

# JOHN DEERE

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## COMPONENT TECHNICAL MANUAL

POWERTECH® 4.5 L & 6.8 L Diesel  
Engines Level 1 Electronic Fuel  
Systems With Delphi (Lucas)  
DP201 Pump

CTM284 14MAY03 English



# **POWERTECH® 4.5L & 6.8L Diesel Engines**

## **Level 1 Electronic Fuel Systems With Delphi (Lucas) DP201 Pump**

### **TECHNICAL MANUAL POWERTECH® 4.5 L & 6.8 L Diesel Engines Level 1 Electronic Fuel Systems With Delphi (Lucas) DP201 Pump**

**14MAY03 (ENGLISH)**

**For complete service information also see:**

*POWERTECH®* 4.5 L and 6.8 L Diesel

<b>Engines—Base Engine .....</b>	<b>CTM104</b>
<b>Alternators and Starter Motors.....</b>	<b>CTM77</b>

**John Deere Power Systems**

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# Introduction

## Forward

This manual (CTM 284) is written for an experienced technician. Essential tools required in performing certain service work are identified in this manual and are recommended for use.

This manual covers only Level 1 Electronic Fuel Systems with the Delphi (Lucas) DP201 injection pump. It is one of six volumes on 4.5 L and 6.8 L engines. The following five companion manuals cover the repair, operation and diagnostics for the base engine and various electronic and mechanical fuel systems. These 6 volumes are included in the binder set (CTM350). The following two companion manuals cover the base engine and mechanical fuel system repair, operation and diagnostics:

- CTM104—4.5 L & 6.8 L Base Engine
- CTM134—6.8 L & 8.1 L Level 3 Electronic Fuel Systems with Bosch In-Line Pump
- CTM170—4.5 L & 6.8 L Level 4 Electronic Fuel Systems with Bosch VP44 Rotary Pump
- CTM207—4.5 L & 6.8 L Mechanical Fuel Systems
- CTM284—4.5 L & 6.8 L Level 1 Electronic Fuel Systems with Delphi (Lucas) DP201 Pump
- CTM331—4.5 L & 6.8 L Level 12 Electronic Fuel Systems with Stanadyne DE10 Rotary 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 summary listings of all applicable essential tools, service equipment and tools, other materials needed to do the job, service parts kits, specifications, wear tolerances, and torque values.

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 is 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.**

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A John Deere ILLUSTRATION® Manual

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# Section 01 General

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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

RG40854,0000049 -19-08AUG01-1/1

### 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

RG40854,000004A -19-08AUG01-1/1

### 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

RG40854,000004B -19-08AUG01-1/1

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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

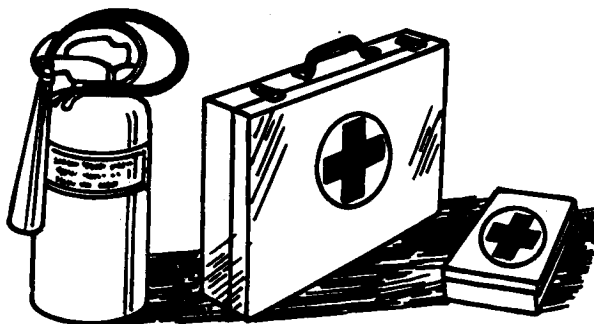
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## Prepare for Emergencies

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

RG40854,000004D -19-08AUG01-1/1

## 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.

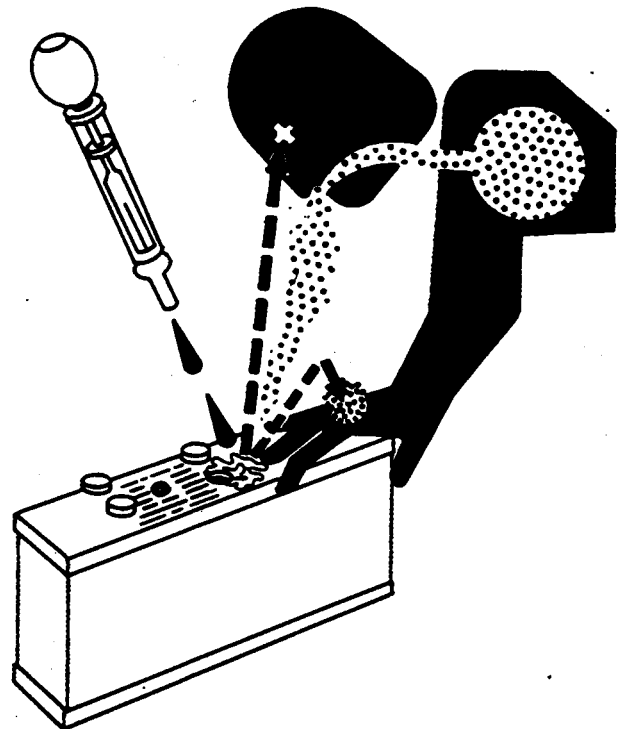
If you spill acid on yourself:

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.**



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TS203 -UN-23AUG88

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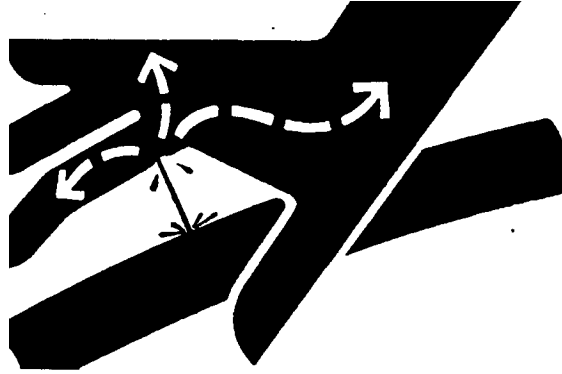
## Avoid High-Pressure Fluids

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.



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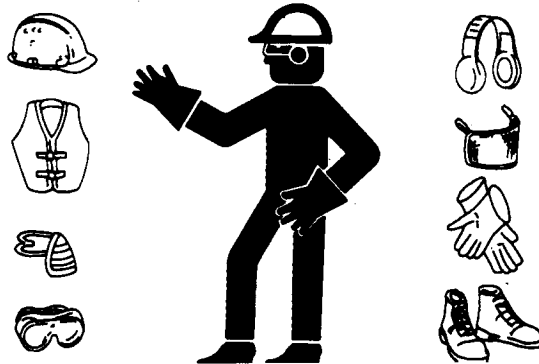
## Wear Protective Clothing

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.



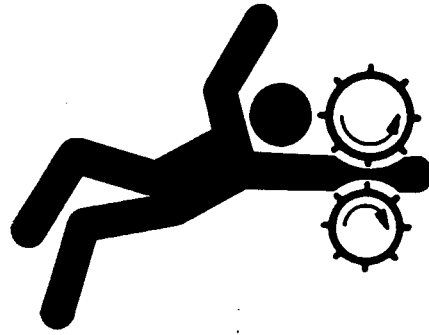
TS206 -UN-23AUG88

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### 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.



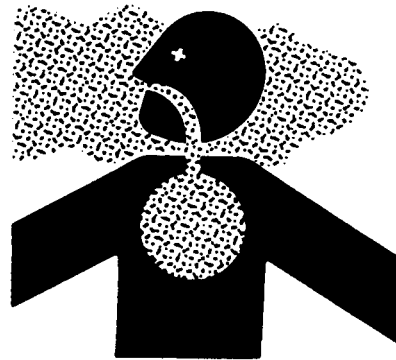
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TS228 -JUN-23AUG88

### 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



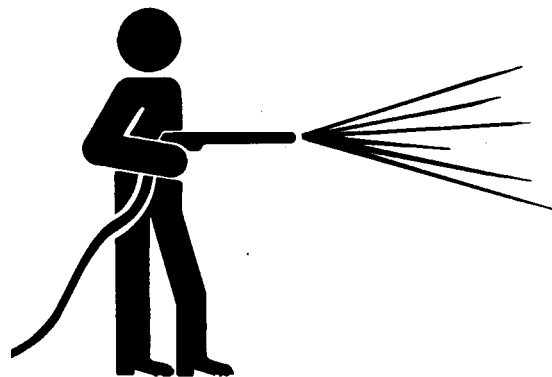
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TS220 -JUN-23AUG88

### 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.



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## Remove Paint Before Welding or Heating

Avoid potentially toxic fumes and dust.

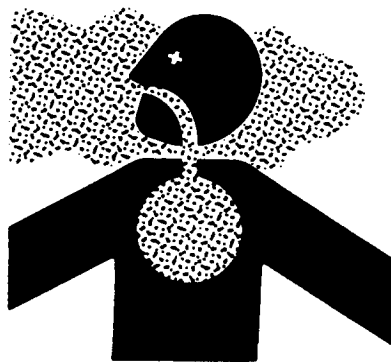
Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

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

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## 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

RG40854,0000055 -19-08AUG01-1/1

## 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.



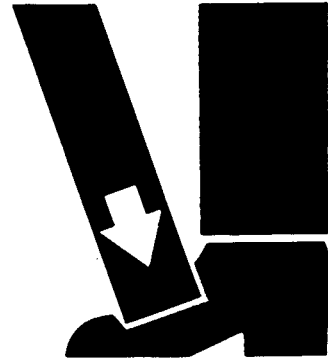
TS223 -UN-23AUG88

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### Use Proper Lifting Equipment

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

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



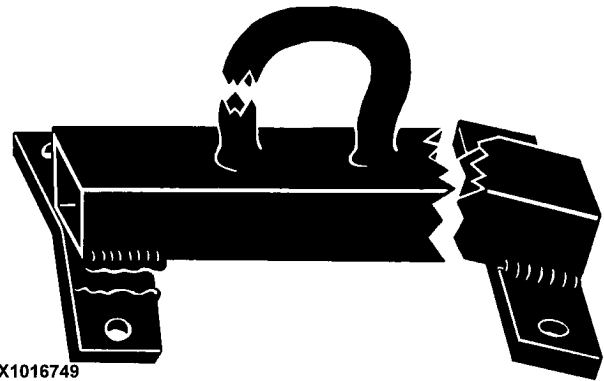
TS226 -UN-23AUG88

RG40854,0000057 -19-08AUG01-1/1

### 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

RG40854,0000059 -19-08AUG01-1/1

## 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

RG40854,000005A -19-08AUG01-1/1

### Dispose of Waste Properly

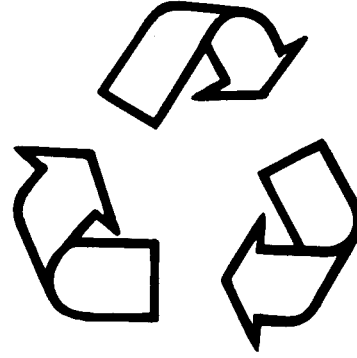
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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

RG40854,000005B -19-08AUG01-1/1

### 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

RG40854,000005C -19-08AUG01-1/1



## 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 applicable code. For example:

### 4045TF150 Engine

4 ..... Number of cylinders  
 4.5 ..... Liter displacement  
 T ..... Aspiration code  
 F ..... User code  
 1 ..... Internal engine configuration type  
 50 ..... *POWERTECH*<sup>®</sup> application code

### Aspiration Code

D ..... Naturally aspirated  
 T ..... Turbocharged and Air-to-Coolant Aftercooled  
 H ..... Turbocharged and Air-to-Air Aftercooled

### User Factory Code

AP ..... Saltillo (Mexico)  
 CQ ..... S.L.C. Horizontina (Brazil)  
 DW ..... John Deere Davenport Works  
 E ..... John Deere Ottumwa Works  
 F ..... OEM (Outside Equipment Manufacturers)  
 FF ..... Kernersville Deere-Hitachi (North Carolina)  
 FG ..... Goldoni (Italy)  
 FM ..... Marine Engines  
 H ..... John Deere Harvester Works  
 KV ..... John Deere Knoxville (Tennessee)  
 L ..... John Deere Werke Mannheim (Germany)  
 LA ..... John Deere Werke Mannheim (Germany)  
 (Engines with Bosch VP44 Injection Pump)  
 LV ..... John Deere Augusta, Georgia  
 N ..... John Deere Des Moines Works  
 P ..... Saltillo/Monterrey (Mexico)  
 RW ..... John Deere Waterloo Tractor Works  
 T ..... John Deere Dubuque Works  
 TJ ..... Forestry (Sweden/Finland/Canada)  
 T8 ..... Cameco (Deere) (Louisiana)  
 YC ..... John Deere Jialian Harvester Co. Limited  
 (China)  
 Z ..... John Deere WERKE Zweibrucken (Germany)

### Model Designation

1 or 2 ..... Indicates different internal engine components

### Application Code

50 or above ..... *POWERTECH*<sup>®</sup> code for specific application

01  
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2

## 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:

#### T04045T000000

T0 .....	Factory producing engine
4045T .....	Engine model designation
000000 .....	Sequential serial number

#### Factory Code (Engine Manufacturer)

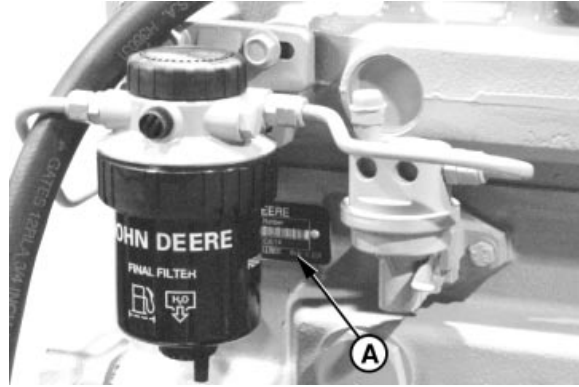
T0 .....	Dubuque, Iowa
CD .....	Saran, France
PE .....	Torreon, Mexico

#### Engine Model Designation

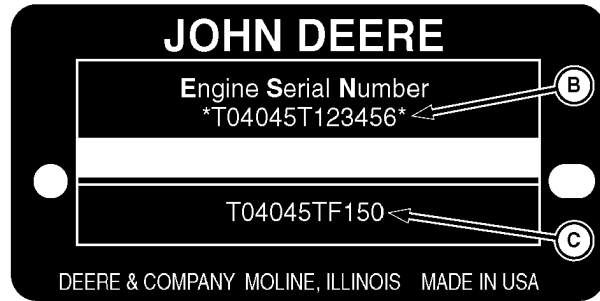
4045T .....	Definition explained previously. See ENGINE MODEL DESIGNATION earlier in this Group.
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#### Sequential Number

000000 .....	6-digit sequential serial number
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Dubuque Engine Serial Number Plate

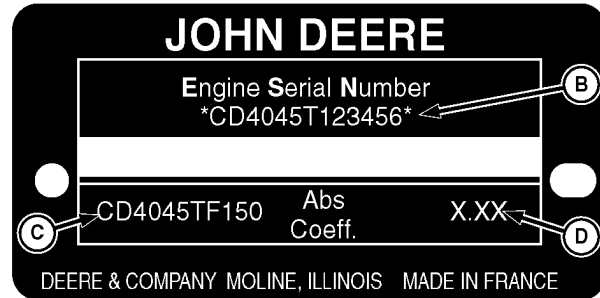
RG9060 -UN-16MAR98

### Engine Application Data (C)

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

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

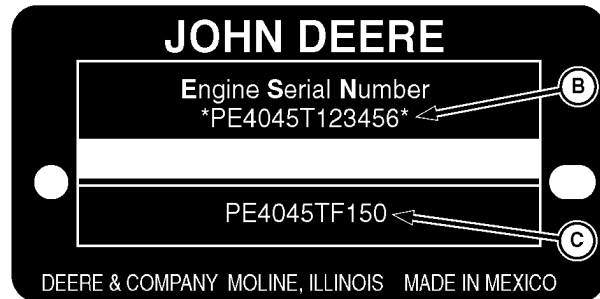
The second line of information on Saran serial number plate also contains the coefficient of absorption value for smoke emissions.



Saran Engine Serial Number Plate

RG9061 -UN-16MAR98

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



Torreon Engine Serial Number Plate

RG9062 -UN-16MAR98

## Engine Application Chart

JOHN DEERE AGRICULTURAL EQUIPMENT (MANNHEIM, GERMANY)	
Machine Model	Engine Model
6310 (European version)	CD4045TL052
6410 (European version)	CD4045TL053
6310 (N.A. version)	CD4045TL055
6410 (N.A. version)	CD4045TL056
6510 (European version)	CD6068DL050
6610	CD6068TL050
6810	CD6068TL051
6910	CD6068TL052, CD6068TL054
6320 (European version)	CD4045HL072
6320 (N.A. version)	CD4045HL073
6420 (European and N.A. version)	CD4045HL070
6520 (European version)	CD6068DL070
7220	CD6068TRW01

RG40854,000005F -19-08AUG01-1/1

*Engine Identification*

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## Lubricants and Coolant

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

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## Diesel Fuel

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

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

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

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

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

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

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

### Sulfur content:

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

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

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## Bio-Diesel Fuel

Bio-diesel fuels may be used ONLY if the fuel properties meet the provisional ASTM PS121 (U.S.) or DIN 51606 (German) specification. It has been shown that bio-diesel fuels have been found to improve lubricity in concentrations up to 5% blend in petroleum diesel fuel.

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

While a major environmental benefit of a biodiesel fuel is its ability to biodegrade, users must recognize that storage and handling is of prime importance as indicated below:

- Ensure the quality of the biodiesel fuel (fuel meets the specifications).
- Keep storage and vehicle tanks as full as possible to prevent moisture from collecting inside.
- Ensure all tank caps and covers are installed properly to prevent water from entering.
- Monitor water content of the fuel regularly (Bonds with water, creating acids).
- Limit the storage tanks from extreme temperatures (i.e. Direct sun or frost).
- Limit the storage to under 1 year due to shelf life (degrades quickly, microbes, oxidation).
- Wash down spills with clean water immediately to prevent corrosion and damage to paint.
- Fuel filter may need to be replaced more often due to premature plugging.
- Check engine oil sump level daily prior to starting, a rising level may indicate lubricating oil dilution. This check is important for all engines and even more critical for engines equipped with rotary fuel injection pumps.
- Instability resulting from blending biodiesel with mineral diesel fuel.
- Consult your fuel supplier for additives to improve storage and performance of biodiesel fuels.

Blending biodiesel fuel above a 5% concentration could have some adverse affects to the engine, such as:

- Power loss and deterioration of performance
- Fuel leakage through seals and hoses
- Corrosion of fuel injection equipment
- Lubricity of biodiesel and the fuel injection equipment
- Coked/blocked injector nozzles, leading to poor atomization of fuel
- Filter plugging
- Lacquering/seizure of internal injection system components
- Sludge and sediments
- Reduced service life

## Lubricity of Diesel Fuel

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

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

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

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

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

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

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

RG40854,0000063 -19-08AUG01-1/1

*Fuels*

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# Section 02

# Repair and Adjustments

## Contents

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## Fuel System — General Information

Some 4.5 L & 6.8 L engines use the Delphi (Lucas) DP201 injection pump. The pump has an electronically-controlled actuator that is located on top of the pump.

Fuel is transferred from fuel tanks with a fuel transfer pump that is located in the fuel tank. From the transfer pump, fuel is routed through a final filter to the injection pump.

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

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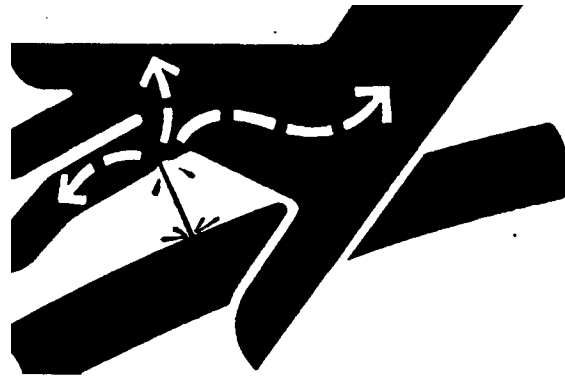
## Relieve Fuel System Pressure



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

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

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



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

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

The final fuel filter (A) can be equipped with a water separator bowl and/or hand primer.

**A—Final Fuel Filter/Water Separator**

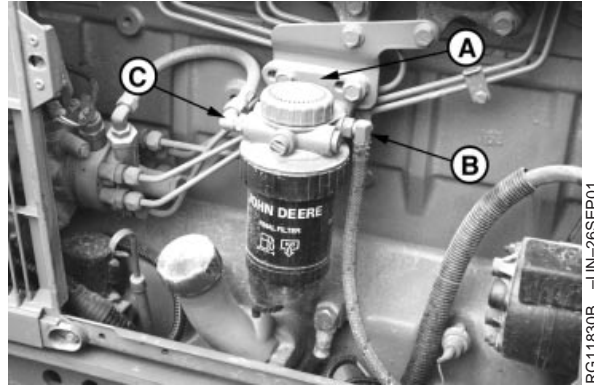


RG11830A -UN-26SEP01

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



RG11830B -UN-26SEP01

A—Final Fuel Filter Base  
 B—Final Filter Inlet Port from Fuel Tank  
 C—Final Filter Outlet Port to Injection Pump

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

5. Disconnect fuel lines from all ports.
6. Remove final fuel filter base (A).
7. Replace parts as necessary.
8. Install mounting brackets and tighten to torque specifications provided below.

**Specification**

Fuel Filter Base Mounting	
Bracket-to-Cylinder Head—	
Torque .....	35 N•m (26 lb-ft)
Final Fuel Filter Mounting	
Base-to-Bracket—Torque .....	35 N•m (26 lb-ft)

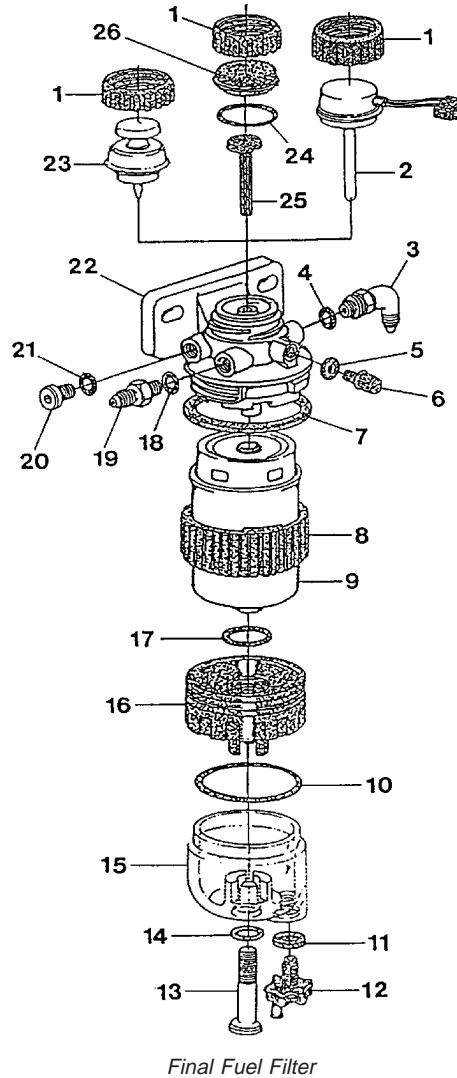
9. Install water separator and fuel filter elements. See REPLACE FINAL FUEL FILTER/WATER SEPARATOR later in this Group.
10. Connect fuel lines to all ports.
11. Bleed the fuel system. See BLEED THE FUEL SYSTEM later in this Group.

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### Final Fuel Filter Assembly

- 1—Retaining Ring
- 2—Fuel Heater (Optional)
- 3—Fitting
- 4—O-Ring
- 5—O-Ring
- 6—Bleed Screw
- 7—O-Ring
- 8—Retaining Ring
- 9—Filter
- 10—O-Ring
- 11—O-Ring
- 12—Drain Adapter
- 13—Screw
- 14—O-Ring
- 15—Water Separator Bowl
- 16—Adapter
- 17—O-Ring
- 18—O-Ring
- 19—Fitting
- 20—Plug
- 21—O-Ring
- 22—Filter Base
- 23—Primer Assembly (Optional)
- 24—O-Ring
- 25—Stem
- 26—Cap



RG9091 -UN-31MAR98

Final Fuel Filter

RG40854,0000068 -19-24AUG01-1/1

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## Replace Final Fuel Filter/Water Separator

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

*Final fuel filters can be equipped with a water separator bowl and/or hand primer*

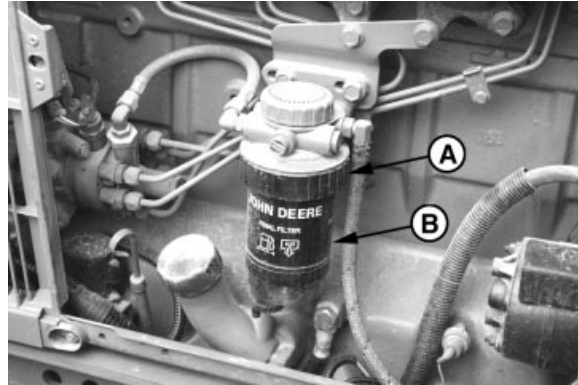
1. Thoroughly clean fuel filter/water separator assembly and surrounding area, if not previously done.
2. Connect a drain line to filter drain adapters and drain all fuel from filters.

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

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

**NOTE:** *The fuel filters 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 later in this Group.



A—Retaining Ring  
B—Filter Element

RG11830C -JUN-29OCT01

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## Remove Fuel Injection Pump

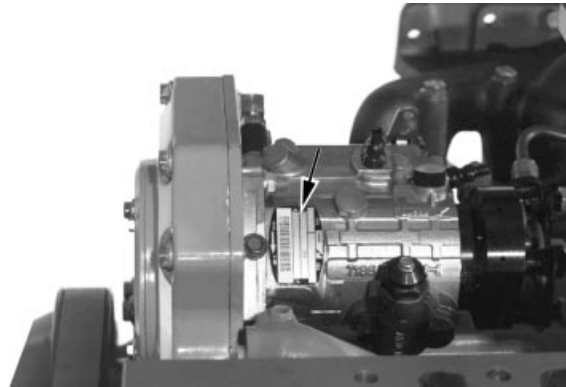
**NOTE:** The injection pump serial number tag (bold arrow) is located on the bottom of the pump.

**IMPORTANT:** Never steam clean or pour cold water on a fuel injection pump while the pump is running or while it is warm. Doing so may cause seizure of internal rotating pump parts.

1. Clean the fuel injection pump, lines and area around the pump with cleaning solvent or a steam cleaner.
2. Disconnect electrical connection to shut-off solenoid or actuator, if equipped. Disconnect cold start switch, if equipped. Tag electrical wires for correct reassembly.

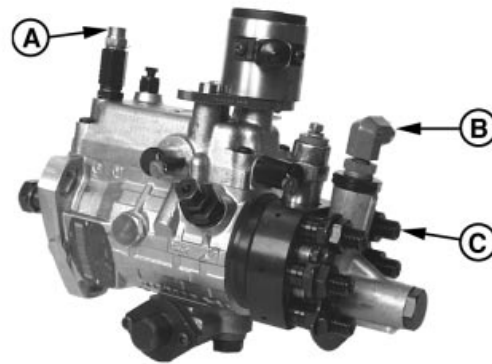
**IMPORTANT:** ALWAYS use a backup wrench when loosening or tightening fuel lines at injection pump so that discharge fittings are not altered to prevent possible internal pump damage.

3. Disconnect fuel return line (A), and fuel supply line (B).
4. Disconnect all fuel delivery (pressure) lines (C) from injection pump using a suitable 17 mm deep-well crowsfoot socket.



Fuel Injection Pump

RG7722 -UN-07NOV97



A—Fuel Return Line  
B—Fuel Supply Line  
C—Fuel Delivery (Pressure) Lines

RG11831A -UN-26SEP01

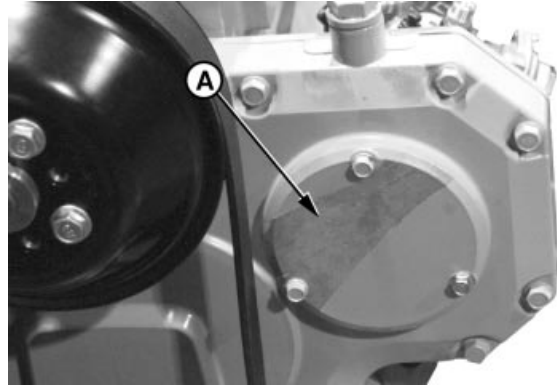
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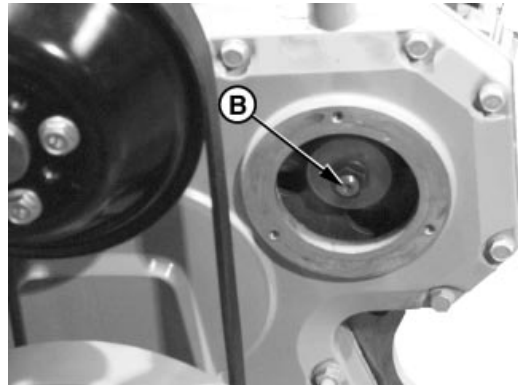
- Remove injection pump drive gear cover (A). Remove drive gear retaining nut (B) and washer from end of pump shaft. Be careful not to let washer fall inside timing gear cover.

A—Drive Gear Cover  
B—Drive Gear Retaining Nut



RG7629A -UN-06NOV97

Injection Pump Drive Cover



RG7630B -UN-06NOV97

Pump Drive Gear Retaining Nut

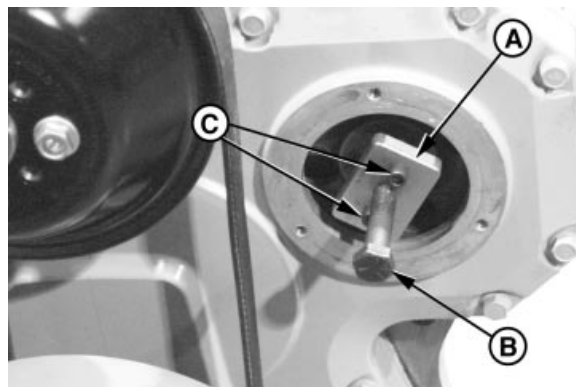
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**NOTE:** The injection pump drive gear fits snugly onto a tapered drive shaft and is indexed by a Woodruff key installed in drive shaft. Use JDG670A Drive Gear Puller (A) to remove drive gear from shaft.

- Attach JDG670A Drive Gear Puller to injection pump drive gear as shown. Follow instructions provided with tool set.

**NOTE:** Replace 6 mm, Grade 12.9 cap screws (C) as needed.

- Evenly tighten the two 6 mm, Grade 12.9 screws (threaded in drive gear) and snugly tighten center forcing screw (B) against end of pump shaft.
- Tighten center forcing screw until pump drive gear is free from tapered shaft. Remove JDG670A Puller from drive gear.



RG7631 -UN-06NOV97

Pump Drive Gear Puller in Place

A—Drive Gear Puller  
B—Forcing Screw  
C—Cap Screws

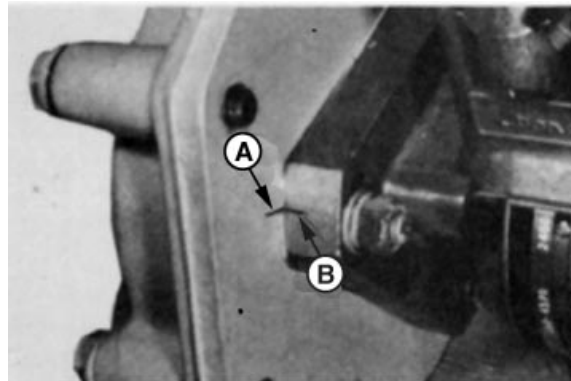
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9. Check to make sure that timing marks on back side of front plate (A) and injection pump flange (B) are present and properly aligned. This ensures that repaired or replacement pump can be properly timed to engine when installed.

If timing mark is not clearly visible on front plate, scribe a visible reference mark as accurately as possible in-line with mark on pump flange.

10. Remove injection pump mounting stud nuts. Remove injection pump from mounting studs.



RG11832 -UN-26SEP01

Injection Pump Timing Marks

A—Timing Mark on Front Plate  
B—Timing Mark on Injection Pump Flange

RG40854,000006A -19-24AUG01-4/4

## Repair Fuel Injection Pump

**IMPORTANT: DO NOT disassemble the fuel injection pump any further than necessary for installing available repair parts, not even for cleaning.**

Have an authorized ADS Diesel Repair Station perform all injection pump testing, adjustments, and repairs.

RG40854,000006B -19-24AUG01-1/1

### Install Fuel Injection Pump

**IMPORTANT:** When replacing injection pump drive gear or installing a new pump, the tapered surfaces of the pump drive shaft OD and drive gear ID **MUST BE cleaned to remove protective coatings and oily residue. Use a suitable cleaner that does not leave a residue. Mating surfaces MUST BE assembled dry. LUBRICANTS MUST NOT BE USED.**

1. Place a new O-ring onto front face of pump mounting flange with mounting slots aligned. Slide injection pump onto mounting studs while inserting pump shaft into drive gear.
2. Check pump shaft Woodruff key for proper alignment with pump drive gear key slot.
3. Install injection pump partially onto mounting studs with engaging pump pilot hub into engine front plate.
4. Install three flat washers, lock washers, and hex nuts onto pump mounting studs. Tighten nuts three turns only so that pump will not fall off mounting studs.
5. Install pump mounting flange flush to engine front plate with drive gear held flush against front side of engine front plate.
6. With the pump shaft key properly engaged in the drive gear key slot, finger tighten mounting stud nuts.

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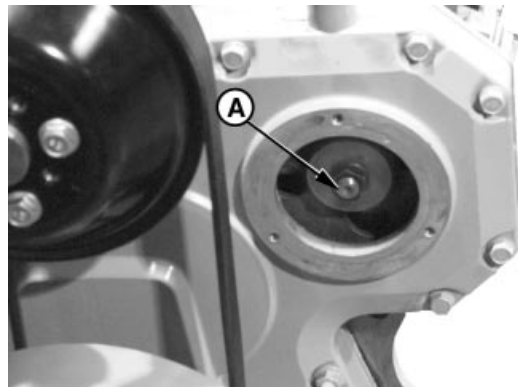
RG40854,000006C -19-24AUG01-1/5

7. Push pump drive gear firmly onto shaft taper. Install washer and retaining nut (A) onto end of shaft. Tighten retaining nut to following specifications:

**Specification**

Fuel Injection Pump Drive	
Gear-to-Shaft Retaining Nut—	
Torque .....	81 N•m (60 lb-ft)

**A—Drive Gear Retaining Nut**



Pump Drive Gear Retaining Nut

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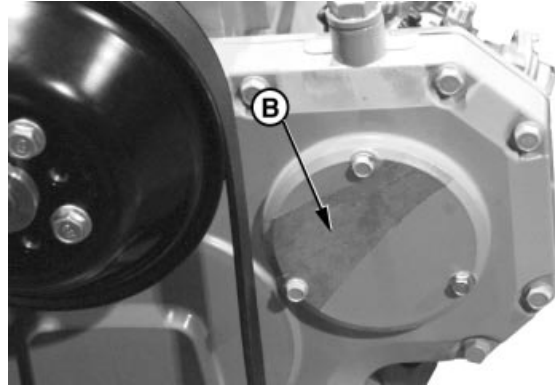
**IMPORTANT: DO NOT overtighten cap screws on pump cover plate to avoid damage to O-ring.**

- 8. Install access plate (B) using a new O-ring, if needed. Apply LOCTITE® 242 (T43512) to cap screw threads and tighten to specifications.

**Specification**

Injection Pump Front Access  
 Plate Cap Screws—Torque..... 6 N•m (4.5Lb-ft) (54 lb-in.)

**B—Injection Pump Drive Gear Access Plate**



Injection Pump Drive Gear Access Plate

RG71629B -UN-06NOV97

LOCTITE is a registered trademark of Loctite Corp.

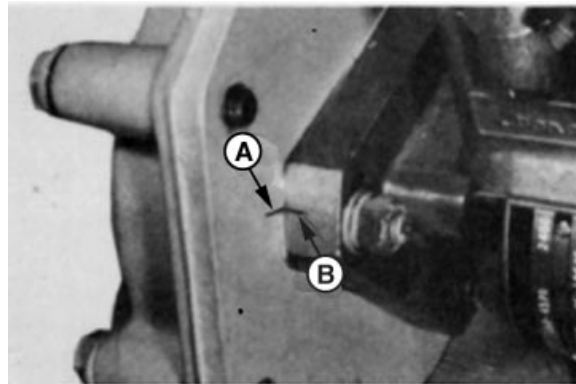
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- 9. Align timing mark on the pump flange (B) with timing mark on front plate (A).
- 10. Tighten hex nuts securing the pump to the front plate to specifications.

**Specification**

Rotary Injection Pump Mounting  
 Nuts—Torque ..... 27 N•m (20 lb-ft)

**A—Timing Mark on Front Plate**  
**B—Timing Mark on Injection Pump Flange**



Injection Pump Timing Marks

RG11832 -UN-26SEP01

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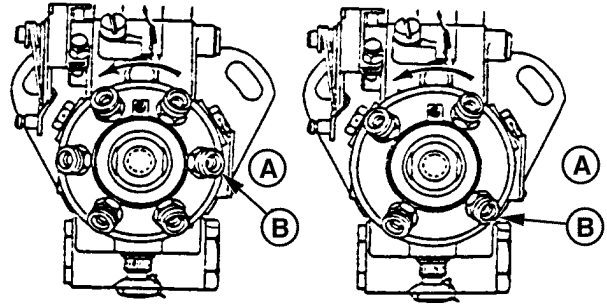
11. Connect fuel delivery lines (D). Beginning with outlet (B) and continuing around the pump head in counterclockwise direction, attach lines in same order as engine firing (1-5-3-6-2-4 on 6-cylinder engines and 1-3-4-2 on 4-cylinder engines).
12. Tighten fuel delivery (pressure) lines at pump to specifications, using a suitable 17 mm deep-well socket.

**Specification**

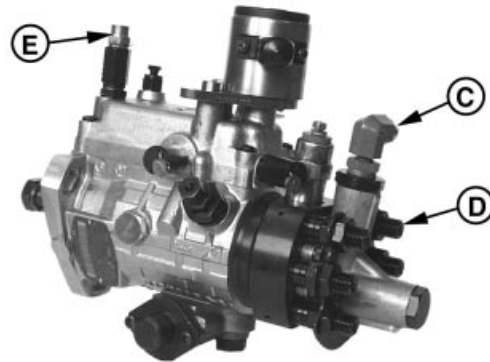
Fuel Injection Pump Delivery  
 Lines—Torque ..... 27 N•m (20 lb-ft)

**IMPORTANT: ALWAYS use a backup wrench when loosening or tightening fuel delivery lines at fuel injection pump, so that the pump discharge fittings are not altered. This prevents possible internal pump damage.**

13. Connect fuel supply line (C), and fuel return line (E).
14. Install and securely tighten electrical connections to actuator and shut-off solenoid, if equipped. Connect cold start switch, if equipped.
15. Bleed air from fuel system as outlined in this group. See BLEED THE FUEL SYSTEM later in this Group. Start engine, run for several minutes and check entire fuel system for leaks.



6-Cylinder Engine (Left)  
 4-Cylinder Engine (Right)



Fuel Supply, Delivery, and Return Lines

- A—Engine Block Side of Injection Pump
- B—Outlet Connection to Number 1 Cylinder
- C—Fuel Supply Line
- D—Fuel Delivery (Pressure) Lines
- E—Fuel Return Line

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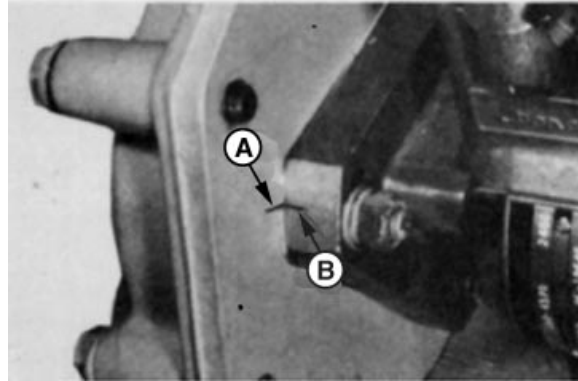
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## Fuel Injection Pump Timing

### Static Timing With External Marks

1. Loosen attaching hex nuts of fuel injection pump and pivot pump housing away from cylinder block as far as slots will allow. Then pivot it back again, but only far enough to align timing mark on pump flange (B) exactly with timing mark on cylinder block front plate (A).
2. Tighten the three hex nuts securing pump to front plate to specifications.



Timing Fuel Injection Pump

#### Specification

Rotary Injection Pump Mounting

Nuts—Torque ..... 27 N•m (20 lb-ft)

To adjust dynamic timing, see CHECK AND ADJUST INJECTION PUMP DYNAMIC TIMING in Section 04, Group 150.

RG40854,000006D -19-24AUG01-1/1

## Remove Fuel Injection Nozzles

### General Nozzle Service Precautions

Before removal, thoroughly remove all dirt from the cylinder head around fuel injection nozzles. Clean with compressed air to prevent dirt from entering the cylinders. Plug the bore in the cylinder head after each nozzle has been removed. Cap fuel line openings as soon as they are disconnected.

Immediately fit protective caps over the nozzle tips and the line connections to avoid handling damage and getting debris in fuel system.

Do not bend the fuel delivery lines, as this may affect their durability. When loosening the fuel pressure lines, hold male union of nozzle line stationary with a backup wrench.

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**NOTE:** When all fuel injection nozzles have to be removed, disconnect leak-off line and remove as a complete assembly. For individual nozzle removal, remove only the section of leak-off line necessary for nozzle removal.

1. Loosen tube nuts at each nozzle to remove leak-off lines and T-fittings as an assembly.



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Fuel Leak-Off Lines

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2. Disconnect fuel injection line from nozzle using a backup wrench on nozzle connection as shown.
3. Remove cap screw securing nozzle in cylinder head nozzle bore.



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Fuel Injection Line at Nozzle

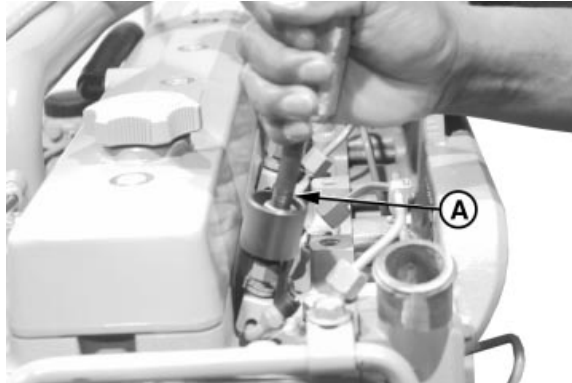
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4. Pull injection nozzle out of cylinder head using JDE38B Injection Nozzle Puller Set (A) or JDG716 Adapter and slide handle from JDE38 or JDE38A Puller Set.

**IMPORTANT:** Do not use screwdrivers, pry bars, or similar tools for this as they might damage the injection nozzle beyond repair.

A—Nozzle Puller



Injection Nozzle Puller Set

RG7726 -UN-07NOV97

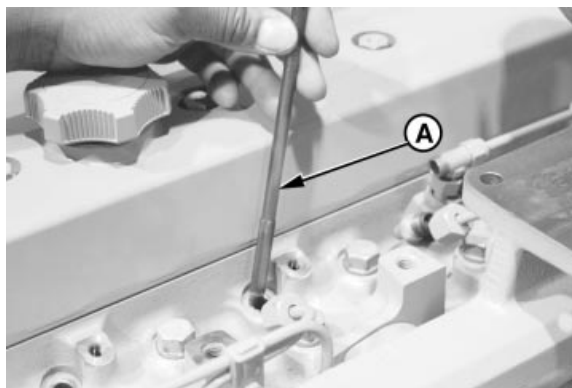
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### Clean Fuel Injection Nozzle Bore

**IMPORTANT:** Always turn tool clockwise in bore to prevent dulling of cutting edges, even when removing tool from bore.

Clean injection nozzle bore using JDE39 Nozzle Bore Cleaning Tool (A). Blow debris from bore using compressed air, and plug the bore to prevent entry of foreign material.

A—Nozzle Bore Cleaning Tool



Clean Injection Nozzle Bore

RG7743 -UN-07NOV97

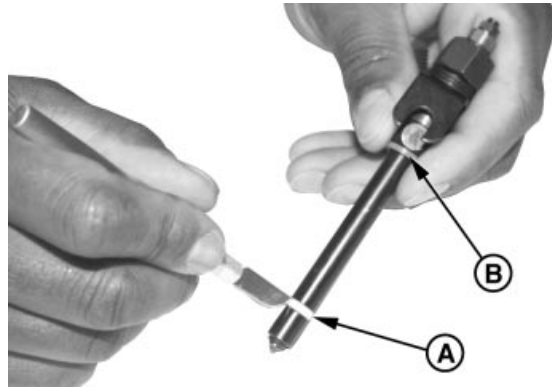
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## Clean Fuel Injection Nozzles

1. Remove carbon stop seal (A) from groove in nozzle body using razor blade or sharp knife and remove upper sealing washer (B). Discard seal and washer.
2. Place nozzle in solvent or clean diesel fuel, so carbon stop seal groove is submerged, and soak for a while.

**IMPORTANT:** Do not scrape or disturb the TEFLON® coating on the nozzle body above the carbon stop seal groove. This coating will become discolored during normal operation, but this is not harmful. Do not use a motor-driven brush to clean nozzle body.

3. After soaking, clean nozzle tip with brass wire brush. Never use a steel wire brush or scraper.



Clean Fuel Injection Nozzle

A—Carbon Stop Seal  
B—Upper Sealing Washer

RG7798 -UN-11NOV97

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## Diagnose Fuel Injection Nozzle Malfunction

Problem	Possible Cause	Suggested Remedy
Failed Carbon Stop Seal Washer	Nozzle replaced without using new seal or washer. Carbon stop seal groove not cleaned when new seal was installed.	Install new seal or washer. Clean groove. Install new seal.
Incorrect Opening Pressure	Improper adjustment. Broken spring.	Adjust opening pressure. Replace spring.
Nozzle Will Not Open	Plugged orifices. Chipped orifices. Bottomed lift screw.	Clean. Replace nozzle. Adjust lift screw.
Poor Spray Pattern	Plugged orifices. Chipped orifices. Cracked nozzle tip.	Clean. Replace nozzle. Replace nozzle.
Poor Atomization	Plugged orifice. Chipped orifice. Cracked nozzle tip. Valve not free.	Clean. Replace nozzle. Replace nozzle. See "Inconsistent Chatter".
Inconsistent Chatter	Spring components misaligned. Varnish on valve. Deposits in seat area. Bent valve. Distorted body.	Adjust opening pressure. Clean guide area. Clean seat. Replace nozzle. Replace nozzle.
No Chatter	Spring components misaligned. Varnish on valve. Deposits in seat area. Bent valve. Valve seat eroded or pitted.  Tip seat pitted.  Seat interference angle worn. Distorted body.	Adjust opening pressure. Clean guide area. Clean seat. Replace nozzle. Lap valve to seat. Replace nozzle as necessary. Lap tip to seat. Replace nozzle as necessary. Replace nozzle. Replace nozzle.
Seat Leakage	Deposits in seat area. Valve seat eroded or pitted.  Tip seat pitted.  Valve not free.  Distorted body. Cracked tip.	Clean seat. Lap valve to seat. Replace nozzle as necessary. Lap tip to seat. Replace nozzle as necessary. See "Inconsistent Chatter". See "No Chatter". Replace nozzle. Replace nozzle.
High Leak-Off	Wear or scratched at guide.	Lap valve to guide. Replace nozzle as necessary.

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**Problem**  
Low Leak-Off

**Possible Cause**  
Varnish on valve.  
Insufficient clearance.

**Suggested Remedy**  
Clean guide area.  
Clean nozzle. Lap valve to guide. Replace nozzle as necessary.

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## Test Fuel Injection Nozzles

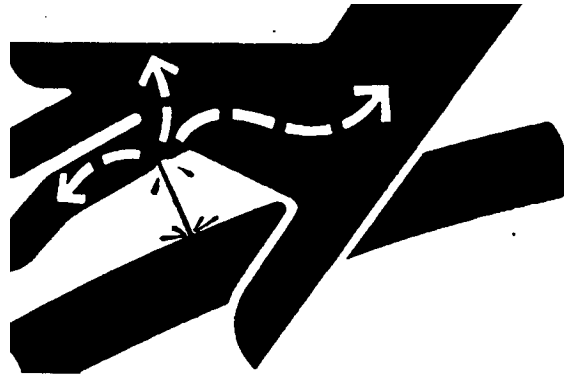


**CAUTION:** The nozzle tip should always be directed away from the operator. Fuel from the spray orifices can penetrate clothing and skin causing serious personal injury. Enclosing the nozzle in a clear glass beaker is recommended.

