4. Read the analog throttle (C) voltage parameter</li> </ol>	<p><b>0.3 V or less:</b>            GO TO ⑤</p> <p><b>Above 0.3 V:</b>            Short to voltage in analog throttle input circuit            OR            Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Throttle Position Ground Circuit Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Analog throttle (C) sensor connector disconnected</li> <li>3. Using a test light connected to battery (+), probe the ground terminal in analog throttle (C) sensor harness connector</li> </ol>	<p><b>Light ON:</b>            Faulty analog throttle (C) sensor connector            OR            Faulty analog throttle (C) sensor</p> <p><b>Light OFF:</b>            Open in analog throttle (C) ground circuit</p> <p style="text-align: right;">-- -1/1</p>

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87

### T18 - Analog Throttle (C) Input Low



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#### Analog Throttle (C) Position Sensor

- The analog throttle (C) position sensor is a variable resistor (potentiometer) used to measure the position of the cruise throttle for Tractor applications. The throttle input voltage normally varies between 0.75 and 4.25 volts depending on throttle position.

#### This code will set if:

- The analog throttle (C) input voltage drops below 0.3 volts. The voltage is lower than what is physically possible for the cruise analog throttle to achieve.

#### If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854.0000015 -19-29APR02-1/1

## T18 - Analog Throttle (C) Input Low

RG40854,0000016 -19-29APR02-1/1

### T18 - Analog Throttle (C) Input Low Diagnostic Procedure

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors and the analog throttle (C) sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connections:</b> GO TO <b>❷</b></p> <p><b>Faulty connections:</b> Repair faulty connection(s).</p>
<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU communication software</li> <li>4. Throttle (C) in the idle position</li> <li>5. Read the analog throttle (C) voltage parameter</li> </ol>	<p><b>0.3 V or less:</b> GO TO <b>❹</b></p> <p><b>Above 0.3 V:</b> GO TO <b>❸</b></p>
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89

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## Trouble Code Diagnostics and Tests

<p><b>③ Throttle Travel Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information</i></p> <p>Read the analog throttle (C) voltage parameter while slowly operating the analog throttle (C) through full travel</p>	<p><b>Goes below 0.3 V:</b>            Faulty analog throttle (C) sensor connector            OR            Open in analog throttle (C) sensor ground circuit            OR            Faulty analog throttle (C) sensor</p> <p><b>Never goes below 0.3 V:</b>            Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group</p>
<p><b>④ Throttle Position Wiring Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect analog throttle (C) sensor connector</li> <li>3. Install a jumper wire between the 5 V supply terminal and the input terminal in the harness side of the sensor connector</li> <li>4. Ignition ON, engine OFF</li> <li>5. Read the analog throttle (C) voltage parameter</li> </ol>	<p><b>Below 4.7 V:</b>            GO TO ⑤</p> <p><b>4.7 V or greater:</b>            Faulty analog throttle (C) sensor connector            OR            Faulty analog throttle sensor</p>
<p><b>⑤ Throttle Position 5 V Supply Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove jumper wire between the two terminals</li> <li>3. Ignition ON, engine OFF</li> <li>4. Using a multimeter, measure the voltage between the throttle ground terminal and the 5 V supply terminal in the sensor harness connector</li> </ol>	<p><b>4.0 - 6.0 V:</b>            Open in analog throttle (C) input circuit            OR            Short to ground in analog throttle (C) input circuit            OR            Faulty ECU connection            OR            Faulty ECU</p> <p><b>Below 4.0 V:</b>            Open in analog throttle (C) 5 V supply circuit            OR            Short to ground in analog throttle (C) 5 V supply circuit            OR            Faulty ECU connection            OR            Faulty ECU</p>

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## 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.

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91

RG41221,0000134 -19-14APR03-1/1

### 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
OEM	See T5 - ANALOG THROTTLE (B) INPUT HIGH DIAGNOSTIC PROCEDURE later in this Group.
Tractors - 6020 Series	See T17 - ANALOG THROTTLE (C) INPUT HIGH DIAGNOSTIC PROCEDURE later in this Group.

RG41221,00000C6 -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
Tractors - 6020 Series	See T18 - ANALOG THROTTLE (C) INPUT LOW DIAGNOSTIC PROCEDURE later in this Group.

RG41221,00000C7 -19-22JAN03-1/1



### 000029.03 — Throttle Voltage High

*Throttle voltage is above the specification.*

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
OEM	See T3 - ANALOG THROTTLE (A) INPUT HIGH DIAGNOSTIC PROCEDURE later in this Group.
Tractors - 6020 Series	See T5 - ANALOG THROTTLE (B) INPUT HIGH DIAGNOSTIC PROCEDURE later in this Group.

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93

RG41221,00000C8 -19-22JAN03-1/1

### 000029.04 — Throttle Voltage Low

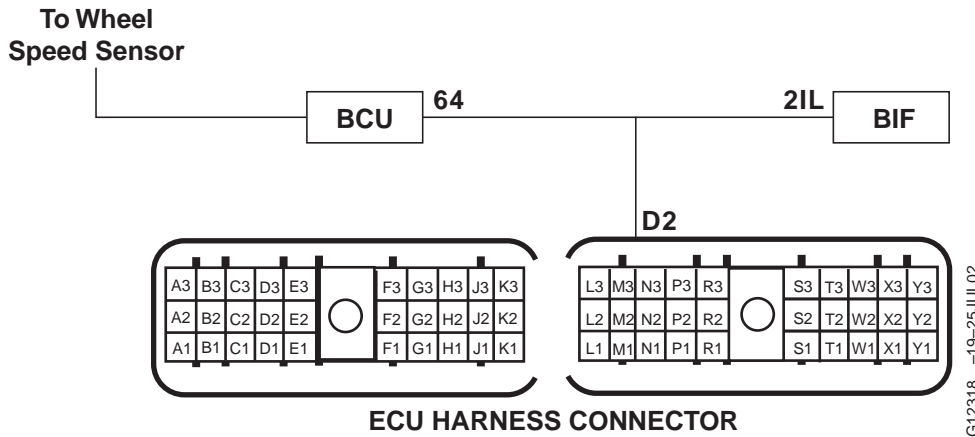
*Throttle voltage is below the specification.*

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
Tractors - 6020 Series	See T6 - ANALOG THROTTLE (B) INPUT LOW DIAGNOSTIC PROCEDURE later in this Group.

RG41221,00000C9 -19-22JAN03-1/1

**000084.31 — Vehicle Speed Mismatch**



RG12318 -19-25JUL02

**NOTE:** Wiring schematic shows limited information. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Vehicle Speed**

- The wheel speed sensor is an inductive type sensor that is mounted on the rear axle. As teeth on the axle rotate past the sensor, AC signals are generated. The frequency of these signals are proportional to the wheel speed. The signal from the sensor is sent to the Basic Control Unit (BCU). The

BCU sends a Pulse Width Modulated (PWM) signal to the Basic Informator (BIF) and ECU. Wheel speed is also delivered to the ECU over CAN from the BIF. Both inputs to the ECU must be the same.

**DTC 000084.31 will set if:**

- The wheel speed from the BCU (PWM signal) and the BIF (CAN) do not match at the ECU.

**If DTC 000084.31 sets, the following will occur:**

- Engine performance may be affected slightly.

RG40854.000012A -19-21JUN02-1/1

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160  
94

## 000084.31 — Vehicle Speed Mismatch

The wheel speed from the BCU (PWM signal) and the BIF (CAN) do not match at the ECU.

RG40854,000012B -19-21JUN02-1/1

### 000084.31 Vehicle Speed Mismatch Diagnostic Procedure

**NOTE:** If DTC 001069.31 occurs with DTC 000084.31, diagnose DTC 001069.31 first.

04  
160  
95

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<p><b>① Connection Check</b></p>	<p><b>NOTE:</b> For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH Diagnostic Procedure supporting information.</p> <p>Perform a preliminary inspection of ECU connectors, BIF, and BCU connectors looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connections:</b> GO TO <b>②</b></p> <p><b>Faulty connections:</b> Repair faulty connection(s).</p> <p>--1/1</p>
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<p><b>② Intermittent Fault Test</b></p>	<p><b>NOTE:</b> For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH Diagnostic Procedure supporting information.</p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU communication software</li> <li>4. Make note of all DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000084.31 reoccurs:</b> GO TO <b>③</b></p> <p><b>000084.31 doesn't reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.</p>
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<p><b>③ CAN Vehicle Speed Check</b></p>	<p><b>NOTE:</b> For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH Diagnostic Procedure supporting information.</p> <ol style="list-style-type: none"> <li>1. Drive vehicle under normal operating conditions</li> <li>2. Read the CAN vehicle speed parameter</li> </ol>	<p><b>Greater than 0 km/hr (0 mph):</b> GO TO <b>⑤</b></p> <p><b>0 km/hr (0 mph):</b> GO TO <b>④</b></p> <p>--1/1</p>
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*Trouble Code Diagnostics and Tests*

<p><b>④ BCU to BIF PWM Wire Check</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH Diagnostic Procedure supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect BCU connector and BIF connector.</li> <li>3. Using multimeter, measure resistance between terminal 64 on the BCU connector and terminal 21L on the BIF connector.</li> </ol>	<p><b>5 ohms or less:</b> Possible CAN error - follow vehicle CAN diagnostic procedure</p> <p><b>Greater than 5 ohms:</b> Open in wheel speed sensor wire between BCU and BIF wire.</p> <p style="text-align: right;">---1/1</p>
<p><b>⑤ Calculated Vehicle Speed Check</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH Diagnostic Procedure supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Drive vehicle under normal operating conditions</li> <li>2. Read the calculated vehicle speed parameter</li> </ol>	<p><b>Greater than 0 rpm:</b> Tire size misprogrammed in BIF</p> <p><b>0 rpm:</b> GO TO ⑥</p> <p style="text-align: right;">---1/1</p>
<p><b>⑥ BCU to ECU PWM Wire Check</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH Diagnostic Procedure supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect ECU connector and BCU connector.</li> <li>3. Using multimeter, measure resistance between terminal D2 of ECU connector and terminal 64 of BCU connector.</li> </ol>	<p><b>5 ohms or less:</b> Faulty ECU connector OR Faulty ECU</p> <p><b>Greater than 5 ohms:</b> Open in wheel speed sensor wire between ECU and BCU.</p> <p style="text-align: right;">---1/1</p>

04  
160  
96

### 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
OEM	See T1 - MULTI-STATE THROTTLE INPUT HIGH DIAGNOSTIC PROCEDURE later in this Group.
Loaders	See T3 - ANALOG THROTTLE (A) INPUT HIGH DIAGNOSTIC PROCEDURE later in this Group.
Motor Graders	See T3 - ANALOG THROTTLE (A) INPUT HIGH DIAGNOSTIC PROCEDURE later in this Group.
Tractors - 6020 Series	See T3 - ANALOG THROTTLE (A) INPUT HIGH DIAGNOSTIC PROCEDURE later in this Group.

04  
160  
97

RG41221,00000CA -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
OEM	See T2 - MULTI-STATE THROTTLE INPUT LOW DIAGNOSTIC PROCEDURE later in this Group.
Loaders	See T4 - ANALOG THROTTLE (A) INPUT LOW DIAGNOSTIC PROCEDURE later in this Group.
Motor Graders	See T4 - ANALOG THROTTLE (A) INPUT LOW DIAGNOSTIC PROCEDURE later in this Group.
Tractors - 6020 Series	See T4 - ANALOG THROTTLE (A) INPUT LOW DIAGNOSTIC PROCEDURE later in this Group.

RG41221,00000CB -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	See T7 - CAN THROTTLE INVALID DIAGNOSTIC PROCEDURE later in this Group.

RG41221,00000CD -19-22JAN03-1/1

## 000091.14 — Throttle Voltage Out of Range

*Throttle voltage is above or below the specification.*

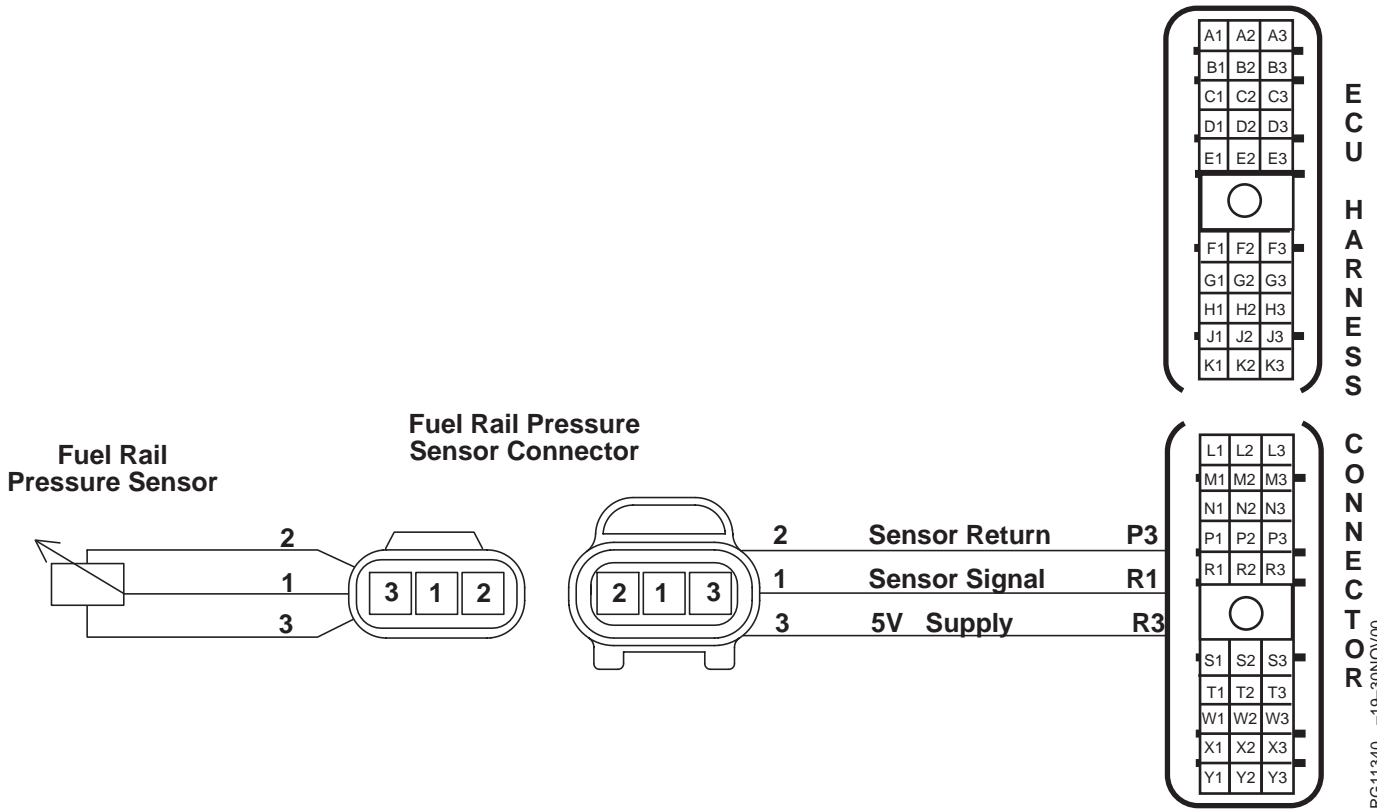
Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure earlier in this group.

Application	Diagnostic Procedure
Loaders	T22 - ANALOG THROTTLE (A) INPUT VOLTAGE OUT OF RANGE

04  
160  
99

RG41221,0000135 -19-14APR03-1/1

**000094.03 — Fuel Rail Pressure Input Voltage High**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Fuel Rail Pressure Sensor**

- The fuel rail pressure sensor uses a pressure transducer to measure the fuel pressure within the rail. The rail pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

**DTC 000094.03 will set if:**

- The rail pressure input voltage exceeds the sensor's high voltage specification. The voltage corresponds

to a pressure that is higher than what is physically possible for rail pressure.

- For OEM applications, the high fuel rail pressure input voltage specification is 4.89 volts.
- For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high fuel rail pressure input voltage specification.

**If DTC 000094.03 sets, the following will occur:**

- The ECU derates the engine 50% per minute until the engine is running at 50% of full power.
- The ECU will command the high pressure fuel pump to a default pressure of 195 MPa (1950 bar) (28,282 psi). Depending on the condition, the high pressure fuel pump will either pump more or less fuel.



## 000094.03 — Fuel Rail Pressure Input Voltage High

The rail pressure input voltage exceeds the sensor's high voltage specification.

RG40854,0000019 -19-29APR02-1/1

### 000094.03 Fuel Rail Pressure Input Voltage High Diagnostic Procedure

04  
160  
,101

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see DTC 000094.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the rail pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Ignition ON, engine running</li> <li>5. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000094.03 reoccurs:</b> GO TO <b>3</b></p> <p><b>000094.03 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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SERVICE ADVISOR is a trademark of Deere & Company

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*Trouble Code Diagnostics and Tests*

<p><b>③ Fuel Rail Pressure Signal Shorted Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect fuel rail pressure sensor connector.</li> <li>3. Ignition ON, engine OFF</li> <li>4. Using the ECU diagnostic software, read fuel rail pressure input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low fuel rail pressure input voltage specification is 0.9V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>0.9 V or below:</b> GO TO ④</p> <p><b>Above 0.9 V:</b> Short to voltage in fuel rail pressure sensor signal circuit OR Faulty ECU</p>
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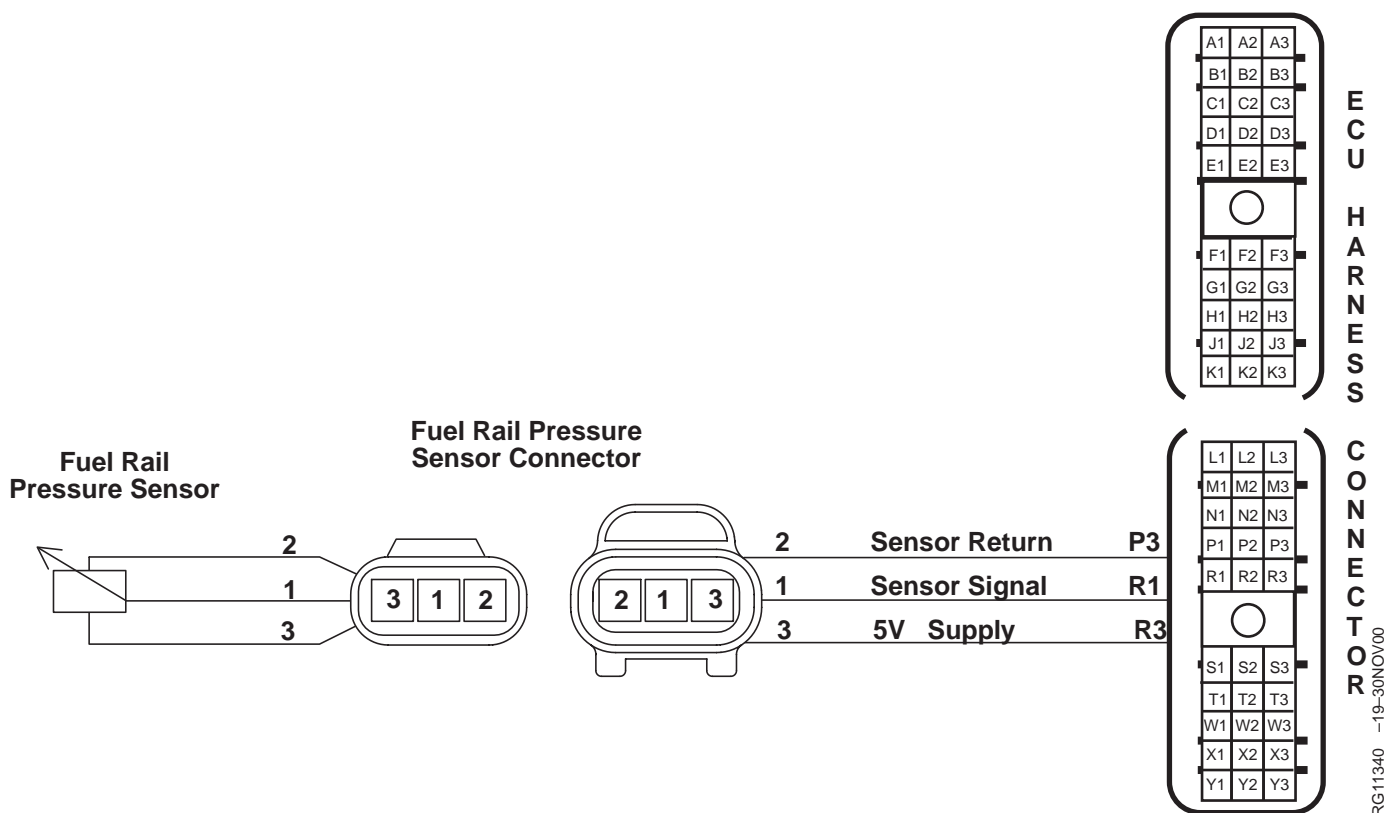
<p><b>④ Fuel Rail Pressure Ground Circuit Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF</li> <li>2. Fuel rail pressure sensor still disconnected</li> <li>3. Probe the fuel rail pressure sensor connector ground terminal (terminal 2) on the engine harness with a test light connected to battery voltage.</li> </ol>	<p><b>Light ON:</b> Faulty rail pressure sensor OR Faulty ECU connection OR Faulty ECU</p> <p><b>Light OFF:</b> Open in rail pressure sensor ground circuit OR Faulty ECU connection OR Faulty ECU</p>
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04  
160  
,102

04  
160  
,103

## 000094.04 Fuel Rail Pressure Input Voltage Low



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### Fuel Rail Pressure Sensor

- The fuel rail pressure sensor uses a pressure transducer to measure the fuel pressure within the rail. The rail pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

### DTC 000094.04 will set if:

- The rail pressure input voltage drops below the sensor's low voltage specification. The voltage

corresponds to a pressure that is lower than what is physically possible for rail pressure.

- For OEM applications, the low fuel rail pressure input voltage specification is 0.9 volts.
- For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low fuel rail pressure input voltage specification.

### If DTC 000094.04 sets, the following will occur:

- The ECU derates the engine 50% per minute until the engine is running at 50% of full power.
- The ECU will command the high pressure fuel pump to a default pressure of 190 MPa (1900 bar) (27,557 psi). Depending on the condition, the high pressure fuel pump will either pump more or less fuel.

## 000094.04 — Fuel Rail Pressure Input Voltage Low

The rail pressure input voltage drops below the sensor's low voltage specification.

RG40854,0000012 -19-30APR02-1/1

### 000094.04 Fuel Rail Pressure Input Voltage Low Diagnostic Procedure

04  
160  
,105

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the fuel rail pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Ignition ON, engine running</li> <li>5. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000094.04 reoccurs:</b> GO TO <b>3</b></p> <p><b>000094.04 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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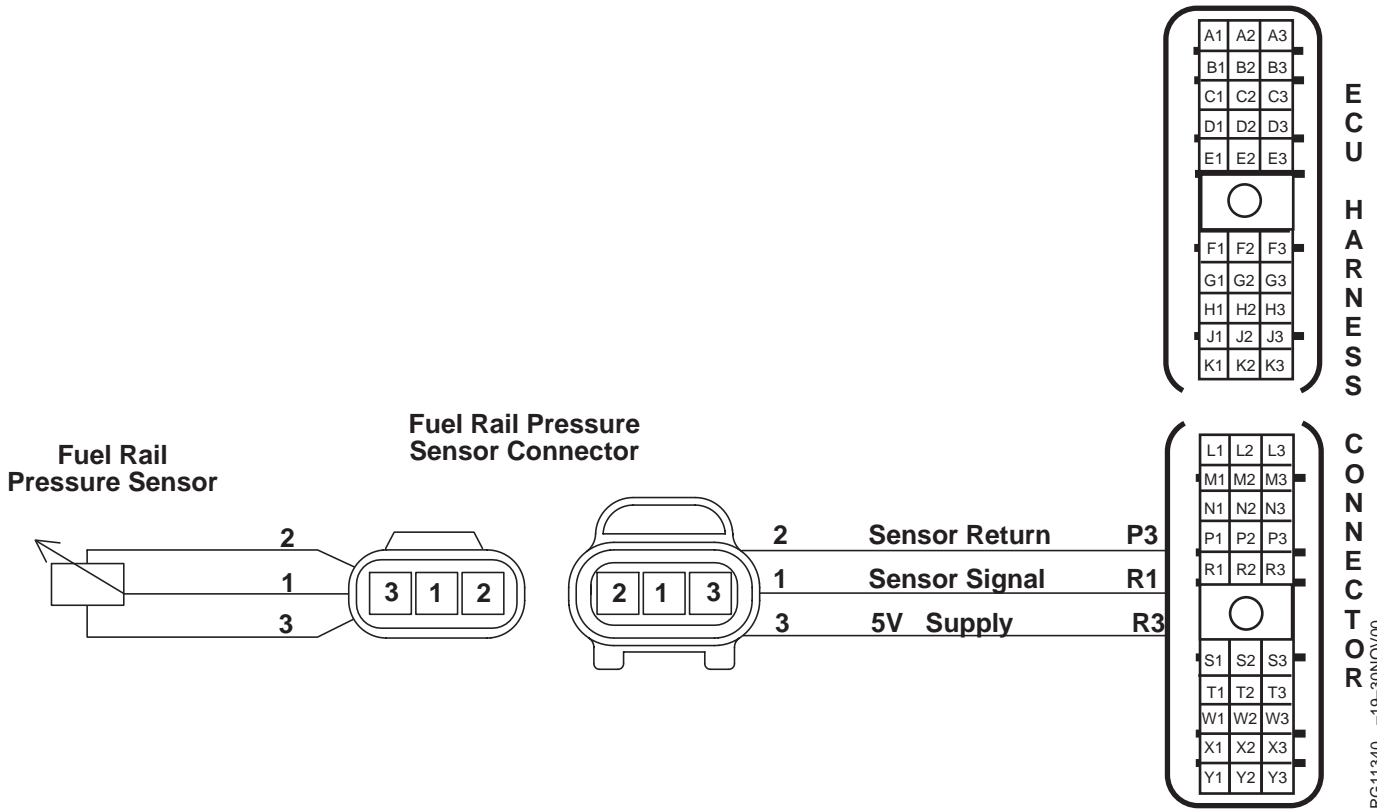
## Trouble Code Diagnostics and Tests

<p><b>③ Fuel Rail Pressure Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect fuel rail pressure sensor connector.</li> <li>3. Install a jumper wire between fuel rail pressure sensor 5 V supply and fuel rail pressure sensor input (terminals 1 and 3) in the sensor connector on the engine harness.</li> <li>4. Ignition ON, engine OFF</li> <li>5. Using the ECU diagnostic software, read fuel rail pressure input voltage</li> </ol> <p><i>NOTE: For OEM applications, the high fuel rail pressure input voltage specification is 4.89V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Below 4.89 V:</b> GO TO ④</p> <p><b>4.89 V or greater:</b> Faulty fuel rail pressure sensor connector OR Faulty fuel rail pressure sensor</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Fuel Rail Pressure 5V Supply Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove jumper wire.</li> <li>3. Ignition ON, engine OFF</li> <li>4. Using a multimeter, measure voltage between fuel rail pressure sensor 5 V supply terminal (terminal 3) in the sensor harness connector on the engine harness and a good chassis ground.</li> </ol>	<p><b>4.0 - 6.0 volts:</b> Open in fuel rail pressure sensor input circuit OR Short to ground in fuel rail pressure sensor input circuit OR Faulty ECU connection OR Faulty ECU</p> <p><b>Below 4.0 volts:</b> Open in fuel rail pressure sensor 5 V supply circuit OR Short to ground in fuel rail pressure sensor 5 V supply circuit OR Faulty ECU connection OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
,106

04  
160  
,107

**000094.10 — Fuel Rail Pressure Loss Detected**



RG11340 -19-30NOV00

*NOTE: Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

**Fuel Rail Pressure Sensor**

- The fuel rail pressure sensor uses a pressure transducer to measure the fuel pressure within the rail. The rail pressure intake voltage varies as rail pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

**DTC 000094.10 will set if:**

- The ECU detects a sudden decrease in fuel pressure while engine is not injecting or pumping. This usually occurs when the engine is shifted from high idle to low idle.

**If DTC 000094.10 sets, the following will occur:**

- Engine may not start due to lack of pressure.
- Engine may start and run normal when no load is applied to engine.

RG40854,0000013 -19-30APR02-1/1



## 000094.10 — Fuel Rail Pressure Loss Detected

The ECU detects a sudden decrease in fuel pressure while engine is not injecting or pumping.

RG40854,0000014 -19-30APR02-1/1

### 000094.10 Fuel Rail Pressure Loss Detected Diagnostic Procedure

NOTE: If DTC 000094.10 is accompanied with DTC 000094.03, DTC 000094.04, DTC 001347.03, or DTC 001347.05, follow that diagnostic procedure first.

04  
160  
,109


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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p>NOTE: For wiring and theory of operation, see DTC 000094.10 FUEL RAIL PRESSURE LOSS DETECTED supporting information.</p> <p>Perform a preliminary inspection of the ECU connectors and the fuel rail pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>2 Fuel Lines/Fittings Leakage Test</b></p>	<p>NOTE: For wiring and theory of operation, see DTC 000094.10 FUEL RAIL PRESSURE LOSS DETECTED supporting information.</p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine running</li> <li>2. Inspect all fuel lines and fittings for leakage.</li> </ol>	<p><b>No fuel leak(s) present:</b> GO TO <b>3</b></p> <p><b>Fuel leak(s) present:</b> Tighten loose fitting to proper specification and retest.</p>

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Trouble Code Diagnostics and Tests

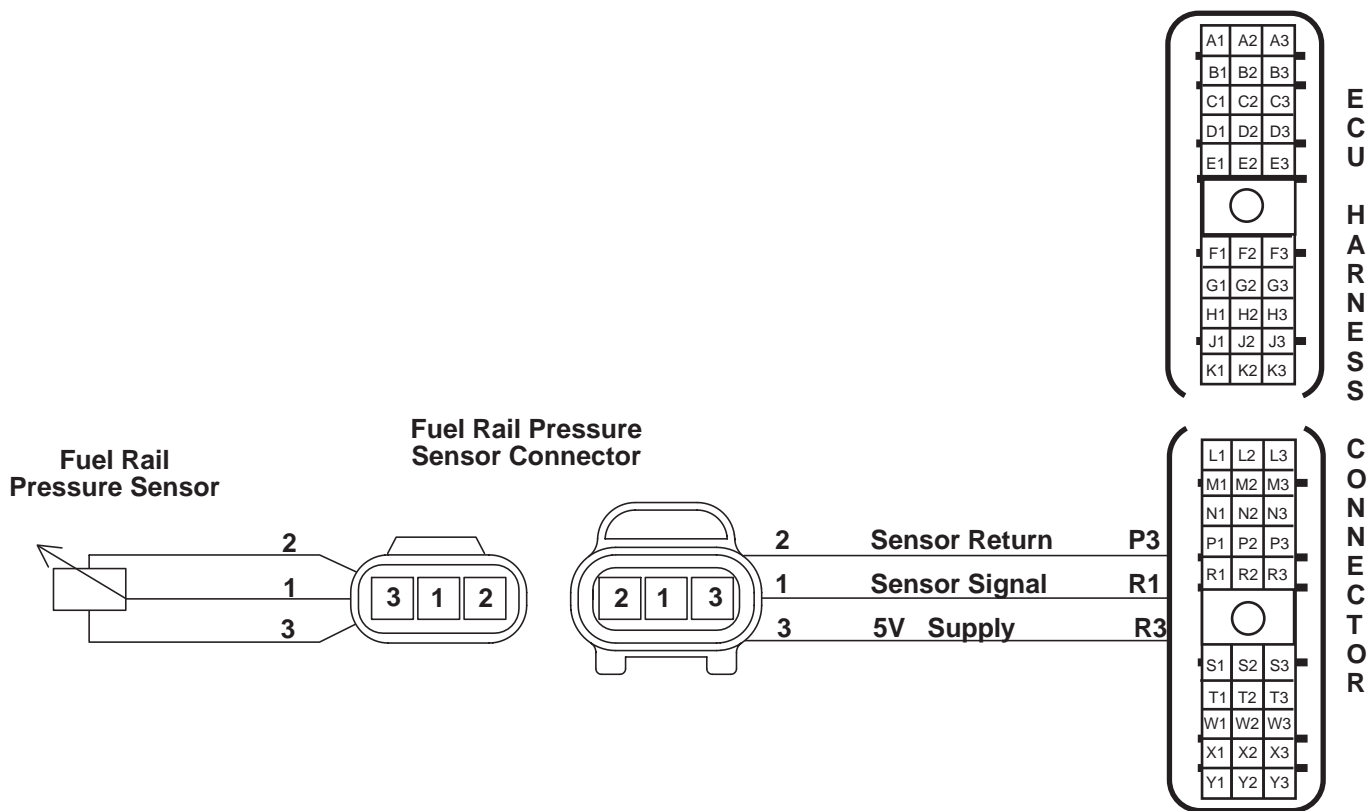
<p><b>③ Pressure Limiter Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.10 FUEL RAIL PRESSURE LOSS DETECTED supporting information.</i></p> <p> <b>CAUTION:</b> Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure 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.</p> <p><b>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 &amp; Company Medical Department in Moline, Illinois, U.S.A.</b></p> <ol style="list-style-type: none"> <li>1. Before removing pressure limiter, turn engine OFF and let sit for 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail.</li> <li>2. Disconnect fitting from fuel leak-off line at the fuel leak-off on high pressure fuel pump.</li> <li>3. Connect a clear line to pressure limiter and place other end in a suitable container.</li> <li>4. Ignition ON, engine running.</li> <li>5. Check fuel flow at flow limiter valve.</li> </ol>	<p><b>Minimal or no fuel present:</b> GO TO ④</p> <p><b>Fuel flow is present:</b> Faulty pressure limiter valve. Replace pressure limiter and retest. See REMOVE AND INSTALL PRESSURE LIMITER in Group 090 earlier in this manual.</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>④ Faulty Electronic Injector Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.10 FUEL RAIL PRESSURE LOSS DETECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect leak-off line at each Electronic Injector.</li> <li>3. Ignition ON, engine running</li> <li>4. Using the DST or Service ADVISOR, perform the Cylinder Cutout Test. For instructions, see ENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST in Section 04, Group 160 of this manual.</li> </ol>	<p><b>All cylinders react with slight misfire:</b> Faulty ECU</p> <p><b>One cylinder does not show a misfire:</b> Faulty EI</p> <p style="text-align: right;">-- -1/1</p>
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04  
160  
,110

04  
160  
,111

**000094.13 — Fuel Rail Pressure Higher Than Expected**



RG11340 -19-30NOV00

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

**Fuel Rail Pressure Sensor**

- The fuel rail pressure sensor uses a pressure transducer to measure the rail pressure within the fuel rail. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel

rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

**DTC 000094.13 will set if:**

- The ECU detects a fuel rail pressure that is higher than expected.

**If DTC 000094.13 sets, the following will occur:**

- This code can not be cleared
- Engine will miss and lose power

RG40854,000012F -19-25JUN02-1/1

## 000094.13 — Fuel Rail Pressure Higher Than Expected

The ECU detects a fuel rail pressure that is higher than expected.

RG40854,0000130 -19-25JUN02-1/1

### 000094.13 Fuel Rail Pressure Higher Than Expected Diagnostic Procedure

04  
160  
,113

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see DTC 000094.13 FUEL RAIL PRESSURE HIGHER THAN EXPECTED supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the fuel rail pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>2 Tampering Check</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.13 FUEL RAIL PRESSURE HIGHER THAN EXPECTED supporting information.</i></p> <p>Recently adjustments or components have been added to the fuel system to supply additional power.</p>	<p><b>No tampering has occurred:</b> GO TO <b>3</b></p> <p><b>Tampering has occurred:</b> Remove added components or change adjustment to normal state AND Call your DTAC representative</p>

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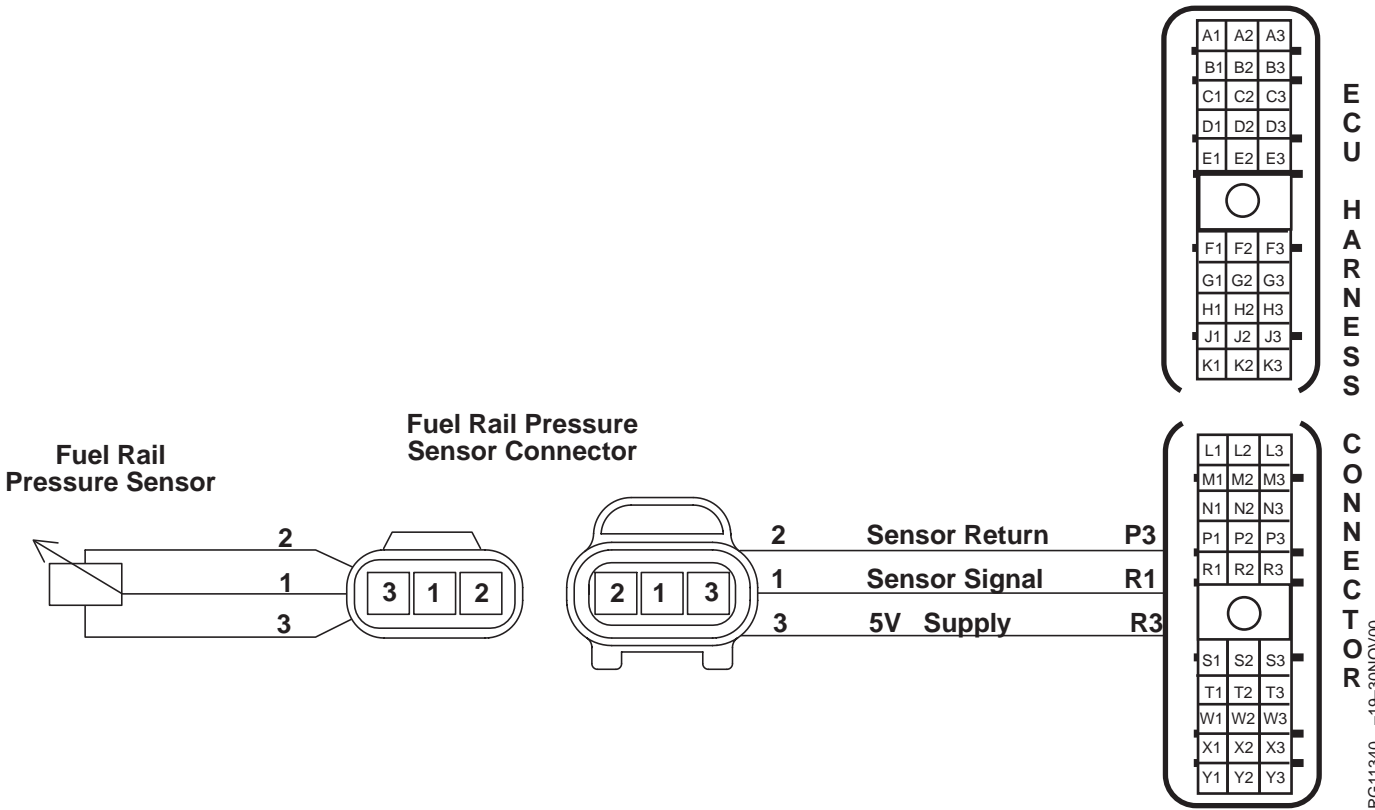
*Trouble Code Diagnostics and Tests*

<p><b>③ Fuel Rail Pressure Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.13 FUEL RAIL PRESSURE HIGHER THAN EXPECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine running at low idle</li> <li>2. Using the ECU diagnostic software, read fuel rail pressure - actual with engine at low idle</li> </ol>	<p><b>Rail pressure consistently around 40 MPa (400 bar) (5800 psi):</b> GO TO ④</p> <p><b>Rail pressure significantly above or below 40 MPa (400 bar) (5800 psi):</b> Faulty sensor. Replace sensor and retest</p> <p style="text-align: right;">---1/1</p>
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<p><b>④ Pressure Limiter Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.13 FUEL RAIL PRESSURE HIGHER THAN EXPECTED supporting information.</i></p> <p> <b>CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.</b></p> <p><b>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 &amp; Company Medical Department in Moline, Illinois, U.S.A.</b></p> <ol style="list-style-type: none"> <li>1. Before removing pressure limiter, turn engine OFF and let sit for 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail.</li> <li>2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure limiter.</li> <li>3. Disconnect fuel leak-off line fitting at the fuel leak-off line from the pressure limiter valve. Do NOT remove the pressure limiter valve.</li> <li>4. Run a clear line from a suitable container for diesel fuel to the pressure limiter valve</li> <li>5. Ignition ON, engine running.</li> <li>6. Check fuel flow at pressure limiter valve.</li> </ol>	<p><b>Minimal or no fuel present:</b> Faulty ECU connection OR Faulty ECU</p> <p><b>Fuel flow is present:</b> Faulty pressure limiter valve. Replace pressure limiter and retest. See REMOVE AND INSTALL PRESSURE LIMITER in Group 090 earlier in this manual.</p> <p style="text-align: right;">---1/1</p>
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04  
160  
,115

**000094.17 — Fuel Rail Pressure Not Developed**



RG11340 -19-30NOV00

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Fuel Rail Pressure Sensor**

- The fuel rail pressure sensor uses a pressure transducer to measure the rail pressure within the fuel rail. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel

rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

**DTC 000094.17 will set if:**

- The ECU does not detect 10 MPa (100 Bar) (1450 psi) of fuel rail pressure after cranking the engine for approximately 3 seconds.

**If DTC 000094.17 sets, the following will occur:**

- Engine will not start.



## 000094.17 — Fuel Rail Pressure Not Developed

The ECU does not detect 10 MPa (100 Bar) (1450 psi) of fuel rail pressure after cranking the engine for approximately 3 seconds.

RG40854,0000017 -19-30APR02-1/1

### 000094.17 Fuel Rail Pressure Not Developed Diagnostic Procedure

NOTE: If DTC 000094.17 is accompanied with DTC 001347.03 or DTC 001347.05, follow that diagnostic procedure first.

04  
160  
,117


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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the fuel rail pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>② Preliminary Check</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.</i></p> <p>Before using this diagnostic procedure, check the following:</p> <ol style="list-style-type: none"> <li>1. If fuel system has been recently opened (filter changed, line removed etc.) perform fuel system bleed procedure. See BLEED THE FUEL SYSTEM in Section 04, Group 150 earlier in this manual and retest.</li> <li>2. Ensure that there is an adequate amount of fuel in the fuel tank.</li> </ol>	<p><b>No problem found:</b> GO TO <b>③</b></p> <p><b>Problem found:</b> Repair and retest.</p>

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## Trouble Code Diagnostics and Tests

<p><b>③ Fuel Lines/Fitting Leakage Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine cranking</li> <li>2. Inspect all fuel lines and fittings for leakage.</li> </ol>	<p><b>No fuel leak(s) present:</b> GO TO <b>④</b></p> <p><b>Fuel leak(s) present:</b> Tighten loose fitting to proper specification and retest.</p> <p style="text-align: right;">---1/1</p>
<p><b>④ Final Fuel Filter Pressure Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Clean the outlet port on the final fuel filter base to avoid contamination.</li> <li>3. Connect proper pressure gauge from Universal Pressure Kit JT05412 to the outlet port on the final fuel filter base.</li> <li>4. Ignition ON, engine cranking</li> <li>5. Using gauge, read pressure</li> </ol>	<p><b>Pressure at or above 30 kPa (0.3 bar) (4.4 psi):</b> GO TO <b>⑦</b></p> <p><b>Pressure below 30 (0.3 bar) (4.4 psi):</b> GO TO <b>⑤</b></p> <p style="text-align: right;">---1/1</p>
<p><b>⑤ Faulty Final Fuel Filter Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.</i></p> <p>Replace final fuel filter element. See REPLACE FINAL FUEL FILTER ELEMENT in Group 090 earlier in this manual.</p>	<p><b>Engine won't start:</b> GO TO <b>⑥</b></p> <p><b>Engine starts:</b> Replacing filter element fixed problem</p> <p style="text-align: right;">---1/1</p>
<p><b>⑥ Restricted Fuel Line Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.</i></p> <p> <b>CAUTION: Fuel in lines may be under high pressure. Use extreme caution while opening fuel lines. Let engine sit for several minutes after cranking or running engine prior to opening fuel lines.</b></p> <p>Check fuel lines between the fuel tank and the high pressure fuel pump for restrictions.</p>	<p><b>No restrictions found:</b> Faulty fuel transfer pump.</p> <p><b>Restrictions found:</b> Clean fuel lines and retest.</p> <p style="text-align: right;">---1/1</p>

**7 Pressure Limiter Valve Test**

*NOTE: For wiring and theory of operation, see DTC 000094.17 FUEL RAIL PRESSURE NOT DEVELOPED supporting information.*



**CAUTION:** Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

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

1. Before removing pressure limiter, turn engine OFF and let sit for 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail.
2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure limiter.
3. Disconnect fuel leak-off line fitting at the fuel leak-off line from the pressure limiter valve. Do NOT remove the pressure limiter valve.
4. Run a clear line from a suitable container for diesel fuel to the pressure limiter valve
5. Ignition ON, engine running.
6. Check fuel flow at pressure limiter.

**Minimal or no fuel present:**

Faulty high pressure fuel pump. Replace and retest.

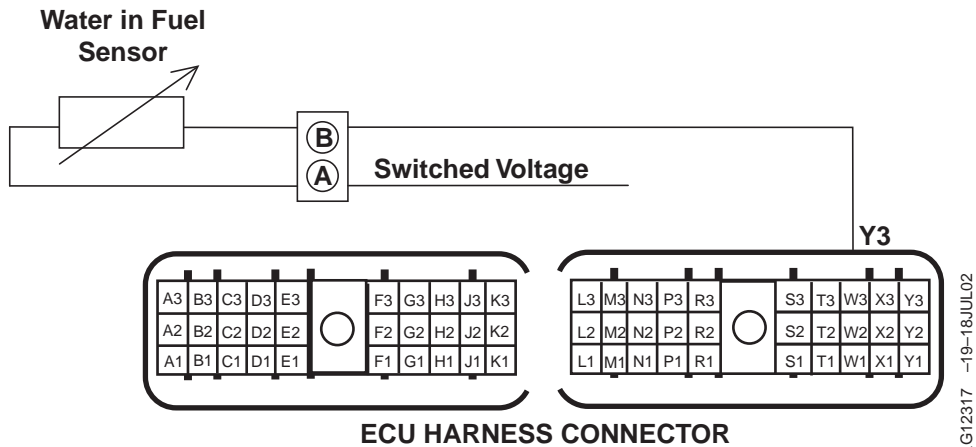
**Fuel flow present:**

Faulty pressure limiter valve. Replace pressure limiter and retest. See REMOVE AND INSTALL PRESSURE LIMITER in Section 02, Group 090 earlier in this manual.

04  
160  
,119

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## 000097.00 — Water in Fuel Continuously Detected



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### Water in Fuel (WIF) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. 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 (WIF) SENSOR in Section 03, Group 140.

### DTC 000097.00 will set if:

- The WIF limit is above a predetermined quantity for an extended period of time.

### If DTC 000097.00 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Derate Feature: On OEM applications, the engine derates 20% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG41221,00000A0 -19-17DEC02-1/1

## 000097.00 — Water in Fuel Continuously Detected

The WIF limit is above a predetermined quantity for an extended period of time.

RG41221,00000A2 -19-17DEC02-1/1

### 000097.00 Water In Fuel Continuously Detected Diagnostic Procedure

04  
160  
,121

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connections:</b> Repair faulty connection(s).</p>
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<p><b>② Moisture Buildup Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all DTCs, then clear all DTCs.</li> <li>5. Drain sediment bowl on the bottom of the primary fuel filter until all the water is out.</li> <li>6. Operate engine in normal use.</li> <li>7. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000097.00 reoccurs:</b> GO TO <b>③</b></p> <p><b>000097.00 does not reoccur:</b> Problem is was most likely caused by moisture build up over time. Monitor the sediment bowl for moisture periodically, drain as needed.</p>
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*Trouble Code Diagnostics and Tests*

<p><b>③ WIF Circuit and Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information.</i></p> <p>Check the following items that can cause water in the fuel:</p> <ul style="list-style-type: none"> <li>• Poor fuel quality or water in fuel storage tank.</li> <li>• Loose fuel tank cap.</li> <li>• Missing or damaged fuel tank cap seal.</li> <li>• Excessive condensation build up in fuel tank.</li> <li>• Loose or damaged fuel filter or sediment bowl.</li> </ul>	<p><b>No cause of water in fuel located:</b> GO TO ④</p> <p><b>Cause of water in fuel located:</b> Repair problem, drain sediment bowl, and retest.</p>
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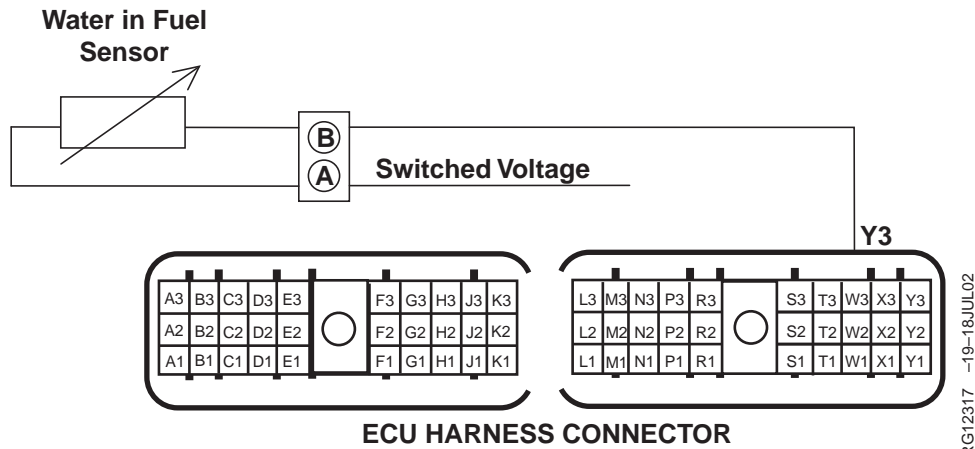
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<p><b>④ Wiring Check</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both ECU connectors</li> <li>3. Using a multimeter, measure resistance between terminal Y3 in the ECU connector on the engine harness and the following:             <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> Faulty ECU</p> <p><b>Any measurement less than 2000 ohms:</b> Short to ground in wiring OR Faulty WIF sensor</p>
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04  
160  
,122

### 000097.03 — Water in Fuel Signal Voltage High



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### Water in Fuel (WIF) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. 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 (WIF) SENSOR in Section 03, Group 140.

#### DTC 000097.03 will set if:

- The WIF input voltage exceeds the sensor's high voltage specification. The voltage corresponds to an amount of water in fuel that is not possible.
  - For OEM applications, the high WIF input voltage specification is 4.8 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for the high WIF input voltage specification.

#### If DTC 000097.03 sets, the following will occur:

- ECU's WIF engine protection feature disabled.

04  
160  
,123

## 000097.03 — Water in Fuel Signal Voltage High

The WIF input voltage exceeds the sensor's high voltage specification.

RG41221,00000A4 -19-17DEC02-1/1

### 000097.03 Water in Fuel Signal Voltage High Diagnostic Procedure

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#### ① 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 DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information.*

Perform a preliminary inspection of the ECU connectors and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connections:**  
Repair faulty connection(s).

--1/1

#### ② Intermittent Fault Test

*NOTE: For wiring and theory of operation, 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine OFF
6. Read DTCs using DST or SERVICE ADVISOR™

**000097.03 reoccurs:**  
GO TO ③

**000097.03 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

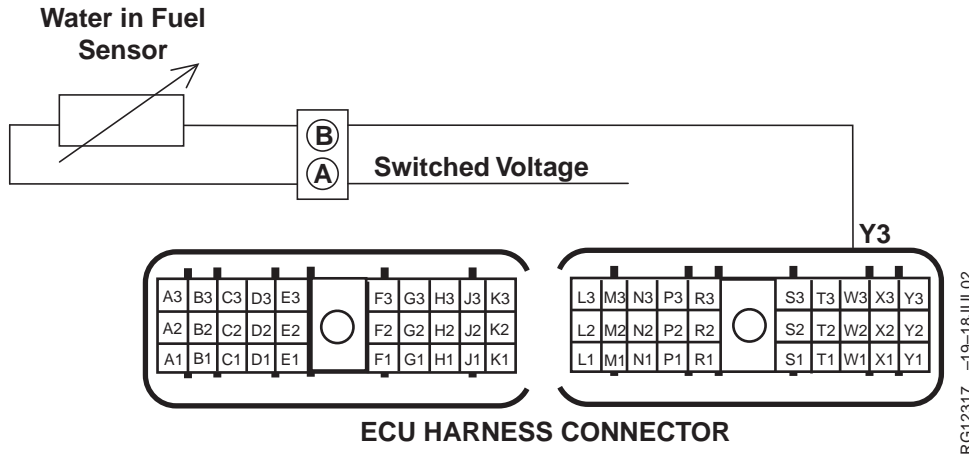


*Trouble Code Diagnostics and Tests*

<p><b>③ WIF Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect the WIF sensor connector.</li> <li>3. Install a jumper wire between both terminals in the WIF sensor connector on the engine harness.</li> <li>4. Ignition ON engine OFF</li> <li>5. Make note of all DTCs, then clear all DTCs</li> <li>6. Using the ECU diagnostic software, read DTCs</li> </ol>	<p><b>000097.03 reoccurs:</b> GO TO ③</p> <p><b>000097.04 occurs:</b> Faulty WIF sensor connector OR Faulty WIF sensor</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ WIF Input Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove jumper wire between both terminals.</li> <li>3. Ignition ON, engine OFF</li> <li>4. Using a multimeter, measure voltage between the WIF input terminal (terminal A) in the sensor connector on the engine harness and a good chassis ground.</li> </ol>	<p><b>4.0 - 6.0 volts:</b> Open in WIF sensor ground circuit OR Faulty ECU connection OR Faulty ECU</p> <p><b>Below 4.0 volts:</b> Open in WIF sensor input circuit OR Faulty ECU connection OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
,125

**000097.04 — Water in Fuel Signal Voltage Low**



04  
160  
.126

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Water in Fuel (WIF) Sensor**

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. 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 (WIF) SENSOR in Section 03, Group 140.

**DTC 000097.04 will set if:**

- The WIF input voltage drops below the sensor's low voltage specification. The voltage corresponds to an amount of water in fuel that is not possible.
  - For OEM applications, the low WIF input voltage specification is 0.5 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for the low WIF input voltage specification.

**If DTC 000097.04 sets, the following will occur:**

- ECU's WIF engine protection feature disabled.

RG41221,00000A5 -19-17DEC02-1/1

## 000097.04 — Water in Fuel Signal Voltage Low

The WIF input voltage drops below the sensor's low voltage specification.

RG41221.00000A6 -19-17DEC02-1/1

### 000097.04 Water in Fuel Signal Voltage Low Diagnostic Procedure

04  
160  
,127

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL SIGNAL VOLTAGE LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connections:</b> Repair faulty connection(s).</p>
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<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL SIGNAL VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine OFF</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™</li> </ol>	<p><b>000097.04 reoccurs:</b> GO TO <b>③</b></p> <p><b>000097.04 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

### ③ WIF Sensor Test

*NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL SIGNAL VOLTAGE LOW supporting information.*

1. Ignition OFF
2. Disconnect WIF sensor connector.
3. Ignition ON, engine OFF
4. Make note of all DTCs, then clear all DTCs.
5. Using the ECU diagnostic software, read DTCs

**000097.04 reoccurs:**  
Short to ground in WIF  
sensor input circuit  
OR  
Faulty ECU

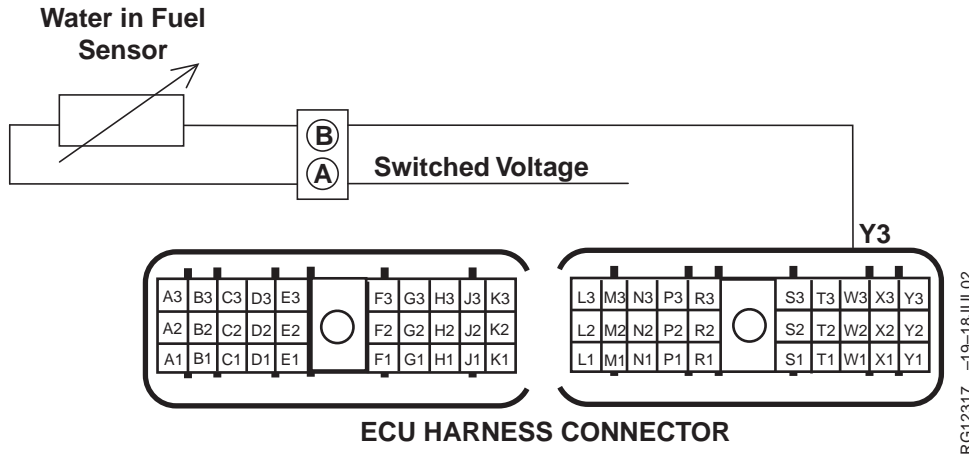
**000097.04 does not  
reoccur:**  
Faulty WIF sensor

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04  
160  
,128

04  
160  
,129

**000097.16 — Water in Fuel Detected**



*NOTE: Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

**Water in Fuel (WIF) Sensor**

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. 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 (WIF) SENSOR in Section 03, Group 140.

**DTC 000097.16 will set if:**

- The ECU detects water in fuel.

**If DTC 000097.16 sets, the following will occur:**

- Engine might not be able to develop full power
- Engine may be difficult to start

RG40854,000001B -19-30APR02-1/1

04  
160  
130

## 000097.16 — Water in Fuel Detected

The ECU detects water in fuel.

RG40854,000001C -19-30APR02-1/1

### 000097.16 Water In Fuel Detected Diagnostic Procedure

04  
160  
,131

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see DTC 000097.16 WATER IN FUEL DETECTED supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connections:</b> Repair faulty connection(s).</p>
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<p><b>② Moisture Buildup Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000097.16 WATER IN FUEL DETECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all DTCs, then clear all DTCs.</li> <li>5. Drain sediment bowl on the bottom of the primary fuel filter until all the water is out.</li> <li>6. Operate engine in normal use.</li> <li>7. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000097.16 reoccurs:</b> GO TO <b>③</b></p> <p><b>000097.16 does not reoccur:</b> Problem is was most likely caused by moisture build up over time. Monitor the sediment bowl for moisture periodically, drain as needed.</p>
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*Trouble Code Diagnostics and Tests*

<p><b>③ WIF Circuit and Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000097.16 WATER IN FUEL DETECTED supporting information.</i></p> <p>Check the following items that can cause water in the fuel:</p> <ul style="list-style-type: none"> <li>• Poor fuel quality or water in fuel storage tank.</li> <li>• Loose fuel tank cap.</li> <li>• Missing or damaged fuel tank cap seal.</li> <li>• Excessive condensation build up in fuel tank.</li> <li>• Loose or damaged fuel filter or sediment bowl.</li> </ul>	<p><b>No cause of water in fuel located:</b> GO TO ④</p> <p><b>Cause of water in fuel located:</b> Repair problem, drain sediment bowl, and retest.</p> <p style="text-align: right;">-- -1/1</p>
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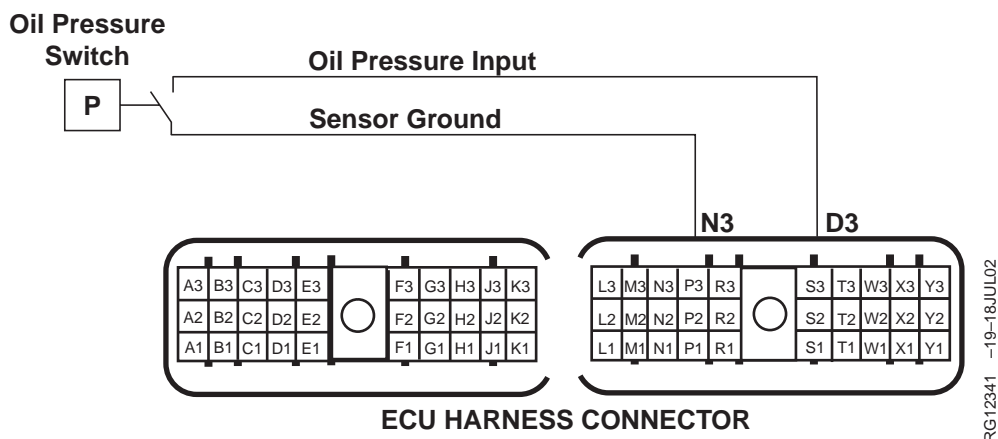
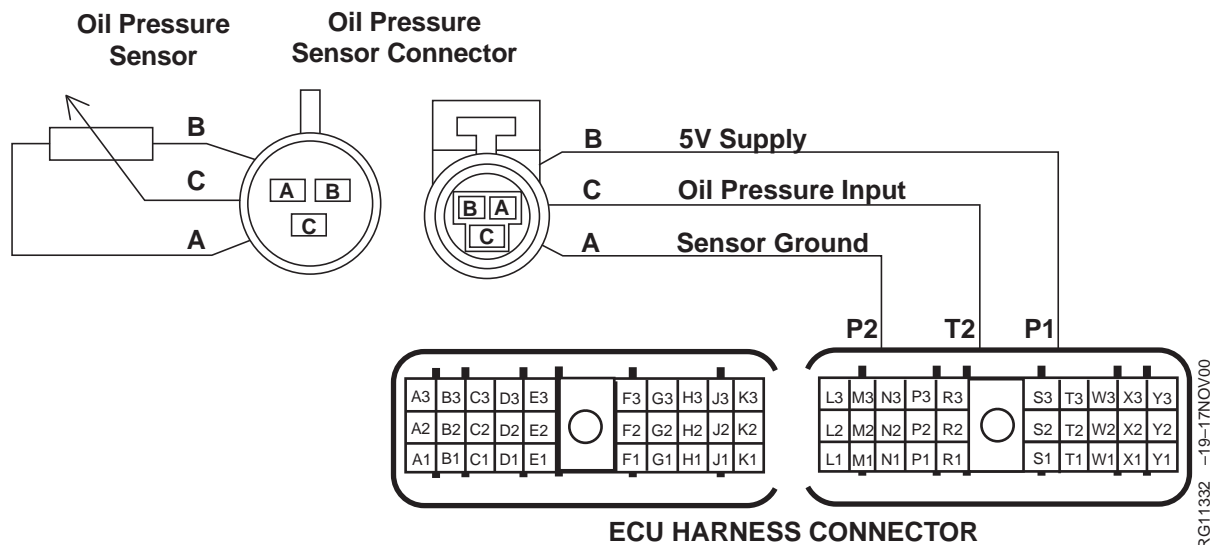
<p><b>④ Wiring Check</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000097.16 WATER IN FUEL DETECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both ECU connectors</li> <li>3. Using a multimeter, measure resistance between terminal Y3 in the ECU connector on the engine harness and the following:             <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> Faulty ECU</p> <p><b>Any measurement less than 2000 ohms:</b> Short to ground in wiring OR Faulty WIF sensor</p> <p style="text-align: right;">-- -1/1</p>
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04  
160  
,132



04  
160  
,133

### 000100.01 — Engine Oil Pressure Extremely Low



**NOTE:** Wiring schematics show OEM engine applications for the oil pressure sensor and Combine applications for the oil pressure switch. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### Oil Pressure Sensor or Switch

- The oil pressure sensor is a pressure transducer connected to the main oil galley. 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 earlier in this manual.

- The oil pressure switch is used to detect a loss of oil pressure. If the proper oil pressure is detected by the switch, it remains closed. The switch is open when the engine is not running and engine is running with sufficient oil pressure.

#### DTC 000100.01 will set if:

- For engines with an oil pressure sensor, the ECU senses an extremely low oil pressure.
- For engines with an oil pressure switch, the ECU senses the oil pressure switch is open after the engine is above cranking RPM for several seconds.

Continued on next page

RG40854,000001D -19-30APR02-1/2

**If DTC 000100.01 sets, the following will occur:**

- On OEM applications, engines with the shutdown feature will shutdown in 30 seconds after the code will set. All OEM applications will derate at 40% per minute until the engine is running at 40% of full

power. For more information on engine protection, see ENGINE PROTECTION in Section 03, Group 140 of this manual.

- On non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for derate information.

RG40854,000001D -19-30APR02-2/2

04  
160  
,135

## 000100.01 — Engine Oil Pressure Extremely Low

For engines with an oil pressure sensor, the ECU senses an extremely low oil pressure. For engines with an oil pressure switch, the ECU senses the oil

pressure switch is open after the engine is above cranking RPM for several seconds.

RG40854.000001E -19-30APR02-1/1

### 000100.01 Engine Oil Pressure Extremely Low Diagnostic Procedure

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#### ① 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 DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information.*

Perform a preliminary inspection of the ECU connectors and the oil pressure sensor or switch connector looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

--1/1

#### ② Oil Pressure Test

*NOTE: For wiring and theory of operation, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information.*

Under the conditions where DTC 000100.01 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).

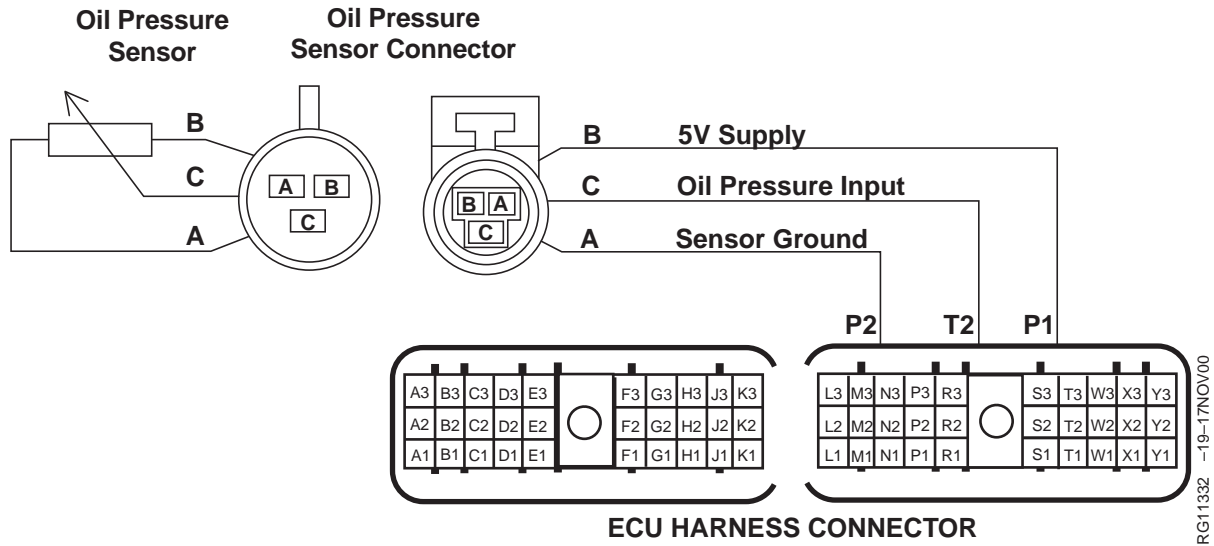
**Oil pressure below specification:**  
See L2 - ENGINE OIL PRESSURE LOW diagnostic procedure in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).

**Oil pressure within specification:**  
Verify oil pressure sensor or switch circuits are OK. If oil pressure sensor or switch circuits are OK, replace oil pressure sensor or switch and retest

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04  
160  
,137

### 000100.03 — Engine Oil Pressure Input Voltage High



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, 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 gallery or oil cooler. The oil pressure input voltage varies as oil pressure varies. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

**DTC 000100.03 will set if:**

- The oil pressure input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a pressure that is higher than what is physically possible for oil pressure.
  - For OEM 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 uses a default oil pressure of 260 kPa (2.6 bar) (37.7 psi).
- ECU's low oil pressure engine protection feature disabled.

## 000100.03 — Engine Oil Pressure Input Voltage High

The oil pressure input voltage exceeds the sensor's high voltage specification.

RG40854,0000020 -19-30APR02-1/1

### 000100.03 Engine Oil Pressure Input Voltage High Diagnostic Procedure

04  
160  
,139

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the oil pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine OFF</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000100.03 reoccurs:</b> GO TO <b>3</b></p> <p><b>000100.03 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

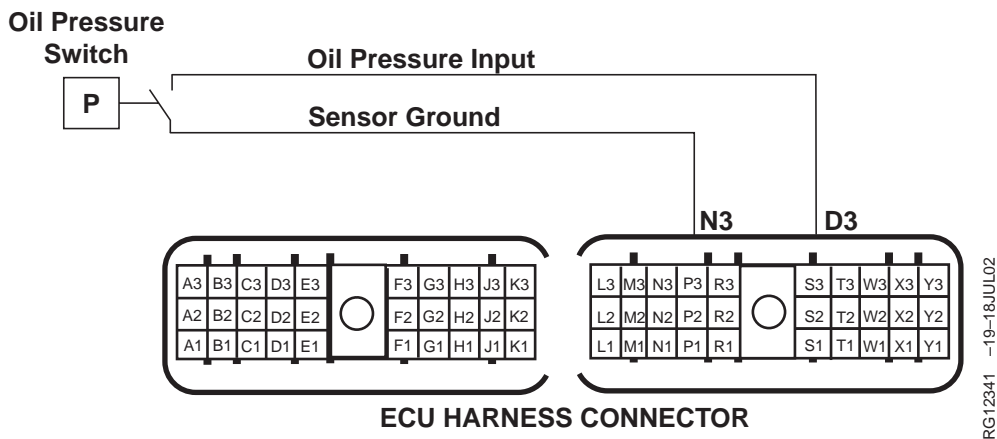
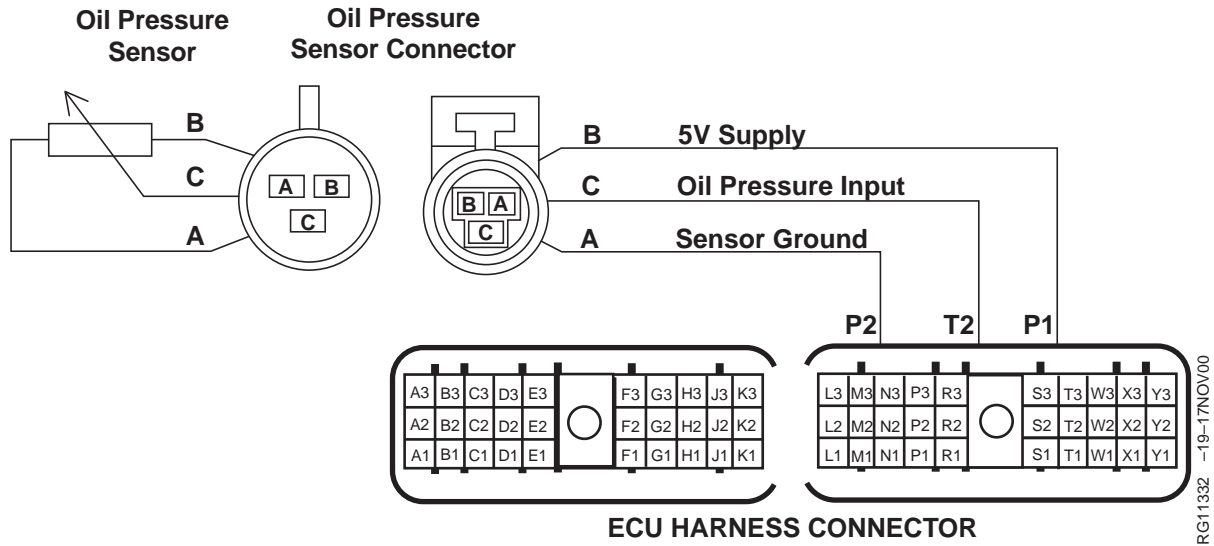
<p><b>③ Oil Pressure Input Shorted Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect oil pressure sensor connector.</li> <li>3. Ignition ON, engine OFF</li> <li>4. Using the ECU diagnostic software, read engine oil pressure input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low oil pressure input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Below 0.3 V:</b> GO TO ④</p> <p><b>0.3 V or greater:</b> Short to voltage in oil pressure sensor input circuit OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Oil Pressure Ground Circuit Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information.</i></p> <p>Probe the oil pressure sensor ground terminal (terminal A) of the sensor connector on the engine harness with a test light connected to battery voltage.</p>	<p><b>Light ON:</b> Faulty oil pressure sensor OR Faulty ECU connection OR Faulty ECU.</p> <p><b>Light OFF:</b> Open in oil pressure sensor ground circuit OR Faulty ECU connection OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>

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160  
,140



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160  
,141

### 000100.04 — Engine Oil Pressure Input Voltage Low



**NOTE:** Wiring schematics show OEM engine applications for the oil pressure sensor and Combine applications for the oil pressure switch. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### Oil Pressure Sensor or Switch

- The oil pressure sensor is a pressure transducer connected to the main oil galley. 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 earlier in this manual.

- The oil pressure switch is used to detect a loss of oil pressure. If the proper oil pressure is detected by the switch, it remains closed. The switch is open when the engine is not running and engine is running with sufficient oil pressure.

#### DTC 000100.04 will set if:

- For oil pressure sensors, the oil pressure input voltage drops below the sensor's low voltage specification. The voltage is lower than what is physically possible for oil pressure.

- For OEM 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.
- For oil pressure switches, the oil pressure switch is closed when key is on and there is no engine speed.

**If DTC 000100.04 sets, the following will occur:**

- ECU uses a default oil pressure of 260 kPa (2.6 bar) (37.7 psi).
- ECU's low oil pressure engine protection feature disabled.

RG40854,0000021 -19-30APR02-2/2

04  
160  
,143

## 000100.04 — Engine Oil Pressure Input Voltage Low

For oil pressure sensors, the oil pressure input voltage drops below the sensor's low voltage specification. For

oil pressure switches, the oil pressure switch is closed when key is on and there is no engine speed.

RG40854.0000023 -19-30APR02-1/1

### 000100.04 Oil Pressure Input Voltage Low Diagnostic Procedure

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#### ① 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 DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.*

Perform a preliminary inspection of the ECU connectors and the oil pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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#### ② Intermittent Fault Test

*NOTE: For wiring and theory of operation, 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running
6. Read DTCs using DST or SERVICE ADVISOR™.

**000100.04 reoccurs:**  
GO TO ③

**000100.04 does not reoccur:**  
Problem is intermittent. If no other codes are present, INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

*Trouble Code Diagnostics and Tests*

<p><b>3 Oil Sensor Check</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.</i></p> <p>Determine whether an oil pressure sensor or an oil pressure switch is being used.</p>	<p><b>Oil pressure sensor being used:</b> GO TO <b>4</b></p> <p><b>Oil pressure switch being used:</b> GO TO <b>6</b></p>
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<p><b>4 Oil Pressure Sensor and Connector Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect oil pressure sensor connector.</li> <li>3. Install a jumper wire between oil pressure sensor 5 V supply and input terminals (terminals B and C) in sensor connector on the engine harness.</li> <li>4. Ignition ON, engine OFF</li> <li>5. Using the ECU diagnostic software, read engine oil pressure input voltage</li> </ol> <p><i>NOTE: For OEM applications, the high oil pressure input voltage specification is 4.5V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Below 4.5 V:</b> GO TO <b>5</b></p> <p><b>4.5 V or greater:</b> Faulty oil pressure sensor connection OR Faulty oil pressure sensor</p>
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160  
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<p><b>5 Oil Pressure 5V Supply Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove jumper wire</li> <li>3. Ignition ON, engine OFF</li> <li>4. Using a multimeter, measure voltage between the 5 V supply (terminal B) of the oil pressure sensor connector on the engine harness and a good chassis ground.</li> </ol>	<p><b>4.0 - 6.0 volts:</b> Open in oil pressure sensor input circuit OR Short to ground in oil pressure sensor input circuit OR Faulty ECU connection OR Faulty ECU</p> <p><b>Below 4.0 volts:</b> 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</p>
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*Trouble Code Diagnostics and Tests*

**⑥ Oil Pressure Switch  
Short in Wire Check**

*NOTE: For wiring and theory of operation, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.*

1. Ignition OFF
2. Disconnect oil pressure switch connector and ECU connector
3. Using a multimeter, measure the resistance between terminal D3 in the ECU connector and:
  - All other terminals in the ECU connector
  - A good ground

**All measurements greater than 2000 ohms:**  
Faulty oil pressure switch  
OR  
Faulty ECU

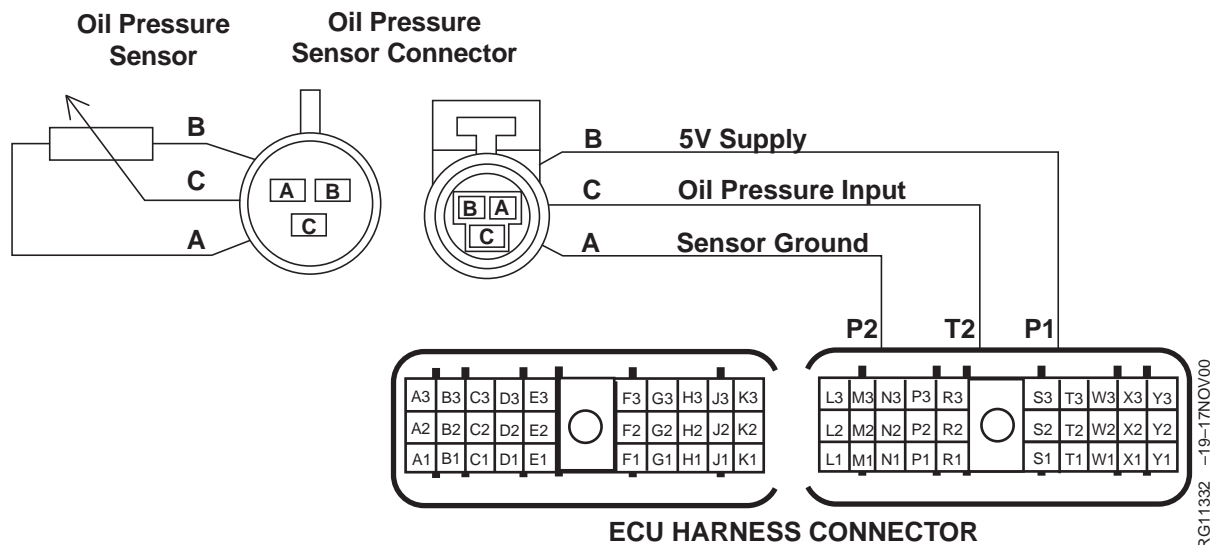
**Any measurement less than 2000 ohms:**  
Short in oil pressure input circuit

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04  
160  
,146

04  
160  
,147

### 000100.18 — Engine Oil Pressure Moderately Low



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 gallery or oil cooler. The oil pressure input voltage varies as oil pressure varies. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

**DTC 000100.18 will set if:**

- The ECU senses an oil pressure below the warning value set point in the ECU. The warning value set point is dependent on engine speed.

**If DTC 000100.18 sets, the following will occur:**

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG40854,000024 -19-30APR02-1/1



## 000100.18 — Engine Oil Pressure Moderately Low

The ECU senses an oil pressure below the warning value set point in the ECU.

RG40854,0000025 -19-30APR02-1/1

### 000100.18 Engine Oil Pressure Moderately Low Diagnostic Procedure

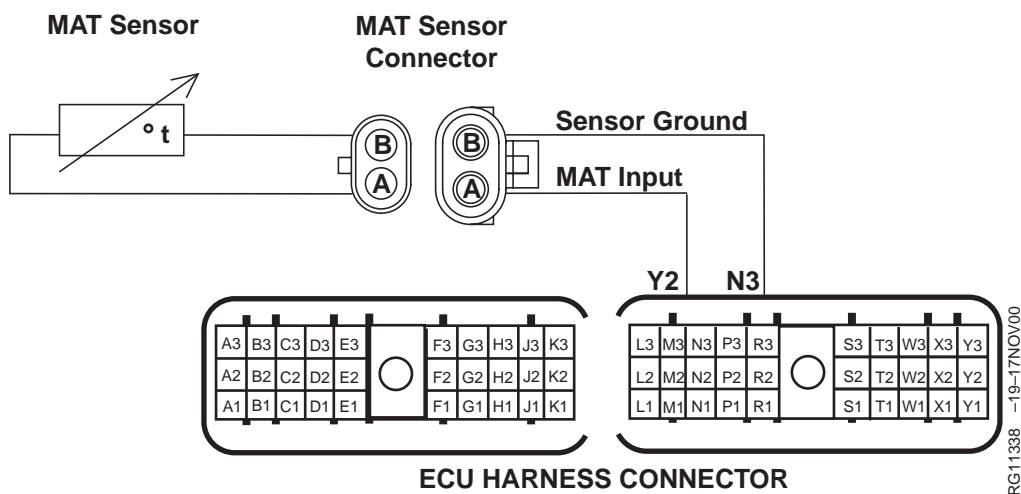
04  
160  
,149

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<p><b>1</b> Connection Check</p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the oil pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>2</b> Oil Pressure Test</p>	<p><i>NOTE: For wiring and theory of operation, see DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information.</i></p> <p>Under the conditions where DTC 000100.18 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in Section 04, Group 150 of 8.1L Diesel Engines Base Engine Manual (CTM 86).</p>	<p><b>Oil pressure below specification:</b> See L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 4.5L &amp; 6.8L Diesel Engines Base Engine Manual (CTM 104).</p> <p><b>Oil pressure within specification:</b> 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.</p>

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## 000105.00 — Manifold Air Temperature Extremely High



**NOTE:** Wiring schematic shows Combine engine applications only. For wiring information 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. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

### DTC 000105.00 will set if:

- The ECU senses a manifold air temperature on Combine applications above 100°C (212°F). For manifold air temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### If DTC 000105.00 sets, the following will occur:

- On Combine applications, the engine derates 20% per minute until the engine is running at 60% of full power. For other applications see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG40854,000002E -19-30APR02-1/1

## 000105.00 — Manifold Air Temperature Extremely High

The ECU senses a manifold air temperature above specification.

RG40854,000002D -19-30APR02-1/1

### 000105.00 Manifold Air Temperature Extremely High Diagnostic Procedure

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160  
,151

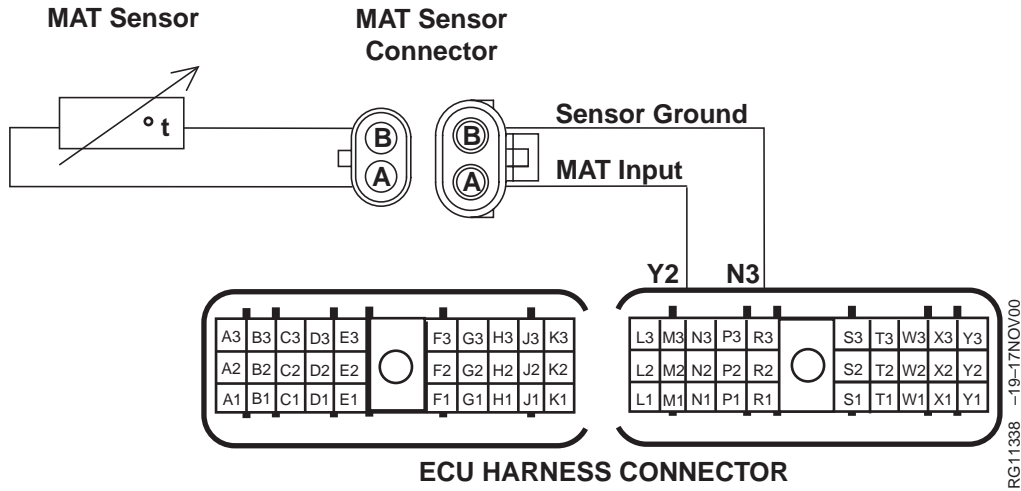
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<p><b>❶ Connector Check</b></p>	<p><b>IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000105.00 MANIFOLD AIR TEMPERATURE EXTREMELY HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the MAT sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>❷ Failures Causing High MAT Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000105.00 MANIFOLD AIR TEMPERATURE EXTREMELY HIGH supporting information.</i></p> <p>Check the following items that can cause high intake air temperature:</p> <ul style="list-style-type: none"> <li>• Excessively high ambient air temperature.</li> <li>• Restricted, dirty, or damaged charge air cooler.</li> <li>• Loose cooling fan belt.</li> <li>• Malfunctioning cooling fan.</li> <li>• Restricted or damaged intake air piping.</li> <li>• Damaged cooling fan shroud.</li> </ul>	<p><b>Cause of high MAT located:</b> Repair problem and retest.</p> <p><b>No cause of high MAT temp located:</b> Verify that MAT sensor input and ground circuits are OK. If MAT sensor circuits are OK, replace MAT sensor and retest.</p>

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**000105.03 — Manifold Air Temperature Input Voltage High**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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. 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. The voltage corresponds to a temperature that is higher than what is physically possible for manifold air temperature.
  - For OEM applications, the high manifold air 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 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.

RG40854,0000026 -19-30APR02-1/1

04  
160  
,152

## 000105.03 — Manifold Air Temperature Input Voltage High

The manifold air temperature input voltage exceeds the sensor's high voltage specification.

RG40854,0000027 -19-30APR02-1/1

### 000105.03 Manifold Air Temperature Input Voltage High Diagnostic Procedure

04  
160  
,153

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the manifold air temperature sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine OFF</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000105.03 reoccurs:</b> GO TO <b>③</b></p> <p><b>000105.03 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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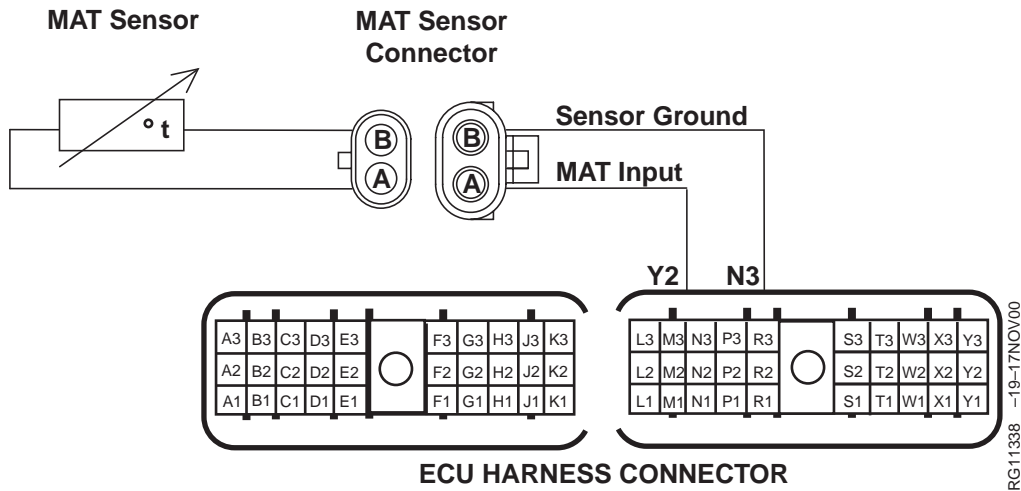
Trouble Code Diagnostics and Tests

<p><b>③ MAT Sensor and Connector Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect MAT sensor connector</li> <li>3. Install a jumper wire between both terminals in the MAT sensor connector on the engine harness.</li> <li>4. Ignition ON, engine OFF</li> <li>5. Using the ECU diagnostic software, read manifold air temperature input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low manifold air temperature input voltage specification is 0.1V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Above 0.1 V:</b> GO TO ④</p> <p><b>0.1 V or below:</b> Faulty MAT sensor connector OR Faulty MAT sensor</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ MAT Sensor Open Ground Circuit Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove jumper wire between both terminals.</li> <li>3. Install a jumper wire between the MAT input terminal (terminal A) of the sensor connector on the engine harness and a good chassis ground.</li> <li>4. Ignition ON, engine OFF</li> <li>5. Using the ECU diagnostic connector, read manifold air temperature input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low manifold air temperature input voltage specification is 0.1V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Above 0.1 V:</b> Open in MAT sensor input circuit OR Faulty ECU connection OR Faulty ECU</p> <p><b>0.1 V or below:</b> Open in MAT sensor ground circuit OR Faulty ECU connection OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
,154

04  
160  
,155

**000105.04 — Manifold Air Temperature Input Voltage Low**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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. 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 drops below the sensor's low voltage specification. The voltage corresponds to a pressure that is lower than what is physically possible for manifold air temperature.
  - For OEM 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.

RG40854,0000028 -19-30APR02-1/1

04  
160  
,156



## 000105.04 — Manifold Air Temperature Input Voltage Low

The manifold air temperature input voltage drops below the sensor's low voltage specification.

RG40854,0000029 -19-30APR02-1/1

### 000105.04 Manifold Air Temperature Input Voltage Low Diagnostic Procedure

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160  
,157

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the MAT sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine OFF</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000105.04 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000105.04 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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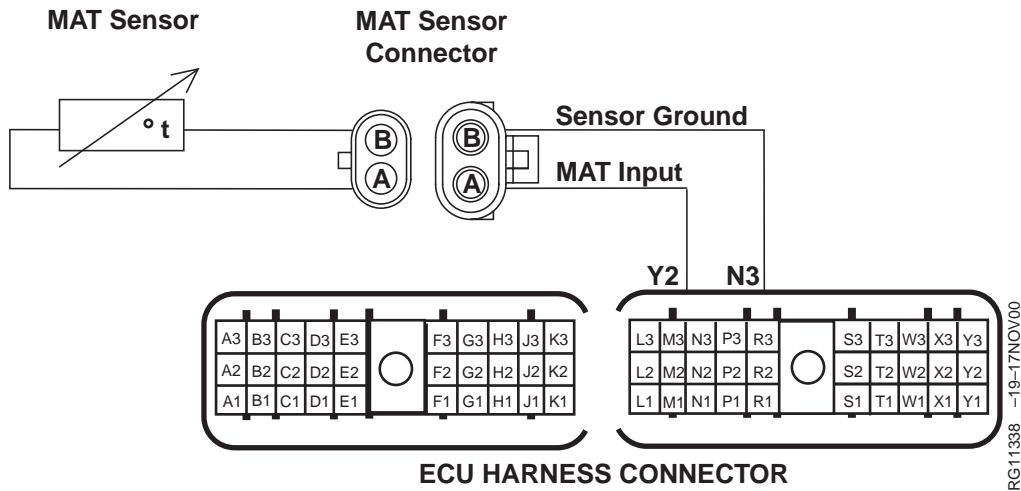
## Trouble Code Diagnostics and Tests

<b>③ MAT Sensor Test</b>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"><li>1. Ignition OFF</li><li>2. Disconnect MAT sensor connector.</li><li>3. Ignition ON, engine OFF</li><li>4. Using the ECU diagnostic software, read manifold air temperature input voltage</li></ol> <p><i>NOTE: For OEM applications, the high manifold air temperature input voltage specification is 4.9V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Below 4.9 V:</b> Short to ground in MAT sensor input circuit OR Faulty ECU connector OR Faulty ECU</p> <p><b>4.9 V or greater:</b> Faulty MAT sensor connector OR Faulty MAT sensor</p> <p style="text-align: right;">-- -1/1</p>
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04  
160  
,158

04  
160  
,159

**000105.16 — Manifold Air Temperature Moderately High**



*NOTE: Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

- The ECU senses a manifold air temperature on OEM applications above 88°C (190°F). For manifold air temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 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. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

**If DTC 000105.16 sets, the following will occur:**

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

**DTC 000105.16 will set if:**

RG40854,000002A -19-30APR02-1/1

## 000105.16 — Manifold Air Temperature Moderately High

The ECU senses a manifold air temperature above specification.

RG40854,000002B -19-30APR02-1/1

### 000105.16 Manifold Air Temperature Moderately High Diagnostic Procedure

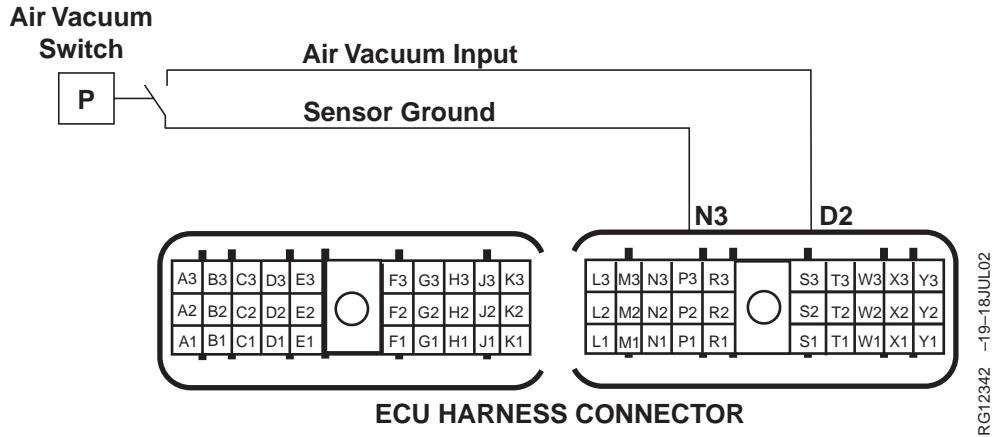
04  
160  
,161

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<p><b>① Connector Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the MAT sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>② Failures Causing High MAT Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.</i></p> <p>Check the following items that can cause high intake air temperature:</p> <ul style="list-style-type: none"> <li>• Excessively high ambient air temperature.</li> <li>• Restricted, dirty, or damaged charge air cooler.</li> <li>• Loose cooling fan belt.</li> <li>• Malfunctioning cooling fan.</li> <li>• Restricted or damaged intake air piping.</li> <li>• Damaged cooling fan shroud.</li> </ul>	<p><b>Cause of high MAT located:</b> Repair problem and retest.</p> <p><b>No cause of high MAT temp located:</b> Verify that MAT sensor input and ground circuits are OK. If MAT sensor circuits are OK, replace MAT sensor and retest.</p>

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**000107.00 — Air Filter Differential Pressure**



RG12342 -19-18.JUL02

**Air Vacuum Switch**

- The air vacuum switch is located on the clean side of the air filter. Higher air pressure causes the contacts on the air vacuum switch to close.

**DTC 000107.00 will set if:**

- The ECU senses a high air pressure from the air vacuum switch.

**If DTC 000107.00 sets, the following will occur:**

- ECU may set a warning light.
- Engine performance will not be affected.

RG40854,000002F -19-30APR02-1/1

04  
160  
,162

## 000107.00 — Air Filter Differential Pressure

The ECU senses a high air pressure from the air vacuum switch.

RG40854,0000030 -19-30APR02-1/1

### 000107.00 Air Filter Differential Pressure Diagnostic Procedure

04  
160  
,163

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<p><b>① Connector Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER DIFFERENTIAL PRESSURE supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the air filter switch connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>No faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>② Air Filter Restriction Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER DIFFERENTIAL PRESSURE supporting information.</i></p> <p>Check air filter for restrictions.</p>	<p><b>Restriction found in air filter:</b> Replace, or clean as needed.</p> <p><b>No problem found with air filter:</b> GO TO <b>③</b></p>

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*Trouble Code Diagnostics and Tests*

<p><b>③ Air Intake Restriction Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER DIFFERENTIAL PRESSURE supporting information.</i></p> <p>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 Section 04, Group 150 of 4.5L &amp; 6.8L Diesel Engines Base Engine Manual (CTM 104).</p>	<p><b>Restriction found in intake system:</b> Replace, repair, or clean components as needed.</p> <p><b>No problem found with intake system:</b> GO TO ④</p>
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<p><b>④ Air Vacuum Switch Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000107.00 AIR FILTER DIFFERENTIAL PRESSURE supporting information.</i></p> <p>Verify air vacuum switch is functioning correctly.</p>	<p><b>Air vacuum switch is failed closed:</b> Replace switch and retest.</p> <p><b>Air vacuum switch functions correctly:</b> Verify that the air vacuum switch wiring is OK.</p>
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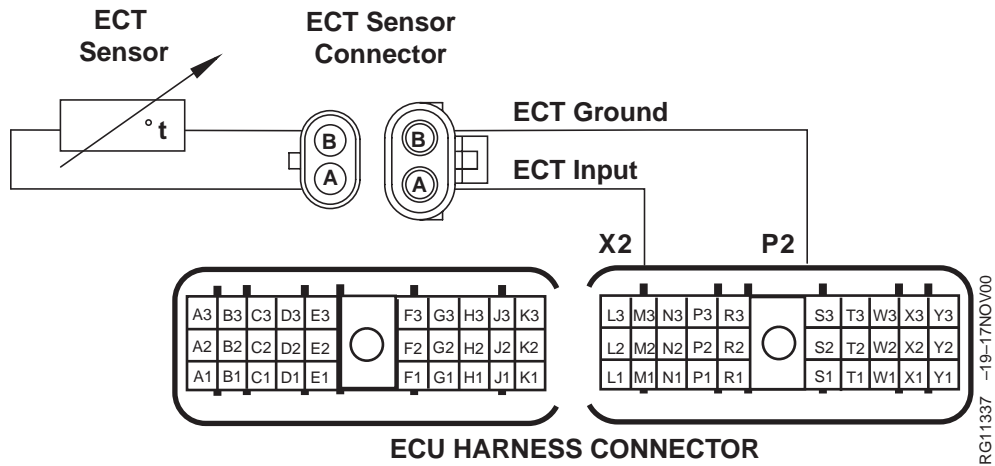
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04  
160  
,164



04  
160  
,165

## 000110.00 — Engine Coolant Temperature Extremely High



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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:**

- On OEM applications, the ECU senses a coolant temperature above 118°C (244°F). For most severe engine coolant temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**If DTC 000110.00 sets, the following will occur:**

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derate 40% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG40854,0000032 -19-30APR02-1/1

## 000110.00 — Engine Coolant Temperature Extremely High

The ECU senses a coolant temperature above specification.

RG40854,0000033 -19-30APR02-1/1

### 000110.00 Engine Coolant Temperature Extremely High Diagnostic Procedure

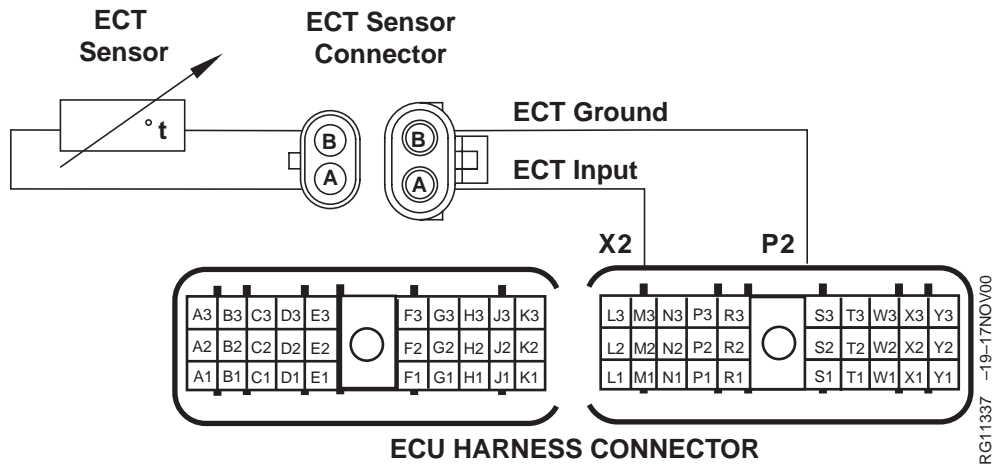
04  
160  
,167

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<p><b>1</b> Connection Check</p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTRMELY HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>2</b> ECT Sensor and Circuit Test</p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTRMELY HIGH supporting information.</i></p> <p>Under the conditions where DTC 000110.00 occurs, using a temperature gauge, verify that engine coolant temperature is above extremely high specification.</p> <p><i>NOTE: On OEM applications, the most severe ECT specification is 118°C (244°F). For the most severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.</i></p>	<p><b>Temperature at or above 118°C (244°F):</b> Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5L &amp; 6.8L Diesel Engines Base Engine Manual (CTM 104).</p> <p><b>Temperature significantly less than 118°C (244°F):</b> Verify that ECT sensor input and ground circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest.</p>

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### 000110.03 — Engine Coolant Temperature Input Voltage High



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 of this manual.

**DTC 000110.03 will set if:**

- The engine coolant temperature input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a temperature that is higher than what is physically possible for engine coolant temperature.
  - For OEM applications, the high 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:**

- When in start mode, the ECU will default the ECT to 0°C (32°F).
- The ECU will use a default "limp-home" ECT value of 95°C (203°F).
- ECU's high coolant temperature engine protection feature disabled.

RG40854,0000034 -19-30APR02-1/1

## 000110.03 — Engine Coolant Temperature Input Voltage High

The engine coolant temperature input voltage exceeds the sensor's high voltage specification.

RG40854,0000035 -19-30APR02-1/1

### 000110.03 Engine Coolant Temperature Input Voltage High Diagnostic Procedure

04  
160  
,169

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000110.03 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000110.03 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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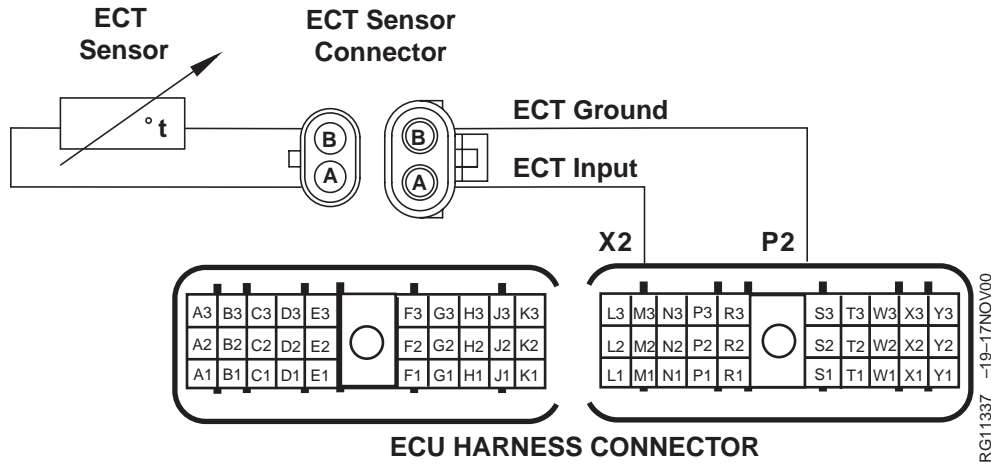
## Trouble Code Diagnostics and Tests

<p><b>③ ECT Sensor and Connector Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect ECT sensor connector.</li> <li>3. Install a jumper wire between both terminals in the ECT sensor connector on the engine harness.</li> <li>4. Ignition ON, engine OFF</li> <li>5. Using the ECU diagnostic software, read engine coolant temperature input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low engine coolant temperature input voltage specification is 0.1V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Above 0.1 V:</b> GO TO ④</p> <p><b>0.1 V or below:</b> Faulty ECT sensor connector OR Faulty ECT sensor</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ ECT Open Ground Circuit Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove jumper wire between both terminals.</li> <li>3. Install a jumper wire between the ECT input terminal (terminal A) of the sensor connector on the engine harness and a good chassis ground.</li> <li>4. Ignition ON, engine OFF</li> <li>5. Using the ECU diagnostic software, read engine coolant temperature input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low engine coolant temperature input voltage specification is 0.1V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Above 0.1 V:</b> Open in ECT input sensor circuit OR Faulty ECU connection OR Faulty ECU</p> <p><b>0.1 V or below:</b> Open in ECT sensor ground circuit OR Faulty ECU connection OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
,170

04  
160  
,171

**000110.04 — Engine Coolant Temperature Input Voltage Low**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 of this manual.

**DTC 000110.04 will set if:**

- The engine coolant temperature input voltage drops below the sensor's low voltage specification. The voltage corresponds to a temperature that is lower than what is physically possible for engine coolant temperature .
  - For OEM 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:**

- When in start mode, the ECU will default the ECT to 0°C (32°F).
- The ECU will use a default "limp-home" ECT value of 95°C (203°F).
- ECU's high coolant temperature engine protection feature disabled.

RG40854,0000036 -19-30APR02-1/1



## 000110.04 — Engine Coolant Temperature Input Voltage Low

The engine coolant temperature input voltage drops below the sensor's low voltage specification.

RG40854,0000037 -19-30APR02-1/1

### 000110.04 Engine Coolant Temperature Input Voltage Low Diagnostic Procedure

04  
160  
,173

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine OFF or running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000110.04 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000110.04 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

### ③ 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, engine OFF
4. Using the ECU diagnostic software, read engine coolant temperature input voltage

*NOTE: For OEM applications, the high engine coolant temperature input voltage specification is 4.9V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.*

#### **Below 4.9 V:**

Short to ground in ECT sensor input circuit  
OR  
Faulty ECU

#### **4.9 V or greater:**

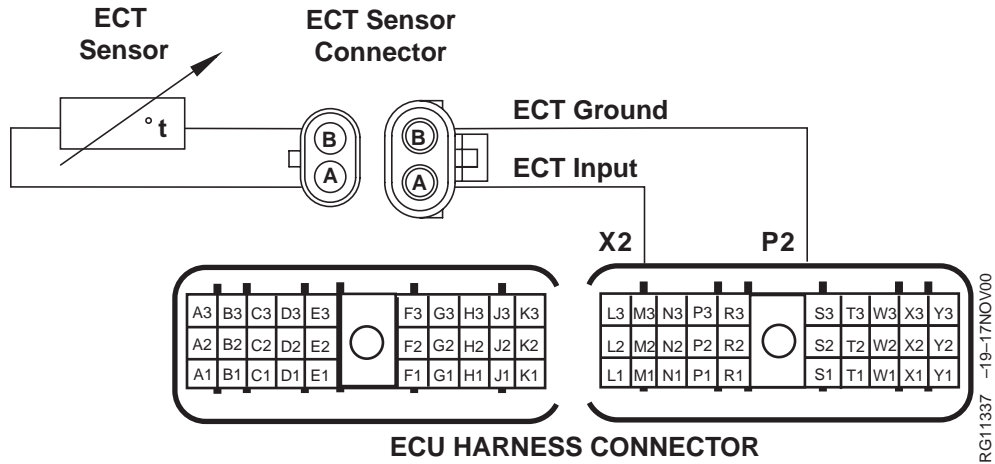
Faulty ECT sensor connector  
OR  
Faulty ECT sensor

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04  
160  
,174

04  
160  
,175

**000110.15 — Engine Coolant Temperature High Least Severe**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 on OEM applications above 108°C (226°F). For least

severe engine coolant temperature specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**If DTC 000110.15 sets, the following will occur:**

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 95% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

## 000110.15 — Engine Coolant Temperature High Least Severe

The ECU senses a coolant temperature above specification.

RG40854,0000039 -19-30APR02-1/1

### 000110.15 Engine Coolant Temperature High Least Severe Diagnostic Procedure

04  
160  
,177

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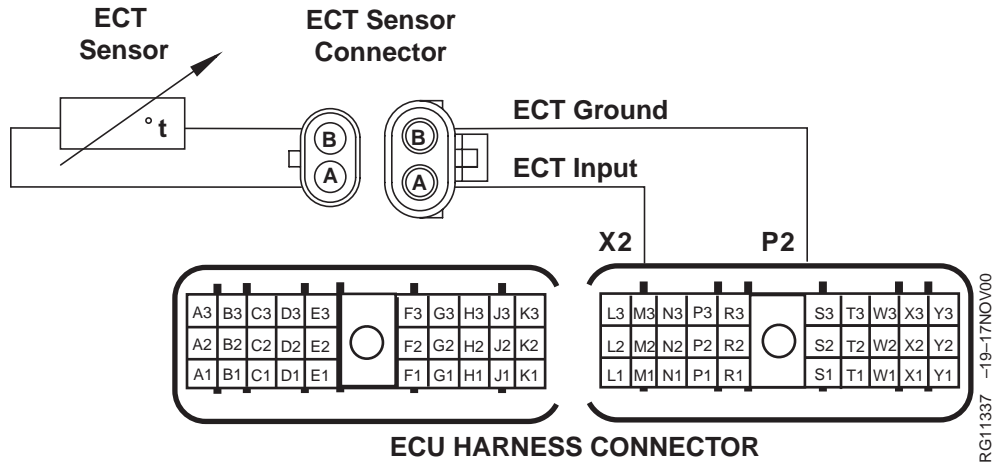
<p><b>1</b> Connection Check</p>	<p><b>IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2</b> ECT Sensor and Circuit Test</p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE supporting information.</i></p> <p>Under the conditions where DTC 000110.15 occurs, using a temperature gauge, verify that engine coolant temperature is above the moderately high specification.</p> <p><i>NOTE: On OEM applications, the most severe ECT specification is 108°C (226°F). For the least severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.</i></p>	<p><b>Temperature at or 108°C (226°F):</b> Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL diagnostic procedure in Section 04, Group 150 of 4.5L &amp; 6.8L Diesel Engines Base Engine Manual (CTM 104).</p> <p><b>Temperature significantly less than 108°C (226°F):</b> Verify that ECT sensor input and ground circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest.</p>
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**000110.16 — Engine Coolant Temperature Moderately High**



04  
160  
178

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

- The ECU senses engine coolant temperature on OEM applications above 113°C (235°F). For moderately high engine coolant temperature specification, 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:**

**If DTC 000110.16 sets, the following will occur:**

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 40% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG40854,000003B -19-30APR02-1/1

## 000110.16 — Engine Coolant Temperature Moderately High

The ECU senses a coolant temperature above specification.

RG40854,000003C -19-30APR02-1/1

### 000110.16 Engine Coolant Temperature Moderately High Diagnostic Procedure

04  
160  
,179

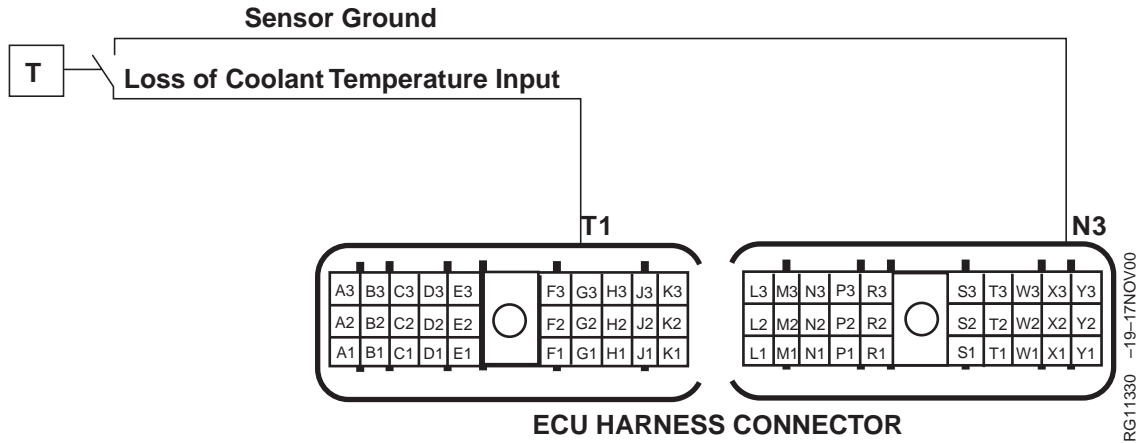
-- -1/1

<p><b>1</b> Connection Check</p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>2</b> ECT Sensor and Circuit Test</p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH supporting information.</i></p> <p>Under the conditions where DTC 000110.16 occurs, using a temperature gauge, verify that engine coolant temperature is above the moderately high specification.</p> <p><i>NOTE: On OEM applications, the high moderately severe ECT specification is 113°C (235°F). For the moderately severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.</i></p>	<p><b>Temperature at or above 113°C (235°F):</b> Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL diagnostic procedure in Section 04, Group 150 of 4.5L &amp; 6.8L Diesel Engines Base Engine Manual (CTM 104).</p> <p><b>Temperature significantly less than 113°C (235°F):</b> Verify that ECT sensor input and ground circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest.</p>

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### 000111.01 — Engine Coolant Level Low

#### Loss of Coolant Temperature Switch



#### 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 rise 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.

#### If DTC 000111.01 sets, the following occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 40% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG40854,000003D -19-30APR02-1/1



## 000111.01 — Engine Coolant Level Low


The loss of coolant temperature switch contacts close causing the ECU to sense continuity to ground.

RG40854,000003E -19-30APR02-1/1

### 000111.01 Engine Coolant Level Low Diagnostic Procedure

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160  
,181

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<p><b>1</b> Connection Check</p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the loss of coolant temperature switch connector, looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>2</b> Coolant Level Test</p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information.</i></p> <p> <b>CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.</b></p> <ul style="list-style-type: none"> <li>• Check coolant level.</li> </ul>	<p><b>Coolant level OK:</b> GO TO <b>3</b></p> <p><b>Coolant level low:</b> Determine cause of low coolant level, repair problem and retest.</p>

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*Trouble Code Diagnostics and Tests*

<p><b>③ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine running</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all active DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine OFF</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000111.01 reoccurs:</b> GO TO ④</p> <p><b>000111.01 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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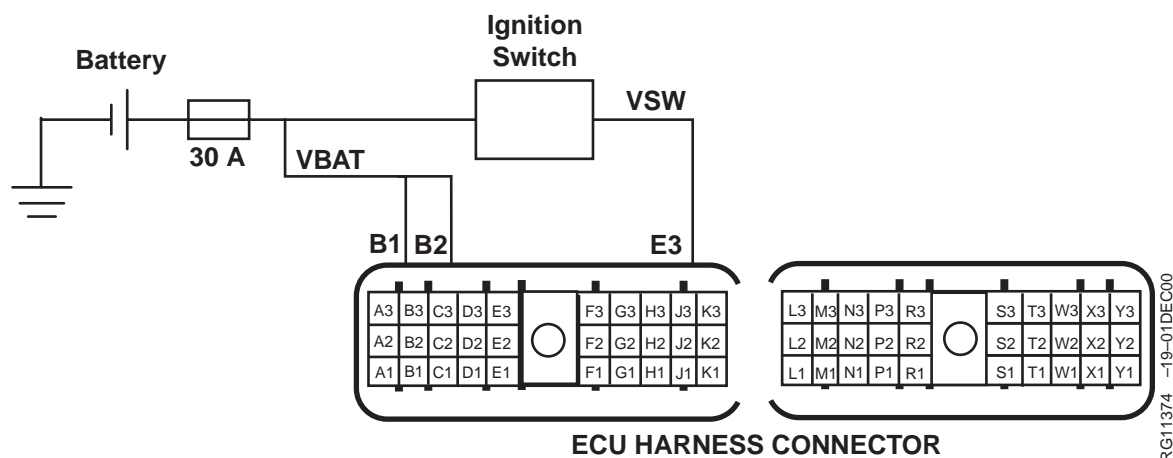
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<p><b>④ Loss of Coolant Temperature Switch Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000111.01 ENGINE COOLANT LEVEL LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect loss of coolant temperature switch connector.</li> <li>3. Ignition ON, engine OFF</li> <li>4. Using the ECU diagnostic software, read DTCs</li> </ol>	<p><b>000111.01 reoccurs:</b> Short to ground in loss of coolant temperature switch input circuit.</p> <p><b>000111.01 does not reoccur:</b> Faulty loss of coolant temperature switch.</p>
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### 000158.17 — ECU Power Down Error



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

ECU detects voltage on the switched voltage input wire to the ECU.

**If DTC 000158.17 sets, the following will occur:**

- Vehicle battery may be drained because ECU will not power down.

**DTC 000158.17 will set if:**

- ECU is unable to complete proper power down procedures after detecting a key off condition. The

## 000158.17 — ECU Power Down Error

*ECU is unable to complete proper power down procedures after detecting a key off condition.*

RG40854,0000040 -19-30APR02-1/1

### 000158.17 ECU Power Down Error Diagnostic Procedure

04  
160  
,185

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the ignition power circuit, looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs</li> <li>5. Cycle ignition OFF for 10 seconds, then back ON.</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000158.17 reoccurs:</b> GO TO <b>③</b></p> <p><b>000158.17 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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Trouble Code Diagnostics and Tests

③ Wiring Test

*NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.*

1. Ignition OFF
2. Disconnect ECU connector.
3. Using a multimeter measure voltage between terminal E3 of the ECU connector on the engine harness and a good chassis ground.

**Measurement above 3.0 volts:**

Faulty ignition switch circuit  
OR  
ECU key-on power supply wires shorted to voltage  
OR  
Faulty ignition switch

**Measurements below 3.0 volts:**

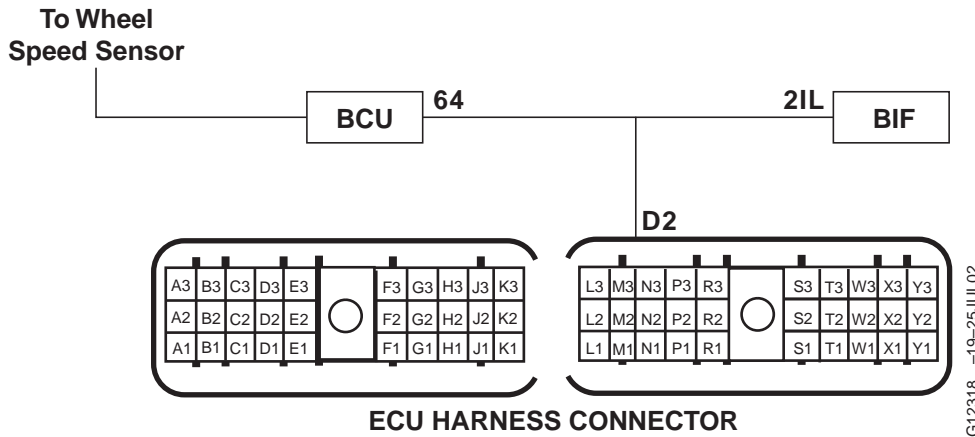
Faulty ECU connection  
OR  
Faulty ECU

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160  
,186

04  
160  
,187

### 000160.02 — Wheel Speed Input Noise



**NOTE:** Wiring schematic shows limited information. For further wiring information, see *APPLICATION SPECIFICATIONS* in Section 06, Group 210 of this manual.

#### Wheel Speed Sensor

- The wheel speed sensor is an inductive type sensor that is mounted on the rear axle. As teeth on the axle rotate past the sensor, AC signals are

generated. The frequency of these signals are proportional to the wheel speed.

#### DTC 000160.02 will set if:

- The ECU detects noise on the wheel speed input.

#### If DTC 000160.02 sets, the following will occur:

- Road speed limiting function is disabled.

RG40854.0000133 -19-11JUL02-1/1



## 000160.02 — Wheel Speed Input Noise

The ECU detects noise on the wheel speed input.

RG40854.0000134 -19-11JUL02-1/1

### 000160.02 Wheel Speed Input Noise Diagnostic Procedure

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,189

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and BCU connectors looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Warm engine</li> <li>3. Ignition ON, engine OFF</li> <li>4. Start ECU communication software</li> <li>5. Read DTCs using DST or SERVICE ADVISOR™.</li> <li>6. Make note of all DTCs, then clear all DTCs</li> <li>7. Ignition ON, engine running</li> <li>8. Read DTCs</li> </ol>	<p><b>000160.02 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000160.02 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.</p>
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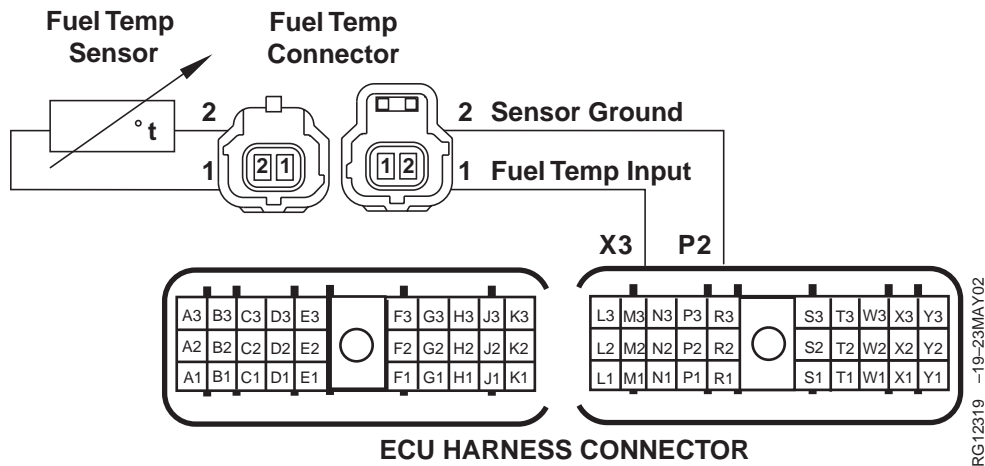
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## Trouble Code Diagnostics and Tests

<p><b>③ Open Wheel Speed Input Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect ECU connector and BCU connector</li> <li>3. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal D2 in the ECU connector and corresponding terminal on the BCU connector.</li> </ul> </li> </ol>	<p><b>Measurement 5 ohms or less:</b> GO TO <b>④</b></p> <p><b>Measurement greater than 5 ohms:</b> Open in wheel speed input wire</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Short in Wheel Speed Input Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Both ECU connectors and BCU connector still disconnected</li> <li>3. Using a multimeter measure resistance between terminal D2 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> GO TO <b>⑤</b></p> <p><b>Any measurement less than 2000 ohms:</b> Faulty wheel speed input wire</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Noise Detection Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.</i></p> <ol style="list-style-type: none"> <li>1. 000160.02 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections anywhere on the machine. Things to check: <ul style="list-style-type: none"> <li>• All harness connectors</li> <li>• Alternator connections</li> <li>• Chassis ground connections, battery ground connection</li> <li>• Corrosion, dirt, or paint can cause intermittent and "noisy" connections</li> <li>• Check the wiring for intermittent open and short circuits; particularly the cam sensor wiring</li> </ul> </li> <li>2. Other possible causes of 000160.02: <ul style="list-style-type: none"> <li>• Electromagnetic interference (EMI) from an incorrectly installed 2-way radio</li> <li>• Interference from some radar source</li> <li>• Possible burrs on the wheel speed timing gear notches, should be clean, square edges</li> </ul> </li> </ol>	<p style="text-align: right;">-- -1/1</p>



**000174.00 — Fuel Temperature High Most Severe**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

- The ECU senses fuel temperature on OEM applications above 88°C (190°F) for an extended period of time. For the most severe fuel temperature specifications 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 base of the fuel filter. It is used to measure the fuel temperature. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for variation in fuel density caused by varying fuel temperatures. For further fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

**If DTC 000174.00 sets, the following will occur:**

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

**DTC 000174.00 will set if:**

RG40854,0000041 -19-30APR02-1/1

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## 000174.00 — Fuel Temperature High Most Severe

The ECU senses a fuel temperature above specification for an extended period of time.

RG40854,0000042 -19-30APR02-1/1

### 000174.00 Fuel Temperature High Most Severe Diagnostic Procedure

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160  
,193

--1/1

<p><b>1 Preliminary Check</b></p>	<p>Before using this diagnostic procedure:</p> <ol style="list-style-type: none"> <li>1. Ensure that fuel level in tank is not extremely low.</li> <li>2. If engine is equipped with a fuel cooler, make sure cooler is clean.</li> </ol>	<p><b>No problem found:</b> GO TO <b>2</b></p> <p><b>Problem found:</b> Repair and retest.</p> <p>--1/1</p>
<p><b>2 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000174.00 FUEL TEMPERATURE HIGH MOST SEVERE supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the fuel temperature sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>3</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p> <p>--1/1</p>
<p><b>3 Fuel Supply Pressure Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000174.00 FUEL TEMPERATURE HIGH MOST SEVERE supporting information.</i></p> <p>Determine the fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE in Section 04, Group 150 earlier in this manual.</p>	<p><b>Fuel pressure within specification:</b> GO TO <b>4</b></p> <p><b>Fuel pressure below specification:</b> Determine cause of low supply pressure. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE in Section 04, Group 150 earlier in this manual.</p> <p>--1/1</p>

*Trouble Code Diagnostics and Tests*

**④ Restricted Fuel  
Leak-off Line Test**

*NOTE: For wiring and theory of operation information, see DTC 000174.00 FUEL TEMPERATURE HIGH MOST SEVERE supporting information.*

Check for restricted fuel leak-off line. See CHECK FOR RESTRICTED FUEL LEAK-OFF LINE in Section 04, Group 150 earlier in this manual.

**No restrictions found:**  
Faulty high pressure fuel pump overflow valve  
OR  
Faulty fuel cooler  
OR  
Faulty high pressure fuel pump

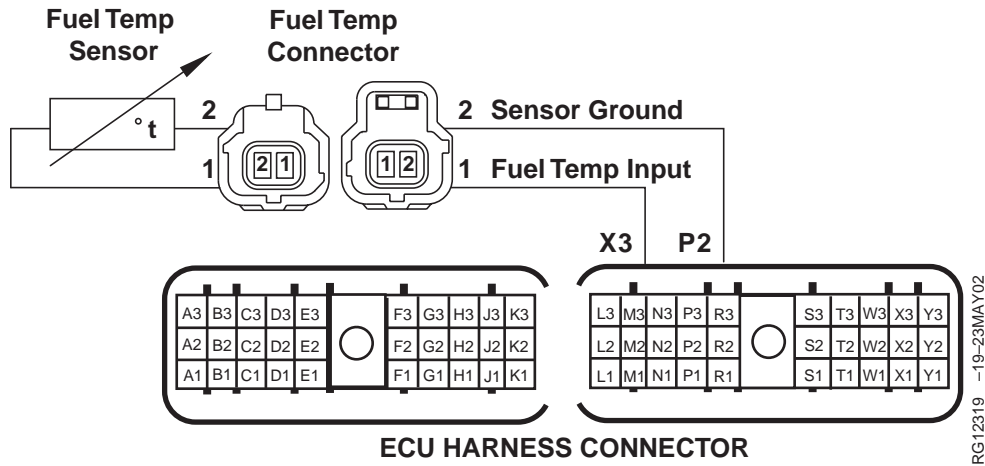
**Restrictions found:**  
Determine cause of restriction, repair, and retest

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**000174.03 — Fuel Temperature Input Voltage High**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 base of the fuel filter. It is used to measure the fuel temperature. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for variation in fuel density caused by varying fuel temperatures. For further fuel temperature sensor information, see MEASURING

TEMPERATURE in Section 03, Group 140 of this manual.

**DTC 000174.03 will set if:**

- The fuel temperature input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a temperature that is higher than what is physically possible for fuel temperature.
  - For OEM 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 60°C (140°F).
- Engine power may be slightly affected.

RG40854,0000043 -19-30APR02-1/1



## 000174.03 — Fuel Temperature Input Voltage High

The fuel temperature input voltage exceeds the sensor's high voltage specification.