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

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.

1. Connect injection nozzle to nozzle tester.



High Pressure Fluid

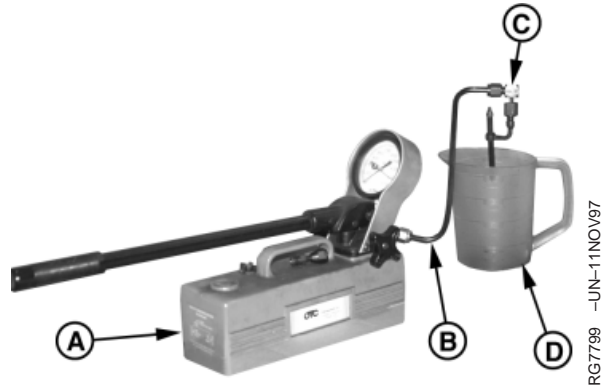
X9811 -UN-23AUG88

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RG40854,0000072 -19-24AUG01-1/5

**NOTE:** When using the Bosch Tester (JT25510), use the KJD10109 Fuel Line and connect line to tester and nozzle.

2. Use Y900-3 and Y900-5 Adapters (C) and Y900-2 Fuel Line (B) from D01110AA Adapter Set to connect nozzles to D01109AA Nozzle Tester.
3. Position tip of nozzle below top of beaker (D) and back out 30° from vertical. This is necessary to contain all spray in beaker, as nozzle spray pattern is at an angle to the nozzle centerline. Leave connections slightly loose.



Injection Nozzle Tester

- A—Nozzle Tester
- B—Fuel Line
- C—Adapters
- D—Beaker

**NOTE:** Rapid operation of pump handle will result in inaccurate cracking pressure readings and cause undue wear on gauge.

4. Pump handle several strokes to flush air from lines and to determine the pumping rate required for proper fuel atomization. Tighten all connections securely after all air has been expelled from nozzle and line.

**IMPORTANT:** Make sure that nozzle tester is in good condition and that gauge works properly. Service nozzle tester as recommended in the operating instructions provided with tester.

### Opening Pressure Test

**NOTE:** Actual nozzle opening pressure is less important than equal opening pressure of all nozzles. For maximum variation between nozzles see specifications below.

1. Actuate the nozzle tester rapidly several times to allow the valve to seat rapidly.
2. Open gauge valve, actuate the tester and raise the pressure to a point where the gauge needle falls rapidly. This is the nozzle opening pressure, and should be as specified for a new or used nozzle.

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3. Compare readings to the following specifications:

**Fuel Injection Nozzles (4045D and 6068D Engines)—Specification**

New or Reconditioned Nozzle  
with New Internal Parts—Opening

Pressure for Setting .....	23 856—24 407 kPa (238—244 bar) (3460—3540 psi)
Opening Pressure for Checking (Minimum).....	21 856 kPa (218 bar) (3170 psi)
Used Nozzle—Opening Pressure for Checking (Minimum).....	19 850 kPa (198 bar) (2880 psi)
Opening Pressure Difference between Cylinders—Pressure Difference (Maximum) .....	700 kPa (7 bar) (100 psi)

**Fuel Injection Nozzles (4045T, 4045H, 6068T, and 6068H Engines)—Specification**

New or Reconditioned Nozzle  
with New Internal Parts—Opening

Pressure for Setting .....	25 511—26 062 kPa (255—260 bar) (3700—3780 psi)
Opening Pressure for Checking (Minimum).....	24 683 kPa (246 bar) (3580 psi)
Used Nozzle—Opening Pressure for Checking (Minimum).....	23 511 kPa (235 bar) (3410 psi)
Opening Pressure Difference between Cylinders—Pressure Difference (Maximum) .....	700 kPa (7 bar) (100 psi)

**IMPORTANT: If any of the nozzle opening pressures are not within specified range, reset pressure and valve lift BEFORE checking chatter and spray pattern. Otherwise, these characteristics may be affected. See ADJUST FUEL INJECTION NOZZLES later in this Group.**

**Chatter Test**

1. Close gauge shut-off valve and operate nozzle tester at a pumping rate that will cause the nozzle to chatter. Nozzle should chatter softly, and spray pattern should be broad and finely atomized.

If nozzle fails to chatter, the nozzle valve may be bent or tight in its guide due to accumulated lacquer deposits. Disassemble nozzle and correct as detailed later in this Group.

*NOTE: Until the chattering range is reached, fuel will emerge in non-atomized streams.*

- Using the pumping rate for proper atomization, operate tester for ten strokes. The nozzle must atomize on at least eight of the ten strokes without consecutive misses.

If the nozzle fails to meet this requirement, repeat procedure. Nozzles which do not meet the requirement after second test should be considered unacceptable and should be either repaired or replaced.

**Spray Pattern Test**

- Close gauge shut-off valve and operate nozzle tester at a pumping rate that will cause the nozzle to chatter.

*NOTE: Partially clogged, chipped, or eroded orifices will cause the spray to deviate from the correct angle. Spray will be streaky, rather than finely atomized.*

- Observe spray pattern and check for plugged orifices.

If nozzle fails to chatter or spray properly, disassemble, clean and recondition as outlined later in this Group.

**Specification**

Fuel Injection Nozzle Tip—Spray  
Angle ..... 144°

**Leakage Test**

- Check nozzle for fuel leakage past valve seat by positioning nozzle on nozzle tester with nozzle tip down.
- Operate pump handle rapidly to firmly seat valve. Wipe the nozzle tip dry with a clean, lint-free cloth

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3. Slowly raise pressure at nozzle to about 2800—3500 kPa (28—35 bar) (400—500 psi) under specified opening pressure and hold at that pressure. Watch for an accumulation of fuel around the nozzle tip orifices.

If fuel drips from nozzle within 5 seconds, nozzle must be lapped.

**Specification**

Nozzle Valve/Seat Tightness  
 Condition at Pressure Test of  
 2800—3500 kPa (28—35 bar)  
 (400—500 psi)—Leakage ..... Nozzle tip dry after 5 seconds.  
 (Slight dampness permissible on  
 used nozzles.)

**Valve Stem and Guide Wear Test**

1. Position nozzle with tip slightly above the horizontal plane.

 **CAUTION: Completely enclose spray zone in a glass beaker to avoid possible personal injury from spray.**

2. Slowly raise pressure to 10 300 kPa (103 bar) (1500 psi) on test gauge

*NOTE: Leakage rate based on use of No. 2 diesel fuel or an equivalent viscosity of test oil at 18°—24° C (65°—75° F) ambient temperature.*

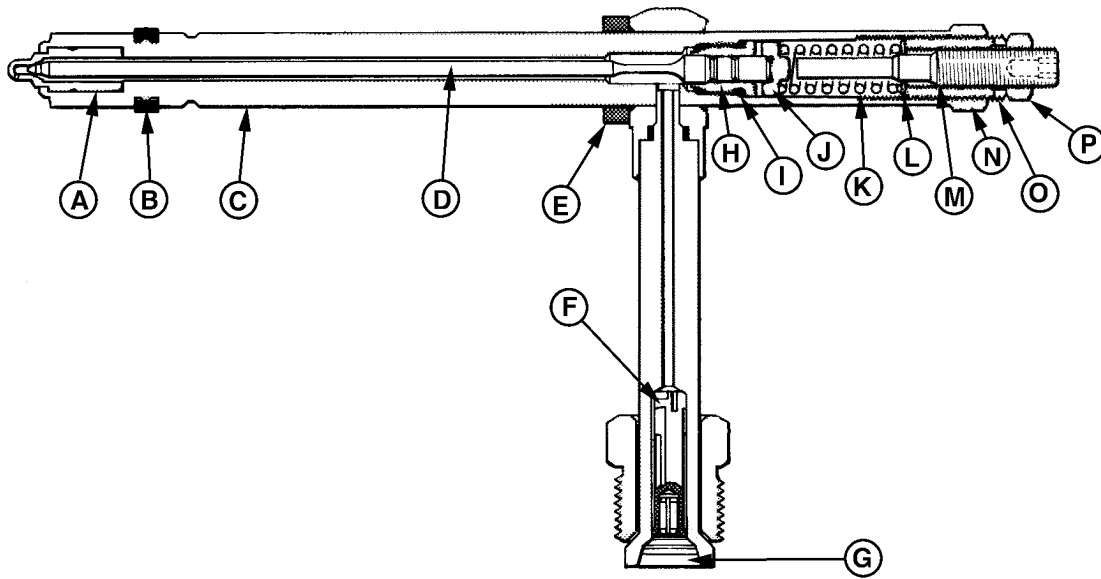
3. Look for leakage from the return end of nozzle. After one drop, leakage should be within specifications.

**Specification**

Fuel Injection Nozzle Return  
 Leakage at Pressure Test of 10  
 300 kPa (103 bar) (1500 psi)—  
 Leakage ..... 3—10 Drops/30 Seconds

If nozzle leakage is not within specified range, nozzle must be reconditioned as outlined later in this Group.

## Disassemble Fuel Injection Nozzles



Fuel Injection Nozzles

A—Nozzle Tip  
 B—Carbon Stop Seal  
 C—Nozzle Body  
 D—Nozzle Valve

E—Upper Sealing Washer  
 F—Edge-Type Filter  
 G—Fuel Inlet  
 H—Upper Guide

I—Upper Seal  
 J—Spring Seat  
 K—Spring Screw  
 L—Spring Washer

M—Lift Adjusting Screw  
 N—Lock Nut  
 O—Pressure Adjusting Screw  
 P—Lock Nut

RG7800A -UN-13NOV97

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RG40854,0000073 -19-24AUG01-1/4

**General Nozzle Repair Notes**

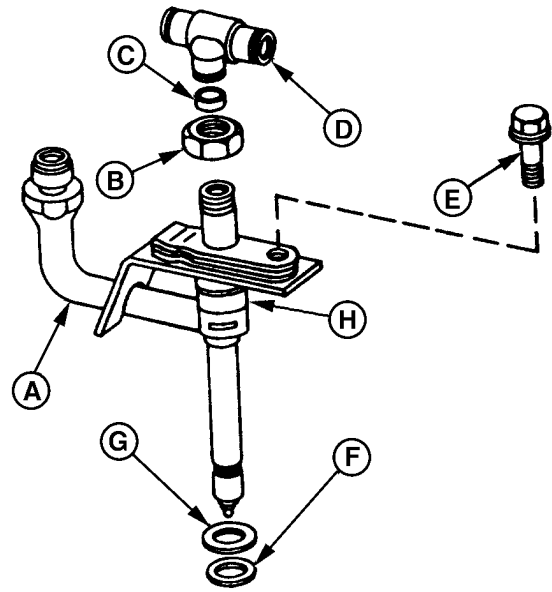
*NOTE: Disassembly of nozzles is not recommended unless servicing is indicated by nozzle operation and testing.*

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

Cover the work bench with clean paper before beginning disassembly of injection nozzles.

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

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



Nozzle Disassembly

- A—Nozzle Assembly
- B—Tube Nut
- C—Packing
- D—Leak-Off-Fitting
- E—Cap Screw
- F—Carbon Stop Seal
- G—Upper Sealing Washer
- H—Spacer

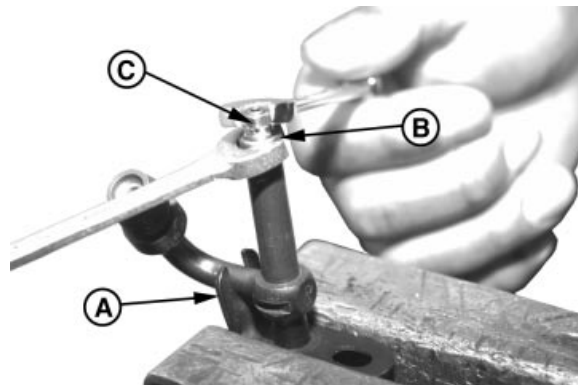
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RG9086 -UN-16MAR98

RG40854.0000073 -19-24AUG01-2/4

**To Disassemble Fuel Injection Nozzle**

1. Place nozzle in index clamp (A)<sup>1</sup> and secure clamp in a vise.
2. Loosen pressure adjusting lock nut (B).
3. Back out lift adjusting screw lock nut (C) and lift assembly.
4. Invert nozzle and allow pressure adjusting spring seat and lift adjusting assembly to fall into your hand. Do not bend stem during removal.



Injection Nozzle in Holding Fixture

- A—Nozzle Index Clamp
- B—Pressure Adjusting Lock Nut
- C—Lift Adjusting Screw Lock Nut

<sup>1</sup>If available, ROS17787 Holding Fixture (obsolete) can be used.

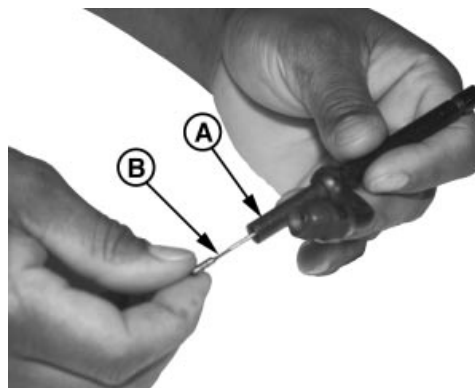
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RG40854.0000073 -19-24AUG01-3/4

RG7802 -UN-21MAY01

5. If valve does not slide freely from body (A), use No. 16481 Valve Retractor<sup>1</sup> (B) to remove valve.
6. Remove locating clamps and spacer from nozzle body.

A—Valve Body  
B—Valve Retractor



Injection Nozzle Body and Valve

RG7803 -UN-11NOV97

<sup>1</sup>No. 16481 Valve Retractor is a Stanadyne tool.

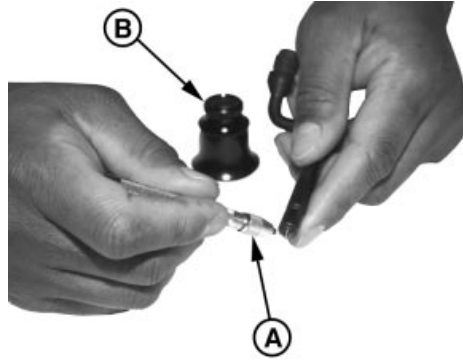
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## Inspect and Clean Fuel Injection Nozzle Body

**NOTE:** Unless otherwise indicated, all tools required for nozzle cleaning can be found in the JDF13B Nozzle Cleaning Kit.

Clean carbon stop seal groove and nozzle tip with a nozzle cleaning wire inserted in holder (A).

Inspect tip for cracks and spray orifices for chipping and erosion using an inspection magnifier (B).<sup>1</sup>



Clean Injection Nozzle Body

A—Holder  
B—Inspection Magnifier

### To Clean Carbon from Nozzle Orifices

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

1. Begin with a cleaning wire 0.07—0.10 mm (0.003—0.004 in.) smaller than the nominal orifice size given in specifications below.

#### Specification

Fuel Injection Nozzle Tip	
Orifice—Number of Orifices per	
Nozzle.....	4
Fuel Injection Nozzle Tip	
Orifice—ID .....	0.29 mm (0.0116 in.)

2. Clamp the wire in pin vise from nozzle cleaning kit. Wire should not protrude from the vise more than 0.8 mm (1/32 in.).
3. Insert wire in orifice and rotate.
4. Use scraper from cleaning kit to clean deposits from valve seating area.

<sup>1</sup>If available, ROS16487 Inspection Magnifier (obsolete) can be used.

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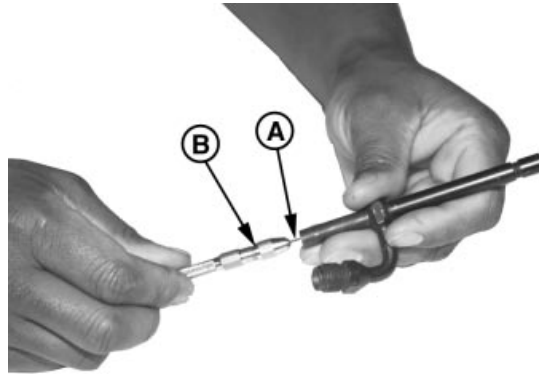
RG40854,0000074 -19-24AUG01-1/2

RG7804 -UN-11NOV97

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5. Grasp sac hole drill (A) with valve retractor (B).
6. For final cleaning, use a cleaning wire 0.03 mm (0.001 in.) smaller than the nominal orifice size and repeat steps 2 and 3.

A—Sac Hole Drill  
B—Valve Retractor



Injection Nozzle Orifices

RG7806 -UN-11NOV97

RG40854,0000074 -19-24AUG01-2/2

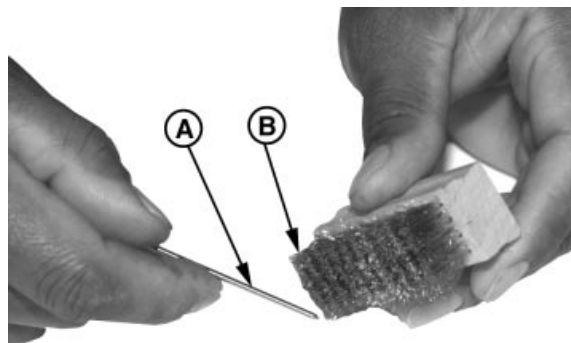
### Inspect and Clean Valve and Valve Seat

**IMPORTANT: NEVER use a steel wire brush on nozzle parts.**

Use brass wire brush (B) to remove deposits from seating area on tip of nozzle valve (A). Use a felt pad to remove varnish deposits.

Inspect guide area for valve scratches which could cause sticking. This area will generally be polished on one side during operation. Visible vertical marks are normal.

A—Nozzle Valve  
B—Brass Wire Brush



Injection Nozzle Valve and Valve Seat

RG7806 -UN-11NOV97

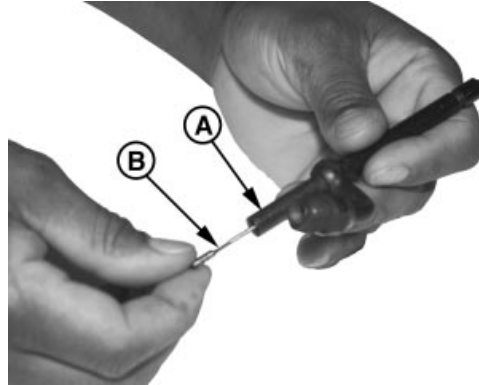
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RG40854,0000075 -19-24AUG01-1/2

### Inconsistent Chatter or No Chatter

A nozzle which during test had spotty chatter or showed definite signs of sticking accompanied by low return leakage, may be corrected by polishing the valve guide area as follows:

1. Place a small amount of nozzle lapping compound on the nozzle valve in guide area only. DO NOT use any other compound for this purpose.
2. Slide valve into body (A).



Nozzle Valve in Nozzle Body

A—Nozzle Body  
B—Retractor

**IMPORTANT: Never attempt to rotate the valve in a motor driven chuck for this purpose.**

3. Grip top of the valve with retractor (B) and rotate valve in the guide by turning retractor. The amount of lapping required can be accomplished in 10—20 turns by hand. The valve should be raised and lowered in the guide every 3—4 revolutions and direction of rotation changed for best results.
4. Wash nozzle body and valve thoroughly in clean fuel before reassembly.

### Seat Leakage

Seat leakage may be caused by dirt, carbon or fuel deposits in valve area. Inspect valve seat and clean as follows:

1. Apply a small amount of lapping compound to valve tip and insert valve in nozzle body.
2. Gripping valve with retractor, rotate valve 3—5 turns to clean up seat.
3. Wash valve and nozzle body thoroughly in clean fuel.

RG7803 -UN-11NOV97

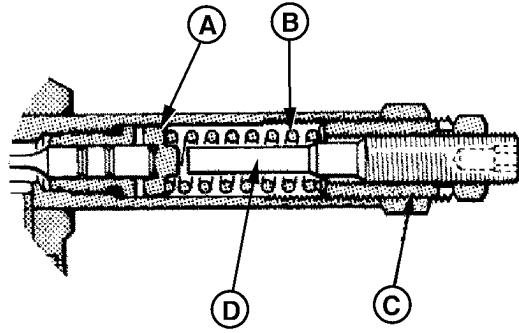
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RG40854,0000075 -19-24AUG01-2/2

### Inspect Valve Adjusting Mechanism

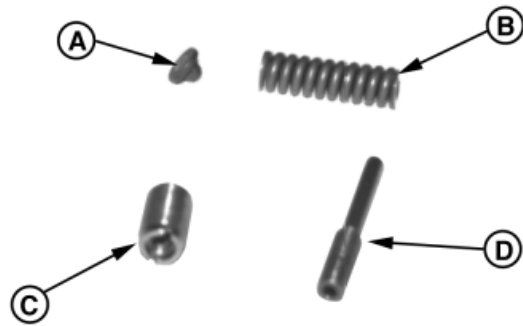
1. Inspect lift adjusting screw (D). Replace if bent or otherwise damaged.
2. Inspect pressure adjusting screw (C). Replace if worn or damaged.
3. Inspect pressure adjusting spring (B). Replace if broken or distorted.
4. Inspect spring seat (A) for wear. Replace as necessary.
5. Replace nozzle clamp if bent.

A—Spring Seat  
 B—Pressure Adjusting Spring  
 C—Pressure Adjusting Screw  
 D—Lift Adjusting Screw



Inspect Nozzle Valve Adjust Mechanism

RG7810A -UN-13SEP02



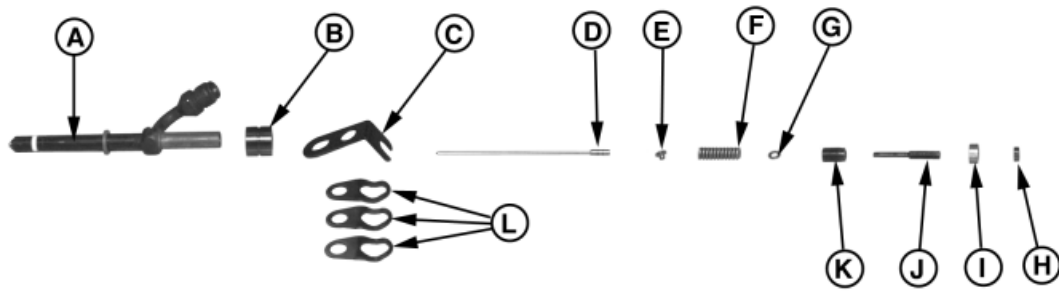
Inspect Nozzle Valve Adjust Mechanism

RG7808 -UN-11NOV97

RG40854.0000076 -19-24AUG01-1/1

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## Assemble Fuel Injection Nozzles



RG8042 -UN-14NOV97

Fuel Injection Nozzles

- |                  |                                 |                                     |                                     |
|------------------|---------------------------------|-------------------------------------|-------------------------------------|
| A—Nozzle Body    | E—Spring Seat                   | I—Pressure Adjusting Screw Lock Nut | K—Pressure Adjusting Screw Lock Nut |
| B—Spacer         | F—Pressure Adjusting Spring     | J—Lift Adjusting Screw              | L—Hold-Down Clamps                  |
| C—Indexing Clamp | G—Washer                        |                                     |                                     |
| D—Nozzle Valve   | H—Lift Adjusting Screw Lock Nut |                                     |                                     |

1. Install nozzle spacer (B) onto upper nozzle body (A). Position nozzle indexing clamp (C) over upper nozzle body with flanges pointing downward. Install three remaining clamps (L) onto nozzle body.

**IMPORTANT: Wear rubber gloves when assembling nozzles.**

2. Dip valve (D) in clean fuel and insert into nozzle body.
3. Thread lift adjusting screw (J) into pressure adjusting screw (K) until top just enters screw.

4. Invert adjusting screw assembly and assemble spring seat (E) and spring (F) to adjusting screw.
5. Tilt body, DO NOT allow valve to fall out, and install spring and adjusting screws to body. Be careful not to dislodge spring or seat during initial assembly.
6. Turn pressure adjusting screw down as far as possible by hand, usually about ten full turns. Adjust nozzle as detailed later in this group.

RG40854,0000077 -19-24AUG01-1/1

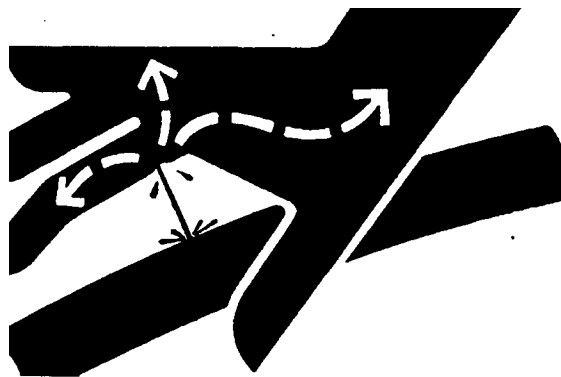
## Adjust Fuel Injection Nozzles

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

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

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

Connect nozzle to nozzle tester. See TEST FUEL INJECTION NOZZLES earlier in this Group.



High Pressure Fluids

X9811 -UN-23AUG88

Continued on next page

RG40854,0000078 -19-24AUG01-1/6

### Adjust Nozzle Opening Pressure

Close pressure gauge valve and flush nozzle by operating pump rapidly.

Raise pressure on pump until nozzle opens (gauge drops sharply).

Refer to nozzle opening pressure specifications below.

#### Fuel Injection Nozzles (RE48786)—Specification

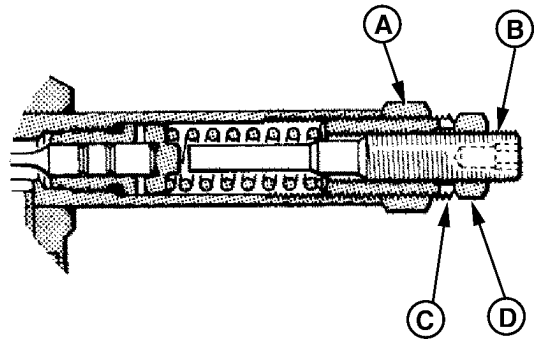
New or Reconditioned Nozzle with New Internal Parts—Opening	
Pressure for Setting .....	25 511—26 062 kPa (255—260 bar) (3700—3780 psi)
Opening Pressure for Checking (Minimum).....	
	24 683 kPa (246 bar) (3580 psi)
Used Nozzle—Opening Pressure for Checking (Minimum) .....	
	23 511 kPa (235 bar) (3410 psi)
Opening Pressure Difference between Cylinders—Pressure	
Difference (Maximum) .....	700 kPa (7 bar) (100 psi)

- A—Pressure Adjusting Screw Lock Nut**
- B—Lift Adjusting Screw**
- C—Pressure Adjusting Screw**
- D—Lift Adjusting Lock Nut**



Injection Nozzle Tester

RG7809 -UN-15JAN98



Injection Nozzle Adjustments

RG7810B -UN-11NOV97

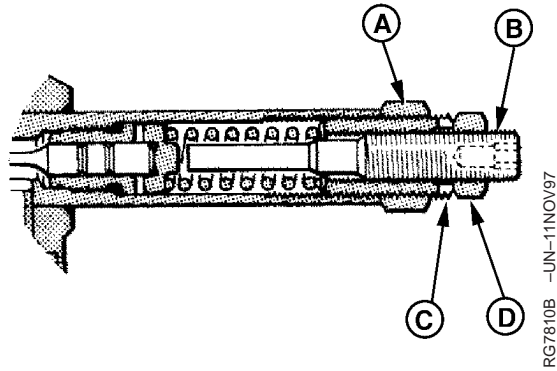
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RG40854.0000078 -19-24AUG01-2/6

**If opening pressure is incorrect:**

1. Remove nozzle from tester and install in holding fixture.
2. Remove lift adjusting lock nut (D).
3. Loosen pressure adjusting screw lock nut (A), using JDG949 Nozzle Wrench.
4. Reconnect nozzle to tester with tip pointing downward.
5. Back out lift adjusting screw (B) far enough (two or three turns) to prevent bottoming when pressure adjusting screw (C) is turned.
6. Turn pressure adjusting screw in (clockwise) to increase opening pressure, or out (counterclockwise) to decrease opening pressure.

**NOTE:** It is desirable to set opening pressure to the high limit of specification. If required, repeat procedure to obtain proper result.



Adjust Nozzle Pressure

- A—Pressure Adjusting Screw Lock Nut
- B—Lift Adjusting Screw
- C—Pressure Adjusting Screw
- D—Lift Adjusting Lock Nut

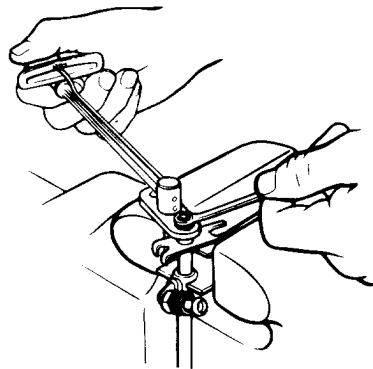
RG7810B -UN-11NOV97

RG40854.0000078 -19-24AUG01-3/6

7. Remove nozzle from tester and secure in holding fixture. While holding pressure adjusting screw, tighten pressure adjusting screw lock nut to specifications using a crowsfoot wrench or torque wrench adapter, if available.<sup>1</sup>

**Specification**

Injection Nozzle Pressure  
 Adjusting Screw Lock Nut—  
 Torque ..... 10 N•m (7 lb-ft)



Nozzle Pressure Adjusting Screw and Lock Nut

RG7811 -UN-15JAN98

<sup>1</sup>If available, ROS18958 (English) or No. 24374 (Stanadyne, Metric) Torque Wrench Adapter (obsolete) can be used.

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RG40854.0000078 -19-24AUG01-4/6

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### Adjust Nozzle Valve Lift

1. Reconnect nozzle to tester. While pumping fuel through nozzle, hold pressure adjusting screw and slowly turn lift adjusting screw in (clockwise) until valve ceases to open.

**IMPORTANT: DO NOT manually bottom the valve with excessive force as bending of the valve may result.**

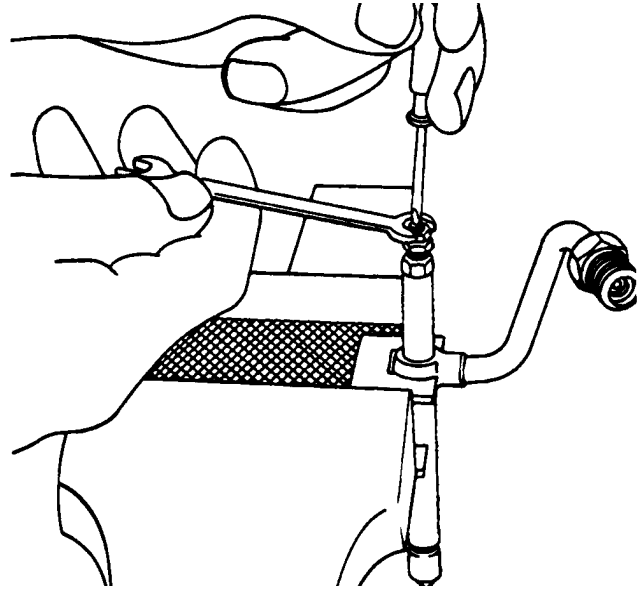
2. Check for valve bottoming by raising pressure to 1380—3450 kPa (14—34 bar) (200—500 psi) above nozzle opening pressure.

Although some fuel may collect at nozzle tip, a rapid dribble should not occur.

3. Remove nozzle from tester and install in holding fixture.
4. Carefully turn lift adjusting screw out specified amount. A tolerance of 1/8 turn is permissible.

#### Specification

Fuel Injection Nozzle Valve  
Needle Lift—Needle Lift (Based  
on Zero Lift) ..... 3/4 Turn Counterclockwise



Injection Nozzle Valve Lift Adjustment

RG9103 -JUN-31MAR98

02  
090  
33

Continued on next page

RG40854.0000078 -19-24AUG01-5/6

5. Hold pressure adjusting screw stationary and tighten lift adjusting screw lock nut to specifications. Use a crow'sfoot wrench or torque wrench adapter, if available.<sup>1</sup>

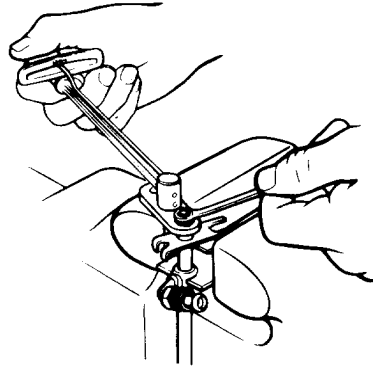
**Specification**

Fuel Injection Nozzle Lift	
Adjusting Screw Lock Nut—	
Torque .....	5 N•m (3.7 lb-ft) (44 lb-in.)

6. Recheck nozzle opening pressure.

If nozzle chatter is incorrect after servicing, valve parts may be misaligned. To correct, screw pressure adjusting screw through its range of adjustment several times and reset valve lift. Recheck nozzle for chatter.

7. Clean nozzle with brass wire brush.



Nozzle Pressure Adjusting Screw and Lock Nut

RG7811 -UN-15JAN98

<sup>1</sup>If available, ROS18958 (English) or No. 24374 (Stanadyne, Metric) Torque Wrench Adapter (obsolete) can be used.

RG40854.0000078 -19-24AUG01-6/6

## Install Seals on Fuel Injection Nozzle

**IMPORTANT:** Each time an injection nozzle is removed from the cylinder head, replace carbon stop seal (B) with a new one.

1. Position JD258 (JD-258) Nozzle Carbon Stop Seal Installer (A) over nozzle tip.
2. Install a new seal washer (C) onto nozzle body.
3. Position a new carbon stop seal (B) on seal installer. Slide the carbon seal until it seats in its groove on nozzle body.

**NOTE:** If nozzle is not going to be installed at this time, install a No. 16189 Nozzle Protector Cap over nozzle tip. Plug all other openings in nozzle to prevent contamination.



Fuel Injection Nozzle Seals

- A—Carbon Stop Seal Installer
- B—Carbon Stop Seal
- C—Seal Washer

RG9096 -UN-27MAR98

RG40854.0000079 -19-24AUG01-1/1

02  
090  
34

## Install Fuel Injection Nozzles

**IMPORTANT:** Before installing injection nozzles, make sure nozzles are clean and free from oil or grease.

*NOTE:* If nozzle bore in cylinder head must be cleaned, use JDE39 Nozzle Bore Cleaning Tool See REMOVE FUEL INJECTION NOZZLES earlier in this Group.

1. Remove plug (if installed previously) from nozzle bore in cylinder head and blow out bore with compressed air.

*NOTE:* Make sure that the sealing surface of the cylinder head (on which the seal washer will be resting) is smooth and free of damage or dirt. This could prevent proper sealing. Dirt and roughness could also cause nozzle to be distorted when the attaching screw is tightened, making the valve stick.

2. Install nozzle with spacer and clamps in cylinder head using a slight twisting motion as nozzle is seated in bore. Illustration shows relationship of parts required for proper installation.
3. Align nozzle clamps and install cap screw. Do not tighten cap screw at this stage.
4. Connect fuel pressure line to nozzle. Leave connection slightly loose until air is bled from system.
5. Tighten nozzle hold-down clamp cap screws to specifications.

### Specification

Fuel Injection Nozzle Hold-Down  
Clamp Cap Screws—Torque..... 40 N•m (30 lb-ft)

6. Install leak-off line assembly.

### Specification

Fuel Leak-Off Hex Nut—Torque ..... 5 N•m (3.7 lb-ft)  
(44 lb-in.)



Injection Nozzle in Cylinder Head

RG7744 -UN-23NOV97



Nozzle Fuel Pressure Line

RG7725 -UN-08JAN97

7. Bleed air from loose injection line connection. Tighten connection using two wrenches to the following specifications.

**Specification**

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

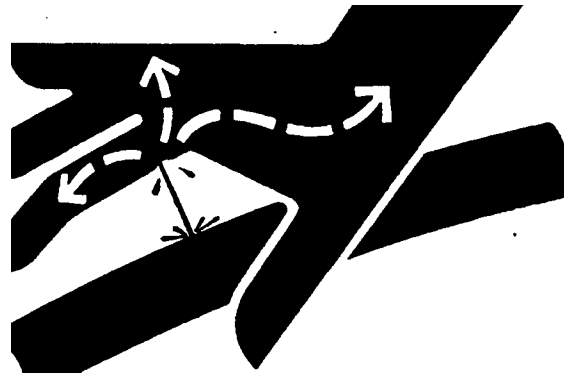
See BLEED THE FUEL SYSTEM in this Group.

RG40854,000007A -19-24AUG01-2/2

02  
090  
36

**Bleed the Fuel System**

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



High Pressure Fluids

X9811 -UN-23AUG88

**If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.**

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.

The fuel system may be bled at one of several locations. On some engine applications it may be necessary to consult your operator's manual and choose the best location for your engine/machine application.

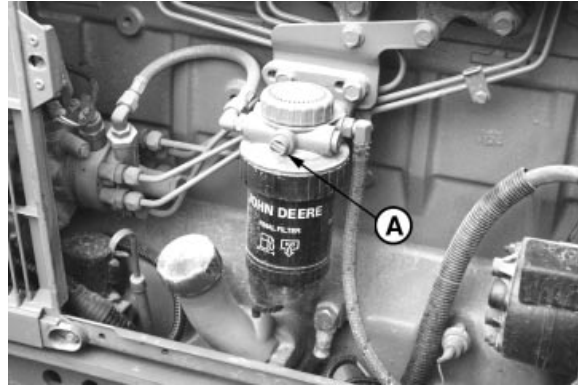
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RG40854,000007B -19-24AUG01-1/4

### Bleed Fuel System at Final Fuel Filter

1. Open air bleed vent screw (A) two full turns by hand.
2. Ignition ON until a fuel is free from air bubbles.
3. Ignition OFF
4. Tighten air bleed vent screw two full turns.

A—Bleed Vent Screw



Fuel Filter Bleed Vent Screw

RG11830D -JUN-26SEP01

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37

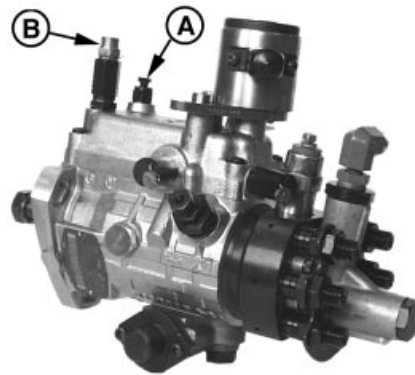
RG40854,000007B -19-24AUG01-2/4

### Bleed Fuel System at Fuel Injection Pump

1. Loosen overflow bleed screw (A) on pump cover or loosen fuel return line (B) on later engines.
2. Ignition ON until fuel flow is free from of bubbles.
3. Ignition OFF
4. Retighten bleed screw or fuel return line.

#### Specification

Fuel Return Line—Torque..... 14 N•m (10.32 lb-ft)



A—Bleed Screw  
B—Fuel Return Line

RG11831C -JUN-29OCT01

Continued on next page

RG40854,000007B -19-24AUG01-3/4

### Bleed Fuel System at Fuel Injection Nozzles

1. Place throttle lever in half-throttle position.

On engines equipped with electronic fuel shut-off solenoid, energize solenoid.

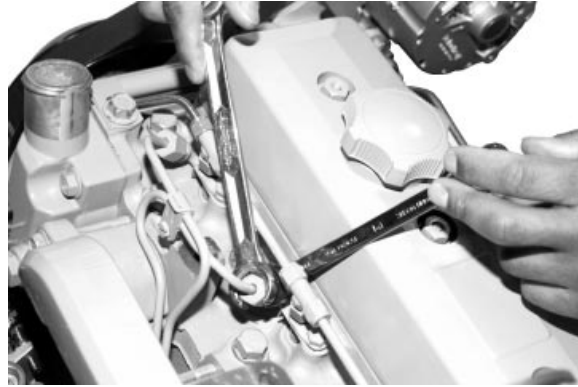
**IMPORTANT: Always use a backup wrench when loosening or tightening fuel lines at nozzles and/or injection pump to avoid damage.**

2. Using two open-end wrenches, loosen two fuel line connections at injection nozzles.
3. Crank engine over with starting motor for 15 seconds (but do not start engine) until fuel free from bubbles flows out of loosened connection. Retighten connection to specifications.

#### Specification

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

4. Repeat procedure for remaining injection nozzles (if necessary) until all air has been removed from fuel system.



Nozzle Fuel Pressure Line

RG7725 -UN-08JAN97

RG40854,000007B -19-24AUG01-4/4

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## 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 ECU CONNECTOR later in this Group.



Engine Control Unit (ECU)

RG-10735 -UN-17MAY00

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1

## Remove and Install Engine Coolant Temperature Sensor

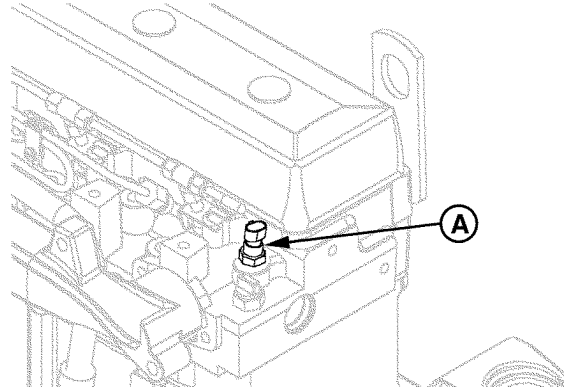
**NOTE:** On 6010/6020/7020 Tractor applications, the ECU uses the ECT sensor in the rear of the cylinder head. Refer to the vehicle manual for information on the coolant temperature sensor in the thermostat housing.

1. Disconnect Engine Coolant Temperature (ECT) sensor wiring connector and remove sensor.
2. Coat sensor O-ring with JDT405 High Temperature Grease and install sensor in the rear of the cylinder head. Tighten to specifications.

### Specification

Coolant Temperature Sensor (In Cylinder Head)—Torque..... 35 N•m (26 lb-ft)

3. Install sensor wiring connector.



A—Engine Coolant Temperature Sensor

RG40854,000007D -19-24AUG01-1/1

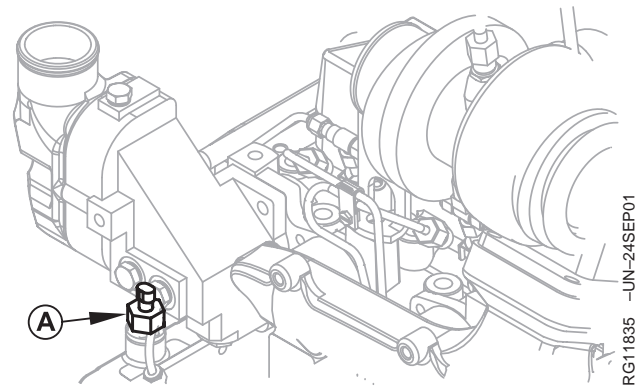
## Replace Engine Speed Sensor

1. Disconnect wiring harness from engine speed sensor connector (shown disconnected).
2. Remove engine speed sensor (A). Discard O-ring.
3. Replace part as necessary.
4. Install engine speed sensor with a new O-ring and tighten to specifications.

### Specification

Engine Speed Sensor—Torque ..... 20 N•m (15 lb-ft)

5. Connect harness to engine speed sensor connector



A—Engine Speed Sensor

RG40854,000007E -19-24AUG01-1/1

## 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 fuel injection pump is removed, it is important to protect the connectors from debris.**

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

RG40854,000007F -19-24AUG01-1/1

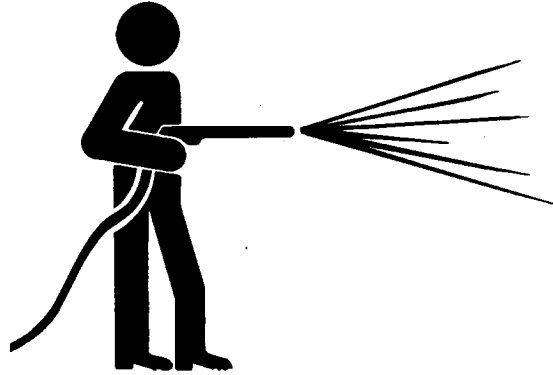
## Use Electrical Insulating Compound

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.

RG40854,0000080 -19-24AUG01-1/1

## 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 -UN-18OCT88

RG40854,0000081 -19-24AUG01-1/1

## Repair WEATHER PACK™ Connector

**IMPORTANT:** Identify wire color locations with connector terminal letters.

Open connector body.

Insert JDG364 Extraction Tool<sup>1</sup> over terminal contact in connector body.

*NOTE: If terminal cannot be removed, insert wire or nail through extractor tool handle and push terminal contact from connector.*

Hold extractor tool fully seated and pull wire from connector body.



TS0128 -UN-23AUG88

*WEATHER PACK is a trademark of Packard Electric*

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

Continued on next page

RG40854,0000082 -19-24AUG01-1/3

**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

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

Push correct size cable seal on wire.

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

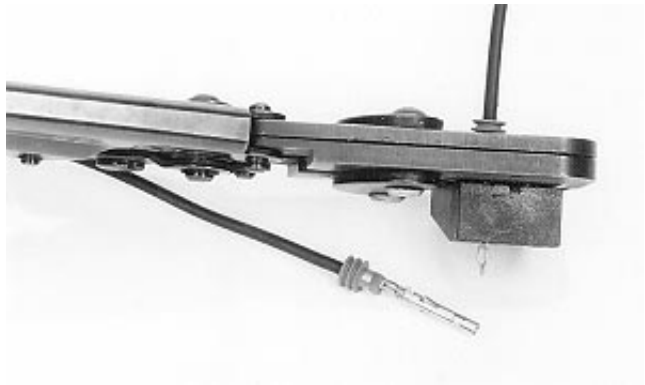
**NOTE:** Contacts have numbered identification for two sizes of wire:

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

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



TS0136 -JUN-23AUG88



TS1623 -JUN-02NOV94

WEATHER PACK is a trademark of Packard Electric

Continued on next page

RG40854.0000082 -19-24AUG01-2/3

**IMPORTANT:** Contact lances must be carefully spread to ensure good seating on connector body.

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

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

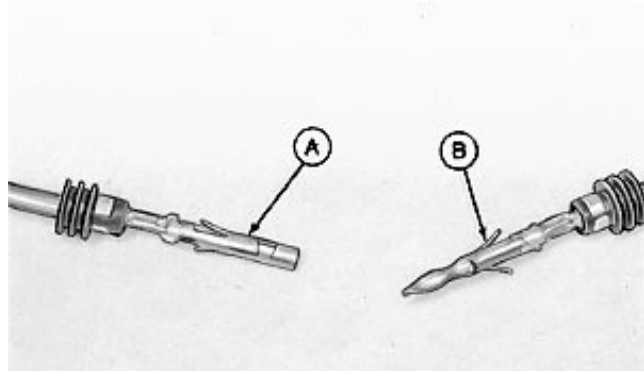
Push contact into new connector body until fully seated.

Pull on wire slightly to insure contact is locked in position.

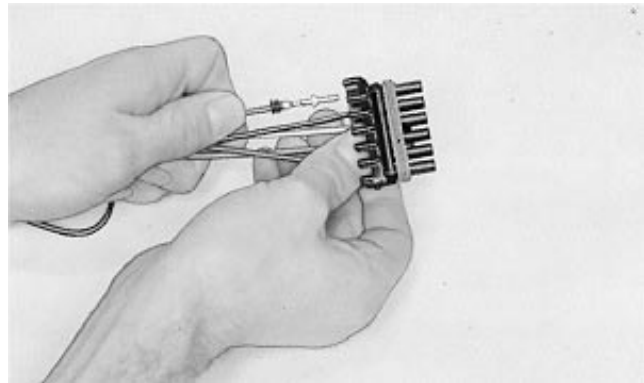
Transfer remaining wires to correct terminal in new connector.

Close connector body.

A—Sleeve  
B—Pin



TS0139 -UN-02DEC88



TS0130 -UN-23AUG88

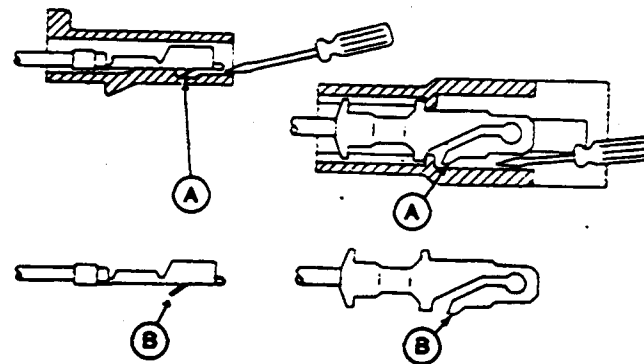
RG40854.0000082 -19-24AUG01-3/3

### Remove Connector Body from Blade Terminals

Depress locking tang (A) on terminal using a small screwdriver. Remove connector body.