RG40854,0000044 -19-30APR02-1/1

### 000174.03 Fuel Temperature Input Voltage High Diagnostic Procedure

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160  
,197

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<p><b>1</b> Connection Check</p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the fuel temperature sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b></p>
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<p><b>2</b> Intermittent Fault Test</p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000174.03 reoccurs:</b> GO TO <b>3</b></p> <p><b>000174.03 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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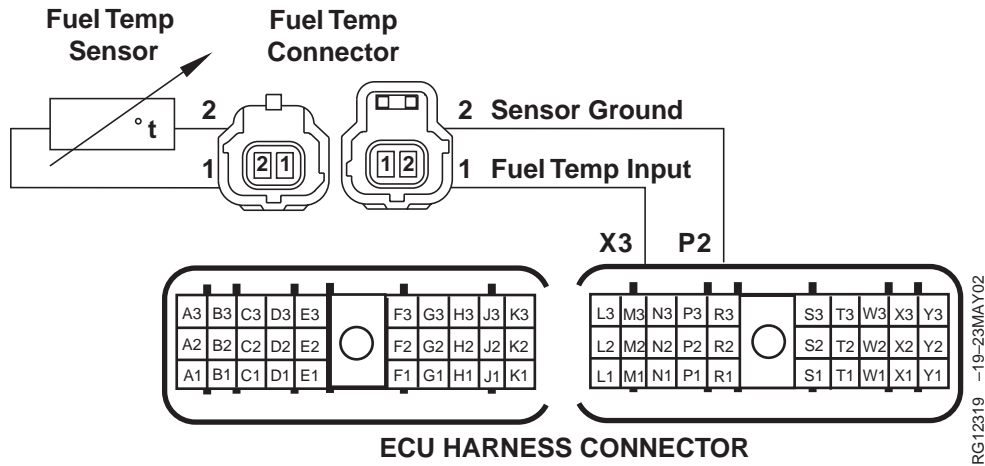
## Trouble Code Diagnostics and Tests

<p><b>③ Fuel Temperature Sensor and Connector Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect fuel temperature sensor connector.</li> <li>3. Install a jumper wire between both terminals in the fuel temperature sensor connector on the engine harness.</li> <li>4. Ignition ON, engine OFF</li> <li>5. Using the ECU diagnostic software, read fuel temperature input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low fuel temperature input voltage specification is 0.1V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Above 0.1 V:</b> GO TO ④</p> <p><b>0.1 V or below:</b> Faulty fuel temp sensor connector OR Faulty temp sensor</p> <p style="text-align: right;">---1/1</p>
<p><b>④ Fuel Temperature Open in Ground Circuit Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove jumper wire between both terminals.</li> <li>3. Install a jumper wire between the fuel temperature input terminal (terminal 1) of the sensor connector on the engine harness and a good chassis ground.</li> <li>4. Ignition ON, engine OFF</li> <li>5. Using the ECU diagnostic software, read fuel temperature input voltage</li> </ol> <p><i>NOTE: For OEM applications, the low fuel temperature input voltage specification is 0.1V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.</i></p>	<p><b>Above 0.1 V:</b> Open in fuel temp sensor input circuit OR Faulty ECU connection OR Faulty ECU</p> <p><b>0.1 V or below:</b> Open in fuel temp sensor ground circuit OR Faulty ECU connection OR Faulty ECU.</p> <p style="text-align: right;">---1/1</p>

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,199

**000174.04 — Fuel Temperature Input Voltage Low**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 base of the fuel filter. It is used to measure the fuel temperature. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for variation in fuel density caused by varying fuel temperatures. For further fuel temperature sensor information, see MEASURING

TEMPERATURE in Section 03, Group 140 of this manual.

**DTC 000174.04 will set if:**

- The fuel temperature input voltage drops below the sensor's low voltage specification. The voltage corresponds to a temperature that is lower than what is physically possible for fuel temperature.
  - For OEM applications, the low fuel 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 fuel temperature input voltage specification.

**If DTC 000174.04 sets, the following will occur:**

- The ECU will use a default "limp-home" value of 60°C (140°F).
- Engine power may be slightly affected.

RG40854,0000045 -19-30APR02-1/1

## 000174.04 — Fuel Temperature Input Voltage Low

The fuel temperature input voltage drops below the sensor's low voltage specification.

RG40854,0000046 -19-30APR02-1/1

### 000174.04 Fuel Temperature Input Voltage Low Diagnostic Procedure

04  
160  
,201

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the fuel temperature sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b></p>
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<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine OFF or running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000174.04 reoccurs:</b> GO TO <b>3</b></p> <p><b>000174.04 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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SERVICE ADVISOR is a trademark of Deere & Company

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## Trouble Code Diagnostics and Tests

### ③ 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, engine OFF
4. Using the ECU diagnostic software, read fuel temperature input voltage.

#### **Below 4.9 V:**

Short to ground in fuel temp sensor input circuit  
OR  
Faulty ECU

#### **4.9 V or greater:**

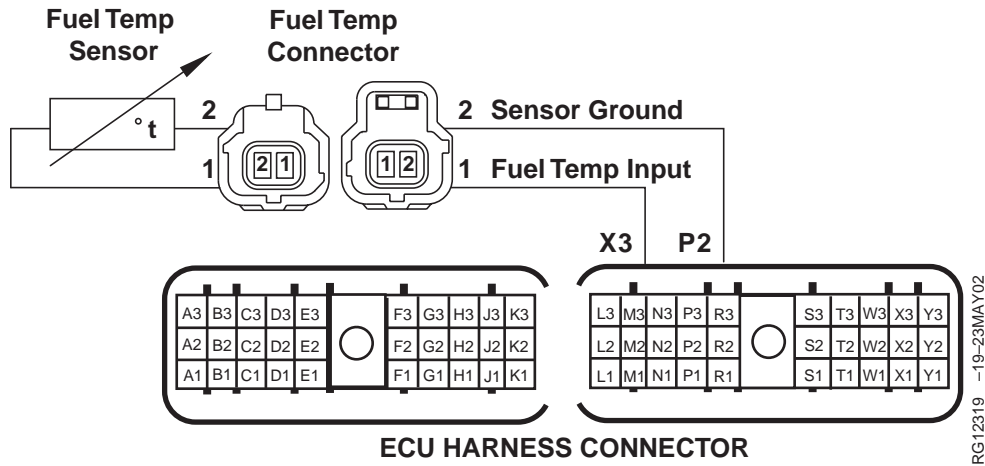
Faulty fuel temp sensor

--1/1

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**000174.16 — Fuel Temperature High Moderately Severe**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 base of the fuel filter. It is used to measure the fuel temperature. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for variation in fuel density caused by varying fuel temperatures. For further fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

**DTC 000174.16 will set if:**

- The ECU senses fuel temperature on OEM applications above 88°C (190°F). For fuel temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**If DTC 000174.16 sets, the following will occur:**

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG40854,0000047 -19-30APR02-1/1

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.204



## 000174.16 — Fuel Temperature High Moderately Severe

The ECU senses a fuel temperature above specification.

RG40854,0000048 -19-30APR02-1/1

### 000174.16 Fuel Temperature High Moderately Severe Diagnostic Procedure

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,205

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<p><b>1 Preliminary Check</b></p>	<p>Before using this diagnostic procedure:</p> <ol style="list-style-type: none"> <li>1. Ensure that fuel level in fuel tank is not extremely low.</li> <li>2. If engine is equipped with a fuel cooler, make sure cooler is clean.</li> </ol>	<p><b>No problem found:</b> GO TO <b>2</b></p> <p><b>Problem found:</b> Repair and retest</p> <p>--1/1</p>
<p><b>2 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the fuel temperature sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>3</b></p> <p><b>Faulty connection(s):</b></p> <p>--1/1</p>
<p><b>3 Fuel Supply Pressure Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information.</i></p> <p>Determine the fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE in Section 04, Group 150 of this manual.</p>	<p><b>Fuel pressure within specification:</b> GO TO <b>4</b></p> <p><b>Fuel pressure below specification:</b> Determine cause of low supply pressure as outlined in CHECK FUEL SUPPLY PRESSURE in Group 150 of this manual. Repair problem and retest.</p> <p>--1/1</p>

Trouble Code Diagnostics and Tests

④ Restricted Fuel Leak-off Line Test

*NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information.*

Check return fuel line for restrictions. See CHECK FOR RESTRICTED FUEL LEAK-OFF LINE in Group 150 of this manual.

**Fuel leak-off line NOT restricted:**

Verify that fuel temperature input and ground circuit are OK. If both circuits are OK, replace fuel temperature sensor and retest.

**Restriction found in fuel leak-off line:**

Determine cause of restricted fuel leak-off line, repair problem, and retest.

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## 000189.00 — Engine Speed Derate

*The ECU detects a condition that requires an engine speed derate.*

### Engine Speed Derate

- The engine speed derate trouble code is set to indicate that the ECU has detected a condition or code such as DTC 002000.13 that requires engine speed to be limited.

### DTC 000189.00 will set if:

- The ECU detects a condition that requires an engine speed derate.

### If DTC 000189.00 sets, the following will occur:

- The ECU will limit engine speed in an attempt to protect the engine.

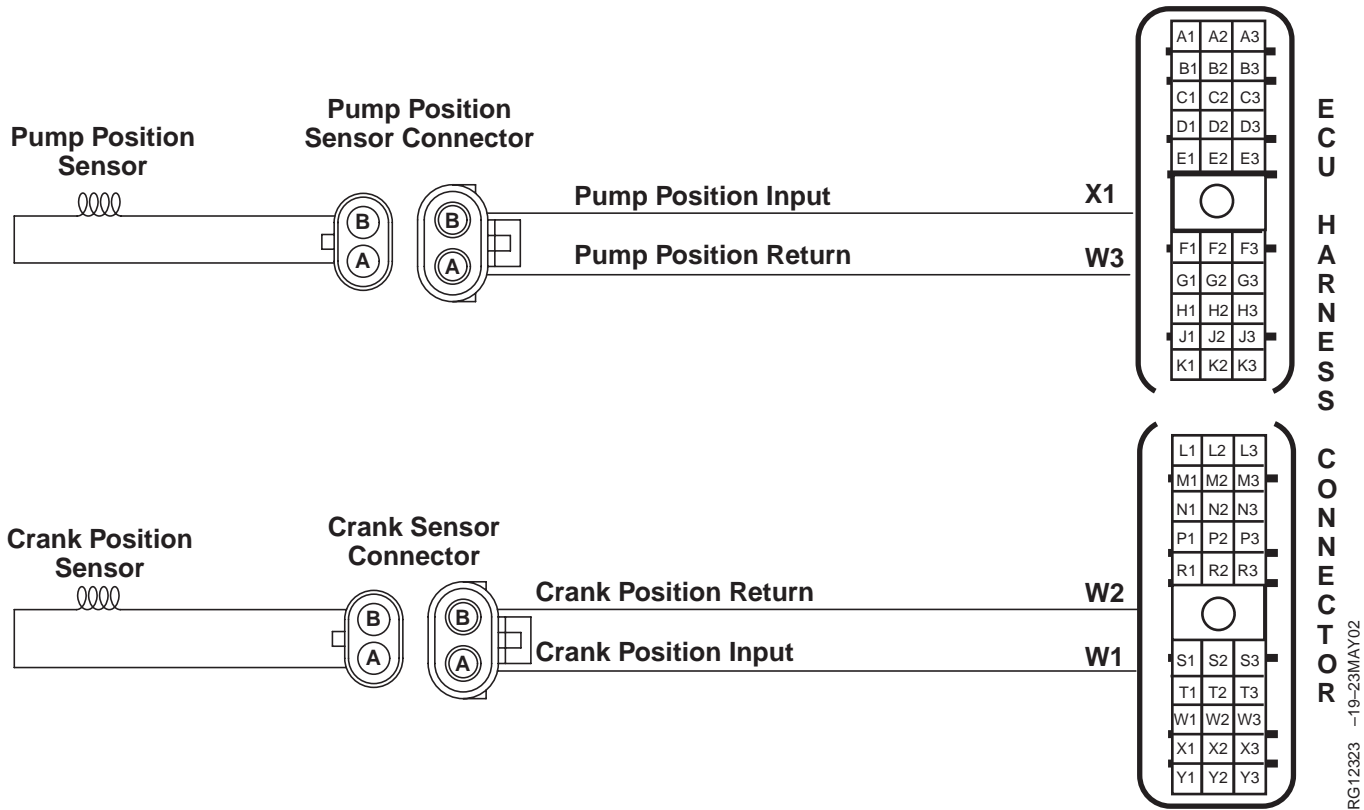
### If DTC 000189.00 sets:

- Check for other stored or active DTCs that indicate the reason for the speed derate.

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RG40854,0000049 -19-30APR02-1/1

## 000190.00 — Engine Overspeed Extreme



RG12323 -19-23MAY02

The ECU detects that engine speed exceeds a maximum rpm.

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### Pump Position Sensor and Crankshaft Position Sensor

- The pump position and crank position sensors are both inductive type pickup sensors that detect notches on their respective gears/timing wheels. The ECU uses the crank position input to determine

engine speed and precise piston position in relation to Top Dead Center (TDC).

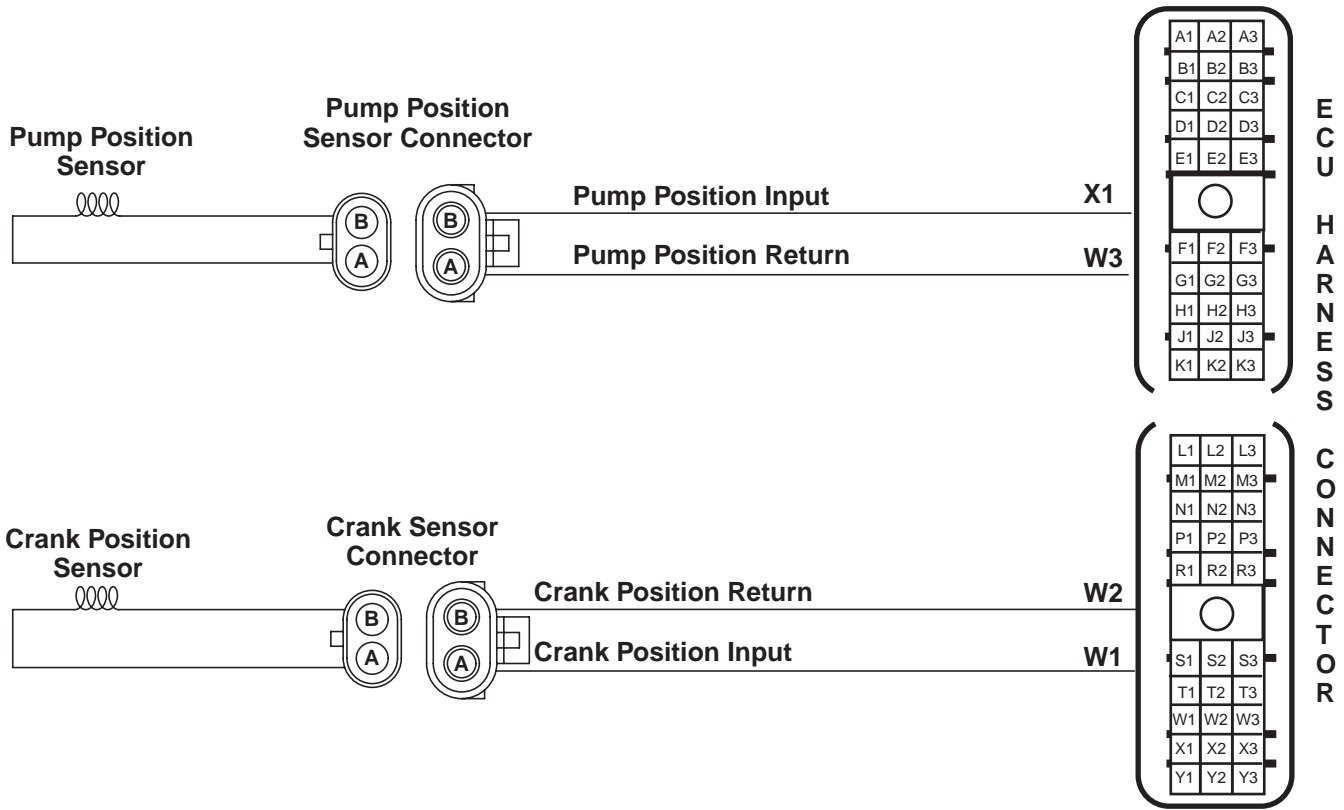
### DTC 000190.00 will set if:

- The ECU detects that engine speed exceeds a maximum rpm.
  - On 6020 through 6620 Tractors, 000190.00 sets when the engine speed exceeds 3650 rpm.
  - On 6820 and 6920 Tractors, 000190.00 sets when the engine speed exceeds 3350 rpm.

### If DTC 000190.00 sets, the following will occur:

- The ECU stops fuel flow to the High Pressure Common Rail (HPCR) through the control of the Pump Control Valve (PCV) solenoid.

**000190.16 — Engine Overspeed Moderate**



04  
160  
,209

RG12323 -19-23MAY02

The ECU detects that engine speed exceeds a maximum rpm.

*NOTE: Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

**Pump Position Sensor and Crankshaft Position Sensor**

- The pump position and crank position sensors are both inductive type pickup sensors that detect notches on their respective gears/timing wheels. The ECU uses the crank position input to determine

engine speed and precise piston position in relation to Top Dead Center (TDC).

**DTC 000190.16 will set if:**

- The ECU detects that engine speed exceeds a maximum rpm.
  - On 6020 through 6620 Tractors, 000190.16 sets when the engine speed exceeds 3450 rpm.
  - On 6820 and 6920 Tractors, 000190.16 sets when the engine speed exceeds 3150 rpm.

**If DTC 000190.16 sets, the following will occur:**

- The ECU stops fuel flow to the High Pressure Common Rail (HPCR) through the control of the Pump Control Valve (PCV) solenoid.

## 000237.02 — Vehicle Identification Number Invalid

*The ECU detects a vehicle serial number on the CCU, ECU or ICU that does not match what the other two controllers have.*

### Vehicle Identification Number (VIN)

- The VIN includes information pertaining to the vehicle model number, the vehicle serial number, and the option code that is available for each specific vehicle. There are several checks set up in the ECU to verify that all of the correct electronic controllers are being used.

### DTC 000237.02 will set if:

- The ECU detects a vehicle serial number on the CCU, ECU or ICU that does not match what the other two controllers have.

### If DTC 000237.02 sets, the following will occur:

- ECU will allow the engine to run normal for 2 hours for testing purposes.
- After 2 hours, the ECU will derate the engine 2% per minute until the engine is running at 90% of full power.
- 000237.02 will NOT reset with a key cycle.

### If DTC 000237.02 sets:

- Place vehicle in diagnostic mode.
- Check the Vehicle Identification Number on the CCU, ECU, and ICU by looking at Address 251.
- Any controllers that has a VIN that does not match the Product Identification Number (PIN), place the original controller back on this vehicle if it was remove for any reason. Otherwise reprogram the controller(s).
- For additional information, see the vehicle diagnostic manual.

RG41221,0000111 -19-03APR03-1/1

## 000237.13 — Vehicle Identification Option Code Invalid

*The ECU detects a the option code on the ECU does not match what the other controllers have.*

### Vehicle Identification Number (VIN)

- The VIN includes information pertaining to the vehicle model number, the vehicle serial number, and the option code that is available for each specific vehicle. There are several checks set up in the ECU to verify that all of the correct electronic controllers are being used.

### DTC 000237.13 will set if:

- The ECU detects a the option code on the ECU does not match what the other controllers have.

### If DTC 000237.13 sets, the following will occur:

- The ECU will limit engine to speed to low idle.
- DTC 000180.00 will also be present.

### If DTC 000237.13 sets:

- Place vehicle in diagnostic mode.
- Check the Vehicle Identification Number on the CCU, ECU, and ICU by looking at Address 251.
- Any controllers that has a VIN that does not match the Product Identification Number (PIN), place the original controller back on this vehicle if it was remove for any reason. Otherwise reprogram the controller(s).
- For additional information, see the vehicle diagnostic manual.

04  
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RG41221,0000112 -19-03APR03-1/1

## 000237.31 — Vehicle Model Number Invalid

*The ECU detects a vehicle model number on the CCU, ECU or ICU that does not match what the other two controllers have.*

### Vehicle Identification Number (VIN)

- The VIN includes information pertaining to the vehicle model number, the vehicle serial number, and the option code that is available for each specific vehicle. There are several checks set up in the ECU to verify that all of the correct electronic controllers are being used.

### DTC 000237.31 will set if:

- The ECU detects a vehicle model number on the CCU, ECU or ICU that does not match what the other two controllers have.

### If DTC 000237.31 sets, the following will occur:

- The ECU will limit engine to speed to low idle.
- DTC 000180.00 will also be present.

### If DTC 000237.31 sets:

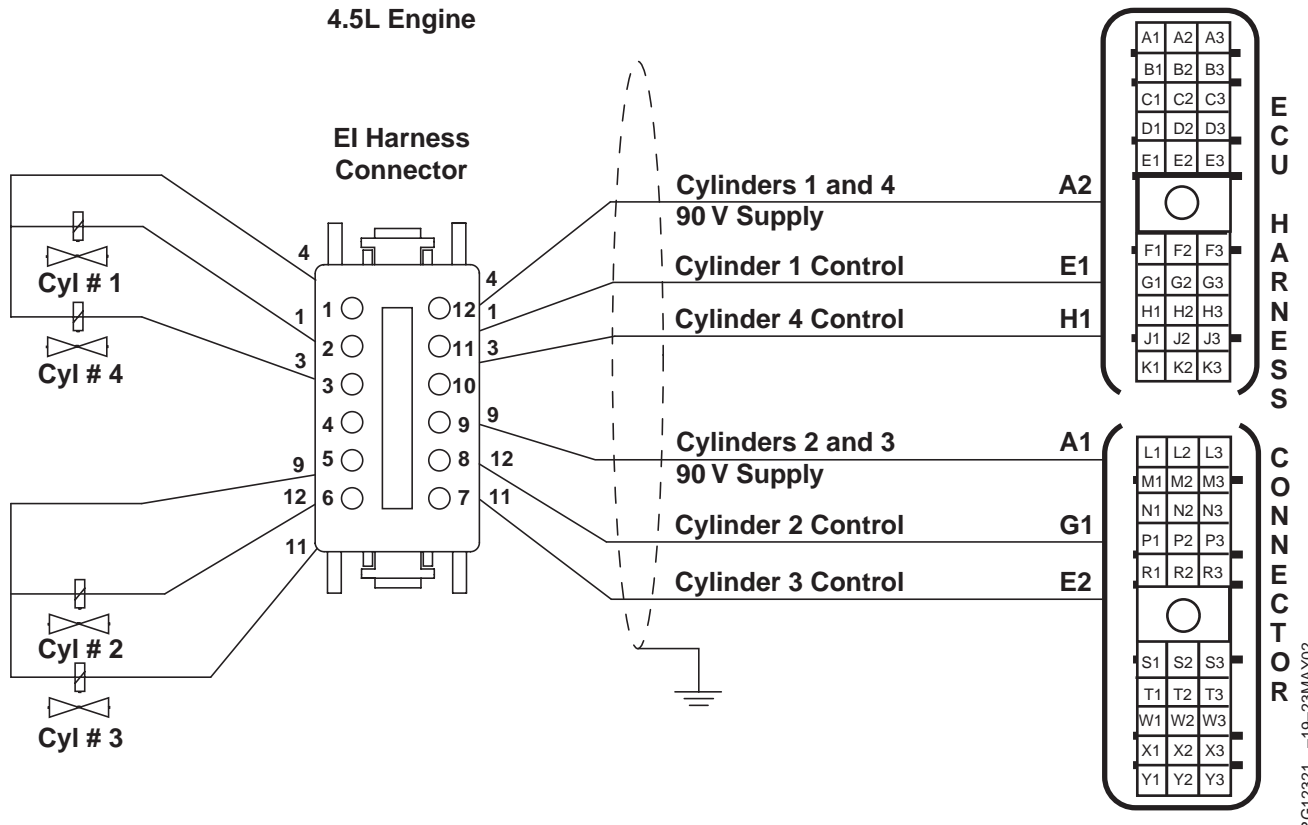
- Place vehicle in diagnostic mode.
- Check the Vehicle Model Number on the CCU, ECU, and ICU by looking at Address 251.
- Any controllers that has a VIN that does not match the Product Identification Number (PIN), place the original controller back on this vehicle if it was remove for any reason. Otherwise reprogram the controller(s).
- For additional information, see the vehicle diagnostic manual.

RG41221,0000113 -19-03APR03-1/1



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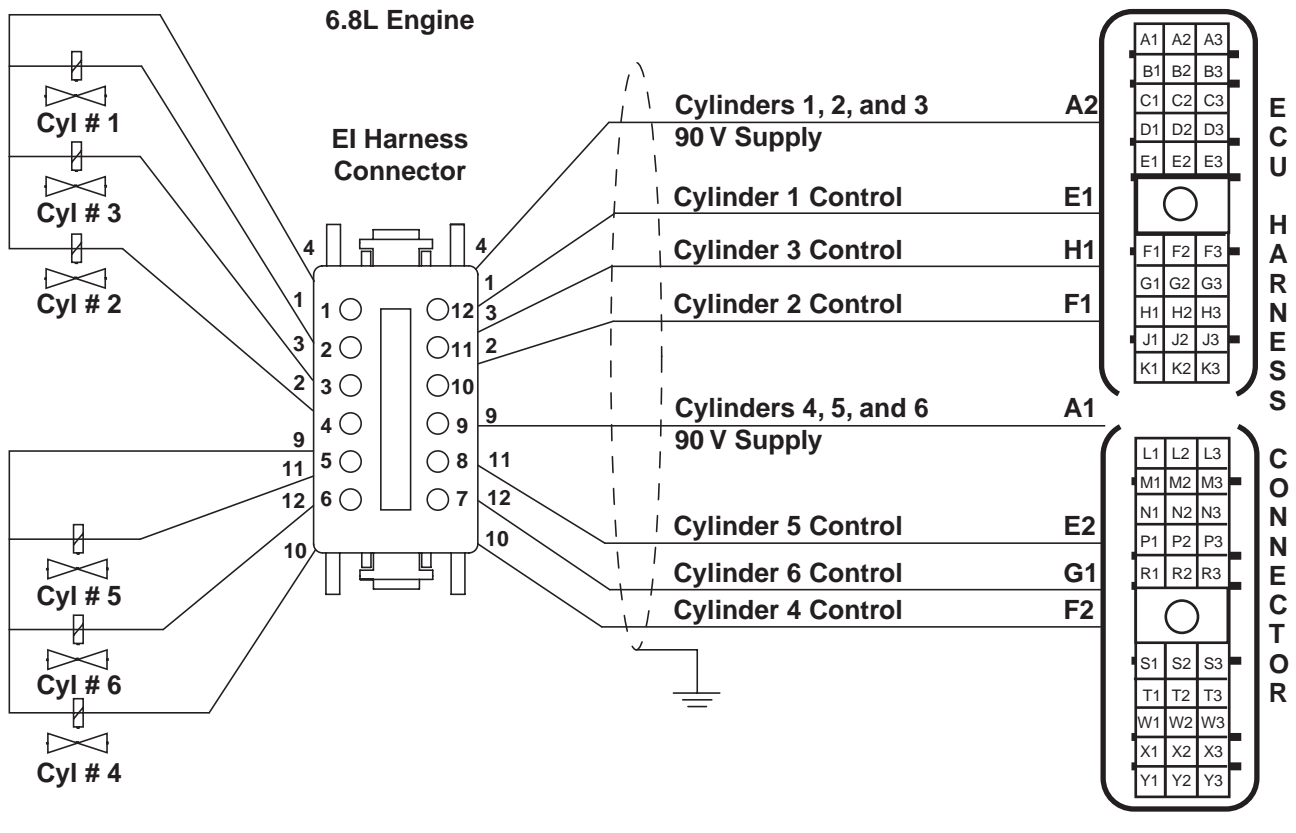
000611.03 — Electronic Injector Wiring Shorted To Power Source



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160  
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Continued on next page

RG40854,000004B -19-30APR02-1/2



04  
160  
,215

RG12320 -19-23MAY02

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Electronic Injector (EI)**

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) EIs, and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs

for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

**DTC 000611.03 will set if:**

- The ECU detects that injector wiring is shorted to a power source.

**If DTC 000611.03 sets, the following will occur:**

- Cylinder misfire or black/gray smoke may be observed.

## 000611.03 — Electronic Injector Wiring Shorted To Power Source

The ECU detects that injector wiring is shorted to a power source.

RG40854,000004C -19-30APR02-1/1

### 000611.03 Electronic Injector Wiring Shorted To Power Source Diagnostic Procedure

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#### ① 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 ELECTRONIC INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.*

Perform a preliminary inspection of the ECU connectors and the EI harness connector looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

--1/1

#### ② Intermittent Fault Test

*NOTE: For wiring and theory of operation information, see DTC 000611.03 ELECTRONIC INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.*

**IMPORTANT: Other DTCs may be set with 000611.03. Follow this procedure first, make repairs as directed.**

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.
2. Ignition ON, engine OFF
3. Start the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running
6. Read DTCs using DST or SERVICE ADVISOR™.

**000611.03 reoccurs:**  
GO TO ③

**000611.03 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

*Trouble Code Diagnostics and Tests*

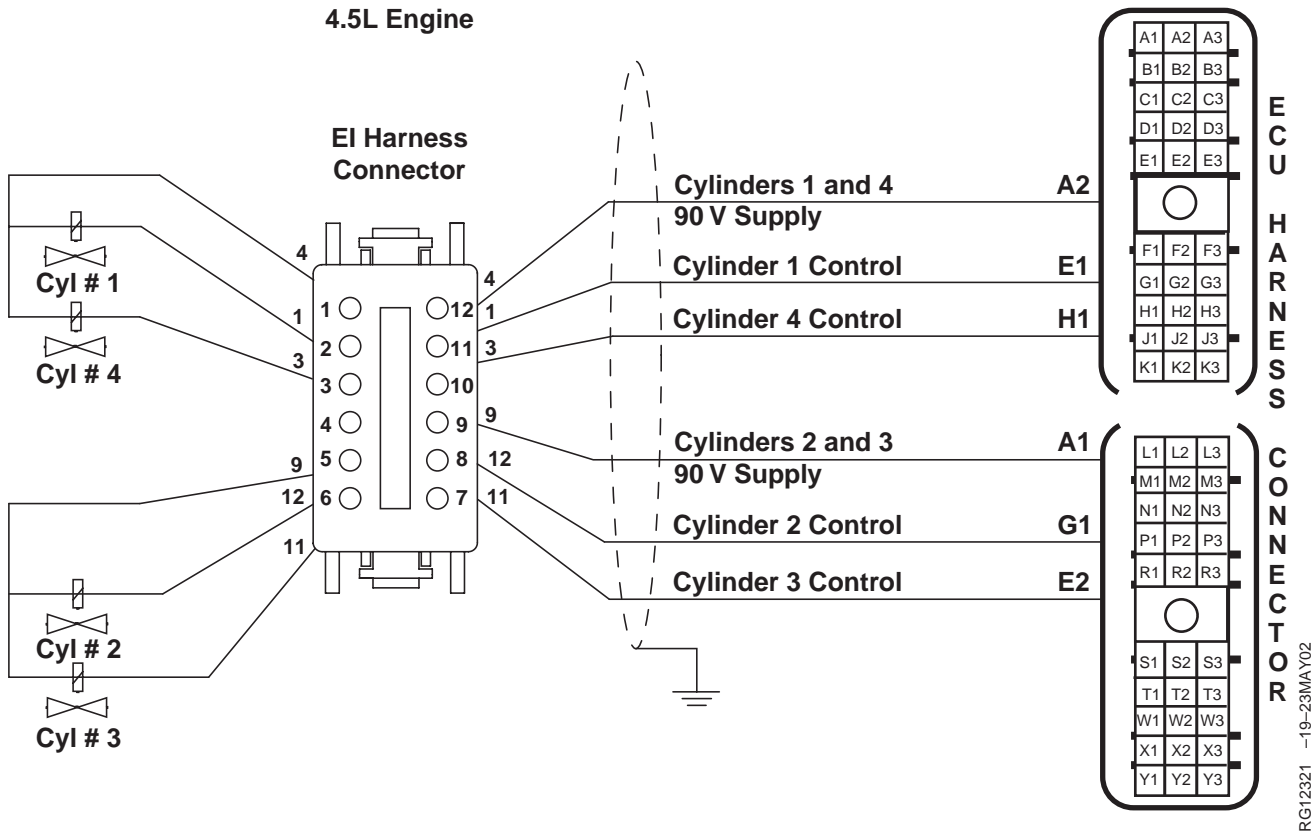
<p><b>3 Engine Operation Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000611.03 ELECTRONIC INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine running</li> <li>2. Run engine at high idle</li> <li>3. Observe engine performance for: <ul style="list-style-type: none"> <li>• Exhaust smoke</li> <li>• Engine misfire</li> <li>• High-idle speed</li> </ul> </li> </ol>	<p><b>Engine has white-gray smoke, a maximum engine speed of 900 RPM, and a lack of response: GO TO 4</b></p> <p><b>Engine has a misfire, little or no smoke, and goes to or near maximum engine speed: GO TO 5</b></p> <p style="text-align: right;">-- -1/1</p>
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<p><b>4 Short in 90V Circuit Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000611.03 ELECTRONIC INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both ECU connectors.</li> <li>3. Disconnect the EI wiring harness connector at rear of cylinder head.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• The Electronic Injector (EI) 90 V terminal A2 in the harness end of the of the ECU connector and all the terminals in both of the ECU connectors.</li> <li>• The Electronic Injector (EI) 90 V terminal A1 in the harness end of the of the ECU connector and all the terminals in both of the ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 20,000 ohms:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>One or more measurements less than 20,000 ohms:</b> Short in EI 90 V circuit</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>5 Short in EI Control Circuit Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000611.03 ELECTRONIC INJECTOR WIRING SHORTED TO POWER SOURCE supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Using the ECU diagnostic software, perform Cylinder Cutout Test. For instructions on how to run this test, see ENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST earlier in this Group. <p style="margin-left: 20px;"><i>NOTE: After performing the Cylinder Cutout Test, you should be able to identify one or more cylinders that did not affect the way the engine ran. This will be the cylinder(s) referred to in the following test.</i></p> </li> <li>2. Ignition OFF</li> <li>3. Disconnect both ECU connectors.</li> <li>4. Disconnect EI wiring harness connector on the side of the cylinder head.</li> <li>5. Using a multimeter, measure resistance between the control terminal of the EI identified in the Cylinder Cutout Test, at the ECU connector and all other terminals in the ECU connectors on the engine harness.</li> </ol>	<p><b>All measurements greater than 20,000 ohms:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>One or more measurements less than 20,000 ohms:</b> Short in EI control circuit</p> <p style="text-align: right;">-- -1/1</p>
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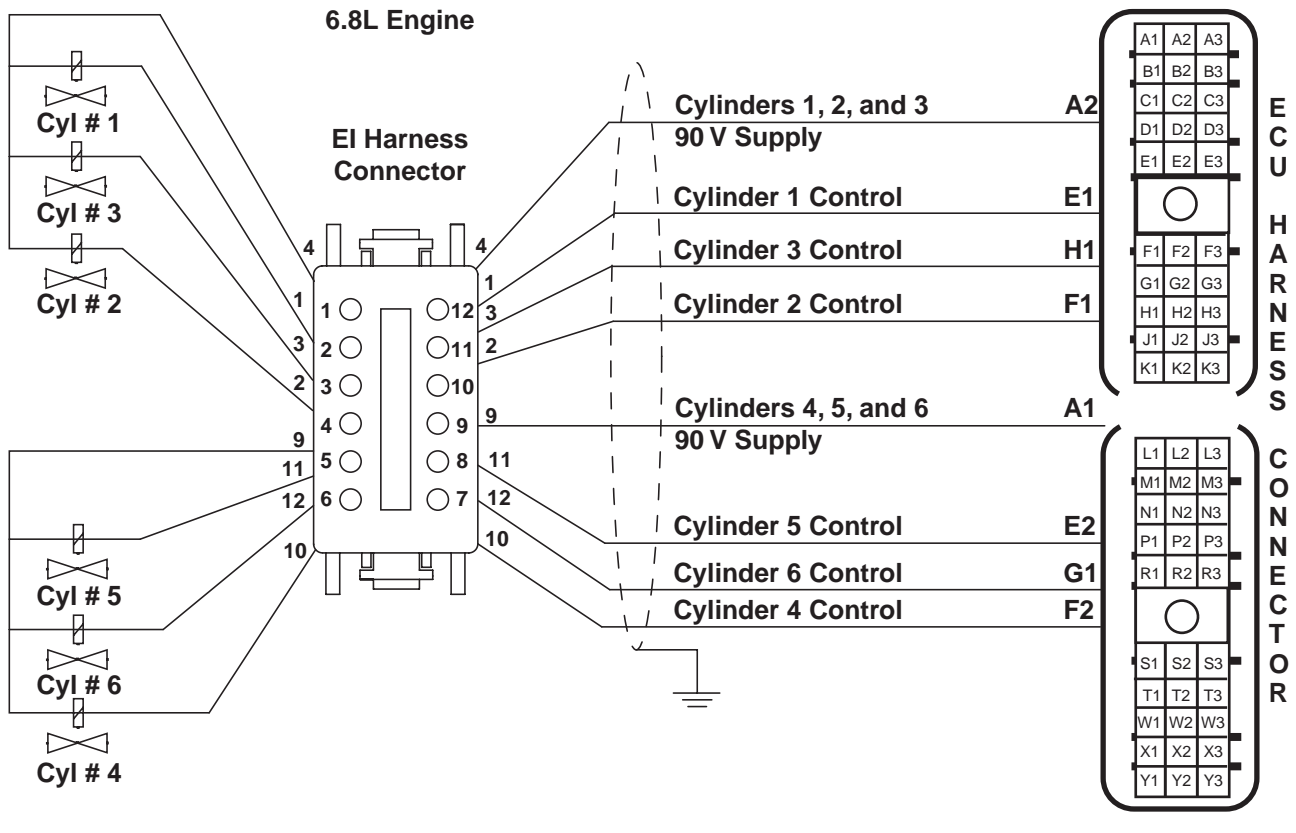
000611.04 — Electronic Injector Wiring Shorted To Ground



04  
160  
.218

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RG40854,000004D -19-30APR02-1/2



04  
160  
,219

RG12320 -19-23MAY02

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Electronic Injector (EI)**

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.
- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs

for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

**DTC 000611.04 will set if:**

- The ECU detects that injector wiring is shorted to ground.

**If DTC 000611.04 sets, the following will occur:**

- With DTC 000611.04 active, the ECU does not control the system any differently. Depending on the cause of this code, the engine may not start, run rough, or have excessive black smoke.

## 000611.04 — Electronic Injector Wiring Shorted To Ground

The ECU detects that injector wiring is shorted to ground.

RG40854,000004F -19-30APR02-1/1

### 000611.04 Electronic Injector Wiring Shorted To Ground Diagnostic Procedure

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#### ① 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 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.*

Perform a preliminary inspection of the ECU connectors and the EI harness connector looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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#### ② Intermittent Fault Test

*NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.*

**IMPORTANT: Other DTCs may be set with 000611.04 Follow this procedure first, make repairs as directed.**

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.
2. Ignition ON, engine OFF
3. Start the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running at high idle or cranking for 15 seconds.
6. Read DTCs using DST or SERVICE ADVISOR™.

**000611.04 reoccurs:**  
GO TO ③

**000611.04 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.



*Trouble Code Diagnostics and Tests*

<p><b>3 Engine Operation Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition ON, engine cranking for 15 seconds or running at high idle.</li> <li>Observe engine performance.</li> </ol>	<p><b>Engine will not start:</b> GO TO <b>4</b></p> <p><b>Engine runs rough and has excessive black smoke:</b> GO TO <b>5</b></p>
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<p><b>4 Short in EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.</i></p> <ol style="list-style-type: none"> <li>Using the ECU diagnostic software, perform Cylinder Cutout Test. For instructions on how to run this test, see ENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST earlier in this Group.</li> </ol> <p><i>NOTE: After performing the Cylinder Cutout Test you should be able to identify one or more cylinders that did not affect the way the engine ran. This will be the cylinder(s) referred to in the following test.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect both ECU connectors.</li> <li>Disconnect EI wiring harness connector on side of cylinder head.</li> <li>Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>Terminal A2 in the harness end of the ECU connector and all other terminals in both ECU connectors and a good chassis ground.</li> <li>Terminal A1 in the harness end of the ECU connector and all other terminals in both ECU connectors and a good chassis ground.</li> </ul> </li> </ol>	<p><b>All measurements greater than 20,000 ohms:</b> GO TO <b>6</b></p> <p><b>Any measurement less than 20,000 ohms:</b> Short in ECU wiring harness</p>
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,221

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<p><b>5 Short in ECU Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect both ECU connectors.</li> <li>Disconnect EI wiring harness connector at side of cylinder head.</li> <li>Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>Terminal A1 in the harness end of the ECU connector and all other terminals in both ECU connectors and a good chassis ground.</li> <li>Terminal A2 in the harness end of the ECU connector and all other terminals in both ECU connectors and a good chassis ground.</li> </ul> </li> </ol>	<p><b>All measurements greater than 20,000 ohms:</b> GO TO <b>6</b></p> <p><b>Any measurement less than 20,000 ohms:</b> Short in ECU wiring harness</p>
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*Trouble Code Diagnostics and Tests*

<p><b>6 ECU and EI Wiring Connection Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. EI wiring harness connector at side of cylinder head disconnected.</li> <li>3. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal 4 in the cylinder head side of the EI wiring harness and a good chassis ground.</li> <li>• Terminal 9 in the cylinder head side of the EI wiring harness and a good chassis ground.</li> </ul> </li> </ol>	<p><b>Any measurement less than 20,000 ohms:</b> GO TO 7</p> <p><b>All measurements greater than 20,000 ohms:</b> Faulty EI wiring connection OR Faulty ECU connection OR Faulty ECU</p>
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<p><b>7 EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000611.04 ELECTRONIC INJECTOR WIRING SHORTED TO GROUND supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove rocker cover.</li> <li>3. Disconnect all electrical connections from the 4 (4.5L engines) or 6 (6.8L engines) EIs.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• One terminal on an EI and the EI body.</li> <li>• The other terminal on the EI and the EI body</li> </ul> </li> <li>5. Perform the above measurements on all of the EIs.</li> </ol>	<p><b>Measurements greater than 20,000 ohms:</b> Faulty EI wiring harness</p> <p><b>Any measurement less than 20,000 ohms:</b> Faulty EI(s)</p>
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04  
160  
,222

04  
160  
,223

## 000620.03 — Sensor Supply 2 Voltage High

### Wiring for Sensor Supply 2 Voltage

*NOTE: For sensor supply 2 wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

- On OEM applications, sensor supply 2 provides voltage to the oil pressure sensor and the performance program connector through ECU terminal P1.
- On Tractor applications, sensor supply 2 provides voltage to the analog throttle (B) sensor, analog throttle (C) sensor, and the oil pressure sensor through ECU terminal P1.

### Sensor Supply Voltage

- On the Level 11 ECU, there are two or three 5V Sensor Supply terminals. The sensors that use

Sensor Supply 2 vary 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 supply voltage greater than 5.26 volts on the ECU 5 volt supply circuit.

### If DTC 000620.03 sets, the following will occur:

- Engine operation might be affected slightly.

RG40854,0000050 -19-30APR02-1/1

## 000620.03 — Sensor Supply 2 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG40854,0000051 -19-30APR02-1/1

### 000620.03 Sensor Supply 2 Voltage High Diagnostic Procedure

04  
160  
,225

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY 2 VOLTAGE HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY 2 VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine OFF</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000620.03 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000620.03 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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Trouble Code Diagnostics and Tests

③ Short in 5V Supply  
Circuit Test

*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY 2 VOLTAGE HIGH supporting information.*

1. Ignition OFF
2. Disconnect both ECU connectors.
3. Using a multimeter, measure resistance between terminal P1 and all other terminals in both ECU connectors.

**Greater than 20,000**

**ohms:**

Faulty ECU connection

OR

Faulty ECU

**20,000 ohms or less:**

Sensor 5V supply circuit shorted to power in ECU harness.

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04  
160  
,226

04  
160  
,227

## 000620.04 — Sensor Supply 2 Voltage Low

### Wiring for Sensor Supply 2 Voltage

*NOTE: For sensor supply 2 wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

- On OEM applications, sensor supply 2 provides voltage to the oil pressure sensor and the performance program connector through ECU terminal P1.
- On Tractor applications, sensor supply 2 provides voltage to the analog throttle (B) sensor, analog throttle (C) sensor, and the oil pressure sensor through ECU terminal P1.

### Sensor Supply Voltage

- On the Level 11 ECU, there are two or three 5V Sensor Supply terminals. The sensors that use

Sensor Supply 2 vary 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 lower than 4.59 volts on the ECU 5 volt supply circuit.

### If DTC 000620.04 sets, the following will occur:

- Engine operation may be affected slightly.

RG40854,0000052 -19-30APR02-1/1

04  
160  
,228



## 000620.04 — Sensor Supply 2 Voltage Low

The ECU detects a supply voltage below specification on the ECU 5 volt supply circuit.

RG40854,0000053 -19-30APR02-1/1

### 000620.04 Sensor Supply 2 Voltage Low Diagnostic Procedure

04  
160  
,229

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY 2 VOLTAGE LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using this 5V supply looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY 2 VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all active DTCs, then clear all DTCs.</li> <li>5. Ignition OFF</li> <li>6. Disconnect the components supplied voltage by the ECU terminal P1.</li> <li>7. Ignition ON, engine running</li> <li>8. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000620.04 reoccurs:</b> GO TO <b>3</b></p> <p><b>000620.04 does not reoccur:</b> GO TO <b>4</b></p>
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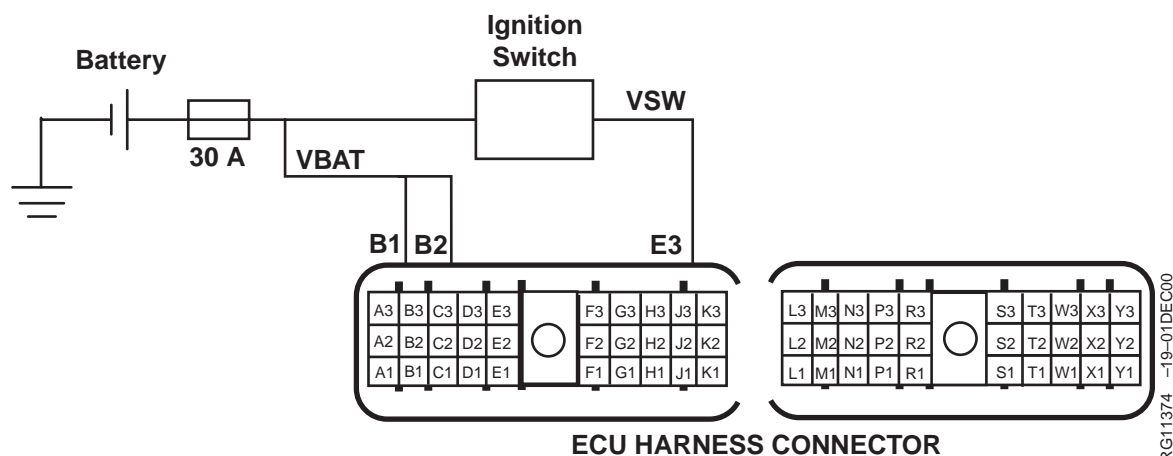
## Trouble Code Diagnostics and Tests

<p><b>③ 5V Supply Circuit Shorted to Ground Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY 2 VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both ECU connectors.</li> <li>3. Using a multimeter, measure resistance between terminal P1 of the ECU connector and::             <ul style="list-style-type: none"> <li>• Good chassis ground.</li> <li>• Terminal C2 of the ECU connector.</li> <li>• Terminal C3 of the ECU connector.</li> <li>• Terminal N3 of the ECU connector.</li> <li>• Terminal P2 of the ECU connector.</li> <li>• Terminal P3 of the ECU connector.</li> </ul> </li> </ol>	<p><b>Greater than 20,000 ohms:</b> Faulty ECU connection OR Faulty ECU</p> <p><b>20,000 ohms or less:</b> Sensor 5V supply circuit shorted to ECU ground circuit.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Faulty Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY 2 VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON</li> <li>2. While reconnecting each component connector one at a time, monitor DTCs using the ECU diagnostic software.</li> <li>3. Read DTCs</li> </ol>	<p><b>000620.04 reoccurs:</b> Sensor that caused 000620.04 to reoccur when it was reconnected is faulty. Replace sensor and retest.</p> <p><b>000620.04 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
,230

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160  
,231

## 000627.01 — Electronic Injector Supply Voltage Problem



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### Electronic Injector (EI)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

### DTC 000627.01 will set if:

- The ECU detects a voltage supply problem which prevents the EIs from working.

### If DTC 000627.01 sets, the following will occur:

- Engine may not start or run.

RG40854,0000054 -19-30APR02-1/1

## 000627.01 — Electronic Injector Supply Voltage Problem

*The ECU detects a voltage supply problem which prevents the EIs from working.*

RG40854,0000055 -19-30APR02-1/1

### 000627.01 Electronic Injector Supply Voltage Problem Diagnostic Procedure

04  
160  
,233

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000627.01 ELECTRONIC INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and all ECU grounds looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000627.01 ELECTRONIC INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make notes of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000627.01 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000627.01 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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*Trouble Code Diagnostics and Tests*

<p><b>③ ECU Power Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000627.01 ELECTRONIC INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both ECU connectors.</li> <li>3. Using a multimeter, measure voltage between a good chassis ground and: <ul style="list-style-type: none"> <li>• Terminal B1 in the ECU connector on the engine harness.</li> <li>• Terminal B2 in the ECU connector on the engine harness.</li> </ul> </li> </ol>	<p><b>Substantially less than battery voltage:</b> GO TO <b>④</b></p> <p><b>At or near battery voltage:</b> Faulty ECU connection OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>④ Battery Voltage Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000627.01 ELECTRONIC INJECTOR SUPPLY VOLTAGE PROBLEM supporting information.</i></p> <p>Using a multimeter, measure battery voltage at the battery across both terminals</p>	<p><b>At or near battery voltage:</b> Faulty ECU power supply fuse OR Faulty ECU connection OR Open or short in ECU power circuit</p> <p><b>Substantially less than battery voltage:</b> Faulty battery or charging system.</p> <p style="text-align: right;">-- -1/1</p>
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160  
,234

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160  
,235

## 000629.13 — ECU Error

The ECU detects an internal problem.

- The ECU detects an internal problem.

### Engine Control Unit (ECU)

If DTC 000629.13 sets, the following will occur:

- The ECU error fault code can only occur because of an incorrectly programmed ECU or a faulty ECU.

- Engine will not start or run.

DTC 000629.13 will set if:

RG40854,0000056 -19-30APR02-1/1

## 000629.13 ECU Error Diagnostic Procedure

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### ① ECU 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs
5. Ignition ON, engine OFF
6. Read DTCs using DST or SERVICE ADVISOR™.

**000629.13 reoccurs:**  
Faulty ECU

**000629.13 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

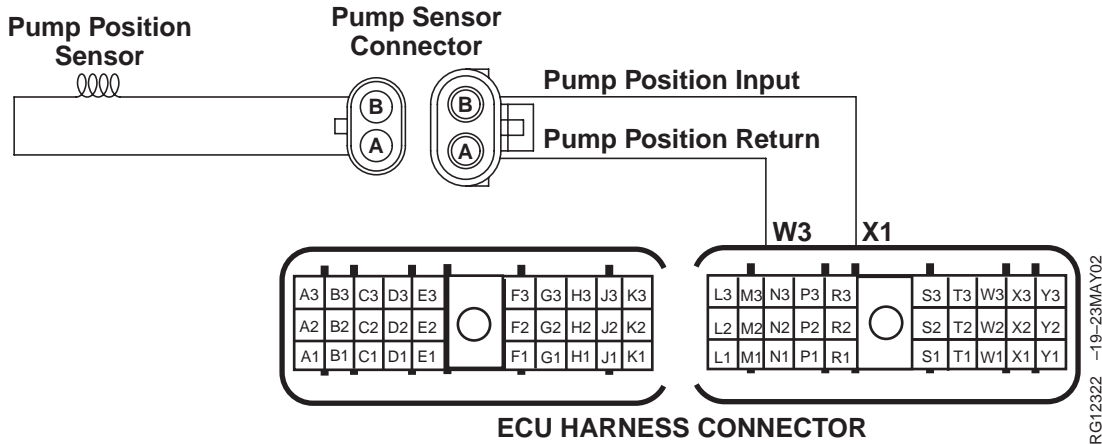
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04  
160  
,237

**000636.02 — Pump Position Sensor Input Noise**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Pump Position Sensor**

- The pump position sensor is located on the idler gear in the side of the high pressure fuel pump. It is an inductive type pickup sensor that detects notches in the back of the upper idler gear. The ECU uses the pump position input to determine cylinder identification to keep the pump in time with the engine. The pump upper idler gear is composed of 11 evenly spaced ribs with one additional rib. The ECU uses the additional notch to determine cylinder #1 is approaching Top-Dead-Center (TDC). For further pump position sensor information, see

MEASURING ENGINE SPEED in Section 03, Group 140.

**DTC 000636.02 will set if:**

- The ECU detects excessive noise (extra pulses) on the pump position sensor input.

**If DTC 000636.02 sets, the following will occur:**

- If a crank position sensor trouble code accompanies DTC 000636.02, the engine will die and will not 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 restart.
- Prolonged cranking time may be required to start the engine.

RG40854,0000057 -19-30APR02-1/1

04  
160  
238

## 000636.02 — Pump Position Sensor Input Noise

The ECU detects excessive noise (extra pulses) on the pump position sensor input.

RG40854,0000058 -19-30APR02-1/1

### 000636.02 Pump Position Sensor Input Noise Diagnostic Procedure

04  
160  
,239

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000636.02 PUMP POSITION SENSOR INPUT NOISE supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the pump position sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.02 PUMP POSITION SENSOR INPUT NOISE supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000636.02 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000636.02 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group</p>
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## Trouble Code Diagnostics and Tests

### ③ Noise Detection Test

*NOTE: For wiring and theory of operation information, see DTC 000636.02 PUMP POSITION SENSOR INPUT NOISE supporting information.*

1. 000636.02 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections anywhere on the machine. Things to check:

- All harness connectors.
- Alternator connections.
- Chassis ground connections, battery ground connection.
- Corrosion, dirt, or paint can cause intermittent and "noisy" connections.
- Check the wiring for intermittent open and short circuits; particularly the cam sensor wiring.
- Check wiring for proper pin location in the high pressure pump speed sensor and ECU connectors.

2. Other possible causes of 000636.02:

- Electromagnetic interference (EMI) from an incorrectly installed 2-way radio.
- Interference from some radar source.
- Possible burrs on the pump position timing wheel notches, should be clean, square edges.

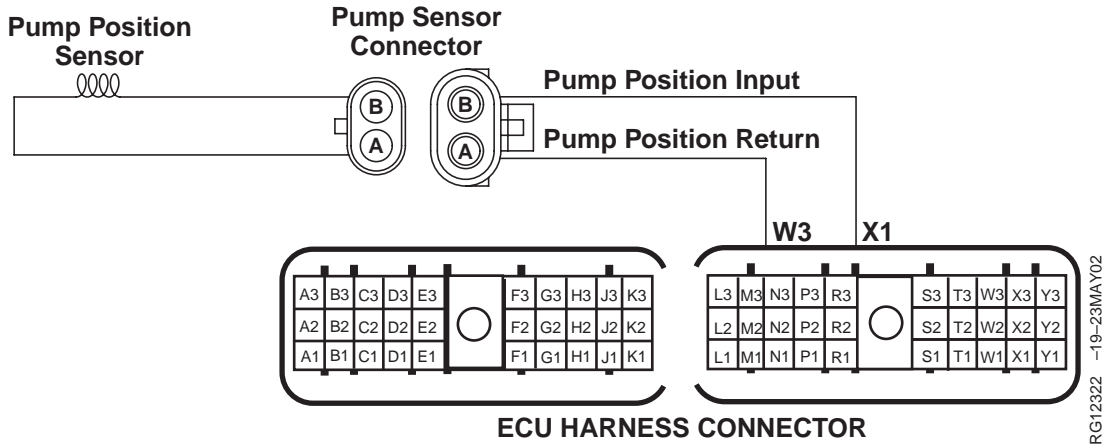
**Problem found:**  
Repair and retest.

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04  
160  
,240

04  
160  
,241

### 000636.08 — Pump Position Sensor Input Missing



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### Pump Position Sensor

- The pump position sensor is located on the idler gear in the side of the high pressure fuel pump. It is an inductive type pickup sensor that detects notches in the back of the upper idler gear. The ECU uses the pump position input to determine cylinder identification to keep the pump in time with the engine. The pump upper idler gear is composed of 11 evenly spaced ribs with one additional rib. The ECU uses the additional notch to determine cylinder #1 is approaching Top-Dead-Center (TDC). For further pump position sensor information, see

MEASURING ENGINE SPEED in Section 03, Group 140.

#### DTC 000636.08 will set if:

- The ECU does not detect the pump position sensor input.

#### If DTC 000636.08 sets, the following will occur:

- If a crank position sensor trouble code accompanies DTC 000636.08, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the crank position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.

RG40854,0000059 -19-30APR02-1/1

## 000636.08 — Pump Position Sensor Input Missing

The ECU does not detect the pump position sensor input.

RG40854,000005B -19-30APR02-1/1

### 000636.08 Pump Position Sensor Input Missing Diagnostic Procedure

04  
160  
,243

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the pump position sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make notes of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000636.08 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000636.08 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

<p><b>③ Pump Position Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect pump position sensor connector.</li> <li>3. Using a multimeter, measure resistance between both terminals of the pump position sensor connector on the engine harness.</li> </ol>	<p><b>Between 2500 and 3500 ohms:</b> GO TO ④</p> <p><b>Below 2500 ohms or above 3500 ohms:</b> Faulty pump position sensor.</p> <p style="text-align: right;">---1/1</p>
<p><b>④ Open in Pump Position Input and Return Circuit Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect pump position sensor connector and both 30-way ECU connectors.</li> <li>3. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal A of the pump position sensor connector and terminal X1 in the ECU connector on the engine harness.</li> <li>• Terminal B of the pump position sensor connector and terminal W3 in the ECU connector on the engine harness.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less:</b> GO TO ⑤</p> <p><b>Either measurement greater than 5 ohms:</b> Open in pump position sensor input wire OR Open in pump position sensor return wire OR Terminals A and B in the pump position sensor harness connector possibly inverted.</p> <p style="text-align: right;">---1/1</p>
<p><b>⑤ Pump Position Sensor Input Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Pump Position Sensor connector and ECU connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminal X1 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> GO TO ⑥</p> <p><b>Any measurement less than 2000 ohms:</b> Faulty pump position sensor input wiring harness.</p> <p style="text-align: right;">---1/1</p>

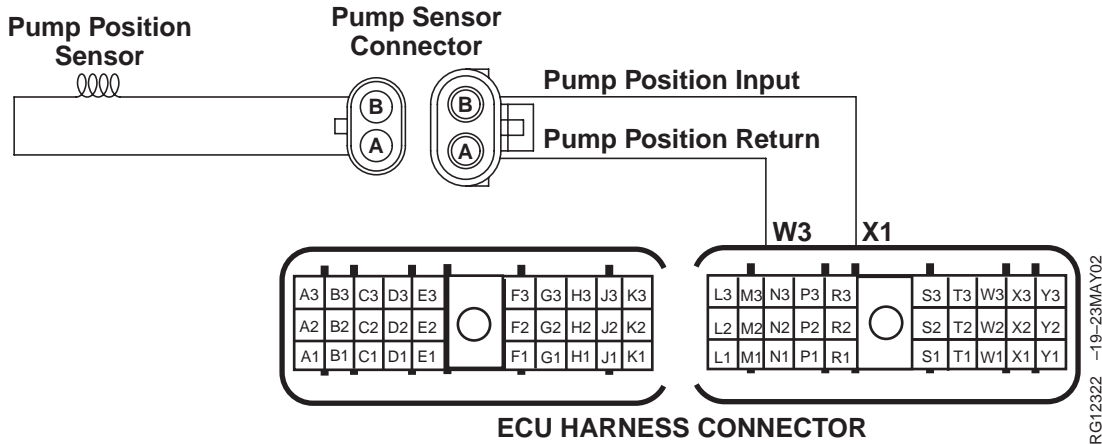


Trouble Code Diagnostics and Tests

<p><b>⑥ Pump Position Sensor Return Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.08 PUMP POSITION SENSOR INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"><li>1. Ignition OFF</li><li>2. Pump position sensor connector and ECU connectors still disconnected.</li><li>3. Using a multimeter, measure resistance between terminal W3 in the ECU connector on the engine harness and the following:<ul style="list-style-type: none"><li>• A good chassis ground.</li><li>• All other terminals in both ECU connectors.</li></ul></li></ol>	<p><b>All measurements greater than 2000 ohms:</b> Faulty pump position sensor connector OR Faulty pump position sensor OR Faulty ECU connector OR Faulty ECU</p> <p><b>Any measurement less than 2000 ohms:</b> Faulty pump position sensor return wiring harness.</p>
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**000636.10 — Pump Position Sensor Input Pattern Error**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Pump Position Sensor**

- The pump position sensor is located on the idler gear in the side of the high pressure fuel pump. It is an inductive type pickup sensor that detects notches in the back of the upper idler gear. The ECU uses the pump position input to determine cylinder identification to keep the pump in time with the engine. The pump upper idler gear is composed of 11 evenly spaced ribs with one additional rib. The ECU uses the additional notch to determine cylinder #1 is approaching Top-Dead-Center (TDC). For further pump position sensor information, see

MEASURING ENGINE SPEED in Section 03, Group 140.

**DTC 000636.10 will set if:**

- The ECU detects an improper pattern on the pump position sensor input.

**If DTC 000636.10 sets, the following will occur:**

- If a crank position sensor trouble code accompanies DTC 000636.10, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the crank position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.

RG40854,000005C -19-30APR02-1/1

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## 000636.10 — Pump Position Sensor Input Pattern Error

The ECU detects an improper pattern on the pump position sensor input.

RG40854,000005D -19-30APR02-1/1

### 000636.10 Pump Position Sensor Input Pattern Error Diagnostic Procedure

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the pump position sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make notes of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000636.10 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000636.10 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

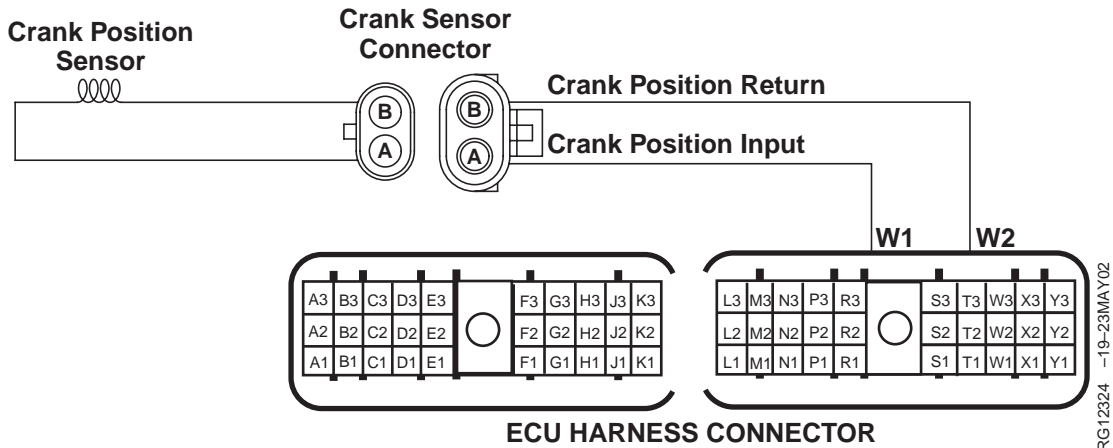
<p><b>③ Pump Position Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect pump position sensor connector.</li> <li>3. Using a multimeter, measure resistance between both terminals of the pump position sensor connector on the engine harness.</li> </ol>	<p><b>Between 2500 and 3500 ohms:</b> GO TO ④</p> <p><b>Below 2500 ohms or above 3500 ohms:</b> Faulty pump position sensor</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Open in Pump Position Input and Return Circuit Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect pump position sensor connector.</li> <li>3. Disconnect both 30-way ECU connectors.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal A of the pump position sensor connector and terminal X1 in the ECU connector on the engine harness.</li> <li>• Terminal B of the pump position sensor connector and terminal W2 in the ECU connector on the engine harness.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less:</b> GO TO ⑤</p> <p><b>Either measurement greater than 5 ohms:</b> Open in pump position sensor input wire OR Open in pump position sensor return wire OR Terminals A and B in the pump position sensor harness connector possibly inverted</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Pump Position Sensor Input Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Pump Position sensor connector and ECU connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminal X1 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> GO TO ⑥</p> <p><b>Any measurement less than 2000 ohms:</b> Faulty pump position sensor input wiring harness.</p> <p style="text-align: right;">-- -1/1</p>

*Trouble Code Diagnostics and Tests*

<p><b>⑥ Pump Position Sensor Return Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000636.10 PUMP POSITION SENSOR INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"><li>1. Ignition OFF</li><li>2. Pump Position Sensor connector and ECU connectors still disconnected.</li><li>3. Using a multimeter, measure resistance between terminal W3 in the ECU connector on the engine harness and the following:<ul style="list-style-type: none"><li>• A good chassis ground.</li><li>• All other terminals in both ECU connectors.</li></ul></li></ol>	<p><b>All measurements greater than 2000 ohms:</b> Faulty ECU connector OR Faulty ECU.</p> <p><b>Any measurement less than 2000 ohms:</b> Faulty pump position sensor return wiring harness.</p> <p style="text-align: right;">-- -1/1</p>
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**000637.02 — Crank Position Input Noise**



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**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Crank Position Sensor**

- The crank position sensor is an inductive type pickup sensor that detects notches on the crank timing wheel. The crank timing wheel has 44 narrow teeth and 1 wide tooth. The ECU uses the crank position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the pump position sensor input to determine piston position in relation to the firing order. Based on information from the crank and pump position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EIs accordingly. For further crank position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

**DTC 000637.02 will set if:**

- The ECU detects excessive noise (extra pulses) on the crank position input.

**If DTC 000637.02 sets, the following will occur:**

- If an pump position sensor trouble code accompanies DTC 000637.02, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the pump position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.
- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Derate Feature: See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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## 000637.02 — Crank Position Input Noise

The ECU detects excessive noise (extra pulses) on the crank position input.

RG40854,000005E -19-30APR02-1/1

### 000637.02 Crank Position Input Noise Diagnostic Procedure

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANK POSITION INPUT NOISE supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors and the crank sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANK POSITION INPUT NOISE supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000637.02 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000637.02 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

### ③ 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 000637.02:

- Electromagnetic interference (EMI) from an incorrectly installed 2-way radio.
- Interference from some radar source.
- Possible broken teeth on the crankshaft timing ring.

**Problem found:**  
Repair and retest.

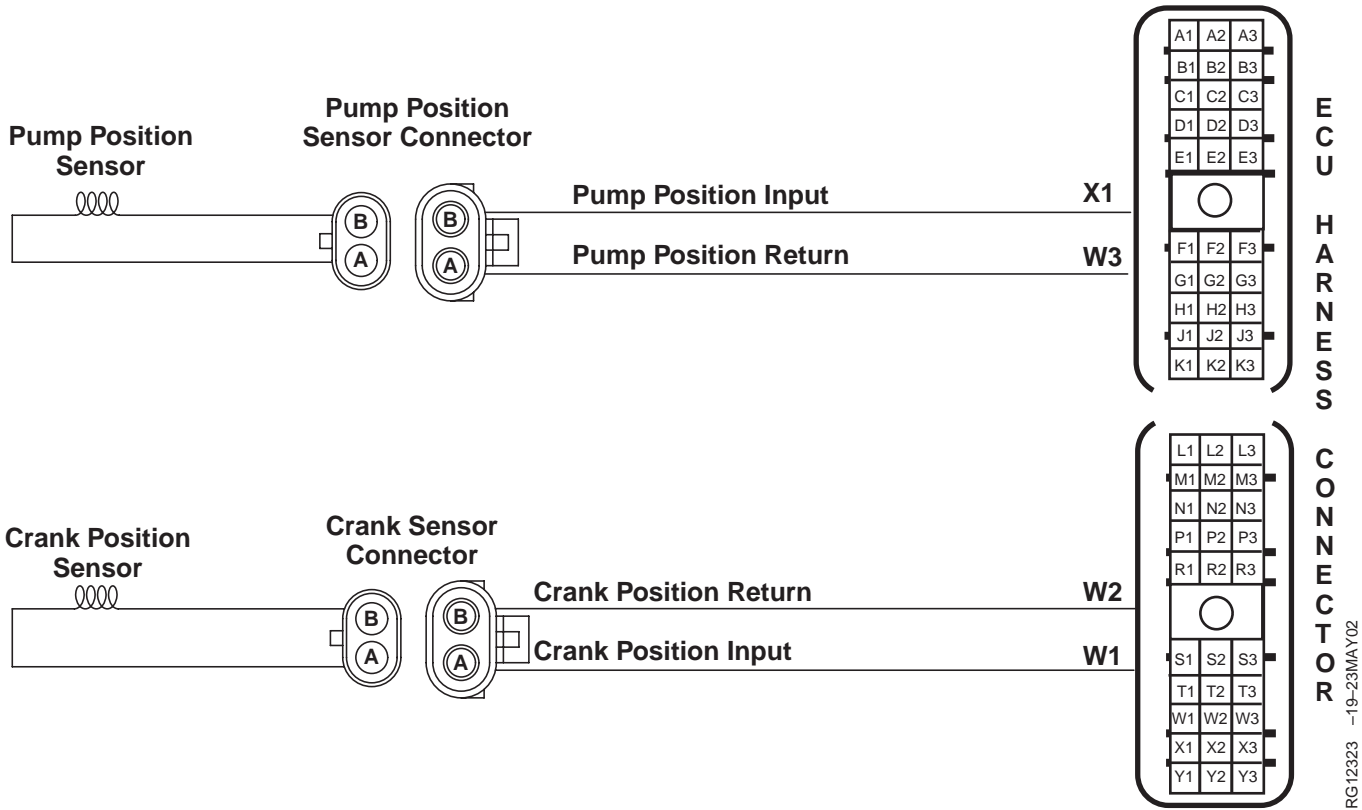
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**000637.07 — Crank Position/Pump Position Timing Moderately Out of Sync**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Pump Position Sensor and Crankshaft Position Sensor**

- The pump position and crank position sensors are both inductive type pickup sensors that detect notches on the uppler idler gear 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 pump position sensor input, the ECU is able to determine when a cylinder is at the end of the compression stroke. Based on this information, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EIs accordingly. A known relationship between the pump position sensor signal and the crank position sensor signal allows the ECU to

recognize when one signal is not in sync with the other. For further pump position and crank position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

**DTC 000637.07 will set if:**

- The ECU detects that the pump position and crank position inputs are not in sync with each other.

**If DTC 000637.07 sets, the following will occur:**

- Depending on the cause of the trouble code, the engine may die, and then it may or may not restart.
- If the engine dies and won't restart, it is possible that disconnecting the crank position sensor will allow the engine to start.
- If the engine continues to run, it will develop low power.
- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.

Continued on next page

RG40854.000060 -19-30APR02-1/2

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*Trouble Code Diagnostics and Tests*

- With Derate Feature: See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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## 000637.07 — Crank Position/Pump Position Timing Moderately Out of Sync

The ECU detects that the pump position and crank position inputs are not in sync with each other.

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### 000637.07 Crank Position/Pump Position Timing Moderately Out of Sync Diagnostic Procedure

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#### ① 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/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.*

Perform a preliminary inspection of ECU connectors and the crank sensor connector looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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#### ② Intermittent Fault Test

*NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY 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 the ECU diagnostic software
4. Make note of all DTCs, then clear all DTCs.
5. Ignition ON, engine running or cranking
6. Read DTCs using DST or SERVICE ADVISOR™.

**000637.07 reoccurs:**  
GO TO ③

**000637.07 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

## Trouble Code Diagnostics and Tests

<p><b>③ Pump Position Timing Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.</i></p> <p>Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING in Section 04, Group 150 earlier in this manual.</p>	<p><b>Timing is OK:</b> GO TO <b>④</b></p> <p><b>Timing out of sync:</b> Adjust timing and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Crank Timing Wheel and Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Inspect crank timing wheel for broken teeth, nicks burrs, or other damage.</li> <li>3. Remove crank sensor. See REMOVE AND INSTALL CRANK POSITION SENSOR SENSOR in Section 02, Group 110 earlier in this manual.</li> <li>4. Inspect crank position sensor for cracks, debris, or other damage.</li> </ol>	<p><b>All components OK:</b> GO TO <b>⑤</b></p> <p><b>Faulty component found:</b> Determine cause and replace of faulty component. Retest</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Crankshaft Position Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect crank position sensor connector.</li> <li>3. Using a multimeter, measure resistance between both terminals of the crank position sensor.</li> </ol>	<p><b>Measurement between 2500 and 3500 ohms:</b> GO TO <b>⑥</b></p> <p><b>Measurement below 2500 ohms or above 3500 ohms:</b> Faulty crankshaft position sensor</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑥ Pump Position Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect pump position sensor connector.</li> <li>3. Using a multimeter, measure resistance between both terminals of the pump position sensor.</li> </ol>	<p><b>Measurement between 2500 and 3500 ohms:</b> GO TO <b>⑦</b></p> <p><b>Measurement below 2500 ohms or above 3500 ohms:</b> Faulty pump position sensor</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
,257

## Trouble Code Diagnostics and Tests

<p><b>7 Open in Crank Position Sensor Input and Return Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect crank position sensor connector.</li> <li>3. Disconnect both ECU connectors.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal A of the crank position sensor connector AND terminal W1 in the ECU connector on the engine harness.</li> <li>• Terminal B of the crank position sensor connector AND terminal W2 in the ECU connector on the engine harness.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less:</b> GO TO ⑧</p> <p><b>Either measurement greater than 5 ohms:</b> 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</p> <p style="text-align: right;">-- -1/1</p>
<p><b>8 Crank Position Sensor Input Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Crank position sensor connector and both ECU connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminal W1 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> GO TO ⑨</p> <p><b>Any measurement less than 2000 ohms:</b> Faulty crank position sensor input wiring harness.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>9 Crank Position Sensor Return Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Crank position sensor connector and both ECU connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminal W2 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> GO TO ⑩</p> <p><b>Any measurement less than 2000 ohms:</b> Faulty crank position sensor return wiring harness.</p> <p style="text-align: right;">-- -1/1</p>

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*Trouble Code Diagnostics and Tests*

<p><b>10 Open in Pump Position Input and Return Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect pump position sensor connector.</li> <li>3. Disconnect both ECU connectors.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal A of the pump position sensor connector AND terminal W3 in the ECU connector on the engine harness.</li> <li>• Terminal B of the pump position sensor connector AND terminal X1 in the ECU connector on the engine harness.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less:</b> GO TO <b>11</b></p> <p><b>Either measurement greater than 5 ohms:</b> Open in pump position sensor input wire OR Open in pump position sensor return wire OR Terminals A and B in the pump position sensor harness connector possibly inverted</p>
<p><b>11 Pump Position Sensor Input Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Pump Position Sensor connector and both ECU connectors still disconnected.</li> <li>3. Using a multimeter measure resistance between terminal X1 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> GO TO <b>12</b></p> <p><b>Any measurement less than 2000 ohms:</b> Faulty pump position sensor input wiring harness.</p>
<p><b>12 Pump Position Sensor Return Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Pump Position Sensor connector and ECU connectors still disconnected.</li> <li>3. Using a multimeter measure resistance between terminal W3 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> Faulty pump position sensor connector OR Faulty crank sensor connector OR Faulty ECU connector OR Faulty ECU</p> <p><b>Any measurement less than 2000 ohms:</b> Faulty pump position sensor return wiring harness</p>

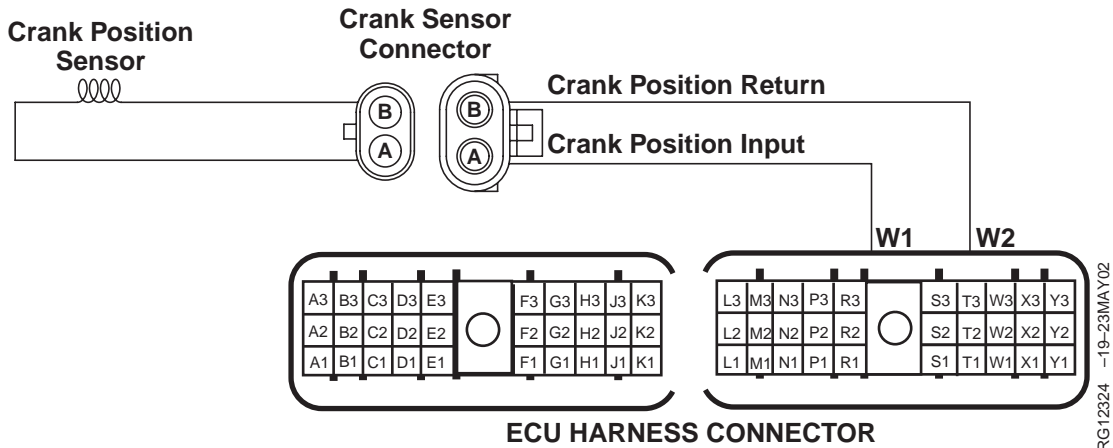
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**000637.08 — Crank Position Input Missing**



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**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Crank Position Sensor**

- The crank position sensor is an inductive type pickup sensor that detects notches on the crank timing wheel. The crank timing wheel has 44 narrow teeth and 1 wide tooth. The ECU uses the crank position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the pump position sensor input to determine piston position in relation to the firing order. Based on information from the crank and pump position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EIs accordingly. For further crank position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

**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 pump position sensor trouble code accompanies DTC 000637.08, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the pump position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.
- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Derate Feature: See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG40854,0000062 -19-01MAY02-1/1



## 000637.08 — Crank Position Input Missing

The ECU does not detect the crank position input.

RG40854,0000063 -19-01MAY02-1/1

### 000637.08 Crank Position Input Missing Diagnostic Procedure

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors and the crank sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000637.08 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000637.08 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

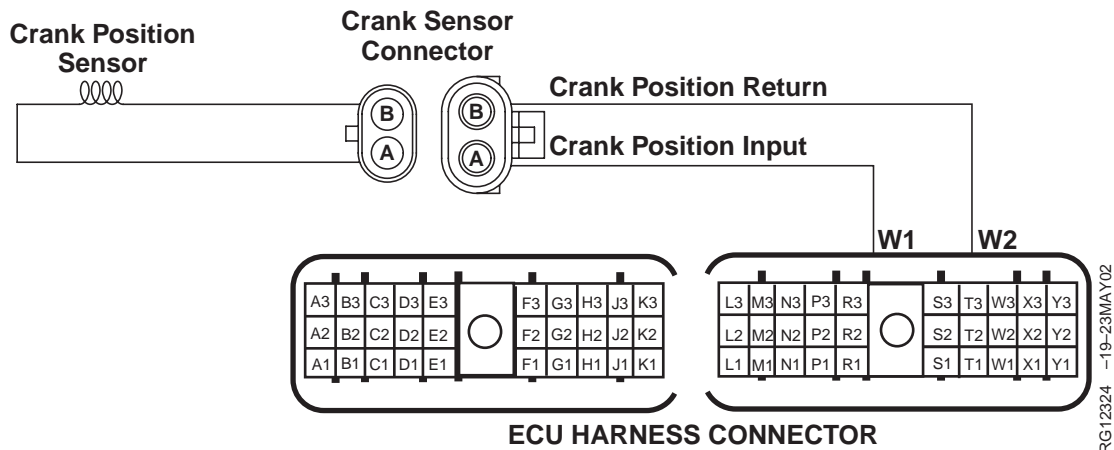
<p><b>③ Crank Sensor Observable Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove crank position sensor. See REMOVE AND INSTALL CRANK POSITION SENSOR in Section 02, Group 110 of this manual.</li> <li>3. Inspect sensor tip for damage, such as cracks or debris.</li> </ol>	<p><b>No signs of damage:</b> GO TO ④</p> <p><b>Damage to sensor:</b> Determine and repair the cause of damage to sensor. Replace sensor and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Crank Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect crank position sensor connector.</li> <li>3. Using a multimeter, measure resistance between both terminals of the crank position sensor.</li> </ol>	<p><b>Measurement between 2500 and 3500 ohms:</b> GO TO ⑤</p> <p><b>Measurement below 2500 ohms or above 3500 ohms:</b> Faulty crank position sensor.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Open in Crank Sensor Input and Return Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect crank position sensor connector.</li> <li>3. Disconnect both 30-way ECU connectors.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal A of the crank position sensor connector and terminal W1 in the ECU connector on the engine harness.</li> <li>• Terminal B of the crank position sensor connector and terminal W2 in the ECU connector on the engine harness.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less:</b> GO TO ⑥</p> <p><b>Either measurement greater than 5 ohms:</b> 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.</p> <p style="text-align: right;">-- -1/1</p>

*Trouble Code Diagnostics and Tests*

<p><b>6 Crank Sensor Input Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Crank position sensor connector and ECU connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminal W1 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms: GO TO 7</b></p> <p><b>Any measurement less than 2000 ohms:</b> Faulty crank position sensor input wiring harness.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>7 Crank Sensor Return Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.08 CRANK POSITION INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Crank position sensor connector and ECU connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminal W2 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> Faulty crank position sensor connector OR Damaged crank position sensor OR Faulty ECU connector OR Faulty ECU</p> <p><b>Any measurement less than 2000 ohms:</b> Faulty crank position sensor return wiring harness.</p> <p style="text-align: right;">-- -1/1</p>

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## 000637.10 — Crank Position Input Pattern Error



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### Crank Position Sensor

- The crank position sensor is an inductive type pickup sensor that detects notches on the crank timing wheel. The crank timing wheel has 44 narrow teeth and 1 wide tooth. The ECU uses the crank position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the pump position sensor input to determine piston position in relation to the firing order. Based on information from the crank and pump position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EIs accordingly. For further crank position sensor information, see MEASURING ENGINE SPEED in Section 03, Group 140.

### DTC 000637.10 will set if:

- The ECU detects an improper pattern on the crank position input.

### If DTC 000637.10 sets, the following will occur:

- If a pump position sensor trouble code accompanies DTC 000637.10, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the pump position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will restart.
- Prolonged cranking time may be required to start the engine.
- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Derate Feature: See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG40854,0000064 -19-01MAY02-1/1

## 000637.10 — Crank Position Input Pattern Error

The ECU detects an improper pattern on the crank position input.

RG40854,0000065 -19-01MAY02-1/1

### 000637.10 Crank Position Input Pattern Error Diagnostic Procedure

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors and the crank sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR™ earlier in this Group.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000637.10 reoccurs:</b> GO TO <b>3</b></p> <p><b>000637.10 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

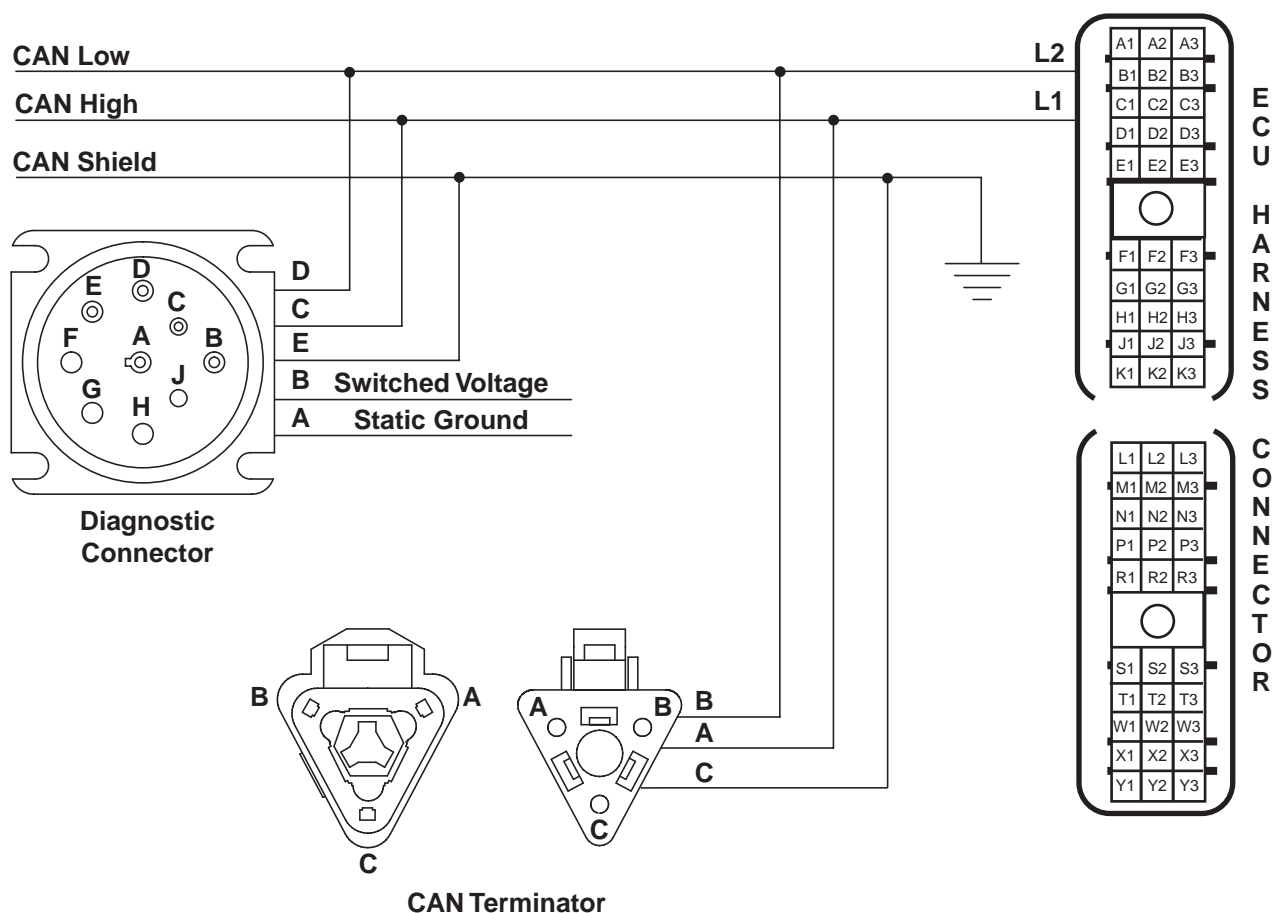
<p><b>③ Crank Position Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect crank position sensor connector.</li> <li>3. Using a multimeter, measure resistance between both terminals of the crank position sensor.</li> </ol>	<p><b>Measurement between 2500 and 3500 ohms:</b> GO TO ④</p> <p><b>Measurement below 2500 ohms or above 3500 ohms:</b> Faulty crank position sensor.</p> <p style="text-align: right;">---1/1</p>
<p><b>④ Crank Position Wiring Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Crank position sensor connector still disconnected.</li> <li>3. Disconnect both ECU connectors.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal A of the crank position sensor connector and terminal W1 in the ECU connector on the engine harness.</li> <li>• Terminal B of the crank position sensor connector and terminal W2 in the ECU connector on the engine harness.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less:</b> GO TO ⑤</p> <p><b>Either measurement greater than 5 ohms:</b> 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.</p> <p style="text-align: right;">---1/1</p>
<p><b>⑤ Crank Position Sensor Return Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Crank position sensor connector and ECU connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminal W2 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> GO TO ⑥</p> <p><b>Any measurement less than 2000 ohms:</b> Faulty crank position sensor input wiring harness.</p> <p style="text-align: right;">---1/1</p>

*Trouble Code Diagnostics and Tests*

<p><b>6 Crank Position Sensor Input Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Crank position sensor connector and ECU connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminal W1 in the ECU connector on the engine harness and the following: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• All other terminals in both ECU connectors.</li> </ul> </li> </ol>	<p><b>All measurements greater than 2000 ohms:</b> GO TO <b>7</b></p> <p><b>Any measurement less than 2000 ohms:</b> Faulty crank position sensor return wiring harness.</p> <p style="text-align: right;">-- 1/1</p>
<p><b>7 Crank Sensor Observable Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove crank sensor.</li> <li>2. Inspect sensor for cracks, corrosion, or any foreign material on the end of the sensor.</li> <li>3. Using a mirror and a flashlight, inspect the crankshaft timing wheel.</li> </ol>	<p><b>All components OK:</b> GO TO <b>8</b></p> <p><b>Fault found in a component:</b> Repair or replace component as needed.</p> <p style="text-align: right;">-- 1/1</p>
<p><b>8 Pump Position Timing Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.</i></p> <p>Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING in Group 150 earlier in this manual.</p>	<p><b>Pump position timing is OK:</b> Faulty crank sensor connector OR Faulty ECU connector OR Faulty ECU</p> <p><b>Pump position timing is out of sync:</b> Adjust timing and recheck.</p> <p style="text-align: right;">-- 1/1</p>

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**000639.13 — CAN Bus Error**



RG11336 -19-17NOV00

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Controller Area Network (CAN)**

- CAN is a network in which the individual controllers on a machine communicate to with each other. The number of controllers communicating on CAN depends on the application. On some applications,

the ECU is the only controller on CAN; on other applications, there are many controllers on CAN. **DTC 000639.13 will set if:**

- The ECU detects a problem communicating on CAN.

**If DTC 000639.13 sets, the following will occur:**

- Depending on application, engine operation may or may not be effected.

RG40854,0000066 -19-01MAY02-1/1

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## 000639.13 — CAN Bus Error

The ECU detects a problem communicating on CAN.

RG40854,0000067 -19-01MAY02-1/1

### 000639.13 CAN Bus Error Diagnostic Procedure

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors, diagnostic connector, and the CAN terminator looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000639.13 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000639.13 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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*Trouble Code Diagnostics and Tests*

<p><b>③ Application Relate DTCs Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information.</i></p> <p>If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs.</p>	<p><b>No CAN related DTCs found on other controllers:</b> GO TO <b>④</b></p> <p><b>Found CAN related DTCs on other controllers:</b> Refer to diagnostic procedures for controller. Repair cause of throttle related DTC and retest.</p> <p style="text-align: right;">-- -1/1</p>
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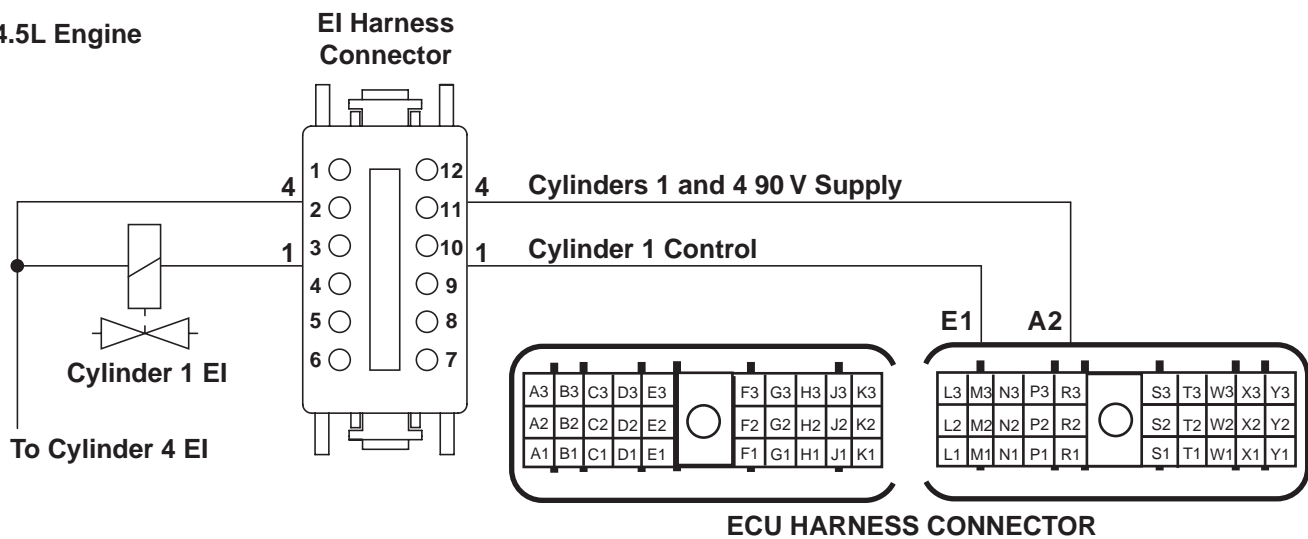
<p><b>④ Resistance Between CAN High and Low Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both ECU connectors.</li> <li>3. Using a multimeter, measure resistance between terminals L1 and L2 in the ECU connector on the engine harness.</li> </ol>	<p><b>Between 55-65 ohms:</b> Faulty ECU connector OR Faulty ECU</p> <p><b>Less than 55 ohms or greater than 65 ohms:</b> Open or short in CAN wiring harness.</p> <p style="text-align: right;">-- -1/1</p>
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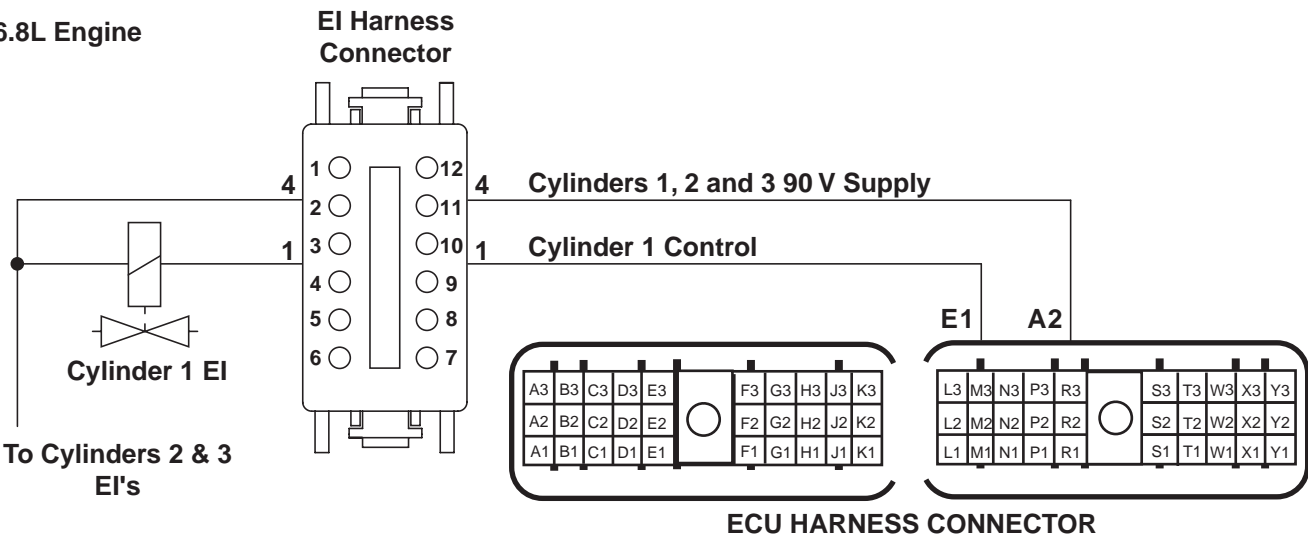
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### 000651.05 — Cylinder #1 EI Circuit Open

#### 4.5L Engine



#### 6.8L Engine



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the

high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

Continued on next page

RG40854,0000068 -19-01MAY02-1/2

*Trouble Code Diagnostics and Tests*

**DTC 000651.05 will set if:**

- The ECU detects an open in the Cylinder #1 EI circuit.

**If DTC 000651.05 sets, the following will occur:**

- Cylinder #1 EI will not fire.

RG40854,0000068 -19-01MAY02-2/2

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## 000651.05 — Cylinder #1 EI Circuit Open

The ECU detects an open in the Cylinder #1 EI circuit.

RG40854,000006A -19-01MAY02-1/1

### 000651.05 Cylinder #1 EI Circuit Open Diagnostic Procedure

**IMPORTANT:** If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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#### ① 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 EI CIRCUIT OPEN supporting information.

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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#### ② Intermittent Fault Test


*NOTE:* For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EI 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running
6. Read DTCs using DST or SERVICE ADVISOR™.

**000651.05 reoccurs:**  
GO TO ③

**000651.05 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

*Trouble Code Diagnostics and Tests*

<p><b>③ Open Wire in 90V Supply or EI Control Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> </ol> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <ol style="list-style-type: none"> <li>2. Disconnect EI wiring harness connector at side of cylinder head.</li> <li>3. Disconnect both 30-way ECU connectors.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal 1 in the harness end of the injector wiring harness connector and terminal E1 in the harness end of ECU connector.</li> <li>• Terminal 4 in the harness end of the injector wiring harness connector and terminal A2 in the harness end of the ECU connector.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less:</b> GO TO <b>④</b></p> <p><b>Measurement between terminals 1 and E1 greater than 5 ohms:</b> Open in wire between terminal 1 and E1.</p> <p><b>Measurement between terminals 4 and A2 greater than 5 ohms:</b> Open in wire between terminal 4 and A2.</p>
<p><b>④ Cylinder 1 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove rocker arm cover.</li> <li>2. Disconnect electrical connections to cylinder 1 EI and a known good EI.</li> <li>3. Using a multimeter measure resistance between: <ul style="list-style-type: none"> <li>• The two terminals on cylinder 1 EI.</li> <li>• The two terminals on the known good EI.</li> </ul> </li> <li>4. Compare the measurement between the two EIs.</li> </ol> <p><i>NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO <b>⑤</b></p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 1 EI solenoid.</p>

04  
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275

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*Trouble Code Diagnostics and Tests*

**5 EI Harness in  
Cylinder Head Test**

*NOTE: For wiring and theory of operation information, see DTC 000651.05 CYLINDER #1 EI CIRCUIT OPEN supporting information.*

1. Ignition OFF
2. Cylinder 1 EI wires still disconnected from EI.
3. Disconnect EI wiring harness connector from side of cylinder head.
4. Using a multimeter, measure resistance between:
  - One of the cylinder 1 EI harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head (either 1 or 4, the EIs are not polarity sensitive).
  - The other cylinder 1 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.

**Both measurements 2.0 ohms or less:**

Faulty ECU connection  
OR  
Faulty EI wiring harness connection  
OR  
Faulty ECU

**Either measurements greater than 2.0 ohms:**

Faulty EI harness in head.

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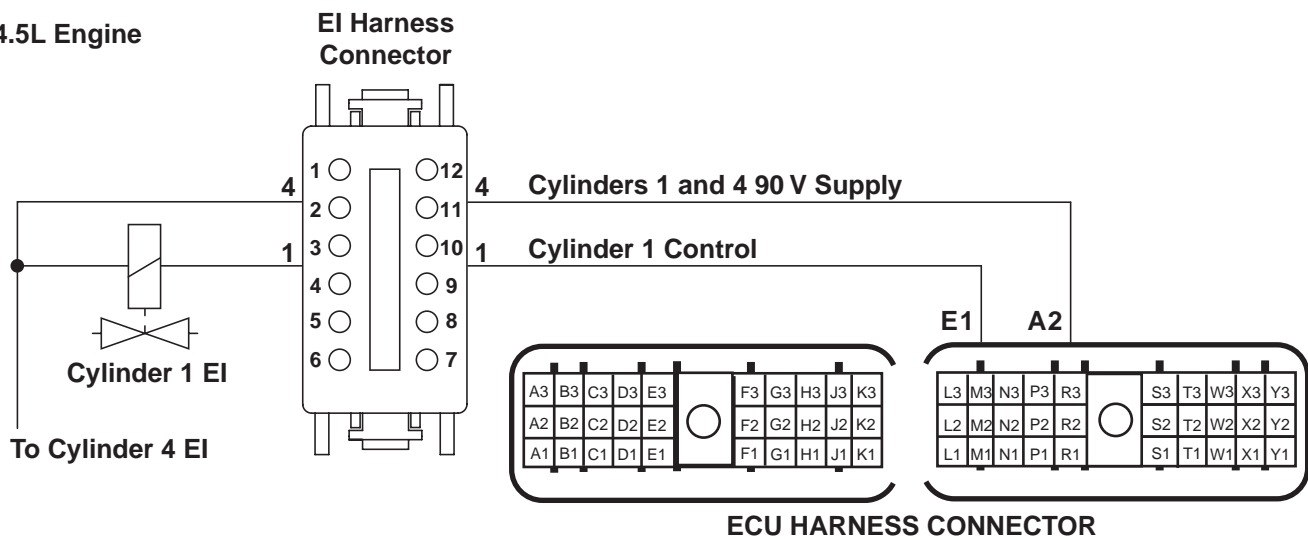
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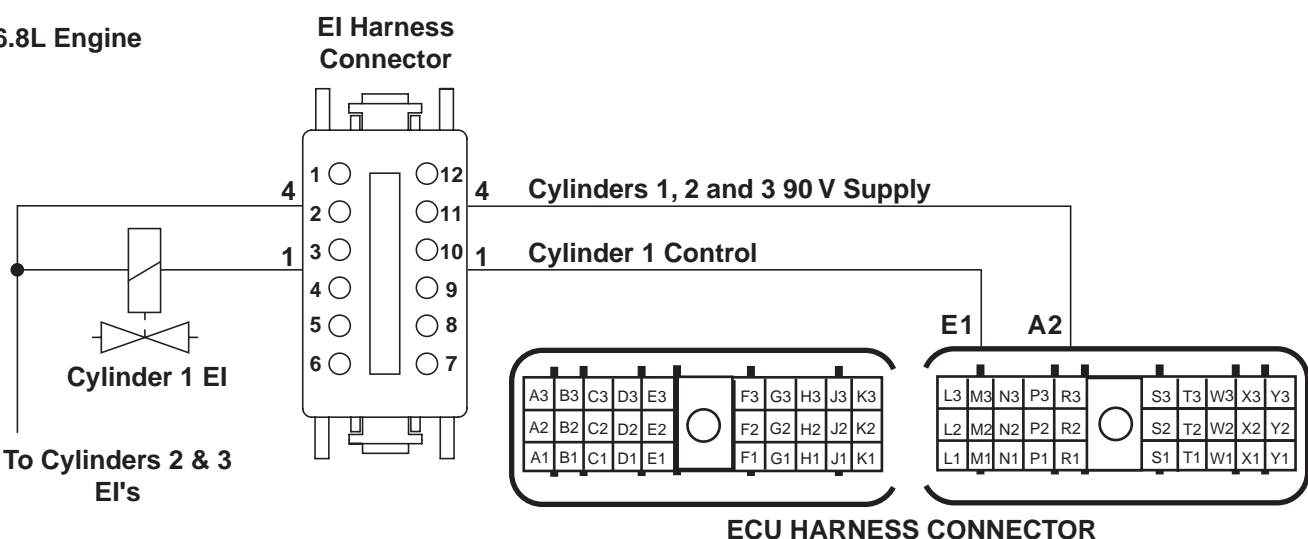
### 000651.06 — Cylinder #1 EI Circuit Shorted

#### 4.5L Engine



RG12326 -19-23MAY02

#### 6.8L Engine



RG12325 -19-23MAY02

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the

high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

Continued on next page

RG40854,000006B -19-01MAY02-1/2

*Trouble Code Diagnostics and Tests*

**DTC 000651.06 will set if:**

- The ECU detects a short in the Cylinder #1 EI circuit.

**If DTC 000651.06 sets, the following will occur:**

- Cylinder #1 EI will not fire.

RG40854,000006B -19-01MAY02-2/2

04  
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**000651.06 — Cylinder #1 EI Circuit Shorted**

The ECU detects a short in the Cylinder #1 EI circuit.

RG40854,000006C -19-01MAY02-1/1

**000651.06 Cylinder #1 EI Circuit Shorted Diagnostic Procedure**

**IMPORTANT:** If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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**① 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 EI CIRCUIT SHORTED supporting information.

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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**② Intermittent Fault Test**

*NOTE:* For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EI 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running
6. Read DTCs using DST or SERVICE ADVISOR™.

**000651.06 reoccurs:**  
GO TO ③

**000651.06 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

04  
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*Trouble Code Diagnostics and Tests*

<p><b>③ Short in EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> </ol> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <ol style="list-style-type: none"> <li>Disconnect EI wiring harness connector at side of cylinder head.</li> <li>Disconnect both ECU connectors.</li> <li>Using a multimeter, measure resistance between terminal 1 in the harness end of EI wiring connector and the following: <ul style="list-style-type: none"> <li>Terminal 4 in the harness end of the EI wiring harness connector.</li> <li>Terminal 9 in the harness end of the EI wiring harness connector.</li> </ul> </li> </ol>	<p><b>Both measurements greater than 20000 ohms:</b> GO TO ④</p> <p><b>Either measurement less than 20000 ohms:</b> Short in ECU wiring harness.</p>
<p><b>④ Cylinder 1 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>Remove rocker arm cover.</li> <li>Disconnect electrical connections to cylinder 1 EI and a known good EI.</li> <li>Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>The two terminals on cylinder 1 EI.</li> <li>The two terminals on the known good EI.</li> </ul> </li> <li>Compare the measurements between the two EIs.</li> </ol> <p><i>NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO ⑤</p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 1 EI solenoid.</p>
<p><b>⑤ EI Wiring Harness in Cylinder Head Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000651.06 CYLINDER #1 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Keep cylinder 1 EI wires disconnected from EI.</li> <li>Keep EI wiring harness connector at side of cylinder head disconnected.</li> <li>Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>Both of the cylinder 1 EI harness eyelets.</li> </ul> </li> </ol>	<p><b>Greater than 20000 ohms:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Less than 20000 ohms:</b> Faulty EI wiring harness.</p>

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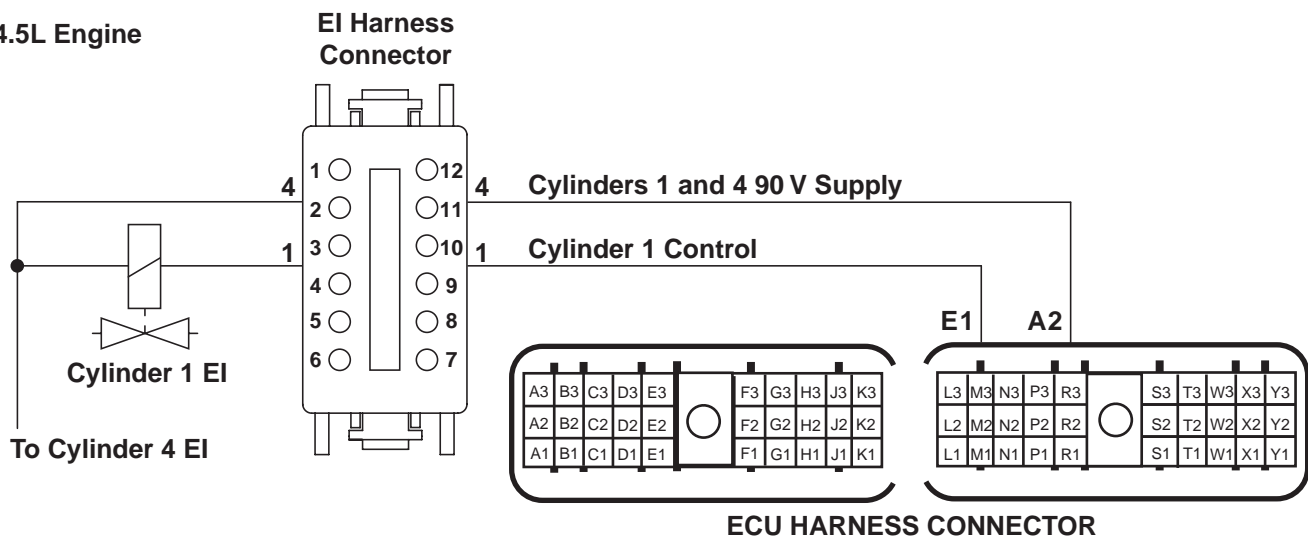
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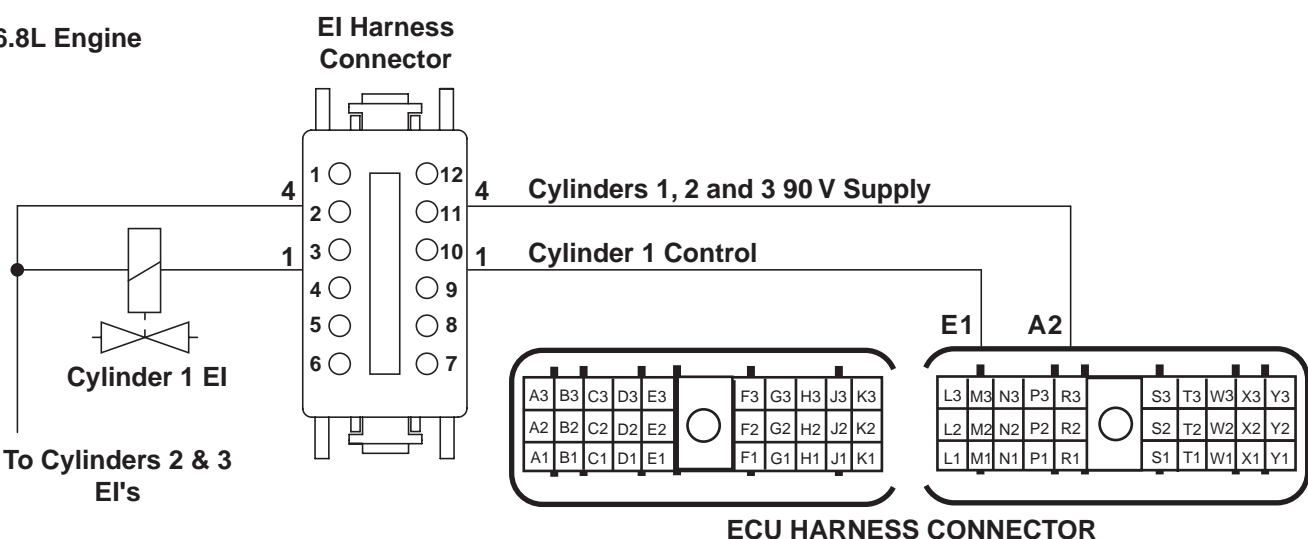
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### 000651.07 — Cylinder #1 EI Mechanical Failure

#### 4.5L Engine



#### 6.8L Engine



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### Electronic Injector (EI)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the

high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

RG12326 -19-23MAY02

RG12325 -19-23MAY02

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RG40854,000006D -19-01MAY02-1/2

*Trouble Code Diagnostics and Tests*

**DTC 000651.07 will set if:**

- The fuel rail pressure does not drop at the injection of fuel to EI #1.

**If DTC 000651.07 sets, the following will occur:**

- Engine will miss at EI #1.

RG40854,000006D -19-01MAY02-2/2

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**000651.07 — Cylinder #1 EI Mechanical Failure**

The fuel rail pressure does not drop at the injection of fuel to EI #1.

RG40854,000006E -19-01MAY02-1/1

**000651.07 Cylinder #1 EI Mechanical Failure Diagnostic Procedure**

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**① 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 000651.07 CYLINDER #1 EI MECHANICAL FAILURE supporting information.*

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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**② EI Wiring Harness Check**

*NOTE: For wiring and theory of operation information, see DTC 000651.07 CYLINDER #1 EI MECHANICAL FAILURE supporting information.*

1. Ignition OFF



**CAUTION: Possible strong electrical shock hazard if engine is cranking or running.**

2. Remove rocker arm cover with vent tube.

3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification.

**Specification**

Injector Solenoid Wire Retaining Nut—

Torque ..... 2 N•m (1.5 lb-ft) (18 lb-in.)

4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM 104.

**All retaining nut torques at specification:**  
GO TO ③

**Retaining nut(s) loose:**  
Tight retaining nut(s) to specification and retest.

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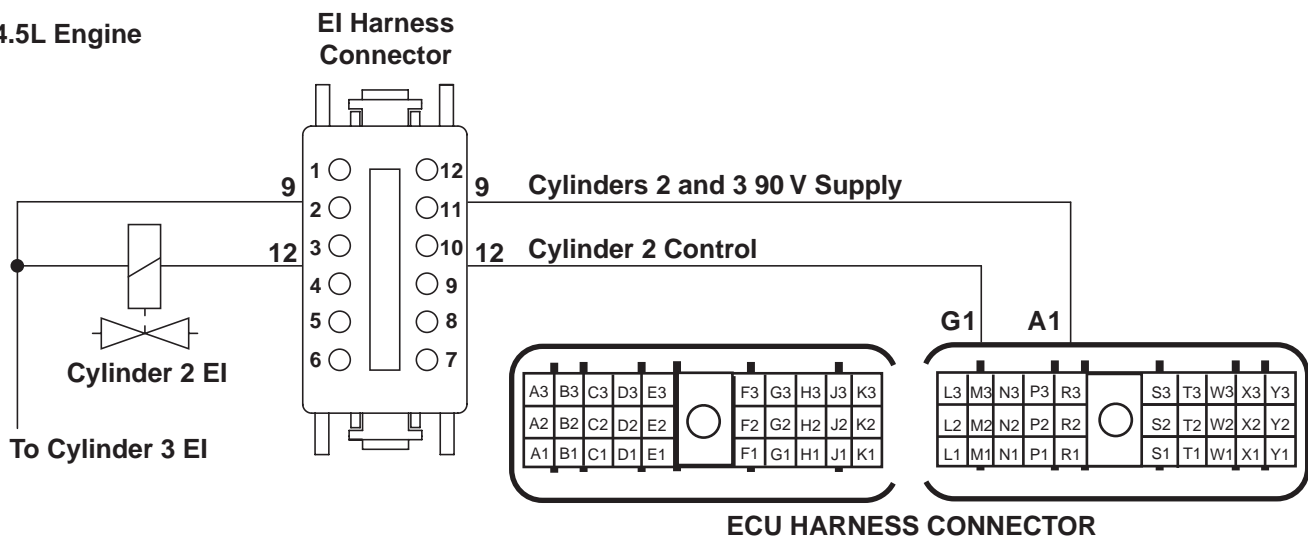
*Trouble Code Diagnostics and Tests*

<p><b>③ EI Fuel Line Restriction Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000651.07 CYLINDER #1 EI MECHANICAL FAILURE supporting information.</i></p> <p>Check fuel lines for restrictions between High Pressure Common Rail (HPCR) and the fuel inlet at EI #1.</p>	<p><b>No restrictions found:</b> GO TO <b>④</b></p> <p><b>Restrictions found:</b> Repair or replace fuel line and retest</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Flow Limiter Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000651.07 CYLINDER #1 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition ON, engine running under condition that sets code.</li> <li>Using the ECU diagnostic software, verify that DTC 000651.07 is an ACTIVE code.</li> <li>Listen to flow limiter that corresponds to EI #1 while turning ignition OFF.</li> </ol> <p><i>NOTE: It is very difficult to distinguish the difference between EI #1 and the other flow limiters clicking. Make sure EI #1 makes the click. It will take 5-10 seconds for the ball to reset.</i></p>	<p><b>Flow damper clicks:</b> GO TO <b>⑤</b></p> <p><b>Flow damper does not click:</b> Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Side Feed Tube Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000651.07 CYLINDER #1 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect the high pressure fuel delivery line for EI #1. Remove the side feed tube retaining nut from the cylinder head.</li> <li>Using a 1/2" hose grip pliers, remove the side feed tube from the cylinder head.</li> <li>Inspect the side feed tube for nicks, burrs, or other damage.</li> <li>Inspect side feed tube o-ring for damage.</li> <li>When inspection is completed, reinstall inspected or install side feed tube and tighten side feed tube retaining nut to specification.</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft)</p> <ol style="list-style-type: none"> <li>Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification:</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft)</p>	<p><b>Side feed tube and o-ring inspection passes:</b> Faulty EI OR Faulty ECU</p> <p><b>Side feed tube and o-ring inspection fails:</b> Replace side feed tube and retest.</p> <p style="text-align: right;">-- -1/1</p>

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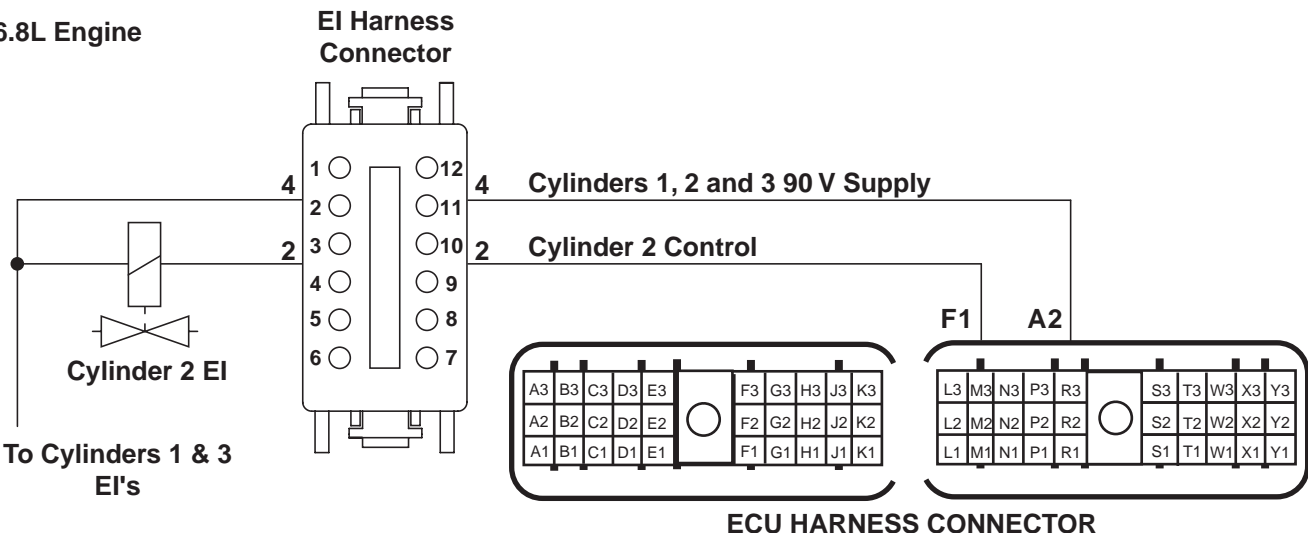
### 000652.05 — Cylinder #2 EI Circuit Open

#### 4.5L Engine



RG12328 -19-23MAY02

#### 6.8L Engine



RG12327 -19-23MAY02

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the

high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

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RG40854,000006F -19-01MAY02-1/2

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286

*Trouble Code Diagnostics and Tests*

**DTC 000652.05 will set if:**

- The ECU detects an open in the Cylinder #2 EI circuit.

**If DTC 000652.05 sets, the following will occur:**

- Cylinder #2 EI will not fire.

RG40854,000006F -19-01MAY02-2/2

04  
160  
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## 000652.05 — Cylinder #2 EI Circuit Open

The ECU detects an open in the Cylinder #2 EI circuit.

RG40854.0000071 -19-01MAY02-1/1

### 000652.05 Cylinder #2 EI Circuit Open Diagnostic Procedure

**IMPORTANT:** If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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#### ① 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 EI CIRCUIT OPEN supporting information.

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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#### ② Intermittent Fault Test



*NOTE:* For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EI 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running
6. Read DTCs using DST or SERVICE ADVISOR™.

**000652.05 reoccurs:**  
GO TO ③

**000652.05 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

*Trouble Code Diagnostics and Tests*

<p><b>3 Engine Displacement Check</b></p>	<p>What is the displacement of engine?</p>	<p><b>4.5L Engine: GO TO 4</b> <b>6.8L Engine: GO TO 5</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>4 4.5L Engines - Open Wire in 90V Supply or EI Control Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EI CIRCUIT OPEN supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <p>2. Disconnect EI wiring harness connector at side of cylinder head.</p> <p>3. Disconnect both ECU connectors.</p> <p>4. Using a multimeter, measure resistance between:</p> <ul style="list-style-type: none"> <li>• Terminal 12 in the harness end of the injector wiring harness connector and terminal G1 in the harness end of ECU connector.</li> <li>• Terminal 9 in the harness end of the injector wiring harness connector and terminal A1 in the harness end of the ECU connector.</li> </ul>	<p><b>Both measurements 5 ohms or less: GO TO 6</b></p> <p><b>Measurement between terminals 12 and G1 greater than 5 ohms:</b> Open in wire between terminal 12 and G1.</p> <p><b>Measurement between terminals 9 and A1 greater than 5 ohms:</b> Open in wire between terminal 9 and A1.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>5 6.8L Engines - Open Wire in 90V Supply or EI Control Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EI CIRCUIT OPEN supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <p>2. Disconnect EI wiring harness connector at side of cylinder head.</p> <p>3. Disconnect both ECU connectors.</p> <p>4. Using a multimeter, measure resistance between:</p> <ul style="list-style-type: none"> <li>• Terminal 2 in the harness end of the injector wiring harness connector and terminal F1 in the harness end of ECU connector.</li> <li>• Terminal 4 in the harness end of the injector wiring harness connector and terminal A2 in the harness end of the ECU connector.</li> </ul>	<p><b>Both measurements 5 ohms or less: GO TO 6</b></p> <p><b>Measurement between terminals 2 and F1 greater than 5 ohms:</b> Open in wire between terminal 2 and F1.</p> <p><b>Measurement between terminals 4 and A2 greater than 5 ohms:</b> Open in wire between terminal 4 and A2.</p> <p style="text-align: right;">-- -1/1</p>

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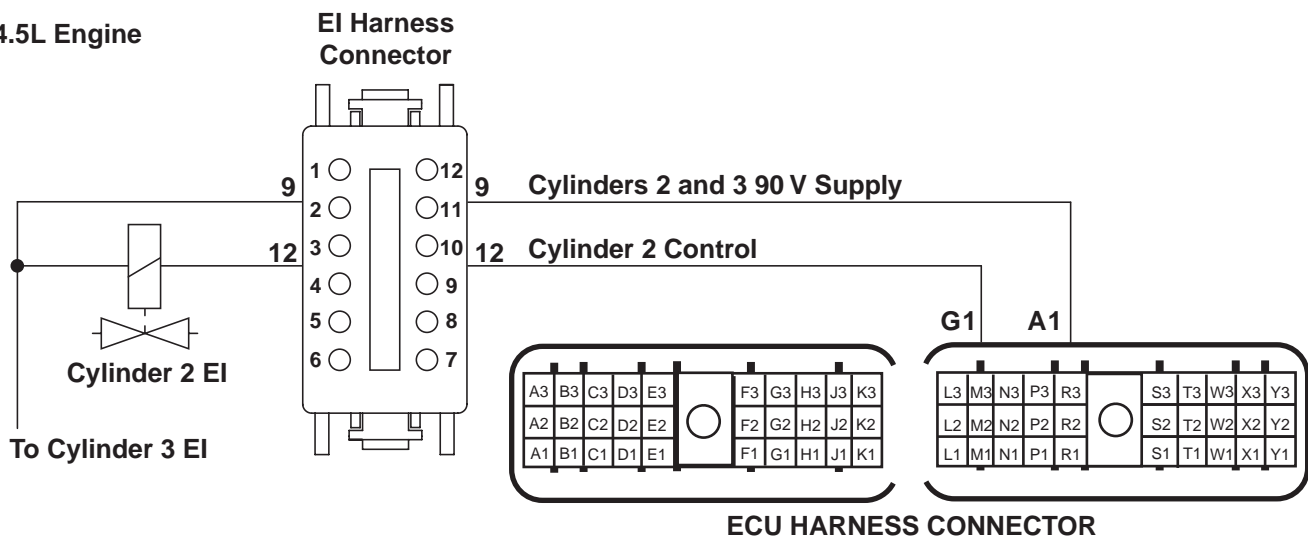
## Trouble Code Diagnostics and Tests

<b>⑥ Cylinder 2 EI Test</b>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove rocker arm cover.</li> <li>2. Disconnect electrical connections to cylinder 2 EI and a known good EI.</li> <li>3. Using a multimeter measure resistance between: <ul style="list-style-type: none"> <li>• The two terminals on cylinder 2 EI.</li> <li>• The two terminals on the known good EI.</li> </ul> </li> <li>4. Compare the measurement between the two EIs.</li> </ol> <p><i>NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO ⑦</p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 2 EI solenoid.</p> <p style="text-align: right;">-- -1/1</p>
<b>⑦ EI Harness in Cylinder Head Test</b>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.05 CYLINDER #2 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Cylinder 2 EI wires still disconnected from EI.</li> <li>3. Disconnect EI wiring harness connector from side of cylinder head.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• One of the cylinder 2 EI harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head.</li> <li>• The other cylinder 2 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.</li> </ul> </li> </ol>	<p><b>Both measurements 2.0 ohms or less:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Either measurements greater than 2.0 ohms:</b> Faulty EI harness in head.</p> <p style="text-align: right;">-- -1/1</p>

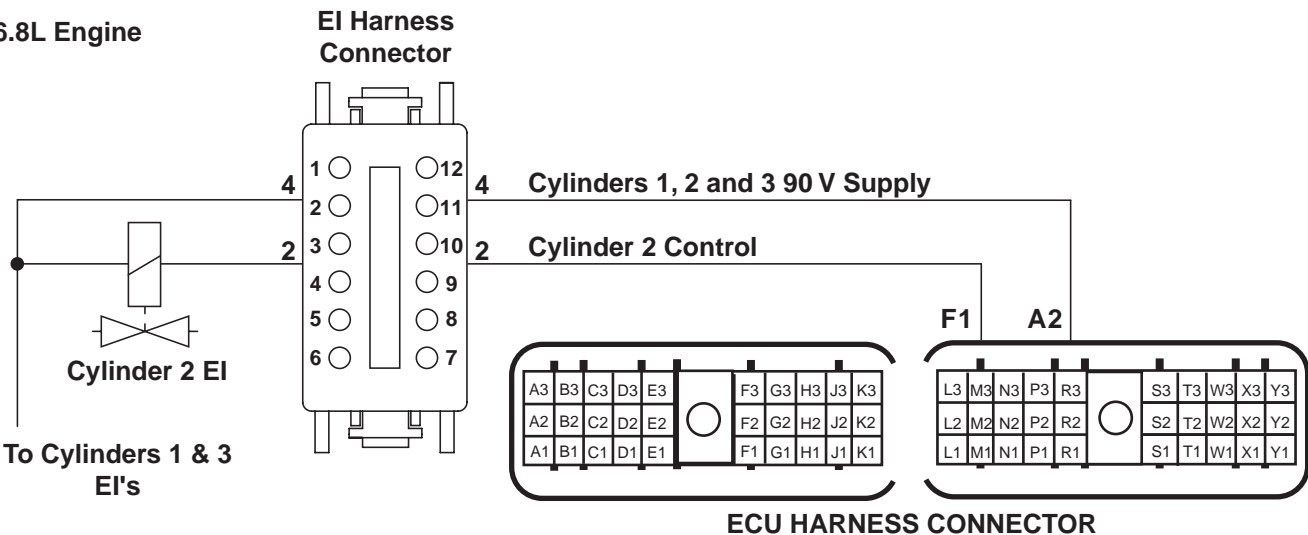
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### 000652.06 — Cylinder #2 EI Circuit Shorted

#### 4.5L Engine



#### 6.8L Engine



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the

high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.



*Trouble Code Diagnostics and Tests*

**DTC 000652.06 will set if:**

- The ECU detects a short in the Cylinder #2 EI circuit.

**If DTC 000652.06 sets, the following will occur:**

- Cylinder #2 EI will not fire.

RG40854,0000072 -19-01MAY02-2/2

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## 000652.06 — Cylinder #2 EI Circuit Shorted

The ECU detects a short in the Cylinder #2 EI circuit.

RG40854.0000074 -19-01MAY02-1/1

### 000652.06 Cylinder #2 EI Circuit Shorted Diagnostic Procedure

**IMPORTANT:** If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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#### ① 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 EI CIRCUIT SHORTED supporting information.

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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#### ② Intermittent Fault Test



*NOTE:* For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running
6. Read DTCs using DST or SERVICE ADVISOR™.