Bend locking tang back to the original position (B) before installing connector body.

A—Locking Tang  
B—Original Position



RW4218 -UN-23AUG88

RG40854.0000083 -19-24AUG01-1/1

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

Disconnect the METRI-PACK connector (A). Remove tie bands and tape.

**NOTE:** Use JDG777 Terminal Extraction Tool<sup>1</sup> to remove terminals.

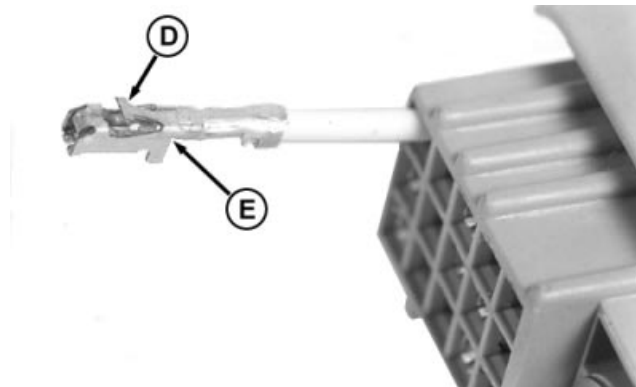
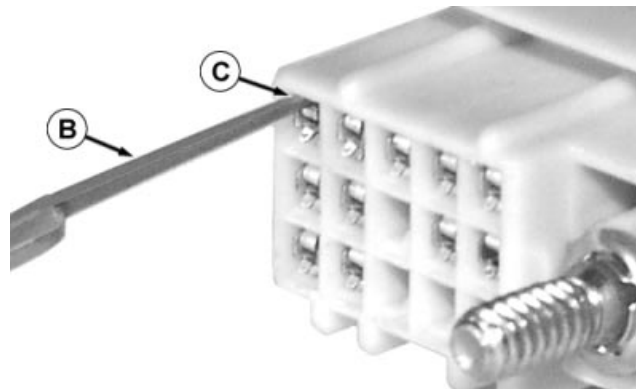
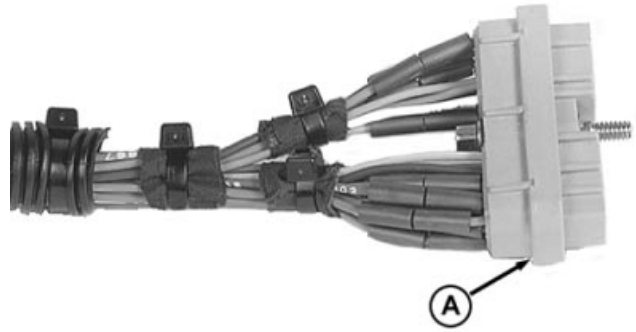
Angle tip so tip slides close to the plastic socket edge pushing inward on terminal locking tab (D).

Insert JDG777 Terminal Extraction Tool (B) 6 mm (1/4 in.) into connector body socket (C).

Remove JDG777 Terminal Extraction Tool and push terminal (E) from socket.

Remove terminal and strip wire using JDG145 Electrician's Pliers<sup>2</sup>.

- A—Connector
- B—JDG777 Terminal Extraction Tool
- C—Body Socket
- D—Locking Tab
- E—Terminal



RW16935A -UN-05AUG98

RW77096 -UN-30JUL98

RW16935A -UN-05AUG98

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*METRI-PACK is a trademark of Delphi Packard Electric Systems*

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

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

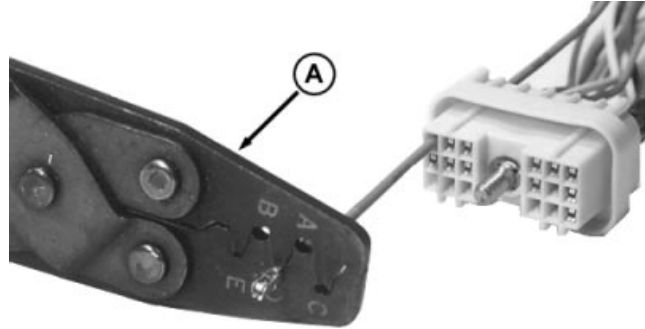
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RG40854,0000084 -19-24AUG01-1/2

Crimp new terminal on wire through connector using JDG144 Crimping Pliers<sup>1</sup> (A).

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

Check to make sure locking tab on new terminal is in outward position, then pull on wire until terminal locks in connector body socket.



RW77143 -UN-07DEC98

A—Crimping Pliers

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

RG40854,0000084 -19-24AUG01-2/2

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

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

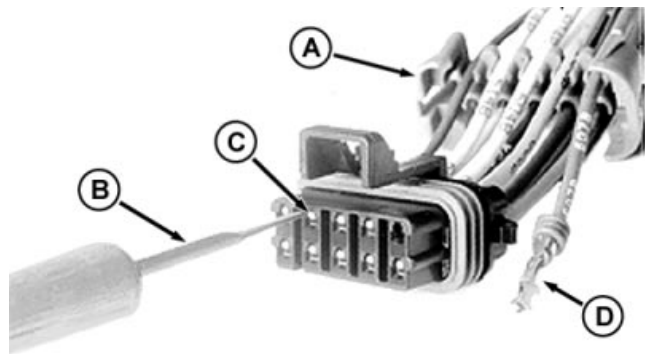
Remove the connector lock (A), and mark wire colors for identification.

Identify wire color locations with connector terminal letters.

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

Insert JDG776 or JDG777 Terminal Extraction Tool<sup>1</sup> (B) into connector body socket (C) pushing the terminal locking tab inward.

Remove extraction tool and pull terminal (D) out of the socket.



RW77137 -UN-08DEC98

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

METRI-PACK is a trademark of Delphi Packard Electric Systems

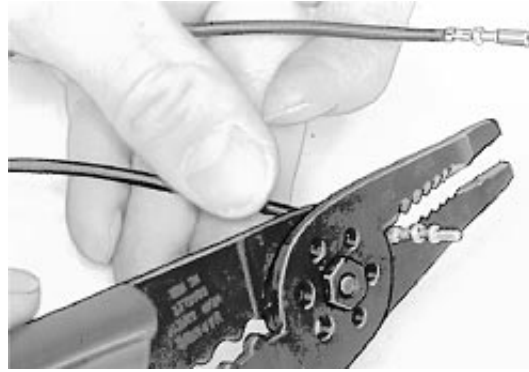
<sup>1</sup>Included in JT07195B Electrical Repair Kit

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Remove old contact from wire using JDG145 Universal Electrical Pliers<sup>1</sup>.



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

RG40854,0000085 -19-24AUG01-2/6

TS0132 -UN-23AUG88

02  
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9

**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

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

Push correct size cable seal on wire.

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



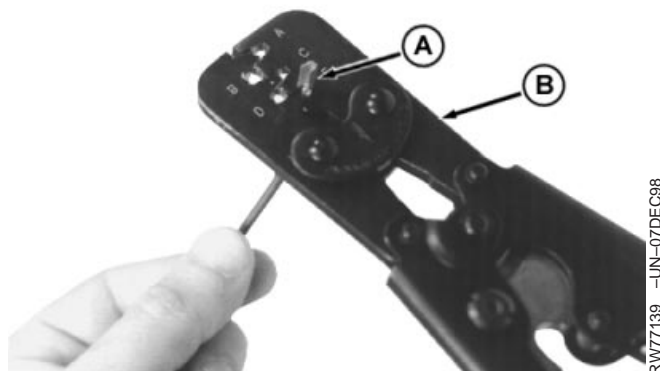
RG40854,0000085 -19-24AUG01-3/6

TS0136 -UN-23AUG88

Install correct size contact on wire.

Crimp contact (A) in position with a “W” type crimp using JDG865 Crimping Tool (B).

- A—Contact
- B—Tool



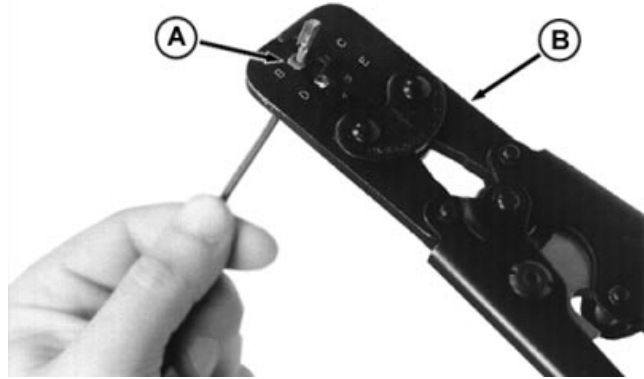
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RW77139 -UN-07DEC88

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

A—Cable Seal  
B—Crimping Tool



RG40854,0000085 -19-24AUG01-5/6

RW77138 -UN-07DEC98

Make sure locking tab (A) on the new terminal is in the outward position.

Push terminal into connector body socket until terminal locks.

A—Tab



RG40854,0000085 -19-24AUG01-6/6

RW77140 -UN-07DEC98

## Repair DEUTSCH™ Connectors

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

*NOTE: JDG361, JDG362, and JDG363 are part of JDG359 DEUTSCH™ Electrical Repair Tool Kit*

- JDG361 Extractor Tool - 12—14 Gauge Wire
- JDG362 Extractor Tool - 16—18 Gauge Wire
- JDG363 Extractor Tool - 20 Gauge Wire

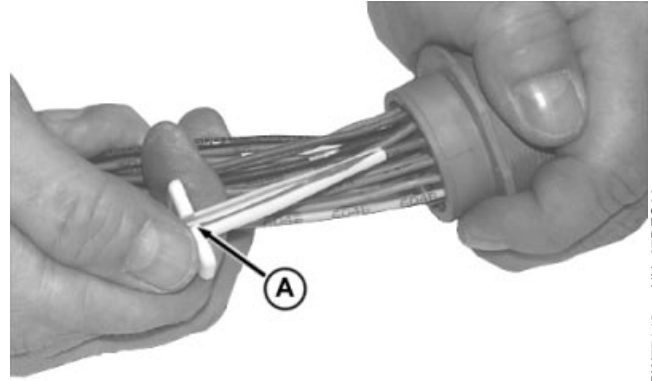
Start correct size extractor tool over wire at handle (A).

Slide extractor tool rearward along wire until tool tip snaps onto wire.

**IMPORTANT: DO NOT twist tool when inserting in connector.**

Slide extractor tool along wire into connector body until tool is positioned over terminal contact.

Pull wire from connector body using extractor tool.



A—Handle

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*DEUTSCH is a trademark of Deutsch Company  
DEUTSCH is a trademark of Deutsch Co.*

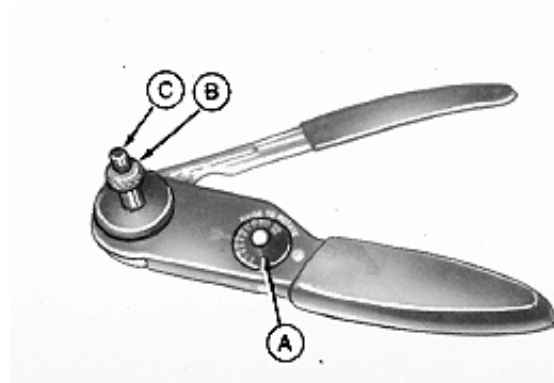
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Strip 6 mm (1/4 in.) insulation from wire.

Adjust selector (A) on JDG360 Crimping Tool<sup>1</sup> for correct wire size .

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

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



TS117 -JUN-23AUG88

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

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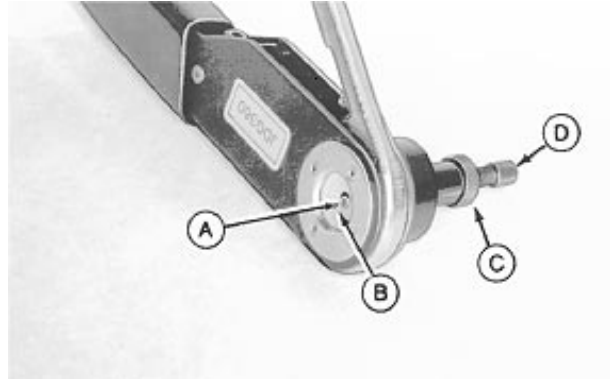
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**IMPORTANT:** Select correct size contact sleeve or pin to fit connector body.

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

Tighten lock nut (C).

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



TS0134 -UN-23AUG88

RG40854,0000086 -19-24AUG01-3/6

**IMPORTANT:** Contact must remain centered between indenters while crimping.

Insert wire in contact and crimp until handle contacts stop.

Release handle and remove contact.



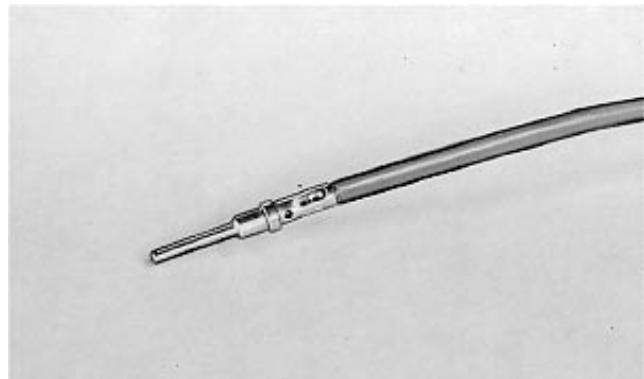
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**IMPORTANT:** If all wire strands are not crimped into contact, cut off wire at contact and repeat contact installation procedures.

*NOTE:* Readjust crimping tool for each crimping procedure.

Inspect contact to ensure all wires are in crimped barrel.



TS0135 -UN-23AUG88

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RG40854,0000086 -19-24AUG01-5/6

**IMPORTANT: Install contact in correct location using correct size grommet.**

Push contact straight into connector body until positive stop is felt.

Pull on wire slightly to insure contact is locked in position.

Transfer remaining wires to correct terminal in new connector.



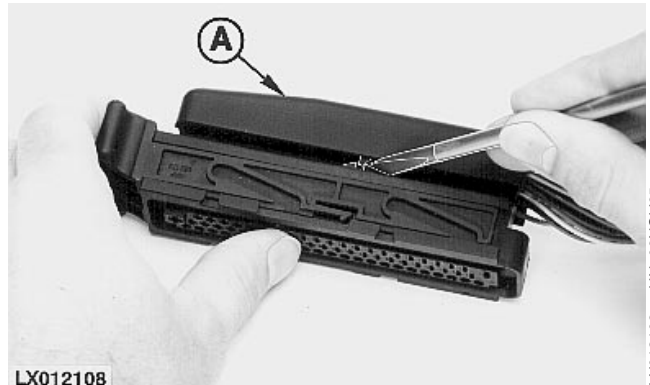
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### Repair ECU Connector

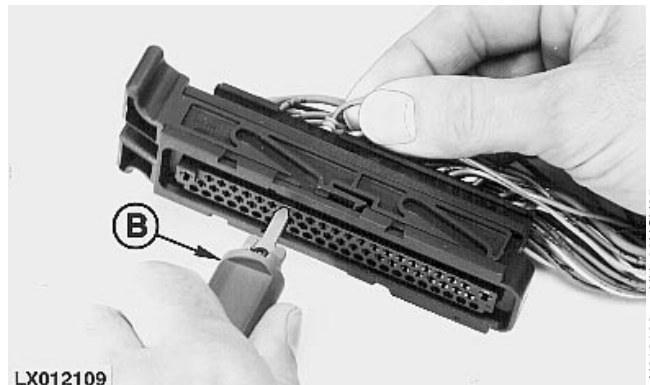
1. Press up locking tang and slide cover (A) to the left, and remove cover.
2. Using FKM10457 Terminal Extraction Tool (B), press terminal locking tang and remove wire with terminal from back of connector.
3. Using JDG144 Crimping Pliers, crimp seal and terminal on wire. Install wire in connector.
4. Reinstall connector cover (A).

A—Connector Cover  
B—FKM10457 Terminal Extraction Tool



Remove Connector Cover

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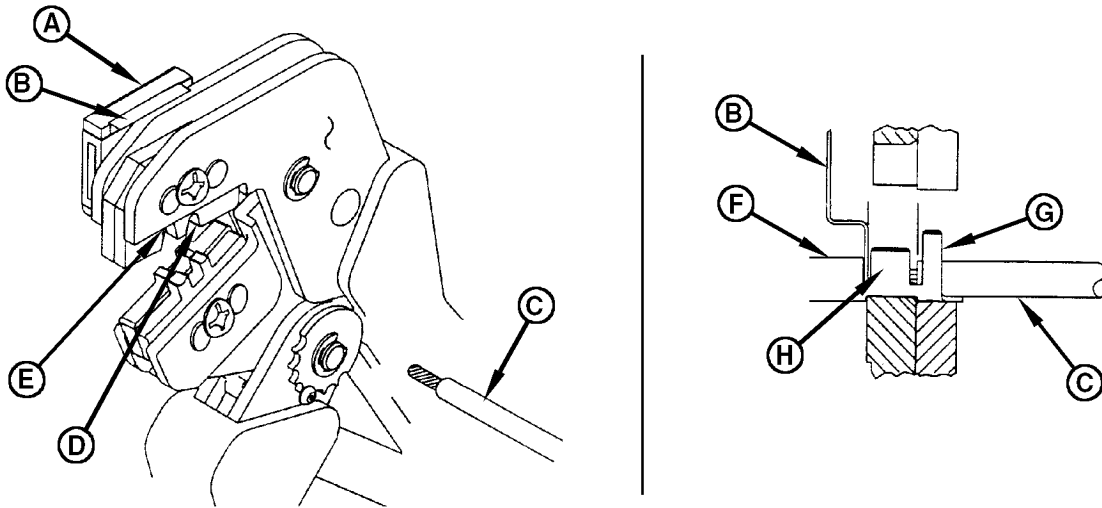


FKM10457 Extraction Tool

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RG40854,0000087 -19-24AUG01-1/1

## Repair Fuel Injection Pump 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. 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.*

2. Strip new wire to length indicated in tool instructions. Do not nick or cut wire strands.
3. 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.*

4. 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 contact.**

5. 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.
6. 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.
7. Insert stripped wire (C) into terminal insulation and wire barrels until it is butted against the wire stop.

RG10742 -UN-31MAY00

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RG40854,0000088 -19-24AUG01-1/2

8. 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.*

9. Install wire in connector.

**A—Wire and Terminal**



*Crimp Terminal*

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T112335B -JUN-24NOV97

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16

# Section 03 Theory of Operation

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03



### **About this Group**

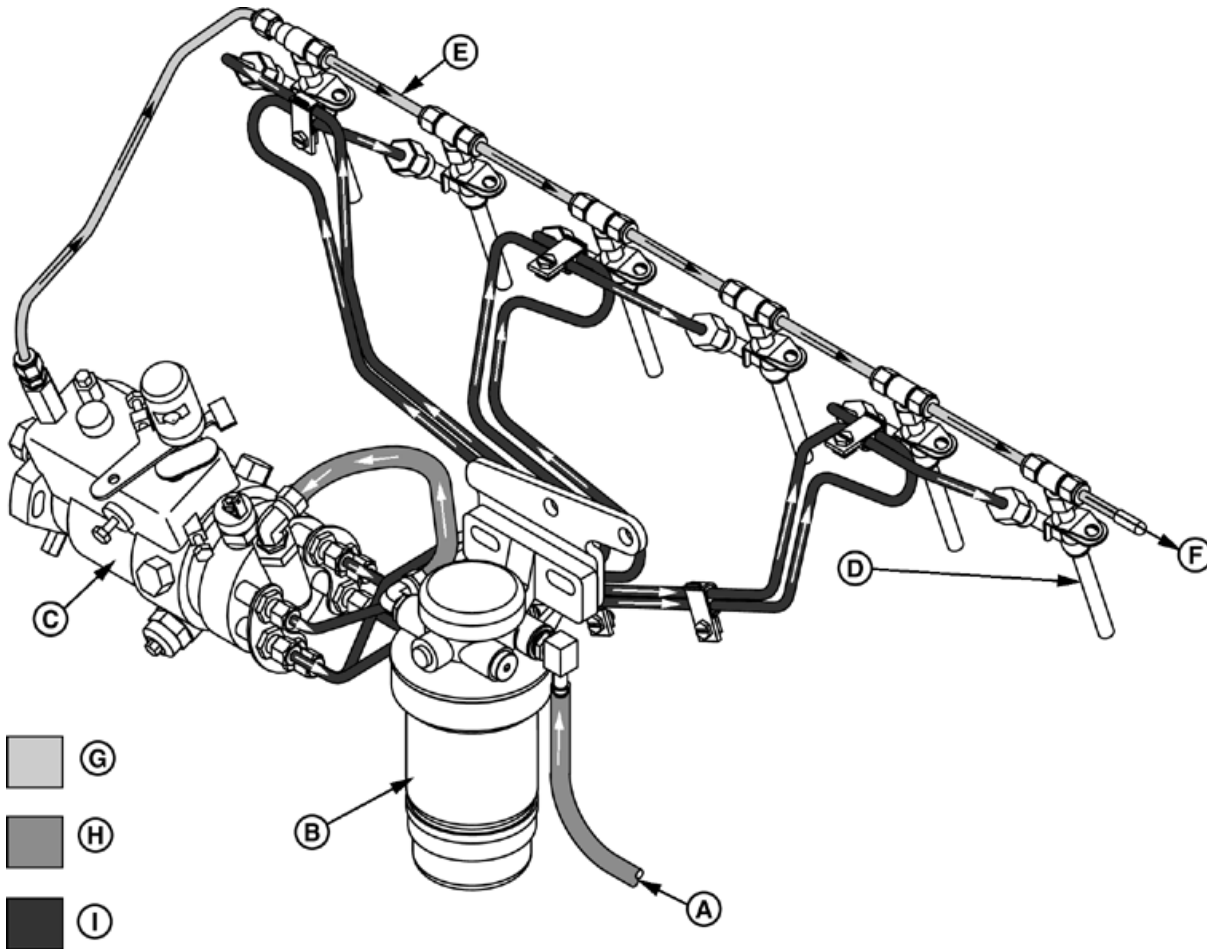
In this group, the fuel system information is described in the following categories:

- Fuel System Operation
- Final Fuel Filter Operation
- Fuel Injection Pump Operation
- Fuel Injection Nozzle Information

RG40854,0000089 -19-24AUG01-1/1

03  
130  
1

Fuel System Operation



A—Fuel line from transfer pump  
 B—Final fuel filter  
 C—Injection pump

D—Injection nozzle  
 E—Injection nozzle leak off line

F—Fuel return line to fuel tank  
 G—Transfer pump pressure fuel

H—Injection pump pressure fuel  
 I—Return pressure fuel

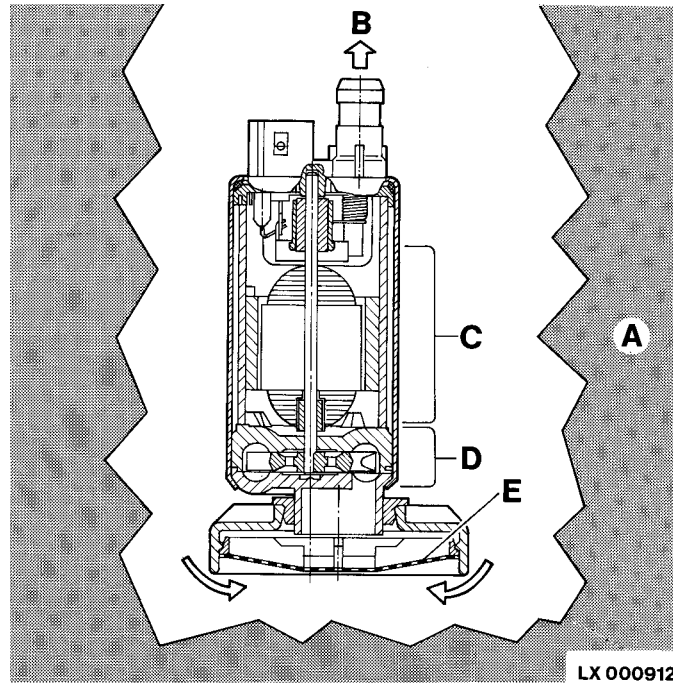
Fuel is drawn from the fuel tank by the transfer pump (not shown) and fed via the final fuel filter (B) to the injection pump (C). Fuel is delivered from the injection pump to the injection nozzles (D). Excess fuel passes

from the injection pump through the injection nozzle leak off line (E) through the fuel return line to the fuel tank (F).

RG11837 -UN-21SEP01

RG40854,000008A -19-24AUG01-1/1

### Fuel Transfer Pump Operation



A—Fuel tank  
B—To fuel filter

C—Electric motor

D—Pump gear

E—Screen

The fuel transfer pump is located in the fuel tank (A). It is an electrically driven vane-type pump and consists of a motor (C) and pump gear (D).

A screen (E) outside the inlet port prevents dirt from entering the system.

The injection pump returns any excess fuel to the tank via the return line.

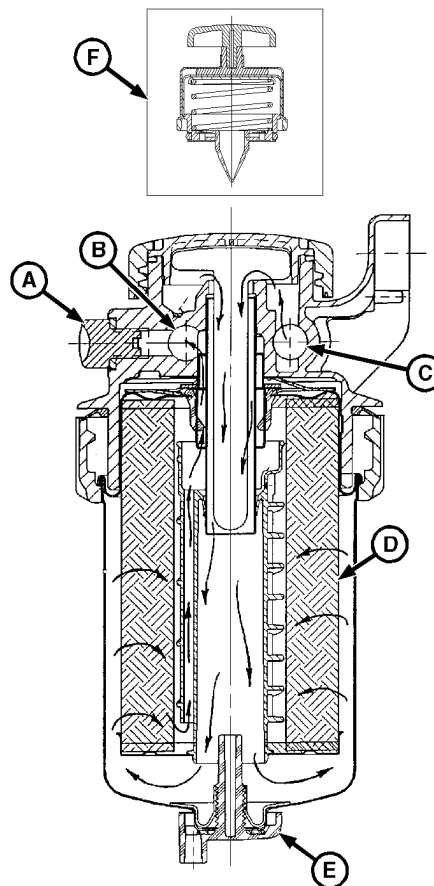
### Final Fuel Filter/Water Separator Operation

Fuel enters the filter at inlet (C), then flows through filter element (D) and exits through outlet (B) to the fuel injection pump. The filter element is housed in a sediment bowl attached to the base with a threaded retaining ring.

Since water and contaminants settle at the bottom of the sediment bowl, a drain plug (E) is provided.

Air in the system can be expelled through the air vent when bleed screw (A) is loosened. Optional priming pump (F) draws fuel from the fuel tank to fill the filter bowl when the filter element is changed. The priming pump also supplies fuel from the filter to the injection pump.

- A—Bleed Screw
- B—Fuel Outlet
- C—Fuel Inlet
- D—Filter Element
- E—Drain Plug
- F—Primer Pump

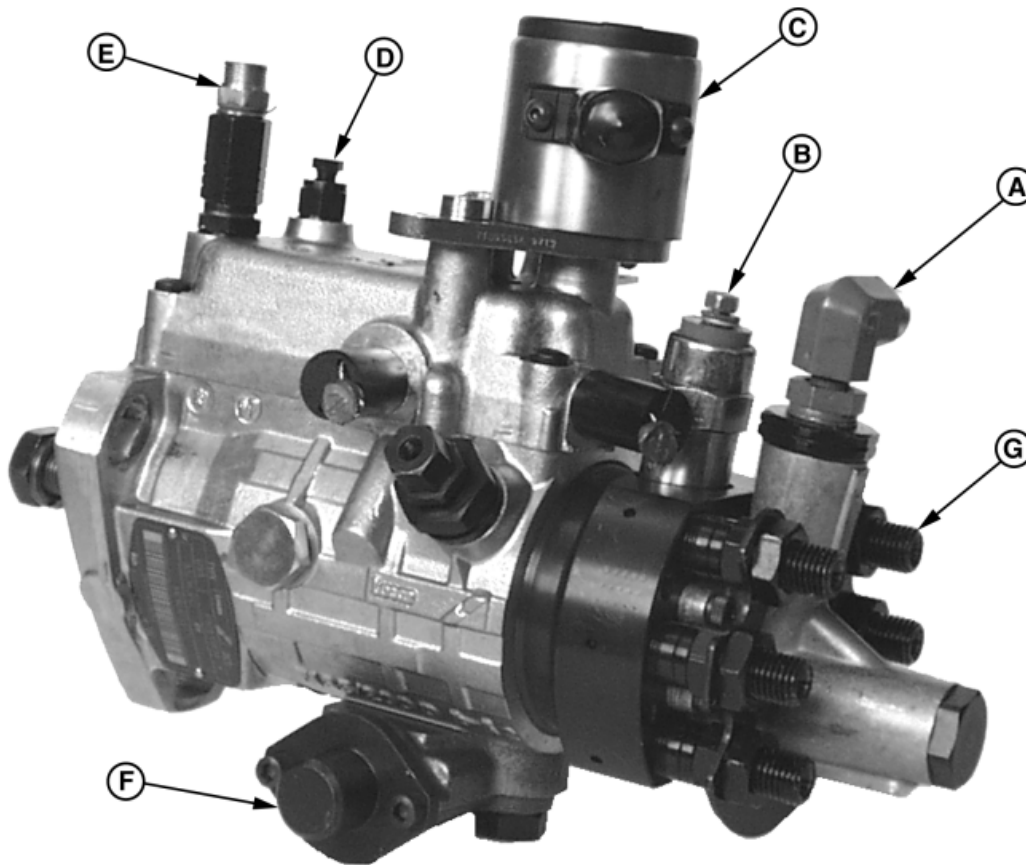


Final Fuel Filter

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## Fuel Injection Pump Operation



A—Inlet to Injection Pump  
B—Electric Shut-off Solenoid

C—Electronic Throttle Actuator

D—Bleed Screw  
E—Fuel Return Line

F—Automatic Advance  
G—Delivery Valve

**IMPORTANT:** Remember that all adjustments to the injection pump, except for slow idle, **MUST BE** carried out on a test bench by a specialist injection pump repair station only. Internal adjustments in the field are not permitted, as this pump is a sealed unit.

The Delphi (Lucas) DP201 injection pump is similar to distributor pumps with mechanical governors. The difference is that the DP201 uses an electronic throttle actuator (C) to control the metering valve within the pump.

An internal supply pump delivers fuel from the final filter through the inlet to the injection pump (A) and

metering valve to the high pressure portion of the pump. Once fuel is in this portion of the pump, an internal cam ring forces plungers to pressurize the fuel. Fuel is then forced out to the delivery valves (G) to the injection nozzles. Excess fuel used for cooling and lubrication purposes returns to the fuel tank through the fuel return line (E). A bleed screw (D) is provided for bleeding the injection pump on earlier pumps.

The quantity of fuel which is needed at any given moment of the combustion cycle is regulated by a metering valve. The metering valve is controlled by an electronic actuator. In the "NO-FUEL" ("OFF") position, the metering valve completely cuts the supply of fuel from supply pump to the rotor.

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RG11831D -UN-26SEP01

An optional electronic shut-off (B) may be provided on these pumps. When the engine is running, switched voltage activates the solenoid to allow fuel flow. When the engine is off, the solenoid becomes deactivated, and fuel can not enter the pump.

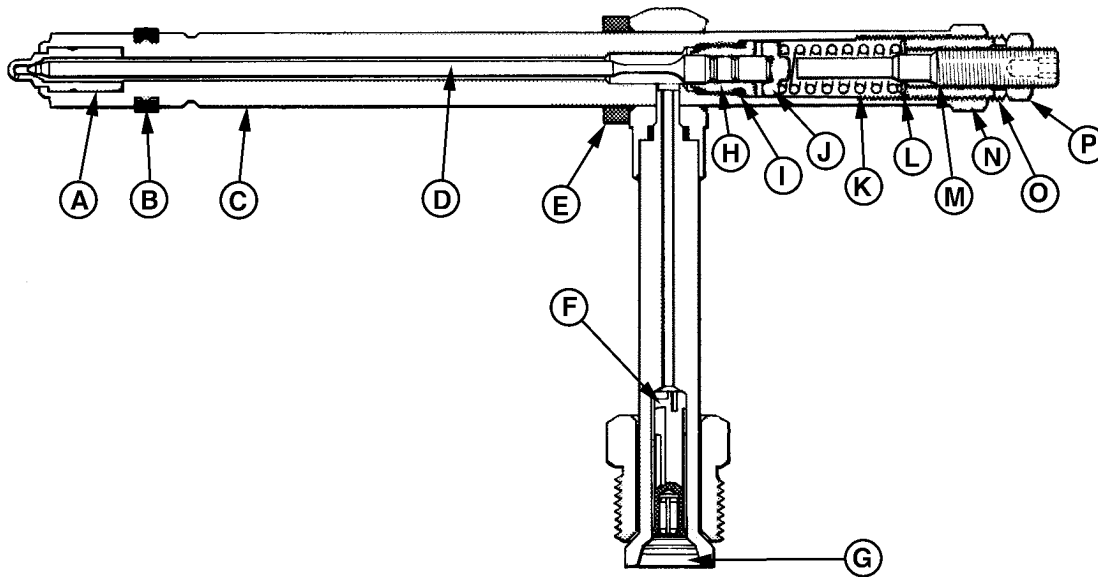
To obtain the best possible performance over the entire speed range, the fuel injection pump is fitted with an automatic, hydraulically operated speed

advance (F). This speed advance is preset at the factory. The speed advance adjusts timing of the fuel injection pump in relation to engine speed and load.

A cold advance switch is optional on these pumps. The switch consists of a housing to which is fitted a spring-loaded piston assembly, a "wax motor", and a spring-loaded ball valve. It is fitted at top of the spring end of the auto advance housing.



## Fuel Injection Nozzle Operation



Fuel Injection Nozzles—Operation

- |                    |                     |                 |                            |
|--------------------|---------------------|-----------------|----------------------------|
| A—Nozzle Tip       | E—Upper Seal Washer | I—Upper Seal    | M—Lift Adjusting Screw     |
| B—Carbon Stop Seal | F—Edge-Type Filter  | J—Spring Seat   | N—Lock Nut                 |
| C—Nozzle Body      | G—Fuel Inlet        | K—Valve Spring  | O—Pressure Adjusting Screw |
| D—Nozzle Valve     | H—Upper Guide       | L—Spring Washer | P—Lock Nut                 |

The injection nozzles are located in the engine cylinder head and are of the spring and valve type, hydraulically operated by fuel delivered from the injection pump.

A locating clamp positions the nozzle assembly in the cylinder head. The nozzle is sealed at the top end by a seal washer (E). A carbon stop seal (B), located on the lower end of the nozzle body (C), prevents carbon from collecting around the nozzle in the cylinder head.

Enclosed in the nozzle body are the valve (D), valve spring (K), and spring seat (J). The nozzle operating pressure is controlled by the pressure adjusting screw (O) in the upper end of the nozzle body. Valve lift is adjusted by the lift adjusting screw (M) located in the pressure adjusting screw. The nozzle tip (A) is pressed into the nozzle body and cannot be separated.

A leak-off line tee is attached to the upper end of the injection nozzle, secured by a grommet and hex nut.

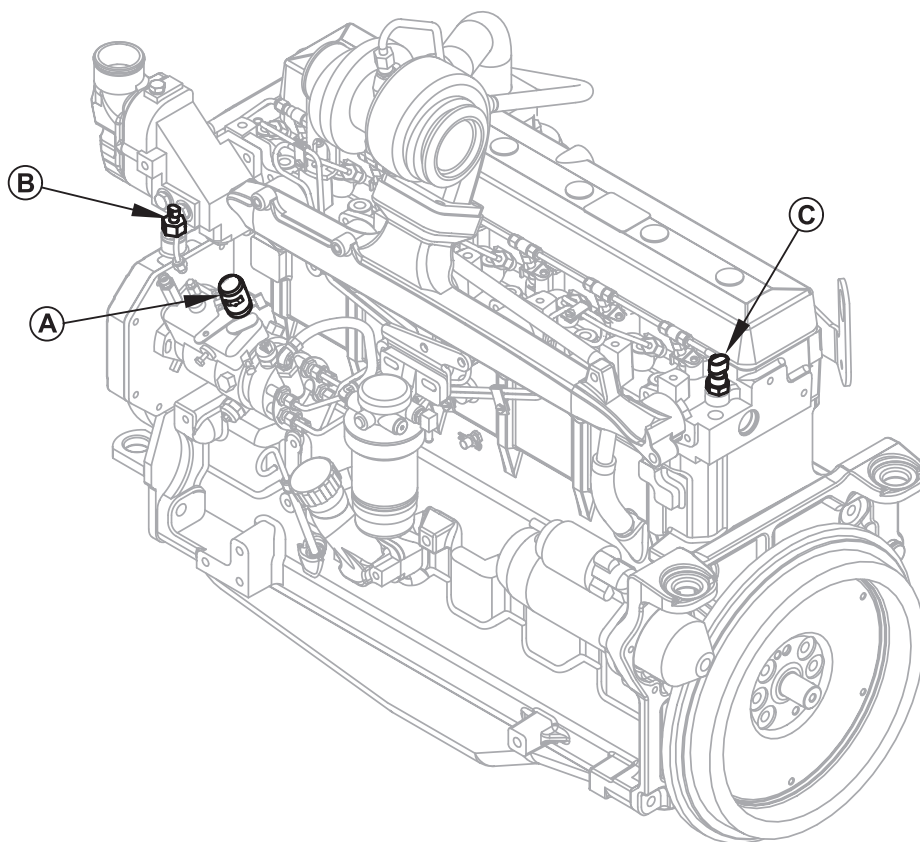
Metered fuel, under high pressure, is delivered by the injection pump through the nozzle inlet (G) on the valve body into the area surrounding the valve. When fuel pressure reaches nozzle opening pressure, the valve is forced from its seat against the pressure of the spring, permitting a measured amount of fuel to enter the combustion chamber through four small holes in the nozzle tip.

After fuel has been injected, the spring closes the valve. In actual operation, the valve opens and closes very rapidly, providing a distinct chatter.

A small amount of fuel leaks past the valve into the spring area. This provides lubrication for the nozzle working parts. This excess fuel is then removed from the nozzle at the top by means of a leak-off line routed to the fuel source.

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## Electronic Control System Overview



RG11833 -UN-24SEP01

**A—Electronic Throttle  
Actuator**

**B—Engine Speed Sensor**

**C—Engine Coolant  
Temperature Sensor**

The electronic control system controls the amount of fuel that the injection pump delivers to the injection nozzles. In order to achieve this, the engine control system performs the following functions:

- Constantly monitors engine operating conditions
- Delivers an optimum amount of fuel for a given set of operating conditions
- Provides multiple control modes
- Performs self-diagnosis

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## 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 volt or 0 to 12 volt signals.
<b>Boost</b>	Air pressure in the intake manifold.
<b>CAN</b>	Controller Area Network. The network on vehicles that allows communication between controllers.
<b>DTC</b>	Diagnostic Trouble Code. A code which is stored in the ECU's memory when the ECU detects a problem in the electronic control system.
<b>DST</b>	Diagnostic Scan Tool. The tool used to read and clear DTCs, read sensor and actuator data, and perform engine tests. The DST consists of an Windows ('95 or '98) or NT compatible computer and 2 kits available from John Deere Distribution Service Center (DSC): JDIS121 - ECU Communication Hardware Kit, and JDIS122 - ECU Communication Software Kit.
<b>Digital</b>	A signal which consists of only two-volt levels — usually 0 volts and +5 volts.
<b>ECT</b>	Engine Coolant Temperature (sensor). Measures the temperature of the engine coolant. See MEASURING TEMPERATURE later in this Group for details.
<b>ECU</b>	Engine Control Unit. The computer which controls the fuel, air, and ignition systems on the engine. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
<b>FMI</b>	Failure Mode Identifier. The second part of a two-part code that identifies control system trouble 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>J1587/J1708</b>	The Society of Automotive Engineers (SAE) standard for the electronic components of heavy duty vehicles. J1587 is the software standard. J1708 is the hardware standard.
<b>PDM</b>	Parallel Data Module. Device used as part of the DST that allows communication with the ECU.
<b>PROM</b>	Programmable, Read-Only Memory. The computer chip which contains the calibration information for the engine control system. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
<b>PWM</b>	Pulse Width Modulation. A digital signal (not analog) which consists of a pulse generated at a fixed frequency. When an actuator is controlled by a PWM signal, the on time of the signal is increased or decreased (modulated) to increase or decrease the output of the actuator.
<b>RAM</b>	Random Access Memory. The portion of computer memory within the ECU which changes as the engine is running and is stored while the engine is off. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
<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>VBAT</b>	Battery voltage or unswitched voltage.
<b>VSW</b>	Switched voltage

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## Electronic Control System Operation

### Engine Starting Mode

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

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

When the ignition switch is turned to the “ON” position, the controller powers the electronic actuator moving the metering valve to the starting fuel position based

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

### Engine Running Mode

Once the engine has started, the ECU controls fuel delivery based on various inputs (primarily throttle and engine speed). When no fuel is desired, the ECU turns off current to the electronic actuator. The level of current is proportional to the amount of fuel desired.

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## Monitoring Engine Parameters

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

- Engine Coolant Temperature (ECT)
- Throttle Position
- Engine Speed Sensor

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## Measuring Temperature

Temperature sensors are temperature sensitive variable resistor. The sensor’s 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.

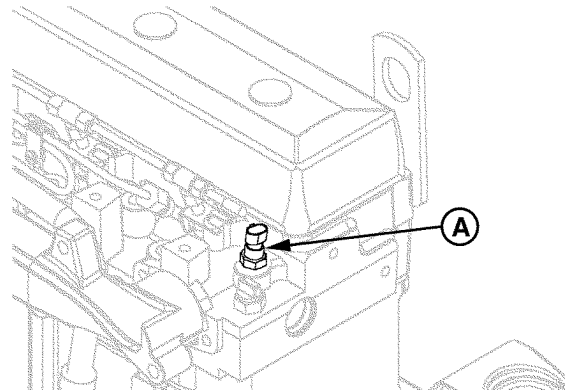
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### ECT (Engine Coolant Temperature) Sensor

The ECT (Engine Coolant Temperature) sensor is located in the rear of the cylinder head (A).

*NOTE: On 6010/6020/7020 Tractor applications, the ECU uses the ECT sensor in the rear of the cylinder head. The sensor in the thermostat housing is used for vehicle purposes only.*



ECT Sensor (Rear of Cylinder Head)

A—ECT Sensor (Rear of Cylinder Head)

RG10766 -UN-26MAY00

The ECU monitors coolant temperature for:

- Engine protection purposes.
- Starting fuel quantity determination — The ECU will adjust the amount of fuel delivered during start-up based on initial ECT readings.
- Idle speed determination — In order to speed engine warm-up, the ECU will increase idle speed after start-up if a low coolant temperature is measured.

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### Measuring Throttle Position

The 4.5 L and 6.8 L engines with a Level 1 ECU have analog throttles. An analog throttle signal comes from a potentiometer-type sensor. The ECU converts the voltage returning from the potentiometer into a percent of full throttle signal.

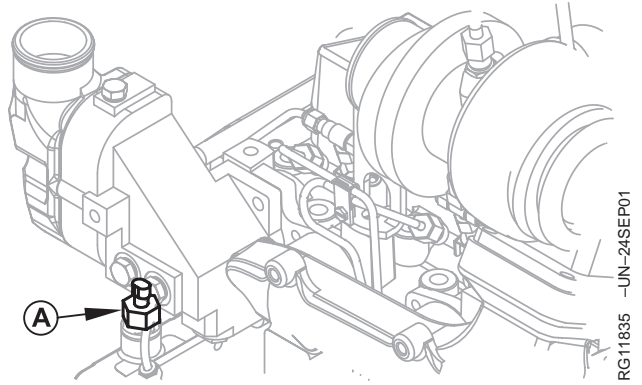
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## Measuring Engine Speed

The engine speed sensor is located on top of the pump drive gear. The engine speed sensor operates by detecting the teeth in the gear. When a notch on gear is directly under the sensor, a voltage is induced. The ECU monitors this voltage to determine the speed of the engine.

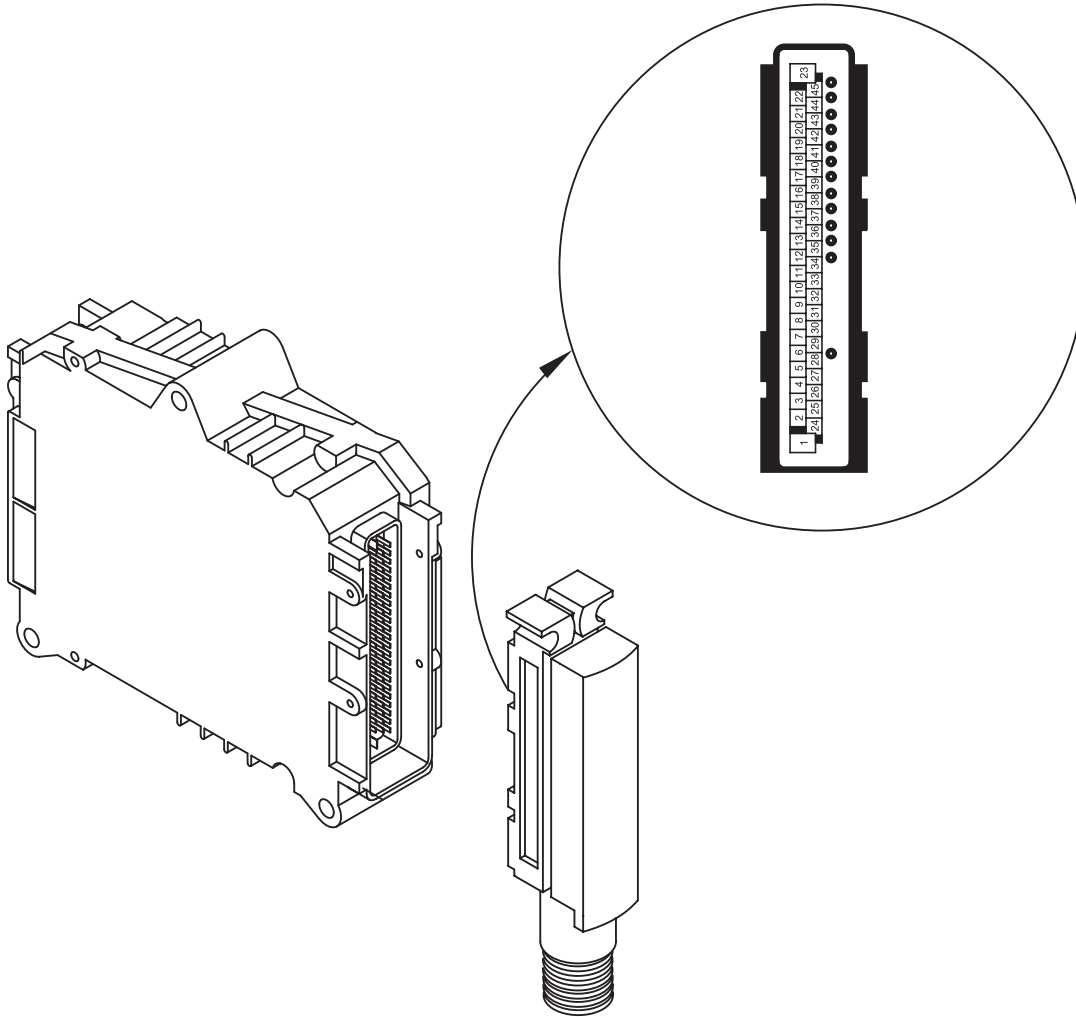
A—Engine Speed Sensor



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## Engine Control Unit (ECU)



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

- Converts the electrical signals from the various sensors into digital signals
- Makes decisions of optimum fuel quantity based on information received from various sensors
- Limits maximum fuel for operation on multiple power curves
- Provides all-speed governing
- Performs self diagnosis on the control system

- Stores trouble codes in memory

The ECU connects to the wiring harness through a 45-way ECU connector. This 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”.

Continued on next page

RG40854,0000093 -19-24AUG01-1/2

### Central Processing Unit (CPU)

The central processing unit performs the mathematical computations and logical functions that are necessary in controlling injection fuel quantity.