**000652.06 reoccurs:**  
GO TO ③

**000652.06 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

*Trouble Code Diagnostics and Tests*

<p><b>3 Engine Displacement Check</b></p>	<p>What is the displacement of engine?</p>	<p><b>4.5L Engine: GO TO 4</b> <b>6.8L Engine: GO TO 5</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>4 4.5L Engines - Short in EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <p>2. Disconnect EI wiring harness connector at side of cylinder head.</p> <p>3. Disconnect both ECU connectors.</p> <p>4. Using a multimeter, measure resistance between terminal 12 in the harness end of EI wiring connector and the following:</p> <ul style="list-style-type: none"> <li>• Terminal 4 in the harness end of the EI wiring harness connector.</li> <li>• Terminal 9 in the harness end of the EI wiring harness connector.</li> </ul>	<p><b>Both measurements greater than 20000 ohms: GO TO 6</b></p> <p><b>Either measurement less than 20000 ohms: Short in ECU wiring harness.</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>5 6.8L Engines - Short in EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <p>2. Disconnect EI wiring harness connector at side of cylinder head.</p> <p>3. Disconnect both ECU connectors.</p> <p>4. Using a multimeter, measure resistance between terminal 2 in the harness end of EI wiring connector and the following:</p> <ul style="list-style-type: none"> <li>• Terminal 4 in the harness end of the EI wiring harness connector.</li> <li>• Terminal 9 in the harness end of the EI wiring harness connector.</li> </ul>	<p><b>Both measurements greater than 20000 ohms: GO TO 6</b></p> <p><b>Either measurement less than 20000 ohms: Short in ECU wiring harness.</b></p> <p style="text-align: right;">-- -1/1</p>

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Trouble Code Diagnostics and Tests

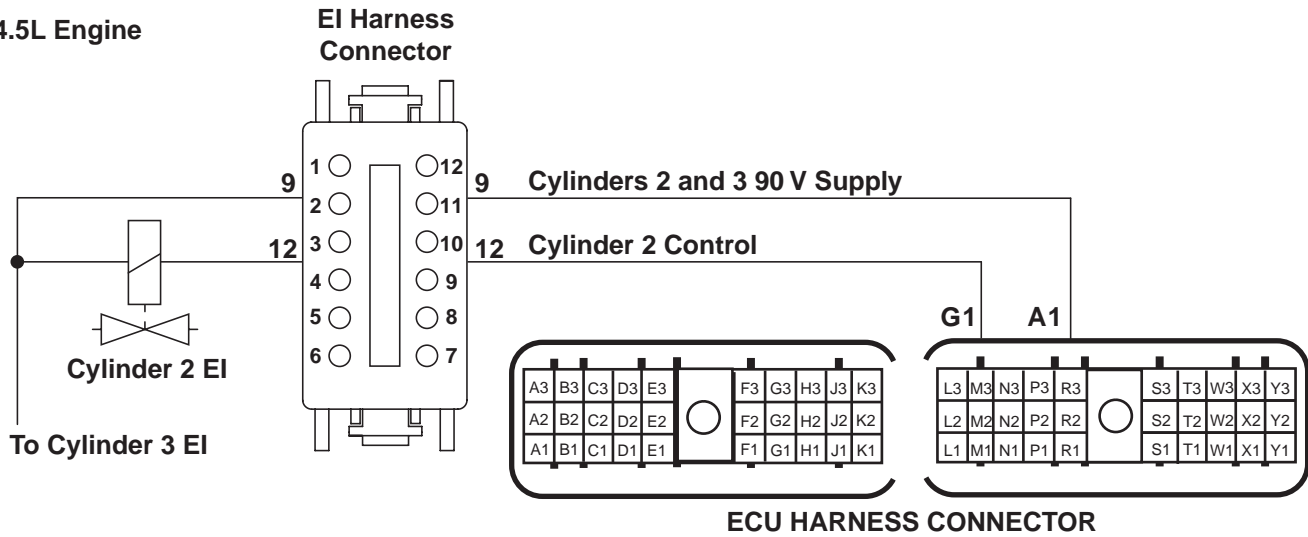
<p><b>6 Cylinder 2 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove rocker arm cover.</li> <li>2. Disconnect electrical connections to cylinder 2 EI and a known good EI.</li> <li>3. Using a multimeter, measure resistance between:             <ul style="list-style-type: none"> <li>• The two terminals on cylinder 2 EI.</li> <li>• The two terminals on the known good EI.</li> </ul> </li> <li>4. Compare the measurements between the two EIs.</li> </ol> <p><i>NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO <b>7</b></p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 2 EI solenoid.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>7 EI Wiring Harness in Cylinder Head Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Keep cylinder 2 EI wires disconnected from EI.</li> <li>3. Keep EI wiring harness connector at side of cylinder head disconnected.</li> <li>4. Using a multimeter, measure resistance between:             <ul style="list-style-type: none"> <li>• Both of the cylinder 2 EI harness eyelets.</li> </ul> </li> </ol>	<p><b>Greater than 20000 ohms:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Less than 20000 ohms:</b> Faulty EI wiring harness.</p> <p style="text-align: right;">-- -1/1</p>

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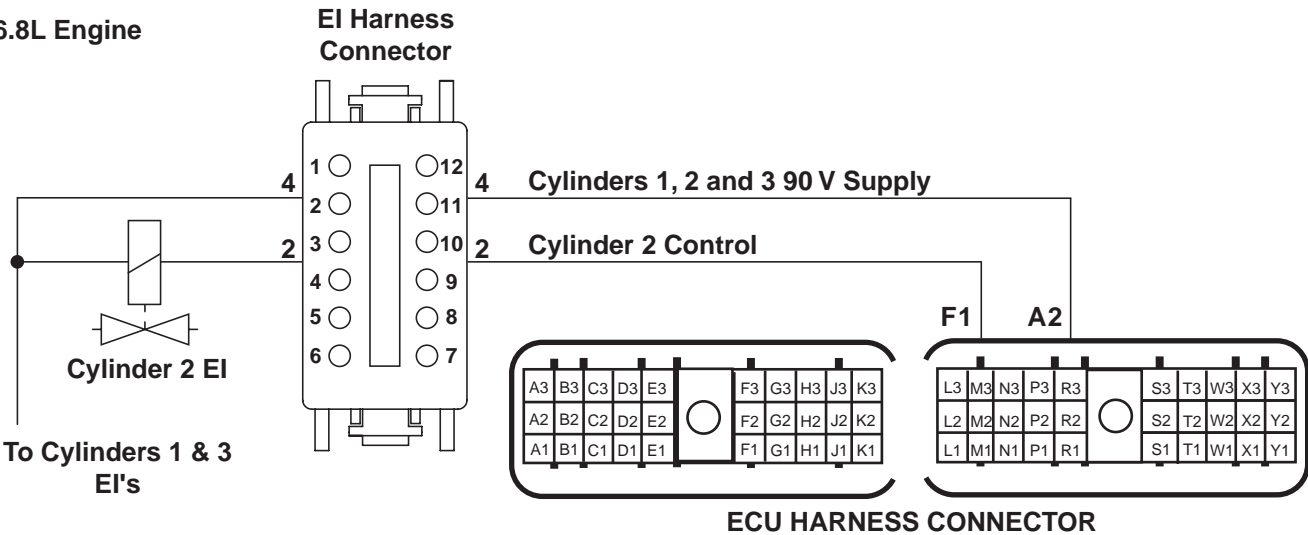
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### 000652.07 — Cylinder #2 EI Mechanical Failure

#### 4.5L Engine



#### 6.8L Engine



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the

high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

*Trouble Code Diagnostics and Tests*

**DTC 000652.07 will set if:**

- The fuel rail pressure does not drop at the injection of fuel to EI #2.

**If DTC 000652.07 sets, the following will occur:**

- Engine will miss at EI #2.

RG40854,0000075 -19-01MAY02-2/2

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**000652.07 — Cylinder #2 EI Mechanical Failure**

The fuel rail pressure does not drop at the injection of fuel to EI #2.

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**000652.07 Cylinder #2 EI Mechanical Failure Diagnostic Procedure**

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**① 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.**

**No faulty connection(s):**  
GO TO ②

*NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI MECHANICAL FAILURE supporting information.*

**Faulty connection(s):**  
Repair faulty connection(s).

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

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**② EI Wiring Harness Check**

*NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI MECHANICAL FAILURE supporting information.*

**All retaining nut torques at specification:**  
GO TO ③

1. Ignition OFF



**CAUTION: Possible strong electrical shock hazard if engine is cranking or running.**

**Retaining nut(s) loose:**  
Tight retaining nut(s) to specification and retest.

2. Remove rocker arm cover with vent tube.

3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification.

**Specification**

Injector Solenoid Wire Retaining Nut—

Torque ..... 2 N•m (1.5 lb-ft) (18 lb-in.)

4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM 104.

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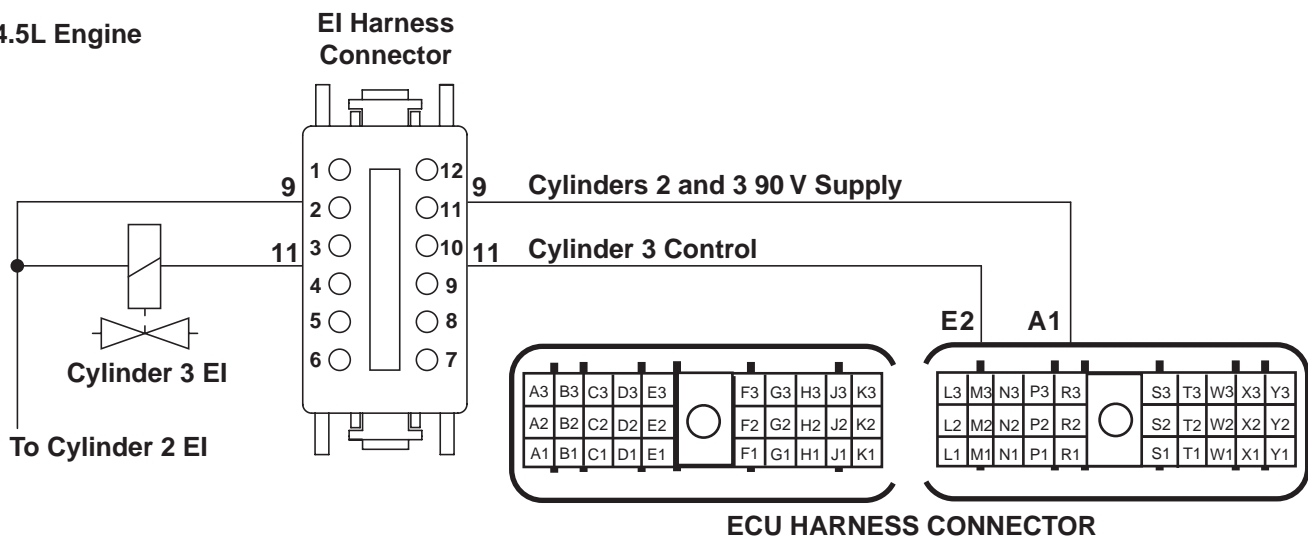
*Trouble Code Diagnostics and Tests*

<p><b>③ EI Fuel Line Restriction Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI MECHANICAL FAILURE supporting information.</i></p> <p>Check fuel lines for restrictions between High Pressure Common Rail (HPCR) and the fuel inlet at EI #2.</p>	<p><b>No restrictions found:</b> GO TO <b>④</b></p> <p><b>Restrictions found:</b> Repair or replace fuel line and retest</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Flow Limiter Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition ON, engine running under condition that sets code.</li> <li>Using the ECU diagnostic software, verify that DTC 000652.07 is an ACTIVE code.</li> <li>Listen to flow limiter that corresponds to EI #2 while turning ignition OFF.</li> </ol> <p><i>NOTE: It is very difficult to distinguish the difference between EI #2 and the other flow limiters clicking. Make sure EI #2 makes the click. It will take 5-10 seconds for the ball to reset.</i></p>	<p><b>Flow damper clicks:</b> GO TO <b>⑤</b></p> <p><b>Flow damper does not click:</b> Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Side Feed Tube Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000652.07 CYLINDER #2 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect the high pressure fuel delivery line for EI #2. Remove the side feed tube retaining nut from the cylinder head.</li> <li>Using a 1/2" hose grip pliers, remove the side feed tube from the cylinder head.</li> <li>Inspect the side feed tube for nicks, burrs, or other damage.</li> <li>Inspect side feed tube o-ring for damage.</li> <li>When inspection is completed, reinstall inspected or install side feed tube and tighten side feed tube retaining nut to specification.</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft)</p> <ol style="list-style-type: none"> <li>Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification:</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft)</p>	<p><b>Side feed tube and o-ring inspection passes:</b> Faulty EI OR Faulty ECU</p> <p><b>Side feed tube and o-ring inspection fails:</b> Replace side feed tube and retest.</p> <p style="text-align: right;">-- -1/1</p>

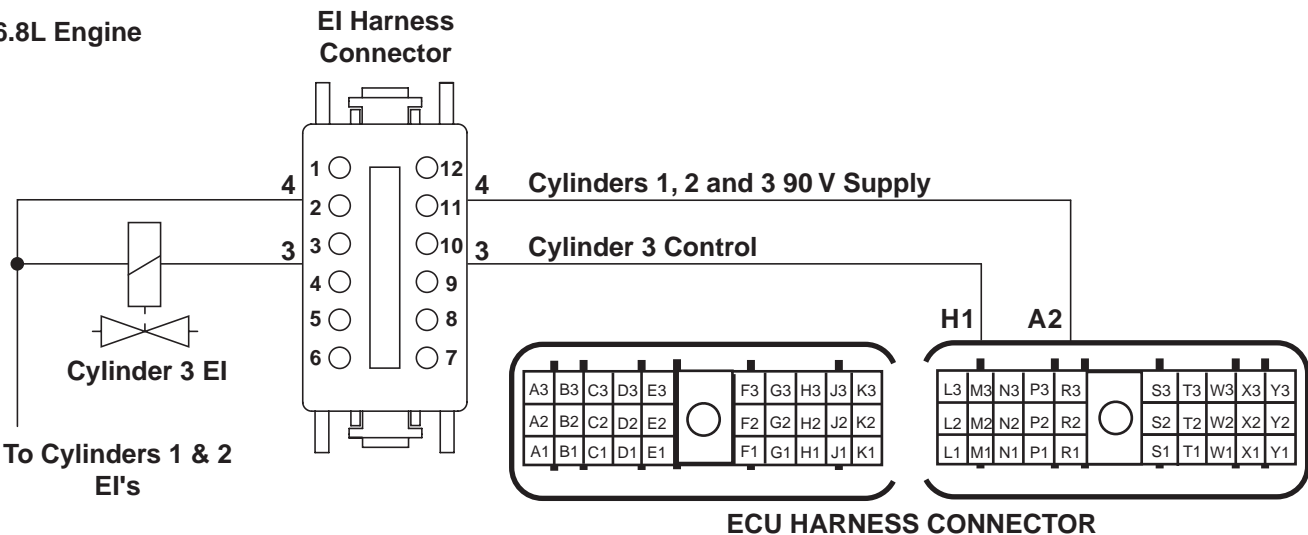
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### 000653.05 — Cylinder #3 EI Circuit Open

#### 4.5L Engine



#### 6.8L Engine



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the

high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

Continued on next page

RG40854,0000077 -19-01MAY02-1/2

*Trouble Code Diagnostics and Tests*

**DTC 000653.05 will set if:**

- The ECU detects an open in the Cylinder #3 EI circuit.

**If DTC 000653.05 sets, the following will occur:**

- Cylinder #3 EI will not fire.

RG40854,0000077 -19-01MAY02-2/2

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## 000653.05 — Cylinder #3 EI Circuit Open

The ECU detects an open in the Cylinder #3 EI circuit.

RG40854.0000079 -19-01MAY02-1/1

### 000653.05 Cylinder #3 EI Circuit Open Diagnostic Procedure

**IMPORTANT:** If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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#### ① 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 EI CIRCUIT OPEN supporting information.

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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#### ② Intermittent Fault Test



*NOTE:* For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EI 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running
6. Read DTCs using DST or SERVICE ADVISOR™.

**000653.05 reoccurs:**  
GO TO ③

**000653.05 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

*Trouble Code Diagnostics and Tests*

<p><b>3 Engine Displacement Check</b></p>	<p>What is the displacement of engine?</p>	<p><b>4.5L Engine: GO TO 4</b> <b>6.8L Engine: GO TO 5</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>4 4.5L Engines - Open Wire in 90V Supply or EI Control Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EI CIRCUIT OPEN supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <p>2. Disconnect EI wiring harness connector at side of cylinder head.</p> <p>3. Disconnect both ECU connectors.</p> <p>4. Using a multimeter, measure resistance between:</p> <ul style="list-style-type: none"> <li>• Terminal 11 in the harness end of the injector wiring harness connector and terminal E2 in the harness end of ECU connector.</li> <li>• Terminal 9 in the harness end of the injector wiring harness connector and terminal A1 in the harness end of the ECU connector.</li> </ul>	<p><b>Both measurements 5 ohms or less: GO TO 6</b></p> <p><b>Measurement between terminal 11 and E2 greater than 5 ohms:</b> Open in wire between terminal 11 and E2 .</p> <p><b>Measurement between terminals 9 and A1 greater than 5 ohms:</b> Open in wire between terminal 9 and A1.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>5 6.8L Engines - Open Wire in 90V Supply or EI Control Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EI CIRCUIT OPEN supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <p>2. Disconnect EI wiring harness connector at side of cylinder head.</p> <p>3. Disconnect both ECU connectors.</p> <p>4. Using a multimeter, measure resistance between:</p> <ul style="list-style-type: none"> <li>• Terminal 3 in the harness end of the injector wiring harness connector and terminal H1 in the harness end of ECU connector.</li> <li>• Terminal 4 in the harness end of the injector wiring harness connector and terminal A2 in the harness end of the ECU connector.</li> </ul>	<p><b>Both measurements 5 ohms or less: GO TO 6</b></p> <p><b>Measurement between terminal 3 and H1 greater than 5 ohms:</b> Open in wire between terminal 3 and H1.</p> <p><b>Measurement between terminals 4 and A2 greater than 5 ohms:</b> Open in wire between terminal 4 and A2.</p> <p style="text-align: right;">-- -1/1</p>

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## Trouble Code Diagnostics and Tests

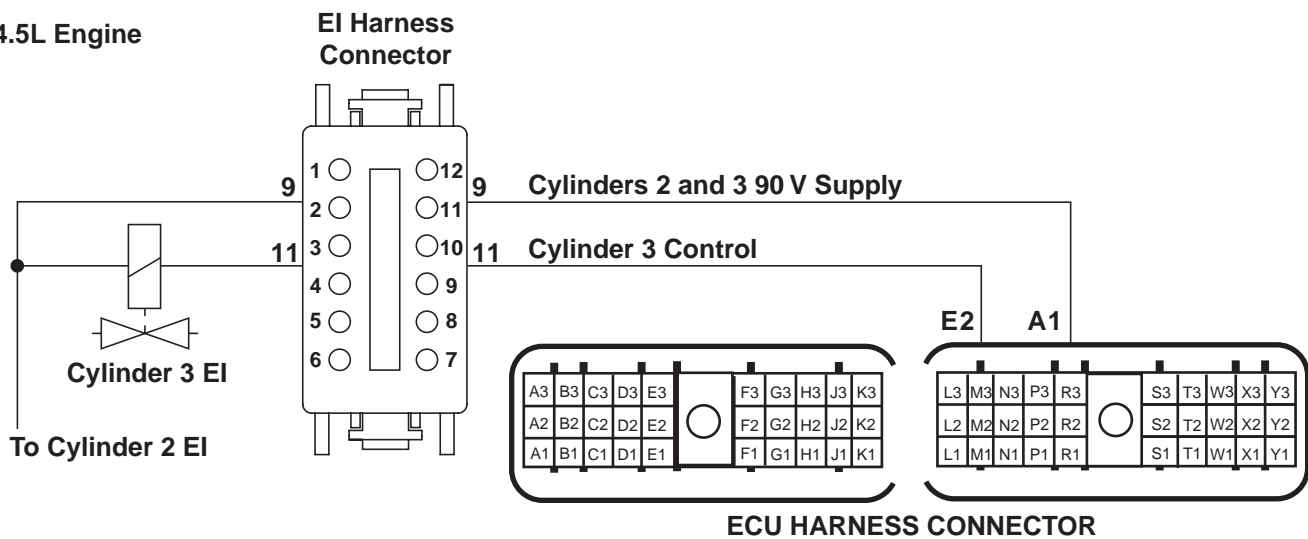
<p><b>6 Cylinder 3 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove rocker arm cover.</li> <li>2. Disconnect electrical connections to cylinder 3 EI and a known good EI.</li> <li>3. Using a multimeter measure resistance between:             <ul style="list-style-type: none"> <li>• The two terminals on cylinder 3 EI.</li> <li>• The two terminals on the known good EI.</li> </ul> </li> <li>4. Compare the measurement between the two EIs.</li> </ol> <p><i>NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO <b>7</b></p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 3 EI solenoid.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>7 EI Harness in Cylinder Head Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.05 CYLINDER #3 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Cylinder 3 EI wires still disconnected from EI.</li> <li>3. Disconnect EI wiring harness connector from side of cylinder head.</li> <li>4. Using a multimeter, measure resistance between:             <ul style="list-style-type: none"> <li>• One of the cylinder 3 EI harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head.</li> <li>• The other cylinder 3 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.</li> </ul> </li> </ol>	<p><b>Both measurements 2.0 ohms or less:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Either measurements greater than 2.0 ohms:</b> Faulty EI harness in head.</p> <p style="text-align: right;">-- -1/1</p>

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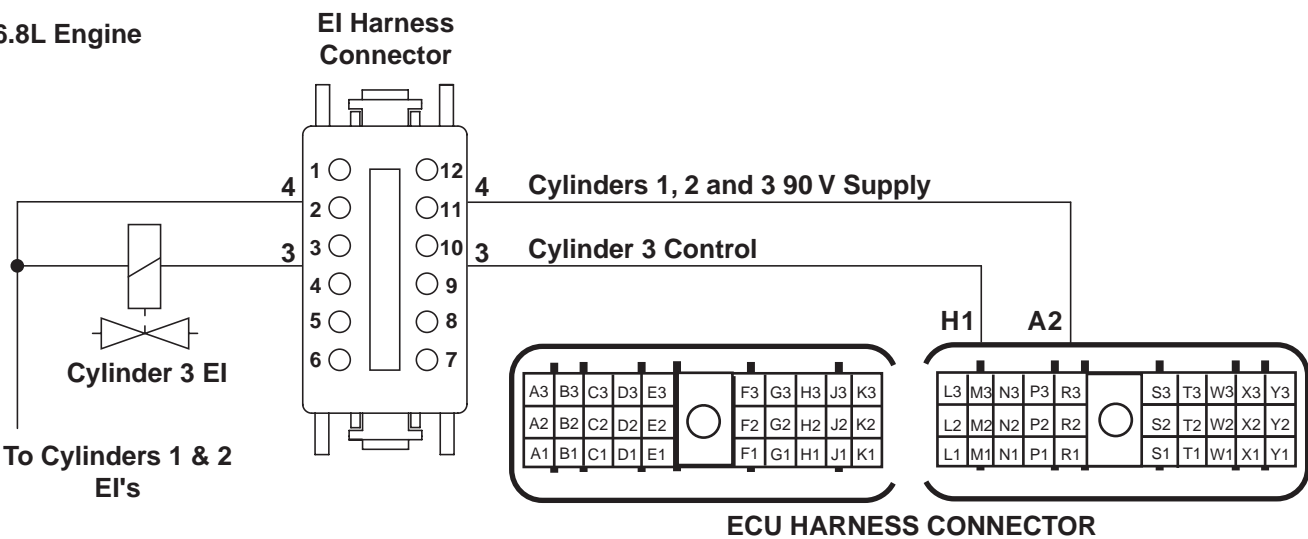
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### 000653.06 — Cylinder #3 EI Circuit Shorted

#### 4.5L Engine



#### 6.8L Engine



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the

high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.



*Trouble Code Diagnostics and Tests*

**DTC 000653.06 will set if:**

- The ECU detects a short in the Cylinder #3 EI circuit.

**If DTC 000653.06 sets, the following will occur:**

- Cylinder #3 EI will not fire.

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**000653.06 — Cylinder #3 EI Circuit Shorted**

The ECU detects a short in the Cylinder #3 EI circuit.

RG40854,000007A -19-01MAY02-1/1

**000653.06 Cylinder #3 EI Circuit Shorted Diagnostic Procedure**

**IMPORTANT:** If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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**① 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 EI CIRCUIT SHORTED supporting information.

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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**② Intermittent Fault Test**

*NOTE:* For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EI 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running
6. Read DTCs using DST or SERVICE ADVISOR™.

**000653.06 reoccurs:**  
GO TO ③

**000653.06 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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*Trouble Code Diagnostics and Tests*

<p><b>3 Engine Displacement Check</b></p>	<p>What is the displacement of engine?</p>	<p><b>4.5L Engine: GO TO 4</b> <b>6.8L Engine: GO TO 5</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>4 4.5L Engines - Short in EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EI CIRCUIT SHORTED supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <p>2. Disconnect EI wiring harness connector at side of cylinder head.</p> <p>3. Disconnect both ECU connectors.</p> <p>4. Using a multimeter, measure resistance between terminal 11 in the harness end of EI wiring connector and the following:</p> <ul style="list-style-type: none"> <li>• Terminal 4 in the harness end of the EI wiring harness connector.</li> <li>• Terminal 9 in the harness end of the EI wiring harness connector.</li> </ul>	<p><b>Both measurements greater than 20000 ohms: GO TO 6</b></p> <p><b>Either measurement less than 20000 ohms: Short in ECU wiring harness.</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>5 6.8L Engines - Short in EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EI CIRCUIT SHORTED supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <p>2. Disconnect EI wiring harness connector at side of cylinder head.</p> <p>3. Disconnect both ECU connectors.</p> <p>4. Using a multimeter, measure resistance between terminal 3 in the harness end of EI wiring connector and the following:</p> <ul style="list-style-type: none"> <li>• Terminal 4 in the harness end of the EI wiring harness connector.</li> <li>• Terminal 9 in the harness end of the EI wiring harness connector.</li> </ul>	<p><b>Both measurements greater than 20000 ohms: GO TO 6</b></p> <p><b>Either measurement less than 20000 ohms: Short in ECU wiring harness.</b></p> <p style="text-align: right;">-- -1/1</p>

04  
160  
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## Trouble Code Diagnostics and Tests

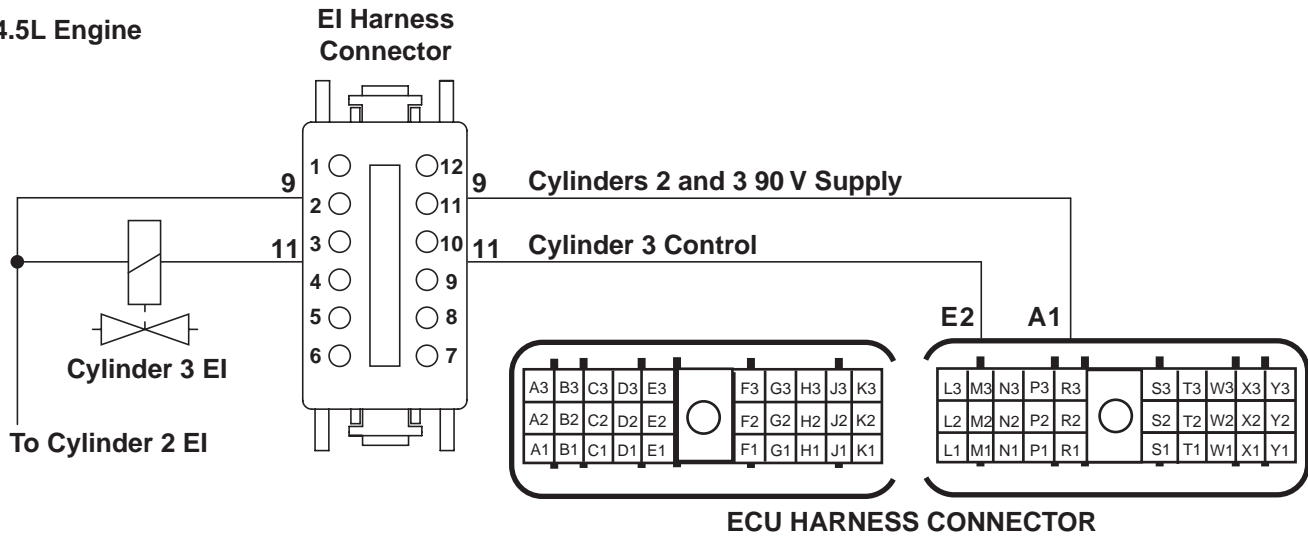
<p><b>6 Cylinder 3 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove rocker arm cover.</li> <li>2. Disconnect electrical connections to cylinder 3 EI and a known good EI.</li> <li>3. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• The two terminals on cylinder 3 EI.</li> <li>• The two terminals on the known good EI.</li> </ul> </li> <li>4. Compare the measurements between the two EIs.</li> </ol> <p><i>NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO <b>7</b></p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 3 EI solenoid.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>7 EI Wiring Harness in Cylinder Head Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.06 CYLINDER #3 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Keep cylinder 3 EI wires disconnected from EI.</li> <li>3. Keep EI wiring harness connector at side of cylinder head disconnected.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Both of the cylinder 3 EI harness eyelets.</li> </ul> </li> </ol>	<p><b>Greater than 20000 ohms:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Less than 20000 ohms:</b> Faulty EI wiring harness.</p> <p style="text-align: right;">-- -1/1</p>

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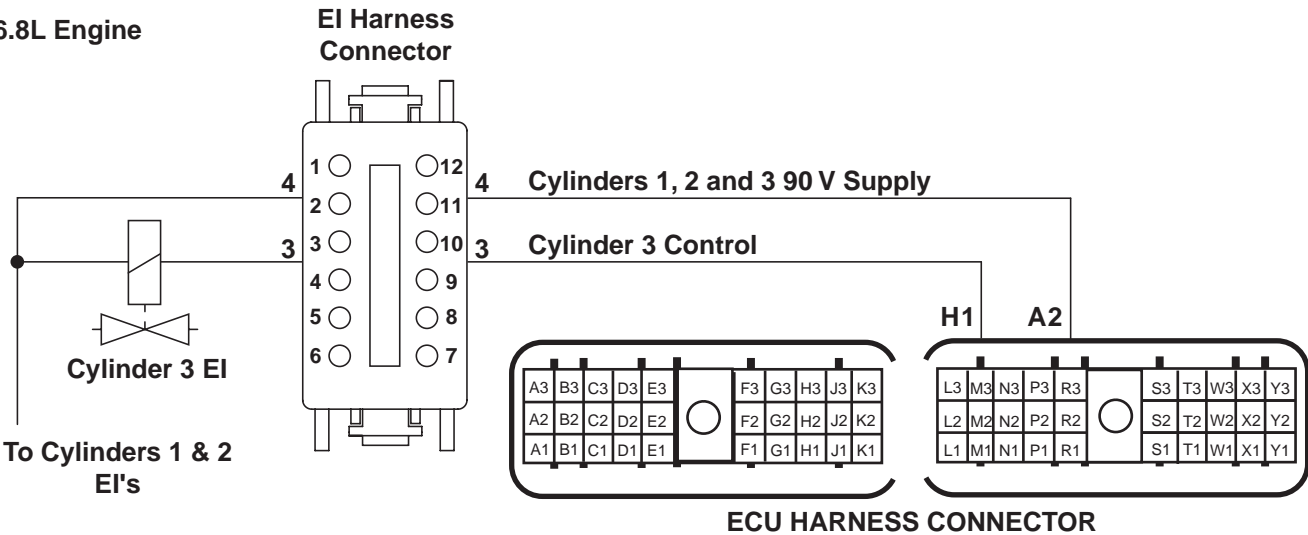
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000653.07 — Cylinder #3 EI Mechanical Failure

4.5L Engine



6.8L Engine



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**EI (Electronic Injector)**

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the

high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

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RG40854,000007B -19-01MAY02-1/2

RG12330 -19-23MAY02

RG12329 -19-23MAY02

04  
160  
,314

*Trouble Code Diagnostics and Tests*

**DTC 000653.07 will set if:**

- The fuel rail pressure does not drop at the injection of fuel to EI #3.

**If DTC 000653.07 sets, the following will occur:**

- Engine will miss at EI #3.

RG40854,000007B -19-01MAY02-2/2

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160  
,315

**000653.07 — Cylinder #3 EI Mechanical Failure**

The fuel rail pressure does not drop at the injection of fuel to EI #3.

RG40854.000015F -19-23JUL02-1/1

**000653.07 Cylinder #3 EI Mechanical Failure Diagnostic Procedure**

--1/1

**① 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 000653.07 CYLINDER #3 EI MECHANICAL FAILURE supporting information.*

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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**② EI Wiring Harness Check**

*NOTE: For wiring and theory of operation information, see DTC 000653.07 CYLINDER #3 EI MECHANICAL FAILURE supporting information.*

1. Ignition OFF



**CAUTION: Possible strong electrical shock hazard if engine is cranking or running.**

2. Remove rocker arm cover with vent tube.

3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification.

**Specification**

Injector Solenoid Wire Retaining Nut—

Torque ..... 2 N•m (1.5 lb-ft) (18 lb-in.)

4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM 104.

**All retaining nut torques at specification:**  
GO TO ③

**Retaining nut(s) loose:**  
Tight retaining nut(s) to specification and retest.

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316



*Trouble Code Diagnostics and Tests*

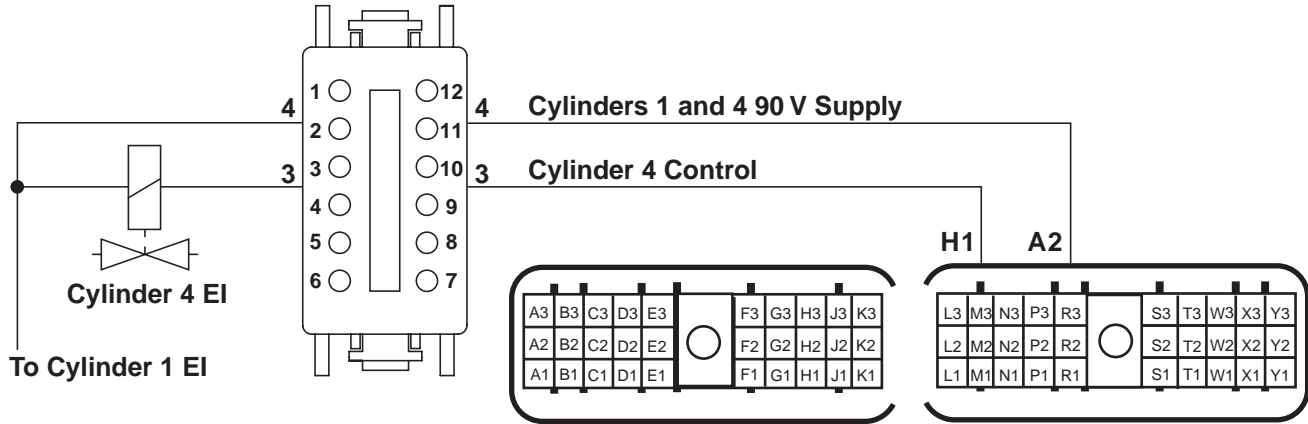
<p><b>③ EI Fuel Line Restriction Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.07 CYLINDER #3 EI MECHANICAL FAILURE supporting information.</i></p> <p>Check fuel lines for restrictions between High Pressure Common Rail (HPCR) and the fuel inlet at EI #3.</p>	<p><b>No restrictions found:</b> GO TO <b>④</b></p> <p><b>Restrictions found:</b> Repair or replace fuel line and retest</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Flow Limiter Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.07 CYLINDER #3 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition ON, engine running under condition that sets code.</li> <li>Using the ECU diagnostic software, verify that DTC 000653.07 is an ACTIVE code.</li> <li>Listen to flow limiter that corresponds to EI #3 while turning ignition OFF.</li> </ol> <p><i>NOTE: It is very difficult to distinguish the difference between EI #3 and the other flow limiters clicking. Make sure EI #3 makes the click. It will take 5-10 seconds for the ball to reset.</i></p>	<p><b>Flow damper clicks:</b> GO TO <b>⑤</b></p> <p><b>Flow damper does not click:</b> Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Side Feed Tube Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000653.07 CYLINDER #3 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect the high pressure fuel delivery line for EI #3. Remove the side feed tube retaining nut from the cylinder head.</li> <li>Using a 1/2" hose grip pliers, remove the side feed tube from the cylinder head.</li> <li>Inspect the side feed tube for nicks, burrs, or other damage.</li> <li>Inspect side feed tube o-ring for damage.</li> <li>When inspection is completed, reinstall inspected or install side feed tube and tighten side feed tube retaining nut to specification.</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft)</p> <ol style="list-style-type: none"> <li>Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification:</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft)</p>	<p><b>Side feed tube and o-ring inspection passes:</b> Faulty EI OR Faulty ECU</p> <p><b>Side feed tube and o-ring inspection fails:</b> Replace side feed tube and retest.</p> <p style="text-align: right;">-- -1/1</p>

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317

**000654.05 — Cylinder #4 EI Circuit Open**

4.5L Engine

EI Harness Connector



**ECU HARNESS CONNECTOR**

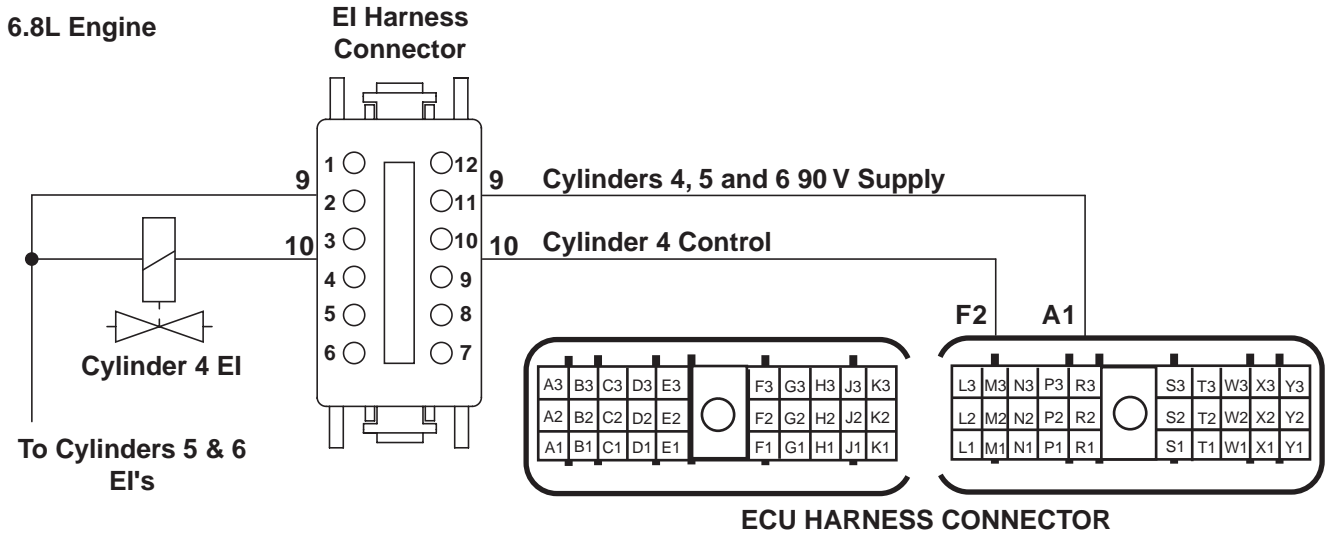
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RG40854,000007D -19-01MAY02-1/2

RG12332 -19-23MAY02

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160  
318

6.8L Engine



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**EI (Electronic Injector)**

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

**DTC 000654.05 will set if:**

- The ECU detects an open in the Cylinder #4 EI circuit.

**If DTC 000654.05 sets, the following will occur:**

- Cylinder #4 EI will not fire.

RG12331 -19-23MAY02

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319

**000654.05 — Cylinder #4 EI Circuit Open**

RG40854,0000083 -19-01MAY02-1/1

**000654.05 Cylinder #4 EI Circuit Open Diagnostic Procedure**

**IMPORTANT: If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.**

--1/1

**1 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 EI CIRCUIT OPEN supporting information.*

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO 2

**Faulty connection(s):**  
Repair faulty connection(s).

--1/1

**2 Intermittent Fault Test**

*NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EI 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running
6. Read DTCs using DST or SERVICE ADVISOR™.

**000654.05 reoccurs:**  
GO TO 3

**000654.05 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

*SERVICE ADVISOR is a trademark of Deere & Company*

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**3 Engine Displacement Check**

What is the displacement of engine?



**4.5L Engine: GO TO 4**

**6.8L Engine: GO TO 5**

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04  
160  
320

## Trouble Code Diagnostics and Tests

<p><b>④ 4.5L Engines - Open Wire in 90V Supply or EI Control Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> </ol> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <ol style="list-style-type: none"> <li>2. Disconnect EI wiring harness connector at side of cylinder head.</li> <li>3. Disconnect both ECU connectors.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal 3 in the harness end of the injector wiring harness connector and terminal H1 in the harness end of ECU connector.</li> <li>• Terminal 4 in the harness end of the injector wiring harness connector and terminal A2 in the harness end of the ECU connector.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less: GO TO ⑥</b></p> <p><b>Measurement between terminals 3 and H1 greater than 5 ohms:</b> Open in wire between terminal 3 and H1.</p> <p><b>Measurement between terminals 4 and A2 greater than 5 ohms:</b> Open in wire between terminal 4 and A2.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ 6.8L Engines - Open Wire in 90V Supply or EI Control Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> </ol> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <ol style="list-style-type: none"> <li>2. Disconnect EI wiring harness connector at side of cylinder head.</li> <li>3. Disconnect both ECU connectors.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal 10 in the harness end of the injector wiring harness connector and terminal F2 in the harness end of ECU connector.</li> <li>• Terminal 9 in the harness end of the injector wiring harness connector and terminal A1 in the harness end of the ECU connector.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less: GO TO ⑥</b></p> <p><b>Measurement between terminals 10 and F2 greater than 5 ohms:</b> Open in wire between terminal 10 and F2.</p> <p><b>Measurement between terminals 9 and A1 greater than 5 ohms:</b> Open in wire between terminal 9 and A1.</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
321

## Trouble Code Diagnostics and Tests

<p><b>6 Cylinder 4 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove rocker arm cover.</li> <li>2. Disconnect electrical connections to cylinder 4 EI and a known good EI.</li> <li>3. Using a multimeter measure resistance between: <ul style="list-style-type: none"> <li>• The two terminals on cylinder 4 EI.</li> <li>• The two terminals on the known good EI.</li> </ul> </li> <li>4. Compare the measurement between the two EIs.</li> </ol> <p><i>NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO <b>7</b></p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 4 EI solenoid.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>7 EI Harness in Cylinder Head Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.05 CYLINDER #4 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Cylinder 4 EI wires still disconnected from EI.</li> <li>3. Disconnect EI wiring harness connector from side of cylinder head.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• One of the cylinder 4 EI harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head.</li> <li>• The other cylinder 4 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.</li> </ul> </li> </ol>	<p><b>Both measurements 2.0 ohms or less:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Either measurements greater than 2.0 ohms:</b> Faulty EI harness in head.</p> <p style="text-align: right;">-- -1/1</p>

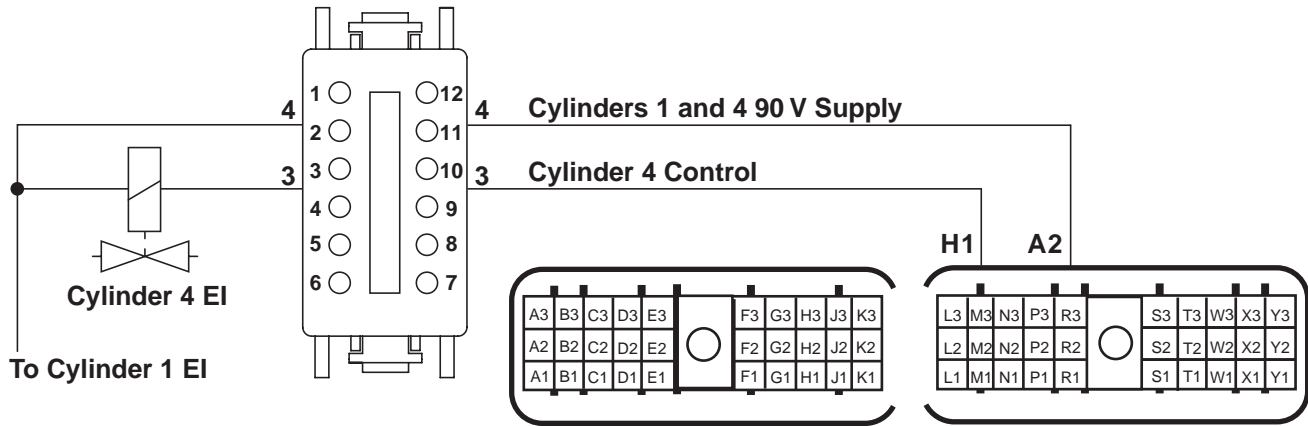
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160  
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**000654.06 — Cylinder #4 EI Circuit Shorted**

4.5L Engine

EI Harness Connector



04  
160  
,324

RG12332 -19-23MAY02

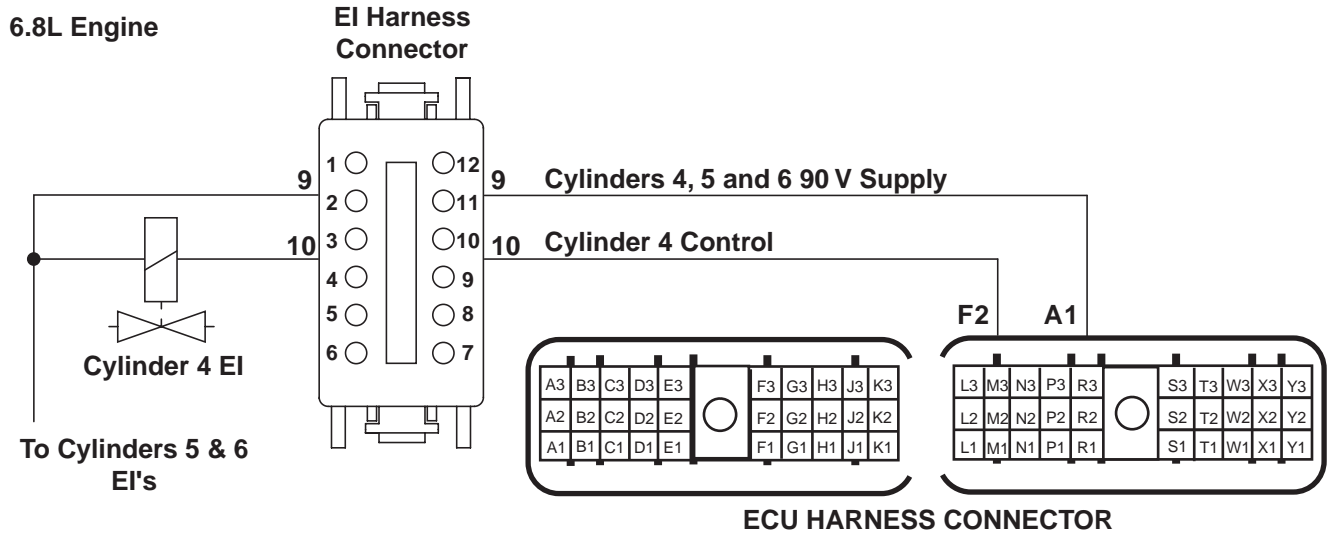
**ECU HARNESS CONNECTOR**

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RG40854,0000080 -19-01MAY02-1/2



6.8L Engine



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**EI (Electronic Injector)**

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

**DTC 000654.06 will set if:**

- The ECU detects a short in the Cylinder #4 EI circuit.

**If DTC 000654.06 sets, the following will occur:**

- Cylinder #4 EI will not fire.

RG12331 -19-23MAY02

04  
160  
325

RG40854,0000080 -19-01MAY02-2/2

**000654.06 — Cylinder #4 EI Circuit Shorted**

The ECU detects a short in the Cylinder #4 EI circuit.

RG40854.0000082 -19-01MAY02-1/1

**000654.06 Cylinder #4 EI Circuit Shorted Diagnostic Procedure**

**IMPORTANT:** If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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**① 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 EI CIRCUIT SHORTED supporting information.

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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**② Intermittent Fault Test**

*NOTE:* For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EI 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 the ECU diagnostic software
4. Make note of any DTCs, then clear all DTCs.
5. Ignition ON, engine running
6. Read DTCs using DST or SERVICE ADVISOR™.

**000654.06 reoccurs:**  
GO TO ③

**000654.06 does not reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

04  
160  
,326

*Trouble Code Diagnostics and Tests*

<p><b>3 Engine Displacement Check</b></p>	<p>What is the displacement of engine?</p>	<p><b>4.5L Engine: GO TO 4</b> <b>6.8L Engine: GO TO 5</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>4 4.5L Engines - Short in EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EI CIRCUIT SHORTED supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <p>2. Disconnect EI wiring harness connector at side of cylinder head.</p> <p>3. Disconnect both ECU connectors.</p> <p>4. Using a multimeter, measure resistance between terminal 3 in the harness end of EI wiring connector and the following:</p> <ul style="list-style-type: none"> <li>• Terminal 4 in the harness end of the EI wiring harness connector.</li> <li>• Terminal 9 in the harness end of the EI wiring harness connector.</li> </ul>	<p><b>Both measurements greater than 20000 ohms: GO TO 6</b></p> <p><b>Either measurement less than 20000 ohms: Short in ECU wiring harness.</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>5 6.8L Engines - Short in EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EI CIRCUIT SHORTED supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <p>2. Disconnect EI wiring harness connector at side of cylinder head.</p> <p>3. Disconnect both ECU connectors.</p> <p>4. Using a multimeter, measure resistance between terminal 3 in the harness end of EI wiring connector and the following:</p> <ul style="list-style-type: none"> <li>• Terminal 4 in the harness end of the EI wiring harness connector.</li> <li>• Terminal 9 in the harness end of the EI wiring harness connector.</li> </ul>	<p><b>Both measurements greater than 20000 ohms: GO TO 6</b></p> <p><b>Either measurement less than 20000 ohms: Short in ECU wiring harness.</b></p> <p style="text-align: right;">-- -1/1</p>

04  
160  
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## Trouble Code Diagnostics and Tests

<p><b>6 Cylinder 4 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove rocker arm cover.</li> <li>2. Disconnect electrical connections to cylinder 4 EI and a known good EI.</li> <li>3. Using a multimeter, measure resistance between:             <ul style="list-style-type: none"> <li>• The two terminals on cylinder 4 EI.</li> <li>• The two terminals on the known good EI.</li> </ul> </li> <li>4. Compare the measurements between the two EIs.</li> </ol> <p><i>NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO <b>7</b></p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 4 EI solenoid.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>7 EI Wiring Harness in Cylinder Head Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.06 CYLINDER #4 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Keep cylinder 4 EI wires disconnected from EI.</li> <li>3. Keep EI wiring harness connector at side of cylinder head disconnected.</li> <li>4. Using a multimeter, measure resistance between:             <ul style="list-style-type: none"> <li>• Both of the cylinder 4 EI harness eyelets.</li> </ul> </li> </ol>	<p><b>Greater than 20000 ohms:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Less than 20000 ohms:</b> Faulty EI wiring harness.</p> <p style="text-align: right;">-- -1/1</p>

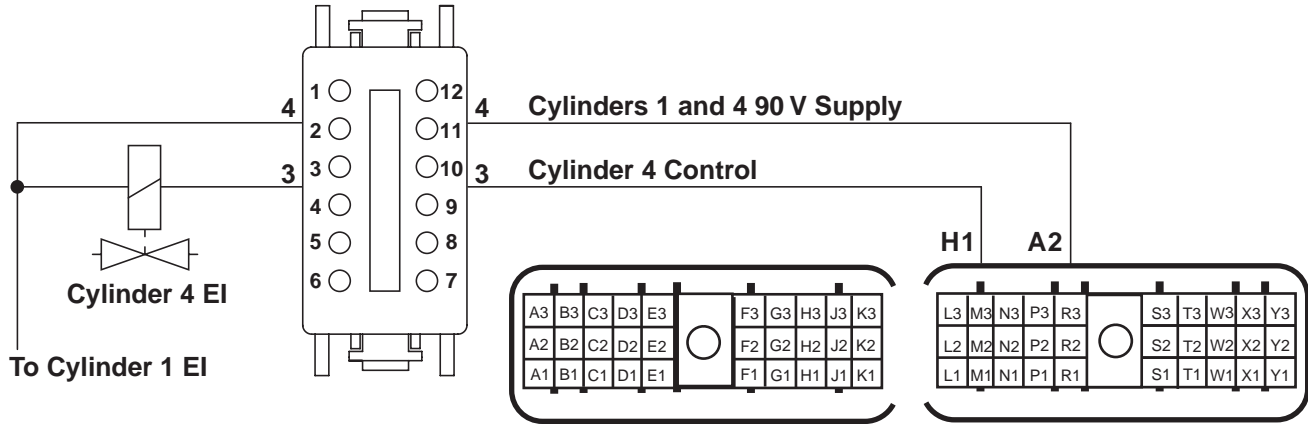
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**000654.07 — Cylinder #4 EI Mechanical Failure**

4.5L Engine

EI Harness Connector



RG12332 -19-23MAY02

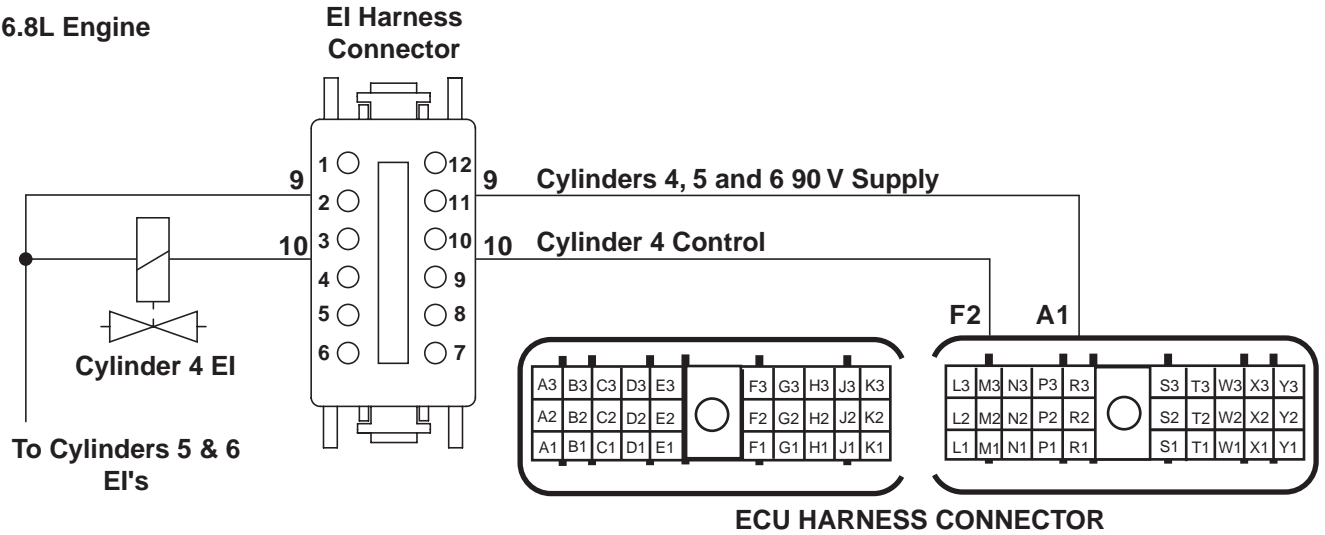
**ECU HARNESS CONNECTOR**

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6.8L Engine



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**EI (Electronic Injector)**

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

**DTC 000654.07 will set if:**

- The fuel rail pressure does drop at the injection of fuel to EI #4.

**If DTC 000654.07 sets, the following will occur:**

- Engine will miss at EI #4.

RG12331 -19-23MAY02

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**000654.07 — Cylinder #4 EI Mechanical Failure**

The fuel rail pressure does drop at the injection of fuel to EI #4.

RG40854.0000160 -19-23JUL02-1/1

**000654.07 Cylinder #4 EI Mechanical Failure Diagnostic Procedure**

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**① 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 000654.07 CYLINDER #4 EI MECHANICAL FAILURE supporting information.*

Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

**No faulty connection(s):**  
GO TO ②

**Faulty connection(s):**  
Repair faulty connection(s).

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**② EI Wiring Harness Check**

*NOTE: For wiring and theory of operation information, see DTC 000654.07 CYLINDER #4 EI MECHANICAL FAILURE supporting information.*

1. Ignition OFF



**CAUTION: Possible strong electrical shock hazard if engine is cranking or running.**

2. Remove rocker arm cover with vent tube.

3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification.

**Specification**

Injector Solenoid Wire Retaining Nut—

Torque ..... 2 N•m (1.5 lb-ft) (18 lb-in.)

4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM 104.

**All retaining nut torques at specification:**  
GO TO ③

**Retaining nut(s) loose:**  
Tight retaining nut(s) to specification and retest.

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*Trouble Code Diagnostics and Tests*

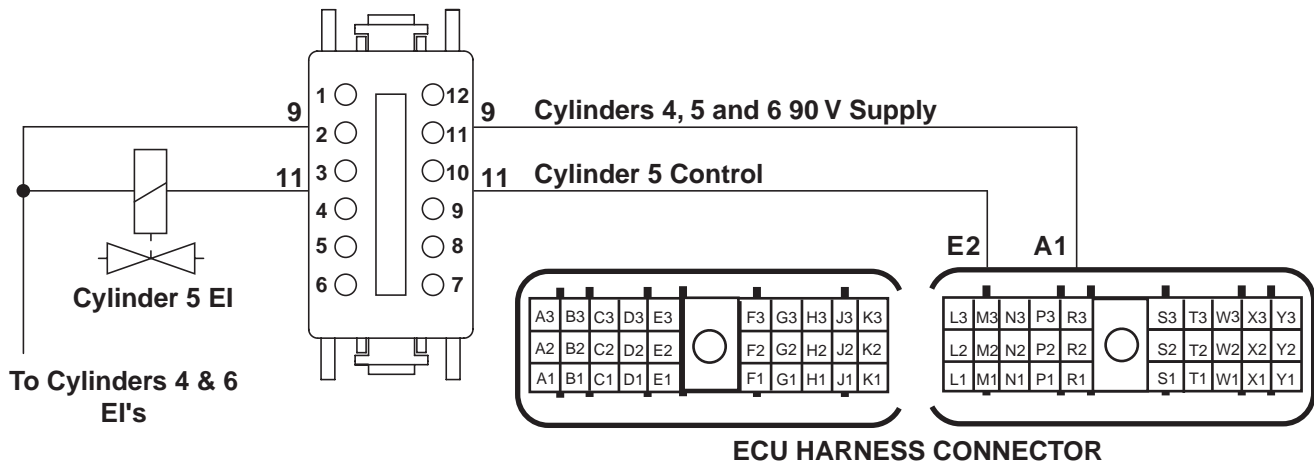
<p><b>③ EI Fuel Line Restriction Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.07 CYLINDER #4 EI MECHANICAL FAILURE supporting information.</i></p> <p>Check fuel lines for restrictions between High Pressure Common Rail (HPCR) and the fuel inlet at EI #4.</p>	<p><b>No restrictions found:</b> GO TO <b>④</b></p> <p><b>Restrictions found:</b> Repair or replace fuel line and retest</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Flow Limiter Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.07 CYLINDER #4 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition ON, engine running under condition that sets code.</li> <li>Using the ECU diagnostic software, verify that DTC 000654.07 is an ACTIVE code.</li> <li>Listen to flow limiter that corresponds to EI #4 while turning ignition OFF.</li> </ol> <p><i>NOTE: It is very difficult to distinguish the difference between EI #4 and the other flow limiters clicking. Make sure EI #4 makes the click. It will take 5-10 seconds for the ball to reset.</i></p>	<p><b>Flow damper clicks:</b> GO TO <b>⑤</b></p> <p><b>Flow damper does not click:</b> Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Side Feed Tube Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000654.07 CYLINDER #4 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Disconnect the high pressure fuel delivery line for EI #4. Remove the side feed tube retaining nut from the cylinder head.</li> <li>Using a 1/2" hose grip pliers, remove the side feed tube from the cylinder head.</li> <li>Inspect the side feed tube for nicks, burrs, or other damage.</li> <li>Inspect side feed tube o-ring for damage.</li> <li>When inspection is completed, reinstall inspected or install side feed tube and tighten side feed tube retaining nut to specification.</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft)</p> <ol style="list-style-type: none"> <li>Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification:</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft)</p>	<p><b>Side feed tube and o-ring inspection passes:</b> Faulty EI OR Faulty ECU</p> <p><b>Side feed tube and o-ring inspection fails:</b> Replace side feed tube and retest.</p> <p style="text-align: right;">-- -1/1</p>

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## 000655.05 — Cylinder #5 EI Circuit Open

6.8L Engine

EI Harness Connector



RG12333 -19-23MAY02

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in their cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

### DTC 000655.05 will set if:

- The ECU detects an open in the Cylinder #5 EI circuit.

### If DTC 000655.05 sets, the following will occur:

- Cylinder #5 EI will not fire.

RG40854,0000087 -19-01MAY02-1/1

## 000655.05 — Cylinder #5 EI Circuit Open

The ECU detects an open in the Cylinder #5 EI circuit.

RG40854,0000088 -19-01MAY02-1/1

### 000655.05 Cylinder #5 EI Circuit Open Diagnostic Procedure

**IMPORTANT:** If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EI CIRCUIT OPEN supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000655.05 reoccurs:</b> GO TO <b>③</b></p> <p><b>000655.05 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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Trouble Code Diagnostics and Tests

<p><b>③ Open Wire in 90V Supply or EI Control Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> </ol> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <ol style="list-style-type: none"> <li>2. Disconnect EI wiring harness connector at side of cylinder head.</li> <li>3. Disconnect both 30-way ECU connectors.</li> <li>4. Using a multimeter, measure resistance between:             <ul style="list-style-type: none"> <li>• Terminal 11 in the harness end of the injector wiring harness connector and terminal E2 in the harness end of ECU connector.</li> <li>• Terminal 9 in the harness end of the injector wiring harness connector and terminal A1 in the harness end of the ECU connector.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less:</b> GO TO ④</p> <p><b>Measurement between terminals 11 and E2 greater than 5 ohms:</b> Open in wire between terminal 11 and E2.</p> <p><b>Measurement between terminals 9 and A1 greater than 5 ohms:</b> Open in wire between terminal 9 and A1.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Cylinder 5 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove rocker arm cover.</li> <li>2. Disconnect electrical connections to cylinder 5 EI and a known good EI.</li> <li>3. Using a multimeter measure resistance between:             <ul style="list-style-type: none"> <li>• The two terminals on cylinder 5 EI.</li> <li>• The two terminals on the known good EI.</li> </ul> </li> <li>4. Compare the measurement between the two EIs.</li> </ol> <p><i>NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO ⑤</p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 5 EI solenoid.</p> <p style="text-align: right;">-- -1/1</p>

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Trouble Code Diagnostics and Tests

<p><b>5</b> EI Harness in Cylinder Head Test</p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.05 CYLINDER #5 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"><li>1. Ignition OFF</li><li>2. Cylinder 5 EI wires still disconnected from EI.</li><li>3. Disconnect EI wiring harness connector from side of cylinder head.</li><li>4. Using a multimeter, measure resistance between:<ul style="list-style-type: none"><li>• One of the cylinder 5 EI harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head</li><li>• The other cylinder 5 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.</li></ul></li></ol>	<p><b>Both measurements 2.0 ohms or less:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Either measurements greater than 2.0 ohms:</b> Faulty EI harness in head.</p>
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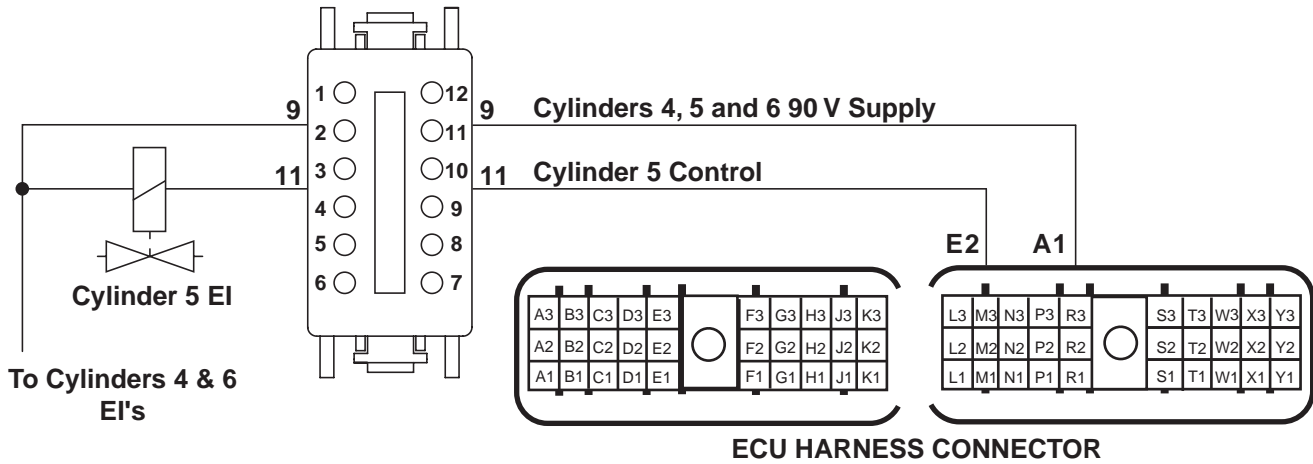
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### 000655.06 — Cylinder #5 EI Circuit Shorted

6.8L Engine

EI Harness Connector



RG12333 -19-23MAY02

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in their cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

#### DTC 000655.06 will set if:

- The ECU detects an open in the Cylinder #5 EI circuit.