### Memory

The ECU contains 3 different types of memory:

— Random Access Memory - RAM

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

— Read Only Memory - ROM

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

— Electrical Erasable Programmable Read Only Memory - EEPROM

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

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### Controller Area Network (CAN)

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

Just about any type of information can be communicated over the CAN Bus. This information includes part numbers, serial numbers, engine speed, fan speed, etc

The engine also uses CAN to talk to other vehicle controllers. Depending on the application, 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 via the CAN Bus.

*SERVICE ADVISOR is a trademark of Deere & Company*

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

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## Engine Control Unit (ECU) Self-Diagnosis

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) is used to read a sensor voltage and calculated value, and there is an active DTC for that sensor, the calculated value for that sensor will be the "limp home" value and the voltage will be the actual sensor voltage. Use the voltage during diagnostics unless otherwise directed by a diagnostic chart.*

### SPN/FMI CODES

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

On all applications with the Level 1 Engine Control Unit (ECU), the ECU transmits SPN/FMI codes over the Controller Area Network (CAN). This allows for service tools such as the DST, SERVICE ADVISOR™, and the Diagnostic Gauge to display active and stored DTCs. When using DST or SERVICE ADVISOR™ the codes will be displayed in a 000000.00 format. For example, SPN 110 FMI 3 will be displayed as 000110.03.

### 2-DIGIT CODES

Some John Deere applications display DTCs as 2-digit codes read from an on-board display.

### CLEARING STORED DTCs

Stored DTCs can be cleared through the Diagnostic Scan Tool (DST). If the DST is unavailable, refer to the vehicle machine manual to determine how to clear the code reader.

*SERVICE ADVISOR is a trademark of Deere & Company*  
SERVICE ADVISOR

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# Section 04 Diagnostics

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## About this Group of the Manual

This section of the manual contains necessary information for observable diagnostics and fuel-related test procedures. Use this information in conjunction with the 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104). 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 4.5 L & 6.8 L Diesel Engines Mechanical Fuel Systems Manual (CTM 207).*

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

– F3 - Fuel in oil

- **(D)** Diagnosing Engine Control Unit (ECU) Communication Malfunctions:
  - D1 - ECU does not communicate with DST or SERVICE ADVISOR™

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:
  - Using TIME TRAC® as a Tachometer
  - Check and Adjust Injection Pump Timing
  - Check Cold Start Switch Operation
  - Check Cold Start Advance System Operation
  - Check Light Load Advance Operation
  - Test Fuel Shut-off Solenoid Resistance
  - Fuel Supply Quality Check
  - Test for Fuel Drain Back
  - Test for Air in Fuel
  - Measure Fuel Supply Pressure
  - Test Cylinder Misfire (Engine Running)
  - Test Fuel Injection Nozzles (Engine Running)
  - Bleed Fuel System

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TIME TRAC is a registered trademark of Stanadyne Automotive Corp.*

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## E1 - Engine Cranks/Won't Start

**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, see E6 - ENGINE WILL NOT CRANK later in this Group.

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

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### ① E1 - Preliminary Check

Before using this diagnostic procedure:

1. Ensure that fuel quality and quantity are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.
2. Ensure that engine cranking speed is OK. See TEST ENGINE CRANKING SPEED in Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).
3. Ensure that oil viscosity is correct.
4. Verify air heater operation in cold temperatures

**No problems found:**  
GO TO ②

**Problem found:**  
Repair and retest

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### ② Active DTC Test

1. Crank engine for 15 seconds
2. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- SERVICE ADVISOR™
- Vehicle code display

**NOTE:** Codes on vehicle code display may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.

**No active DTCs present:**  
GO TO ③


**Active DTC(s) present:**  
Diagnose active DTCs first. If any of the DTCs have a SPN 190, diagnose those first.

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

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Observable Diagnostics and Tests

<p><b>3 Engine Speed Sensor Indicator Test</b></p>	<p><i>NOTE: This check is not required for engines that are in 6010 Tractors. For these engines, GO TO 5</i></p> <ol style="list-style-type: none"> <li>1. Start cranking engine</li> <li>2. Using the DST or Service ADVISOR, observe engine speed noise while cranking.</li> </ol> <p><i>NOTE: For an explanation of these parameters see DATA PARAMETER DESCRIPTION in Group 160.</i></p>	<p><b>Engine Speed Noise Above 0:</b> GO TO <b>4</b></p> <p><b>Engine Speed Noise is 0:</b> GO TO <b>5</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>4 Vehicle Wiring Inspection Check</b></p>	<p>Inspect the vehicle for possible failures that can cause either of the following conditions:</p> <ol style="list-style-type: none"> <li>1. Bad electrical connections</li> <li>2. Damaged engine speed sensor</li> <li>3. EMI from improperly installed radio equipment, or other electronic devices</li> <li>4. Once problem is found, repair and retest.</li> </ol>	<p style="text-align: right;">04 150 3</p> <p style="text-align: right;">-- -1/1</p>
<p><b>5 Fuel Present at Injection Nozzles Check</b></p>	<p>Perform following procedure to check for fuel at injection nozzle:</p> <p> <b>CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Keep hands and body away from pinholes and nozzles which could inject fluids under high pressure.</b></p> <p><b>If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere and Company Medical Department in Moline, Illinois, or other knowledgeable medical source.</b></p> <ol style="list-style-type: none"> <li>1. Using two open-end wrenches, loosen fuel line connection at one of the injection nozzles.</li> <li>2. Crank engine while monitoring loosened connection for consistent squirts of fuel.</li> <li>3. Retighten connection at nozzle to specification.</li> </ol> <p style="text-align: center;"><b>Specification</b></p> <p>Fuel Injection Nozzle Delivery Lines— Torque ..... 27 N•m (20 lb-ft)</p>	<p><b>Consistent squirts of fuel observed:</b> GO TO <b>3</b></p> <p><b>Don't observe consistent squirts of fuel:</b> GO TO <b>6</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>6 Fuel Shutoff Solenoid Check</b></p>	<p>Check for faulty fuel shutoff solenoid operation. See TEST FUEL SHUT-OFF SOLENOID later in this Group.</p>	<p><b>Solenoid is ok:</b> GO TO <b>7</b></p> <p><b>Faulty solenoid found:</b> Repair and retest</p> <p style="text-align: right;">-- -1/1</p>

*Observable Diagnostics and Tests*

<p><b>7 Fuel Supply System Check</b></p>	<p>Check the fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group. Repair problem and retest</p>	<p><b>Fuel supply system is OK:</b> GO TO ⑧</p> <p><b>Fuel supply system problem found:</b> Repair fuel supply system problem and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>8 Intake and Exhaust Restrictions Test</b></p>	<p>Check for intake and exhaust restrictions. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Group 150 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM 104).</p>	<p><b>All components operating correctly:</b> GO TO ⑨</p> <p><b>Restrictions are found:</b> Repair faulty component and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>9 Compression Test</b></p>	<p>Check compression pressure. See TEST ENGINE COMPRESSION PRESSURE in Section 04, Group 150 of 4.5L &amp; 6.8L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>Compression pressure is within specification:</b> GO TO ⑩</p> <p><b>Compression pressure is not within specification:</b> GO TO ⑪</p> <p style="text-align: right;">-- -1/1</p>
<p><b>10 Fuel Injection Nozzles Check</b></p>	<p>Test fuel injection nozzles. See TEST FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.</p>	<p><b>Injection nozzles test good:</b> Faulty injection pump. Have injection pump repaired by an authorized diesel repair station or replace pump.</p> <p><b>Faulty injection nozzle(s) found:</b> Repair or replace injection nozzles.</p> <p style="text-align: right;">-- -1/1</p>

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*Observable Diagnostics and Tests*

<p><b>11 Piston Ring Check</b></p>	<p>Apply oil to ring area of piston through injection nozzle bore. DO NOT use too much oil. DO NOT get oil on the valves. Retest the compression pressure.</p>	<p><b>Compression pressure is within specification:</b> GO TO <b>14</b></p> <p><b>Compression pressure is not within specification:</b> GO TO <b>12</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>12 Valve Lash Check</b></p>	<p>Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>Valve lash is within specification:</b> GO TO <b>13</b></p> <p><b>Valve lash on one or more valves out of specification:</b> Adjust valve lash and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>13 Valve Lift Check</b></p>	<p>Check valve lift. See MEASURE VALVE LIFT in Group 020 in Section 02 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>Lift on all valves within specification:</b> GO TO <b>14</b></p> <p><b>Valve lift on one or more valves is out of specification:</b> Reset clearance to specification after measuring lift. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p> <p style="text-align: right;">-- -1/1</p>

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*Observable Diagnostics and Tests*

**14** **Pistons, Rings,  
Cylinder Liners  
Check**

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

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

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

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## E2 - Engine Misfires/Runs Irregularly

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

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<p><b>① E2 - Preliminary Check</b></p>	<p>Before using this diagnostic procedure, make the following checks that could cause or be mistaken as miss/rough running:</p> <ol style="list-style-type: none"> <li>1. Check for intake manifold air leaks</li> <li>2. Check for mechanical problems</li> <li>3. Check for transmission problems</li> <li>4. Check engine accessories, such as A/C, cycling on and off</li> <li>5. Check for electromagnetic interference (EMI) from improperly installed radios, etc.</li> </ol>	<p><b>No problems found:</b> GO TO <b>②</b></p> <p><b>Problem 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. Engine idling</li> <li>2. Monitor DTCs on: <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• SERVICE ADVISOR™</li> <li>• Vehicle code display</li> </ul> <p><i>NOTE: Codes on vehicle code display or Service ADVISOR may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.</i></p> </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 190, diagnose those first.</p> <p><b>ECU will not communicate with DST or Service ADVISOR:</b> See D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR DIAGNOSTIC PROCEDURE later in this Group.</p>
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<p><b>③ Engine Performance Test</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>④</b></p> <p><b>Running rough:</b> GO TO <b>⑥</b></p>
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Observable Diagnostics and Tests

<p><b>4 Recreate Conditions</b></p>	<p>Operate engine under conditions where the miss/rough running complaint occurs.</p>	<p><b>Running rough:</b> GO TO <b>5</b></p> <p><b>Not running rough:</b> No problem found, verify complaint and try to reproduce conditions of miss/rough running complaint.</p> <p style="text-align: right;">---1/1</p>
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<p><b>5 Active DTC Test</b></p>	<p>1. Continue to run engine where the miss/rough running complaint occurs.</p> <p>2. Monitor DTCs using:</p> <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• SERVICE ADVISOR™</li> <li>• Vehicle code display</li> </ul> <p><i>NOTE: Codes on vehicle code display or Service ADVISOR may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.</i></p>	<p><b>No active DTCs present:</b> GO TO <b>6</b></p> <p><b>Active DTC(s) present:</b> Diagnose active DTCs first. If any of the DTCs have a SPN 190, diagnose those first.</p>
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<p><b>6 Head Gasket Failure Check</b></p>	<p>Check for head gasket joint failures. See CHECK FOR HEAD GASKET FAILURES in Section 04, Group 150 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>No sign of head gasket failure:</b> GO TO <b>7</b></p> <p><b>Signs of head gasket failure found:</b> Replace head gasket and retest.</p> <p style="text-align: right;">---1/1</p>
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<p><b>7 Cylinder Misfire Check</b></p>	<p>Check cylinders for misfire. See TEST FOR CYLINDER MISFIRE (ENGINE RUNNING) later in this Group.</p>	<p><b>Single cylinder misfire:</b> GO TO <b>8</b></p> <p><b>Random or all cylinder misfire:</b> See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.</p> <p style="text-align: right;">---1/1</p>
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Observable Diagnostics and Tests

<p><b>8 Compression Pressure Check</b></p>	<p>Check compression pressure. See TEST ENGINE COMPRESSION PRESSURE Section 04, Group 150 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>Compression pressure is within specification:</b> GO TO <b>9</b></p> <p><b>Compression pressure is not within specification:</b> GO TO <b>11</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>9 Fuel Delivery Line Check</b></p>	<p><b>Perform the following steps to determine if fuel delivery lines are restricted:</b></p> <ol style="list-style-type: none"> <li>1. Disconnect the suspected fuel delivery line on the injection nozzle end and injection pump end.</li> <li>2. Force air through one end of the delivery line.</li> <li>3. If the delivery line is not restricted, the compressed air should flow freely out the other side.</li> <li>4. If air does not flow freely, there are restrictions in the fuel line.</li> </ol>	<p><b>Lines are not restricted:</b> GO TO <b>10</b></p> <p><b>Lines are restricted:</b> Repair or replace lines and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>10 Fuel Injection Nozzle Check</b></p>	<p>Test fuel injection nozzles. See TEST FUEL INJECTION NOZZLES (ENGINE RUNNING) later in this Group.</p>	<p><b>Injection nozzles test good:</b> Have injection pump repaired by authorized diesel repair station or replace pump. See Section 02, Group 090 of this manual.</p> <p><b>Faulty injection nozzle(s) found:</b> Repair or replace injection nozzles.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>11 Piston Ring Check</b></p>	<p>Apply oil to ring area of piston through injection nozzle bore. DO NOT use too much oil. DO NOT get oil on the valves. Retest the compression pressure.</p>	<p><b>Compression pressure is within specification:</b> GO TO <b>14</b></p> <p><b>Compression pressure is not within specification:</b> GO TO <b>12</b></p> <p style="text-align: right;">-- -1/1</p>

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Observable Diagnostics and Tests

<p><b>12 Valve Lash Check</b></p>	<p>Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>Valve lash is within specification:</b> GO TO <b>13</b></p> <p><b>Valve lash on one or more valves out of specification:</b> Adjust valve lash and retest.</p> <p style="text-align: right;">---1/1</p>
<p><b>13 Valve Lift Check</b></p>	<p>Check valve lift. See MEASURE VALVE LIFT in Group 020 in Section 02 of 4.5L &amp; 6.8L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>Lift on all valves within specification:</b> GO TO <b>14</b></p> <p><b>Valve lift on one or more valves is out of specification:</b> Reset clearance to specification after measuring lift. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p> <p style="text-align: right;">---1/1</p>
<p><b>14 Pistons, Rings, Cylinder Liners Check</b></p>	<p>At this point, the most likely cause of the low engine compression pressure is one of the following failures in the pistons, rings, and/or cylinder liners or in the valve guides. Check the most likely items as needed.</p> <ul style="list-style-type: none"> <li>• Oil control rings worn or broken</li> <li>• Scored cylinder liners or pistons</li> <li>• Piston ring grooves excessively worn</li> <li>• Piston rings sticking in ring grooves</li> <li>• Insufficient piston ring tension</li> <li>• Piston ring gaps not staggered</li> <li>• Cylinder liners glazed (insufficient load during engine break-in)</li> <li>• Worn valve guides or stems</li> <li>• Cylinder head may need reconditioning</li> </ul>	<p><b>Problem found with pistons, rings, and/or liners or valve guides:</b> Repair problem as necessary.</p> <p style="text-align: right;">---1/1</p>

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## E3 - Engine Does Not Develop Full Power

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

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<p><b>① E3 - Preliminary Check</b></p>	<p>Before using this diagnostic procedure, ensure that:</p> <ul style="list-style-type: none"> <li>• There are no problems with transmission</li> <li>• There are no engine mechanical problems</li> <li>• There is not an excessive load on the engine</li> <li>• There is no unbalanced ballast</li> <li>• The air and fuel filters are not restricted or plugged</li> <li>• Fuel quality is OK</li> </ul>	<p><b>No problems found:</b> GO TO <b>②</b></p> <p><b>Problem found:</b> Repair and retest</p>
<p><b>② Active DTC Check</b></p>	<p>1. Key ON, engine OFF</p> <p>2. Monitor DTCs on:</p> <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• SERVICE ADVISOR™</li> <li>• Vehicle code display</li> </ul> <p><i>NOTE: Codes on vehicle code display or Service ADVISOR may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.</i></p>	<p><b>No DTCs present:</b> GO TO <b>③</b></p> <p><b>DTCs present:</b> See appropriate diagnostic procedure.</p>
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Observable Diagnostics and Tests

<p><b>③ Exhaust Emission Test</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: Engines in 6010, 6020, and 7020 Tractors do not have multiple torque curves. For these applications, GO TO <b>⑤</b>.</i></p> <p>Some ECUs on 4.5 L &amp; 6.8 L engines have the ability to operate on multiple torque curves. To check that the engine is operating on the correct torque curve under the operating conditions where there is a low power complaint:</p> <ol style="list-style-type: none"> <li>1. Recreate the conditions of the low power complaint.</li> <li>2. Using the DST or Service ADVISOR, read the Torque Curve Parameter</li> <li>3. Compare the torque curve parameter to the appropriate torque curve chart. See TORQUE CURVE SELECTION in Section 06, Group 210 of this manual.</li> </ol>	<p><b>Correct torque curve number displayed for corresponding operating conditions:</b> GO TO <b>⑤</b></p> <p><b>Incorrect torque curve number displayed for corresponding operating conditions:</b> Refer to machine manual to determine components that if faulty could prevent the correct torque curve from being selected OR Faulty torque curve select wiring</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>⑤ Governor Droop Mode Selection Check</b></p>	<p><i>NOTE: This check is not required for engines that are in 6010 Tractors. For these engines, GO TO <b>⑥</b></i></p> <ol style="list-style-type: none"> <li>1. Operate engine and attempt to recreate the low power condition.</li> <li>2. Using the DST or Service ADVISOR, read the Desired Speed Governor parameter and the Maximum Speed Governor parameter.</li> <li>3. Compare governor selection to the appropriate governor mode chart. See GOVERNOR DROOP MODE SELECTION in Section 06, Group 210 of this manual.</li> </ol>	<p><b>Correct governor selection:</b> GO TO <b>⑥</b></p> <p><b>Incorrect governor selection:</b> Refer to machine manual to determine components that if faulty could prevent the correct governor from being selected OR Faulty governor select wiring</p> <p style="text-align: right;">-- -1/1</p>
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Observable Diagnostics and Tests

<p><b>6 Throttle Test</b></p>	<p><i>NOTE: This check is not required for engines in 6010 Tractors. For these engines, GO TO 7</i></p> <ol style="list-style-type: none"> <li>1. Operate engine at full load rated speed.</li> <li>2. Using the DST or Service ADVISOR, read the Percent Throttle data parameter at these conditions.</li> </ol>	<p><b>97% or above:</b> GO TO <b>7</b></p> <p><b>Below 97%:</b> Refer to machine manual and perform the throttle calibration procedure; then retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>7 Turbocharger Boost Pressure Check</b></p>	<p>Check the Turbo Boost pressure. See MEASURE INTAKE MANIFOLD PRESSURE (TURBOCHARGER BOOST) in Section 04, Group 150 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM 104).</p>	<p><b>Intake manifold pressure within range or above, compared to boost specification:</b> GO TO <b>8</b></p> <p><b>Intake manifold pressure below range compared to boost specification:</b> GO TO <b>9</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>8 Fuel Supply System Check with Normal Boost Pressure</b></p>	<p>Check the fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE in this Group.</p>	<p><b>Fuel supply system is OK:</b> Engine appears to be delivering full power. Check for vehicle problems that could cause an excessive load on the engine.</p> <p><b>Fuel supply system problem found:</b> Repair fuel supply system problem and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>9 Compression Pressure Check</b></p>	<p>Check compression pressure. See TEST ENGINE COMPRESSION PRESSURE Section 04, Group 150 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>Compression pressure is within specification:</b> GO TO <b>10</b></p> <p><b>Compression pressure is not within specification:</b> GO TO <b>13</b></p> <p style="text-align: right;">-- -1/1</p>

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*Observable Diagnostics and Tests*

<p><b>10</b> Checking Potential Causes of Low Boost Pressure</p>	<p><b>Check for the following that can cause reduced boost pressure:</b></p> <ol style="list-style-type: none"> <li>1. Restricted air cleaner</li> <li>2. Intake air leak</li> <li>3. Exhaust air leak</li> <li>4. Restriction in exhaust</li> <li>5. Faulty turbocharger. See TURBOCHARGER SEVEN-STEP INSPECTION in Section 02, Group 080 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM 104).</li> </ol>	<p><b>None of the above problems found:</b> GO TO <b>11</b></p> <p><b>Problem found:</b> Repair problem and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>11</b> Fuel Supply System Check with Low Boost Pressure</p>	<p>Check the fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.</p>	<p><b>Fuel supply system is OK:</b> GO TO <b>12</b></p> <p><b>Fuel supply system problem found:</b> Repair fuel supply system problem and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>12</b> Fuel Injection Nozzles Test</p>	<p>Test fuel injection nozzles. See TEST FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.</p>	<p><b>Injection nozzles test good:</b> Faulty injection pump OR Faulty ECU</p> <p><b>Faulty injection nozzle(s) found:</b> Repair or replace faulty injection nozzles.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>13</b> Piston Ring Check</p>	<p>Apply oil to ring area of piston through injection nozzle bore. DO NOT use too much oil. DO NOT get oil on the valves. Retest the compression pressure.</p>	<p><b>Compression pressure is within specification:</b> GO TO <b>16</b></p> <p><b>Compression pressure is not within specification:</b> GO TO <b>14</b></p> <p style="text-align: right;">-- -1/1</p>

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*Observable Diagnostics and Tests*

<p><b>14 Valve Lash Check</b></p>	<ol style="list-style-type: none"> <li>1. Ensure there are no engine mechanical problems and that there isn't something drawing excessive engine power</li> <li>2. Ensure that valve lash is correctly adjusted. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM 104).</li> </ol>	<p><b>Valve clearance within specification:</b> GO TO <b>15</b></p> <p><b>Valve clearance out of specification:</b> Adjust valves to specification and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>15 Valve Lift Check</b></p>	<p>Check valve lift. See MEASURE VALVE LIFT in Group 020 in Section 02 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>Lift on all valves within specification:</b> GO TO <b>16</b></p> <p><b>Valve lift on one or more valves is out of specification:</b> Reset clearance to specification after measuring lift. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p> <p style="text-align: right;">-- -1/1</p>
<p><b>16 Pistons, Rings, Cylinder Liners Check</b></p>	<p>At this point, the most likely cause of the low engine compression pressure is one of the following failures in the pistons, rings, and/or cylinder liners or in the valve guides. Check the most likely items as needed.</p> <ul style="list-style-type: none"> <li>• Oil control rings worn or broken</li> <li>• Scored cylinder liners or pistons</li> <li>• Piston ring grooves excessively worn</li> <li>• Piston rings sticking in ring grooves</li> <li>• Insufficient piston ring tension</li> <li>• Piston ring gaps not staggered</li> <li>• Cylinder liners glazed (insufficient load during engine break-in)</li> <li>• Worn valve guides or stems</li> <li>• Cylinder head may need reconditioning</li> </ul>	<p><b>Problem found with pistons, rings, and/or liners or valve guides:</b> Repair problem as necessary.</p> <p style="text-align: right;">-- -1/1</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 go to 4.5L/6.8L - L1 - EXCESSIVE OIL CONSUMPTION in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).*

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#### ① E4 - Preliminary Check

Before using this diagnostic procedure:

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

**No problems found:**  
GO TO ②

**Problem found:**  
Repair and retest

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#### ② Head Gasket Failure Test

Check for a failed head gasket. See CHECK FOR HEAD GASKET FAILURES in Section 04, Group 150 of 4.5 L & 6.8 L 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 Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

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#### ③ Compression Pressure Check

Check compression pressure. See TEST ENGINE COMPRESSION PRESSURE Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).

**Compression pressure is within specification:**  
GO TO ④

**Compression pressure is not within specification:**  
GO TO ⑦

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Observable Diagnostics and Tests

<p><b>4 Fuel Supply Pressure Check</b></p>	<p>Check fuel pressure. See CHECK FUEL SUPPLY PRESSURE later in this Group.</p>	<p><b>Fuel pressure within specification:</b> GO TO <b>5</b></p> <p><b>Fuel pressure below specification:</b> Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>5 Injection Pump Timing Check</b></p>	<p>Check injection pump timing. See the following:</p> <ul style="list-style-type: none"> <li>• CHECK AND ADJUST INJECTION PUMP DYNAMIC TIMING later in this Group</li> <li>• CHECK COLD START SWITCH OPERATION later in this Group</li> <li>• CHECK COLD START ADVANCE SYSTEM OPERATION later in this Group</li> <li>• CHECK LIGHT LOAD ADVANCE OPERATION later in this Group</li> </ul>	<p><b>Timing is correct:</b> GO TO <b>6</b></p> <p><b>Timing is incorrect:</b> Follow adjustment procedure in timing check procedure.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>6 Fuel Injection Nozzle Check</b></p>	<p>Test fuel injection nozzles. See TEST FUEL INJECTION NOZZLES (ENGINE RUNNING) later in this Group.</p>	<p><b>Injection nozzles test good:</b> Have injection pump repaired by authorized diesel repair station or replace pump. See Section 02, Group 090 of this manual.</p> <p><b>Faulty injection nozzle(s) found:</b> Repair or replace injection nozzles</p> <p style="text-align: right;">-- -1/1</p>
<p><b>7 Piston Ring Check</b></p>	<p>Apply oil to ring area of piston through injection nozzle bore. DO NOT use too much oil. DO NOT get oil on the valves. Retest the compression pressure.</p>	<p><b>Compression pressure is within specification:</b> GO TO <b>10</b></p> <p><b>Compression pressure is not within specification:</b> GO TO <b>8</b></p> <p style="text-align: right;">-- -1/1</p>

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*Observable Diagnostics and Tests*

<p><b>8 Valve Lash Check</b></p>	<ol style="list-style-type: none"> <li>1. Ensure there are no engine mechanical problems and that there isn't something drawing excessive engine power</li> <li>2. Ensure that valve lash is correctly adjusted. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM 104).</li> </ol>	<p><b>Valve clearance within specification:</b> GO TO <b>9</b></p> <p><b>Valve clearance out of specification:</b> Adjust valves to specification and retest.</p> <p style="text-align: right;">---1/1</p>
<p><b>9 Valve Lift Check</b></p>	<p>Check valve lift. See MEASURE VALVE LIFT in Group 020 in Section 02 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>Lift on all valves within specification:</b> GO TO <b>10</b></p> <p><b>Valve lift on one or more valves is out of specification:</b> Reset clearance to specification after measuring lift. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p> <p style="text-align: right;">---1/1</p>
<p><b>10 Pistons, Rings, Cylinder Liners Check</b></p>	<p>At this point, the most likely cause of the low engine compression pressure is one of the following failures in the pistons, rings, and/or cylinder liners or in the valve guides. Check the most likely items as needed.</p> <ul style="list-style-type: none"> <li>• Oil control rings worn or broken</li> <li>• Scored cylinder liners or pistons</li> <li>• Piston ring grooves excessively worn</li> <li>• Piston rings sticking in ring grooves</li> <li>• Insufficient piston ring tension</li> <li>• Piston ring gaps not staggered</li> <li>• Cylinder liners glazed (insufficient load during engine break-in)</li> <li>• Worn valve guides or stems</li> <li>• Cylinder head may need reconditioning</li> </ul>	<p><b>Problem found with pistons, rings, and/or liners or valve guides:</b> Repair problem as necessary.</p> <p style="text-align: right;">---1/1</p>

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

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

*NOTE: This procedure should be used if the engine emits excessive black or gray smoke. If engine emits a less heavy, bluish exhaust smoke go to 4.5L/6.8L - L1 - EXCESSIVE OIL CONSUMPTION in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Manual (CTM 104).*

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<p><b>① E5 - Preliminary Check</b></p>	<p>Before using this diagnostic procedure, check the following:</p> <ul style="list-style-type: none"> <li>• Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.</li> <li>• Ensure engine is not excessively loaded</li> <li>• Ensure air filter is not restricted or plugged</li> </ul>	<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 Air Intake and Exhaust Test</b></p>	<p>Check for intake and exhaust restrictions and air leaks. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS, TEST FOR INTAKE AIR LEAKS and CHECK FOR EXHAUST AIR LEAKS (TURBOCHARGED ENGINES in Section 04, Group 150 of 4.5 L &amp; 6.8 L 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 Injection Pump Timing Check</b></p>	<p>Check injection pump timing. See CHECK AND ADJUST INJECTION PUMP DYNAMIC TIMING later in this Group.</p>	<p><b>Timing is correct:</b> GO TO <b>④</b></p> <p><b>Timing is incorrect:</b> Follow adjustment procedure in timing check procedure.</p> <p>-- 1/1</p>

Observable Diagnostics and Tests

<p><b>4 Turbocharger Check</b></p>	<p>Check for turbocharger failure. See TURBOCHARGER SEVEN-STEP INSPECTION in Section 02, Group 080 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM 104).</p>	<p><b>No turbocharger failure found:</b> GO TO 5</p> <p><b>Turbocharger failure found:</b> Follow appropriate repair procedure in Group 080 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p> <p style="text-align: right;">---1/1</p>
<p><b>5 Valve Lash Check</b></p>	<p>Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Group 020 of 4.5 L &amp; 6.8 L Diesel Engines Base Engine Manual (CTM104).</p>	<p><b>Valve lash on all valves within specification:</b> GO TO 6</p> <p><b>Valve lash on one or more valves out of specification:</b> Adjust valve lash and retest</p> <p style="text-align: right;">---1/1</p>
<p><b>6 Fuel Return Line Check</b></p>	<p>Check for restricted fuel return line and fitting.</p>	<p><b>No restriction found:</b> GO TO 7</p> <p><b>Restriction found:</b> Repair and retest.</p> <p style="text-align: right;">---1/1</p>
<p><b>7 Fuel Injection Nozzle Check</b></p>	<p>Test fuel injection nozzles. See TEST FUEL INJECTION NOZZLES (ENGINE RUNNING) later in this Group.</p>	<p><b>Injection nozzles test good:</b> Have injection pump repaired by authorized diesel repair station or replace pump. See Section 02, Group 090 of this manual.</p> <p><b>Faulty injection nozzle(s) found:</b> Repair or replace injection nozzles</p> <p style="text-align: right;">---1/1</p>

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## E6 - Engine Will Not Crank

Symptom	Problem	Solution
<b>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.
	Starter circuit defective	Check wiring, fuses, and relays

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## E7 - Engine Idles Poorly

Symptom	Problem	Solution
<b>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 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).
	Electronic control system problem or basic engine problem	See E2 - ENGINE MISFIRES/RUNS IRREGULARLY diagnostic procedure earlier in this Group.

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## E8 - Abnormal Engine Noise

Symptom	Problem	Solution
<b>Abnormal Engine Noise</b>	Worn main or connecting rod bearings	Determine bearing clearance. See CYLINDER BLOCK, LINERS, PISTONS, AND RODS SPECIFICATIONS in Section 06, Group 200 or CRANKSHAFT , MAIN BEARINGS, AND FLYWHEEL SPECIFICATIONS in Section 06, Group 200 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).
	Excessive crankshaft end play	Check crankshaft end play. See CHECK CRANKSHAFT END PLAY in Section 02, Group 040 of 4.5 L & 6.8 L 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 Section 06, 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 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM 104).
	Scored pistons	Inspect pistons. See PRELIMINARY LINER, PISTON, AND ROD CHECKS in Section 02, Group 030 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

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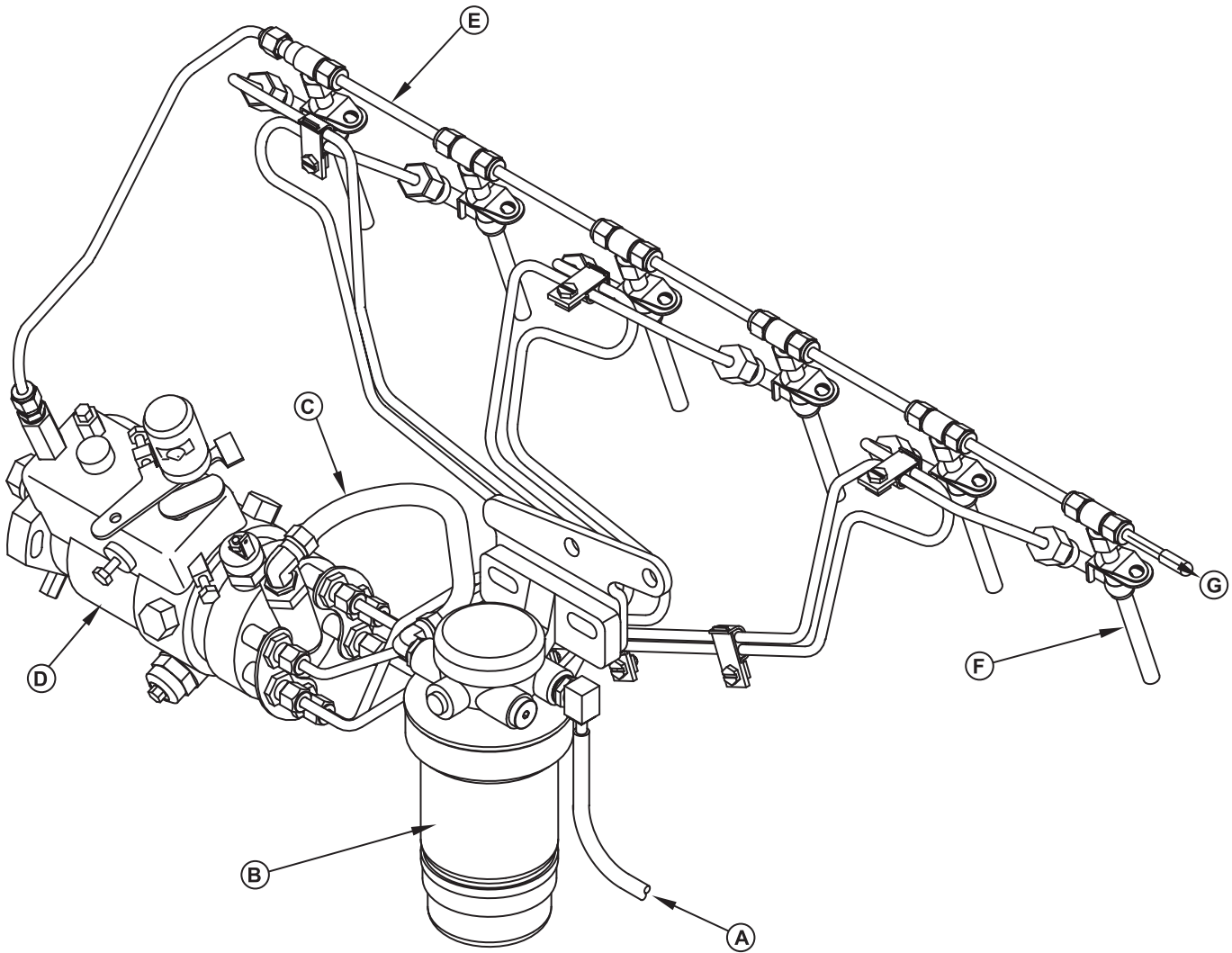
Observable Diagnostics and Tests

Symptom	Problem	Solution
	Worn timing gears or excess back lash	Check timing gear back lash. See MEASURE TIMING GEAR BACKLASH in Section 02, Group 050 of 4.5 L & 6.8 L 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 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).
	Worn camshaft	Inspect camshaft. See VISUALLY INSPECT CAMSHAFT in Section 02, Group 050 of 4.5 & 6.8 L 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 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).
	Insufficient engine lubrication	See 4.5L/6.8L - L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM 104).
	Turbocharger noise	See TURBOCHARGER SEVEN-STEP INSPECTION in Section 02, Group 080 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

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### F1 - Fuel Supply System Check



A—Fuel line from transfer pump  
B—Final fuel filter

C—Fuel line between final fuel filter and injection pump

D—Fuel injection pump  
E—Injection nozzle leak off line

F—Injection nozzle

The above illustration is intended to aid in the F1 - Fuel Supply System Check Diagnostic Procedure. For fuel system theory of operation information, see FUEL

SYSTEM OPERATION in Section 03, Group 130 of this manual.

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## F1 - Fuel Supply System Check

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### F1 - Fuel Supply System Check Diagnostic Procedure

*NOTE: This procedure diagnoses the fuel system up to the injection pump. It does not include diagnose a failed, injection pump, fuel delivery lines, and injection nozzles.*

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<p><b>❶ F1 - Preliminary Check</b></p>	<p>Before using this diagnostic procedure:</p> <ul style="list-style-type: none"> <li>• Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group.</li> <li>• Inspect all fuel lines and fittings for ruptures or leaks.</li> <li>• If fuel system has recently been opened, bleed fuel system. See BLEED THE FUEL SYSTEM later in this Group.</li> </ul>	<p><b>No problem found:</b> GO TO <b>❷</b></p> <p><b>Problem found:</b> Repair and retest.</p>
<p><b>❷ Air In Fuel Check</b></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>❸</b></p> <p><b>Air found in fuel system:</b> Bleed fuel system. See BLEED THE FUEL SYSTEM later in this Group.</p>
<p><b>❸ Fuel Supply Pressure Check</b></p>	<p>Check fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE later in this Group.</p>	<p><b>Pressure within specification:</b> GO TO <b>❷</b></p> <p><b>Pressure is below specification:</b> GO TO <b>❹</b></p>

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*Observable Diagnostics and Tests*

<p><b>4 Fuel Filter Test</b></p>	<ol style="list-style-type: none"> <li>1. Replace final fuel filter and retest.</li> <li>2. Replace primary fuel filter (if equipped) and retest.</li> <li>3. Check fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE later in this Group.</li> </ol>	<p><b>Pressure within specification:</b> Problem resolved</p> <p><b>Pressure below specification:</b> GO TO <b>5</b></p> <p style="text-align: right;">---1/1</p>
<p><b>5 Fuel Supply Lines Check</b></p>	<p>Remove fuel supply lines and determine if there are any internal restrictions.</p>	<p><b>No restrictions found:</b> GO TO <b>6</b></p> <p><b>Restrictions found:</b> Repair or replace components as needed.</p> <p style="text-align: right;">---1/1</p>
<p><b>6 Fuel Transfer Pump Check</b></p>	<p>At this point, the most likely cause for low fuel pressure is a failure in the transfer pump or the wiring to the transfer pump. See CHECK FUEL TRANSFER PUMP later in this Group.</p>	<p style="text-align: right;">---1/1</p>
<p><b>7 Return Fuel Check</b></p>	<ol style="list-style-type: none"> <li>1. Disconnect fuel line from injection pump overflow valve.</li> <li>2. Loosen overflow valve from injection pump.</li> <li>3. Turn ignition switch to "ON" position.</li> <li>4. Operate hand primer on fuel supply pump until fuel flows out the overflow valve fitting location. If fuel flow out the hole cannot be obtained, retighten all fittings.</li> </ol>	<p><b>Good fuel flow out of loose overflow valve:</b> No fuel supply problem found.</p> <p><b>NOT good fuel flow or no flow out of loose overflow valve:</b> GO TO <b>8</b></p> <p style="text-align: right;">---1/1</p>

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Observable Diagnostics and Tests

<p><b>⑧ Restricted Pre-Injection Fuel Line Check</b></p>	<p>This check will help determine if the pre-injection fuel line is restricted.</p> <ul style="list-style-type: none"><li>• Disconnect fuel line from the final filter to the injection pump.</li><li>• Force air through the fuel line.</li></ul>	<p><b>No restrictions found:</b> No fuel supply problems found. Return to diagnostic procedure earlier in this Group for: E1 - ENGINE CRANKS/WON'T START OR E3 - ENGINE DOES NOT DEVELOP FULL POWER</p> <p><b>Restrictions found:</b> Repair or replace components as needed.</p>
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## 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.

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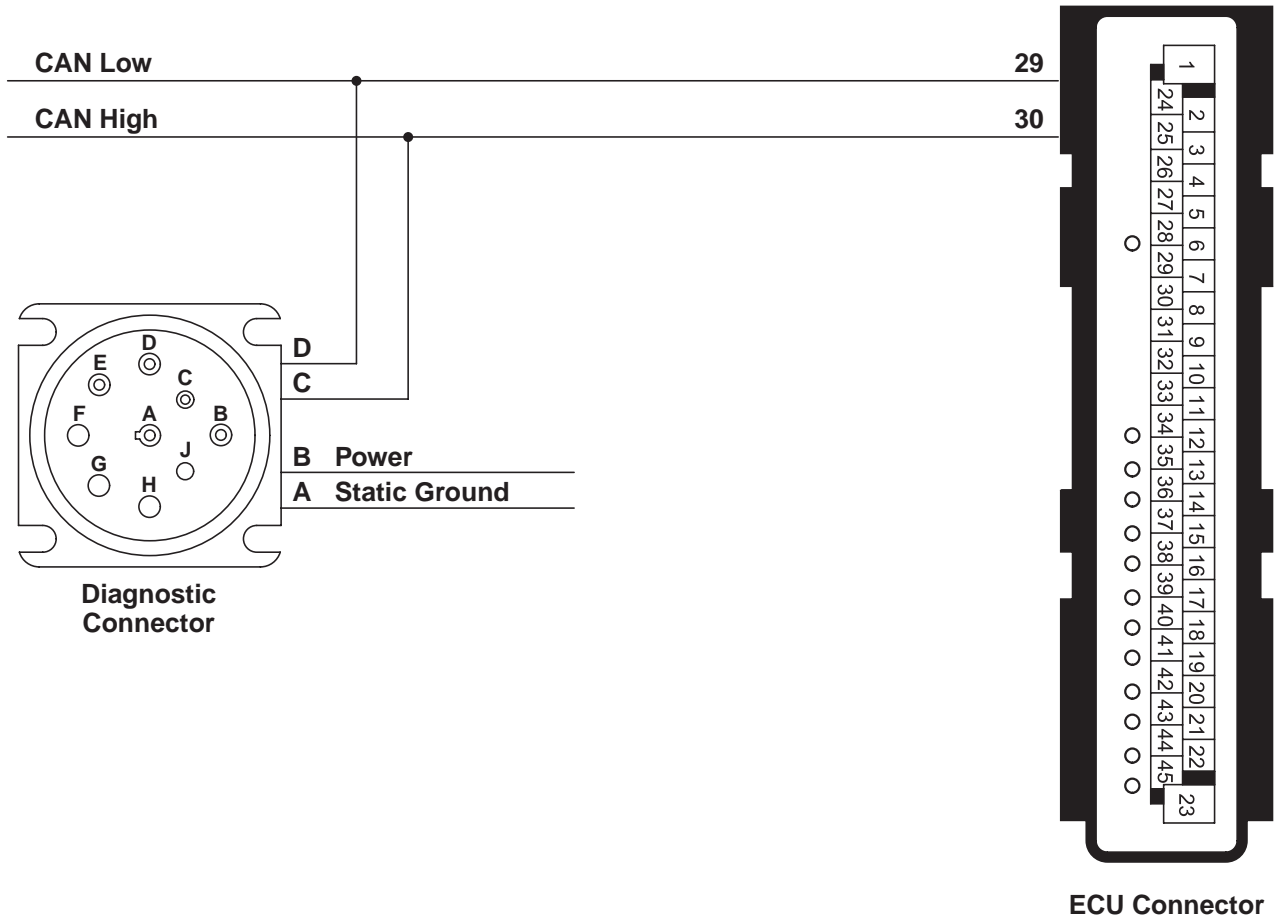
## F3 - Fuel in Oil

Symptom	Problem	Solution
<b>F3 - Fuel in Oil</b>	Faulty Injection Pump Seal	Repair/replace components as required.

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



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**IMPORTANT:** Do not force probes into connector terminals or damage will result. Use the JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

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

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

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

*NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector, diagnostic connector, and the CAN terminator looking for dirty, damaged, or poorly positioned terminals.*

SERVICE ADVISOR is a trademark of Deere & Company

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<p><b>❶ DST Communication Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information</i></p> <p><i>For more information on CAN, see CONTROLLER AREA NETWORK (CAN) in Section 03, Group 130 earlier in this manual.</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>ECU does not communicate:</b> GO TO <b>❷</b></p> <p><b>ECU communicates:</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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<p><b>❷ Sensor Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation 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 Engine Coolant Temperature (ECT) sensor</li> <li>3. Ignition ON</li> <li>4. Using a multimeter, measure the voltage between both terminals of the selected ECT sensor harness connector</li> </ol>	<p><b>3.0 V or above:</b> GO TO <b>❹</b></p> <p><b>Below 3.0 V:</b> GO TO <b>❸</b></p>
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*Observable Diagnostics and Tests*

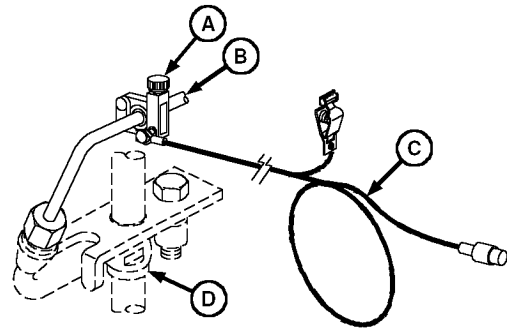
<p><b>③ Power Supply Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH DST OR SERVICE ADVISOR supporting information</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect ECU connector</li> <li>3. Ignition ON</li> <li>4. Using a multimeter, measure the voltage between a good ground and terminal 1 in the harness end of the ECU connector</li> </ol>	<p><b>3.0 V or above:</b>                      Faulty ECU power fuse                      OR                      Faulty ECU power wiring                      OR                      Faulty ECU</p> <p><b>Below 3.0 V:</b>                      Key-on signal wire open or shorted to ground                      OR                      Faulty ignition switch                      OR                      Faulty key-on power fuse</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ PDM Power Light Test</b></p>	<p><i>NOTE: For wiring and theory of operation 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. Observe the power light on the Parallel Data Module (PDM)</li> </ol>	<p><b>Power light ON:</b>                      GO TO <b>⑥</b></p> <p><b>Power light OFF:</b>                      GO TO <b>⑤</b></p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑤ Open in Diagnostic Ground Connector Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation 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</li> <li>3. Probe power ground terminal in diagnostic connector with a test light connected to battery voltage.</li> </ol>	<p><b>Light ON:</b>                      Open or short to ground in diagnostic connector power wire</p> <p><b>Light OFF:</b>                      Open in diagnostic connector ground wire</p> <p style="text-align: right;">-- -1/1</p>
<p><b>⑥ Open in Harness Circuit Test</b></p>	<p><i>NOTE: For wiring and theory of operation 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 ECU connector 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>• CAN low terminal in the diagnostic connector and terminal 29 in the ECU connector</li> <li>• CAN high terminal in the diagnostic connector and terminal 30 in the ECU connector</li> </ul> </li> </ol>	<p><b>Both measurements 5 ohms or less:</b>                      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</p> <p><b>One or more measurements greater than 5 ohms:</b>                      Open in harness circuit</p> <p style="text-align: right;">-- -1/1</p>

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## Using TIME TRAC® as a Tachometer

The TIME TRAC® meter can be used as a tachometer by using clamp-on transducer JT07177 (A) at nozzle end of any high-pressure fuel injection line.

1. Remove paint and thoroughly clean the area of the high-pressure line to which the clamp-on transducer is to be attached.
2. Install transducer (A) on high-pressure fuel delivery line (B) close to No. 1 injector and connect JT07172 cable (C) between transducer and JT07170 meter port marked "SR".
3. Switch on meter and start the engine to measure and record engine speed.



Transducer

- A—JT07177 6 mm (Green) Clamp-On Transducer
- B—Fuel Injection Delivery Line
- C—JT07172 Transducer Cable
- D—No. 1 Injector

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## Check and Adjust Injection Pump Dynamic Timing

The JT07158 (or FKM10429A) TIME TRAC® Kit electronically indicates start of injection with respect to piston top dead center (TDC), and allows accurate setting of injection pump timing to provide optimum power, smoke, and exhaust emissions.

Timing engines with this timing kit improves consistency between engines and helps to control cylinder firing pressures which can be a factor in head gasket failures as well as improve overall engine performance efficiencies.



TIME TRAC Kit

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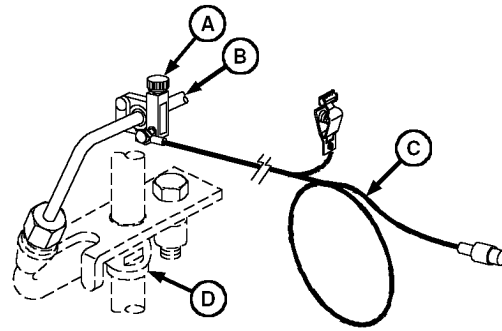
RG40854,00000B4 -19-04SEP01-1/9

**Install JT07158 (or FKM10429A) TIME TRAC® Kit:**

**IMPORTANT:** All transducers and sensors must be installed at nozzle end of No. 1 fuel injection line. If access to No. 1 line is restricted, sensor can be installed on No. 4 injection line (4-cylinder engines) and No. 6 injection line (6-cylinder engines).

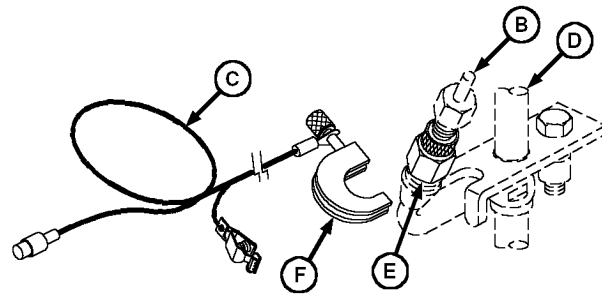
Remove all paint from injection line where clamp-on transducer will be installed and be sure this location is thoroughly clean.

1. On engines with optional JT07155 In-Line SOI Sensor (E) installed between injection nozzle and fuel delivery line, install JT07173 SOI Clamp Assembly (F) onto clean sensor and tighten securely.
2. On engines without optional JT07155 In-Line Sensor, install JT07177 6 mm (green) Clamp-on Transducer (A) onto clean, paint-free injection line and tighten securely.
3. Assemble red lead of JT07172 Transducer Cable (C) onto in-line sensor or transducer, however equipped.
4. Attach spring clip to a solid ground. Plug connector into JT07170 meter port marked SR.



Transducer

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TIME TRAC Hook-Up—w/SOI Sensor

- A—JT07177 6 mm (Green) Clamp-On Transducer
- B—Fuel Injection Delivery Line
- C—JT07172 Transducer Cable
- D—No. 1 Injector
- E—JT07155 In-Line SOI Sensor
- F—JT07173 SOI Clamp Assembly

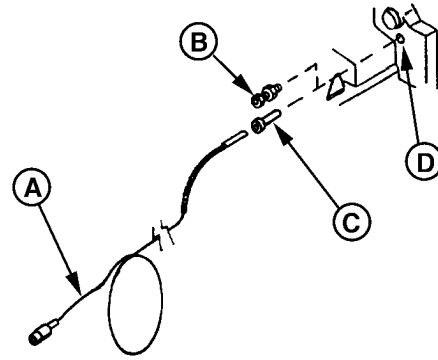
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5. Use JDE81-4 Timing Pin in flywheel timing hole (D) to ensure engine is NOT stopped at TDC. Magnetic pick-up probe will enter TDC timing hole in flywheel and may be damaged when engine is started. An air gap of 0.64 mm (0.025 in.) is recommended between tip of probe and flywheel face.
6. Install JDG793 Threaded Magnetic Pick-up Adapter (B) into flywheel housings with tapped hole until it bottoms. Insert probe of magnetic pickup (A) into adapter until it contacts flywheel. Back out hex head of adapter two flats and tighten lock nut; this will provide recommended air gap.
7. Install JDG821 Tapered Magnetic Pick-Up Adapter (C) into flywheel housings without tapped hole. Lightly tap adapter to lock into position. Insert probe into adapter until it contacts the flywheel. Pull probe back out to provide 0.64 mm (0.025 in.) gap.
8. Plug magnetic pick-up connector into JT07170 meter port marked MP.



Magnetic Pick-Up in Timing Hole

- A—Magnetic Pick-Up
- B—JDG793 Threaded Magnetic Pick-Up Adapter
- C—JDG821 Tapered Magnetic Pick-Up Adapter
- D—Flywheel Timing Hole

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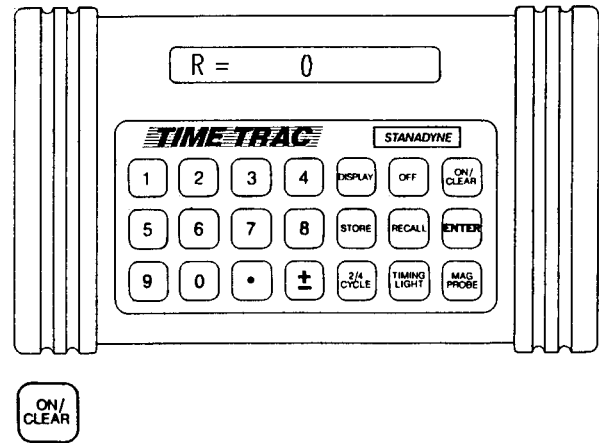
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**Check Injection Pump Rated Load Dynamic Timing:**

1. Engine OFF. Push ON/CLEAR button.

Display shows: R=0



TIME TRAC® Display Shows R=0

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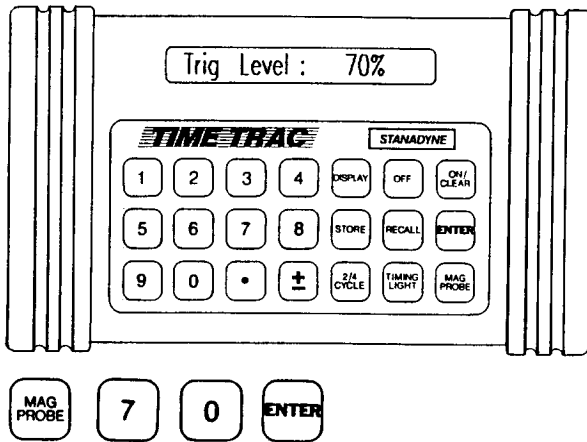
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2. Push MAG PROBE button.

Display shows: Trig Level: 30%

3. Change to 70% and push ENTER.



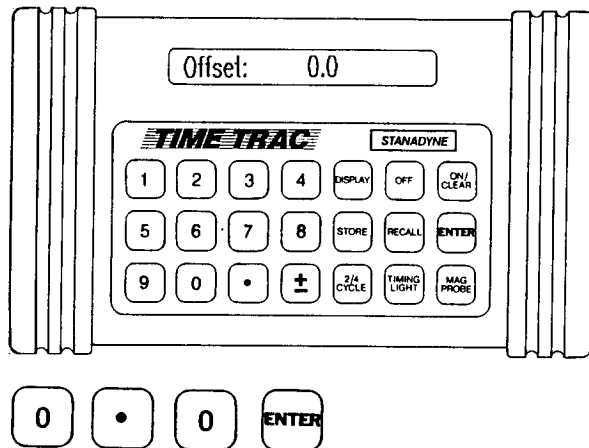
TIME TRAC® Display Shows Trig Level: 70%

RG7032 -UN-27SEP94

RG40854,00000B4 -19-04SEP01-5/9

4. Display shows: Offset: 20.0°

Change to offset 0° and push ENTER.



TIME TRAC® Display Shows Offset: 0.0

RG7033 -UN-27SEP94

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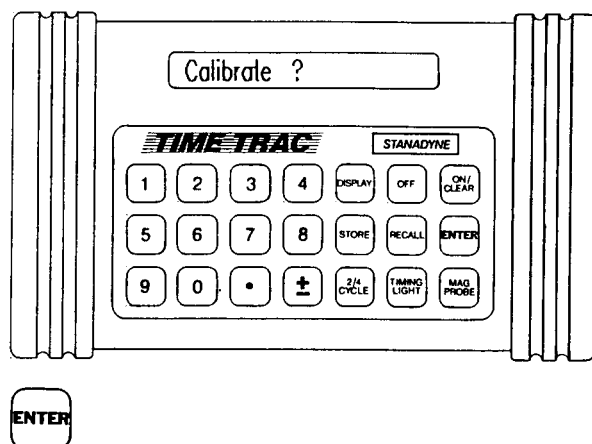
5. Display shows: Calibrate?

Start engine and push ENTER.

6. Run engine at 1300 rpm. Push ENTER. Display shows: Calibrating then Engine rpm and timing.

*NOTE: If display shows NO PROBE, the magnetic pick-up probe has not been installed properly [air gap exceeds 0.64 mm (0.025 in.)] or there is debris on the back of the flywheel. Check for proper air gap or clean the back side of the flywheel by inserting a soft wooden dowel into the engine timing pin hole with the engine running at low idle speed.*

7. Warm engine to normal operating temperature, check slow and fast idle rpm. See FUEL INJECTION PUMP SPECIFICATIONS in Section 06, Group 210 of this manual. Adjust speeds as necessary.



TIME TRAC® Display Shows Calibrate

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RG40854,00000B4 -19-04SEP01-7/9

**IMPORTANT:** Many machines have hydraulic pumps that have adequate flow to load engine well below rated load rpm. Some equipment may need to be driven in high gear or pull a load to bring engine speed to rated load rpm.

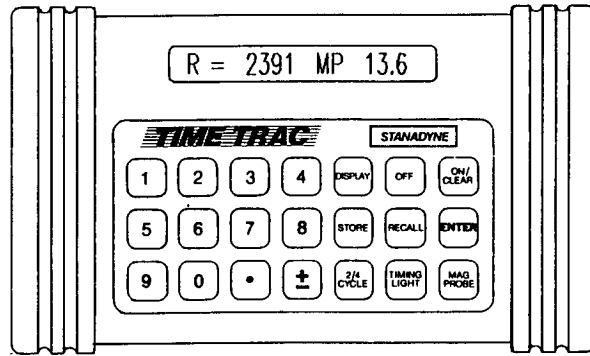
8. Run engine at wide open throttle (WOT) and load engine down gradually to rated speed rpm.
9. Record engine speed (rpm) and timing degrees.
10. Compare recorded speeds and timing degrees to charts in Section 06, Group 210 for OEM applications or refer to machine technical manual.

**IMPORTANT:** Stop engine prior to making timing adjustments. Injection pump can seize if adjustment is made with engine running.

11. Stop engine.

If dynamic timing reading is more than 8 degrees retarded with pump flange and front plate timing marks at original location as shipped from factory, this may indicate the pump advance is not functioning. For advance-related problems, see CHECK COLD START SWITCH OPERATION, CHECK COLD START ADVANCE SYSTEM OPERATION, and CHECK LIGHT LOAD ADVANCE OPERATION later in this Group. Also, check the following:

- Change fuel filter(s).
- Check transfer pump for positive fuel pressure to injection pump.
- Check camshaft movement on injection pumps with rectangular timing window.
- Check pump drive shaft-to-gear key or pin to ensure key or pin has not sheared.
- If none of the above checks are conclusive, remove pump and have necessary repairs made at an authorized diesel repair station.



TIME TRAC® Display Shows R=? MP=?

RG7037 -UN-27SEP94

**Adjust Injection Pump Dynamic Timing:**

1. Loosen injection pump mounting flange nuts and adjust pump timing.

To advance pump timing, rotate top of pump clockwise, viewed from rear (flywheel end) of engine. To retard timing, rotate top of pump counterclockwise. Pump flange movement of 1.524 mm (0.060 in.) is equivalent to 2 degrees of engine timing.

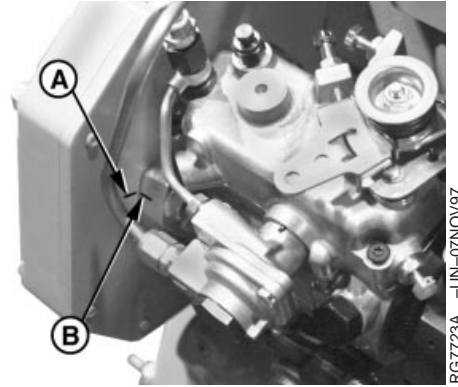
2. Tighten injection pump mounting flange nuts to specifications.

**Specification**

Injection Pump Mounting Nuts—

Torque ..... 27 N•m (20 lb-ft)

3. Start engine and check injection pump dynamic timing again. Adjust timing as needed.
4. After all adjustments are made and engine is performing to specification, perform the following:
  - a. Grind away the original timing mark (A) on front plate.
  - b. Stamp a new timing mark (A) on front plate, aligned with timing mark (B) on injection pump flange.



RG7723A -UN-07NOV97

*Rotary Injection Pump Timing Marks*

**A—Front Plate Timing Mark**  
**B—Pump Timing Mark**

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## Check Cold Start Switch Operation

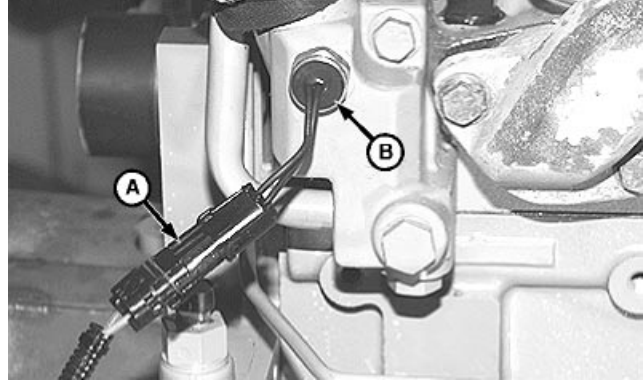
The cold start switch (B) is an option available on rotary injection pumps.

1. Disconnect cold start switch connector (A) from pump wiring harness.
2. Remove cold start switch from thermostat housing/water manifold.
3. Submerge switch in water at 60°C (140°F) for a few minutes.
4. Check for open or closed switch. On Delphi (Lucas) pumps, the switch should be closed.
5. Replace switch if defective.
6. Install switch in thermostat housing/water manifold and tighten to specifications.

### Specification

Cold Start Switch—Torque..... 5 N•m (3.5 lb-ft) (42 lb-in.)

7. Connect cold start switch connector to pump wiring harness.



Cold Start Switch Check

A—Connector  
B—Cold Start Switch

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## Check Cold Start Advance System Operation

**NOTE:** To check operation of the cold start advance system, the engine will be operating in an advanced timing mode. After checks are completed, ensure that cold start circuits are returned to their original configuration to ensure proper injection pump timing and conformance to emission control standards.

Use JT07158 (FKM10429A) TIME TRAC® Kit to check injection pump timing when performing operational checks on the cold start advance system. See CHECK AND ADJUST INJECTION PUMP DYNAMIC TIMING earlier in this Group.

### Cold Start Advance

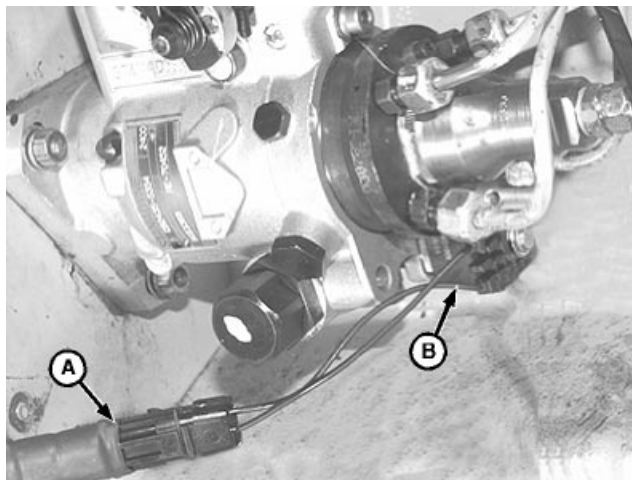
**NOTE:** Checks must be performed on a cold engine.

*The cold start advance solenoid is located on the bottom, outboard side of the injection pump. There is a single terminal input lead to the wax motor.*

1. Install JT07158 (FKM10429A) TIME TRAC® Kit.
2. Disconnect wiring connector from the cold start switch to wax motor harness. Verify that there is a voltage potential (12 or 24 volts, depending on application) at the wax motor connector.
3. Start cold engine and run at 1200 rpm. Check and record injection pump timing.
4. Connect a jumper wire across the wax motor connector terminals. After approximately 30 seconds, check injection pump timing.

There should be a 7—10° decrease in timing indicating proper operation of the cold start advance system.

If no decrease in timing was noted, have the injection pump serviced/repared by an authorized ADS Diesel Repair Station.



Cold Start Advance System Check

A—Connector  
B—Cold Start Advance Solenoid

RG9144 -UN-18MAY98

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### Check Light Load Advance Operation

To check operation of the light load advance, perform the following:

1. Install JT07158 (FKM10429A) TIME TRAC® Kit.
2. Operate engine at full load and rated speed. Note injection pump timing on TIME TRAC®.
3. Gradually decrease load to the engine. Timing should continue to retard as the load is removed, but should start to advance again as the light load advance begins to operate at about 50 percent load.
4. If timing does not advance, the light load advance is not operating properly. Have the injection pump serviced/repaired by an authorized ADS Diesel Repair Station.

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### Test Fuel Shut-Off Solenoid

1. Disconnect wire to solenoid.
2. Remove solenoid, noting if plunger is binding in bore.
3. Check coil resistance with ohmmeter and compare reading to the following specification.

**Specification**

Fuel Shut-Off Solenoid—  
 Resistance..... 9 Ohms

4. Check plunger retraction using a 12 volt source.

Connect positive cable to connector terminal and negative cable to solenoid body. From the relaxed position, plunger should retract into the solenoid body when voltage is applied.

If resistance specification is not met and/or plunger does not retract, replace solenoid.

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## Check Fuel Transfer Pump

1. Take off the filler cap and turn the key switch one position to the right (to "ON"). With the key in this position, it should be possible to hear the fuel transfer pump running.

If you cannot hear the pump running:

- Check the electrical circuit.
- Replace the pump (its motor is defective).

2. Open the vent screw on the fuel filter, and repeat the check.

If the pump is running but no fuel emerges:

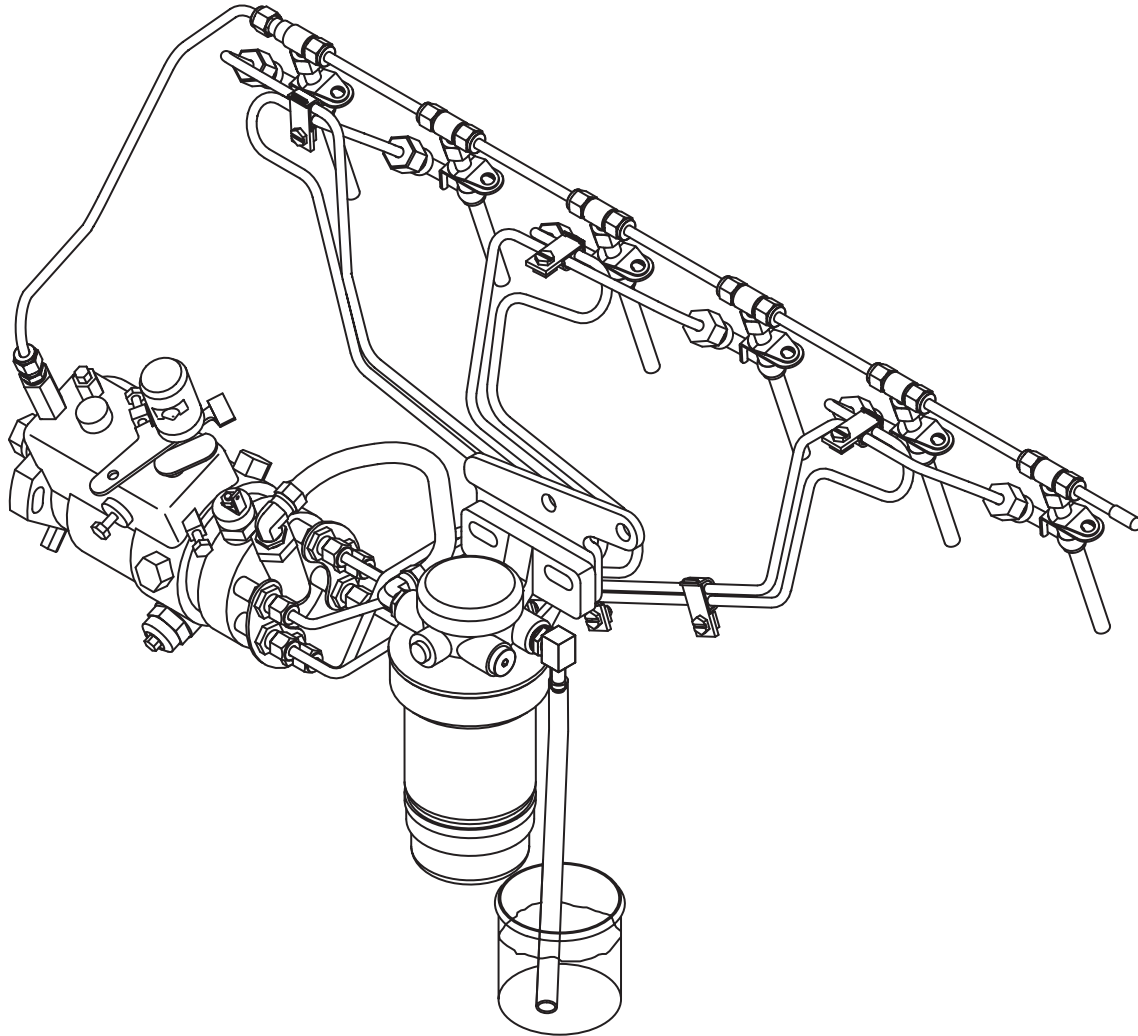
- Check if lines are crossed, pinched or blocked.
- Check if pump is located properly in the tank.
- Check if the pump is blocked.
- Check if the pump gear is OK.

If fuel is not being transferred properly:

- Check if the tank is venting properly (filler cap).

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**Check Fuel Supply Quality**

RG11843 -UN-21SEP01

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 primary (if equipped) and final fuel filters for serviceability. If filter is equipped with a water separator, empty and clean separator bowl.
2. Start engine and operate under load, observing engine performance.

3. Disconnect fuel line from inlet side of primary fuel filter (if equipped) or fuel tank outlet (on engines without primary filter).
4. Connect a hose to inlet port.
5. Submerge hose in a container of clean, good quality fuel meeting engine specifications.
6. Operate engine under load and observe performance.

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


## Test for Fuel Drain Back

Fuel draining back through the fuel system may cause hard starting. This procedure will determine if air is entering the system at connections and allowing fuel to siphon back to the fuel tank.

1. Disconnect fuel supply and return lines at fuel tank.

**IMPORTANT: Fuel return line MUST extend below fuel level in fuel tank before performing this test. Fill fuel tank if necessary.**

2. Drain all fuel from the system, including the fuel transfer pump, fuel injection pump, fuel filters, and water separator (if equipped).
3. Securely plug off the end of the fuel return pipe.

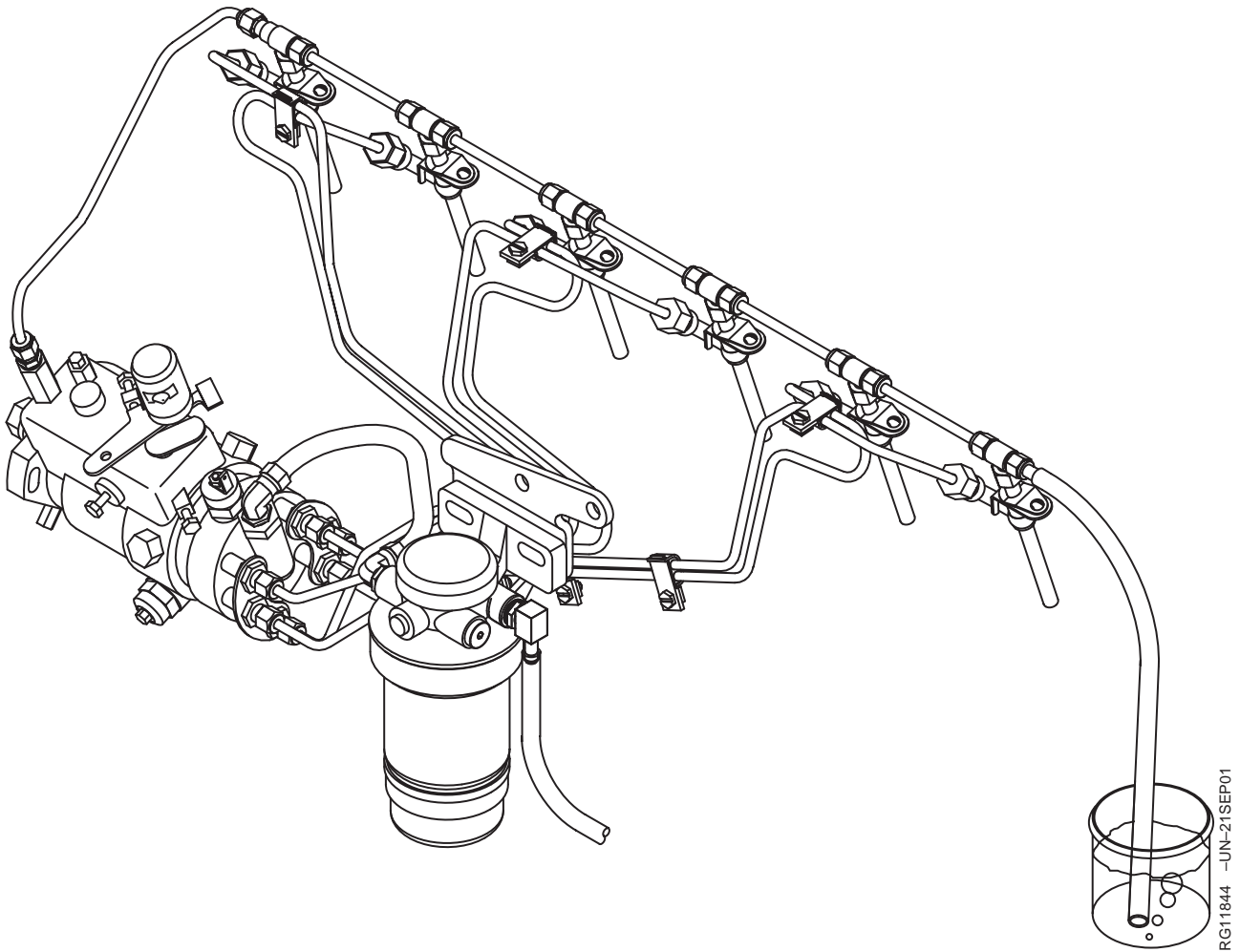
 **CAUTION: Maximum air pressure should be 100 kPa (1 bar) (15 psi) when performing this test.**

4. Using a low pressure air source, pressurize the fuel system at the fuel supply line.
5. Apply liquid soap and water solution to all joints and connections in the fuel system and inspect for leaks.

*NOTE: Connections may allow air to enter the system without allowing fuel to leak out.*

6. If any leaks are found, take necessary steps to repair.
7. Reconnect supply and return lines and prime system.
8. Start engine and run for approximately 10 minutes.
9. Allow engine to sit overnight and try starting the following morning.

## Test for Air in Fuel



**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 leak-off line assembly. Connect a hose to end of leak-off line assembly and place opposite end of hose in a suitable container filled with fuel as shown.

2. Operate engine and check for air bubbles in container. If bubbles are present, bleed the fuel system and repeat test. See **BLEED THE FUEL SYSTEM** in this Group of this Section.

3. If bubbles are still present, check the following:

- Check for loose fuel fittings from the suction side of the fuel supply pump to the fuel tank to include all lines and filters.
- Check fuel tank suction tube (if equipped) and welded joints for cracks or holes.

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

## Check Fuel Supply Pressure

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

1. Loosen final fuel filter fitting (A) from outlet of the final filter.
2. Connect a 0-1000 kPa (0-150 psi) gauge at the final filter outlet.
3. Start engine. Fuel transfer pump should maintain minimum pressure shown in specification.



A—Final Fuel Filter Fitting

### Specification

Fuel Transfer Pump—Static Pressure .....	25—30 kPa (0.25—0.30 bar) (3.5—4.5 psi)
Fuel Transfer Pump—Minimum Static Pressure at 850 rpm Engine Speed .....	15 kPa (0.15 bar) (2.0 psi)
Fuel Transfer Pump—Minimum Positive Pressure at 2400 rpm Engine Speed .....	21—34 kPa (0.21—0.34 bar) (3—5 psi)

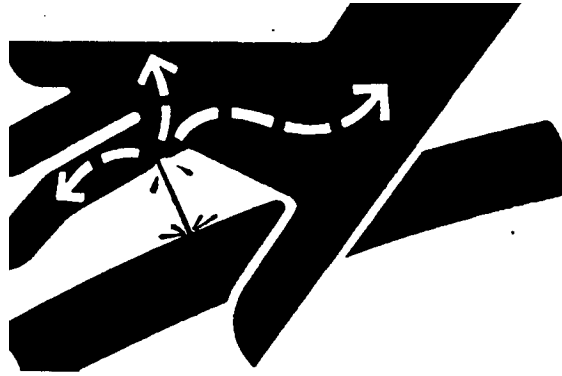
4. If engine can not be started, perform bleed procedure. See BLEED THE FUEL SYSTEM in this Group of this Section.

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## Bleed the Fuel System

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



High Pressure Fluids

X9811 -UN-23AUG88

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

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.

The fuel system may be bled at one of several locations. On some engine applications it may be necessary to consult your operator's manual and choose the best location for your engine/machine application.

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## Bleed Fuel System at Final Fuel Filter

1. Open air bleed vent screw (A) two full turns by hand.
2. Ignition ON until a fuel is free from air bubbles.
3. Ignition OFF
4. Tighten air bleed vent screw two full turns.

A—Bleed Vent Screw



Fuel Filter Bleed Vent Screw

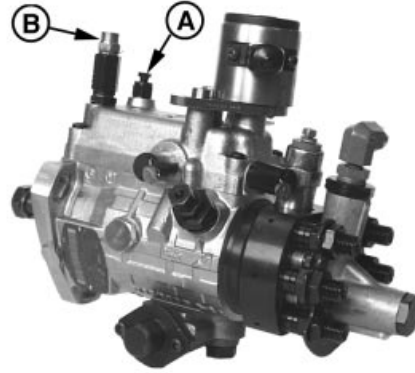
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### Bleed Fuel System at Fuel Injection Pump

1. Loosen overflow bleed screw (A) on pump cover on earlier engines or the fuel return line (B) on later engines.
2. Ignition ON until fuel flow is free from air bubbles.
3. Ignition OFF
4. Retighten bleed screw or fuel return line.



A—Bleed Screw  
B—Fuel Return Line

RG11831C -JUN-29OCT01

#### Specification

Fuel Return Line—Torque..... 14 N•m (10.32 lb-ft)

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### Bleed Fuel System at Fuel Injection Nozzles

1. Place throttle lever in half-throttle position.

On engines equipped with electronic fuel shut-off solenoid, energize solenoid.

**IMPORTANT:** Always use a backup wrench when loosening or tightening fuel lines at nozzles and/or injection pump to avoid damage.

2. Using two open-end wrenches, loosen two fuel line connections at injection nozzles.
3. Crank engine over with starting motor for 15 seconds (but do not start engine) until fuel free from bubbles flows out of loosened connection. Retighten connection to specifications.



Nozzle Fuel Pressure Line

RG7725 -JUN-08JAN97

#### Specification

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

4. Repeat procedure for remaining injection nozzles (if necessary) until all air has been removed from fuel system.

RG40854,000007B -19-24AUG01-4/4

### Test for Cylinder Misfire (Engine Running)



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

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

1. Operate engine at intermediate speed with no load.
2. Place a shop towel around nozzle-to-line connection to absorb escaping fuel.
3. Slowly loosen the fuel pressure line at one of the nozzles until fuel escapes at the connection (fuel not opening nozzle valve).
  - If engine speed changes, the cylinder is probably working satisfactory.
  - If engine speed does not change, a cylinder is faulty.
4. Repeat test for each remaining cylinder.
5. Tighten fuel lines to specifications.

**Specification**

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

RG40854,00000B1 -19-30AUG01-1/1

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150  
50

### Test Fuel Injection Nozzles (Engine Running)



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

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

1. Operate engine at intermediate speed with no load.
2. Slowly loosen the fuel pressure line at one of the nozzles until fuel escapes at the connection (fuel not opening nozzle valve).

If engine speed changes, the injection nozzle is probably working satisfactory.

If engine speed does not change, a nozzle is faulty and must be checked and repaired (or replaced).

*NOTE: The injection nozzle before and/or after nozzle being checked could be the faulty nozzle.*

3. Repeat test for each remaining nozzle assembly.
4. Remove faulty injection nozzles and repair as required. See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.
5. Tighten fuel lines to specifications.

**Specification**

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

04  
150  
51

04  
150  
52

## About this Group of the Manual

This section of the manual contains necessary information to diagnose the electronic control system. Use this information in conjunction with the 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).

See the 4.5 L & 6.8 L 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, Section 06, Group 210 DIAGNOSTIC

SPECIFICATIONS contains useful information, such as ECU terminal identification and a system wiring schematic.

**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 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.*

04  
160  
1

RG40854,000000F -19-10JUL01-1/1

## 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

RG40854,0000010 -19-10JUL01-1/1

## 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

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2

RG40854.0000011 -19-10JUL01-1/1

## Electrical Circuit Malfunctions

### Circuit Malfunctions

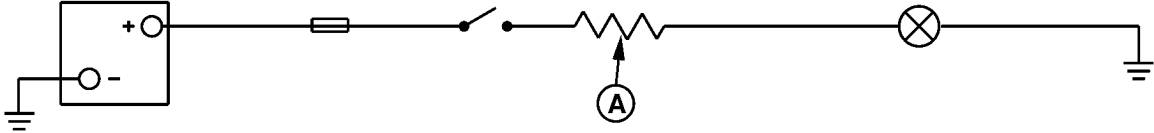
There are four major circuit malfunctions. They are:

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

Continued on next page

RG40854.0000012 -19-10JUL01-1/6

RG9891 -UN-06JAN99



High Resistance Circuit

A—Unwanted Resistance

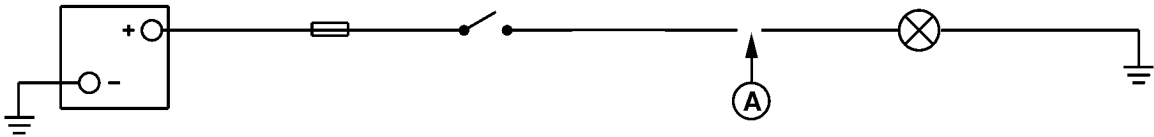
**Definition of Circuit Malfunctions**

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

**1. High Resistance Circuit:**

RG40854.0000012 -19-10JUL01-2/6

RG9892 -UN-06JAN99



Open Circuit

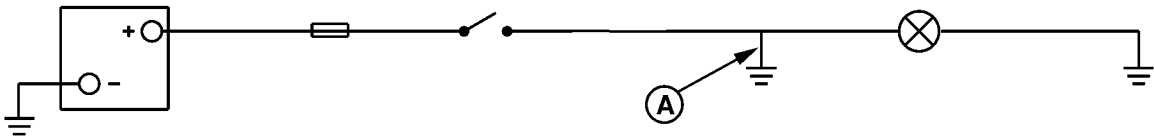
A—Break or Separation in Circuit

**2. Open Circuit:**

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

RG40854.0000012 -19-10JUL01-3/6

RG9893 -UN-06JAN99



Grounded Circuit

A—Voltage Wire in Contact with Machine Frame

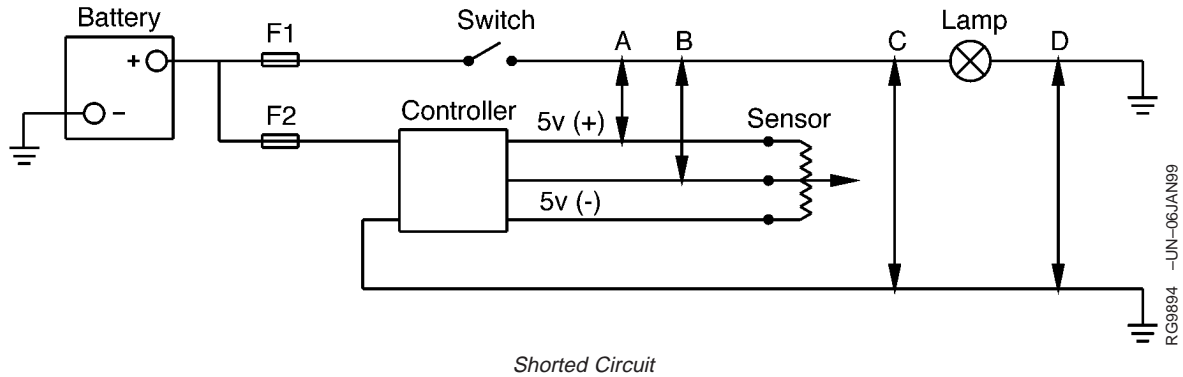
**3. Grounded Circuit:**

A voltage wire in contact with the machine frame (A), providing continuity with the battery ground terminal.

Continued on next page

RG40854.0000012 -19-10JUL01-4/6

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3



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:

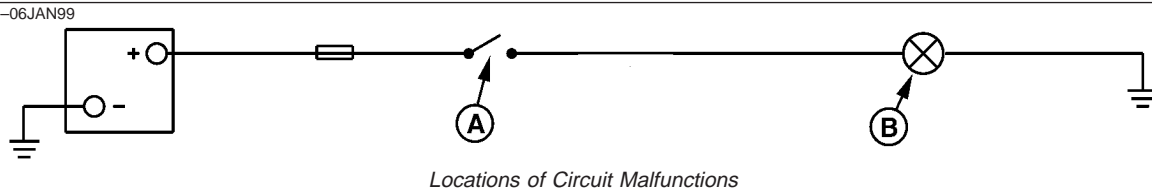
- Voltage wire shorted to another voltage wire (wires of equal or unequal voltage).
- Voltage wire shorted to a sensor signal wire (wires of unequal voltage).
- Voltage wire shorted to a ground wire (wires of battery voltage or regulated voltage, shorted to a

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.*

RG40854.0000012 -19-10JUL01-5/6



A—Controlling Switch

B—Load

**Locations of Circuit Malfunctions:**

In a “Simple Electrical Circuit” the circuit malfunctions occur at only three locations. They are:

1. Before the controlling switch (A).
2. Between the controlling switch (A) and the load (B).
3. After the load (B).

Electrical components can become faulty with the same four circuit malfunctions. Sometimes component malfunctions can easily be confused with circuit

malfunctions. Therefore, care must be exercised when isolating the cause of the problem.

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

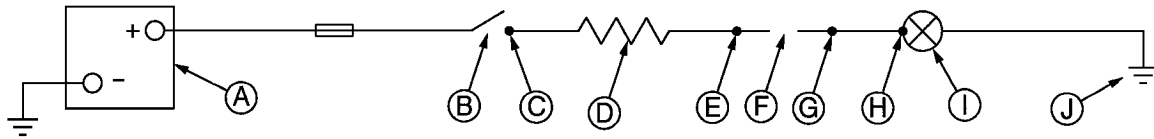
**Reason:** Oxidation of the terminals created “High Resistance” and a voltage drop that prevents the proper amount of current flow to the component. Disconnecting and reconnecting the connector, removed some oxidation and re-established good continuity through the connector.

RG40854.0000012 -19-10JUL01-6/6

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4

## 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).

### 2. Open Circuit:

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

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

- a. With the controlling switch (B) closed (on) and the load (I) connected into the circuit, check for

proper voltage at a location easily accessible between (C) and (H).

- If voltage is low, move toward the voltage source (A) to locate the point of voltage drop.
- If voltage is correct, move toward the load (I) and ground terminal (J) to locate the voltage drop.

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

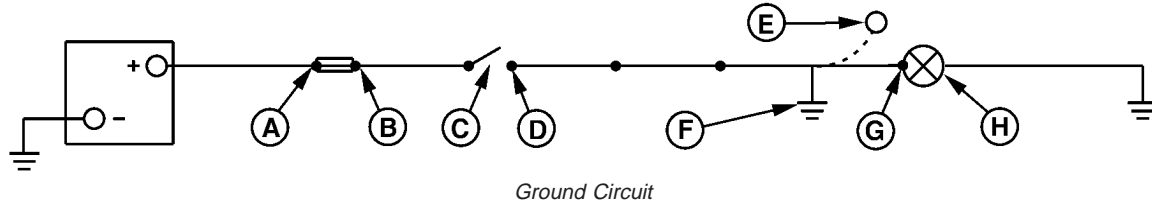
- b. Repair the circuit as required.
- c. Perform an operational check-out on the component after completing the repair.

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Continued on next page

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RG9897 -UN-06JAN99



A—Fuse “A” Terminal  
B—Fuse “B” Terminal

C—Switch  
D—Component Terminal

E—Wire Terminal  
F—Grounded Circuit

G—Component Terminal  
H—Load (Lamp)

### 3. Ground Circuit:

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

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

- a. Switch (C) must be open (off). Check for continuity to ground between (B) and (C).
  - If there is continuity, there is a grounded circuit between (B) and (C). Repair the circuit.
  - No continuity, go to step b.

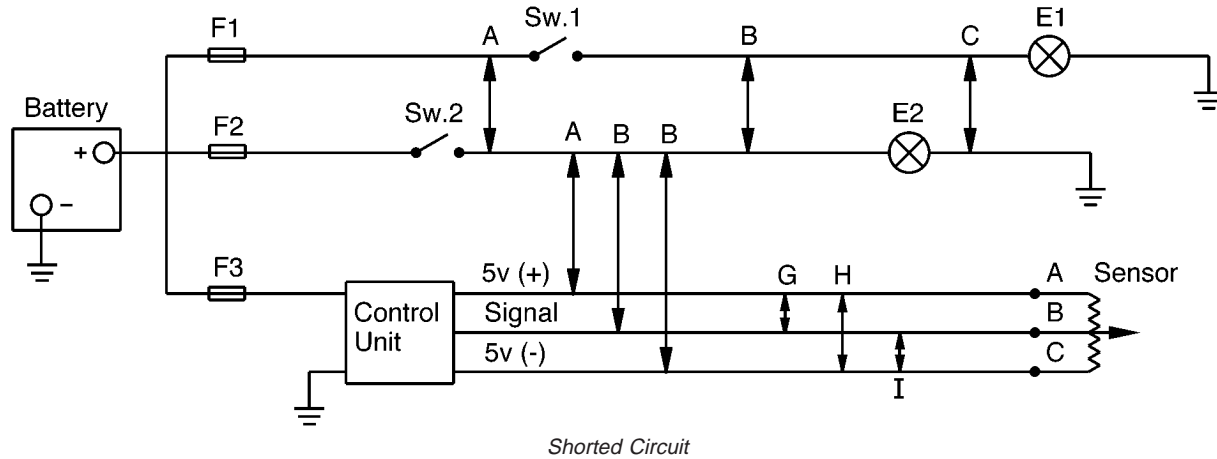
- b. Disconnect the load (H) at component terminal (G).
- c. With the controlling switch (C) open (off), check for continuity to ground between (D) and (E).
  - If there is continuity, there is a grounded circuit between (D) and (E). Repair the circuit.

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

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

Continued on next page

RG40854.0000013 -19-10JUL01-2/4



**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.

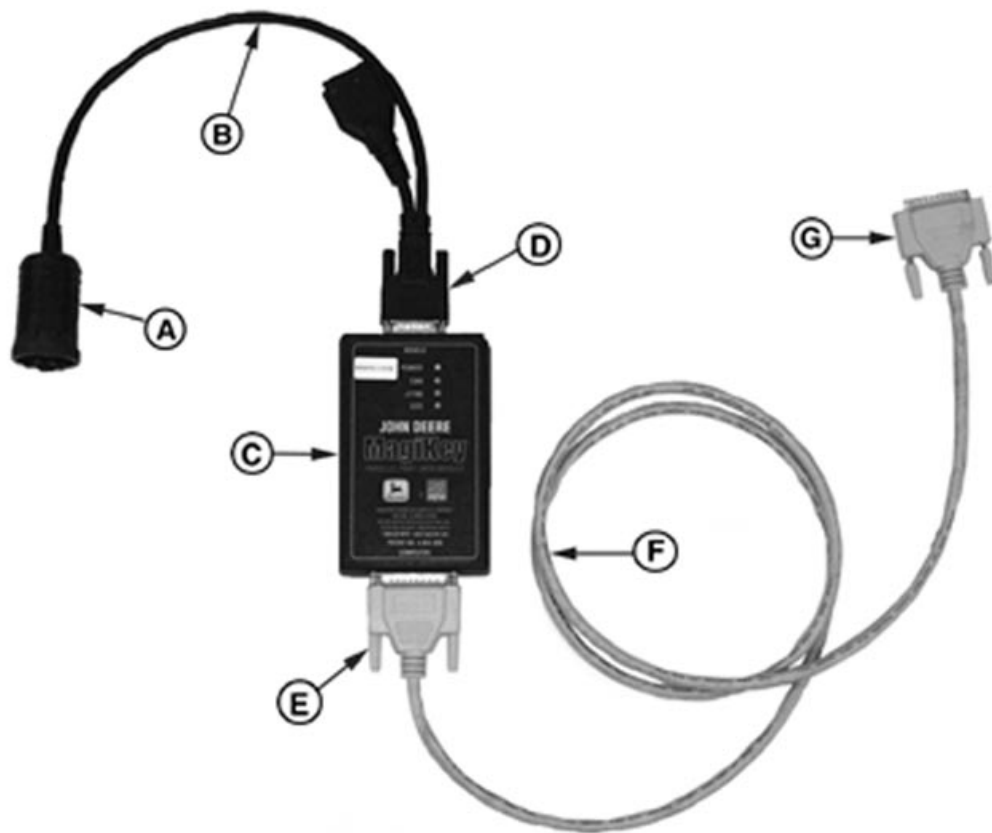
Connect one meter lead to a good frame ground. With the other meter probe, touch each of the suspected circuits one at a time. If there is a voltage reading, the circuit is shorted to another voltage wire. Repair the circuit.

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.
7. Start the diagnostic software and select the appropriate application.

RG11737A -UN-18MAY01

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9

*Trouble Code Diagnostics and Tests*

8. Connect to the application. The CAN light on the MagiKey should illuminate red when the connection to the ECU is made.
9. If DST or SERVICE ADVISOR™ does not connect see D1 - ECU DOES NOT COMMUNICATE WITH

- DST OR SERVICE ADVISOR DIAGNOSTIC PROCEDURE in Group 150 of this manual.
10. Replace the dust cap on the diagnostic connector.

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RG40854,00000F1 -19-24OCT01-2/2

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10



## Data Parameter Description

Following is a list of the data parameters that can be read on the Diagnostic Scan Tool (DST) or on SERVICE ADVISOR™. If the DST is being used, it consists of a Windows ('95, '98, or 2000) or NT compatible computer, JDIS121 ECU Communication Hardware Kit, and the ECU Communication Software Kit, available from John Deere. Included in the list below is a brief description of each parameter, the range of possible readings, and each parameter's unit of measurement.

Parameter	Units	Description
Actual Actuator Current	amps	The current the ECU sees on the return wire from the electronic actuator.
Analog Throttle (A) Input Voltage	volts	Voltage from analog throttle (A) position sensor (potentiometer).
Analog Throttle (B) Input Voltage	volts	Voltage from analog throttle (B) position sensor (potentiometer).
Analog Throttle (C) Input Voltage	volts	Voltage from analog throttle (C) position sensor (potentiometer).
Battery Voltage	volts	Switched battery voltage may vary depending on application
Current Calibration MFG	N/A <sup>a</sup>	Parameter used for EOL programming only.
Current Calibration Slope	N/A <sup>a</sup>	Parameter used for EOL programming only.
Desired Speed Governor Curve	N/A <sup>a</sup>	The mode selected is dependent on the application. See GOVERNOR DROOP MODE SELECTION in Section 06, Group 210 of this manual.
Desired Fuel	N/A <sup>a</sup>	Amount of fuel the ECU determines to run the engine.
Desired Actuator Current	amps	The current the ECU plans to supply to the electronic actuator.
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 Parameter	N/A <sup>a</sup>	Part number for the part number programmed into the ECU at the end of line (EOL) in assembly.
ECU Part Number	N/A <sup>a</sup>	Part number for the ECU hardware.
ECU Serial Number	N/A <sup>a</sup>	Serial Number for the ECU
ECU Software Assembly Part Number	N/A <sup>a</sup>	Part number for the ECU software assembly.
ECU Software Part Number	N/A <sup>a</sup>	Part number for the ECU operating software.