#### If DTC 000655.06 sets, the following will occur:

- Cylinder #5 EI will not fire.

RG40854,0000089 -19-01MAY02-1/1

## 000655.06 — Cylinder #5 EI Circuit Shorted

The ECU detects an open in the Cylinder #5 EI circuit.

RG40854,000008A -19-01MAY02-1/1

### 000655.06 Cylinder #5 EI Circuit Shorted Diagnostic Procedure

**IMPORTANT:** If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

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<p><b>1</b> Connection Check</p>	<p><b>IMPORTANT:</b> 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.</p> <p><i>NOTE:</i> For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EI CIRCUIT SHORTED supporting information.</p> <p>Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2</b> Intermittent Fault Test</p>	<p><i>NOTE:</i> For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EI CIRCUIT SHORTED supporting information.</p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000655.06 reoccurs:</b> GO TO <b>3</b></p> <p><b>000655.06 does not reoccur:</b> Problem is intermittent. If no other codes are present, see earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

<p><b>③ Short in EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> </ol> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <ol style="list-style-type: none"> <li>2. Disconnect EI wiring harness connector at side of cylinder head.</li> <li>3. Disconnect both ECU connectors.</li> <li>4. Using a multimeter, measure resistance between terminal 11 in the harness end of EI wiring connector and the following: <ul style="list-style-type: none"> <li>• Terminal 4 in the harness end of the EI wiring harness connector.</li> <li>• Terminal 9 in the harness end of the EI wiring harness connector.</li> </ul> </li> </ol>	<p><b>Both measurements greater than 20000 ohms:</b> GO TO ④</p> <p><b>Either measurement less than 20000 ohms:</b> Short in ECU wiring harness.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Cylinder 5 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove rocker arm cover.</li> <li>2. Disconnect electrical connections to cylinder 5 EI and a known good EI.</li> <li>3. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• The two terminals on cylinder 5 EI.</li> <li>• The two terminals on the known good EI.</li> </ul> </li> <li>4. Compare the measurements between the two EIs.</li> </ol> <p><i>NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO ⑤</p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 5 injector solenoid.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ EI Wiring Harness in Cylinder Head Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.06 CYLINDER #5 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Keep cylinder 5 EI wires disconnected from EI.</li> <li>3. Keep EI wiring harness connector at side of cylinder head disconnected.</li> <li>4. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Both of the cylinder 5 EI harness eyelet's.</li> </ul> </li> </ol>	<p><b>Greater than 20000 ohms:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Less than 20000 ohms:</b> Faulty EI wiring harness.</p> <p style="text-align: right;">-- -1/1</p>

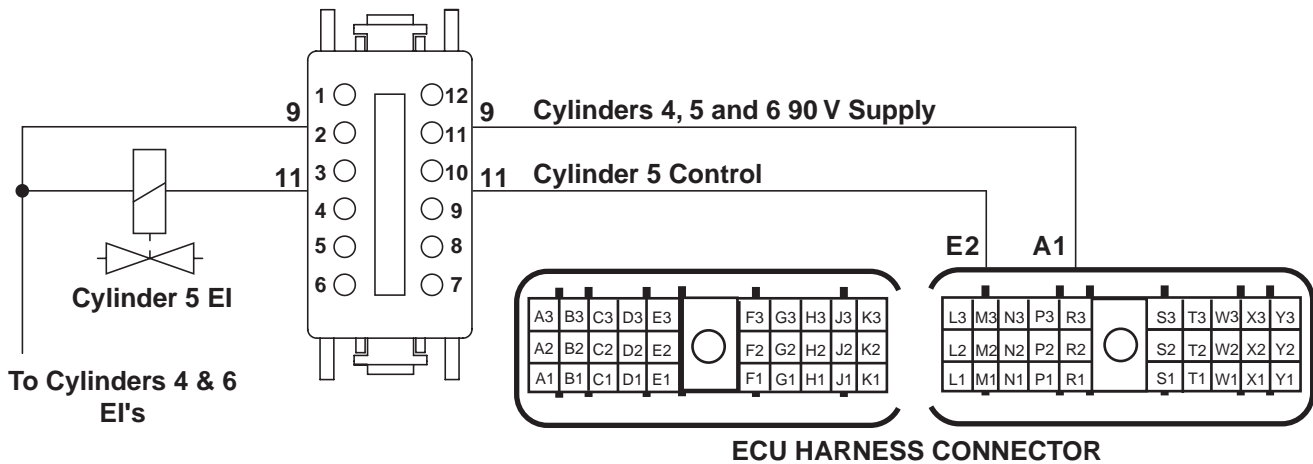


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### 000655.07 — Cylinder #5 EI Mechanical Failure

6.8L Engine

EI Harness Connector



RG12333 -19-23MAY02

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in their cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

#### DTC 000655.07 will set if:

- The fuel rail pressure does not drop at the injection of fuel to EI #5.

#### If DTC 000655.07 sets, the following will occur:

- Engine will miss at EI #5.

RG40854,000008B -19-01MAY02-1/1

## 000655.07 — Cylinder #5 EI Mechanical Failure


The fuel rail pressure does not drop at the injection of fuel to EI #5.

RG40854.0000161 -19-23JUL02-1/1

### 000655.07 Cylinder #5 EI Mechanical Failure Diagnostic Procedure

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<p><b>1</b> Connection Check</p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI MECHANICAL FAILURE supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p> <p>-- -1/1</p>
<p><b>2</b> EI Wiring Harness Check</p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI MECHANICAL FAILURE supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electrical shock hazard if engine is cranking or running.</b></p> <p>2. Remove rocker arm cover with vent tube.</p> <p>3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification.</p> <p style="text-align: center;"><b>Specification</b></p> <p>Injector Solenoid Wire Retaining Nut— Torque ..... 2 N•m (1.5 lb-ft) (18 lb-in.)</p> <p>4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM 104.</p>	<p><b>All retaining nut torques at specification:</b> GO TO <b>3</b></p> <p><b>Retaining nut(s) loose:</b> Tight retaining nut(s) to specification and retest.</p> <p>-- -1/1</p>

*Trouble Code Diagnostics and Tests*

<p><b>③ EI Fuel Line Restriction Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI MECHANICAL FAILURE supporting information.</i></p> <p>Check fuel lines for restrictions between High Pressure Common Rail (HPCR) and the fuel inlet at EI #5.</p>	<p><b>No restrictions found:</b> GO TO <b>④</b></p> <p><b>Restrictions found:</b> Repair or replace fuel line and retest</p> <p style="text-align: right;">-- -1/1</p>
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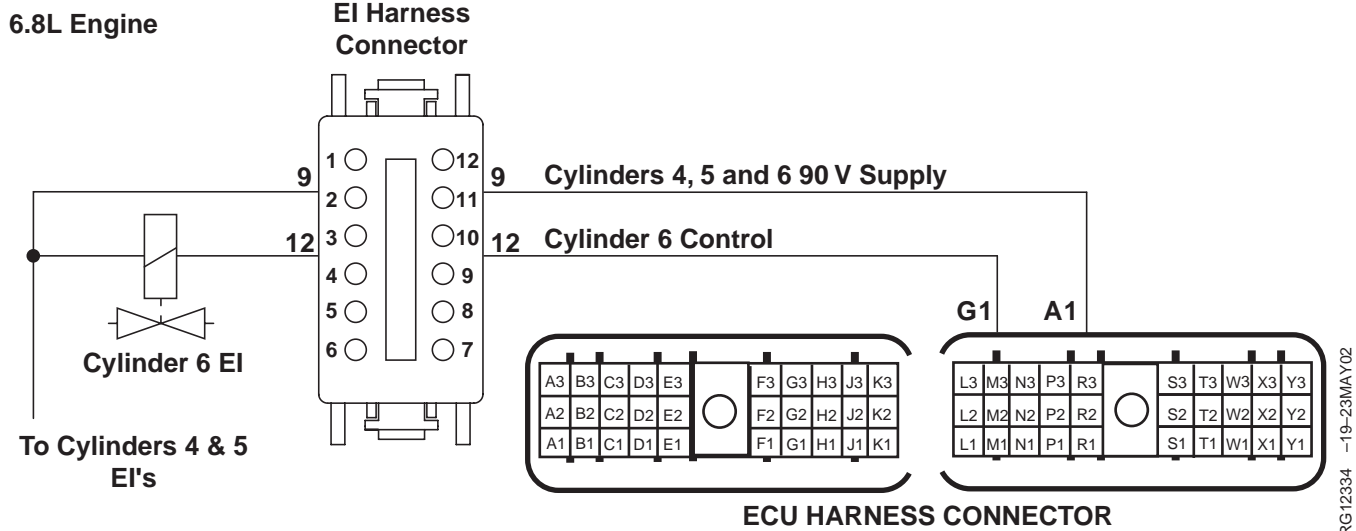
<p><b>④ Flow Limiter Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine running under condition that sets code.</li> <li>2. Using the ECU diagnostic software, verify that DTC 000655.07 is an ACTIVE code.</li> <li>3. Listen to flow limiter that corresponds to EI #5 while turning ignition OFF.</li> </ol> <p><i>NOTE: It is very difficult to distinguish the difference between EI #5 and the other flow limiters clicking. Make sure EI #5 makes the click. It will take 5-10 seconds for the ball to reseat.</i></p>	<p><b>Flow damper clicks:</b> GO TO <b>⑤</b></p> <p><b>Flow damper does not click:</b> Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual.</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>⑤ Side Feed Tube Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000655.07 CYLINDER #5 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect the high pressure fuel delivery line for EI #5. Remove the side feed tube retaining nut from the cylinder head.</li> <li>3. Using a 1/2" hose grip pliers, remove the side feed tube from the cylinder head.</li> <li>4. Inspect the side feed tube for nicks, burrs, or other damage.</li> <li>5. Inspect side feed tube o-ring for damage.</li> <li>6. When inspection is completed, reinstall inspected or install side feed tube and tighten side feed tube retaining nut to specification.</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft)</p> <ol style="list-style-type: none"> <li>7. Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification:</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft)</p>	<p><b>Side feed tube and o-ring inspection passes:</b> Faulty EI OR Faulty ECU</p> <p><b>Side feed tube and o-ring inspection fails:</b> Replace side feed tube and retest.</p> <p style="text-align: right;">-- -1/1</p>
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## 000656.05 — Cylinder #6 EI Circuit Open



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in their cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

### DTC 000656.05 will set if:

- The ECU detects an open in the Cylinder #6 EI circuit.

### If DTC 000656.05 sets, the following will occur:

- Cylinder #6 EI will not fire.

RG40854.000008D -19-01MAY02-1/1

## 000656.05 — Cylinder #6 EI Circuit Open

The ECU detects an open in the Cylinder #6 EI circuit.

RG40854,000008E -19-01MAY02-1/1

### 000656.05 Cylinder #6 EI Circuit Open Diagnostic Procedure

**IMPORTANT:** If DTCs 000611.03, 000611.04, or 000627.01 are active, repair those DTCs first.

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<p><b>1</b> Connection Check</p>	<p><b>IMPORTANT:</b> 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.</p> <p><i>NOTE:</i> For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EI CIRCUIT OPEN supporting information.</p> <p>Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2</b> Intermittent Fault Test</p>	<p><i>NOTE:</i> For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EI CIRCUIT OPEN supporting information.</p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000656.05 reoccurs:</b> GO TO <b>3</b></p> <p><b>000656.05 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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Trouble Code Diagnostics and Tests

<p><b>③ Open Wire in 90V Supply or EI Control Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> </ol> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <ol style="list-style-type: none"> <li>2. Disconnect EI wiring harness connector at side of cylinder head.</li> <li>3. Disconnect both ECU connectors.</li> <li>4. Using a multimeter, measure resistance between:             <ul style="list-style-type: none"> <li>• Terminal 12 in the harness end of the injector wiring harness connector and terminal G1 in the harness end of ECU connector.</li> <li>• Terminal 9 in the harness end of the injector wiring harness connector and terminal A1 in the harness end of the ECU connector.</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less:</b> GO TO ④</p> <p><b>Measurement between terminals 12 and G1 greater than 5 ohms:</b> Open in wire between terminal 12 and G1.</p> <p><b>Measurement between terminals 9 and A1 greater than 5 ohms:</b> Open in wire between terminal 9 and A1.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Cylinder 6 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Remove rocker arm cover.</li> <li>2. Disconnect electrical connections to cylinder 6 EI and a known good EI.</li> <li>3. Using a multimeter measure resistance between:             <ul style="list-style-type: none"> <li>• The two terminals on cylinder 6 EI.</li> <li>• The two terminals on the known good EI.</li> </ul> </li> <li>4. Compare the measurement between the two EIs.</li> </ol> <p><i>NOTE: Because EI solenoid resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typically, injector resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO ⑤</p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 6 EI solenoid.</p> <p style="text-align: right;">-- -1/1</p>

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Trouble Code Diagnostics and Tests

<p>5 EI Harness in Cylinder Head Test</p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.05 CYLINDER #6 EI CIRCUIT OPEN supporting information.</i></p> <ol style="list-style-type: none"><li>1. Ignition OFF</li><li>2. Cylinder 6 EI wires still disconnected from EI.</li><li>3. Disconnect EI wiring harness connector from side of cylinder head.</li><li>4. Using a multimeter, measure resistance between:<ul style="list-style-type: none"><li>• One of the cylinder 6 EI harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head</li><li>• The other cylinder 6 EI harness eyelet and the other corresponding terminal at the connector on the side of the cylinder head.</li></ul></li></ol>	<p><b>Both measurements 2.0 ohms or less:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Either measurements greater than 2.0 ohms:</b> Faulty EI harness in head.</p>
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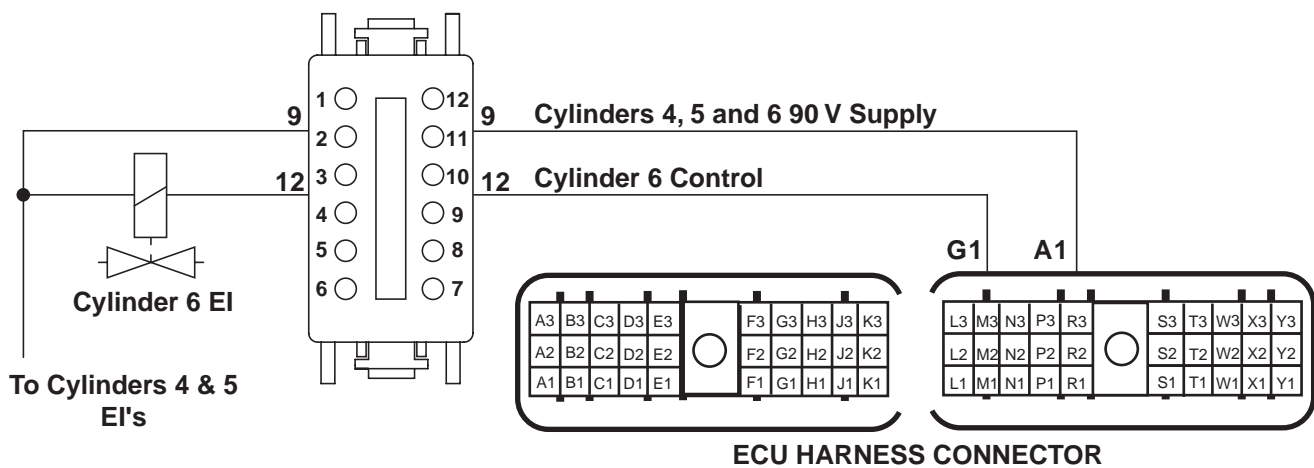
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## 000656.06 — Cylinder #6 EI Circuit Shorted

6.8L Engine

EI Harness Connector



RG12334 -19-23MAY02

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in their cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

### DTC 000656.06 will set if:

- The ECU detects an open in the Cylinder #6 EI circuit.

### If DTC 000656.06 sets, the following will occur:

- Cylinder #6 EI will not fire.

RG40854,000008F -19-01MAY02-1/1

## 000656.06 — Cylinder #6 EI Circuit Shorted

The ECU detects an open in the Cylinder #6 EI circuit.

RG40854,0000090 -19-01MAY02-1/1

### 000656.06 Cylinder #6 EI Circuit Shorted Diagnostic Procedure

**IMPORTANT: If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .**

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EI CIRCUIT SHORTED supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000656.06 reoccurs:</b> GO TO <b>③</b></p> <p><b>000656.06 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

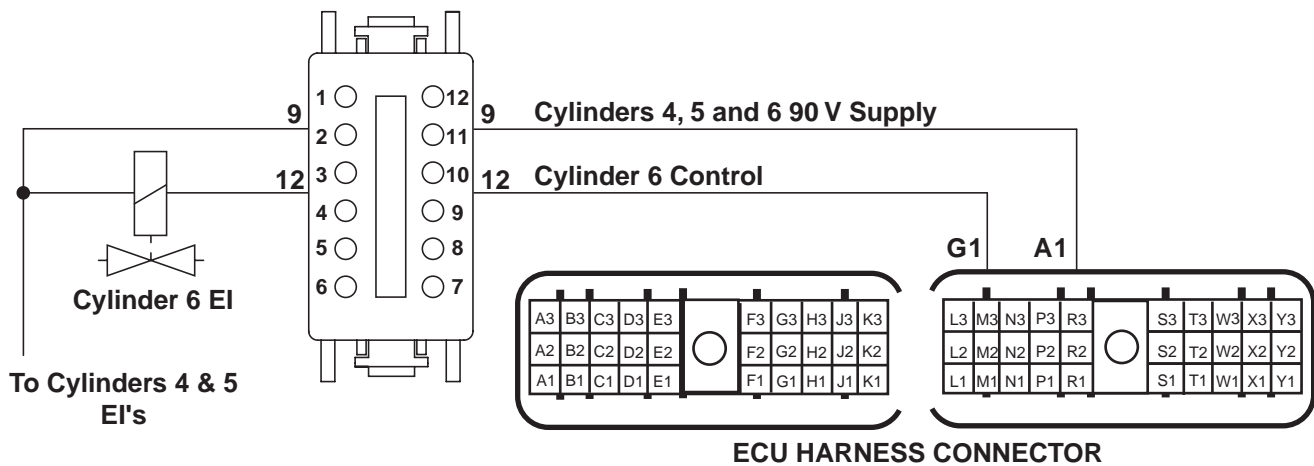
<p><b>③ Short in EI Wiring Harness Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> </ol> <p> <b>CAUTION: Possible strong electric shock hazard if engine is cranking or running!</b></p> <ol style="list-style-type: none"> <li>Disconnect EI wiring harness connector at side of cylinder head.</li> <li>Disconnect both ECU connectors.</li> <li>Using a multimeter, measure resistance between terminal 12 in the harness end of EI wiring connector and the following: <ul style="list-style-type: none"> <li>Terminal 4 in the harness end of the EI wiring harness connector.</li> <li>Terminal 9 in the harness end of the EI wiring harness connector.</li> </ul> </li> </ol>	<p><b>Both measurements greater than 20000 ohms:</b> GO TO ④</p> <p><b>Either measurement less than 20000 ohms:</b> Short in ECU wiring harness.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Cylinder 6 EI Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>Remove rocker arm cover.</li> <li>Disconnect electrical connections to cylinder 6 EI and a known good EI.</li> <li>Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>The two terminals on cylinder 6 EI.</li> <li>The two terminals on the known good EI.</li> </ul> </li> <li>Compare the measurements between the two EIs.</li> </ol> <p><i>NOTE: Because EI resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical EI resistance should be 0.35—0.55 ohms.</i></p>	<p><b>Difference between measurements 0.1 ohms or less:</b> GO TO ⑤</p> <p><b>Difference between measurements greater than 0.1 ohms:</b> Faulty cylinder 6 EI solenoid.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ EI Wiring Harness in Cylinder Head Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.06 CYLINDER #6 EI CIRCUIT SHORTED supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> <li>Keep cylinder 6 EI wires disconnected from EI.</li> <li>Keep EI wiring harness connector at side of cylinder head disconnected.</li> <li>Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>Both of the cylinder 6 EI harness eyelets.</li> </ul> </li> </ol>	<p><b>Greater than 20000 ohms:</b> Faulty ECU connection OR Faulty EI wiring harness connection OR Faulty ECU</p> <p><b>Less than 20000 ohms:</b> Faulty EI wiring harness.</p> <p style="text-align: right;">-- -1/1</p>

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## 000656.07 — Cylinder #6 EI Mechanical Failure

6.8L Engine

EI Harness Connector



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

### EI (Electronic Injector)

- The fuel in the 4.5L engine is delivered by 4 (one for each cylinder) electronic injectors (EIs), and the 6.8L engine is delivered by 6 EIs. The EIs are mounted in their cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EI receives high pressure fuel from the high pressure common rail. The ECU controls the start of injection and the amount of fuel injected by turning the Two-Way Valve (TWV) in the EI valve housing on and off which in turn opens and closes the EI spill valve.

- On 4.5L engines, power is supplied to the EIs for cylinders 1 and 4 by a common wire, and to the EIs for cylinders 2 and 3 by a common wire. On 6.8L engines, power is supplied to the EIs for cylinders 1, 2, and 3 by a common wire, and to the EIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and de-energizes the TWV of individual EIs by closing and opening the individual EI ground circuits.

### DTC 000656.07 will set if:

- The fuel rail pressure does not drop at the injection of fuel to EI #6.

### If DTC 000656.07 sets, the following will occur:

- Engine will miss at EI #6.

RG40854,0000091 -19-01MAY02-1/1

## 000656.07 — Cylinder #6 EI Mechanical Failure


The fuel rail pressure does not drop at the injection of fuel to EI #6.

RG40854.0000162 -19-23JUL02-1/1

### 000656.07 Cylinder #6 EI Mechanical Failure Diagnostic Procedure

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI MECHANICAL FAILURE supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO ②</p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p> <p>-- -1/1</p>
<p><b>② EI Wiring Harness Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI MECHANICAL FAILURE supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Possible strong electrical shock hazard if engine is cranking or running.</b></p> <p>2. Remove rocker arm cover with vent tube.</p> <p>3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification.</p> <p style="text-align: center;"><b>Specification</b></p> <p>Injector Solenoid Wire Retaining Nut— Torque ..... 2 N•m (1.5 lb-ft) (18 lb-in.)</p> <p>4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM 104.</p>	<p><b>All retaining nut torques at specification:</b> GO TO ③</p> <p><b>Retaining nut(s) loose:</b> Tight retaining nut(s) to specification and retest.</p> <p>-- -1/1</p>

*Trouble Code Diagnostics and Tests*

<p><b>③ EI Fuel Line Restriction Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI MECHANICAL FAILURE supporting information.</i></p> <p>Check fuel lines for restrictions between High Pressure Common Rail (HPCR) and the fuel inlet at EI #6.</p>	<p><b>No restrictions found:</b> GO TO <b>④</b></p> <p><b>Restrictions found:</b> Repair or replace fuel line and retest</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>④ Flow Limiter Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine running under condition that sets code.</li> <li>2. Using the ECU diagnostic software, verify that DTC 000656.07 is an ACTIVE code.</li> <li>3. Listen to flow limiter that corresponds to EI #6 while turning ignition OFF.</li> </ol> <p><i>NOTE: It is very difficult to distinguish the difference between EI #6 and the other flow limiters clicking. Make sure EI #6 makes the click. It will take 5-10 seconds for the ball to reseat.</i></p>	<p><b>Flow damper clicks:</b> GO TO <b>⑤</b></p> <p><b>Flow damper does not click:</b> Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual.</p> <p style="text-align: right;">-- -1/1</p>
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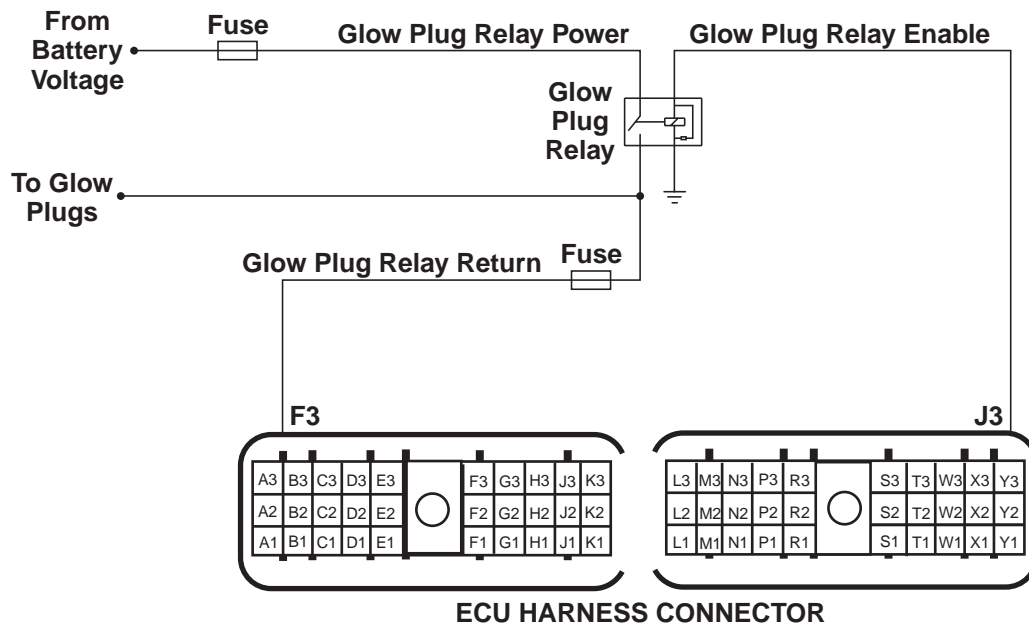
<p><b>⑤ Side Feed Tube Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000656.07 CYLINDER #6 EI MECHANICAL FAILURE supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect the high pressure fuel delivery line for EI #6. Remove the side feed tube retaining nut from the cylinder head.</li> <li>3. Using a 1/2" hose grip pliers, remove the side feed tube from the cylinder head.</li> <li>4. Inspect the side feed tube for nicks, burrs, or other damage.</li> <li>5. Inspect side feed tube o-ring for damage.</li> <li>6. When inspection is completed, reinstall inspected or install side feed tube and tighten side feed tube retaining nut to specification.</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft)</p> <ol style="list-style-type: none"> <li>7. Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification:</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft)</p>	<p><b>Side feed tube and o-ring inspection passes:</b> Faulty EI OR Faulty ECU</p> <p><b>Side feed tube and o-ring inspection fails:</b> Replace side feed tube and retest.</p> <p style="text-align: right;">-- -1/1</p>
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### 000676.03 — Glow Plug Relay Voltage High



RG12346 -19-19JUL02

#### Glow Plugs

- A glow plug is located above each cylinder combustion chamber. It is used to preheat the air prior to starting the engine. The ECU reads engine fuel temperature at the key ON position. If the temperature is below specification, the ECU sends out battery voltage to energize the glow plug relay coil. This allows 12 volts to be sent to the glow plugs.

#### DTC 000676.03 will set if:

- The ECU detects the glow plug relay output is high when the ECU is not energizing the relay.

#### DTC 000676.03 sets, the following will occur:

- Engine may run rough or be hard to start.

RG40854,000093 -19-01MAY02-1/1

## 000676.03 — Glow Plug Relay Voltage High

The ECU detects the glow plug relay output is high when the ECU is not energizing the relay.

RG40854,0000094 -19-01MAY02-1/1

### 000676.03 Glow Plug Relay Voltage High Diagnostic Procedure

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see 000676.03 GLOW PLUG RELAY VOLTAGE HIGH supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors, the glow plug relay, and other connectors between looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see 000676.03 GLOW PLUG RELAY VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF</li> <li>2. Disconnect glow plug connector on any of the glow plugs.</li> <li>3. Using a multimeter, measure voltage between glow plug connector and a good chassis ground.</li> </ol>	<p><b>Approximately battery voltage:</b> GO TO <b>3</b></p> <p><b>Substantially less than battery voltage:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>

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*Trouble Code Diagnostics and Tests*

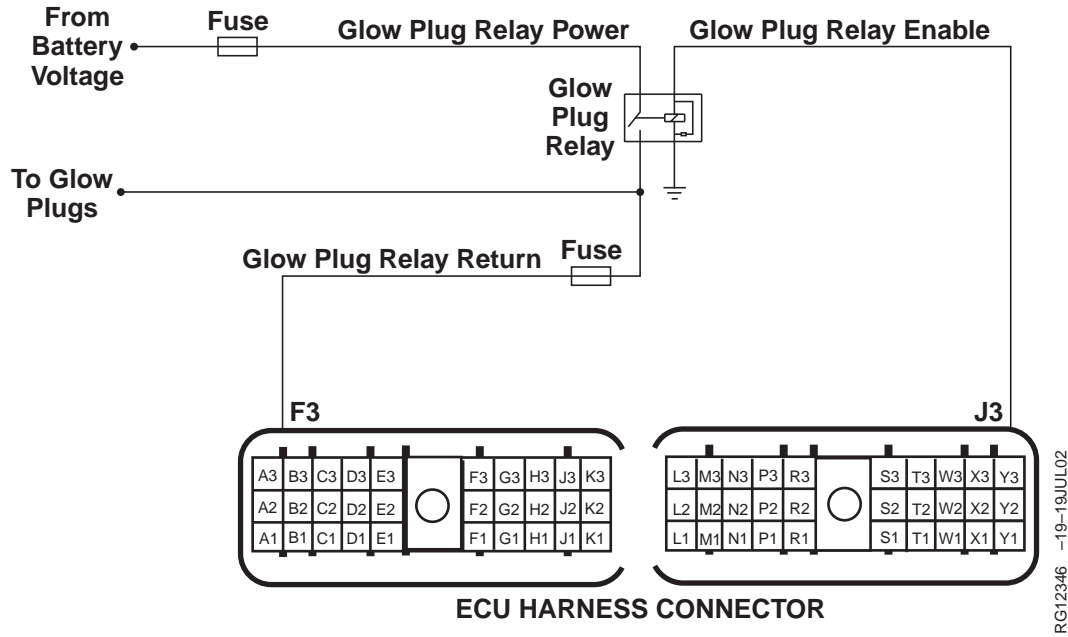
<p><b>③ Glow Plug Relay Return Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see 000676.03 GLOW PLUG RELAY VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both ECU connectors</li> <li>3. Disconnect the glow plug relay enable wire and the glow plug relay return wire from the glow plug relay.</li> <li>4. Using a multimeter, measure resistance between terminal F3 in the harness end of the ECU connector and all terminals in the ECU connectors.</li> </ol>	<p><b>All measurements 20000 ohms or greater: GO TO ④</b></p> <p><b>Any measurement less than 20000 ohms:</b> Glow plug relay return wire shorted to power.</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>④ Glow Plug Relay Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see 000676.03 GLOW PLUG RELAY VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Keep both ECU connectors disconnected</li> <li>3. Keep the glow plug relay enable wire and the glow plug relay return wire disconnected from the glow plug relay.</li> <li>4. Using a multimeter, measure resistance between terminal J3 in the harness end of the ECU connector and all terminals in the ECU connectors.</li> </ol>	<p><b>All measurements 20000 ohms or greater:</b> Faulty glow plug relay</p> <p><b>Any measurement less than 20000 ohms:</b> Glow plug relay enable wire shorted to power.</p> <p style="text-align: right;">-- -1/1</p>
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160  
,360

04  
160  
,361

**000676.05 — Glow Plug Relay Voltage Low**



**Glow Plugs**

- A glow plug is located above each cylinder combustion chamber. It is used to preheat the air prior to starting the engine. The ECU reads engine fuel temperature at the key ON position. If the temperature is below specification, the ECU sends out battery voltage to energize the glow plug relay coil. This allows 12 volts to be sent to the glow plugs.

**DTC 000676.05 will set if:**

- The ECU is sending current to the glow plug relay, but does not detect 12 volts going to the glow plugs.

**DTC 000676.05 sets, the following will occur:**

- Engine performance will not be affected while running.
- Hard starting may occur

RG40854,000095 -19-01MAY02-1/1

## 000676.05 — Glow Plug Relay Voltage Low

The ECU is sending current to the glow plug relay, but does not detect 12 volts going to the glow plugs.

RG40854,0000096 -19-01MAY02-1/1

### 000676.05 Glow Plug Relay Voltage Low Diagnostic Procedure

04  
160  
,363

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see 000676.05 GLOW PLUG RELAY VOLTAGE LOW supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors, the glow plug relay, and other connectors between looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see 000676.05 GLOW PLUG RELAY VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU communication software</li> <li>4. Make note of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>000676.05 reoccurs:</b> GO TO <b>❸</b></p> <p><b>000676.05 doesn't reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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*Trouble Code Diagnostics and Tests*

<p><b>3 Glow Plug Relay Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see 000676.05 GLOW PLUG RELAY VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Identify location of glow plug relay</li> <li>2. Cycle ignition from OFF to ON</li> <li>3. Listen to glow plug relay</li> </ol>	<p><b>Relay clicks:</b> GO TO <b>4</b></p> <p><b>Relay does not click:</b> Open in glow plug relay enable wire OR Open in glow plug relay ground OR Faulty glow plug relay</p> <p style="text-align: right;">-- -1/1</p>
<p><b>4 Glow Plug Relay Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see 000676.05 GLOW PLUG RELAY VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF</li> <li>2. Disconnect the glow plug relay power wire from the glow plug relay.</li> <li>3. Using a multimeter, measure voltage between the glow plug relay power wire at the relay and a good chassis ground</li> </ol>	<p><b>Approximately battery voltage:</b> GO TO <b>5</b></p> <p><b>Substantially less than battery voltage:</b> Open in glow plug relay power wire OR Short to ground in glow plug relay power wire</p> <p style="text-align: right;">-- -1/1</p>
<p><b>5 Glow Plug Coil Power Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see 000676.05 GLOW PLUG RELAY VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF</li> <li>2. Disconnect glow plug connector</li> <li>3. Using a multimeter, measure voltage between the disconnected glow plug connector and a good chassis ground</li> </ol>	<p><b>Approximately battery voltage:</b> Open in glow plug relay return wire</p> <p><b>Substantially less than battery voltage:</b> Open in wire between glow plug relay and glow plugs OR Short to ground in wire between glow plug relay and glow plugs</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
,364



## 000898.09 — Vehicle Speed or Torque Message Invalid

*The ECU does not receive the engine speed or torque message over CAN, or the message is not valid.*

### **CAN (Controlled Area Network) Vehicle Speed or Torque Message**

- The CAN (Controlled Area Network) transmit the vehicle's desired engine speed or torque to the ECU from another controller.

### **DTC 000898.09 will set if:**

- The ECU does not receive the engine speed or torque message over CAN, or the message is not valid.

### **If DTC 000898.09 sets, the following will occur:**

- The ECU will default engine speed to low idle.

### **If DTC 000898.09 sets:**

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.
- With ignition ON and engine OFF, start the ECU diagnostic software
- Read active DTCs and stored DTCs using DST or SERVICE ADVISOR™. If DTC 000639.13 also occurs, see DTC 000639.13 CAN BUS ERROR DIAGNOSTIC PROCEDURE earlier in this Group.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.

04  
160  
,365

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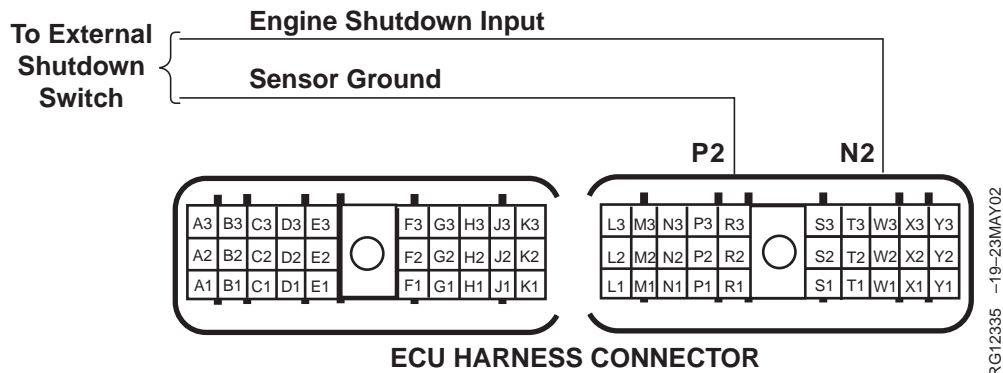
RG40854,0000097 -19-01MAY02-1/1

### 000970.31 — Engine Shutdown - Auxiliary Request

The ECU does not detect an input voltage.

RG40854.0000098 -19-01MAY02-1/2

04  
160  
,366



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 detect an input voltage.

#### If DTC 000970.31 sets, the following will occur:

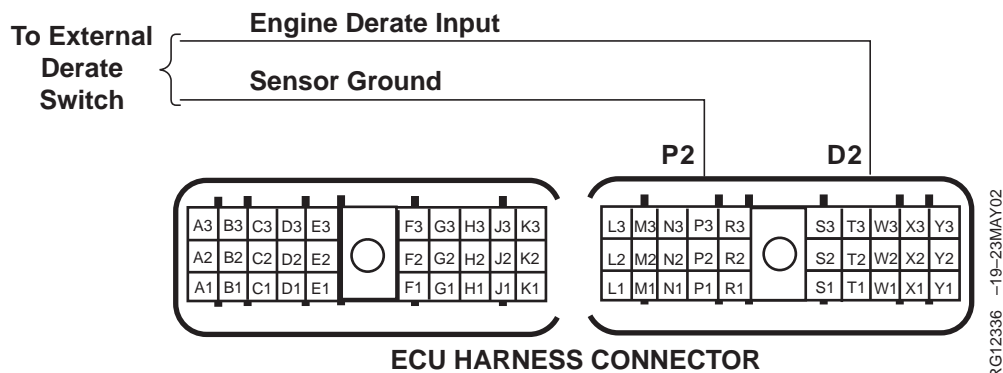
- The ECU will shut the engine down.

RG40854.0000098 -19-01MAY02-2/2

### 000971.31 — External Fuel Derate Switch Active

The ECU does not read an input voltage.

RG40854,0000099 -19-01MAY02-1/2



04  
160  
.367

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 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 derate the engine.

**DTC 000971.31 will set if:**

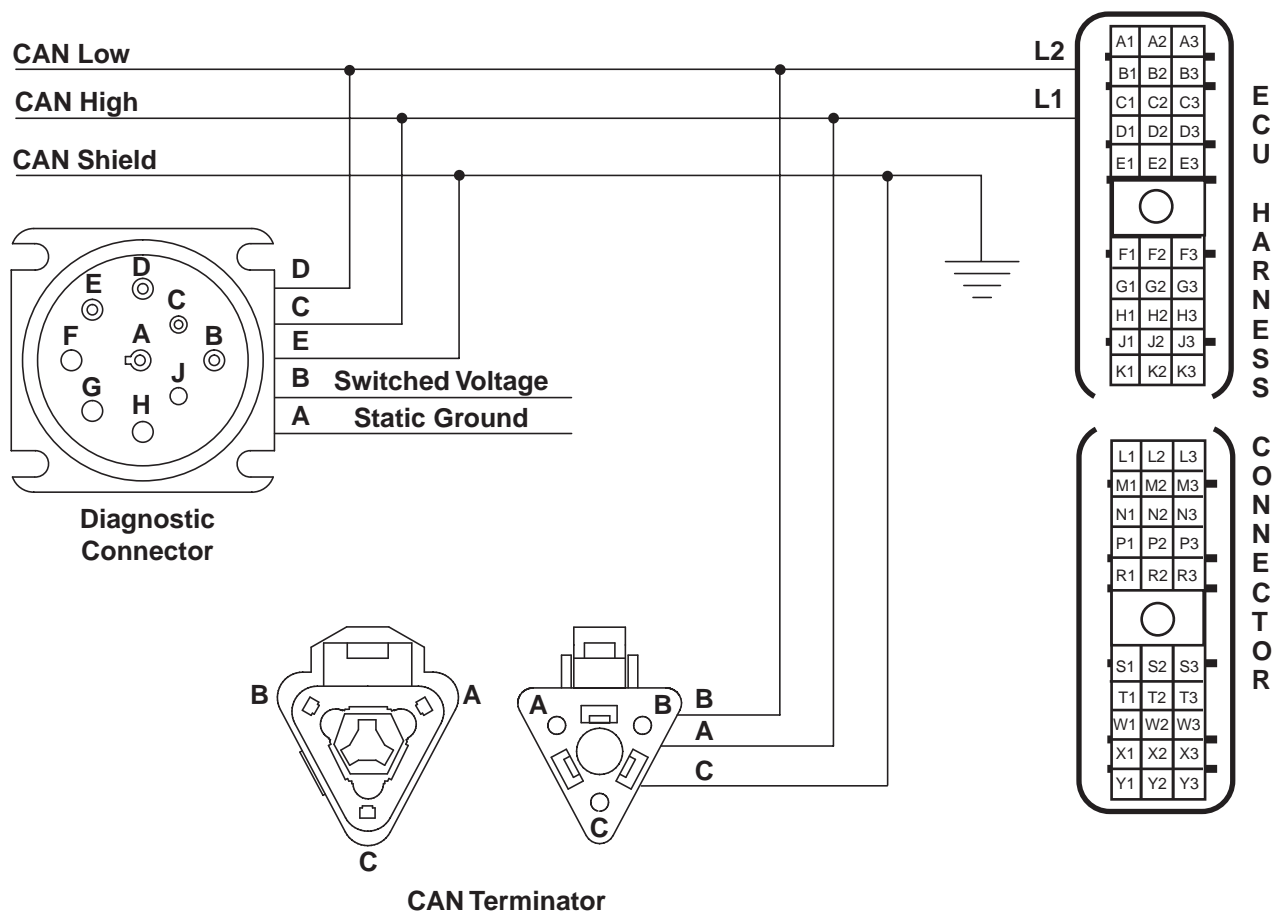
- The ECU does not read an input voltage.

**If DTC 000971.31 sets, the following will occur:**

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 20% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG40854,0000099 -19-01MAY02-2/2

**001069.09 — Tire Size Invalid**



RG11336 -19-17NOV00

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Tire Size**

- Tire size is input into the vehicle for a given size of tire.

**DTC 001069.09 will set if:**

- The ECU either does not receive tire size information over CAN, or the information received is not valid.

**If DTC 001069.09 sets, the following will occur:**

- ECU will assume the largest tire size
- Road speed limiting may occur at a speed that is less than the specified speed.

RG40854.0000139 -19-11JUL02-1/1

**001069.09 — Tire Size Invalid**

The ECU either does not receive tire size information over CAN, or the information received is not valid.

RG40854.0000138 -19-11JUL02-1/1

**001069.09 Tire Size Invalid Diagnostic Procedure**

04  
160  
,369

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation, see DTC 001069.09 TIRE SIZE INVALID supporting information.</i></p> <p>Perform a preliminary inspection of ECU connectors looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connections:</b> GO TO <b>2</b></p> <p><b>Faulty connections:</b> Repair faulty connection(s).</p>
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<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 001069.09 TIRE SIZE INVALID supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>001069.09 reoccurs:</b> GO TO <b>3</b></p> <p><b>001069.09 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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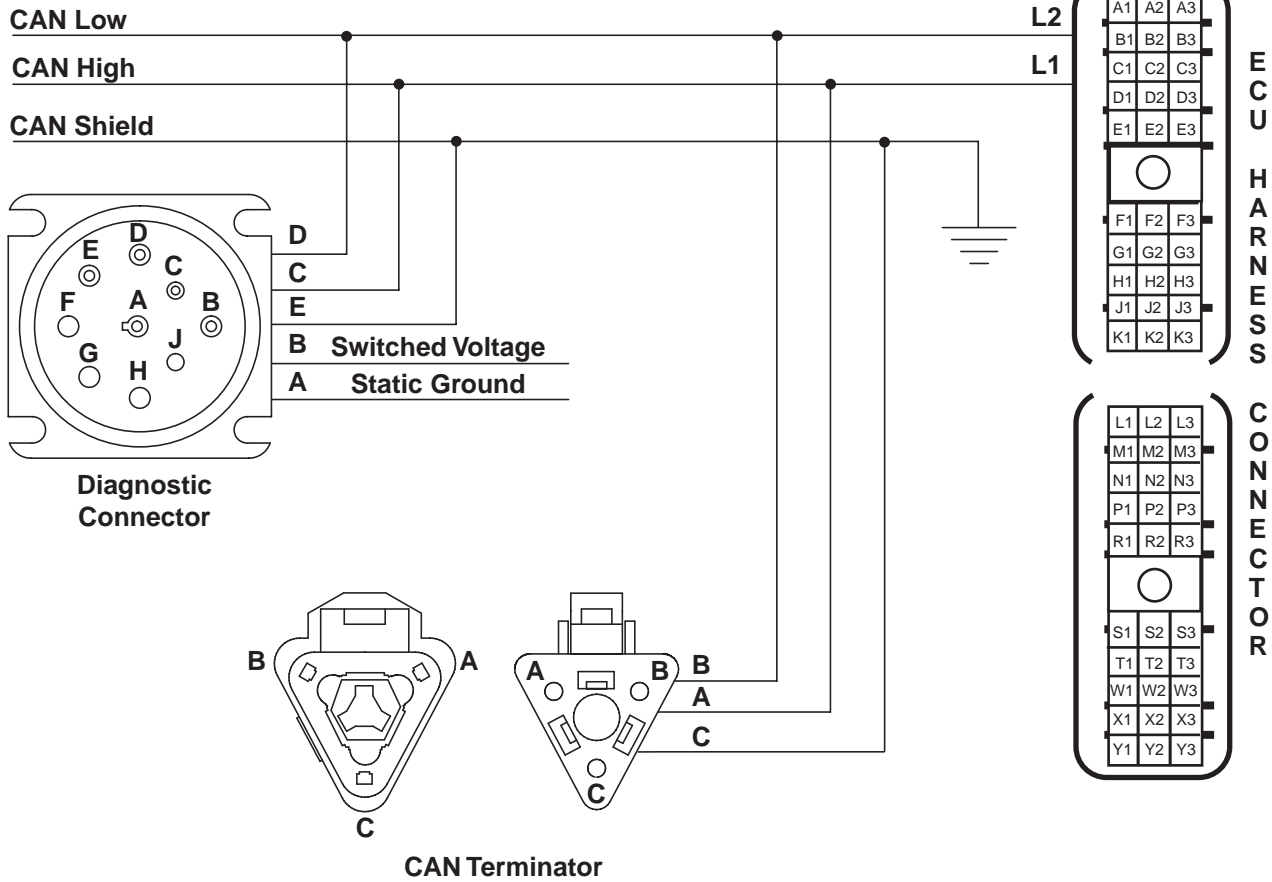
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## Trouble Code Diagnostics and Tests

<p><b>③ Application Related DTCs Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 001069.09 TIRE SIZE INVALID supporting information.</i></p> <p>If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs.</p>	<p><b>No CAN related DTCs found on other controllers:</b> GO TO <b>④</b></p> <p><b>Found CAN related DTCs found on other controllers:</b> Refer to diagnostic procedure for that controller.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Resistance Between CAN High and Low Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 001069.09 TIRE SIZE INVALID supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Using a multimeter, measure resistance between terminals C and D in the harness end of the diagnostic connector.</li> </ol>	<p><b>Between 45-75 ohms:</b> GO TO <b>⑤</b></p> <p><b>Less than 45 or greater than 75 ohms:</b> Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ CAN Wiring Shorted to Ground or Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation, see DTC 001069.09 TIRE SIZE INVALID supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Using a multimeter, measure voltage between a good chassis ground and: <ul style="list-style-type: none"> <li>• Terminal C in the diagnostic connector.</li> <li>• Terminal D in the diagnostic connector.</li> </ul> </li> </ol>	<p><b>Both measurements between 1.5 and 3.5 volts:</b> Faulty ECU connector OR Other connector in the CAN system OR Faulty ECU.</p> <p><b>Either measurement less than 1.5 or greater than 3.5 volts:</b> CAN wiring shorted to ground or voltage OR Another controller in the CAN system is faulty OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
,371

**001069.31 — Tire Size Error**



RG11336 -19-17NOV00

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Tire Size**

- Tire size is input into the vehicle for a given size of tire.

**DTC 001069.31 will set if:**

- Tire size has been incorrectly programmed into the vehicle.

**If DTC 001069.31 sets, the following will occur:**

- ECU will assume the largest tire size
- Road speed limiting may occur at a speed that is less than the specified speed.

RG40854.0000136 -19-11JUL02-1/1

04  
160  
,372



## 001069.31 — Tire Size Error

*Tire size has been incorrectly programmed into the vehicle.*

RG40854.0000137 -19-11JUL02-1/1

### 001069.31 Tire Size Error Diagnostic Procedure

04  
160  
.373

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 001069.31 Tire Size Error supporting information.</i></p> <p>Perform a preliminary inspection of the ECU, BIF, and BCU connectors looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001069.31 Tire Size Error supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start ECU communication software.</li> <li>4. Read DTCs using DST or SERVICE ADVISOR™.</li> <li>5. Clear all DTCs</li> <li>6. Engine running, vehicle under normal operating conditions.</li> <li>7. Read DTCs</li> </ol>	<p><b>001069.31 reoccurs:</b> Reprogram tire size on vehicle.</p> <p><b>001069.31 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.</p>
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## 001079.03 — Sensor Supply 1 Voltage High

### Wiring for Sensor Supply 1 Voltage

*NOTE: For sensor supply 1 wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

- On OEM applications, sensor supply 1 provides voltage to the analog throttle (A) sensor and the analog throttle (B) sensor through ECU terminal N1.
- On Tractor applications, sensor supply 1 provides voltage to the analog throttle (A) sensor through ECU terminal N1.

### Sensor Supply Voltage

- On the Level 11 ECU, there are two or three 5V Sensor Supply terminals. The sensors that use Sensor Supply 1 vary 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 001079.03 will set if:

- The ECU detects a voltage greater than 5.26 volts on the sensor 5 volt supply 1 circuit.

### If DTC 001079.03 sets, the following will occur:

- The ECU will use a default value for the affected sensors.

RG40854,000009A -19-01MAY02-1/1

## 001079.03 — Sensor Supply 1 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG40854,000009B -19-01MAY02-1/1

### 001079.03 Sensor Supply 1 Voltage High Diagnostic Procedure

04  
160  
375

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY 1 VOLTAGE HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using this 5V supply looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY 1 VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>001079.03 reoccurs:</b> GO TO <b>③</b></p> <p><b>001079.03 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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Trouble Code Diagnostics and Tests

③ Short in 5V Supply  
Circuit Test

*NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY 1 VOLTAGE HIGH supporting information.*

1. Ignition OFF
2. Disconnect both ECU connectors.
3. Using a multimeter, measure resistance between terminal N1 and all other terminals in both ECU connectors on the engine harness.

**Greater than 20000**

**ohms:**

Faulty ECU connection  
OR  
Faulty ECU

**20000 ohms or less:**

Sensor 5V supply circuit  
shorted to power in ECU  
harness.

--1/1

04  
160  
,376

04  
160  
,377

## 001079.04 — Sensor Supply 1 Voltage Low

### Wiring for Sensor Supply 1 Voltage

*NOTE: For sensor supply 2 wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*

- On OEM applications, sensor supply 1 provides voltage to the analog throttle (A) sensor and the analog throttle (B) sensor through ECU terminal N1.
- On Tractor applications, sensor supply 1 provides voltage to the analog throttle (A) sensor through ECU terminal N1.

### Sensor Supply Voltage

- On the Level 11 ECU, there are two or three 5V Sensor Supply terminals. The sensors that use Sensor Supply 1 vary 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 001079.04 will set if:

- The ECU detects a voltage lower than 4.59 volts on the sensor 5 volt supply 1 circuit.

### If DTC 001079.04 sets, the following will occur:

- The ECU will use a default value for any sensors that use the 5 volts supply 1.

RG40854,000009C -19-01MAY02-1/1

04  
160  
378

## 001079.04 — Sensor Supply 1 Voltage Low

The ECU detects a supply voltage below specification on the ECU 5 volt supply circuit.

RG40854,000009D -19-01MAY02-1/1

### 001079.04 Sensor Supply 1 Voltage Low Diagnostic Procedure

04  
160  
,379

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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY 1 VOLTAGE LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using this 5V supply looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY 1 VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all active DTCs, then clear all DTCs.</li> <li>5. Ignition OFF</li> <li>6. Disconnect all sensors that get their 5 volt supply from terminal N1 of the ECU connector.</li> <li>7. Ignition ON, engine running</li> <li>8. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>001079.04 reoccurs:</b> GO TO <b>❸</b></p> <p><b>001079.04 does not reoccur:</b> GO TO <b>❹</b></p>
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*Trouble Code Diagnostics and Tests*

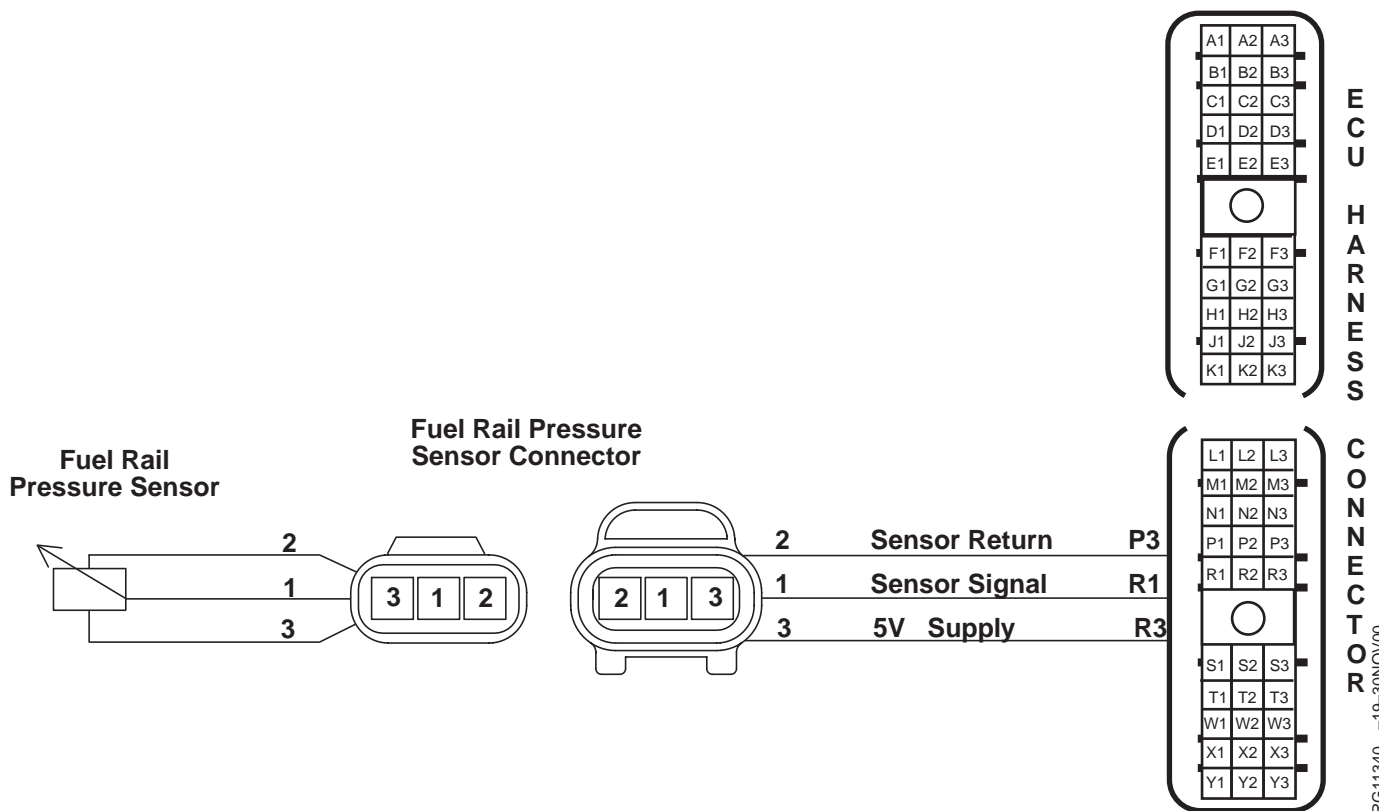
<p><b>③ 5V Supply Circuit Shorted to Ground Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY 1 VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both ECU connectors.</li> <li>3. Using a multimeter, measure resistance between terminal N1 of the ECU connector and: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• Terminal C2 of the ECU connector.</li> <li>• Terminal C3 of the ECU connector.</li> <li>• Terminal N3 of the ECU connector.</li> <li>• Terminal P2 of the ECU connector.</li> <li>• Terminal P3 of the ECU connector</li> </ul> </li> </ol>	<p><b>Greater than 20000 ohms:</b> Faulty ECU connection OR Faulty ECU</p> <p><b>20000 ohms or less:</b> Sensor 5V supply circuit shorted to ECU ground circuit.</p> <p style="text-align: right;">---1/1</p>
<p><b>④ Faulty Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY 1 VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF</li> <li>2. Using the ECU diagnostic software, read DTCs while reconnecting one sensor at a time.</li> </ol>	<p><b>001079.04 reoccurs:</b> Replace faulty sensor and retest.</p> <p><b>001079.04 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p> <p style="text-align: right;">---1/1</p>

04  
160  
,380



04  
160  
,381

### 001080.03 — Fuel Rail Pressure Sensor Supply Voltage High



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 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 001080.03 will set if:

- The ECU detects a voltage higher than 5.26 volts on the Fuel Rail Pressure Sensor 5 volt supply circuit.

#### If DTC 001080.03 sets, the following will occur:

- The ECU will command the high pressure fuel pump to stop pumping fuel.

RG40854,000009E -19-02MAY02-1/1

## 001080.03 — Fuel Rail Pressure Sensor Supply Voltage High

The ECU detects a supply voltage above specification on the Fuel Rail Pressure Sensor 5 volt supply circuit.

RG40854,000009F -19-02MAY02-1/1

### 001080.03 Fuel Rail Pressure Sensor Supply Voltage High Diagnostic Procedure

04  
160  
,383

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 001080.03 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the fuel rail pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2 Intermittent Fault Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001080.03 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Using the DST, make note of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>001080.03 reoccurs:</b> GO TO <b>3</b></p> <p><b>001080.03 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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*Trouble Code Diagnostics and Tests*

**③ Short in 5V Supply  
Circuit Test**

*NOTE: For wiring and theory of operation information, see DTC 001080.03 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE HIGH supporting information.*

1. Ignition OFF
2. Disconnect both ECU connectors.
3. Using a multimeter, measure resistance between terminal R3 and all other terminals in both ECU connectors on the engine harness.

**Greater than 10000  
ohms:**

Faulty ECU connection  
OR  
Faulty ECU.

**10000 ohms or less:**

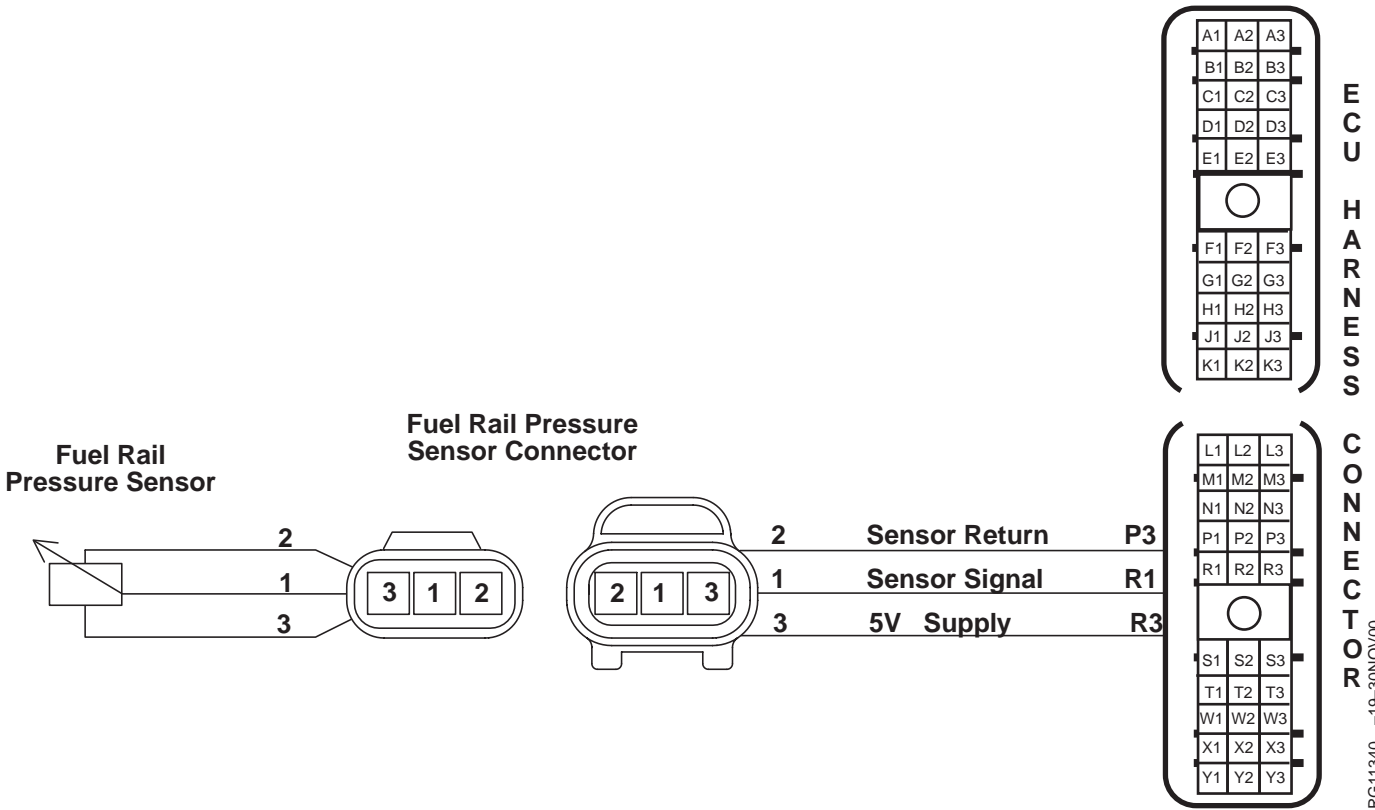
Sensor 5V supply circuit  
shorted to ECU battery  
voltage supply circuit.

--1/1

04  
160  
,384

04  
160  
,385

**001080.04 — Fuel Rail Pressure Sensor Supply Voltage Low**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information 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 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 001080.04 will set if:**

- The ECU detects a voltage lower than 4.59 volts on the Fuel Rail Pressure Sensor 5 volt supply circuit.

**If DTC 001080.04 sets, the following will occur:**

- The ECU will command the high pressure fuel pump to stop pumping fuel.

RG40854,00000A0 -19-02MAY02-1/1

## 001080.04 — Fuel Rail Pressure Sensor Supply Voltage Low

The ECU detects a supply voltage below specification on the Fuel Rail Pressure Sensor 5 volt supply circuit.