<sup>a</sup>N/A = Not Applicable

## Trouble Code Diagnostics and Tests

Parameter	Units	Description
Engine Coolant Temperature	°C (°F)	Engine Coolant Temperature value.  <i>NOTE: If there is an active fault for the ECT circuit, a default ECT value will be displayed.</i>
Engine Coolant Temperature Input Voltage	volts	Engine Coolant Temperature sensor input voltage to the ECU
Engine Hour Meter	hours -min- -sec	Total hours the ECU has run on an engine.
Engine Load at Current Speed	%	Percentage of load on engine at a given speed.
Engine Model Number	N/A <sup>a</sup>	The model number for the engine.
Engine Speed Noise Indicator	%	"0" reading means that there is NO noise. Between 0—100, the noise on the event sensor signal becomes progressively worse. When 100 is reached, a trouble code is thrown.
Engine Speed	rpm	The speed that the ECU detects from the engine speed sensor on the injection pump drive gear.
Fuel Mode	N/A <sup>a</sup>	This code explains the operation mode of the engine.
Fuel Usage Rate	L (gal)	Total amount of fuel the ECU has commanded the pump control unit to deliver during the total hours shown by the Engine Hour Meter parameter.
Maximum Speed Governor Curve	N/A <sup>a</sup>	The mode selected is dependent on the application. See GOVERNOR DROOP MODE SELECTION in Section 06, Group 210 of this manual.
Sensor Supply Voltage	volts	Voltage that ECU supplies sensors on voltage supply
Throttle Type	N/A <sup>a</sup>	Type of throttle(s) active
Throttle Position	%	Percentage of throttle
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. See TORQUE CURVE SELECTION in Section 06, Group 210 of this manual.
<sup>a</sup> N/A = Not Applicable		

04  
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13

RG40854,0000014 -19-10JUL01-2/2

## **Reprogramming Engine Control Unit (ECU)**

John Deere Ag and Construction dealers are able to reprogram ECUs using SERVICE ADVISOR™. See REPROGRAMMING ENGINE CONTROL UNIT USING SERVICE ADVISOR later in this Group.

OEM Distributors are able to to reprogram ECUs using Diagnostic Scan Tool (DST). See REPROGRAMMING ENGINE CONTROL UNIT USING DST later in this Group.

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*SERVICE ADVISOR is a trademark of Deere & Company*

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).

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15

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"/>

**B**

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

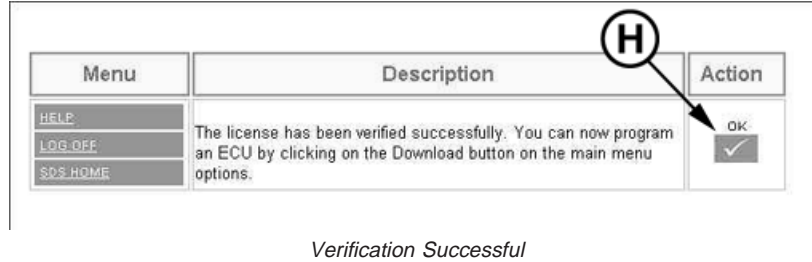
Grant Always Screen

4. Click on "Grant Always" (G).

Continued on next page

RG41221,0000097 -19-04NOV02-4/11

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16

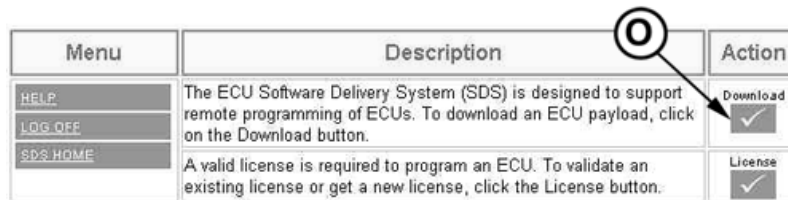


RG12631 -19-19SEP02

Verification Successful

- Click "OK" (H) when license verification has completed.

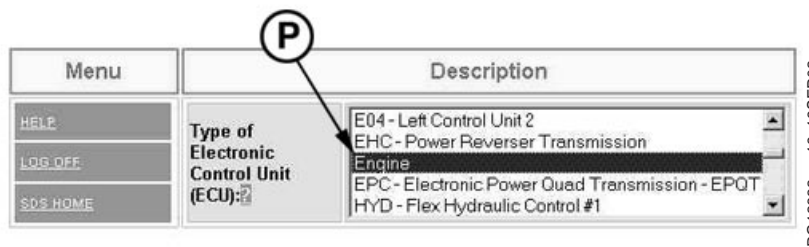
RG41221.0000097 -19-04NOV02-5/11



RG12579 -19-06SEP02

- Click on "Download" button (O). A screen will appear as the system verifies that a valid license file is present.

RG41221.0000097 -19-04NOV02-6/11



RG12632 -19-19SEP02

Selecting Engine for ECU Type

- Scroll down and click on "Engine" (P).

Continued on next page

RG41221.0000097 -19-04NOV02-7/11

04  
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17

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.

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18

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.

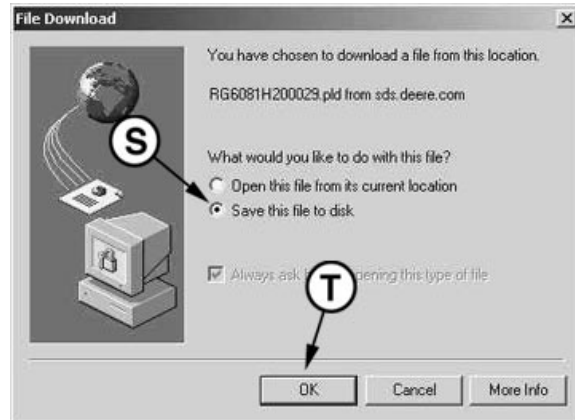
**NOTE:** Sometimes the original ECU will not be available for reprogramming. When a new ECU is being programmed to replace the

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).

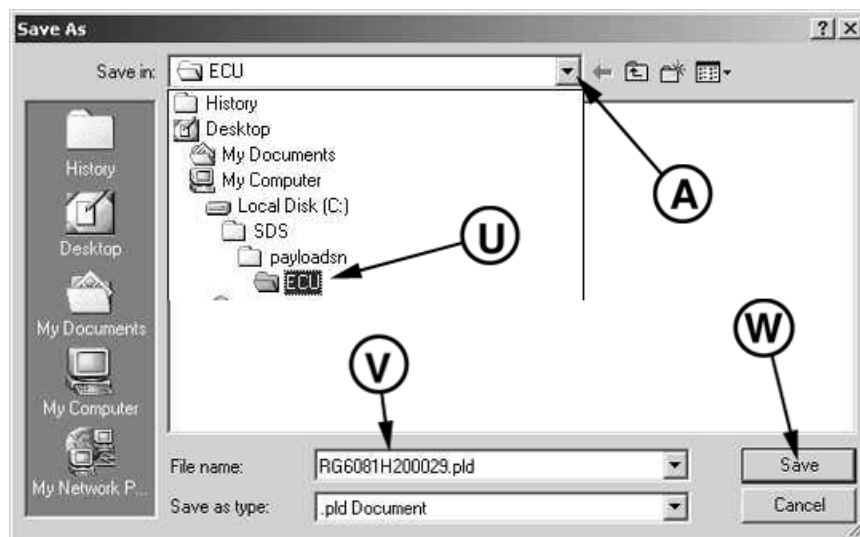


File Download

RG12619 -19-18SEP02

RG41221,0000097 -19-04NOV02-10/11

04  
160  
19



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

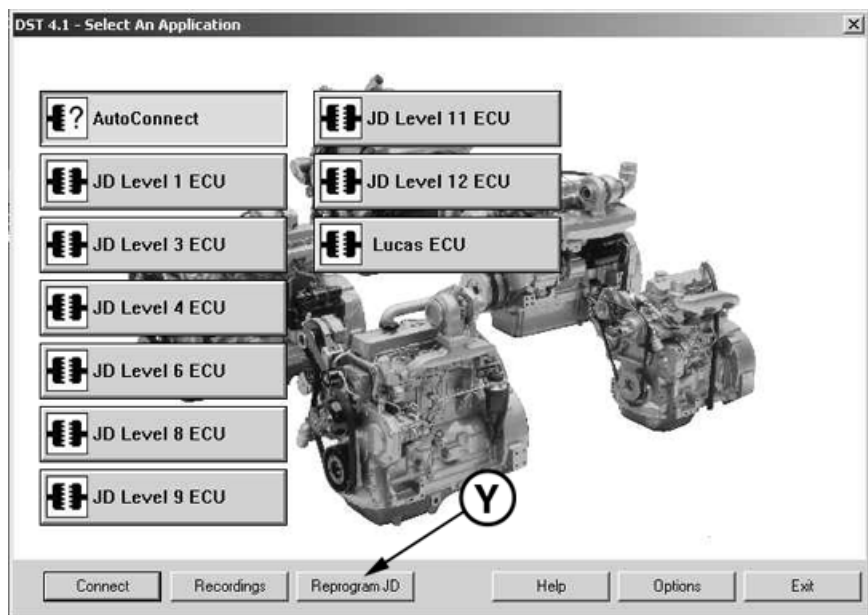
## Reprogramming Engine Control Unit (ECU) With DST

**IMPORTANT:** Diagnostic Scan Tool (DST) Version 4.1 or later must be installed prior to performing the following instructions.

*NOTE:* Internet connection is not required to program an engine control unit.

1. If payload file has not been downloaded to computer, download now. See DOWNLOADING PAYLOAD FILE FOR DST earlier in this Group.
2. Ignition ON, engine OFF.
3. Connect computer with DST to the Diagnostic Connector on the engine.

RG41221,0000098 -19-04NOV02-1/9



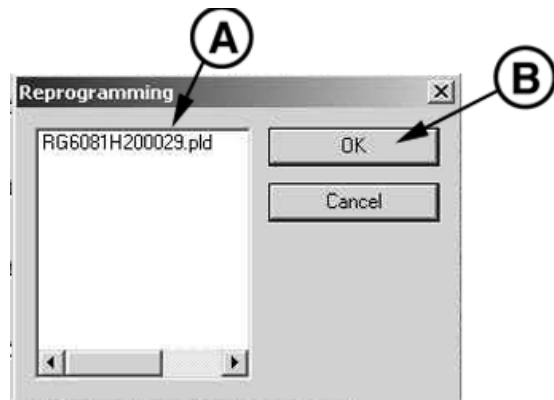
DST Main Screen

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).



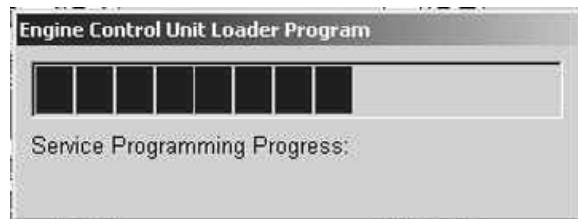
Selecting Payload file for Reprogramming

RG12623 -19-18SEP02

04  
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21

RG41221,0000098 -19-04NOV02-3/9

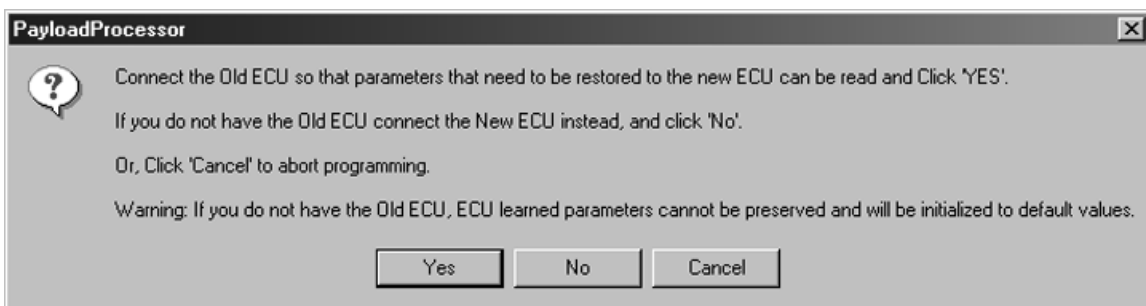
6. A progress bar will appear while reprogramming the ECU. If the engine is equipped with warning alarms, these may come on while in process of reprogramming and should be ignored.



Status Bar

RG12624 -19-18SEP02

RG41221,0000098 -19-04NOV02-4/9



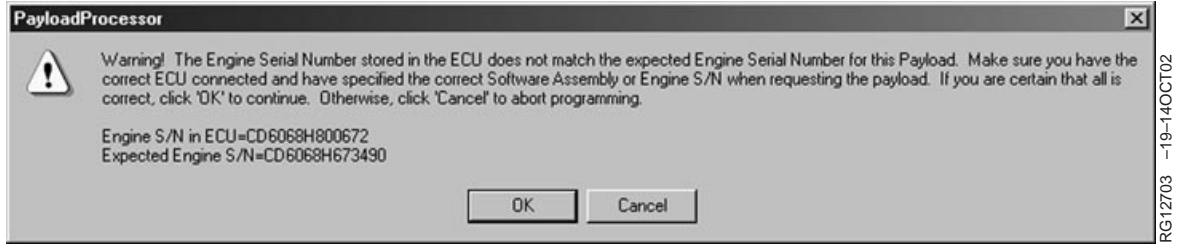
RG12702 -19-11OCT02

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".



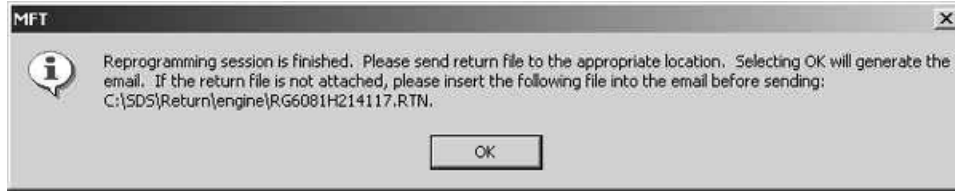
*Payload Processor Completed*

Continued on next page

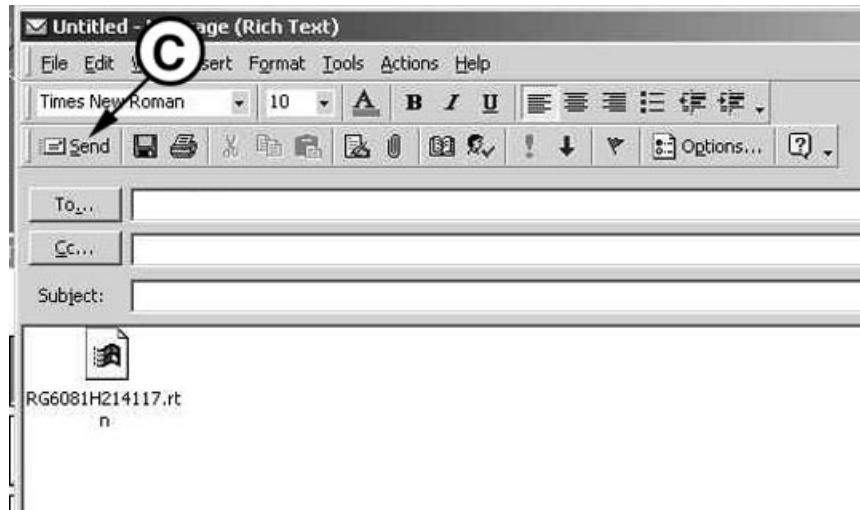
RG41221,0000098 -19-04NOV02-7/9

04  
160  
22

RG12626 -19-18SEP02



Return File Message



Automatic E-mail Generated

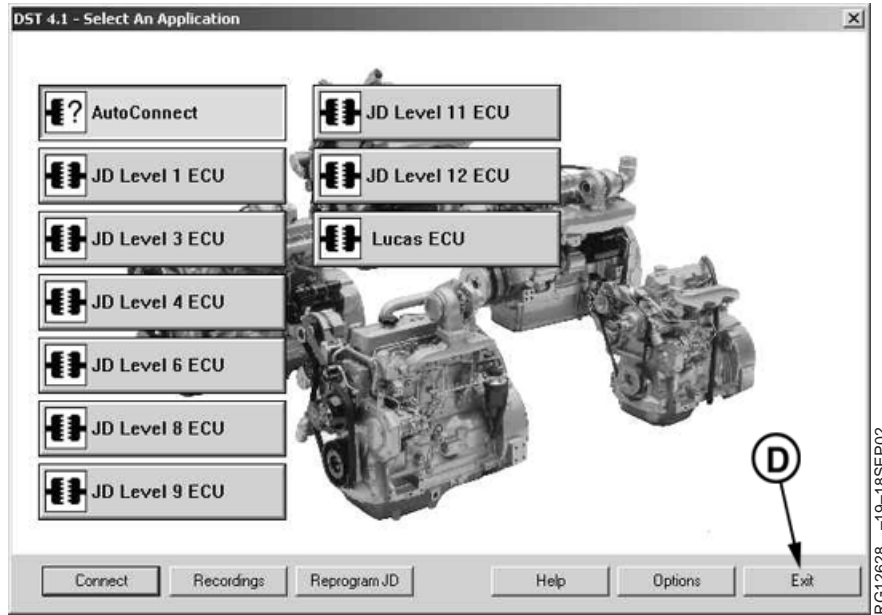
04  
160  
23

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

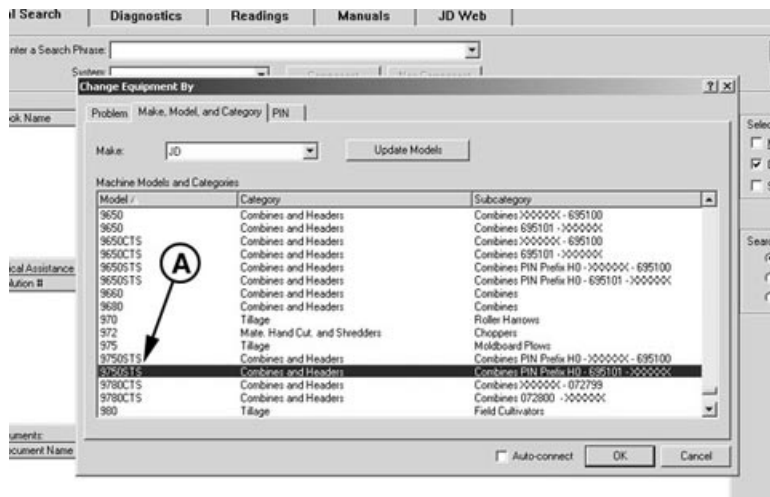
## Downloading Payload File For SERVICE ADVISOR™

*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



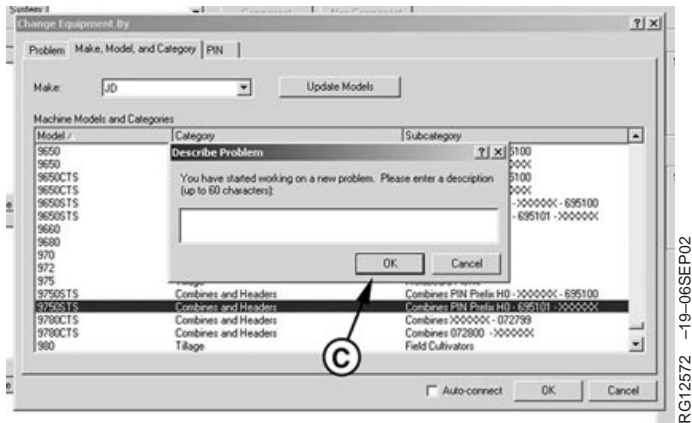
2. Select vehicle model (A) with the proper serial number range or if PIN is known select the PIN tab and enter PIN number. Click OK.

Continued on next page

RG41221.000094 -19-04NOV02-2/16

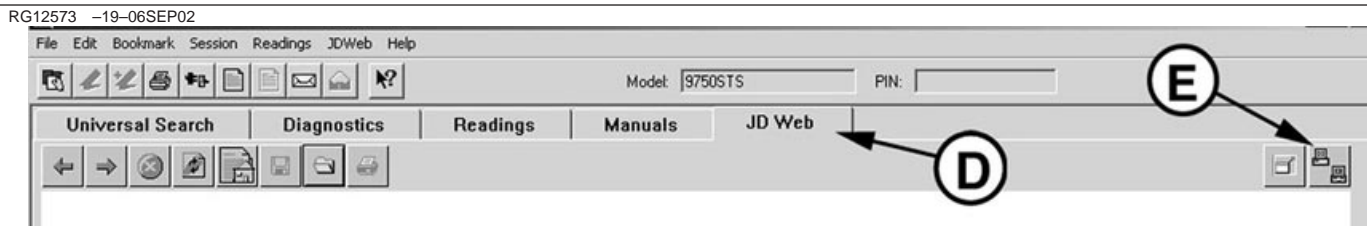
04  
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25

## Trouble Code Diagnostics and Tests



3. Describe Problem window will appear, click OK (C).

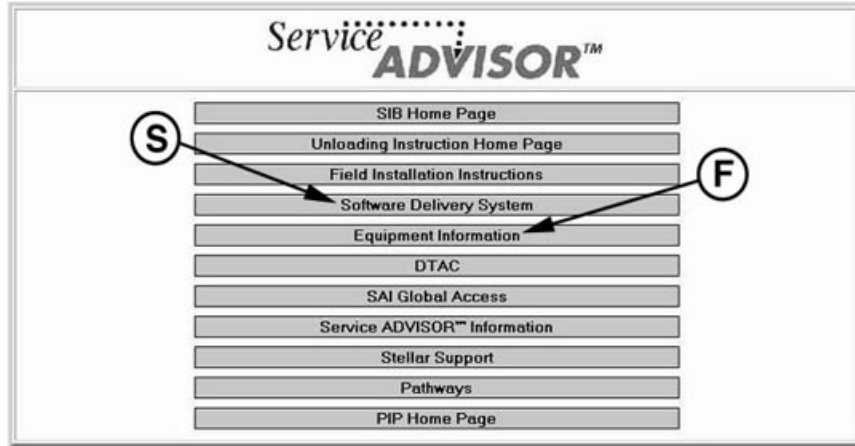
RG41221,0000094 -19-04NOV02-3/16



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



NOTE: Menu options may vary on the SERVICE ADVISOR™ menu.

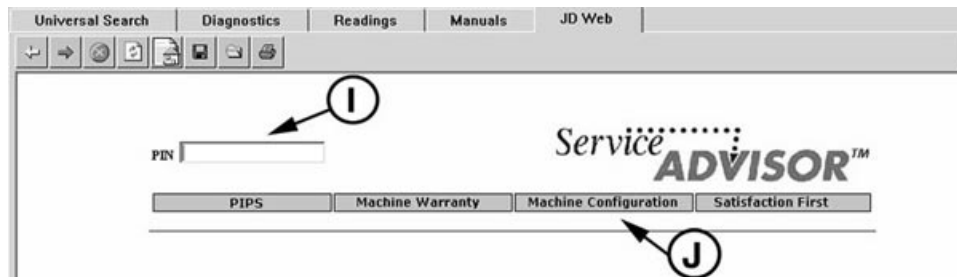
to step 10. With the PIN number only available click on "Equipment Information" (F) button.

5. If the Engine Serial number (ESN) is available click on "Software Delivery System" button (S) and skip

04  
160  
27

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RG41221,0000094 -19-04NOV02-5/16



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

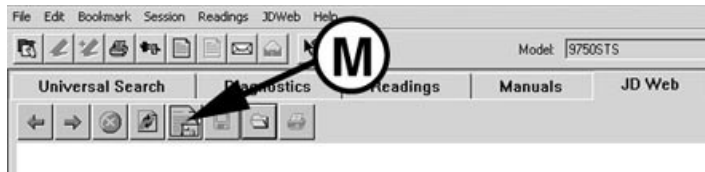
7. Hold left mouse button down and drag across the ESN so that it is highlighted. Click the right mouse

button and select "Copy" (L) or record the ESN for later use.

04  
160  
28

RG41221,0000094 -19-04NOV02-7/16

RG12577 -19-06SEP02

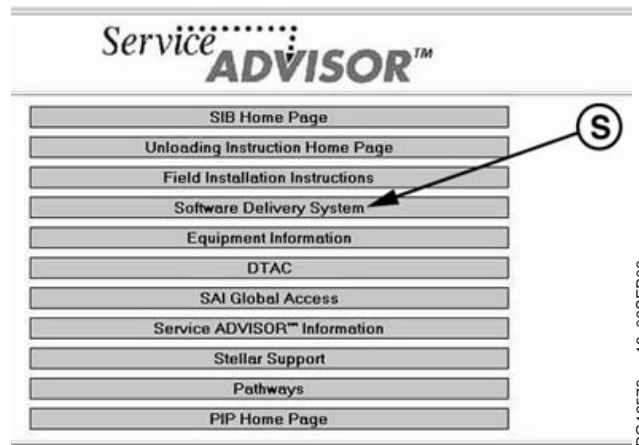


8. Click on the "Home" button (M) within SERVICE ADVISOR™ to go back to the menu.

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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™		



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™		



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  
29

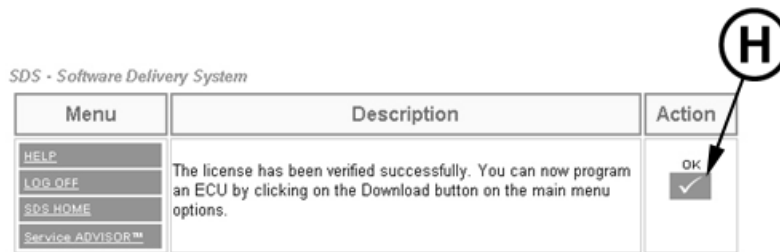


RG12613 -19-20SEP02

11. Click on "Grant Always" (G).

04  
160  
30

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  
31

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".

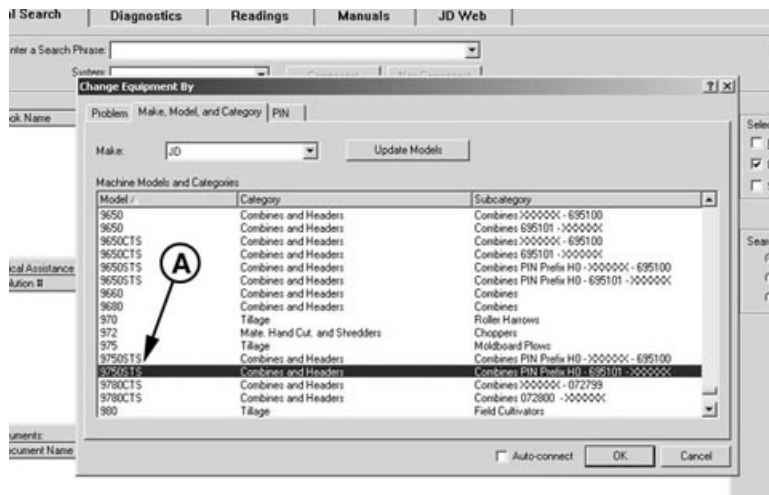
## Reprogramming Engine Control Unit (ECU) With SERVICE ADVISOR™

**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  
160  
33

**NOTE:** Internet connection is not required to program an engine control unit.

known select the PIN tab and enter PIN number. Click OK.

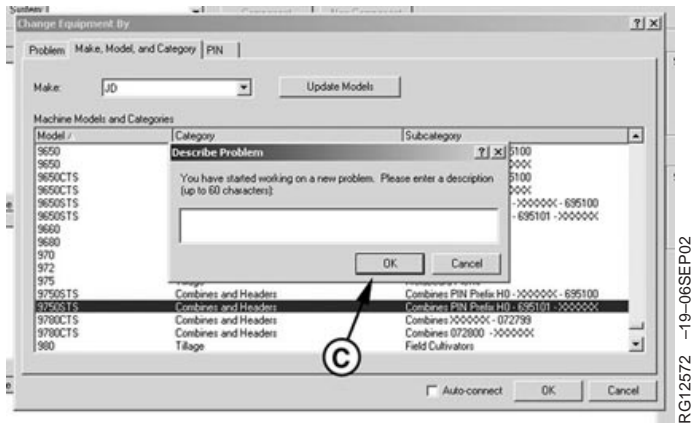
1. Start SERVICE ADVISOR™. Select vehicle model (A) with the proper serial number range or if PIN is

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Continued on next page

RG41221.000099 -19-04NOV02-2/8

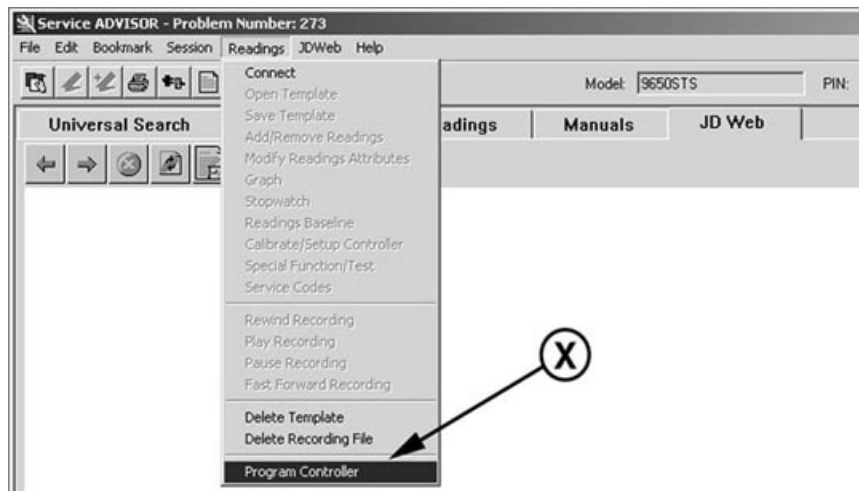
## Trouble Code Diagnostics and Tests



2. Describe Problem window will appear, click OK (C).

04  
160  
34

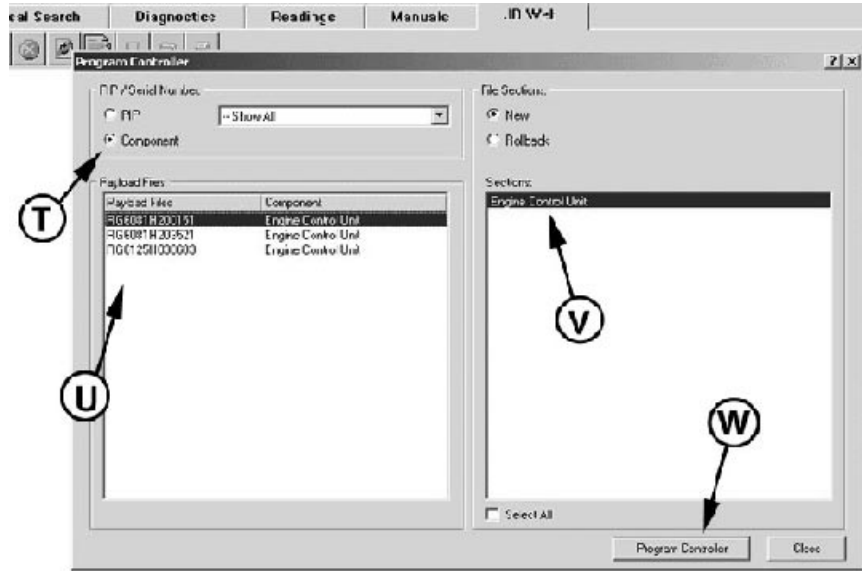
RG41221,0000099 -19-04NOV02-3/8



3. Click on "Readings" pull down menu and select "Program Controller" (X).

Continued on next page

RG41221,0000099 -19-04NOV02-4/8



RG12583 -19-06SEP02

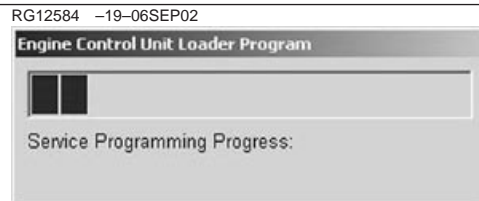
04  
160  
35

4. Select radio button for "Component" (T). Select the proper payload file for engine ECU (U).

5. Click once on "Engine Control Unit" (V) and click on "Program Controller" (W).

RG41221,0000099 -19-04NOV02-5/8

6. A progress bar will appear while reprogramming the ECU. The engine warning light may come on and a warning may sound while in process of reprogramming and should be ignored.



Continued on next page

RG41221,0000099 -19-04NOV02-6/8

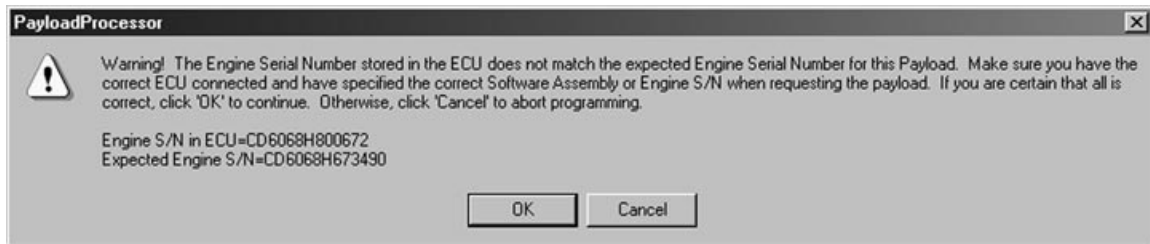


7. If the ECU is being replaced, the above message will appear. If you have the old ECU, connect to it

and click YES. If the old ECU is not available, click NO.

04  
160  
36

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.

### 2-DIGIT CODES

Most John Deere applications display DTCs as 2-digit codes read from an on-board display. An example is DTC 11. On most agricultural applications, the display or SERVICE ADVISOR™ will show ECU 11.

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

If diagnosing an application that shows DTCs as SPNs and FMIs, using the list below, determine the equivalent 2-digit code and use the diagnostic procedure later in this Group for that 2-digit code.

### CLEARING STORED DTCs

Stored DTCs can be cleared through the Diagnostic Scan Tool (DST) or through SERVICE ADVISOR™. If the DST or Service ADVISOR is unavailable, refer to the vehicle machine manual to determine how to clear the code reader on the vehicle.

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SERVICE ADVISOR

RG40854,0000015 -19-10JUL01-1/1

## Listing of Diagnostic Trouble Codes (DTCs) on ECU

Trouble codes can be displayed either as a 2-Digit code or as an SPN/FMI code. In this manual, the codes are shown as SPN/FMI codes. If the application is displaying the code in a 2-digit format, it will be necessary to convert the code using the code lists below.

### Ascending SPN/FMI Codes

#### DTC's Listing in Ascending SPN/FMI Codes

SPN	FMI	2-Digit Code	Definition
000028	03	13	Throttle #3 Input Voltage High
	04	14	Throttle #3 Input Voltage Low
000029	03	15	Throttle #2 Input Voltage High
	04	16	Throttle #2 Input Voltage Low
000091	03	11	Throttle #1 Input Voltage High
	04	12	Throttle #1 Input Voltage Low
	07	65	Throttle Calibration Aborted
000110	13	64	Throttle Not Properly Calibrated
	03	18	Engine Coolant Temperature Input Voltage High
	04	19	Engine Coolant Temperature Input Voltage Low
000190	00	42	Engine Overspeed
000190	02	42	Engine Speed Input Noise
000639	13	55	Controlled Area Network (CAN) Error
000810	02	92	Calculated Vehicle Speed Input Noise
000931	02	83	Pump Current Instability
	03	81	Pump Current Feedback Input Voltage High
	04	82	Pump Current Feedback Input Voltage Low
	15	85	Pump Current Measurement Error (Engine OFF)
	31	84	Pump Current Not Controllable
001041	02	41	Start Signal Missing
	03	46	Start Signal Always Active
001069	02	93	Tire Size Error
001079	03	21	Sensor Supply 1 Voltage High
	04	22	Sensor Supply 1 Voltage Low
002000	13	78	Security Violation

Continued on next page

RG40854.0000016 -19-10JUL01-1/2

**Ascending 2-Digit Codes**

**DTC's Listing in Ascending 2-Digit Codes**

2-Digit Code	SPN	FMI	Definition
11	000091	03	Throttle #1 Input Voltage High
12	000091	04	Throttle #1 Input Voltage Low
13	000028	03	Throttle #3 Input Voltage High
14	000028	04	Throttle #3 Input Voltage Low
15	000029	03	Throttle #2 Input Voltage High
16	000029	04	Throttle #2 Input Voltage Low
18	000110	03	Engine Coolant Temperature Input Voltage High
19	000110	04	Engine Coolant Temperature Input Voltage Low
21	001079	03	Sensor Supply 1 Voltage High
22	001079	04	Sensor Supply 1 Voltage Low
39	000190	02	Engine Speed Input Noise
41	001041	02	Start Signal Missing
42	000190	00	Engine Overspeed
46	001041	03	Start Signal Always Active
55	000639	13	Controlled Area Network (CAN) Error
64	000091	13	Throttle Calibration Aborted
65	000091	07	Throttle Not Calibrated Properly
78	002000	13	Security Violation
81	000931	03	Pump Current Feedback Input Voltage High
82	000931	04	Pump Current Feedback Input Voltage Low
83	000931	02	Pump Current Instability
84	000931	31	Pump Current Not Controllable
85	000931	15	Pump Current Measurement Error (Engine OFF)
92	000810	02	Calculated Vehicle Speed Input Signal Noise
93	001069	02	Tire Size Error

04  
160  
39

## Diagnostic Procedure

Diagnosis of the electronic control system should be performed according to the following procedure:

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly.
2. Read and record DTC(s).
3. Go to the diagnostic chart that corresponds to the DTC(s) present.

*NOTE: If more than one DTC is present, go to the chart corresponding to the lowest number DTC and diagnose that problem to correction unless directed to do otherwise.*

4. If no DTC(s) are present, proceed to the appropriate symptom diagnostic chart in Group 150 of this Section.
5. After any repairs are made, recheck to make sure all DTCs have been eliminated.

*NOTE: After using the DST, 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.**

RG40854.0000017 -19-10JUL01-1/1

04  
160  
40

## Intermittent Fault Diagnostics

Intermittent faults are problems that periodically “go away”. A problem such as a loose terminal that intermittently doesn’t make contact is a likely cause of an intermittent fault. Other intermittent faults may be set only under certain operating conditions such as heavy load, extended idle, etc. When diagnosing intermittent faults, take special note of the condition of wiring and connectors since a high percentage of intermittent problems originate here. Check for loose, dirty, or disconnected connectors. Inspect the wiring routing looking for possible shorts caused by contact with external parts (for example, rubbing against sharp sheet metal edges). Inspect the connector vicinity looking for wires that have pulled out of connector terminals, damaged connectors, poorly positioned terminals, and corroded or damaged terminals. Look for broken wires, damaged splices, and wire-to-wire shorts. Use good judgement if component replacement is thought to be required.

*NOTE: The ECU is the component LEAST likely to fail.*

### Suggestions for diagnosing intermittent faults:

- If diagnostic chart indicates that the problem is intermittent, try to reproduce the operating conditions that were present when the DTC set. The Diagnostic Scan Tool (DST) or SERVICE ADVISOR™ can be used to help locate intermittent problems, as it

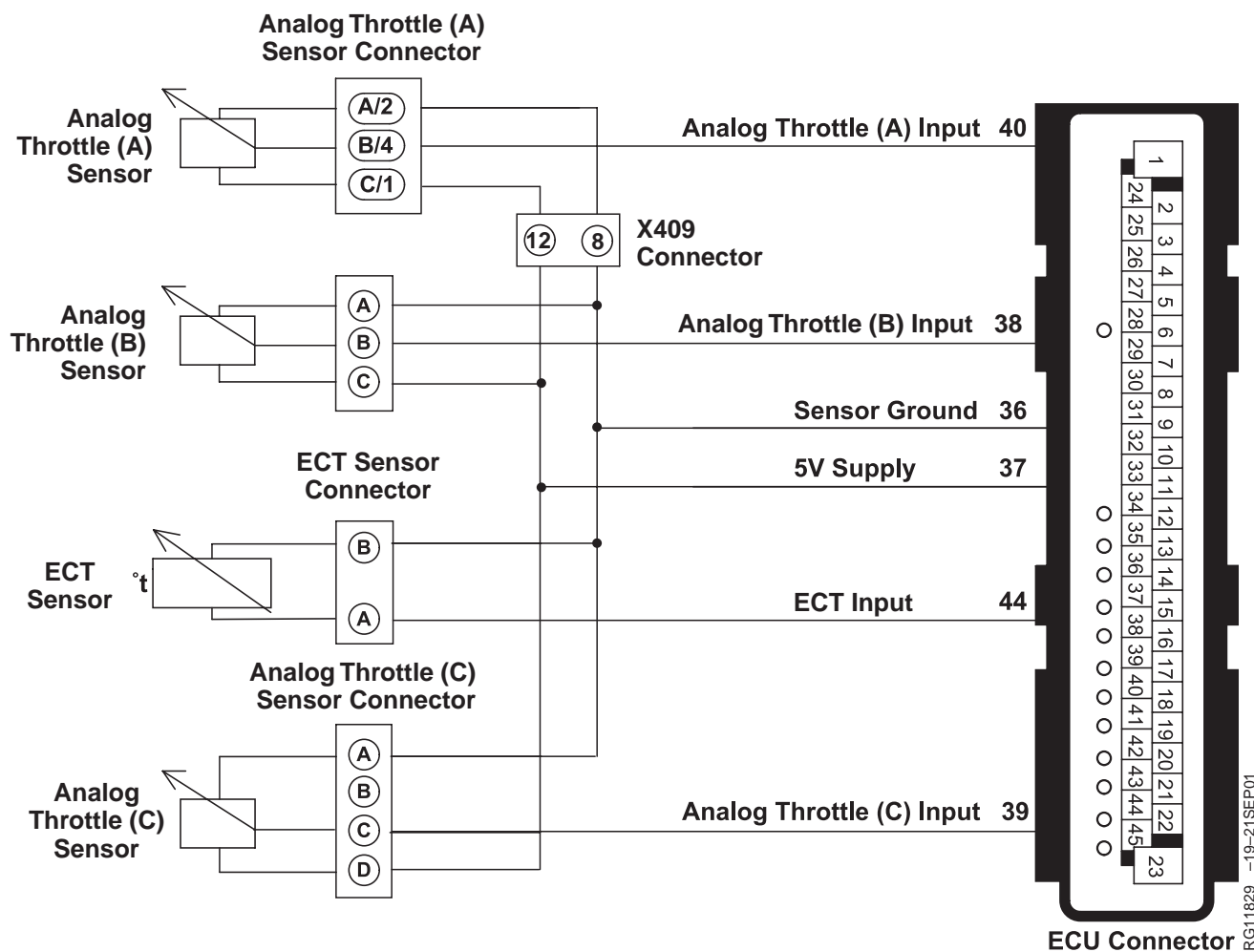
includes a function called Recording. This function permits the recording of data parameter values during a diagnostic session. If a DTC sets during a certain diagnostic session, the parameters can be played back and observed to see what each parameters’ value was when the DTC occurred.

- 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.

### 000028.03 — Analog Throttle (C) Input High



**NOTE:** Wiring diagram shows 6020 and 7020 Series Tractors. For wiring information on 6010 Tractors, see *ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM FOR 6010 SERIES TRACTORS* in Section 06, Group 210 of this manual. For wiring information on other applications, refer to machine manual.

#### 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. 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 4.75 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:

- When this code is set, the ECU will limit engine speed to 1400 rpm.

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### 000028.03 — Analog Throttle (C) Input High

The analog throttle (C) input voltage exceeds 4.75 volts. The voltage is higher than what is physically possible for the cruise analog throttle to achieve.

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### 000028.03 Analog Throttle (C) Input High Diagnostic Procedure

**IMPORTANT: Do not force probes into connector terminals 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: Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and the analog throttle (C) sensor connector looking for dirty, damaged, or poorly positioned terminals.*

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<p><b>1 Intermittent Fault Test</b></p>	<p><i>NOTE: If DTC 000028.03 is accompanied with DTC SPN 001079.03, follow the DTC 001079.03 diagnostic procedure first.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF</li> <li>2. Throttle in idle position</li> <li>3. If available, connect to and start the DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</i></p> <ol style="list-style-type: none"> <li>4. Monitor DTCs on: <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• Service ADVISOR</li> <li>• Vehicle code display</li> </ul> </li> </ol> <p><i>NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.</i></p> <ol style="list-style-type: none"> <li>5. Ignition ON, engine running</li> <li>6. Monitor DTCs</li> </ol>	<p><b>000028.03 reoccurs:</b> GO TO <b>3</b></p> <p><b>000028.03 cleared:</b> GO TO <b>2</b></p>
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Trouble Code Diagnostics and Tests

<p><b>2 Throttle Travel Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000028.03 Analog Throttle (C) Input High supporting information.</i></p> <p>Monitor DTCs while slowly operating the analog throttle (C) through full travel.</p>	<p><b>000028.03 reoccurs:</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>000028.03 cleared:</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 Throttle Position Input Shorted Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000028.03 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 (C) sensor connector</li> <li>3. Ignition ON, engine OFF</li> <li>4. Monitor DTCs, then clear all DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Monitor DTCs</li> </ol> <p><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p>	<p><b>000028.04 occurs:</b>                      GO TO <b>4</b></p> <p><b>000028.03 reoccurs:</b>                      Short to voltage in analog throttle (C) input circuit                      OR                      Faulty ECU</p>
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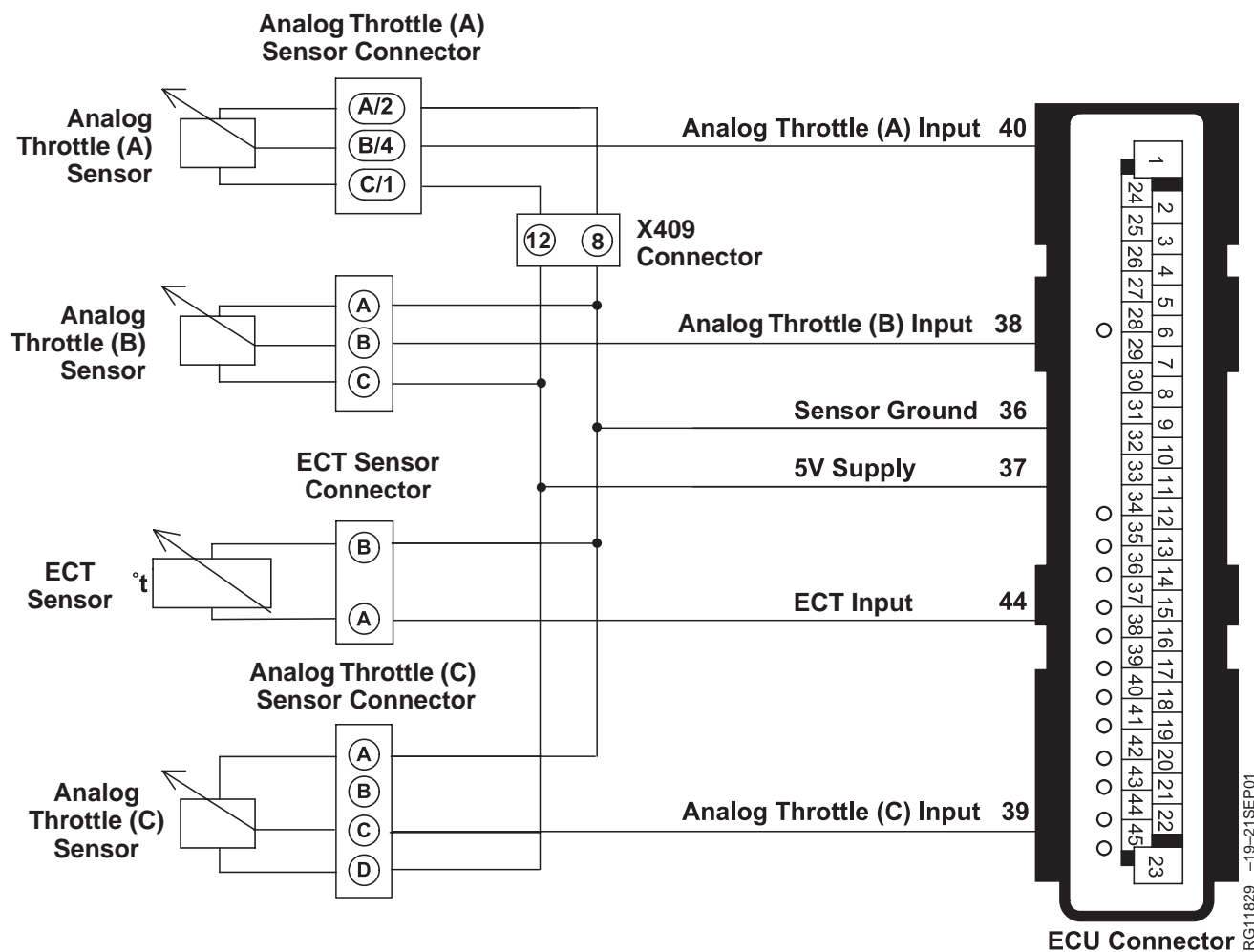
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<p><b>4 Throttle Position Ground Circuit Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000028.03 Analog Throttle (C) Input High supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition 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>
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### 000028.04 — Analog Throttle (C) Input Low



**NOTE:** Wiring diagram shows 6020 and 7020 Series Tractors. For wiring information on 6010 Tractors, see *ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM FOR 6010 SERIES TRACTORS* in Section 06, Group 210 of this manual. For wiring information on other applications, refer to machine manual.

#### 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. 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 goes below 0.25 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:

- When this code is set, the ECU will limit engine speed to 1400 rpm.

## 000028.04 — Analog Throttle (C) Input Low

The analog throttle (C) input voltage goes below 0.25 volts. The voltage is lower than what is physically possible for the cruise analog throttle to achieve.

RG40854,00000BD -19-05SEP01-1/1

### 000028.04 Analog Throttle (C) Input Low Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:** Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and the analog throttle (C) sensor connector looking for dirty, damaged, or poorly positioned terminals.

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#### 1 Intermittent Fault Test

**NOTE:** If DTC 000028.04 is accompanied with DTC 001079.04, follow the DTC 001079.04 diagnostic procedure first.

1. Ignition ON, engine OFF
2. Throttle in idle position
3. If available, connect to and start the DST or SERVICE ADVISOR™.

**NOTE:** For connection instructions, see *CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR* earlier in this Group.

#### 4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

**NOTE:** Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See *LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU* in Group 160 of this manual.

5. Ignition ON, engine running
6. Monitor DTCs

**000028.04 reoccurs:**  
GO TO 3

**000028.04 cleared:**  
GO TO 2

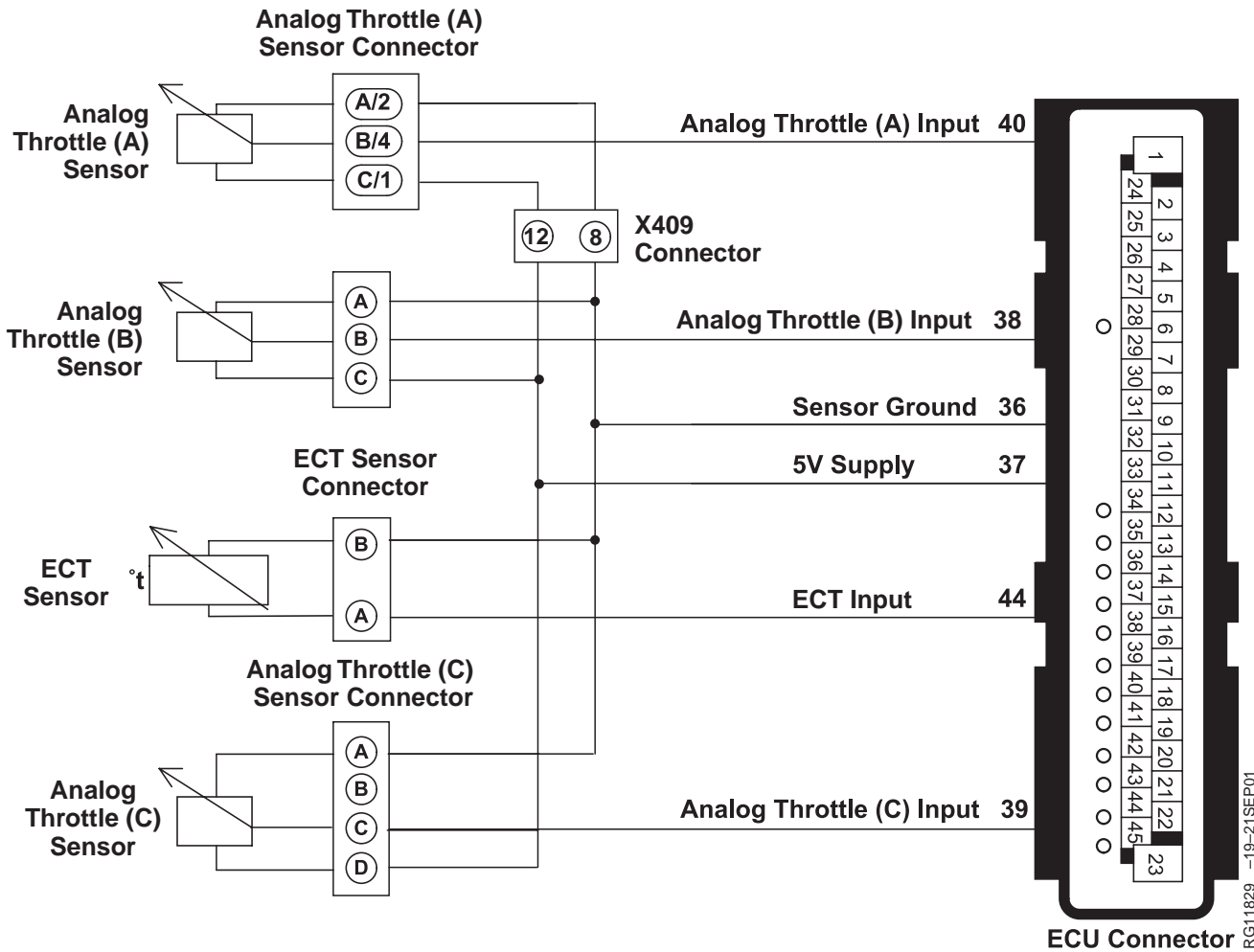
Trouble Code Diagnostics and Tests

<p><b>2 Throttle Travel Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000028.04 Analog Throttle (C) Input Low supporting information.</i></p> <p>Monitor DTCs while slowly operating the analog throttle (C) through full travel.</p>	<p><b>000028.04 reoccurs:</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>000028.04 cleared:</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>3 Throttle Position Wiring Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000028.04 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. Monitor DTCs</li> </ol>	<p><b>000028.04 reoccurs:</b>            GO TO <b>4</b></p> <p><b>000028.03 occurs:</b>            Faulty analog throttle (C) sensor connector            OR            Faulty analog throttle sensor</p> <p style="text-align: right;">-- -1/1</p>
<p><b>4 Throttle Position 5 V Supply Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000028.04 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><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p>	<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> <p style="text-align: right;">-- -1/1</p>

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160  
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000029.03 — Analog Throttle (B) Input High



**NOTE:** Wiring diagram shows 6020 and 7020 Series Tractors. For wiring information on 6010 Tractors, see *ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM FOR 6010 SERIES TRACTORS* in Section 06, Group 210 of this manual. For wiring information on other applications, refer to machine manual.

**Analog Throttle (B) Position Sensor**

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the hand throttle. 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 (B) input voltage exceeds the 4.5 volts. The voltage is higher than what is physically possible for the hand analog throttle to achieve.

**If this code sets, the following will occur:**

- The ECU will ignore the input from the hand analog throttle, and it will use the input values from the foot and cruise analog throttles.
- If the foot analog throttle is also faulted, the ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

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## 000029.03 — Analog Throttle (B) Input High

The analog throttle (B) input voltage exceeds the 4.5 volts. The voltage is higher than what is physically possible for the hand analog throttle to achieve.

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### 000029.03 Analog Throttle (B) Input High Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:** Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and the analog throttle (B) sensor connector looking for dirty, damaged, or poorly positioned terminals.

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04  
160  
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#### 1 Intermittent Fault Test

**NOTE:** For wiring and theory of operation information, see DTC 000029.03 Analog Throttle (B) Input Voltage High supporting information.

**NOTE:** If DTC 000029.03 is accompanied with DTC 001079.03, follow the DTC 001079.03 diagnostic chart first.

1. Ignition ON, engine OFF
2. Throttle in idle position
3. If available, connect to and start the DST or SERVICE ADVISOR™.

**NOTE:** For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.

4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

**NOTE:** Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.

5. Ignition ON, engine running
6. Monitor DTCs

**000029.03 reoccurs:**  
GO TO 3

**000029.03 cleared:**  
GO TO 2

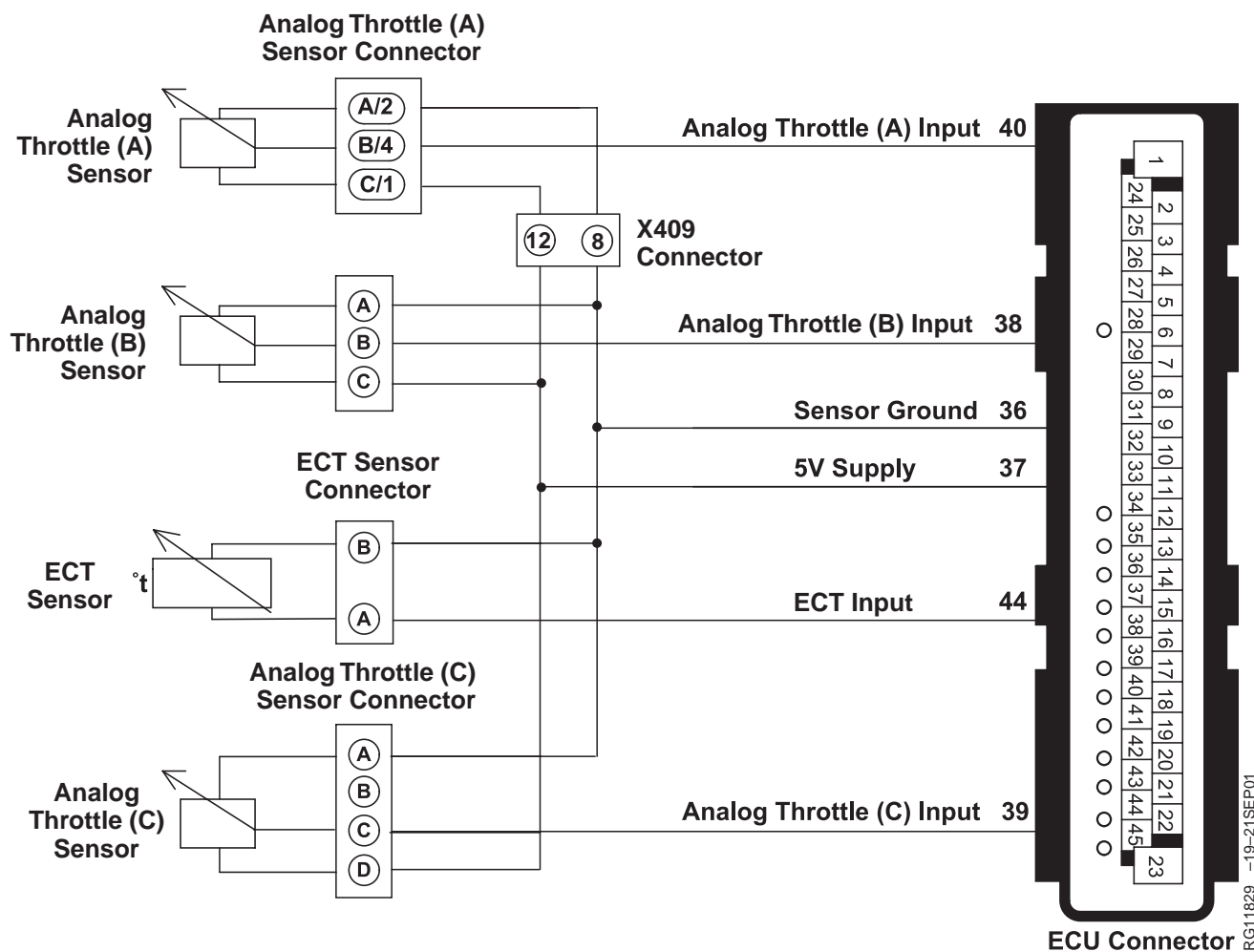
Trouble Code Diagnostics and Tests

<p><b>2 Throttle Travel Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000029.03 Analog Throttle (B) Input Voltage High supporting information.</i></p> <p>Monitor DTCs while slowly operating the analog throttle (B) through full travel.</p>	<p><b>000029.03 reoccurs:</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>000029.03 cleared:</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>3 Throttle Position Input Shorted Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000029.03 Analog Throttle (B) Input Voltage High supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect analog throttle (B) sensor connector</li> <li>3. Ignition ON, engine OFF</li> <li>4. Monitor DTCs, then clear DTCs</li> <li>5. Ignition ON, engine running</li> <li>6. Monitor DTCs</li> </ol>	<p><b>000029.04 occurs:</b>            GO TO 4</p> <p><b>000029.03 occurs:</b>            Short to voltage in analog throttle (B) input circuit            OR            Faulty ECU</p> <p style="text-align: right;">-- -1/1</p>
<p><b>4 Throttle Position Ground Circuit Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000029.03 Analog Throttle (B) Input Voltage High supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Analog throttle (B) sensor connector disconnected</li> <li>3. Using a test light connected to battery (+), probe the ground terminal in analog throttle (B) sensor harness connector</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  
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### 000029.04 — Analog Throttle (B) Input Low



**NOTE:** Wiring diagram shows 6020 and 7020 Series Tractors. For wiring information on 6010 Tractors, see *ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM FOR 6010 SERIES TRACTORS* in Section 06, Group 210 of this manual. For wiring information on other applications, refer to machine manual.

#### Analog Throttle (B) Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the hand throttle. 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 (B) input voltage goes below 0.5 volts. The voltage is lower than what is physically possible for the hand analog throttle to achieve.

#### If this code sets, the following will occur:

- The ECU will ignore the input from the hand analog throttle, and it will use the input values from the foot and cruise analog throttles.
- If the foot analog throttle is also faulted, the ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

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## 000029.04 — Analog Throttle (B) Input Low

The analog throttle (B) input voltage goes below exceeds the 0.5 volts. The voltage is lower than what

is physically possible for the hand analog throttle to achieve.

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### 000029.04 Analog Throttle (B) Input Low Diagnostic Procedure

**IMPORTANT: Do not force probes into connector terminals 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: Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and the analog throttle (B) sensor connector looking for dirty, damaged, or poorly positioned terminals.*

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160  
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#### ① Intermittent Fault Test

*NOTE: For wiring and theory of operation information, see DTC 000029.04 Analog Throttle (B) Input Voltage Low supporting information.*

*NOTE: If DTC 000029.04 is accompanied with DTC 001079.04, follow the DTC 001079.04 diagnostic procedure first.*

1. Ignition ON, engine OFF
2. Throttle in idle position
3. If available, connect to and start the DST or SERVICE ADVISOR™.

*NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.*

4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

*NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.*

5. Ignition ON, engine running
6. Monitor DTCs

**000029.04 reoccurs:**  
GO TO ③

**000029.04 cleared:**  
GO TO ②

Trouble Code Diagnostics and Tests

<p><b>2 Throttle Travel Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000029.04 Analog Throttle (B) Input Voltage Low supporting information.</i></p> <p>Monitor DTCs while slowly operating the analog throttle (B) through full travel.</p>	<p><b>000029.04 reoccurs:</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>000029.04 cleared:</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 Throttle Position Wiring Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000029.04 Analog Throttle (B) Input Voltage Low supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect analog throttle (B) 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. Monitor DTCs</li> </ol>	<p><b>000029.04 reoccurs:</b>                      GO TO <b>4</b></p> <p><b>000029.03 occurs:</b>                      Faulty analog throttle (B) sensor connector                      OR                      Faulty analog throttle sensor</p>
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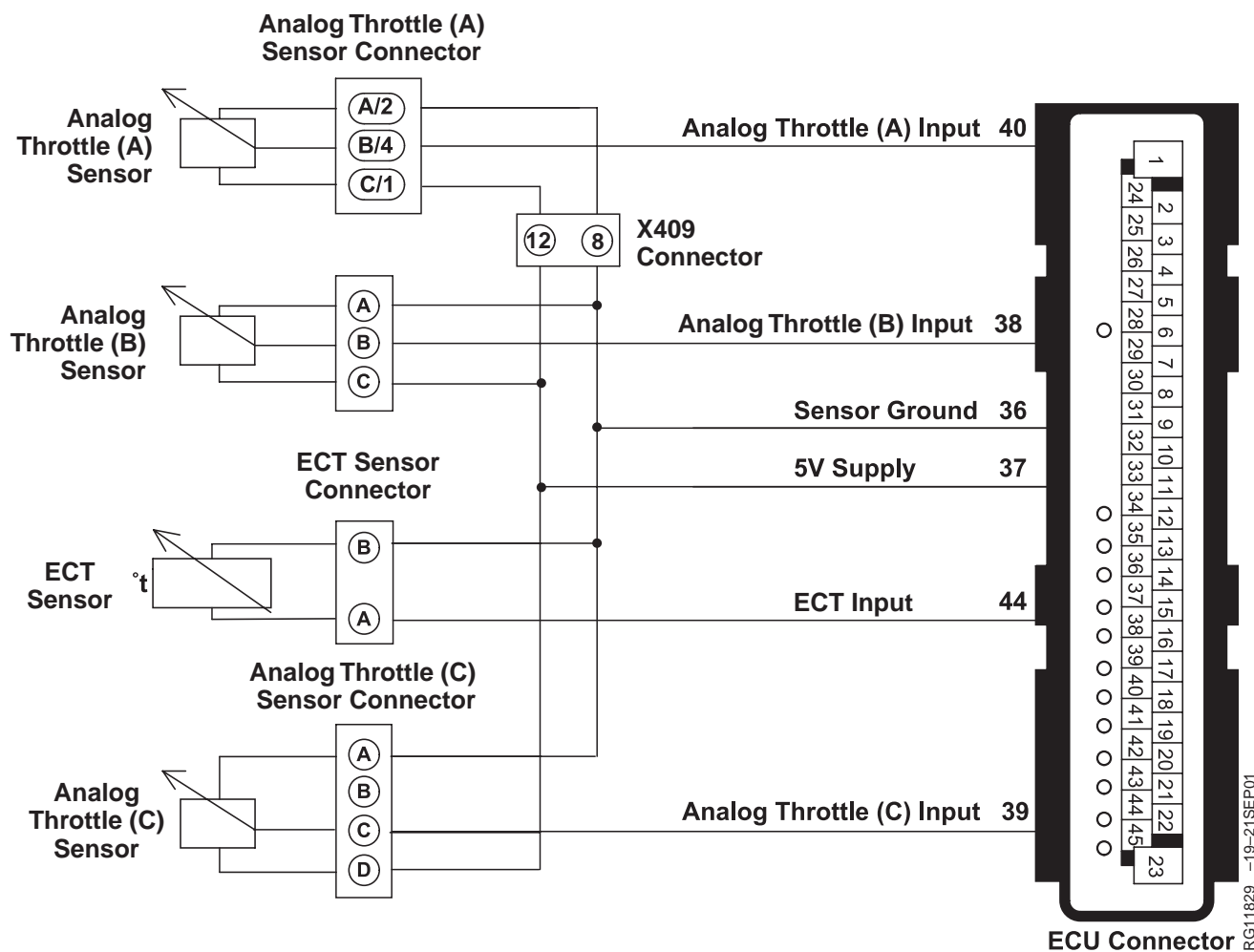
<p><b>4 Throttle Position 5 V Supply Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000029.04 Analog Throttle (B) Input Voltage Low supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Remove jumper wire between the two terminals</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><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p>	<p><b>4.0 - 6.0 V:</b>                      Open in analog throttle (B) input circuit                      OR                      Short to ground in analog throttle (B) input circuit                      OR                      Faulty ECU connection                      OR                      Faulty ECU</p> <p><b>Below 4.0 V:</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 connection                      OR                      Faulty ECU</p>
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04  
160  
56



### 000091.03 — Analog Throttle (A) Input High



**NOTE:** Wiring diagram shows 6020 and 7020 Series Tractors. For wiring information on 6010 Tractors, see *ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM FOR 6010 SERIES TRACTORS* in Section 06, Group 210 of this manual. For wiring information on other applications, refer to machine manual.

#### Analog Throttle (A) Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the foot throttle. 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 (A) input voltage exceeds the 4.5 volts. The voltage is higher than what is physically possible for the foot analog throttle to achieve.

#### If this code sets, the following will occur:

- The ECU will ignore the input from the foot analog throttle, and it will use the input values from the hand and cruise analog throttles.
- If the hand analog throttle is also faulted, the ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

### 000091.03 — Analog Throttle (A) Input High

The analog throttle (A) input voltage exceeds the 4.5 volts. The voltage is higher than what is physically possible for the foot analog throttle to achieve.

RG40854,00000C1 -19-05SEP01-1/1

#### 000091.03 Analog Throttle (A) Input High Diagnostic Procedure

**IMPORTANT: Do not force probes into connector terminals 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: Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and the analog throttle (A) sensor connector looking for dirty, damaged, or poorly positioned terminals.*

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04  
160  
59

<p><b>1 Intermittent Fault Test</b></p>	<p><i>NOTE: If DTC 000091.03 is accompanied with DTC 001079.03, follow the DTC 001079.03 diagnostic procedure first.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON, engine OFF</li> <li>2. Throttle in idle position</li> <li>3. If available, connect to and start the DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</i></p> <ol style="list-style-type: none"> <li>4. Monitor DTCs on: <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• Service ADVISOR</li> <li>• Vehicle code display</li> </ul> </li> </ol> <p><i>NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.</i></p> <ol style="list-style-type: none"> <li>5. Ignition ON, engine running</li> <li>6. Monitor DTCs</li> </ol>	<p><b>000091.03 reoccurs:</b> GO TO <b>4</b></p> <p><b>000091.03 cleared:</b> GO TO <b>2</b></p>
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*Trouble Code Diagnostics and Tests*

<p><b>② Throttle Travel Voltage Test</b></p>	<p><i>NOTE: This check is not required for engines that are in 6010 Tractors. For these engines GO TO ③.</i></p> <p>Monitor DTCs while slowly operating the analog throttle (A) through full travel.</p>	<p><b>000091.03 reoccurs :</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>000091.03 cleared:</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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04  
160  
60

<p><b>③ Travel Related Problem</b></p>	<p><i>NOTE: The check below is only required on 6010 Tractors.</i></p> <p>At what point in the throttle travel did 000091.03 reoccur?</p>	<p><b>Only present at upper range of throttle travel:</b>            Perform throttle calibration procedure.            See ADJUST HAND THROTTLE LEVER AND ACCELERATOR PEDAL and DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</p> <p><b>Always present:</b>            Faulty analog throttle (A) sensor connector            OR            Open in analog throttle (A) sensor ground circuit            OR            Faulty analog throttle (A) sensor</p> <p style="text-align: right;">-- -1/1</p>
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## Trouble Code Diagnostics and Tests

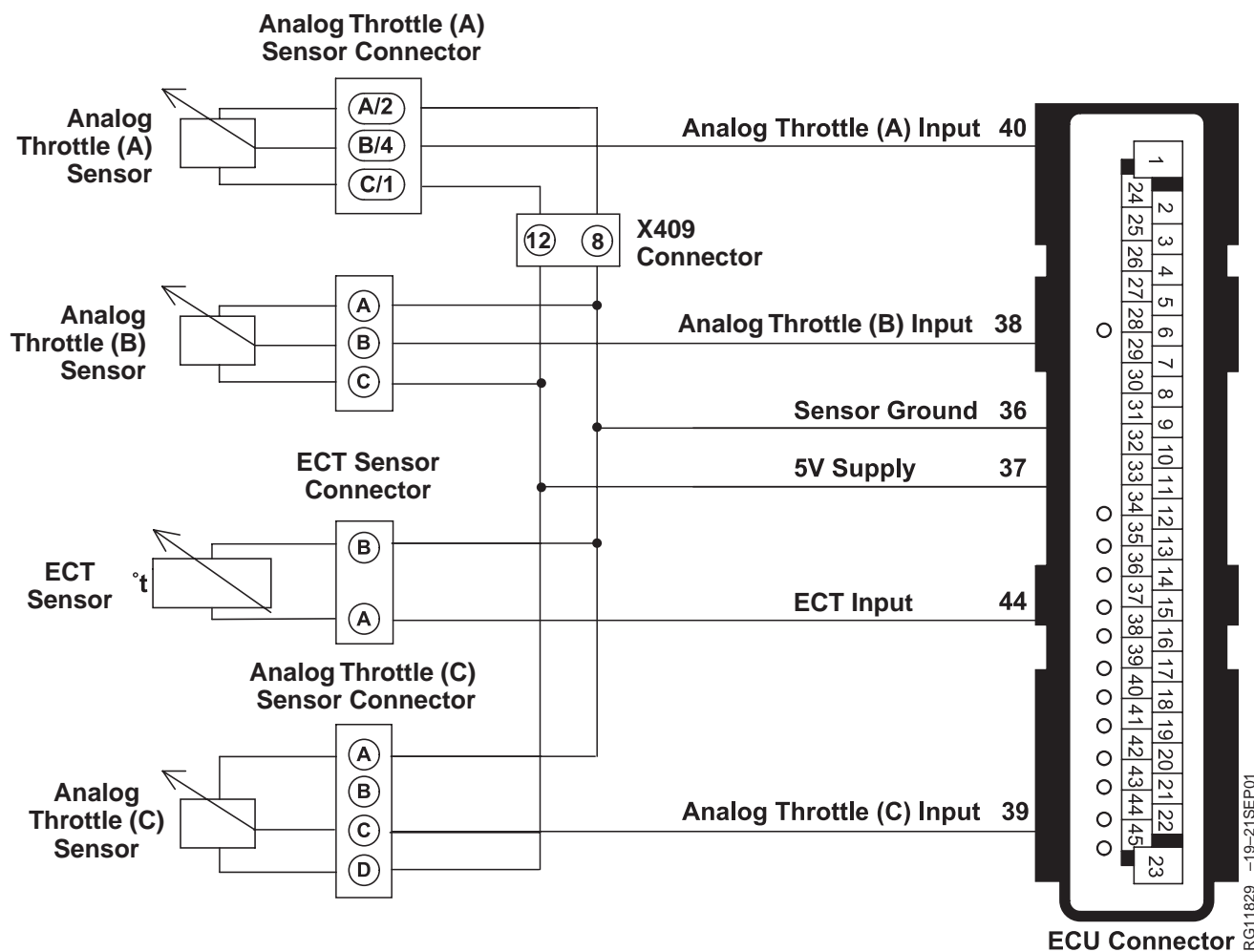
<p><b>④ Throttle Position Input Shorted Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000091.03 Analog Throttle (A) Input Voltage High supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect analog throttle (A) sensor connector</li> <li>3. Ignition ON, engine OFF</li> <li>4. Monitor DTCs, then clear all DTCs.</li> <li>5. Ignition ON, engine running</li> <li>6. Monitor DTCs</li> </ol> <p><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p>	<p><b>000091.04 occurs:</b> GO TO <b>⑤</b></p> <p><b>000091.03 occurs:</b> Short to voltage in analog throttle input circuit OR Faulty ECU</p>
<p><b>⑤ Throttle Position Ground Circuit Open Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000091.03 Analog Throttle (A) Input Voltage 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 in analog throttle (A) sensor harness connector</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>

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160  
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### 000091.04 — Analog Throttle (A) Input Low



**NOTE:** Wiring diagram shows 6020 and 7020 Series Tractors. For wiring information on 6010 Tractors, see *ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM FOR 6010 SERIES TRACTORS* in Section 06, Group 210 of this manual. For wiring information on other applications, refer to machine manual.

#### Analog Throttle (A) Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the foot throttle. 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 (A) input voltage goes below 0.5 volts. The voltage is lower than what is physically possible for the foot analog throttle to achieve.

#### If this code sets, the following will occur:

- The ECU will ignore the input from the foot analog throttle, and it will use the input values from the hand and cruise analog throttles.
- If the hand analog throttle is also faulted, the ECU will use a default “limp-home” throttle value that will only allow idle engine speed.

## 000091.04 — Analog Throttle (A) Input Low

The analog throttle (A) input voltage goes below 0.5 volts. The voltage is lower than what is physically possible for the foot analog throttle to achieve.

RG40854,00000C2 -19-05SEP01-1/1

### 000091.04 - Analog Throttle (A) Input Low Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:* Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and the analog throttle (A) sensor connector looking for dirty, damaged, or poorly positioned terminals.

-- 1/1

04  
160  
63

#### 1 Intermittent Fault Test

*NOTE:* If DTC 000091.04 is accompanied with DTC 001079.04, follow the DTC 001079.04 diagnostic procedure first.

1. Ignition ON, engine OFF
2. Throttle in idle position
3. If available, connect to and start the DST or SERVICE ADVISOR™.

*NOTE:* For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.

#### 4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

*NOTE:* Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.

5. Ignition ON, engine running
6. Monitor DTCs

**000091.04 reoccurs:**  
GO TO 4

**000091.04 cleared:**  
GO TO 2

## Trouble Code Diagnostics and Tests

<p><b>② Throttle Travel Voltage Test</b></p>	<p><i>NOTE: This check is not required for engines that are in 6010 Tractors. For these engines GO TO ③.</i></p> <p>Monitor DTCs while slowly operating the analog throttle (A) through full travel</p>	<p><b>000091.04 reoccurs:</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>000091.04 cleared:</b>            Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group</p>
<p><b>③ Calibration Related Check</b></p>	<p><i>NOTE: The check below is only required on 6010 Tractors.</i></p> <p>At what point in the throttle travel did 000091.03 reoccur?</p> <p>When did 000091.03 reoccur when the throttle was operated through full travel?</p>	<p><b>Only present at upper range of throttle travel:</b>            Perform throttle calibration procedure. See ADJUST HAND THROTTLE LEVER AND ACCELERATOR PEDAL and DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</p> <p><b>Always present:</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>④ Throttle Position Wiring Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000091.04 Analog Throttle (A) Input Voltage Low supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect analog throttle (A) 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. Monitor DTCs</li> </ol>	<p><b>000091.04 reoccurs:</b>            GO TO ⑤</p> <p><b>000091.03 occurs:</b>            Faulty analog throttle (A) sensor connector            OR            Faulty analog throttle sensor</p>

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-- -1/1

-- -1/1

Trouble Code Diagnostics and Tests

<p><b>5 Throttle Position 5V Supply Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000091.04 Analog Throttle (A) Input Voltage 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><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p>	<p><b>4.0 - 6.0 V:</b> Open in analog throttle (A) input circuit OR Short to ground in analog throttle (A) input circuit OR Faulty ECU connection OR Faulty ECU</p> <p><b>Below 4.0 V:</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 connection OR Faulty ECU</p> <p>-- -1/1</p>
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04  
160  
65

## 000091.07 — Throttle Not Calibrated Properly

*A new ECU has been installed and the throttle calibration has yet to be performed.*

### Throttle Calibration

Throttle calibration is necessary to allow the ECU to learn the range of the throttle. It is done when a new ECU or a new throttle has been installed.

### DTC 000091.07 will set if:

- A new ECU has been installed and the throttle calibration has yet to be performed.

### If DTC 000091.07 sets, the following will occur:

- The engine will not run if this code is active.

### If DTC 000091.07 sets:

- Diagnose other ECU codes first.
- Check hand throttle (foot throttle) adjustment. See ADJUST HAND THROTTLE LEVER AND ACCELERATOR PEDAL in Section 230 Group 15 of TM 4552.
- Calibrate ECU Controller. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.
- A mechanical fault may exist at throttle lever.

RG40854,00000F2 -19-24OCT01-1/1

04  
160  
66

## 000091.13 — Throttle Calibration Aborted

*Throttle calibration mode was enabled but was aborted before it was completed.*

### Throttle Calibration

Throttle calibration is necessary to allow the ECU to learn the range of the throttle. It is done when a new ECU or a new throttle has been installed.

### DTC 000091.13 will set if:

- Throttle calibration mode was enabled but was aborted before it was completed.

### If DTC 000091.13 sets, the following will occur:

- The engine will not run if this code is active.

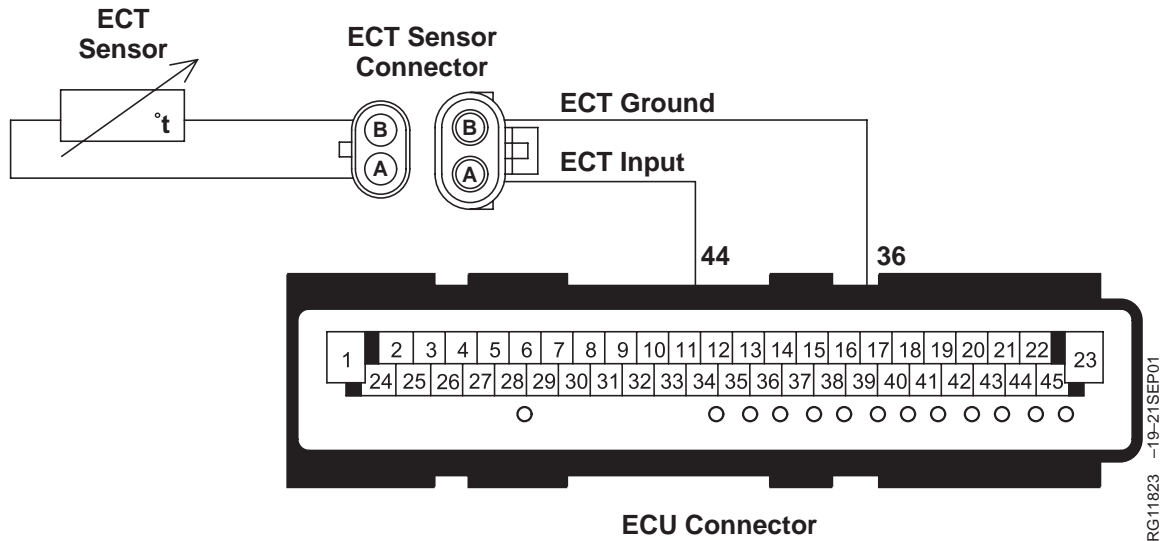
### If DTC 000091.13 sets:

- Diagnose other ECU codes first.
- Check hand throttle (foot throttle) adjustment. See ADJUST HAND THROTTLE LEVER AND ACCELERATOR PEDAL in Section 230 Group 15 of TM 4552.
- Calibrate ECU Controller. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.
- A mechanical fault may exist at throttle lever.
- If 000091.13 occurs while attempting to perform the throttle calibration, ensure that the procedure is being done correctly. If the procedure is being done correctly, but the DTC still occurs, refer to the diagnostic procedures for 001041.03 and 000190.02 to check that the start signal circuit is not intermittently shorting to the voltage source, and to make sure the engine speed circuit is not picking up a faulty signal.

04  
160  
67

RG40854,00000F3 -19-25OCT01-1/1

### 000110.03 — Engine Coolant Temperature Input Voltage High



RG11823 -19-21SEP01

#### ECT (Engine Coolant Temperature) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the rear of cylinder head. 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.

- The ECT input voltage exceeds 4.975 volts. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant.

#### If DTC 000110.03 sets, the following will occur:

- When in start mode, the ECU will default the ECT to -30°C (-22°F).
- When in running mode, the ECU will default the ECT to 80°C (176°F).

#### DTC 000110.03 will set if:

RG40854,00000C7 -19-05SEP01-1/1

### 000110.03 — Engine Coolant Temperature Input Voltage High

The ECT input voltage exceeds 4.975 volts. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant.

RG40854,00000C4 -19-05SEP01-1/1

#### 000110.03 Engine Coolant Temperature Input Voltage High Diagnostic Procedure

**IMPORTANT: Do not force probes into connector terminals 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: Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.*

-- 1/1

04  
160  
69

#### 1 Intermittent Fault Test

*NOTE: For wiring and theory of operation information, see DTC 000110.03 Engine Coolant Temperature Input Voltage High supporting information.*

1. Warm engine
2. Ignition ON, engine OFF
3. If available, connect to and start the DST or SERVICE ADVISOR™.

*NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.*

#### 4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

*NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.*

5. Make note of DTCs and clear all DTCs
6. Ignition ON, engine running
7. Monitor DTCs

**000110.03 reoccurs:**  
GO TO 2

**000110.03 doesn't reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

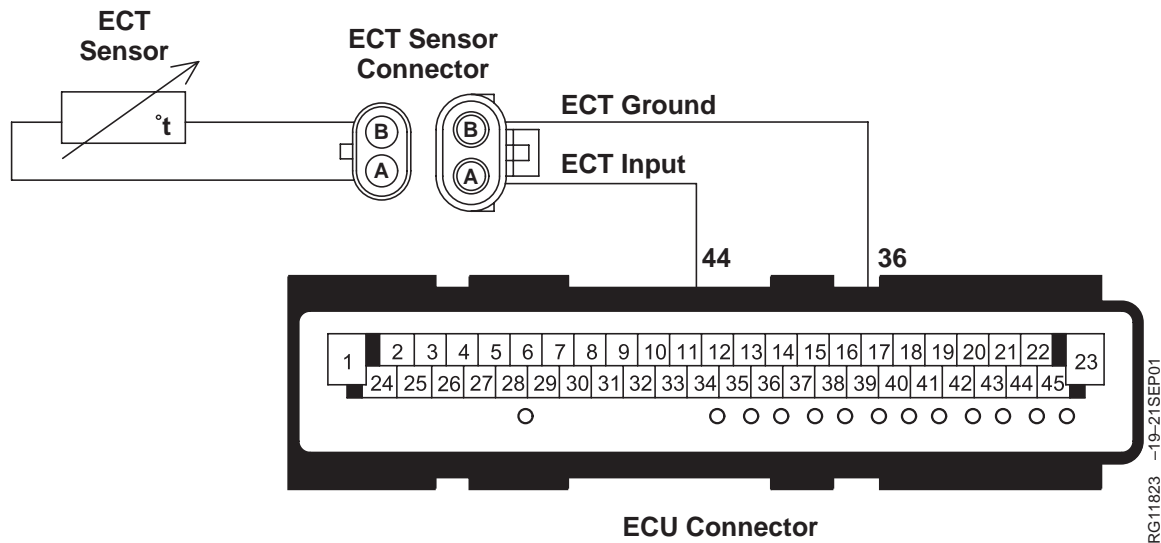
## Trouble Code Diagnostics and Tests

<p><b>② Engine Coolant Temperature (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 harness connector</li> <li>4. Ignition ON, engine OFF</li> <li>5. Monitor DTCs, then clear all DTCs</li> <li>6. Ignition ON, engine running</li> <li>7. Monitor DTCs</li> </ol>	<p><b>000110.03 reoccurs:</b> GO TO ④</p> <p><b>000110.04 occurs:</b> Faulty ECT sensor connector OR Faulty ECT sensor</p> <p style="text-align: right;">-- -1/1</p>
<p><b>③ Engine Coolant Temperature (ECT) Open Ground 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. Ignition ON, engine OFF</li> <li>4. Using a multimeter, measure voltage between ECU 5 V supply terminal and a good chassis ground.</li> </ol> <p><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p>	<p><b>4.0 - 6.0 V:</b> Open in ECT input sensor circuit OR Faulty ECU connection OR Faulty ECU</p> <p><b>Below 4.0 V:</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  
70

04  
160  
71

### 000110.04 — Engine Coolant Temperature Input Voltage Low



RG11823 -19-21SEP01

#### 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.

#### DTC 000110.04 will set if:

- The ECT input voltage drops below 0.05 volts. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.

#### If DTC 000110.04 sets, the following will occur:

- When in start mode, the ECU will default the ECT to -30°C (-22°F).
- When in running mode, the ECU will default the ECT to 80°C (176°F).
- ECU's high ECT engine protection feature disabled.

RG40854,00000C5 -19-05SEP01-1/1

## 000110.04 — Engine Coolant Temperature Input Voltage Low

The ECT input voltage drops below 0.05 volts. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.

RG40854,00000C6 -19-05SEP01-1/1

### 000110.04 Engine Coolant Temperature Input Voltage Low Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:** Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.

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04  
160  
73

#### ① Intermittent Fault Test

**NOTE:** For wiring and theory of operation information, see DTC 000110.04 Engine Coolant Temperature Input Voltage Low supporting information

1. Warm engine
2. Ignition ON, engine OFF
3. If available, connect to and start the DST or SERVICE ADVISOR™.

**NOTE:** For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.

4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

**NOTE:** Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.

5. Make note of DTCs and clear all DTCs
6. Ignition ON, engine running
7. Monitor DTCs

**000110.04 occurs:**  
GO TO ②

**000110.04 doesn't reoccur:**  
Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

Trouble Code Diagnostics and Tests

② Engine Coolant Temperature (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. Make note of all DTCs, then clear all DTCs
4. Ignition ON, engine running
5. Monitor DTCs

*NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.*

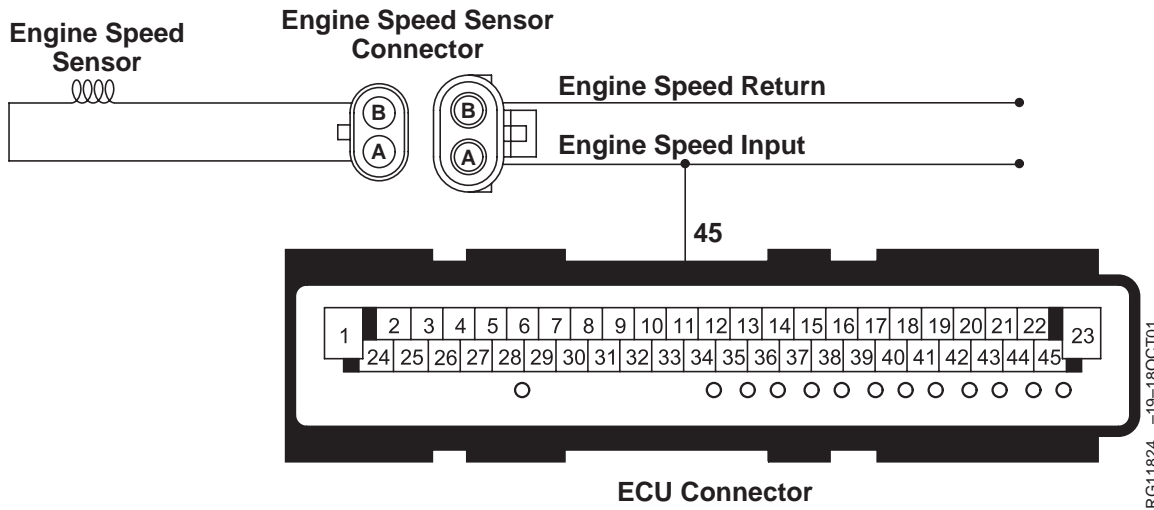
**000110.04 reoccurs:**  
Short to ground in ECT sensor input circuit  
OR  
Faulty ECU

**000110.03 occurs:**  
Faulty ECT sensor

--1/1

04  
160  
74

**000190.00 — Engine Overspeed**



The ECU detects that engine speed exceeds 2800 rpm.

**Engine Speed Sensor**

- The engine speed sensor is located in the injection pump gear housing. It is an inductive type pickup sensor that detects teeth on the pump gear. The ECU uses the engine speed sensor to determine engine speed.

**DTC 000190.00 will set if:**

- The ECU detects that engine speed exceeds 2800 rpm.

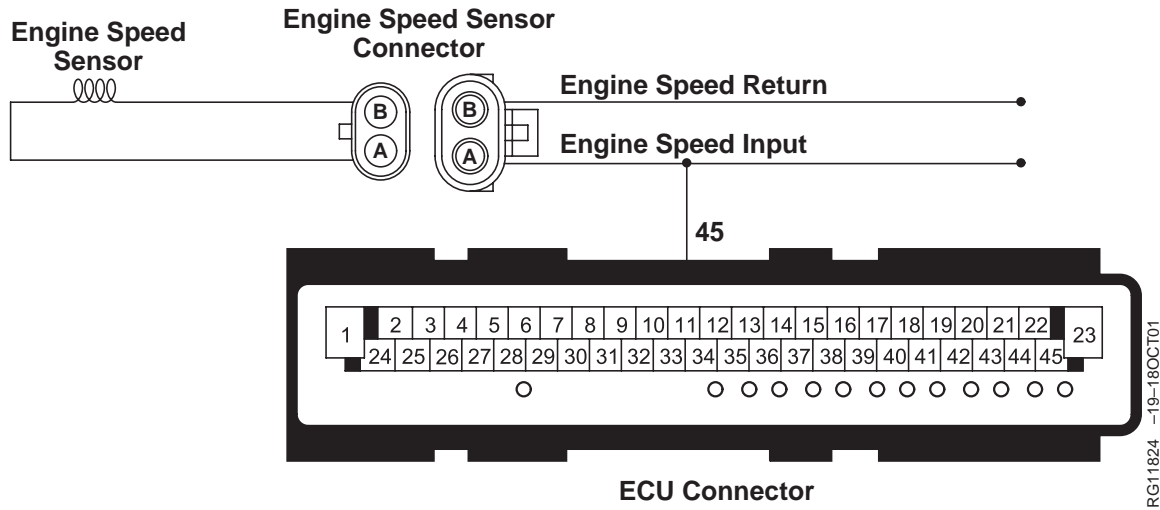
**If DTC 000190.00 sets:**

- Change gears to slow engine speed.

RG40854.00000C8 -19-05SEP01-1/1

04  
160  
75

**000190.02 — Engine Speed Input Noise**



04  
160  
76

**Engine Speed Sensor**

- The engine speed sensor is located in the injection pump gear housing. It is an inductive type pickup sensor that detects teeth on the pump gear. The ECU uses the engine speed sensor to determine engine speed.

**DTC 000190.02 will set if:**

- The ECU detects a missing signal or an erratic signal from the engine speed sensor when the engine is cranking or running.

**If DTC 000190.02 sets, the following will occur:**

- In most cases, the engine will not run.

RG40854,00000C9 -19-05SEP01-1/1

## 000190.02 — Engine Speed Input Noise

The ECU detects a missing signal or an erratic signal from the engine speed sensor when the engine is cranking or running.

RG40854,00000CA -19-05SEP01-1/1

### 000190.02 Engine Speed Input Noise Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:* Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and the engine speed sensor connector looking for dirty, damaged, or poorly positioned terminals.

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04  
160  
77

#### ① Intermittent Fault Test

*NOTE:* For wiring and theory of operation information, see DTC 000190.02 Engine Speed Input Noise supporting information.

1. Warm engine
2. Ignition ON, engine OFF
3. If available, connect to and start the DST or SERVICE ADVISOR™.

*NOTE:* For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.

#### 4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

*NOTE:* Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.

5. Make note of DTCs and clear all DTCs
6. Ignition ON, engine running
7. Monitor DTCs

**000190.02 occurs:**  
GO TO ②

**000190.02 doesn't 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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## Trouble Code Diagnostics and Tests

<p><b>② Engine Speed Sensor Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000190.02 Engine Speed Input Noise supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect engine speed sensor connector</li> <li>3. Using a multimeter, measure resistance between both terminals of the engine speed sensor</li> </ol>	<p><b>Between 2500 and 3500 ohms:</b> GO TO ③</p> <p><b>Below 2500 ohms or above 3500 ohms:</b> Faulty engine speed sensor</p> <p style="text-align: right;">-- -1/1</p>
<p><b>③ Open in Engine Speed Sensor Input Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000190.02 Engine Speed Input Noise supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Disconnect engine speed sensor connector</li> <li>2. Disconnect ECU connector</li> <li>3. Using a multimeter, measure resistance between terminal A of the engine speed sensor harness connector and terminal 45 in the harness end of the ECU connector.</li> </ol>	<p><b>Measurement 5 ohms or less:</b> GO TO ④</p> <p><b>Measurement greater than 5 ohms:</b> Open in engine speed sensor input wire</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Short in Engine Speed Sensor Input Wire Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000190.02 Engine Speed Input Noise supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Engine speed sensor connector and ECU connector still disconnected</li> <li>3. Using a multimeter measure resistance between terminal 45 in the harness end of the ECU connector and: <ul style="list-style-type: none"> <li>• A good ground</li> <li>• All other terminals in the ECU connector</li> </ul> </li> </ol>	<p><b>All measurements greater than 2,000 ohms:</b> GO TO ⑤</p> <p><b>Any measurement less than 2,000 ohms:</b> Faulty engine speed sensor input wiring harness</p> <p style="text-align: right;">-- -1/1</p>

04  
160  
78

## Trouble Code Diagnostics and Tests

### 5 Noise Detection Test

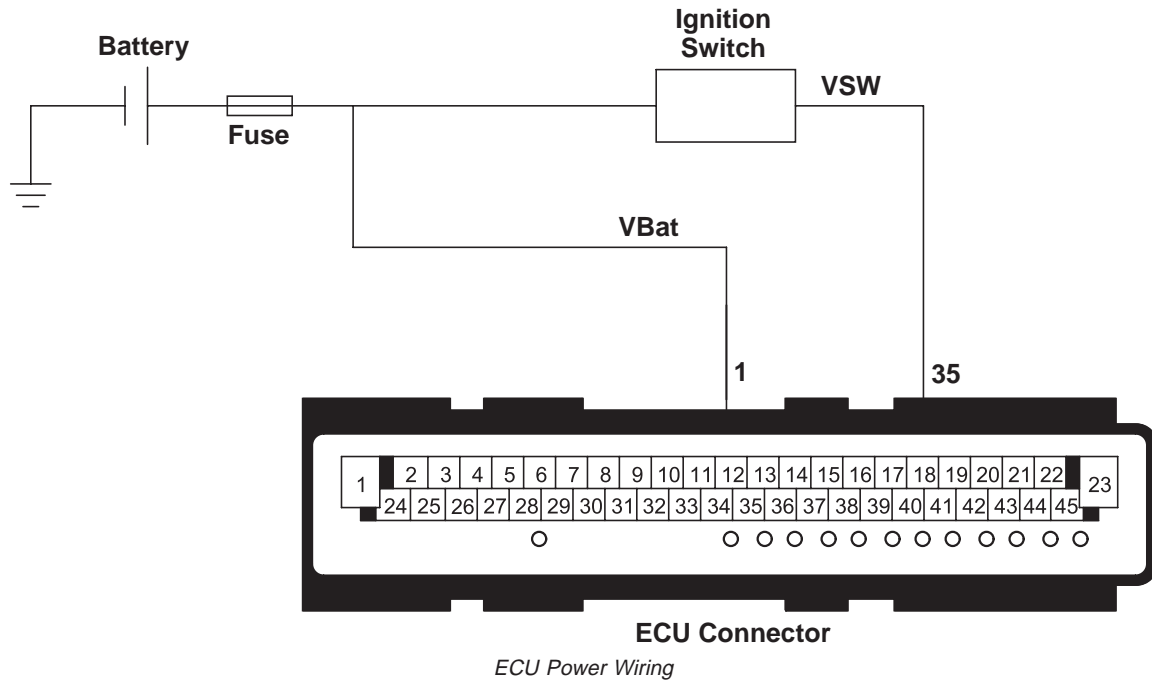
*NOTE: For wiring and theory of operation information, see DTC 000190.02 Engine Speed Input Noise supporting information.*

1. 000190.02 may be 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
  - Recheck the wiring for intermittent open and short circuits; particularly the engine speed sensor wiring
  - Check wiring for proper pin location in the engine speed sensor and ECU connector
2. Other possible causes of 000190.02:
  - Electromagnetic interference (EMI) from an incorrectly installed 2-way radio
  - Interference from some radar source
  - Possible burrs on injection pump gear.
  - Notches should have clean edges.