RG40854,00000A1 -19-02MAY02-1/1

### 001080.04 Fuel Rail Pressure Sensor Supply Voltage Low Diagnostic Procedure

04  
160  
,387

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<p><b>1</b> Connection Check</p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 001080.04 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE LOW supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using this 5V supply looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2</b> Intermittent Fault Test</p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001080.04 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all active DTCs, then clear all DTCs</li> <li>5. Ignition OFF</li> <li>6. Disconnect the fuel rail pressure sensor.</li> <li>7. Ignition ON, engine OFF</li> <li>8. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>001080.04 reoccurs:</b> GO TO <b>3</b></p> <p><b>001080.04 does not reoccur:</b> GO TO <b>4</b></p>
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*Trouble Code Diagnostics and Tests*

<p><b>③ 5V Supply Circuit Shorted to Ground Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001080.04 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect both ECU connectors.</li> <li>3. Using a multimeter, measure resistance between terminal R3 of the ECU connector and: <ul style="list-style-type: none"> <li>• A good chassis ground.</li> <li>• Terminal C2 of the ECU connector.</li> <li>• Terminal C3 of the ECU connector.</li> <li>• Terminal N3 of the ECU connector.</li> <li>• Terminal P2 of the ECU connector.</li> </ul> </li> </ol>	<p><b>Greater than 10000 ohms:</b> Faulty ECU connection OR Faulty ECU</p> <p><b>10000 ohms or less:</b> Sensor 5V supply circuit shorted to ECU ground circuit.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Faulty Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001080.04 FUEL RAIL PRESSURE SENSOR SUPPLY VOLTAGE LOW supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF</li> <li>2. Reconnect the fuel rail pressure sensor.</li> <li>3. Using the diagnostic software, read DTCs</li> </ol>	<p><b>001080.04 reoccurs:</b> Fuel rail pressure sensor is faulty. Replace and retest.</p> <p><b>001080.04 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
,388



04  
160  
,389

## 001109.31 — Engine Protection Shutdown Warning

### *Engine Protection Shutdown Warning*

#### **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, 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 oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects a loss of engine coolant.

#### **If DTC 001109.31 sets, the following will occur:**

- If the ECU has engine protection with shutdown, it will derate the engine for 30 seconds and will shut the engine down.

#### **If DTC 001109.31 sets:**

- If DTC 000100.01 is active, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group.
- If DTC 000110.00 is active, see DTC 000110.00 ENGINE COOLANT TEMPERATURE HIGH MOST SEVERE DIAGNOSTIC PROCEDURE earlier in this Group.
- If DTC 000111.01 is active, see DTC 000111.01 ENGINE COOLANT LEVEL LOW DIAGNOSTIC PROCEDURE earlier in this Group.

RG40854,00000A2 -19-02MAY02-1/1

## 001110.31 — Engine Protection Shutdown

### *Engine Protection Shutdown*

#### **Engine Protection Shutdown:**

This code informs the operator that the ECU shut the engine down because it has detected a condition such as low fuel pressure, low oil pressure, high engine coolant temperature, ECU error or low coolant level. If the ECU is programmed with engine protection with shutdown, the ECU has shut the engine down.

#### **DTC 001110.31 will set if:**

- The ECU detects low oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects a loss of engine coolant.

#### **If DTC 001110.31 sets, the following will occur:**

- The ECU will have shut the engine down.

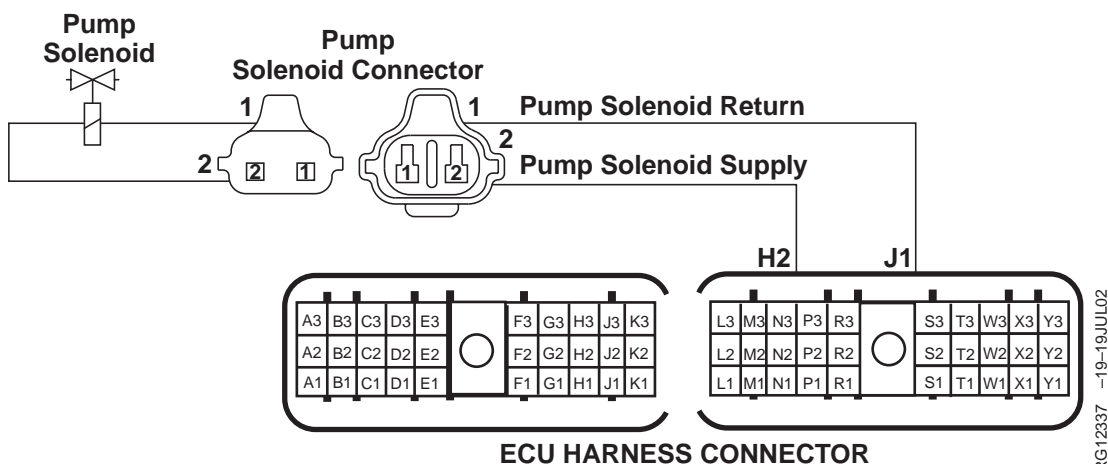
#### **If DTC 001110.31 sets:**

- If DTC 000100.01 is active, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group.
- If DTC 000110.00 is active, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group.
- If DTC 000111.01 is active, see DTC 000111.01 ENGINE COOLANT LEVEL LOW DIAGNOSTIC PROCEDURE earlier in this Group.

04  
160  
,391

RG40854,00000A3 -19-02MAY02-1/1

### 001347.03 — Pump Control Valve Current High



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

#### Pump Control Valve:

- The Pump Control Valve (PCV) solenoid regulates the volume of fuel entering the high pressure pump to regulate the fuel pressure in the high pressure common rail (HPCR). The solenoid is supplied with constant power. The ECU supplies a ground to the solenoid for a calculated time to discharge the required amount of fuel to the HPCR. The amount of fuel is in direct correlation with the fuel being

injected by the electronic injectors. If more fuel is needed the solenoid is energized for a longer period of time. If less fuel is needed, the solenoid is energized for a shorter period of time. For further PCV information, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140.

#### DTC 001347.03 will set if:

- The ECU detects high current in the pump control return wire. Typically, this means that there is a short to power in the PCV circuit.

#### If DTC 001347.03 sets, the following will occur:

- Engine operation may be affected.

## 001347.03 — Pump Control Valve Current High

The ECU detects high current in the pump control return wire.

RG41221,0000BB -19-01APR02-1/1

### 001347.03 Pump Control Valve Current High Diagnostic Procedure

04  
160  
,393

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<p><b>1</b> Connection Check</p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 001347.03 PUMP CONTROL VALVE CURRENT HIGH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the PCV connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2</b> Intermittent Fault Test</p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001347.03 PUMP CONTROL VALVE CURRENT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all active DTCs, then clear all DTCs</li> <li>5. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>001347.03 reoccurs:</b> GO TO <b>3</b></p> <p><b>001347.03 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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*Trouble Code Diagnostics and Tests*

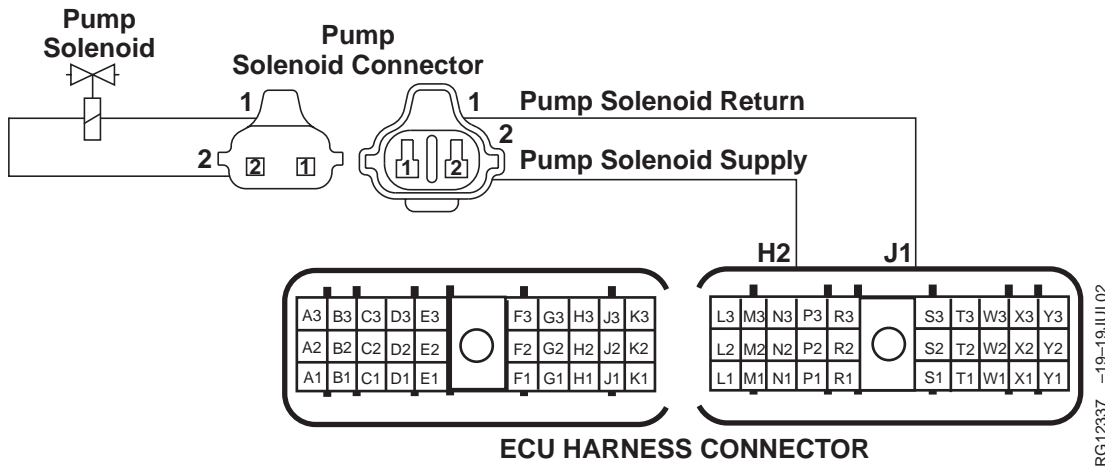
<p><b>③ Short in PCV Supply Wire Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001347.03 PUMP CONTROL VALVE CURRENT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect PCV connector and both ECU connectors.</li> <li>3. Using a multimeter, measure resistance between terminal J1 on the ECU connector and all other terminals in both ECU connectors.</li> </ol>	<p><b>Greater than 20000 ohms:</b> GO TO ④</p> <p><b>20000 ohms or less:</b> Short in PCV Supply Wire</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>④ Short in PCV Return Wire Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001347.03 PUMP CONTROL VALVE CURRENT HIGH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. PCV connector and both ECU connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminal H2 of the ECU connector and all other terminals on both ECU connectors</li> </ol>	<p><b>Greater than 20000 ohms:</b> Faulty PCV</p> <p><b>20000 ohms or less:</b> Short in PCV Return Wire</p> <p style="text-align: right;">-- -1/1</p>
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160  
,394

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160  
,395

**001347.05 — Pump Control Valve Current Mismatch**



04  
160  
396

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Pump Control Valve:**

Review

- The Pump Control Valve regulates the volume of fuel discharged by the supply pump to regulate the fuel pressure in the high pressure common rail (HPCR). The solenoid is supplied with constant power. The ECU supplies a ground to the solenoid for a calculated time to discharge the required amount of fuel to the HPCR. The amount of fuel is in direct correlation with the fuel being injected by the

electronic injectors. If more fuel is needed the solenoid is energized for a longer period of time. If less fuel is needed, the solenoid is energized for a shorter period of time. For further PCV information, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140.

**DTC 001347.05 will set if:**

- The ECU is unable to match the measured pump current with the commanded pump current.

**If DTC 001347.05 sets, the following will occur:**

- Engine will increase in power for a short period time until the rail fuel pressure exceeds the pressure relief valve high pressure specification.

RG40854,00000A5 -19-02MAY02-1/1



## 001347.05 — Pump Control Valve Current Mismatch

The ECU is unable to match the measured pump current with the commanded pump current.

RG40854,00000A8 -19-02MAY02-1/1

### 001347.05 Pump Control Valve Current Mismatch Diagnostic Procedure

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160  
,397

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE CURRENT MISMATCH supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors and the PCV connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE CURRENT MISMATCH supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all active DTCs, then clear all DTCs</li> <li>5. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>001347.05 reoccurs:</b> GO TO <b>3</b></p> <p><b>001347.05 does not reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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*Trouble Code Diagnostics and Tests*

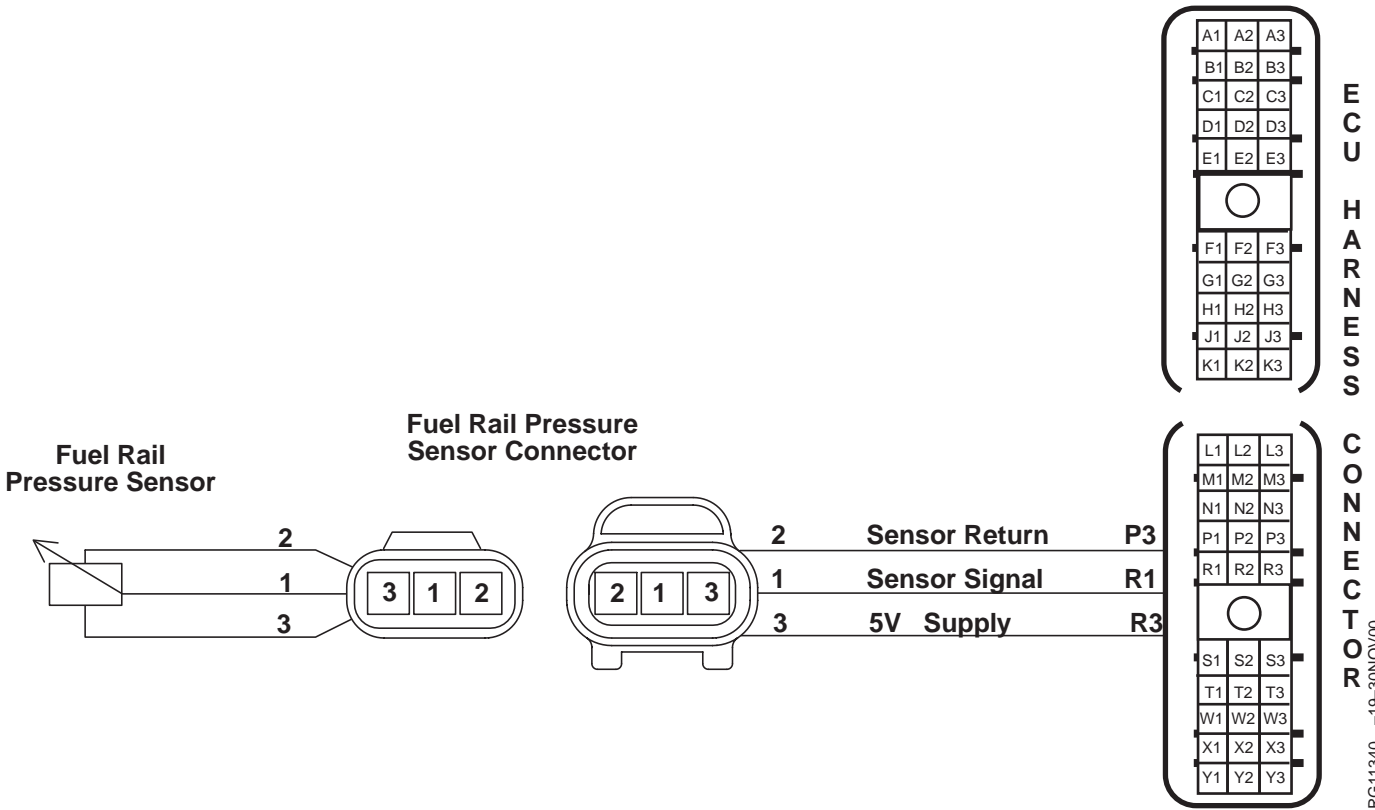
<p><b>③ Open in PCV Wiring Harness Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE CURRENT MISMATCH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect PCV connector and both ECU connectors.</li> <li>3. Using a multimeter, measure resistance of the PCV supply wire between terminal 1 of the PCV connector and terminal J1 of the ECU connector on the engine harness.</li> <li>4. Using a multimeter, measure resistance of the PCV return wire between terminal 2 of the PCV connector and terminal H2 of the ECU connector on the engine harness.</li> </ol>	<p><b>5 ohms or less:</b> GO TO <b>④</b></p> <p><b>Greater than 5 ohms:</b> Open in PCV supply wire OR Open in PCV return wire</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>④ Short in PCV Wiring Harness Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001347.05 PUMP CONTROL VALVE CURRENT MISMATCH supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. PCV connector and both ECU connectors still disconnected.</li> <li>3. Using a multimeter, measure resistance between terminal J1 of the ECU connector and all other terminals in the ECU connector.</li> <li>4. Using a multimeter, measure resistance between terminal H2 of the ECU connector and all other terminals in the ECU connector.</li> </ol>	<p><b>20000 ohms or greater:</b> Faulty PCV.</p> <p><b>Less than 20000 ohms:</b> Short in PCV supply wire OR Short in PCV return wire</p> <p style="text-align: right;">-- -1/1</p>
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04  
160  
,398

04  
160  
,399

**001347.07 — Fuel Rail Pressure Control Error**



**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Fuel Rail Pressure Sensor:**

- The fuel rail pressure sensor uses a pressure transducer to measure the fuel pressure within the rail. The rail pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases. For further fuel rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140.

**DTC 001347.07 will set if:**

- The ECU detects fuel rail pressure 5 MPa (50 Bar) (725 psi) above or below the expected pressure.

**If DTC 001347.07 sets, the following will occur:**

- The ECU will command the high pressure fuel pump to increase or decrease the amount of fuel supplied to the HPCR.
- Engine could miss or run rough.
- Engine may have low power.

RG40854,00000A7 -19-02MAY02-1/1

## 001347.07 — Fuel Rail Pressure Control Error

The ECU detects fuel rail pressure 5 MPa (50 Bar) (725 psi) above or below the expected pressure.

RG40854,00000A9 -19-02MAY02-1/1

### 001347.07 Fuel Rail Pressure Control Error Diagnostic Procedure

**IMPORTANT:** If DTC 001347.07 is accompanied with DTC 000094.03, DTC 000094.04, or DTC 000094.10, follow that diagnostic procedure first.

04  
160  
401

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<p><b>1</b> Connection Check</p>	<p><b>IMPORTANT:</b> 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.</p> <p><i>NOTE:</i> For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.</p> <p>Perform a preliminary inspection of the ECU connectors and the rail pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2</b> Intermittent Fault Test</p>	<p><i>NOTE:</i> For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.</p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine running or cranking</li> <li>3. Compare fuel rail pressure - desired and fuel rail pressure - actual parameters using DST or SERVICE ADVISOR™. See DATA PARAMETER DESCRIPTION earlier in this Group for an explanation of each.</li> </ol> <p><i>NOTE:</i> If actual pressure is more than the desired pressure the engine will most likely not start. The ECU will think that there is enough fuel in the rail and will not command the high pressure pump to distribute fuel to the rail.</p>	<p><b>Desired is more than 5 MPa (50 Bar) (725 psi) above Actual:</b> GO TO <b>3</b></p> <p><b>Actual is more than 5 MPa (50 Bar) (725 psi) above Desired:</b> GO TO <b>4</b></p> <p><b>Desired and Actual are within 5 MPa (50 Bar) (725 psi) of each other:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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*Trouble Code Diagnostics and Tests*

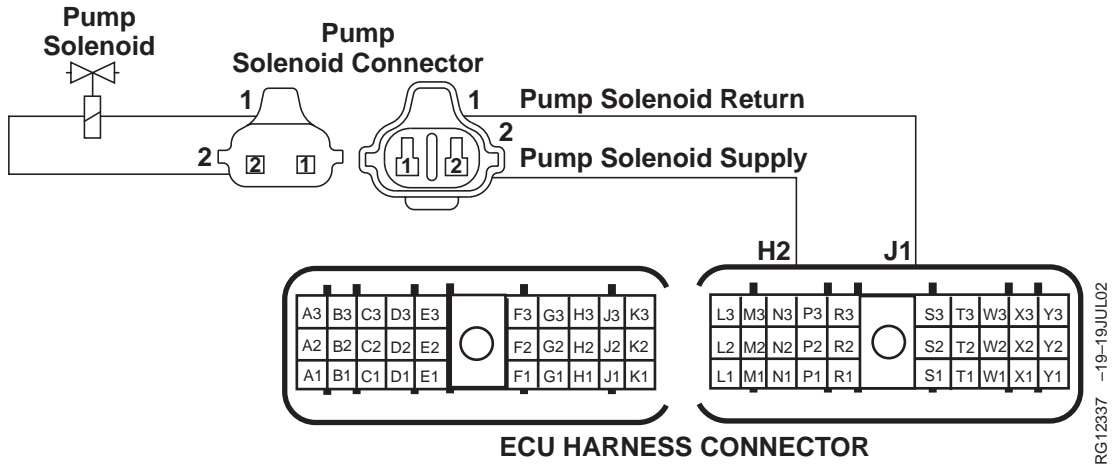
<p><b>③ Fuel Lines/Fittings Leakage Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001347.07 FUEL RAIL PRESSURE CONTROL ERROR supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine running</li> <li>2. Inspect all fuel lines and fittings for leakage.</li> </ol>	<p><b>No fuel leak(s) present:</b> Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE in Group 150 of this manual.</p> <p><b>Fuel leak(s) present:</b> Tighten loose fitting to proper specification and retest.</p> <p style="text-align: right;">---1/1</p>
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<p><b>④ Pump Position Timing Check</b></p>	<p>Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING later in this Group.</p>	<p><b>Pump position timing OK:</b> Replace ECU and retest.</p> <p><b>Pump position timing out of sync:</b> Adjust timing and retest.</p> <p style="text-align: right;">---1/1</p>
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403

**001347.10 — Pump Control Valve Fuel Flow Not Detected**



04  
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404

**NOTE:** Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

**Pump Control Valve:**

Review

- The Pump Control Valve regulates the volume of fuel discharged by the supply pump to regulate the fuel pressure in the high pressure common rail (HPCR). The solenoid is supplied with constant power. The ECU supplies a ground to the solenoid for a calculated time to discharge the required amount of fuel to the HPCR. The amount of fuel is in direct correlation with the fuel being injected by the

electronic injectors. If more fuel is needed the solenoid is energized for a longer period of time. If less fuel is needed, the solenoid is energized for a shorter period of time. For further PCV information, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140.

**DTC 001347.10 will set if:**

- Fuel pressure inside rail does NOT rise to injection pressure.

**If DTC 001347.10 sets, the following will occur:**

- Depending on application, limited power at higher loads
- Rail pressure may be lower than expected. This should also set DTC 001347.07.

RG41221,000011D -19-11APR03-1/1



## 001347.10 — Pump Control Valve Fuel Flow Not Detected

Fuel pressure inside rail does NOT rise to injection pressure.

RG41221.000011E -19-11APR03-1/1

### 001347.10 Pump Control Valve Fuel Flow Not Detected Diagnostic Procedure


**IMPORTANT:** If DTC 001347.10 is accompanied with DTC 001347.05, follow that diagnostic procedure first.

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405

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<p><b>1</b> Connection Check</p>	<p><b>IMPORTANT:</b> 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.</p> <p><i>NOTE:</i> For wiring and theory of operation information, see DTC 001347.10 PUMP CONTROL VALVE FUEL FLOW NOT DETECTED supporting information.</p> <p>Perform a preliminary inspection of the ECU connectors and the rail pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2</b> Pump Control Valve Test</p>	<p><i>NOTE:</i> For wiring and theory of operation information, see DTC 001347.10 PUMP CONTROL VALVE FUEL FLOW NOT DETECTED supporting information.</p> <p>1. Ignition OFF</p> <p> <b>CAUTION:</b> 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.</p> <p>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 &amp; Company Medical Department in Moline, Illinois, U.S.A.</p> <p>2. Disconnect both fuel lines from the fuel inlets on the high pressure common rail.</p> <p>3. Ignition ON, engine cranking</p> <p>4. Check for fuel flow at disconnected lines.</p>	<p><b>No fuel flow present:</b> GO TO <b>3</b></p> <p><b>Fuel flow present:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

### ③ Fuel Line Check

*NOTE: For wiring and theory of operation information, see DTC 001347.10 PUMP CONTROL VALVE FUEL FLOW NOT DETECTED supporting information.*

1. Ignition OFF
2. Disconnect the fuel lines between the fuel outlet on the high pressure pump and the fuel inlet to the high pressure common rail.
3. Check fuel lines for restrictions.

#### **No restriction found:**

Faulty pump control valve.  
Replace the high pressure pump and retest.

#### **Restriction(s) found:**

Fix restriction(s) and retest.

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## 001568.02 — Torque Curve Selection Invalid

*The ECU receives torque curve selection information over CAN, but the information received is not valid.*

### CAN (Controller Area Network) Torque Curve Selection

- The ECU has the ability operate the engine on multiple different torque curves. Individual curves can be selected based on information sent to the ECU over CAN (Controller Area Network) by another controller.

#### DTC 001568.02 will set if:

- The ECU receives torque curve selection information over CAN, but the information received is not valid.

#### If DTC 001568.02 sets, the following will occur:

- The ECU will select a default torque curve to continue running.
- Depending on application, the selected default torque curve may be a lower power curve.

#### If DTC 001568.02 sets:

- If DTC 000639.13 - CAN Bus Error is active, see DTC 000639.13 CAN BUS ERROR DIAGNOSTIC PROCEDURE earlier in this Group.
- Check to see if any other controllers on the machine have any active or stored CAN related DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN related DTCs are found, replace the ECU and retest.

RG40854,00000AB -19-02MAY02-1/1

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408

## 001569.31 — Fuel Derate

### Fuel Derate

#### 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:

- ECU detects a low oil pressure.
- ECU detects a high manifold air temperature.
- ECU detects a high engine coolant temperature.
- The ECU detects water in fuel above the threshold quantity for an extended period of time.
- The ECU detects a loss of engine coolant.
- ECU detects a high fuel temperature.
- ECU detect a timing problem with the crankshaft position sensor.

#### If DTC 001569.31 sets, the following will occur:

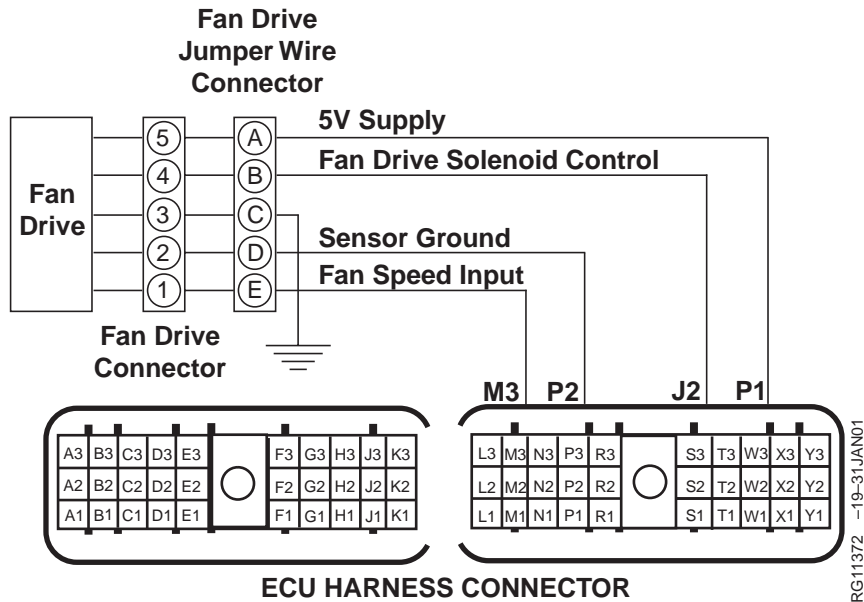
- The ECU will limit the amount of fuel available to the engine in an attempt to protect the engine.

#### If DTC 001569.31 sets:

- If DTC 000100.01 or DTC 000100.18 is active, see one of the following procedures earlier in this Group:
  - DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE
  - DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW DIAGNOSTIC PROCEDURE
- If DTC 000105.00 or DTC 000105.16 is active, see one of the following procedures earlier in this Group:

- DTC 000105.00 MANIFOLD AIR TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE
- DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE
- If DTC 000110.00, DTC 000110.15, or DTC 000110.16 is active, see one of the following procedures earlier in this Group:
  - 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.
- If DTC 000174.00 or DTC 000174.16 is active, see one of the following procedures earlier in this Group:
  - DTC 000174.00 FUEL TEMPERATURE HIGH MOST SEVERE DIAGNOSTIC PROCEDURE
  - DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE DIAGNOSTIC PROCEDURE
- If DTC 000637.02, DTC 000637.07, DTC 000637.08, or DTC 000637.10 is active, see one of the following procedures earlier in this Group:
  - DTC 000637.02 CRANK POSITION INPUT NOISE
  - DTC 000637.07 CRANK POSITION/PUMP POSITION TIMING MODERATELY OUT OF SYNC
  - DTC 000637.08 CRANK POSITION INPUT MISSING
  - DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR

**001639.01 — Fan Speed Input Missing**



RG-11372 -19-31JAN01

**Fan Speed Drive**

The ECU monitors various parameters such as engine coolant temperature, oil temperature, air temperature, and other components on the engine. When these become excessive, the ECU commands the fan drive to run at a higher speed. The ECU sends a PWM signal through the fan drive solenoid control wire to energize the fan drive solenoid. This controls the fan speed. The ECU monitors fan speed through a hall effect sensor in the fan drive. This allows the ECU to

determine if there is any significant difference between desired and actual fan speed.

**DTC 001639.01 will set if:**

- The ECU detects that fan speed input is missing.

**If DTC 001639.01 sets, the following will occur:**

- The ECU commands the fan to run at the highest possible speed.

RG41221,0000122 -19-14APR03-1/1

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## 001639.01 — Fan Speed Input Missing

The ECU detects that fan speed input is missing.

RG41221,0000123 -19-14APR03-1/1

### 001639.01 Fan Speed Input Missing Diagnostic Procedure

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160  
,411

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<p><b>1 Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors, the Fan Drive connector, and any connector between looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>2</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>2 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of any DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>001639.01 reoccurs:</b> GO TO <b>3</b></p> <p><b>001639.01 doesn't reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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*Trouble Code Diagnostics and Tests*

<p><b>③ 5 Volt Supply Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> </ol> <p> <b>CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.</b></p> <ol style="list-style-type: none"> <li>Disconnect Fan Drive connector</li> <li>Ignition ON, engine running</li> <li>Using a multimeter, measure voltage at fan drive harness connector between terminal 2 and terminal 5 of the fan drive connector.</li> </ol>	<p><b>4.0 volts or greater:</b> GO TO <b>⑤</b></p> <p><b>Less than 4.0 volts:</b> GO TO <b>④</b></p>
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<p><b>④ Sensor Ground Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> </ol> <p> <b>CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.</b></p> <ol style="list-style-type: none"> <li>Fan Drive connector still disconnected</li> <li>Probe terminal 2 of the fan drive connector with a test light connected to battery voltage.</li> </ol>	<p><b>Light ON:</b> Open in 5V supply wire OR Short to ground in 5V supply wire OR Faulty ECU connector OR Faulty ECU</p> <p><b>Light OFF:</b> Open in sensor ground wire OR Faulty ECU connector OR Faulty ECU</p>
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<p><b>⑤ Fan Input Wire Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> </ol> <p> <b>CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.</b></p> <ol style="list-style-type: none"> <li>Disconnect both 30-way ECU connectors.</li> <li>Fan drive connector still disconnected.</li> <li>Install a jumper wire between terminals 1 and 2 of the fan drive connector.</li> <li>Using a multimeter, measure resistance between terminal M3 and terminal P2 of the ECU connectors.</li> </ol>	<p><b>Less than 5 ohms:</b> GO TO <b>⑥</b></p> <p><b>5 ohms or greater:</b> Open in fan speed input wire OR Short to ground in fan speed input wire OR Faulty fan drive jumper wire connector OR Faulty ECU connector OR Faulty ECU</p>
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,412



Trouble Code Diagnostics and Tests

⑥ Observe Fan Performance

*NOTE: For wiring and theory of operation information, see DTC 001639.01 FAN SPEED INPUT MISSING supporting information.*

1. Ignition OFF



**CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.**

2. Connect fan drive connector
3. Ignition ON, engine running



**CAUTION: Keep hands away from fan drive at all times. Hand injury can occur.**

4. Monitor fan to determine if it is operational.

*NOTE: Fan operation only occurs when commanded by ECU.*

**Fan runs:**

Faulty fan drive connector  
OR  
Faulty fan speed sensor

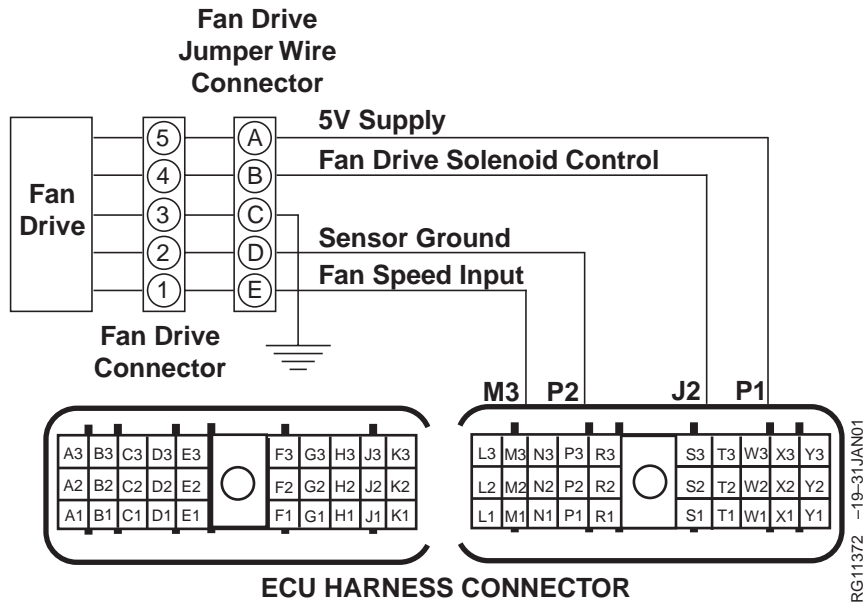
**Fan will not run:**

Faulty fan drive connector  
OR  
Faulty fan drive

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413

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**001639.16 — Fan Speed Higher Than Expected**



RG-11372 -19-31JAN01

**Fan Speed Drive**

The ECU monitors various parameters such as engine coolant temperature, oil temperature, air temperature, and other components on the engine. When these become excessive, the ECU commands the fan drive to run at a higher speed. The ECU sends a PWM signal through the fan drive solenoid control wire to energize the fan drive solenoid. This controls the fan speed. The ECU monitors fan speed through a hall effect sensor in the fan drive. This allows the ECU to

determine if there is any significant difference between desired and actual fan speed.

**DTC 001639.16 will set if:**

- The ECU detects fan speed higher than expected.

**If DTC 001639.16 sets, the following will occur:**

- There is no change in engine performance.

RG41221,0000124 -19-14APR03-1/1

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.414

## 001639.16 — Fan Speed Higher Than Expected

The ECU detects fan speed higher than expected.

RG41221\_0000125 -19-14APR03-1/1

### 001639.16 Fan Speed Higher Than Expected Diagnostic Procedure

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160  
415

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<p><b>① Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 001639.16 FAN SPEED HIGHER THAN EXPECTED supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors, the Fan Drive connector, and any connector between looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>②</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.16 FAN SPEED HIGHER THAN EXPECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all active DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>001639.16 reoccurs:</b> GO TO <b>③</b></p> <p><b>001639.16 doesn't reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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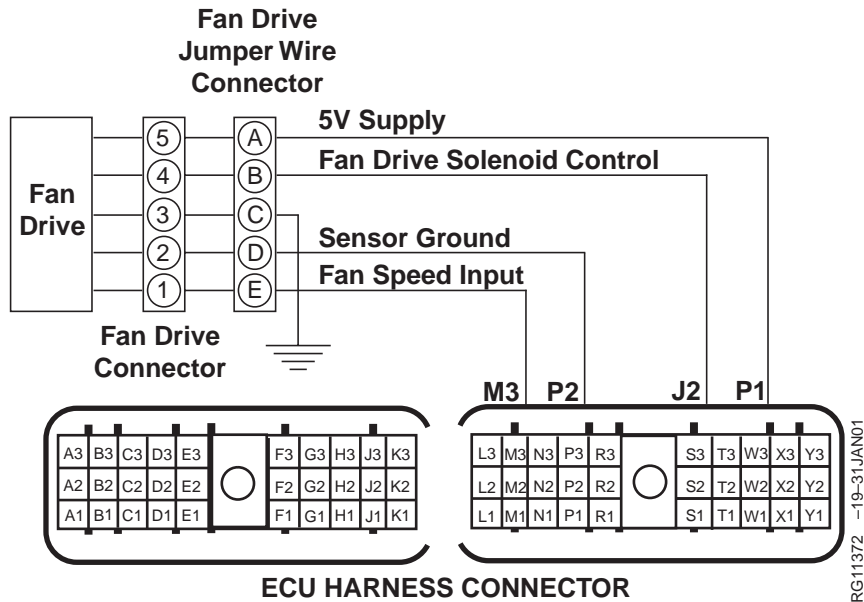
Trouble Code Diagnostics and Tests

<p><b>③ Fan Speed Solenoid Control Wire Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.16 FAN SPEED HIGHER THAN EXPECTED supporting information.</i></p> <p>1. Ignition OFF</p> <p> <b>CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.</b></p> <p>2. Disconnect both 30-way ECU connectors.</p> <p>3. Disconnect the fan drive connector.</p> <p>4. Using a multimeter, measure resistance between terminal J2 on the ECU connector and all other terminals on both 30-way ECU connectors.</p>	<p><b>All measurements greater than 2000 ohms: GO TO ④</b></p> <p><b>Any measurement less than 2000 ohms:</b> Faulty fan drive solenoid control wire</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Fan Drive Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.16 FAN SPEED HIGHER THAN EXPECTED supporting information.</i></p> <p>At this point, the most likely cause of DTC 001639.16 is a failure in the fan drive or fan drive solenoid. Before checking these, check for connection problems first. For more fan drive diagnostics, refer to application manual.</p>	<p><b>Problem found:</b> Repair and retest</p> <p><b>No problem found:</b> Replace ECU and retest</p> <p style="text-align: right;">-- -1/1</p>

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160  
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**001639.18 — Fan Speed Lower Than Expected**



**Fan Speed Drive**

The ECU monitors various parameters such as engine coolant temperature, oil temperature, air temperature, and other components on the engine. When these become excessive, the ECU commands the fan drive to run at a higher speed. The ECU sends a PWM signal through the fan drive solenoid control wire to energize the fan drive solenoid. This controls the fan speed. The ECU monitors fan speed through a hall effect sensor in the fan drive. This allows the ECU to

determine if there is any significant difference between desired and actual fan speed.

**DTC 001639.18 will set if:**

- The ECU detects fan speed higher than expected.

**If DTC 001639.18 sets, the following will occur:**

- There is no change to engine performance.

## 001639.18 — Fan Speed Lower Than Expected

The ECU detects fan speed higher than expected.

RG41221\_0000127 -19-14APR03-1/1

### 001639.18 Fan Speed Lower Than Expected Diagnostic Procedure

**IMPORTANT: If DTC 001639.01 is accompanied with DTC 001639.18, follow that diagnostic procedure first.**

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160  
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<p><b>❶ Connection Check</b></p>	<p><b>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.</b></p> <p><i>NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.</i></p> <p>Perform a preliminary inspection of the ECU connectors, the Fan Drive connector, and any connector between looking for dirty, damaged, or poorly positioned terminals.</p>	<p><b>No faulty connection(s):</b> GO TO <b>❷</b></p> <p><b>Faulty connection(s):</b> Repair faulty connection(s).</p>
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<p><b>❷ Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Ignition ON, engine OFF</li> <li>3. Start the ECU diagnostic software</li> <li>4. Make note of all active DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Read DTCs using DST or SERVICE ADVISOR™.</li> </ol>	<p><b>001639.18 reoccurs:</b> GO TO <b>❸</b></p> <p><b>001639.18 doesn't reoccur:</b> Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.</p>
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## Trouble Code Diagnostics and Tests

<p><b>③ Fan Belt Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition ON, engine running</li> </ol> <p> <b>CAUTION: Keep hands away from fan drive at all times. Hand injury can occur.</b></p> <ol style="list-style-type: none"> <li>Monitor fan operation and observe fan belt.</li> </ol> <p><i>NOTE: Fan operation only occurs when commanded by ECU.</i></p>	<p><b>Fan belt appears normal:</b> GO TO <b>④</b></p> <p><b>Fan belt slips or is broken:</b> Determine cause for belt slipping or for broken belt. Repair and retest</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Short in Fan Drive Solenoid Control Wire Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> </ol> <p> <b>CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.</b></p> <ol style="list-style-type: none"> <li>Disconnect both 30-way ECU connectors.</li> <li>Disconnect the fan drive connector.</li> <li>Ignition ON</li> <li>Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>Terminal J2 in the harness end of the ECU connector and all other terminals in both 30-way ECU connectors and a good chassis ground.</li> </ul> </li> </ol>	<p><b>All measurements greater than 20k ohms:</b> GO TO <b>⑤</b></p> <p><b>Any measurement less than 20k ohms:</b> Fan drive solenoid control wire shorted to wire that corresponds to measurement</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Fan Speed Solenoid Control Wire Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.</i></p> <ol style="list-style-type: none"> <li>Ignition OFF</li> </ol> <p> <b>CAUTION: Do NOT continue this procedure until engine is OFF and the fan is no longer running. Hand injury can occur.</b></p> <ol style="list-style-type: none"> <li>Disconnect both 30-way ECU connectors.</li> <li>Fan drive connector still disconnected.</li> <li>Install a jumper wire between terminal 5 and terminal 4 of the fan drive connector.</li> <li>Using a multimeter, measure resistance between terminal J2 and terminal P1 on the ECU connector.</li> </ol>	<p><b>5 ohms or less:</b> GO TO <b>⑥</b></p> <p><b>Greater than 5 ohms:</b> Faulty fan drive solenoid control wire OR Faulty fan drive jumper wire connector OR Faulty ECU connector OR Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>



*Trouble Code Diagnostics and Tests*

<b>⑥ Fan Drive Check</b>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001639.18 FAN SPEED LOWER THAN EXPECTED supporting information.</i></p> <p>At this point, the most likely cause of DTC 001639.16 is a failure in the fan drive or fan drive solenoid. Before checking these, check for connection problems first. For more fan drive diagnostics, refer to application manual.</p>	<p><b>Problem found:</b> Repair and retest</p> <p><b>No problem found:</b> Replace ECU and retest</p> <p>-- -1/1</p>
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04  
160  
,421

## 002000.13 — Security Violation

*The ECU determines that it OR another controller on the machine is not the right controller for the particular machine.*

### Security Violation

- When the ignition switch is first turned on, all of the controllers on the machine communicate with each other to make sure that all controllers are correct for the particular machine.

### DTC 002000.13 will set if:

- The ECU determines that it OR another controller on the machine is not the right controller for the particular machine.

### If DTC 002000.13 sets, the following will occur:

- The ECU will allow the engine to start, but will only allow low idle engine speed.

### If DTC 002000.13 sets:

- If one of the controllers on the machine has just been replaced, make sure the correct controller was installed.
- If all controllers on the machine are the correct part numbers, check to see if any of the controllers have active or stored CAN related DTCs. If they do, go to the appropriate diagnostic procedure.

RG40854,00000AD -19-02MAY02-1/1

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160  
422

## 002005.09 — ACU Signal Missing

*The ECU does not receive the torque speed select message over CAN, or the message is not valid.*

### **CAN (Controlled Area Network)**

- The CAN (Controlled Area Network) transmits the vehicle's desired torque speed control to the ECU from the ACU.

### **DTC 002005.09 will set if:**

- The ECU does not receive the torque speed select message over CAN, or the message is not valid.

### **If DTC 002005.09 sets, the following will occur:**

- The ECU will default engine speed to low idle.

### **If DTC 002005.09 sets:**

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.
- With ignition ON and engine OFF, Start the ECU diagnostic software
- Read active DTCs and stored DTCs using DST or SERVICE ADVISOR™. If DTC 000639.13 also occurs, see DTC 000639.13 CAN ERROR DIAGNOSTIC PROCEDURE earlier in this Group.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.

*SERVICE ADVISOR is a trademark of Deere & Company*

RG41221,000011F -19-11APR03-1/1

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423

## 002049.09 — CAB Signal Missing

*The ECU does not receive the a/c clutch status message over CAN, or the message is not valid.*

### **CAN (Controlled Area Network)**

- The CAN (Controlled Area Network) transmits the vehicle's desired a/c (air conditioner) clutch status to the ECU from the CAB.

### **DTC 002049.09 will set if:**

- The ECU does not receive the a/c clutch status message over CAN, or the message is not valid.

### **If DTC 002049.09 sets, the following will occur:**

- The ECU will default the fan speed to 1200 rpm.

### **If DTC 002049.09 sets:**

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE

ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.

- With ignition ON and engine OFF, Start the ECU diagnostic software
- Read active DTCs and stored DTCs using DST or SERVICE ADVISOR™. If DTC 000639.13 also occurs, see DTC 000639.13 CAN ERROR DIAGNOSTIC PROCEDURE earlier in this Group.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.
- With ignition ON and engine OFF, Start the ECU diagnostic software
- Read active DTCs and stored DTCs using DST or SERVICE ADVISOR™. If DTC 000639.13 also occurs, see DTC 000639.13 CAN ERROR DIAGNOSTIC PROCEDURE earlier in this Group.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.

*SERVICE ADVISOR is a trademark of Deere & Company*

RG41221,0000120 -19-11APR03-1/1

## 002071.09 — CCU Signal Missing

*The EC U does not receive the CCU messages over CAN, or the messages is not valid.*

### CAN (Controlled Area Network)

- The CCU transmits the vehicle's transmission oil temperature, tire size, and vehicle speed to the ECU over CAN (Controlled Area Network).

### DTC 002049.09 will set if:

- The ECU does not receive the CCU messages over CAN, or the messages is not valid.

### If DTC 002049.09 sets, the following will occur:

- The ECU will default to the highest fan speed to compensate for transmission oil temperature.
- The ECU will use a default tire size.
- The ECU will not allow transport boost.

### If DTC 002049.09 sets:

- Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.
- With ignition ON and engine OFF, Start the ECU diagnostic software
- Read active DTCs and stored DTCs using DST or SERVICE ADVISOR™. If DTC 000639.13 also occurs, see DTC 000639.13 CAN ERROR DIAGNOSTIC PROCEDURE earlier in this Group.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.
- With ignition ON and engine OFF, Start the ECU diagnostic software
- Read active DTCs and stored DTCs using DST or SERVICE ADVISOR™. If DTC 000639.13 also occurs, see DTC 000639.13 CAN ERROR DIAGNOSTIC PROCEDURE earlier in this Group.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.

04  
160  
425

*SERVICE ADVISOR is a trademark of Deere & Company*

RG41221,0000121 -19-11APR03-1/1

04  
160  
,426

# Section 05 Tools

## Contents

Page

**Group 170—Electronic Fuel/Control System Repair  
Tools and Other Materials**

Electronic Fuel System Repair and Adjustment Essential Tools . . . . .	05-170-1
Fuel System Repair and Adjustment Other Materials . . . . .	05-170-2
Electronic Engine Control Repair Tools . . . . .	05-170-3
Control Repair and Adjustment Other Materials . . . . .	05-170-8

**Group 180—Diagnostic Service Tools**

Electronic Fuel/Control System Diagnostic Tools . . . . .	05-180-1
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05

*Contents*

05



Electronic Fuel System Repair and Adjustment Essential Tools

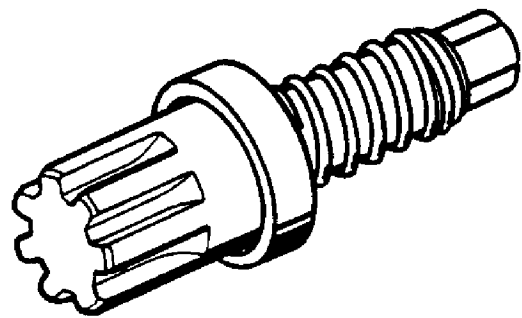
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

SERVICEGARD is a trademark of Deere & Company

RG40854,0000156 -19-22JUL02-1/5

Flywheel Turning Tool . . . . . JDG820

Used to rotate engine flywheel to lock engine at "TDC" to check high pressure fuel pump timing. Use with JDE81-4 Timing Pin.



RG7056

RG7056 -UN-05DEC97

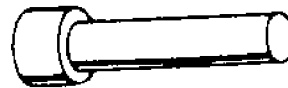
RG40854,0000156 -19-22JUL02-2/5

05  
170  
1

RG5068 -UN-05DEC97

Timing Pin . . . . . JDE81-4

Used to lock engine at "TDC". Use with JDG820 Flywheel Turning Tool.



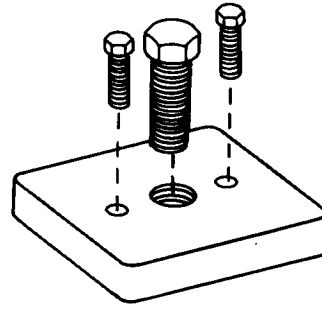
RG5068

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RG40854,0000156 -19-22JUL02-3/5

Injection Pump Drive Gear Puller . . . . . JDG670A

Remove drive gear from tapered shaft on Denso HP3 high pressure fuel pump.



JDG670A

RG6032 -UN-13JAN92

RG40854.0000156 -19-22JUL02-4/5

05  
170  
2

Electronic Injector Removal Tool . . . . . JDG1652

Used to remove electronic injector from cylinder head.

RG40854.0000156 -19-22JUL02-5/5

**Fuel System Repair and Adjustment Other Materials**

Number	Name	Use
T43512 (U.S.) TY9473 (Canadian) 242 (LOCTITE®)	Pipe Sealant	Apply to threads of fuel transfer pump capscrews and injector leak-off fitting.

LOCTITE is a registered trademark of Loctite Corp.

RG40854.0000159 -19-22JUL02-1/1

### Electronic Engine Control Repair Tools

*NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).*

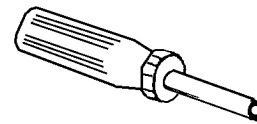
*SERVICEGARD is a trademark of Deere & Company*

RG40854,0000158 -19-22JUL02-1/17

RW25539 -UN-28AUG96

#### Terminal Extraction Tool<sup>1</sup> . . . . . JDG364

Used to extract WEATHER PACK™ terminals from electrical connectors.



*WEATHER PACK is a trademark of Packard Electric*

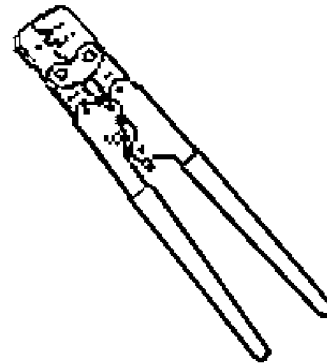
<sup>1</sup>Included in Technician's Electrical Repair Kit - JT07195B

RG40854,0000158 -19-22JUL02-2/17

05  
170  
3

#### 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.



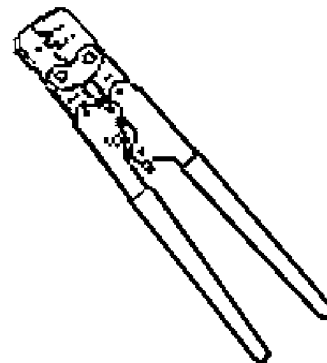
RW25542A -UN-07MAR02

*WEATHER PACK is a trademark of Packard Electric*

RG40854,0000158 -19-22JUL02-3/17

#### 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.*

Continued on next page

RG40854,0000158 -19-22JUL02-4/17

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.

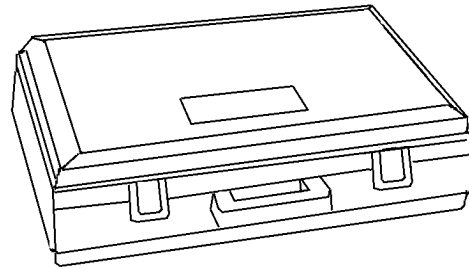


RG11679 -UN-05FEB01

RG40854,0000158 -19-22JUL02-5/17

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.

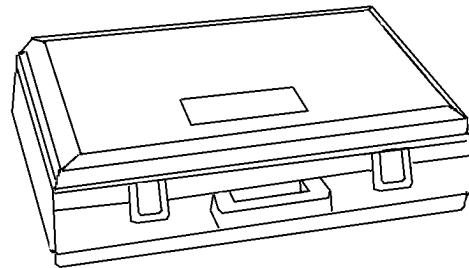


RW25558 -UN-29AUG96

RG40854,0000158 -19-22JUL02-6/17

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

RG40854,0000158 -19-22JUL02-7/17

Continued on next page

05  
170  
4

Electronic Fuel/Control System Repair Tools and Other Materials

Electrician's Pliers<sup>1</sup> . . . . . JDG145

Used to cut, strip, and splice wires.



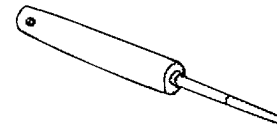
RG11686 -JUN-13FEB01

<sup>1</sup>Included in Technician's Electrical Repair Kit - JDG155

RG40854,0000158 -19-22JUL02-8/17

METRI-PACK™ Extractor (Wide)<sup>1</sup> . . . . . JDG776

Used to remove terminals from 56-Series, 280-Series, and 630-Series METRI-PACK™ connectors.



RW25541 -UN-20AUG96

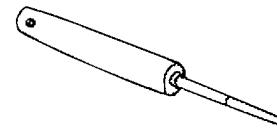
METRI-PACK is a trademark of Packard Electric Inc.

<sup>1</sup>Included in Technician's Electrical Repair Kit - JT07195B

RG40854,0000158 -19-22JUL02-9/17

METRI-PACK™ Extractor (Narrow)<sup>1</sup>. . . . . JDG777

Used to remove terminals from 150-Series METRI-PACK™, SUMITOMO, and YAZAKI connectors.



RW25541 -UN-20AUG96

METRI-PACK is a trademark of Packard Electric Inc.

<sup>1</sup>Included in Technician's Electrical Repair Kit - JT07195B

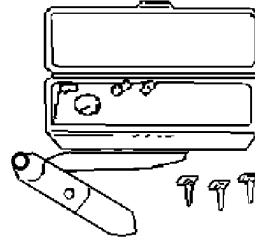
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RG40854,0000158 -19-22JUL02-10/17

05  
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5

DEUTSCH™ Electrical Repair Tool Kit . . . . .JDG359

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)



RW25540 -UN-06SEP96

DEUTSCH is a trademark of Deutsch Co.

RG40854,0000158 -19-22JUL02-11/17

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170  
6

12—14 Gauge Extractor (Set of Two)<sup>1</sup>. . . . . JDG361

Used to remove terminals on 12-14 gauge wires in DEUTSCH connectors.



Deutsch Extraction Tool

RG12278 -UN-22APR02

<sup>1</sup>Included in DEUTSCH Electrical Repair Kit - JDG359

Continued on next page

RG40854,0000158 -19-22JUL02-12/17

16—18 Gauge Extractor (Set of Two)<sup>1</sup> . . . . . JDG362

Used to remove terminals on 16-18 gauge wires in DEUTSCH connectors.



Deutsch Extraction Tool

RG12278 -JUN-22APR02

<sup>1</sup>Included in DEUTSCH Electrical Repair Kit - JDG359

RG40854,0000158 -19-22JUL02-13/17

20—24 Gauge Extractor (Set of Two)<sup>1</sup> . . . . . JDG363

Used to remove terminals on 20-24 gauge wires in DEUTSCH connectors.



Deutsch Extraction Tool

RG12278 -JUN-22APR02

<sup>1</sup>Included in DEUTSCH Electrical Repair Kit - JDG359

RG40854,0000158 -19-22JUL02-14/17

Crimping Tool<sup>1</sup> . . . . . JDG360

Used to crimp DEUTSCH closed barrel terminals on 12-24 gauge wires.



RG12235 -JUN-15MAR02

<sup>1</sup>Included in DEUTSCH Electrical Repair Kit - JDG359

Continued on next page

RG40854,0000158 -19-22JUL02-15/17

05  
170  
7

Electronic Fuel/Control System Repair Tools and Other Materials

RG10740 -UN-31MAY00

Terminal Extraction Tool . . . . .FKM10457

Used to extract female terminals from Level 1 and Level 4 Engine Control Unit (ECU) using Amp connectors.



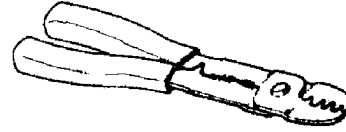
FKM10457

RG40854.0000158 -19-22JUL02-16/17

RG10739 -UN-26MAY00

Crimping Pliers<sup>1</sup> . . . . .JDG144

Universal crimp tool is used to crimp terminals on wires. It is recommended to use crimp tools specific for the terminal being crimped. If there is not a specified crimp tool, use this tool.



JDG144

<sup>1</sup>Included in Technician's Electrical Repair Kit - JDG155

RG40854.0000158 -19-22JUL02-17/17

05  
170  
8

**Control Repair and Adjustment Other Materials**

Number	Name	Use
JDT405 (U.S.)	High Temperature Grease	Sensor O-rings.
T43512 (U.S.) TY9473 (Canadian) 242 (LOCTITE®)	Pipe Sealant	Apply to threads of electronic injector studs.
AT66865 (U.S.)	Lubricant	Insulate electrical connectors.

LOCTITE is a registered trademark of Loctite Corp.

RG40854.0000157 -19-22JUL02-1/1



**Electronic Fuel/Control System Diagnostic Tools**

*NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or in the*

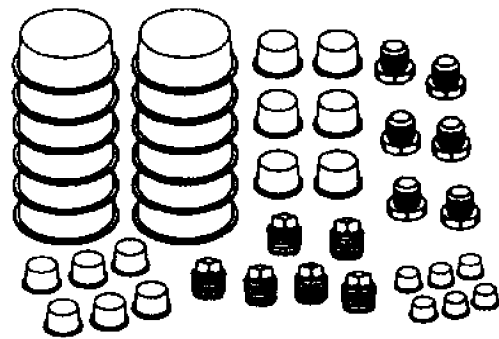
*European Microfiche Tool Catalog (MTC) unless otherwise noted.*

*SERVICEGARD is a trademark of Deere & Company.*

RG40854.000015A -19-22JUL02-1/12

**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.



JDG998

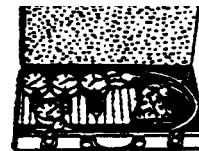
RG8518 -UN-09OCT02

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RG40854.000015A -19-22JUL02-2/12

**Universal Pressure Test Kit . . . . . JT05412**

Used for testing engine oil pressure, intake manifold pressure (turbo boost), and fuel transfer pump pressure.



JT05412

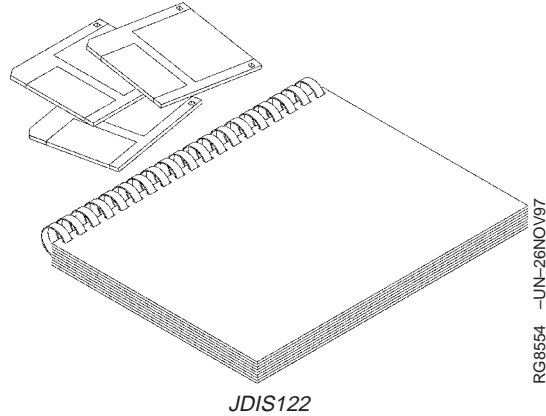
RG5162 -UN-23AUG88

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RG40854.000015A -19-22JUL02-3/12

ECU Communication Software Kit . . . . . JDIS122

Please refer to your John Deere Dealer website for information on obtaining the latest version of software.



RG40854,000015A -19-22JUL02-4/12

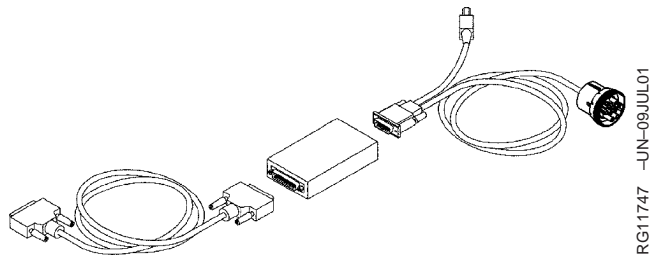
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**NOTE:** Available from John Deere Distribution Service Center (DSC). United States and Canadian Agricultural dealers **DO NOT ORDER** without first contacting your Branch or TAM.

RG40854,000015A -19-22JUL02-5/12

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.

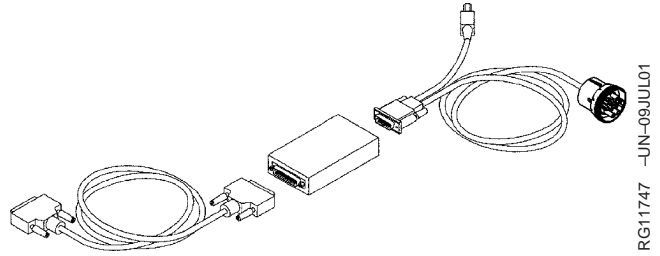


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RG40854,000015A -19-22JUL02-6/12

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

RG40854.000015A -19-22JUL02-7/12

**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.**

05  
180  
3

RG40854.000015A -19-22JUL02-8/12

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.



JT07306 - Digital Multimeter

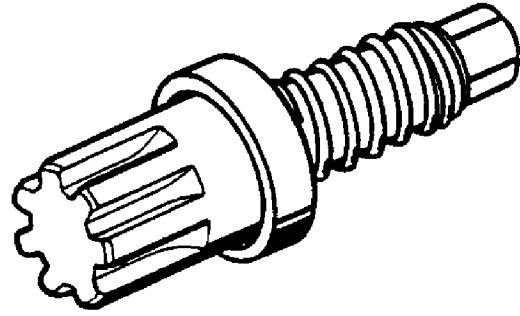
RG11126 -UN-19JUN00

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RG40854.000015A -19-22JUL02-9/12

Flywheel Timing Tool . . . . . JDG820

Used to rotate engine flywheel to lock engine at "TDC" to check high pressure fuel pump timing. Use with JDE81-4 Timing Pin.

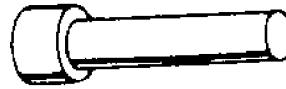


RG7056 -UN-05DEC97  
RG7056

RG40854,000015A -19-22JUL02-10/12

Timing Pin . . . . . JDE81-4

Used to lock engine at "TDC". Use with JDG820 Flywheel Turning Tool.



JDE81-4 Timing Pin

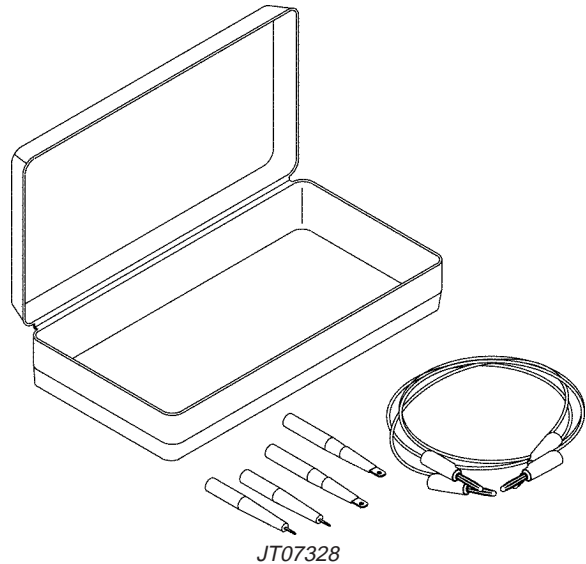
RG5068

RG5068 -UN-05DEC97

RG40854,000015A -19-22JUL02-11/12

Connector Adapter Test Kit . . . . . JT07328

Used with JT05791 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

RG8803 -UN-26NOV97

RG40854,000015A -19-22JUL02-12/12

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# Section 06 Specifications

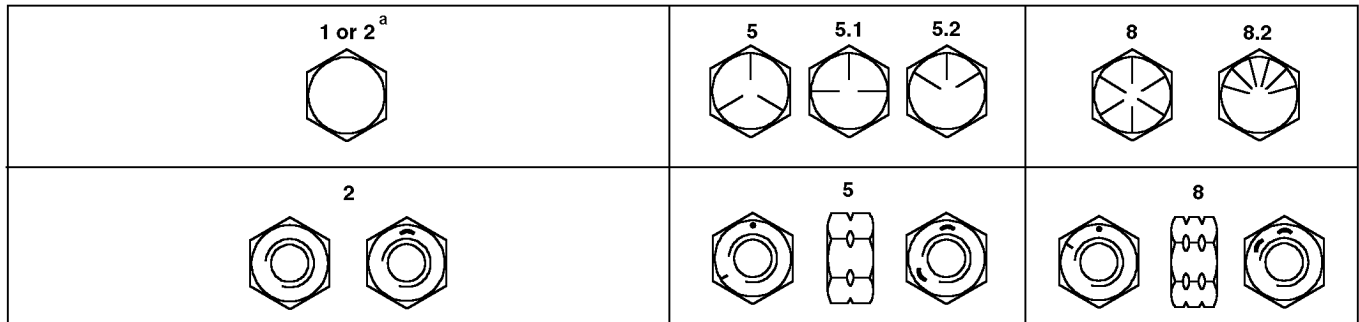
## Contents

	Page	Page
<b>Group 200—Repair Specifications</b>		
Unified Inch Bolt and Cap Screw Torque Values . . . . .	06-200-1	
Metric Bolt and Cap Screw Torque Values . . . . .	06-200-2	
Electronic Fuel System Repair and Adjustment Specifications . . . . .	06-200-3	
Electronic Engine Control Repair and Adjustment Specifications . . . . .	06-200-5	
<b>Group 210—Diagnostic Specifications</b>		
Fuel System Diagnostic Specifications . . . . .	06-210-1	
Application Specifications . . . . .	06-210-3	
Combines - Sensor Specifications . . . . .	06-210-6	
Combines - Torque Curve Selection . . . . .	06-210-8	
Combines - Governor Mode Selection . . . . .	06-210-8	
Combines - ECU Terminal Identification . . . . .	06-210-9	
Loaders - Sensor Specifications . . . . .	06-210-10	
Loaders - Torque Curve Selection . . . . .	06-210-12	
Loaders - Governor Mode Selection . . . . .	06-210-13	
Loaders - ECU Terminal Identification . . . . .	06-210-14	
Motor Graders - Sensor Specifications . . . . .	06-210-15	
Motor Graders - Torque Curve Selection . . . . .	06-210-17	
Motor Graders - Governor Mode Selection . . . . .	06-210-17	
Motor Graders - ECU Terminal Identification . . . . .	06-210-18	
OEM Engines - Sensor Specifications . . . . .	06-210-20	
OEM Engines - Torque Curve Selection . . . . .	06-210-22	
OEM Engines - Governor Mode Selection . . . . .	06-210-23	
OEM Engines - ECU Terminal Identification . . . . .	06-210-24	
OEM Engines - Electronic Control System Wiring Diagram . . . . .	06-210-26	
OEM Engines - 4.5L & 6.8L Instrument Panel/Engine Start Components Electrical Wiring Diagram . . . . .	06-210-28	
6020 Tractors - Sensor Specifications . . . . .	06-210-30	
6020 Tractors - Torque Curve Selection . . . . .	06-210-32	
6020 Tractors - Governor Mode Selection . . . . .	06-210-33	
6020 Tractors - ECU Terminal Identification . . . . .	06-210-34	
Tractors - 7720 - 7820 Series - Sensor Specifications . . . . .	06-210-36	
Tractors - 7720 - 7820 Series - Torque Curve Selection . . . . .	06-210-38	
Tractors - 7720 - 7820 Series - Governor Mode Selection . . . . .	06-210-39	
Tractors - 7720 - 7820 Series - ECU Terminal Identification . . . . .	06-210-40	

06

*Contents*

## Unified Inch Bolt and Cap Screw Torque Values



Top, SAE Grade and Head Markings; Bottom, SAE Grade and Nut Markings

Size	Grade 1 (No Mark)		Grade 2 <sup>a</sup> (No Mark)		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
	Lubricated <sup>b</sup> N•m(lb-ft)	Dry <sup>c</sup> N•m(lb-ft)	Lubricated <sup>b</sup> N•m(lb-ft)	Dry <sup>c</sup> N•m(lb-ft)	Lubricated <sup>b</sup> N•m(lb-ft)	Dry <sup>c</sup> N•m(lb-ft)	Lubricated <sup>b</sup> N•m(lb-ft)	Dry <sup>c</sup> 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)

<sup>a</sup> 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.

<sup>b</sup> "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

<sup>c</sup> "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

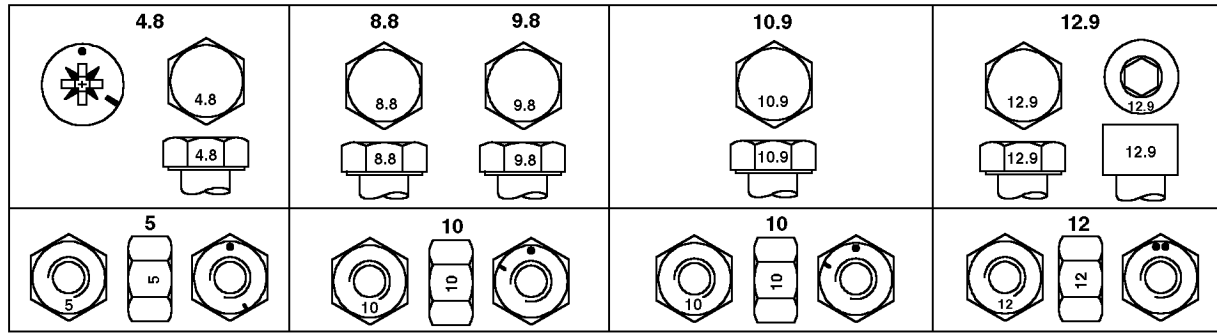
Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

TORQ1A -UN-27SEP99

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### Metric Bolt and Cap Screw Torque Values



Top, Property Class and Head Markings; Bottom, Property Class and Nut Markings

TOR02 -UN-07SEP99

Size	Class 4.8		Class 8.8 or 9.8		Class 10.9		Class 12.9	
	Lubricated <sup>a</sup> N•m(lb-ft)	Dry <sup>b</sup> N•m(lb-ft)	Lubricated <sup>a</sup> N•m(lb-ft)	Dry <sup>b</sup> N•m(lb-ft)	Lubricated <sup>a</sup> N•m(lb-ft)	Dry <sup>b</sup> N•m(lb-ft)	Lubricated <sup>a</sup> N•m(lb-ft)	Dry <sup>b</sup> 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)

<sup>a</sup> "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

<sup>b</sup> "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.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

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.

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.



## Electronic Fuel System Repair and Adjustment Specifications

Item	Measurement	Specification
Pre-filter Inlet and Outlet Lines	Torque	9 N•m (6.6 lb-ft)
Pre-filter Mounting Bracket-to-Cylinder Head Cap Screws	Torque	73 N•m (53.8 lb-ft)
Pre-filter Fuel Filter Base-to-Bracket Cap Screws	Torque	50 N•m (36.9 lb-ft)
Final Fuel Filter Inlet and Outlet Lines	Torque	9 N•m (6.6 lb-ft)
Final Fuel Filter Outlet Line	Torque	9 N•m (6.6 lb-ft)
Air Bleed Valve Fitting (Combine engines)	Torque	20 N•m (14.8 lb-ft)
Final Fuel Filter Base-to-Bracket	Torque	50 N•m (36.9 lb-ft)
Final Fuel Filter Bracket to Cylinder Head	Torque	73 N•m (53.4 lb-ft)
Fuel Transfer Pump Cap Screws (OEM engines only)	Torque	30 N•m (22 lb-ft)
High Pressure Fuel Pump to Adapter Plate	Torque	40 N•m (29.5 lb-ft)
High Pressure Fuel Pump Gear Nut	Torque	68 N•m (50.1 lb-ft)
High Pressure Fuel Pump Adapter Plate to Front Cover	Torque	40 N•m (29.5 lb-ft)
High Pressure Fuel Lines - Injection Pump Fitting	Torque	27 N•m (19.9 lb-ft)
High Pressure Fuel Lines - High Pressure Common Rail Fitting	Torque	27 N•m (19.9 lb-ft)
High Pressure Fuel Pump Leak-off Line Fitting	Torque	6 N•m (4.4 lb-ft)
High Pressure Fuel Pump Inlet Filter Plug	Torque	18 N•m (13.3 lb-ft)

*Repair Specifications*

Item	Measurement	Specification
High Pressure Common Rail Bracket to Engine	Torque	52 N•m (38.4 lb-ft)
High Pressure Common Rail to Bracket	Torque	52 N•m (38.4 lb-ft)
High Pressure Common Rail - Delivery Lines to Electronic Injectors	Torque	27 N•m (19.9 lb-ft)
High Pressure Common Rail - Fuel Inlet Lines	Torque	27 N•m (20 lb-ft)
High Pressure Pump - Fuel Outlet Lines	Torque	27 N•m (20 lb-ft)
High Pressure Rail Leak-off Line Fitting	Torque	6 N•m (4.4 lb-ft)
Flow Damper	Torque	176 N•m (130 lb-ft)
Fitting - High Pressure Injection Line to High Pressure Common Rail	Torque	27 N•m (20 lb-ft)
High Pressure Rail Delivery Fuel Line - Fitting at Side Feed Tube Retaining Nut	Torque	27 N•m (20 lb-ft)
First Torque - Side Feed Tube Retaining Nut	Torque	5 N•m (3.7 lb-ft)
Hold Down Clamp Bolt	Torque	47 N•m (34.7 lb-ft)
Second Torque - Side Feed Tube Retaining Nut	Torque	35 N•m (25.8 lb-ft)
High Pressure Delivery Line Fitting	Torque	27 N•m (19.9 lb-ft)
Injector Solenoid Wire Retaining Nut	Torque	2 N•m (1.5 lb-ft) (18 lb-in.)
Heat Shield Cylinder Head Cap Screws	Torque	60 N•m (44 lb-ft)
Heat Shield Rocker Arm Carrier Cap Screws	Torque	10 N•m (7.4 lb-ft)
Injector Leak-off Fitting	Torque	18 N•m (13.3 lb-ft)

RG40854.000013E -19-15JUL02-2/2

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## Electronic Engine Control Repair and Adjustment Specifications

Item	Measurement	Specification
Fuel Temperature Sensor	Torque	10 N•m (7 lb-ft)
Manifold Air Temperature (MAT) Sensor	Torque	10 N•m (7 lb-ft)
Oil Pressure Sensor	Torque	9 N•m (7 lb-ft)
Fuel Rail Pressure Sensor	Torque	98 N•m (72 lb-ft)
Crankshaft Position Sensor	Torque	14 N•m (10 lb-ft)
Pump Position Sensor	Torque	14 N•m (10 lb-ft)
Glow Plug	Torque	15 N•m (11 lb-ft)
Heat Shield Cylinder Head Cap Screws	Torque	60 N•m (44 lb-ft)
Heat Shield Rocker Arm Carrier Cap Screws	Torque	10 N•m (7.4 lb-ft)

RG40854,000013F -19-15JUL02-1/1

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**Fuel System Diagnostic Specifications**

Item	Measurement	Specification
Minimum Fuel Transfer Pump Pressure	Cranking	30 kPa (0.3 bar) (4.4 psi)
	Running (Low Idle)	40 kPa (0.4 bar) (5.8 psi)
Minimum Fuel Rail Pressure	Cranking	20 MPa (200 bar) (2900 psi)
	Running (Low Idle)	35 MPa (350 bar) (5076 psi)

RG40854.0000140 -19-15JUL02-1/1

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## Application Specifications

Below is an overview of the specifications listed for applications in the next few pages.

### • Combines

- Sensor Specifications - See COMBINES - SENSOR SPECIFICATIONS later in this Group.
- Torque Curve Selection - See COMBINES - TORQUE CURVE SELECTION later in this Group.
- Governor Mode Selection - See COMBINES - GOVERNOR MODE SELECTION later in this Group.
- ECU Terminal Identification - See COMBINES - ECU TERMINAL IDENTIFICATION later in this Group.
- Vehicle Wiring - See Vehicle manual.

### • Loaders

- Sensor Specifications - See LOADERS - SENSOR SPECIFICATIONS later in this Group.
- Torque Curve Selection - See LOADERS - TORQUE CURVE SELECTION later in this Group.
- Governor Mode Selection - See LOADERS - GOVERNOR MODE SELECTION later in this Group.
- ECU Terminal Identification - See LOADERS - ECU TERMINAL IDENTIFICATION later in this Group.
- Vehicle Wiring - See Vehicle manual.

### • Motor Graders

- Sensor Specifications - See MOTOR GRADERS - SENSOR SPECIFICATIONS later in this Group.
- Torque Curve Selection - See MOTOR GRADERS - TORQUE CURVE SELECTION later in this Group.
- Governor Mode Selection - See MOTOR GRADERS - GOVERNOR MODE SELECTION later in this Group.
- ECU Terminal Identification - See MOTOR GRADERS - ECU TERMINAL IDENTIFICATION later in this Group.
- Vehicle Wiring - See Vehicle manual.

### • OEM Engines

- Sensor Specifications - See OEM ENGINES - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See OEM ENGINES - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See OEM ENGINES - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See OEM ENGINES - ECU TERMINAL IDENTIFICATION later in this Group.
  - Electronic Control System Wiring Diagram - See OEM ENGINES - ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM later in this Group.
  - 4.5L & 6.8L OEM Application Instrument Panel/Engine Start Components Electrical Wiring Diagram - See OEM ENGINES - 4.5L & 6.8L INSTRUMENT PANEL/ENGINE START COMPONENTS ELECTRICAL WIRING DIAGRAM later in this Group.
- ### • Tractors - 6020 Series
- Sensor Specifications - See 6020 TRACTORS - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See 6020 TRACTORS - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See 6020 TRACTORS - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See 6020 TRACTORS - ECU TERMINAL IDENTIFICATION later in this Group.
  - Vehicle Wiring - See Vehicle manual.
- ### • Tractors - 7220-7520 Series
- Sensor Specifications - See 7220-7520 TRACTORS - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See 7220-7520 TRACTORS - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See 7220-7520 TRACTORS - GOVERNOR MODE SELECTION later in this Group.

*Diagnostic Specifications*

- ECU Terminal Identification - See 7220-7520  
TRACTORS - ECU TERMINAL IDENTIFICATION  
later in this Group.
- Vehicle Wiring - See Vehicle manual.
- **Tractors - 7720-7820 Series**
  - Sensor Specifications - See 7720-7820  
TRACTORS - SENSOR SPECIFICATIONS later  
in this Group.
  - Torque Curve Selection - See 7720-7820  
TRACTORS - TORQUE CURVE SELECTION  
later in this Group.
  - Governor Mode Selection - See 7720-7820  
TRACTORS - GOVERNOR MODE SELECTION  
later in this Group.
  - ECU Terminal Identification - See 7720-7820  
TRACTORS - ECU TERMINAL IDENTIFICATION  
later in this Group.
  - Vehicle Wiring - See Vehicle manual.

RG40854,0000145 -19-16JUL02-2/2





## **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

RG40854.0000144 -19-16JUL02-1/3

*Diagnostic Specifications*

**Sensor Specifications for Combines**

Sensor	SPN-FMI	Measured Sensor Parameter	Out of Range Value	Derate
Fuel Rail Pressure	000094.03	High Input Voltage	Above 4.89 Volts	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000094.04	Low Input Voltage	Below 0.9 Volts	ECU derates engine 50% per minute until engine runs at 50% of full power.
Manifold Air Temperature (MAT)	000105.00	Extremely High	Exceeds 100°C (212°F)	ECU derates engine 20% per minute until the engine until engine runs at 60% of full power.
	000105.03	High Input Voltage	Above 4.9 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	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until the engine until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 120°C (248°F)	ECU derates engine 60% 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	Least Severe Temperature	Exceeds 105°C (221°F)	ECU derates engine 2% per minute until engine runs at 95% of full power.
	000110.16	Moderately Severe Temperature	Exceeds 110°C (230°F)	ECU derates engine 40% per minute until engine runs at 60% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 80°C (176°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Crankshaft Position	000637.02	Input Noise	Noise detection of 100%	ECU derates engine 50% per minute until engine runs at 50% of full power.

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Continued on next page

RG40854,0000144 -19-16JUL02-2/3

## Diagnostic Specifications

### Sensor Specifications for Combines

	000637.07	Crankshaft Position mismatch with Pump Position	Speed sensors out of sync.	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000637.08	Input Missing	No signal detected	ECU derates engine 50% per minute until engine runs at 50% of full power.

RG40854.0000144 -19-16JUL02-3/3

### Combines - Torque Curve Selection

#### Torque Curve Selection for Combines

Torque Curve # on DST or SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal operation

SERVICE ADVISOR is a trademark of Deere & Company

RG40854.0000143 -19-16JUL02-1/1

### Combines - Governor Mode Selection

#### Desired Speed Governor Selection for Combines

Mode Selected on DST or SERVICE ADVISOR™	Conditions
0	Normal droop

#### Max. Speed Governor Selection for Combines

Mode Selected on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop

SERVICE ADVISOR is a trademark of Deere & Company

RG40854.0000142 -19-16JUL02-1/1

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210  
8

**Combines - ECU Terminal Identification**

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal#
Switched Battery	E3	N/A <sup>a</sup>
Unswitched Battery	B1, B2	N/A <sup>a</sup>
System Ground	C2, C3	N/A <sup>a</sup>
CAN High	L1	N/A <sup>a</sup>
CAN Low	L2	N/A <sup>a</sup>
Fuel Rail Pressure 5V Sensor Supply	R3	3
Fuel Rail Pressure Sensor Ground	P3	2
Fuel Rail Pressure Input	R1	1
Engine Oil Pressure Input	D3	B
Air Filter Vacuum Input	D2	B
Sensor Ground 2	N3	Varies depending on sensor/switch
Manifold Air Temperature (MAT) Input	Y2	A
Engine Coolant Temperature (ECT) Input	X2	A
Fuel Temperature Input	X3	1
Sensor Ground 1	P2	Varies depending on sensor/switch
Crank Position Input	W1	A
Crank Position Return	W2	B
Pump Position Input	X1	B
Pump Position Return	W3	A
Pump Solenoid Return	J1	1
Pump Solenoid Supply	H2	2
Glow Plug Control	J3	NA <sup>a</sup>
Glow Plug Diagnostic	F3	NA <sup>a</sup>
Transfer Pump Control	K1	NA <sup>a</sup>
Cylinder 1, 2, and 3 90V Supply	A2	4
Cylinder 4, 5, and 6 90V Supply	A1	9
Cylinder 1 Control	E1	1
Cylinder 2 Control	F1	2
Cylinder 3 Control	H1	3
Cylinder 4 Control	F2	10
Cylinder 5 Control	E2	11
Cylinder 6 Control	G1	12
<sup>a</sup> 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

RG41221,0000128 -19-14APR03-1/3

*Diagnostic Specifications*

**Sensor Specifications for Loaders**

Sensor	SPN-FMI	Measured Sensor Parameter	Out of Range Value	Derate
Fuel Rail Pressure	000094.03	High Input Voltage	Above 4.89 Volts	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000094.04	Low Input Voltage	Below 0.9 Volts	ECU derates engine 50% per minute until engine runs at 50% of full power.
Oil Pressure	000100.01	Extremely Low Pressure	Below an extremely low engine oil pressure. This pressure increases with engine speed.	ECU will shut the engine down immediately.
	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.
	000100.16	High Pressure	Oil pressure is above the high pressure specification.	The ECU does NOT derate the engine.
	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 90% of full power.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.9 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	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until the engine until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 110°C (230°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	Least Severe Temperature	Exceeds 105°C (221°F)	ECU derates engine 2% per minute until engine runs at 95% of full power.
	000110.16	Moderately Severe Temperature	Exceeds 108°C (226°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	High fuel temperature engine protection is disabled.

06  
210  
11

Continued on next page

RG41221.0000128 -19-14APR03-2/3

## Diagnostic Specifications

### Sensor Specifications for Loaders

	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 65°C (149°F)	ECU does not derate the engine. 2% per minute until engine runs at 80% of full power.
Crankshaft Position	000637.02	Input Noise	Noise detection of 100%	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000637.07	Crankshaft Position mismatch with Pump Position	Speed sensors out of sync.	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000637.08	Input Missing	No signal detected	ECU derates engine 50% per minute until engine runs at 50% of full power.

RG41221,0000128 -19-14APR03-3/3

## Loaders - Torque Curve Selection

Torque Curve Selection for Loaders	
Torque Curve # on DST or SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal operation

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RG41221,0000129 -19-14APR03-1/1



## Loaders - Governor Mode Selection

### Desired Speed Governor Selection for Loaders

Mode Selected on DST or SERVICE ADVISOR™	Conditions
0	Normal droop

### Max. Speed Governor Selection for Loaders

Mode Selected on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop

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RG41221,000012A -19-14APR03-1/1

06  
210  
13

**Loaders - ECU Terminal Identification**

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal#
Switched Battery	E3	N/A <sup>a</sup>
Unswitched Battery	B1, B2	N/A <sup>a</sup>
System Ground	C2, C3	N/A <sup>a</sup>
CAN High	L1	N/A <sup>a</sup>
CAN Low	L2	N/A <sup>a</sup>
Fuel Rail Pressure 5V Sensor Supply	R3	3
Fuel Rail Pressure Sensor Ground	P3	2
Fuel Rail Pressure Input	R1	1
Engine Oil Pressure Input	T2	B
Air Filter Vacuum Input	F3	B
Sensor Ground 2	P2	Varies depending on sensor/switch
Manifold Air Temperature (MAT) Input	Y2	A
Engine Coolant Temperature (ECT) Input	X2	A
Fuel Temperature Input	X3	1
Sensor Ground 1	N3	Varies depending on sensor/switch
Crank Position Input	W1	A
Crank Position Return	W2	B
Pump Position Input	X1	B
Pump Position Return	W3	A
Pump Solenoid Return	J1	1
Pump Solenoid Supply	H2	2
Cylinder 1, 2, and 3 90V Supply	A2	4
Cylinder 4, 5, and 6 90V Supply	A1	9
Cylinder 1 Control	E1	1
Cylinder 2 Control	F1	2
Cylinder 3 Control	H1	3
Cylinder 4 Control	F2	10
Cylinder 5 Control	E2	11
Cylinder 6 Control	G1	12
<sup>a</sup> N/A = Not Applicable		

RG41221,000012B -19-14APR03-1/1

## **Motor Graders - 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

RG41221.000012F -19-14APR03-1/3

06  
210  
15

*Diagnostic Specifications*

**Sensor Specifications for Motor Graders**

Sensor	SPN-FMI	Measured Sensor Parameter	Out of Range Value	Derate
Fuel Rail Pressure	000094.03	High Input Voltage	Above 4.89 Volts	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000094.04	Low Input Voltage	Below 0.9 Volts	ECU derates engine 50% per minute until engine runs at 50% of full power.
Oil Pressure	000100.01	Extremely Low Pressure	Below an extremely low engine oil pressure. This pressure increases with engine speed.	ECU will shut the engine down immediately.
	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 4.9 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	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until the engine until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 110°C (230°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	Least Severe Temperature	Exceeds 105°C (221°F)	ECU derates engine 2% per minute until engine runs at 95% of full power.
	000110.16	Moderately Severe Temperature	Exceeds 108°C (226°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	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.

Continued on next page

RG41221,000012F -19-14APR03-2/3

06  
210  
16

## Diagnostic Specifications

### Sensor Specifications for Motor Graders

	000174.16	Moderately High Temperature	Exceeds 65°C (149°F)	ECU does not derate the engine. 2% per minute until engine runs at 80% of full power.
Crankshaft Position	000637.02	Input Noise	Noise detection of 100%	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000637.07	Crankshaft Position mismatch with Pump Position	Speed sensors out of sync.	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000637.08	Input Missing	No signal detected	ECU derates engine 50% per minute until engine runs at 50% of full power.

RG41221,000012F -19-14APR03-3/3

### Motor Graders - Torque Curve Selection

#### Torque Curve Selection for Motor Graders

Torque Curve # on DST or SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal operation

06  
210  
17

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RG41221,000012E -19-14APR03-1/1

### Motor Graders - Governor Mode Selection

#### Desired Speed Governor Selection for Motor Graders

Mode Selected on DST or SERVICE ADVISOR™	Conditions
0	Normal droop

#### Max. Speed Governor Selection for Motor Graders

Mode Selected on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop

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RG41221,000012D -19-14APR03-1/1

**Motor Graders - ECU Terminal Identification**

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal#
Switched Battery	E3	N/A <sup>a</sup>
Unswitched Battery	B1, B2	N/A <sup>a</sup>
System Ground	C2, C3	N/A <sup>a</sup>
CAN High	L1	N/A <sup>a</sup>
CAN Low	L2	N/A <sup>a</sup>
Fuel Rail Pressure 5V Sensor Supply	R3	3
Fuel Rail Pressure Sensor Ground	P3	2
Fuel Rail Pressure Input	R1	1
Engine Oil Pressure Input	T2	B
Sensor Ground 2	P2	Varies depending on sensor/switch
Manifold Air Temperature (MAT) Input	Y2	A
Engine Coolant Temperature (ECT) Input	X2	A
Fuel Temperature Input	X3	1
Sensor Ground 1	N3	Varies depending on sensor/switch
Crank Position Input	W1	A
Crank Position Return	W2	B
Pump Position Input	X1	B
Pump Position Return	W3	A
Pump Solenoid Return	J1	1
Pump Solenoid Supply	H2	2
Glow Plug Control	J3	N/A <sup>a</sup>
Cylinder 1, 2, and 3 90V Supply	A2	4
Cylinder 4, 5, and 6 90V Supply	A1	9
Cylinder 1 Control	E1	1
Cylinder 2 Control	F1	2
Cylinder 3 Control	H1	3
Cylinder 4 Control	F2	10
Cylinder 5 Control	E2	11
Cylinder 6 Control	G1	12
Throttle Input	R2	N/A <sup>a</sup>
Tachometer Output	M1	N/A <sup>a</sup>

<sup>a</sup>N/A = Not Applicable



## **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

RG40854.0000147 -19-16JUL02-1/3

06  
210  
20



*Diagnostic Specifications*

**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.
	000029.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Analog Throttle (B)	000028.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000028.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Fuel Rail Pressure	000094.03	High Input Voltage	Above 4.89 Volts	ECU derates engine 50% per minute until the engine runs at 50% of full power.
	000094.04	Low Input Voltage	Below 0.9 Volts	ECU derates engine 50% per minute until the engine runs at 50% of full power.
Oil Pressure	000100.00	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 4.9 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 118°C (244°F)	ECU derates engine 60% 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.

06  
210  
21

Continued on next page

RG40854,0000147 -19-16JUL02-2/3

## Diagnostic Specifications

### Sensor Specifications for OEM Engines

	000110.15	Least Severe Temperature	Exceeds 108°C (226°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 40% per minute until engine runs at 60% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 80°C (176°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG40854.0000147 -19-16JUL02-3/3

## OEM Engines - Torque Curve Selection

Torque Curve Selection for OEM Engines	
Torque Curve # on DST or SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal Curve

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RG40854.0000146 -19-16JUL02-1/1

## OEM Engines - Governor Mode Selection

Desired Speed Governor Selection for OEM Engines	
Mode Selected on DST or SERVICE ADVISOR™	Conditions
0	Normal Droop (Default Gainset)
1	Isochronous Droop (Default Gainset)
2	Normal Droop (Selectable Gainset)
3	Isochronous Droop (Selectable Gainset)
6	Engine Cruise

Max. Speed Governor Selection for OEM Engines	
Mode Selected on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop with default gainset
10	Isochronous droop with default gainset
11	Normal droop with selectable gainset
12	Isochronous droop with selectable gainset
15	Absolute Maxspeed (used for speed derates)

06  
210  
23

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RG40854,000014A -19-16JUL02-1/1

## OEM Engines - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal#
Switched Battery	E3	N/A <sup>a</sup>
Unswitched Battery	B1, B2	N/A <sup>a</sup>
System Ground	C2, C3	N/A <sup>a</sup>
CAN High	L1	N/A <sup>a</sup>
CAN Low	L2	N/A <sup>a</sup>
Sensor Supply 1 (Analog (A) Throttle, Analog (B) Throttle, MAT)	N1	Varies on sensor connected to
Sensor Ground 1 (Analog (A) Throttle, MAT, Multi-state return)	N3	Varies on sensor connected to
Sensor Supply 2 (Oil pressure, ECT, Fuel Temp, Performance Program Connector)	P1	Varies on sensor connected to
Sensor Ground 2 (Oil Pressure, ECT, Fuel Temp, Analog Throttle (B))	P2	Varies on sensor connected to
Analog Throttle (A) Input	S3	B
Analog Throttle (B) Input	S1	B
High/Low Idle Input	Y1	B
Fuel Rail Pressure 5V Sensor Supply	R3	3
Fuel Rail Pressure Sensor Ground	P3	2
Fuel Rail Pressure Input	R1	1
Engine Oil Pressure Input	T2	C
Manifold Air Temperature (MAT) Input	Y2	A
Engine Coolant Temperature (ECT) Input	X2	A
Fuel Temperature Input	X3	1
Crank Position Input	W1	A
Crank Position Return	W2	B
Pump Position Input	X1	B
Pump Position Return	W3	A
Pump Solenoid Return	J1	1
Pump Solenoid Supply	H2	2
Glow Plug Control	J3	NA <sup>a</sup>
Cylinder 1, 2, and 3 90V Supply (6 cylinder engines)	A2	4
Cylinder 4, 5, and 6 90V Supply (6 cylinder engines)	A1	9
Cylinder 1 Control (6 cylinder engines)	E1	1
Cylinder 2 Control (6 cylinder engines)	F1	2
Cylinder 3 Control (6 cylinder engines)	H1	3
Cylinder 4 Control (6 cylinder engines)	F2	10
Cylinder 5 Control (6 cylinder engines)	E2	11
Cylinder 6 Control (6 cylinder engines)	G1	12
<sup>a</sup> N/A = Not Applicable		

06  
210  
24

*Diagnostic Specifications*

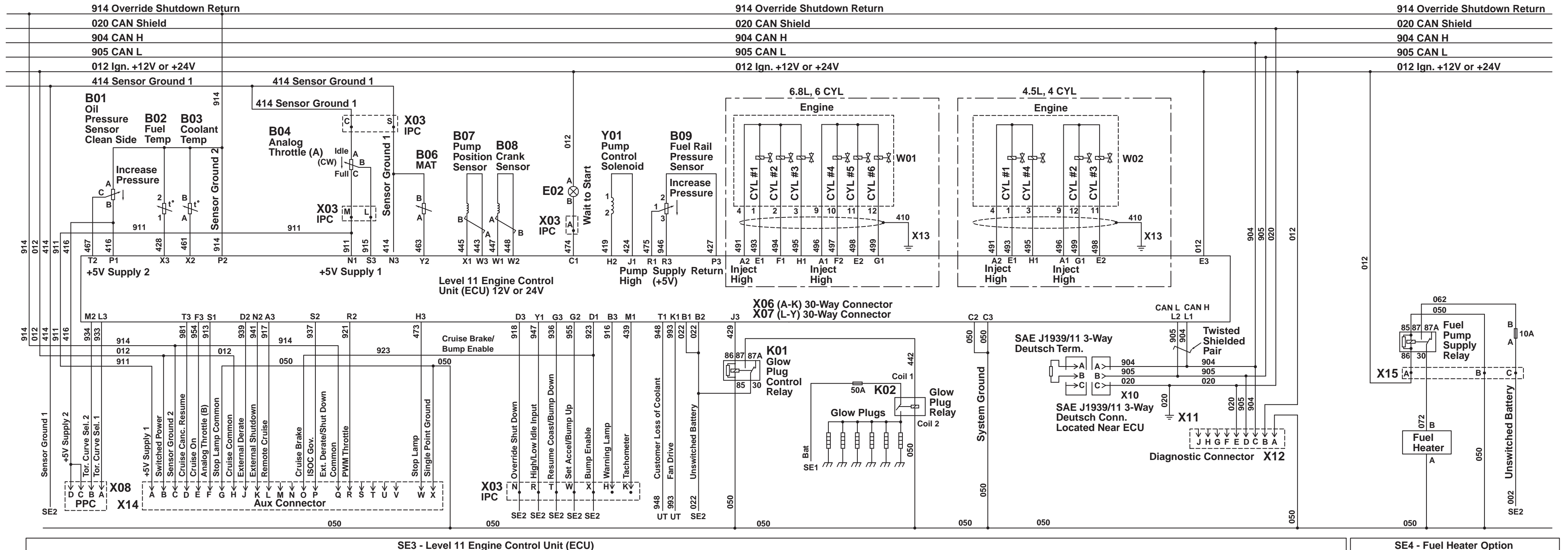
Cylinders 2 and 3 90V Supply (4-cylinder engines)	A1	9
Cylinders 1 and 4 90V Supply (4-cylinder engines)	A2	4
Cylinder 1 Control (4-cylinder engines)	E1	1
Cylinder 2 Control (4-cylinder engines)	G1	12
Cylinder 3 Control (4-cylinder engines)	E2	11
Cylinder 4 Control (4-cylinder engines)	H1	3

RG40854.0000149 -19-16JUL02-2/2

06  
210  
25

OEM Engines - Electronic Control System Wiring Diagram

RG12338 -19-18JUL02

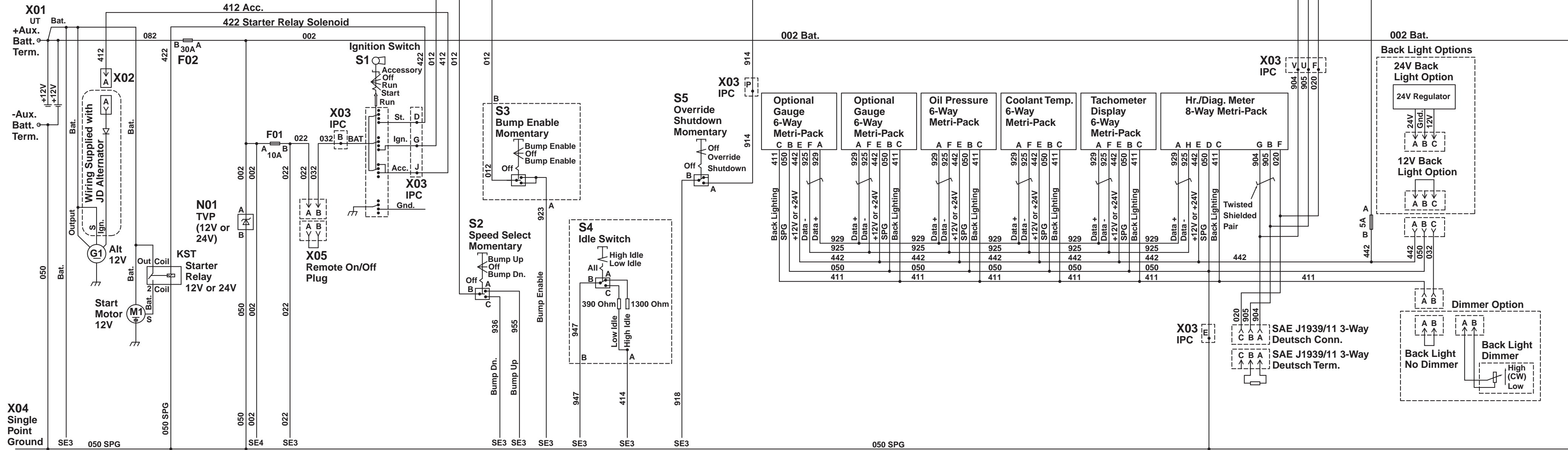


06  
210  
27

OEM Engines - 4.5L & 6.8L Instrument Panel/Engine Start Components Electrical Wiring Diagram

RG12339 -19-18JUL02

914 Override Shutdown Return	914 Override Shutdown Return	914 Override Shutdown Return
020 CAN Shield	020 CAN Shield	020 CAN Shield
904 CAN H	904 CAN H	904 CAN H
905 CAN L	905 CAN L	905 CAN L
012 Ign. +12V or +24V	012 Ign. +12V or +24V	012 Ign. +12V or +24V
412 Acc.	002 Bat.	002 Bat.
422 Starter Relay Solenoid	002 Bat.	002 Bat.



SE1 - Engine Start Components

SE2 - Instrument Panel





## **6020 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

RG40854.000014C -19-16JUL02-1/3

*Diagnostic Specifications*

**Sensor Specifications for 6020 Tractors**

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.
Analog Throttle (C)	000028.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000028.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Fuel Rail Pressure	000094.03	High Input Voltage	Above 4.89 Volts	ECU derates engine 50% per minute until the engine runs at 50% of full power.
	000094.04	Low Input Voltage	Below 0.9 Volts	ECU derates engine 50% per minute until the engine runs at 50% of full power.
Oil Pressure	000100.00	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 4.9 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 100°C (212°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

06  
210  
31

Continued on next page

RG40854,000014C -19-16JUL02-2/3

## Diagnostic Specifications

### Sensor Specifications for 6020 Tractors

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	Least Severe Temperature	Exceeds 110°C (230°F)	No derate
	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	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 80°C (176°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG40854.000014C -19-16JUL02-3/3

## 6020 Tractors - Torque Curve Selection

Torque Curve Selection for 6020 Series Tractors	
Torque Curve # on DST or SERVICE ADVISOR™	Conditions for Torque Curve
1	Below 15 km/hr and no boost
2	15-16 km/hr get 20% of boost
3	16-17 km/hr get 40% of boost
4	17-18 km/hr get 60% of boost
5	18-19 km/hr get 80% of boost
6	Greater than 19 km/hr (100% boost) OR PTO boost active (must be greater than 2 km/hr)

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RG40854.000014F -19-16JUL02-1/1

### 6020 Tractors - Governor Mode Selection

Desired Speed Governor Selection for 6020 Series Tractors	
Mode Selected on DST or SERVICE ADVISOR™	Conditions
0	Normal droop
1	Field cruise w/isochronous gov.
2	Bus Controlled Request/isochronous gov.
3	Bus Controlled Request/isochronous gov. (non-linear droop)
5	Bus Controlled Request with linear droop
6	Bus Controlled Request with linear droop

Max. Speed Governor Selection for 6020 Series Tractors	
Mode Selected on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop
10	Field cruise w/isochronous gov.
11	Maximum speed during Bus Request with EIS
12	Absolute maximum speed with isochronous governor
13	Road Speed Limiting with isochronous gov.

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RG40854,000014E -19-16JUL02-1/1

## 6020 Tractors - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal#
Switched Battery	E3	N/A <sup>a</sup>
Unswitched Battery	B1, B2	N/A <sup>a</sup>
System Ground	C2, C3	N/A <sup>a</sup>
CAN High	L1	N/A <sup>a</sup>
CAN Low	L2	N/A <sup>a</sup>
Sensor Supply 1 (Analog (A) Throttle)	N1	1
Sensor Ground 1 (Analog (A) Throttle)	N3	2
Sensor Supply 2 (Oil pressure, Analog Throttle (B), Analog Throttle (C), ECT, Fuel Temp, MAT)	P1	Varies on sensor connected to
Sensor Ground 2 (Oil Pressure, Analog Throttle (B), Analog Throttle (C), ECT, Fuel Temp, MAT)	P2	Varies on sensor connected to
Analog Throttle (A) Input	S3	4
Analog Throttle (B) Input	T3	B
Analog Throttle (C) Input	S1	C
Fuel Rail Pressure 5V Sensor Supply	R3	3
Fuel Rail Pressure Sensor Ground	P3	2
Fuel Rail Pressure Input	R1	1
Engine Oil Pressure Input	T2	C
Manifold Air Temperature (MAT) Input	Y2	A
Engine Coolant Temperature (ECT) Input	X2	A
Fuel Temperature Input	X3	1
Wheel Speed Input	D2	NA
Crank Position Input	W1	A
Crank Position Return	W2	B
Pump Position Input	X1	B
Pump Position Return	W3	A
Pump Solenoid Return	J1	1
Pump Solenoid Supply	H2	2
Glow Plug Control	J3	NA <sup>a</sup>
Glow Plug Diagnostic	F3	NA <sup>a</sup>
Cylinder 1, 2, and 3 90V Supply (6 cylinder engines)	A2	4
Cylinder 4, 5, and 6 90V Supply (6 cylinder engines)	A1	9
Cylinder 1 Control (6 cylinder engines)	E1	1
Cylinder 2 Control (6 cylinder engines)	F1	2
Cylinder 3 Control (6 cylinder engines)	H1	3
Cylinder 4 Control (6 cylinder engines)	F2	10
Cylinder 5 Control (6 cylinder engines)	E2	11
Cylinder 6 Control (6 cylinder engines)	G1	12
<sup>a</sup> N/A = Not Applicable		

06  
210  
34

Continued on next page

RG41221,0000136 -19-16APR03-1/2

*Diagnostic Specifications*

Cylinders 2 and 3 90V Supply (4-cylinder engines)	A1	9
Cylinders 1 and 4 90V Supply (4-cylinder engines)	A2	4
Cylinder 1 Control (4-cylinder engines)	E1	1
Cylinder 2 Control (4-cylinder engines)	G1	12
Cylinder 3 Control (4-cylinder engines)	E2	11
Cylinder 4 Control (4-cylinder engines)	H1	3

RG41221,0000136 -19-16APR03-2/2

06  
210  
35

## **Tractors - 7720 - 7820 Series - 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

RG41221,0000130 -19-14APR03-1/3



*Diagnostic Specifications*

**Sensor Specifications for Tractors - 7720 - 7820 Series**

Sensor	SPN-FMI	Measured Sensor Parameter	Out of Range Value	Derate
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	Above 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	High Least Severe Temperature	Exceeds 110°C (230°F)	No derate
	000110.16	Moderately High Temperature	Exceeds 112°C (233°F)	ECU derates engine 2% per minute until engine runs at 90% of full power.
Fuel Rail Pressure	000094.03	High Input Voltage	Above 4.7 Volts	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000094.04	Low Input Voltage	Below 0.9 Volts	ECU derates engine 50% per minute until engine runs at 50% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.3 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 68°C (154°F)	NA <sup>a</sup>
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.
Oil Pressure	000100.01	Loss of Oil Pressure	Oil pressure drops below threshold for running condition.	ECU derates engine 40% per minute until engine runs at 40% of full power.
	000100.03	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	Loss of Oil Pressure	Oil pressure drops below threshold for running condition.	ECU derates engine 2% per minute until engine runs at 80% of full power.

<sup>a</sup>Not Applicable

06  
210  
37

Continued on next page

RG41221.0000130 -19-14APR03-2/3

## Diagnostic Specifications

### Sensor Specifications for Tractors - 7720 - 7820 Series

Crankshaft Position	000637.02	Input Noise	Noise detection of 100%	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000637.07	Crankshaft Position mismatch with Pump Position	Speed sensors out of sync.	ECU derates engine 50% per minute until engine runs at 50% of full power.
	000637.08	Input Missing	No signal detected	ECU derates engine 50% per minute until engine runs at 50% of full power.

RG41221,0000130 -19-14APR03-3/3

### Tractors - 7720 - 7820 Series - Torque Curve Selection

Torque Curve Selection for 7720 - 7820 Series Tractors	
Torque Curve # on DST or SERVICE ADVISOR™	Conditions
0	When an error has occurred.
1	Normal Operation
2	Transport Boost
3	Field Cruise
4	PTO Boost (IVT <sup>a</sup> only)
<sup>a</sup> Infinite Variable Transmission	

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RG41221,0000131 -19-14APR03-1/1

### Tractors - 7720 - 7820 Series - Governor Mode Selection

Desire Speed Governor Mode Selection on 7720 - 7820 Series Tractors	
Governor Mode	Condition
1	IVT <sup>a</sup> Drooped - Standard Gains
2	IVT <sup>a</sup> Isochronous - Standard Gains
3	IVT <sup>a</sup> Isochronous - High Speed Gains
4	IVT <sup>a</sup> Drooped - High Speed Gains
5	PQ <sup>b</sup> /APQ <sup>c</sup> Normal Droop
6	PQ <sup>b</sup> /APQ <sup>c</sup> Field Cruise
<sup>a</sup> Infinite Variable Transmission	
<sup>b</sup> Power Quad Transmission	
<sup>c</sup> Auto Power Quad Transmission	

Max. Speed Governor Mode Selection on 7020 Series Tractors	
Governor Mode	Condition
9	IVT <sup>a</sup> Drooped
10	IVT <sup>a</sup> Isochronous
11	PQ <sup>b</sup> /APQ <sup>c</sup> Normal Droop
12	PQ <sup>b</sup> /APQ <sup>c</sup> Field Cruise
<sup>a</sup> Infinite Variable Transmission	
<sup>b</sup> Power Quad Transmission	
<sup>c</sup> Auto Power Quad Transmission	

RG41221,0000132 -19-14APR03-1/1

06  
210  
39

**Tractors - 7720 - 7820 Series - ECU Terminal Identification**

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Air Vacuum Switch Input	G3	B
Battery Power	B1	Battery (+)
Battery Power	B2	Battery (+)
CAN High	L1	NA <sup>a</sup>
CAN Low	L2	NA <sup>a</sup>
Crank Sensor Input	W1	B
Crank Sensor Return	W2	A
Cylinders 1, 2, and 3 EI 90 V Supply	A2	8
Cylinder 1 EI Control	E1	1
Cylinder 2 EI Control	F1	2
Cylinder 3 EI Control	H1	3
Cylinders 4, 5, and 6 EI 90 V Supply	A1	7
Cylinder 4 EI Control	F2	4
Cylinder 5 EI Control	E2	5
Cylinder 6 EI Control	G1	6
ELX Power	G2	Battery (+)
Engine Coolant Temperature Input	X2	A
Fan Drive Solenoid Control	J2	4
Fan Speed Signal	M3	1
Fuel Rail Pressure Sensor 5V Supply	R3	3
Fuel Rail Pressure Sensor Input	R1	1
Fuel Rail Pressure Sensor Return	P3	2
Fuel Temperature Input	X3	A
Manifold Air Temperature Input	Y2	A
Oil Pressure Input	T2	C
PCV 1 Return	K3	PCV1
PCV 2 Return	K2	PCV2
PCV's Supply Voltage	J1	B+
Pump Position Sensor Input	X1	A
Pump Position Sensor Return	W3	B
Sensor Return 1	N3	Changes with every sensor
Sensor Return 2	P2	Changes with every sensor
Sensor 5V Supply	P1	Changes with every sensor
Switched Power	E3	NA <sup>a</sup>
System Ground	C2	Battery (-)
System Ground	C3	Battery (-)
<sup>a</sup> Not Applicable		

Continued on next page

RG41221,0000133 -19-14APR03-1/2

*Diagnostic Specifications*

Water In Fuel Input	Y3	A
Wheel Speed Input	D2	NA <sup>a</sup>
<sup>a</sup> Not Applicable		

RG41221\_0000133 -19-14APR03-2/2

06  
210  
41

06  
210  
42

# Index

	Page		Page
<b>A</b>			
Air in fuel test . . . . .	04-150-49	Coolant temperature sensor	
Air temperature, manifold		Operation . . . . .	03-140-6
Sensor		Remove and install . . . . .	02-110-2
Operation . . . . .	03-140-7	Crank position sensor	
Replace . . . . .	02-110-3	Operation . . . . .	03-140-13
Application specifications		Remove and install . . . . .	02-110-6
Combines . . . . .	06-210-3	Cruise control operation . . . . .	03-140-19
Loaders . . . . .	06-210-3	Cylinder Cutout Test	
Motor Grader . . . . .	06-210-3	Engine Test Instructions . . . . .	04-160-24
OEM Engines . . . . .	06-210-3	Cylinder Misfire Test	
Tractors		Engine Test Instructions . . . . .	04-160-22
6020 Series . . . . .	06-210-3	<b>D</b>	
7220-7520 Series . . . . .	06-210-3	Data parameter description	
7720-7820 Series . . . . .	06-210-3	Diagnostic Scan Tool (DST) . . . . .	04-160-18
<b>B</b>			
Bio-Diesel fuel . . . . .	01-002-2	Service ADVISOR . . . . .	04-160-18
Bleed fuel system . . . . .	04-150-53	Derate Programs	
<b>C</b>			
CAN		Application Specifications . . . . .	06-210-3
Definition of . . . . .	03-140-2	Derate programs	
Operation . . . . .	03-140-18	Operation . . . . .	03-140-20
Circuit malfunctions		Diagnostic gauge	
Locations . . . . .	04-160-5	Clearing stored codes . . . . .	04-160-16
Troubleshooting . . . . .	04-160-6	Diagnostics	
Combines		ACP-Err/Bus EP . . . . .	04-150-36
Application Specifications . . . . .	06-210-3	ACP-Err/Bus Error . . . . .	04-150-36
Compression Test		Does not communicate with ECU . . . . .	04-150-36
Engine Test Instructions . . . . .	04-160-23	EE-error . . . . .	04-150-36
Connecting to DST . . . . .	04-160-10	Engine configuration parameters . . . . .	04-160-13
Connecting to Service ADVISOR . . . . .	04-160-10	Viewing active codes . . . . .	04-160-15
Connectors, electrical		Viewing stored codes . . . . .	04-160-15
AMP . . . . .	02-110-22	Diagnostic procedure . . . . .	04-160-54
DEUTSCH . . . . .	02-110-19	Diagnostic Scan Tool (DST)	
General information . . . . .	02-110-8	Connecting to . . . . .	04-160-10
METRI-PACK, pull type . . . . .	02-110-14	Data parameter description . . . . .	04-160-18
METRI-PACK, push type . . . . .	02-110-16	Downloading Payload Files . . . . .	04-160-27
Remove blade terminals from connector		ECU does not communicate with	
body . . . . .	02-110-13	DST . . . . .	04-150-30
Sumitomo . . . . .	02-110-24	Reprogramming ECU . . . . .	04-160-32
Weatherpack . . . . .	02-110-10	Tests	
Yazaki . . . . .	02-110-26	Compression Test . . . . .	04-160-23
Controller Area Network (CAN)		Cylinder Cutout Test . . . . .	04-160-24
operation . . . . .	03-140-18	Cylinder Misfire Test . . . . .	04-160-22
Coolant . . . . .	01-002-1	Tractor Torque Curve Change Test . . . . .	04-160-25
		Diagnostic Trouble Codes (DTCs)	
		Active vs. inactive . . . . .	03-140-22
		Blinking codes . . . . .	04-160-12
		Clearing stored codes . . . . .	04-160-49
		Diagnostic gauge	
		Clearing stored codes . . . . .	04-160-16
		Viewing active codes . . . . .	04-160-15

Index

	Page		Page
Viewing stored codes	.04-160-15	000620.03	.04-160-224
Diagnostic procedure	.04-160-54	000620.04	.04-160-228
Intermittent fault diagnostics	.04-160-55	000627.01	.04-160-232
List of SPN/FMI	.04-160-50	000629.13	.04-160-236
List of 2-Digit codes	.04-160-52	000636.02	.04-160-238
SPN/FMI		000636.08	.04-160-242
000028.03	.04-160-92	000636.10	.04-160-246
000028.04	.04-160-92	000637.02	.04-160-250
000029.03	.04-160-93	000637.07	.04-160-254
000029.04	.04-160-93	000637.08	.04-160-260
000084.31	.04-160-94	000637.10	.04-160-264
000091.03	.04-160-97	000639.13	.04-160-268
000091.04	.04-160-98	000651.05	.04-160-272
000091.09	.04-160-98	000651.06	.04-160-278
000091.14	.04-160-99	000651.07	.04-160-282
000094.03	.04-160-100	000652.05	.04-160-286
000094.04	.04-160-104	000652.06	.04-160-292
000094.10	.04-160-108	000652.07	.04-160-298
000094.13	.04-160-112	000653.05	.04-160-302
000094.17	.04-160-116	000653.06	.04-160-308
000097.00	.04-160-120	000653.07	.04-160-314
000097.03	.04-160-123	000654.05	.04-160-318
000097.04	.04-160-126	000654.06	.04-160-324
000097.16	.04-160-130	000654.07	.04-160-330
000100.01	.04-160-134	000655.05	.04-160-334
000100.03	.04-160-138	000655.06	.04-160-338
000100.04	.04-160-142	000655.07	.04-160-342
000100.18	.04-160-148	000656.05	.04-160-346
000105.00	.04-160-150	000656.06	.04-160-350
000105.03	.04-160-152	000656.07	.04-160-354
000105.04	.04-160-156	000676.03	.04-160-358
000105.16	.04-160-160	000676.05	.04-160-362
000107.00	.04-160-162	000898.09	.04-160-365
000110.00	.04-160-166	000970.31	.04-160-366
000110.03	.04-160-168	000971.31	.04-160-367
000110.04	.04-160-172	001069.09	.04-160-368
000110.15	.04-160-176	001069.31	.04-160-372
000110.16	.04-160-178	001079.03	.04-160-374
000111.01	.04-160-180	001079.04	.04-160-378
000158.17	.04-160-184	001080.03	.04-160-382
000160.02	.04-160-188	001080.04	.04-160-386
000174.00	.04-160-192	001109.31	.04-160-390
000174.03	.04-160-196	001110.31	.04-160-391
000174.04	.04-160-200	001347.03	.04-160-392
000174.16	.04-160-204	001347.05	.04-160-396
000189.00	.04-160-207	001347.07	.04-160-400
000190.00	.04-160-208	001347.10	.04-160-404
000190.16	.04-160-209	001568.02	.04-160-408
000237.02	.04-160-210	001569.31	.04-160-409
000237.13	.04-160-211	001639.01	.04-160-410
000237.31	.04-160-212	001639.16	.04-160-414
000611.03	.04-160-214	001639.18	.04-160-418
000611.04	.04-160-218	002000.13	.04-160-422



Page	Page
002005.09 . . . . .	04-160-423
002049.09 . . . . .	04-160-424
002071.09 . . . . .	04-160-425
SPN/FMI vs. 2-Digit codes . . . . .	04-160-49
Warning light. . . . .	03-140-22
2-Digit codes	
DTC 11 . . . . .	04-160-52
DTC 12 . . . . .	04-160-52
DTC 13 . . . . .	04-160-52
DTC 15 . . . . .	04-160-52
DTC 17 . . . . .	04-160-52
DTC 18 . . . . .	04-160-52
DTC 19 . . . . .	04-160-52
DTC 21 . . . . .	04-160-52
DTC 22 . . . . .	04-160-52
DTC 23 . . . . .	04-160-52
DTC 24 . . . . .	04-160-52
DTC 25 . . . . .	04-160-52
DTC 26 . . . . .	04-160-52
DTC 27 . . . . .	04-160-52
DTC 28 . . . . .	04-160-52
DTC 29 . . . . .	04-160-52
DTC 31 . . . . .	04-160-52
DTC 32 . . . . .	04-160-52
DTC 33 . . . . .	04-160-52
DTC 34 . . . . .	04-160-52
DTC 35 . . . . .	04-160-52
DTC 36 . . . . .	04-160-52
DTC 37 . . . . .	04-160-52
DTC 38 . . . . .	04-160-52
DTC 39 . . . . .	04-160-52
DTC 41 . . . . .	04-160-52
DTC 42 . . . . .	04-160-52
DTC 43 . . . . .	04-160-52
DTC 44 . . . . .	04-160-52
DTC 45 . . . . .	04-160-52
DTC 48 . . . . .	04-160-52
DTC 49 . . . . .	04-160-52
DTC 51 . . . . .	04-160-52
DTC 52 . . . . .	04-160-52
DTC 54 . . . . .	04-160-52
DTC 55 . . . . .	04-160-52
DTC 56 . . . . .	04-160-52
DTC 59 . . . . .	04-160-52
DTC 61 . . . . .	04-160-52
DTC 62 . . . . .	04-160-52
DTC 63 . . . . .	04-160-52
DTC 64 . . . . .	04-160-52
DTC 65 . . . . .	04-160-52
DTC 66 . . . . .	04-160-52
DTC 67 . . . . .	04-160-52
DTC 68 . . . . .	04-160-52
DTC 71 . . . . .	04-160-52
	DTC 74 . . . . . 04-160-52
	DTC 75 . . . . . 04-160-52
	DTC 76 . . . . . 04-160-52
	DTC 77 . . . . . 04-160-52
	DTC 78 . . . . . 04-160-52
	DTC 79 . . . . . 04-160-52
	DTC 82 . . . . . 04-160-52
	DTC 83 . . . . . 04-160-52
	DTC 84 . . . . . 04-160-52
	DTC 85 . . . . . 04-160-52
	DTC 86 . . . . . 04-160-52
	DTC 88 . . . . . 04-160-52
	DTC 91 . . . . . 04-160-52
	DTC 92 . . . . . 04-160-52
	DTC 93 . . . . . 04-160-52
	DTC 94 . . . . . 04-160-52
	DTC 95 . . . . . 04-160-52
	DTC 96 . . . . . 04-160-52
	DTC 97 . . . . . 04-160-52
	DTC 98 . . . . . 04-160-52
	DTC 99 . . . . . 04-160-52
	Diagnostics
	Communication malfunctions
	ECU does not communicate with
	DST . . . . . 04-150-30
	ECU does not communicate with Service
	ADVISOR. . . . . 04-150-30
	Diagnostic Gauge Does Not Communicate With
	ECU . . . . . 04-150-36
	Fuel system
	Excessive fuel consumption. . . . . 04-150-29
	Fuel in oil . . . . . 04-150-29
	Supply system check. . . . . 04-150-24
	Glow plug check . . . . . 04-150-42
	Observable
	Abnormal engine noise . . . . . 04-150-20
	Analog throttle (A) does not
	respond . . . . . 04-150-22
	Analog throttle (B) does not
	respond . . . . . 04-150-22
	Engine cranks/won't start. . . . . 04-150-2
	Engine does not develop full power. . . 04-150-9
	Engine emits excessive black or gray exhaust
	smoke . . . . . 04-150-17
	Engine emits excessive white exhaust
	smoke . . . . . 04-150-14
	Engine idles poorly . . . . . 04-150-19
	Engine misfires/runs irregularly . . . . 04-150-5
	Engine will not crank . . . . . 04-150-19
	OEM wiring diagram . . . . . 06-210-26
	Diesel fuel . . . . . 01-002-1
	Digital multimeter, how to use . . . . . 04-160-2

Indx  
3

	Page		Page
Downloading Payload Files		Glow plug operation . . . . .	.03-140-18
Diagnostic Scan Tool . . . . .	.04-160-27	Governor modes . . . . .	.03-140-21
Service ADVISOR . . . . .	.04-160-37	Multi-state throttle operation . . . . .	.03-140-10
DST		Operation . . . . .	.03-140-3
Connecting to . . . . .	.04-160-10	Overview . . . . .	.03-140-4
Definition of . . . . .	.03-140-2	Ramp throttle operation . . . . .	.03-140-10
DTC		Terminology . . . . .	.03-140-2
Definition of . . . . .	.03-140-2	Tri-state throttle operation . . . . .	.03-140-10
<b>E</b>			
ECT		Electronic injector	
Definition of . . . . .	.03-140-2	Clean body . . . . .	.02-090-21
ECU		Clean bore . . . . .	.02-090-21
Definition of . . . . .	.03-140-2	Clean orifice . . . . .	.02-090-21
Engine Control Unit		Inspect body . . . . .	.02-090-21
Self-diagnosis . . . . .	.03-140-22	Install . . . . .	.02-090-22
Operation . . . . .	.03-140-16	Operation . . . . .	.03-130-8
Repair and adjustment . . . . .	.02-110-1	Remove . . . . .	.02-090-20
EI		Wiring harness connector . . . . .	.03-140-15
Clean injector body . . . . .	.02-090-21	Emissions information . . . . .	.01-001-3
Clean injector bore . . . . .	.02-090-21	Engine	
Clean injector orifice . . . . .	.02-090-21	Application charts . . . . .	.01-001-4
Definition of . . . . .	.03-140-2	Derate programs . . . . .	.03-140-20
Inspect injector body . . . . .	.02-090-21	Model designation . . . . .	.01-001-1
Install . . . . .	.02-090-22	Serial number plate . . . . .	.01-001-2
Operation . . . . .	.03-130-8	Engine configuration parameters . . . . .	.04-160-13
Remove . . . . .	.02-090-20	Engine Control Unit	
Wiring harness connector . . . . .	.03-140-15	Reprogramming . . . . .	.04-160-26
Electrical circuit		Terminal Identification	
Diagnosis . . . . .	.04-160-3	Application Specifications . . . . .	.06-210-3
Malfunctions . . . . .	.04-160-3	Engine Control Unit (ECU)	
Troubleshooting . . . . .	.04-160-6	Operation . . . . .	.03-140-16
Electrical Concepts . . . . .	.04-160-2	Repair and adjustment . . . . .	.02-110-1
Electrical connectors		Self-diagnosis . . . . .	.03-140-22
Remove blade terminals . . . . .	.02-110-13	Engine coolant temperature sensor	
Electrical Connectors		Install . . . . .	.02-110-2
Repair AMP . . . . .	.02-110-22	Measuring temperature . . . . .	.03-140-6
Repair DEUTSCH . . . . .	.02-110-19	Remove . . . . .	.02-110-2
Repair Metri-Pack Pull Type . . . . .	.02-110-14	Engine cranks/won't start . . . . .	.04-150-2
Repair Metri-Pack Push Type . . . . .	.02-110-16	Engine does not develop full power . . . . .	.04-150-9
Repair Sumitomo . . . . .	.02-110-24	Engine emits excessive black or gray exhaust	
Repair Weathrepack . . . . .	.02-110-10	smoke . . . . .	.04-150-17
Repair Yazaki . . . . .	.02-110-26	Engine emits excessive white exhaust	
Electrical insulating compound . . . . .	.02-110-8	smoke . . . . .	.04-150-14
Electronic control system		Engine idles poorly . . . . .	.04-150-19
Analog throttle operation . . . . .	.03-140-10	Engine misfires/runs irregularly . . . . .	.04-150-5
CAN throttle operation . . . . .	.03-140-10	Engine parameters . . . . .	.03-140-5
Cruise control operation . . . . .	.03-140-19	Engine protection . . . . .	.03-140-20
Derate programs . . . . .	.03-140-20	Engine speed, measuring . . . . .	.03-140-13
Dual state throttle operation . . . . .	.03-140-10	Engine Test Instructions	
		Compression Test . . . . .	.04-160-23
		Cylinder Cutout Test . . . . .	.04-160-24
		Cylinder Misfire Test . . . . .	.04-160-22
		Tractor Torque Curve Change Test . . . . .	.04-160-25
		Engine will not crank . . . . .	.04-150-19





	Page		Page
<b>R</b>			
Rail		Tests	
Install . . . . .	02-090-14	Compression Test . . . . .	04-160-23
Operation . . . . .	03-130-7	Cylinder Cutout Test . . . . .	04-160-24
Remove . . . . .	02-090-14	Cylinder Misfire Test . . . . .	04-160-22
Rail pressure sensor		Tractor Torque Curve Change Test . . . . .	04-160-25
Measuring pressure . . . . .	03-140-8	Service codes	
Remove and install . . . . .	02-110-5	List of SPN/FMI . . . . .	04-160-50
Reprogramming ECU . . . . .	04-160-26	Viewing active codes . . . . .	04-160-15
Diagnostic Scan Tool . . . . .	04-160-32	Viewing stored codes . . . . .	04-160-15
Downloading Payload Files		Software Files	
Diagnostic Scan Tool . . . . .	04-160-27	Reprogramming ECU	
Service ADVISOR . . . . .	04-160-37	Diagnostic Scan Tool . . . . .	04-160-27
Service ADVISOR . . . . .	04-160-45	Service ADVISOR . . . . .	04-160-37
Restricted fuel leak-off line . . . . .	04-150-51	Specifications	
<b>S</b>			
Sensors		Combines	
Crank position		ECU terminal identification . . . . .	06-210-9
Operation . . . . .	03-140-13	Governor mode selection . . . . .	06-210-8
Remove and install . . . . .	02-110-6	Sensors . . . . .	06-210-6
Engine coolant temperature		Torque curve selection . . . . .	06-210-8
Operation . . . . .	03-140-6	Control system repair . . . . .	06-200-5
Remove and install . . . . .	02-110-2	Fuel system diagnostics . . . . .	06-210-1
Fuel rail pressure		Fuel system repair . . . . .	06-200-3
Operation . . . . .	03-140-8	Loaders	
Remove and install . . . . .	02-110-5	ECU terminal identification . . . . .	06-210-14
Fuel system . . . . .	02-110-2	Governor mode selection . . . . .	06-210-13
Fuel temperature		Sensors . . . . .	06-210-10
Operation . . . . .	03-140-6	Torque curve selection . . . . .	06-210-12
Remove and install . . . . .	02-110-3	Motor Graders	
Manifold air temperature		ECU terminal identification . . . . .	06-210-18
Operation . . . . .	03-140-7	Governor mode selection . . . . .	06-210-17
Remove and install . . . . .	02-110-3	Sensors . . . . .	06-210-15
Oil pressure		Torque curve selection . . . . .	06-210-17
Operation . . . . .	03-140-9	OEM engines	
Remove and install . . . . .	02-110-4	ECU terminal identification . . . . .	06-210-24
Pump position		Governor mode selection . . . . .	06-210-23
Remove and install . . . . .	02-110-6	Instrument panel wiring diagram . . . . .	06-210-28
Water in Fuel		Sensors . . . . .	06-210-20
Operation . . . . .	03-140-14	Start components wiring diagram . . . . .	06-210-28
Serial number plate . . . . .	01-001-2	Torque curve selection . . . . .	06-210-22
Service ADVISOR		Wiring diagram . . . . .	06-210-26
Conecting to . . . . .	04-160-10	Tractors	
Downloading Payload Files . . . . .	04-160-37	6020 Series	
ECU does not communicate with Service		ECU Terminal Identification . . . . .	06-210-34
ADVISOR . . . . .	04-150-30	Governor Mode Selection . . . . .	06-210-33
Reprogramming ECU . . . . .	04-160-45	Sensors . . . . .	06-210-30
		Torque Curve Selection . . . . .	06-210-32
		7720-7820 Series	
		ECU Terminal Identification . . . . .	06-210-40
		Governor Mode Selection . . . . .	06-210-39
		Sensors . . . . .	06-210-36
		Torque Curve Selection . . . . .	06-210-38
		Speed governing . . . . .	03-140-21