-- -1/1

04  
160  
79

**000629.04 — ECU Unswitched Power Missing**



**DTC 000629.04 will set if:**

- The ECU does not detect battery voltage.

- The engine will not start or run.
- The ECU will set a BLINKING warning light.

**If DTC 000629.04 sets, the following will occur:**

RG41183,00000DC -19-07MAR03-1/1

04  
160  
80

## 000629.04 — ECU Unswitched Power Missing

The ECU does not detect battery voltage.

RG41183.00000DD -19-07MAR03-1/1

### 000629.04 ECU Unswitched Power Missing Diagnostic Procedure

04  
160  
81

-- -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 information, see DTC 000629.04 ECU UNSWITCHED POWER MISSING supporting information.</i></p> <p>Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and all ECU grounds 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 ECU and ECU Connector Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000629.04 ECU UNSWITCHED POWER MISSING supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect ECU connector</li> <li>3. Using a multimeter, measure voltage between a good chassis ground and: <ul style="list-style-type: none"> <li>• Terminal 1 in the ECU connector on the engine harness</li> </ul> </li> </ol>	<p><b>Voltage is substantially less than battery voltage:</b> GO TO <b>③</b></p> <p><b>Voltages are at or near battery voltage on both terminals:</b> Faulty ECU connection OR Faulty ECU</p>

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*Trouble Code Diagnostics and Tests*

**③ Battery Voltage Check**

*NOTE: For wiring and theory of operation information, see DTC 000629.04 ECU UNSWITCHED POWER MISSING supporting information.*

Using a multimeter, measure battery voltage at the battery terminals.

**Voltage within specification for battery:**

Faulty ECU power supply fuse  
OR  
Faulty ECU connection  
OR  
Open or short in ECU power circuit

**Voltage substantially less than battery voltage:**

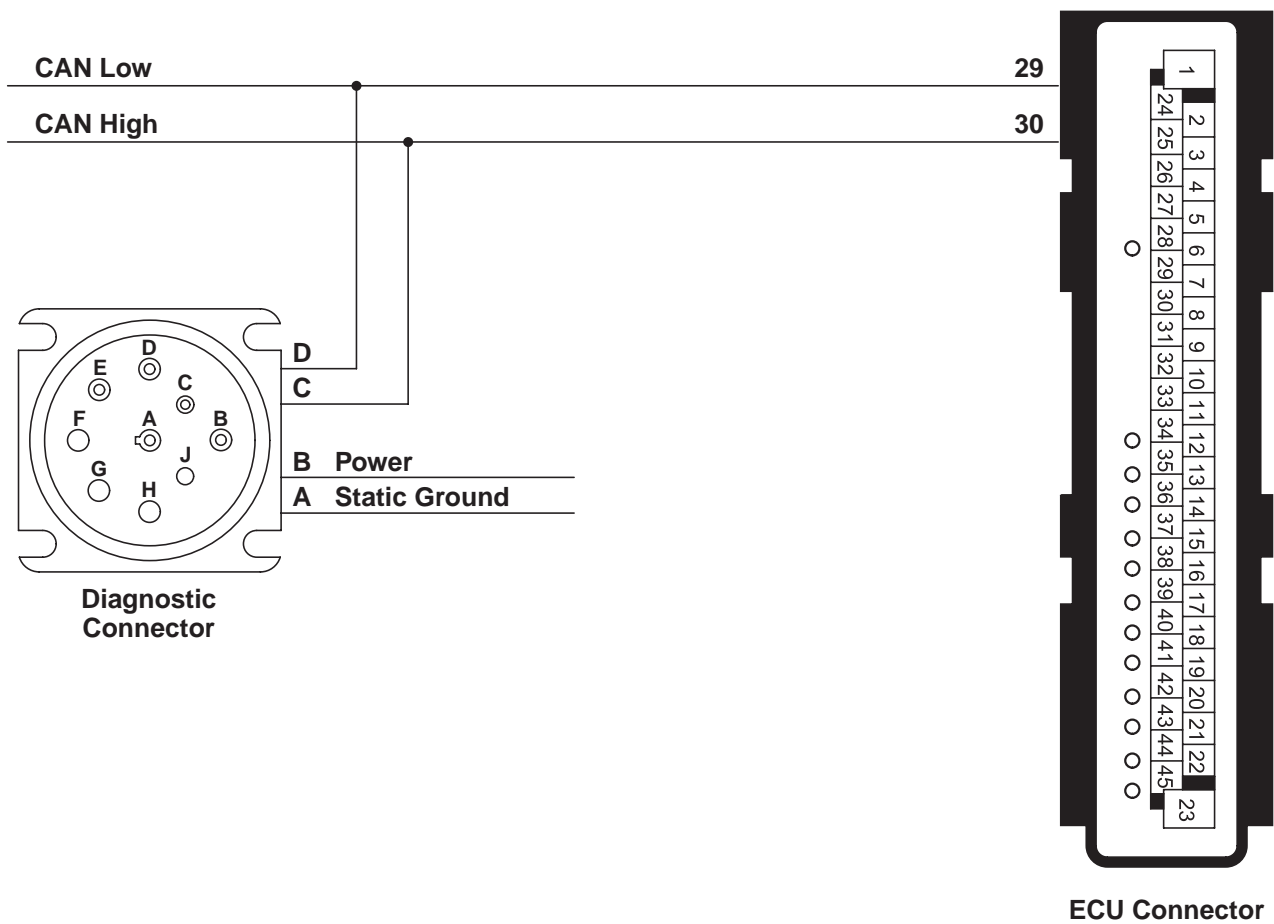
Faulty battery or charging system

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04  
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**000639.13 — CAN Error**



04  
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84

**Controller Area Network (CAN)**

- CAN is the network in which the individual controllers on a machine communicate with each other. The number of controllers communicating on CAN depends on the application. On some applications, the ECU is the only controller on CAN; on other applications, there are many controllers on CAN.

**DTC 000639.13 will set if:**

- The ECU detects a problem communicating on CAN.

**If DTC 000639.13 sets, the following will occur:**

- Depending on the application, engine operation may or may not be effected.

RG40854,00000CB -19-05SEP01-1/1

**000639.13 — CAN Error - Continued**

The ECU detects a problem communicating on CAN.

RG40854,0000CC -19-05SEP01-1/1

**000639.13 CAN Error Diagnostic Procedure**

**IMPORTANT: Do not force probes into connector terminals 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: Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector and other connectors on the CAN bus looking for dirty, damaged, or poorly positioned terminals.*

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160  
85

<p><b>① Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN Error supporting information</i></p> <ol style="list-style-type: none"> <li>1. Warm engine</li> <li>2. Ignition ON, engine OFF</li> <li>3. If available, connect to and start the DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</i></p> <ol style="list-style-type: none"> <li>4. Monitor DTCs on: <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• Service ADVISOR</li> <li>• Vehicle code display</li> </ul> </li> </ol> <p><i>NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.</i></p> <ol style="list-style-type: none"> <li>5. Make note of DTCs and clear all DTCs</li> <li>6. Ignition ON, engine running</li> <li>7. Monitor DTCs</li> </ol>	<p><b>DTC 000639.13 reoccurs:</b> GO TO ②</p> <p><b>DTC 000639.13 cleared:</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*

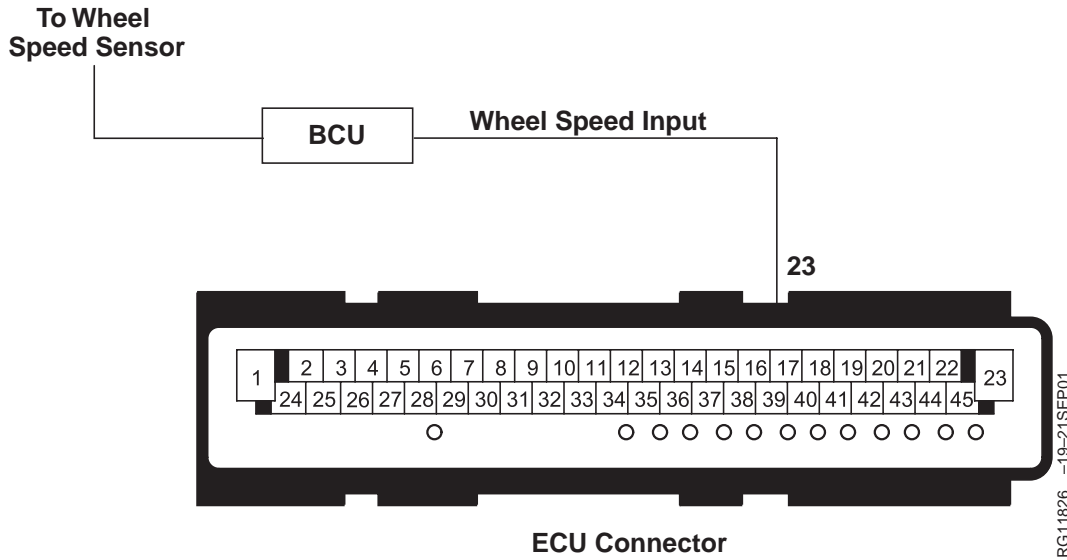
<p><b>2 Check Other Controllers For CAN Related DTCs</b></p>	<p>If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs</p>	<p><b>No CAN related DTCs found on other controllers:</b> GO TO 3</p> <p><b>Did find CAN related DTCs on other controllers:</b> Refer to machine manual to diagnose and repair the cause of DTC, then determine if DTC 000639.13 reoccurs</p> <p style="text-align: right;">-- -1/1</p>
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<p><b>3 CAN Resistance Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN Error supporting information</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect ECU connector</li> <li>3. Using a multimeter, measure resistance between terminal 30 and terminal 29 in the harness end of the ECU connector</li> </ol>	<p><b>Between 55 - 65 ohms:</b> Faulty ECU connector OR Faulty ECU</p> <p><b>Less than 55 or greater than 65 ohms:</b> Open or short in CAN communication circuit</p> <p style="text-align: right;">-- -1/1</p>
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**000810.02 — Calculated Vehicle Speed Input Signal Noise**



*NOTE: Above wiring information may change based on application. Refer to machine manual for this information.*

**Calculated 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 ECU.

**DTC 000810.02 will set if:**

- ECU detects noise on the wheel speed signal between the ECU and the BCU.

**If DTC 000810.02 sets, the following will occur:**

- Road limiting speed function disabled
- DTC 000810.02 may also cause DTC 001069.02 to set.

RG40854,00000CD -19-06SEP01-1/1

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## 000810.02 — Calculated Vehicle Speed Input Signal Noise

*ECU detects noise on the wheel speed signal between the ECU and the BCU.*

RG40854,0000CE -19-06SEP01-1/1

### 000810.02 Vehicle Speed Input Signal Noise Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:* Before using this diagnostic procedure, perform a preliminary inspection of the ECU and BCU connectors looking for dirty, damaged, or poorly positioned terminals.

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#### ① Intermittent Fault Test

*NOTE:* For wiring and theory of operation information, see DTC 000810.02 Vehicle Speed Input Signal Noise supporting information.

1. Warm engine
2. Ignition ON, engine OFF
3. If available, connect to and start the DST or SERVICE ADVISOR™.

*NOTE:* For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.

#### 4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

*NOTE:* Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.

5. Make note of DTCs and clear all DTCs
6. Ignition ON, engine running
7. Monitor DTCs

**000810.02 reoccurs:**  
GO TO ②

**000810.02 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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## Trouble Code Diagnostics and Tests

### ② Noise Test

*NOTE: For wiring and theory of operation information, see DTC 000810.02 Vehicle Speed Input Signal Noise supporting information.*

1. 000810.02 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 connections
- Corrosion, dirt, or paint can cause intermittent and "noisy" connections
- Check wiring harness for intermittent open and short circuits; particularly the wheel speed sensor wiring.

2. Other possible causes of 000810.02:

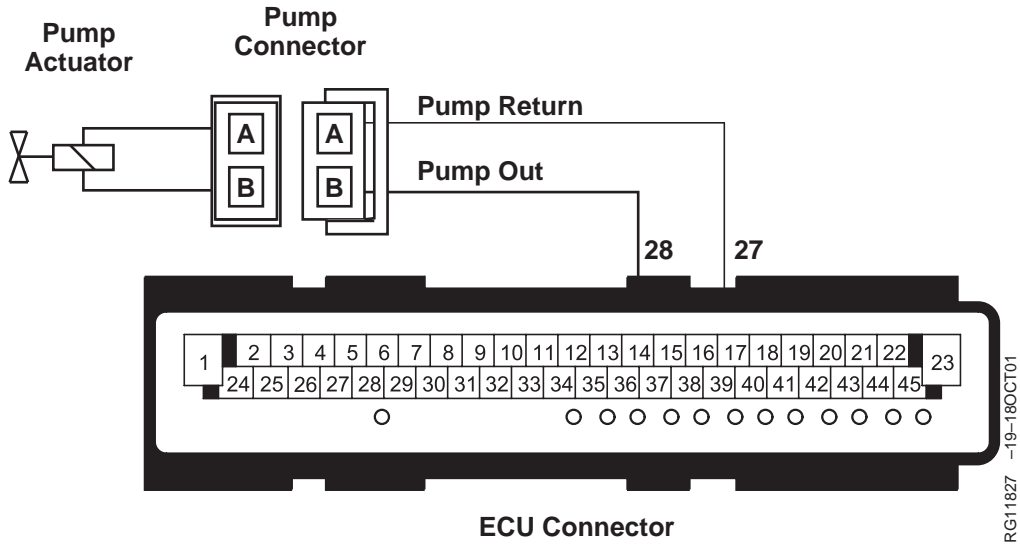
- Electromagnetic interference (EMI) from an incorrectly installed 2-way radio
- Interference from some radar source

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**000931.02 — Pump Current Instability**



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**Injection Pump**

- The Delphi (Lucas) DP201 injection pump has an electronically-controlled throttle. The actuator solenoid controls the amount of fuel entering the injection pump.

**DTC 000931.02 will set if:**

- The ECU has detected the pump actuator current draw has become unstable.

**If DTC 000931.02 sets, the following will occur:**

- Engine will not be able to run.

## 000931.02 — Pump Current Instability

The ECU has detected the pump actuator current draw has become unstable.

RG40854,00000D0 -19-06SEP01-1/1

### 000931.02 Pump Current Instability Diagnostic Procedure

**IMPORTANT: Do not force probes into connector terminals 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: Before using this diagnostic procedure, perform a preliminary inspection of the ECU and pump connectors looking for dirty, damaged, or poorly positioned terminals.*

**IMPORTANT: Do not put voltage on pins 27 and 28 of the ECU. ECU damage will occur.**

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#### ① Intermittent Fault Test

*NOTE: For wiring and theory of operation information, see DTC 000931.02 Pump Current Instability supporting information.*

1. Warm engine
2. Ignition ON, engine OFF
3. If available, connect to and start the DST or SERVICE ADVISOR™.

*NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.*

#### 4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

*NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.*

5. Make note of DTCs and clear all DTCs
6. Ignition ON, engine running
7. Monitor DTCs

**000931.02 reoccurs:**  
GO TO ②

**000931.02 doesn't 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>② Pump Actuator Resistance Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.02 Pump Current Instability supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Turn ignition OFF.</li> <li>2. Disconnect the pump connector</li> <li>3. Measure resistance across the two terminals on the pump connector on the actuator side.</li> </ol>	<p><b>Between 3.1 and 5.8 ohms:</b> GO TO ③</p> <p><b>Less than 3.1 or greater than 5.8 ohms:</b> Actuator shorted or open. Replace actuator and retest</p> <p style="text-align: right;">-- -1/1</p>
<p><b>③ Actuator Ground Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.02 Pump Current Instability supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Keep pump connector disconnected</li> <li>3. Measure resistance between each pump connector (actuator side) terminal and injection pump housing</li> </ol>	<p><b>Both measurements greater than 2000 ohms:</b> GO TO ④</p> <p><b>Either measurement less than 2000 ohms:</b> Actuator coil is grounded. Replace actuator and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Open in Pump Wiring (Circuits 354 and 355) Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.02 Pump Current Instability supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Disconnect pump connector and ECU connector</li> <li>2. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal A in the pump harness connector and terminal 27 in the ECU harness connector</li> <li>• Terminal B in the pump harness connector and terminal 28 in the ECU harness connector</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 Out wire (Circuit 354) OR Open in Pump Return wire (Circuit 355) OR Faulty Pump connector OR Faulty ECU connector</p> <p style="text-align: right;">-- -1/1</p>

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94

## Trouble Code Diagnostics and Tests

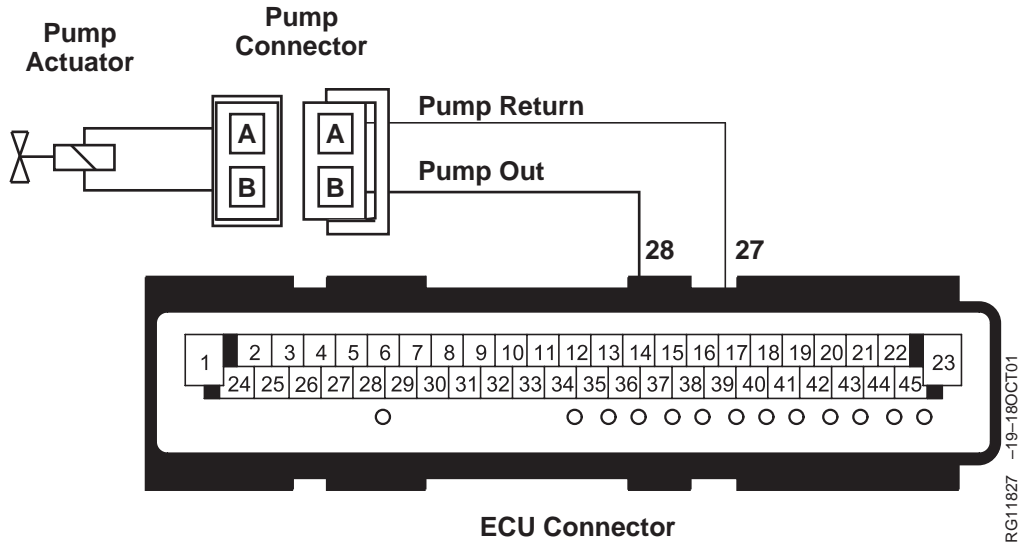
<p><b>5 Short in Pump Wiring (Circuits 354 and 355) Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.02 Pump Current Instability supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Disconnect pump connector and ECU connector</li> <li>2. Using a multimeter, measure resistance between terminal 27 in the ECU harness connector and: <ul style="list-style-type: none"> <li>• A good ground</li> <li>• All other terminals in ECU connector</li> </ul> </li> <li>3. Using a multimeter, measure resistance between terminal 28 in the ECU harness connector and: <ul style="list-style-type: none"> <li>• A good ground</li> <li>• All other terminals in ECU connector</li> </ul> </li> </ol>	<p><b>All measurements greater than 2,000 ohms:</b> GO TO <b>6</b></p> <p><b>Any measurement less than 2,000 ohms:</b> Short in Pump Out wire (Circuit 354) OR Short in Pump Return wire (Circuit 355)</p>
<p><b>6 ECU Check</b></p>	<p>At this point the problem could be one of the following</p> <ul style="list-style-type: none"> <li>• Intermittent actuator failure</li> <li>• Intermittent wiring problem</li> <li>• Failed ECU</li> </ul> <p><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p> <p>Check for causes of intermittent faults such as faulty connectors, damaged terminals, bared wires contacting metal, etc. If code only occurs under certain operating conditions, try to reproduce the conditions because the code may be temperature or vibration related. If an intermittent cause cannot be located, replace the ECU and retest.</p>	

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160  
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**000931.03 — Pump Current Feedback Input Voltage High**



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**IMPORTANT:** Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.

**DTC 000931.03 will set if:**

- Pump feedback voltage (an internal voltage in the ECU) is higher than the normal operating range.

**If DTC 000931.03 sets, the following will occur:**

- Engine may not be able to run.

**Injection Pump**

- The Delphi (Lucas) DP201 injection pump has an electronically-controlled throttle. The actuator solenoid controls the amount of fuel entering the injection pump.

## 000931.03 — Pump Current Feedback Input Voltage High

*Pump feedback voltage (an internal voltage in the ECU) is higher than the normal operating range.*

RG40854.0000043 -19-16JUL01-1/1

### 000931.03 Pump Current Feedback Input Voltage High Diagnostic Procedure

**IMPORTANT: Do not put voltage on pins 27 and 28 of the ECU. ECU damage will occur.**

**IMPORTANT: Do not force probes into connector terminals 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: Before using this diagnostic procedure, perform a preliminary inspection of the ECU and pump connectors looking for dirty, damaged, or poorly positioned terminals.*

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160  
97

#### ① Intermittent Fault Test

*NOTE: If DTC 000931.03 is accompanied with DTC 000931.15, follow the DTC 000931.03 diagnostic procedure first.*

1. Ignition ON, engine OFF
2. If available, connect to and start the DST or SERVICE ADVISOR™.

*NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.*

3. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

*NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.*

4. Make note of DTCs and clear all DTCs
5. Ignition ON, engine running
6. Monitor DTCs

**000931.03 reoccurs:**  
GO TO ②

**000931.03 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

*Trouble Code Diagnostics and Tests*

**2 Replace Faulty ECU**

An internal failure has occurred in the ECU.

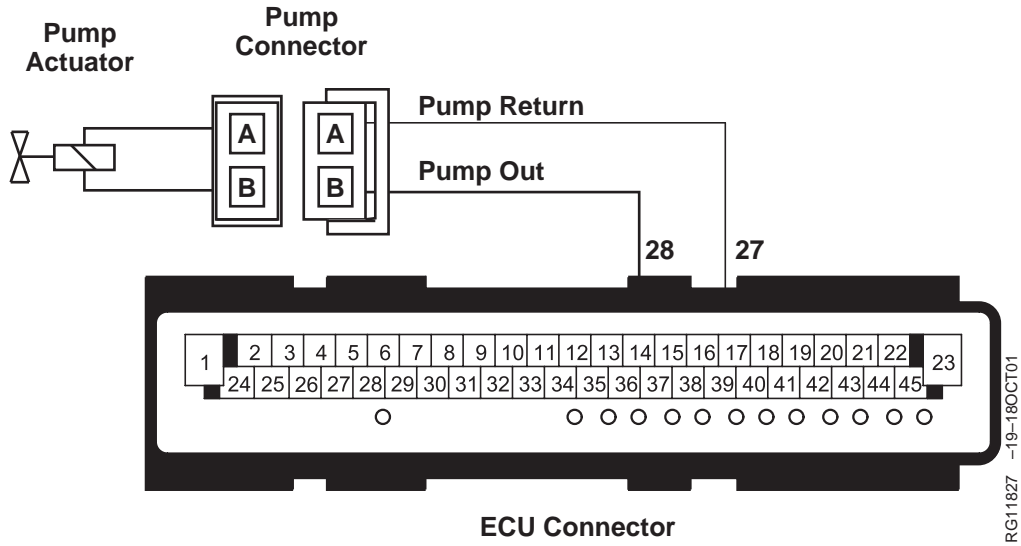
*NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.*

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160  
98



**000931.04 — Pump Current Feedback Input Voltage Low**



**Injection Pump**

- The Delphi (Lucas) DP201 injection pump has an electronically-controlled throttle. The actuator solenoid controls the amount of fuel entering the injection pump.

**DTC 000931.03 will set if:**

- Pump feedback voltage (an internal voltage in the ECU) is lower than the normal operating range.

**If DTC 000931.04 sets, the following will occur:**

- Engine may not be able to run.

## 000931.04 — Pump Current Feedback Input Voltage Low

*Pump feedback voltage (an internal voltage in the ECU) is lower than the normal operating range.*

RG40854,00000D3 -19-06SEP01-1/1

### 000931.04 Pump Current Feedback Input Voltage Low Diagnostic Procedure

**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.**

**IMPORTANT: Do not put voltage on pins 27 and 28 of the ECU. ECU damage will occur.**

*NOTE: Before using this diagnostic procedure, perform a preliminary inspection of the ECU and pump connectors looking for dirty, damaged, or poorly positioned terminals.*

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160  
,101

#### ① Intermittent Fault Test

*NOTE: If DTC 000931.04 is accompanied with DTC 000931.15 or DTC 000931.31, follow the diagnostic procedures for those codes first.*

1. Warm engine
2. Ignition ON, engine OFF
3. If available, connect to and start the DST or SERVICE ADVISOR™.

*NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.*

4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

*NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.*

5. Make note of DTCs and clear all DTCs
6. Ignition ON, engine running
7. Monitor DTCs

**000931.04 reoccurs:**  
GO TO ②

**000931.04 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

*Trouble Code Diagnostics and Tests*

**2 Replace Faulty ECU**

An internal failure has occurred in the ECU.

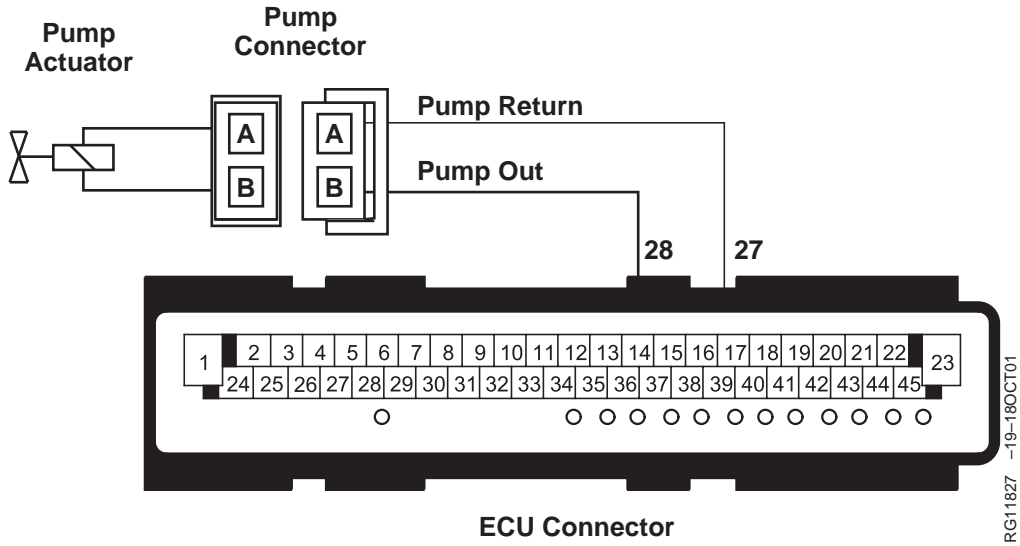
*NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.*

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04  
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**000931.15 — Pump Current Measurement Error (Engine OFF)**



**Injection Pump**

- The Delphi (Lucas) DP201 injection pump has an electronically-controlled throttle. The actuator solenoid controls the amount of fuel entering the injection pump.

**DTC 000931.15 will set if:**

- The ECU measures a current feedback voltage (an internal voltage in the ECU) while the ignition is ON; engine NOT started. Under these conditions, the feedback voltage should be 0.

**If DTC 000931.15 sets, the following will occur:**

- Engine may not run or may run erratically.

RG40854,00000D4 -19-06SEP01-1/1

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160  
,104

### 000931.15 — Pump Current Measurement Error (Engine OFF)

The ECU measures a current feedback voltage (an internal voltage in the ECU) while the ignition is ON;

engine NOT started. Under these conditions, the feedback voltage should be 0.

RG40854,00000D5 -19-06SEP01-1/1

### 000931.15 Pump Current Measurement Error (Engine OFF) Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:* Before using this diagnostic procedure, perform a preliminary inspection of the ECU and pump connectors looking for dirty, damaged, or poorly positioned terminals.

**IMPORTANT:** Do not put voltage on pins 27 and 28 of the ECU. ECU damage will occur.

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<p><b>1 Intermittent Fault Test</b></p>	<p><i>NOTE:</i> For wiring and theory of operation information, see DTC 000931.15 Pump Current Measurement Error (Engine OFF) supporting information.</p> <ol style="list-style-type: none"> <li>1. Warm engine</li> <li>2. Ignition ON, engine OFF</li> <li>3. If available, connect to and start the DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE:</i> For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</p> <ol style="list-style-type: none"> <li>4. Monitor DTCs on: <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• Service ADVISOR</li> <li>• Vehicle code display</li> </ul> </li> </ol> <p><i>NOTE:</i> Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.</p> <ol style="list-style-type: none"> <li>5. Make note of DTCs and clear all DTCs</li> <li>6. Ignition ON, engine running</li> <li>7. Monitor DTCs</li> </ol>	<p><b>000931.15 reoccurs:</b> GO TO <b>2</b></p> <p><b>000931.15 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>2 Short in Pump Wiring (Circuits 354 and 355) Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.15 Pump Current Measurement Error (Engine OFF) supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Disconnect pump connector and ECU connector</li> <li>2. Using a multimeter, measure resistance between terminal 27 in the ECU harness connector and: <ul style="list-style-type: none"> <li>• A good ground</li> <li>• All other terminals in ECU connector</li> </ul> </li> <li>3. Using a multimeter, measure resistance between terminal 28 in the ECU harness connector and: <ul style="list-style-type: none"> <li>• A good ground</li> <li>• All other terminals in ECU connector</li> </ul> </li> </ol>	<p><b>All measurements greater than 2,000 ohms:</b> GO TO 3</p> <p><b>Any measurement less than 2,000 ohms:</b> Short in Pump Out wire (Circuit 354) OR Short in Pump Return wire (Circuit 355)</p>
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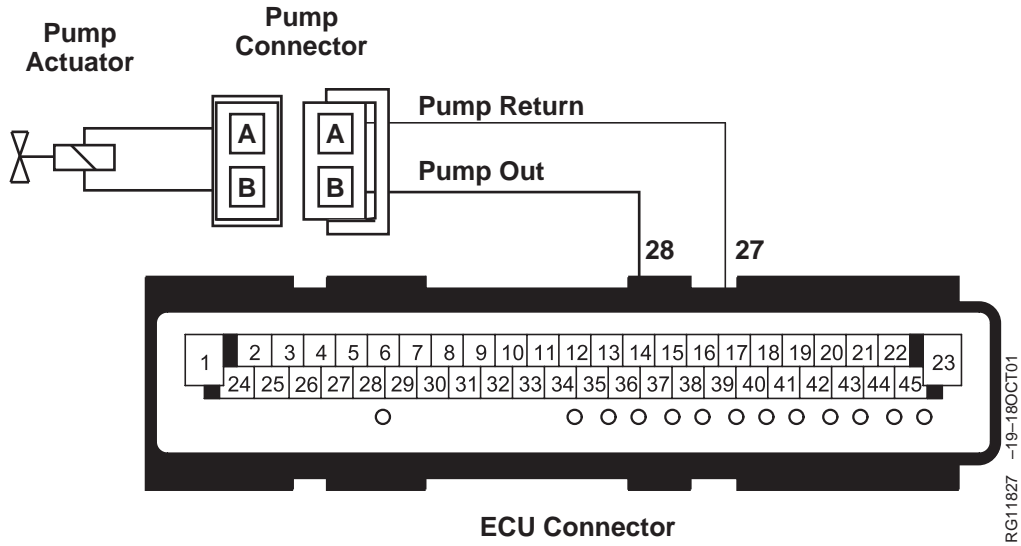
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<p><b>3 ECU Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.15 Pump Current Measurement Error (Engine OFF) supporting information.</i></p> <p>At this point the problem could be one of the following:</p> <ul style="list-style-type: none"> <li>• Intermittent actuator failure</li> <li>• Intermittent wiring problem</li> <li>• Failed ECU</li> </ul> <p><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p> <p>Check for causes of intermittent faults such as faulty connectors, damaged terminals, bared wires contacting metal, etc. If code only occurs under certain operating conditions, try to reproduce the conditions because the code may be temperature or vibration related. If an intermittent cause cannot be located, replace the ECU and retest.</p>	
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04  
160  
,107

**000931.31 — Pump Current Not Controllable**



**Injection Pump**

- The Delphi (Lucas) DP201 injection pump has an electronically-controlled throttle. The actuator solenoid controls the amount of fuel entering the injection pump.

**DTC 000931.31 will set if:**

Pump actuator current draw is lower than the amount the ECU is expecting to measure for the current operating conditions of the engine.

**If DTC 000931.31 sets, the following will occur:**

- Engine may not run or may run erratically.

RG40854.0000041 -19-11JUL01-1/1

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,108

## 000931.31 — Pump Current Not Controllable

*Pump actuator current draw is lower than the amount the ECU is expecting to measure for the current operating conditions of the engine.*

RG40854.0000046 -19-16JUL01-1/1

### 000931.31 Pump Current Not Controllable Diagnostic Procedure

**IMPORTANT: Do not force probes into connector terminals 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: Before using this diagnostic procedure, perform a preliminary inspection of the ECU and pump connectors looking for dirty, damaged, or poorly positioned terminals.*

**IMPORTANT: Do not put voltage on pins 27 and 28 of the ECU. ECU damage will occur.**

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04  
160  
,109

#### ① Intermittent Fault Test

*NOTE: For wiring and theory of operation information, see DTC 000931.31 Pump Current Not Controllable supporting information.*

1. Warm engine
2. Ignition ON, engine OFF
3. If available, connect to and start the DST or SERVICE ADVISOR™.

*NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.*

4. Monitor DTCs on:

- DST (Not available on 6010 Tractors)
- Service ADVISOR
- Vehicle code display

*NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.*

5. Make note of DTCs and clear all DTCs
6. Ignition ON, engine running
7. Monitor DTCs

**000931.31 reoccurs:**  
GO TO ②

**000931.31 doesn't 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>② Pump Actuator Resistance Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.31 Pump Current Not Controllable supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Turn ignition OFF.</li> <li>2. Disconnect the pump connector.</li> <li>3. Measure resistance across the two terminals of the pump connector (actuator side).</li> </ol>	<p><b>Between 3.1 and 5.8 ohms:</b> GO TO ③</p> <p><b>Less than 3.1 or greater than 5.8 ohms:</b> Actuator coil is shorted or open. Replace actuator and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>③ Actuator Grounded Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.31 Pump Current Not Controllable supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition still OFF.</li> <li>2. Measure resistance between each pump connector (actuator side) terminal and injection pump housing.</li> </ol>	<p><b>Both measurements greater than 2000 ohms:</b> GO TO ④</p> <p><b>Either measurement less than 2000 ohms:</b> Actuator coil is grounded. Replace actuator and retest.</p> <p style="text-align: right;">-- -1/1</p>
<p><b>④ Open in Pump Wiring (Circuits 354 and 355) Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.31 Pump Current Not Controllable supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Disconnect pump connector and ECU connector</li> <li>2. Using a multimeter, measure resistance between: <ul style="list-style-type: none"> <li>• Terminal A in the pump actuator harness connector and terminal 27 in the ECU harness connector</li> <li>• Terminal B in the pump actuator harness connector and terminal 28 in the ECU harness connector</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 Out wire (Circuit 354) OR Open in Pump Return wire (Circuit 355) OR Faulty Pump connector OR Faulty ECU connector</p> <p style="text-align: right;">-- -1/1</p>

## Trouble Code Diagnostics and Tests

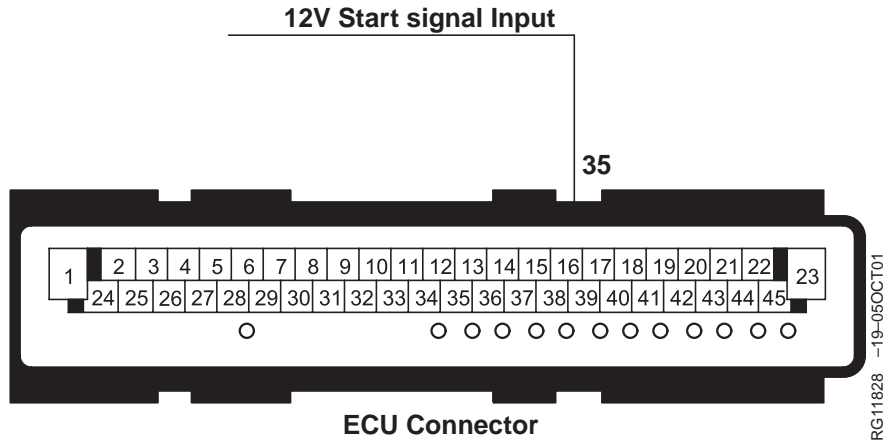
<p><b>5 Short in Pump Wiring (Circuits 354 and 355) Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.31 Pump Current Not Controllable supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Disconnect pump connector and ECU connector</li> <li>2. Using a multimeter, measure resistance between terminal 27 in the ECU harness connector and: <ul style="list-style-type: none"> <li>• A good ground</li> <li>• All other terminals in ECU connector</li> </ul> </li> <li>3. Using a multimeter, measure resistance between terminal 28 in the ECU harness connector and: <ul style="list-style-type: none"> <li>• A good ground</li> <li>• All other terminals in ECU connector</li> </ul> </li> </ol>	<p><b>All measurements greater than 2,000 ohms:</b> GO TO <b>6</b></p> <p><b>Any measurement less than 2,000 ohms:</b> Short in Pump Out wire (Circuit 354) OR Short in Pump Return wire (Circuit 355)</p>
<p><b>6 ECU Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 000931.31 Pump Current Not Controllable supporting information.</i></p> <p>At this point the problem could be one of the following:</p> <ul style="list-style-type: none"> <li>• Intermittent actuator failure</li> <li>• Intermittent wiring problem</li> <li>• Failed ECU</li> </ul> <p><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p> <p>Check for causes of intermittent faults such as faulty connectors, damaged terminals, bared wires contacting metal, etc. If code only occurs under certain operating conditions, try to reproduce the conditions because the code may be temperature or vibration related. If an intermittent cause cannot be located, replace the ECU and retest.</p>	

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160  
,111

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**001041.02 — Start Signal Missing**



04  
160  
,112

**Start Signal**

- The start signal is an input to the ECU that is typically connected to the starter relay circuit such that battery voltage is present when the ignition is in the START position. This input is used to allow the ECU to position the injection pump in the starting fuel position slightly ahead of the time that an engine speed input is detected.

**DTC 001041.02 will set if:**

- The ECU has detected an engine speed greater than low idle without having detected a voltage at the start signal input terminal.

**If DTC 001041.02 sets, the following will occur:**

- Under normal conditions, the engine should start and run normally.
- Under adverse starting conditions, slightly longer cranking times may occur.

RG40854,00000D6 -19-06SEP01-1/1

## 001041.02 — Start Signal Missing

The ECU has detected an engine speed greater than low idle without having detected a voltage at the start signal input terminal.

RG40854,00000D7 -19-06SEP01-1/1


### 001041.02 Start Signal Missing Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:* Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector looking for dirty, damaged, or poorly positioned terminals.

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160  
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<p><b>① Start Signal Voltage Test</b></p>	<p> <b>CAUTION:</b> Instruction is given to crank the engine. Although the engine will not start because of the disconnected ECU, be aware that the engine will be cranking and use appropriate safeguards.</p> <p><i>NOTE:</i> For wiring and theory of operation information, see DTC 001041.02 Start Signal Missing supporting information.</p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect ECU connector</li> <li>3. Turn ignition to START position while monitoring voltage from the start signal terminal 35 in the harness end of the ECU connector <b>and</b> a good ground (-)</li> </ol>	<p><b>Greater than 3.0 volts:</b> GO TO <b>②</b></p> <p><b>3.0 volts or less:</b> Open in start signal circuit OR Short to ground in start signal circuit</p>
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## Trouble Code Diagnostics and Tests

<p><b>② Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001041.02 Start Signal Missing supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Warm engine</li> <li>2. Ignition ON, engine OFF</li> <li>3. If available, connect to and start the DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</i></p> <ol style="list-style-type: none"> <li>4. Monitor DTCs on: <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• Service ADVISOR</li> <li>• Vehicle code display</li> </ul> </li> </ol> <p><i>NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.</i></p> <ol style="list-style-type: none"> <li>5. Make note of DTCs and clear all DTCs</li> <li>6. Ignition ON, engine running</li> <li>7. Monitor DTCs</li> </ol> <p><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See in Section 230 Group 15 of TM 4552.</i></p>	<p><b>001041.02 cleared and doesn't reoccur:</b> GO TO ③</p> <p><b>001041.02 reoccurs:</b> Faulty engine speed sensor wiring causing a false speed signal to the ECU while the engine is stopped OR Faulty ECU</p>
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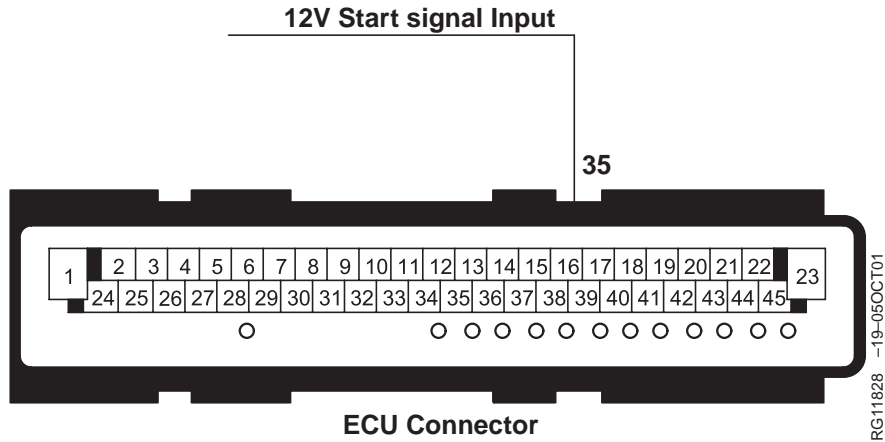
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<p><b>③ Intermittent DTC 001041.02 Checks</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001041.02 Start Signal Missing supporting information.</i></p> <p>An intermittent DTC 001041.02 can be caused by:</p> <ul style="list-style-type: none"> <li>• Rapidly cycling the ignition switch from ON to OFF back to ON without the engine dying</li> <li>• Faulty ignition switch</li> <li>• Intermittent faulty start signal circuit</li> <li>• Intermittent faulty ECU power supply</li> <li>• Intermittent faulty ECU ground circuit</li> </ul>	
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**001041.03 — Start Signal Always Active**



**Start Signal**

- The start signal is an input to the ECU that is typically connected to the starter relay circuit such that battery voltage is present when the ignition is in the START position. This input is used to allow the ECU to position the injection pump in the starting fuel position slightly ahead of the time that an engine speed input is detected.

**DTC 001041.03 will set if:**

- The ECU detects a low idle or greater engine speed and is still detecting a voltage at the start signal input terminal.

**If DTC 001041.03 sets, the following will occur:**

- The engine should start and run normally.
- Depending on the cause of the fault, it is possible that the starter is engaged even though the key is not in the START position. If this is the case, starter damage may occur.

RG40854,00000D8 -19-06SEP01-1/1

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160  
,116

### 001041.03 — Start Signal Always Active

The ECU detects a low idle or greater engine speed and is still detecting a voltage at the start signal input terminal.

RG40854,00000D9 -19-06SEP01-1/1

### 001041.03 Start Signal Always Active Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:* Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector looking for dirty, damaged, or poorly positioned terminals.

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,117

<p><b>1 Intermittent Fault Test</b></p>	<p><i>NOTE:</i> For wiring and theory of operation information, see DTC 001041.03 Start Signal Always Active supporting information</p> <ol style="list-style-type: none"> <li>1. Warm engine</li> <li>2. Ignition ON, engine OFF</li> <li>3. If available, connect to and start the DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE:</i> For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</p> <ol style="list-style-type: none"> <li>4. Monitor DTCs on: <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• Service ADVISOR</li> <li>• Vehicle code display</li> </ul> </li> </ol> <p><i>NOTE:</i> Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.</p> <ol style="list-style-type: none"> <li>5. Make note of DTCs and clear all DTCs</li> <li>6. Ignition ON, engine running</li> <li>7. Monitor DTCs</li> </ol>	<p><b>001041.03 reoccurs:</b> GO TO <b>2</b></p> <p><b>001041.03 cleared and 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>② Start Signal Voltage Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001041.03 Start Signal Always Active supporting information</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Disconnect ECU connector</li> <li>3. Ignition ON, engine OFF</li> <li>4. Using a multimeter, measure voltage from the start signal terminal 35 in the harness end of the ECU connector <b>and</b> a good ground (-)</li> </ol>	<p><b>Less than 1.0 volts:</b> GO TO ④</p> <p><b>1.0 volts or greater:</b> Short to power in start signal circuit</p>
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<p><b>③ Start Signal Shorted Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001041.03 Start Signal Always Active supporting information</i></p> <ol style="list-style-type: none"> <li>1. Ignition OFF</li> <li>2. Using a multimeter, measure resistance between start signal input terminal 35 in the harness end of the ECU connector <b>and</b> all other terminals in the ECU connector</li> </ol> <p><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p>	<p><b>All measurements greater than 2000 ohms:</b> Faulty ECU</p> <p><b>Any measurement less than 2000 ohms:</b> Short to power in start signal circuit</p>
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04  
160  
,118

04  
160  
,119

## 001069.02 — Tire Size Error

### Tire Size

- Tire size is input into the vehicle for a given size of tire.

### DTC 001069.02 will set if:

- Tire size has been incorrectly programmed into the vehicle.

### If DTC 001069.02 sets, the following will occur:

- ECU will assume the largest tire size
- Road speed limiting may occur at a speed that is less than 50 km/hr (31.1 mi/hr)

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,120

RG40854,0000033 -19-10JUL01-1/1

**001069.02 — Tire Size Error**

*Tire size has been incorrectly programmed into the vehicle.*

RG40854,0000DA -19-06SEP01-1/1

**001069.02 Tire Size Error Diagnostic Procedure**

**IMPORTANT: Do not force probes into connector terminals 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: Before using this diagnostic procedure, perform a preliminary inspection of the ECU, BIF, and BCM connectors looking for dirty, damaged, or poorly positioned terminals.*

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160  
,121

**1 Intermittent Fault Test**

*NOTE: For wiring and theory of operation information, see DTC 001069.02 Tire Size Error supporting information.*

1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.
2. Ignition ON, engine OFF
3. Start ECU communication software.
4. Read DTCs using DST or SERVICE ADVISOR™.
5. Clear all DTCs
6. Engine running, vehicle under normal operating conditions.
7. Read DTCs

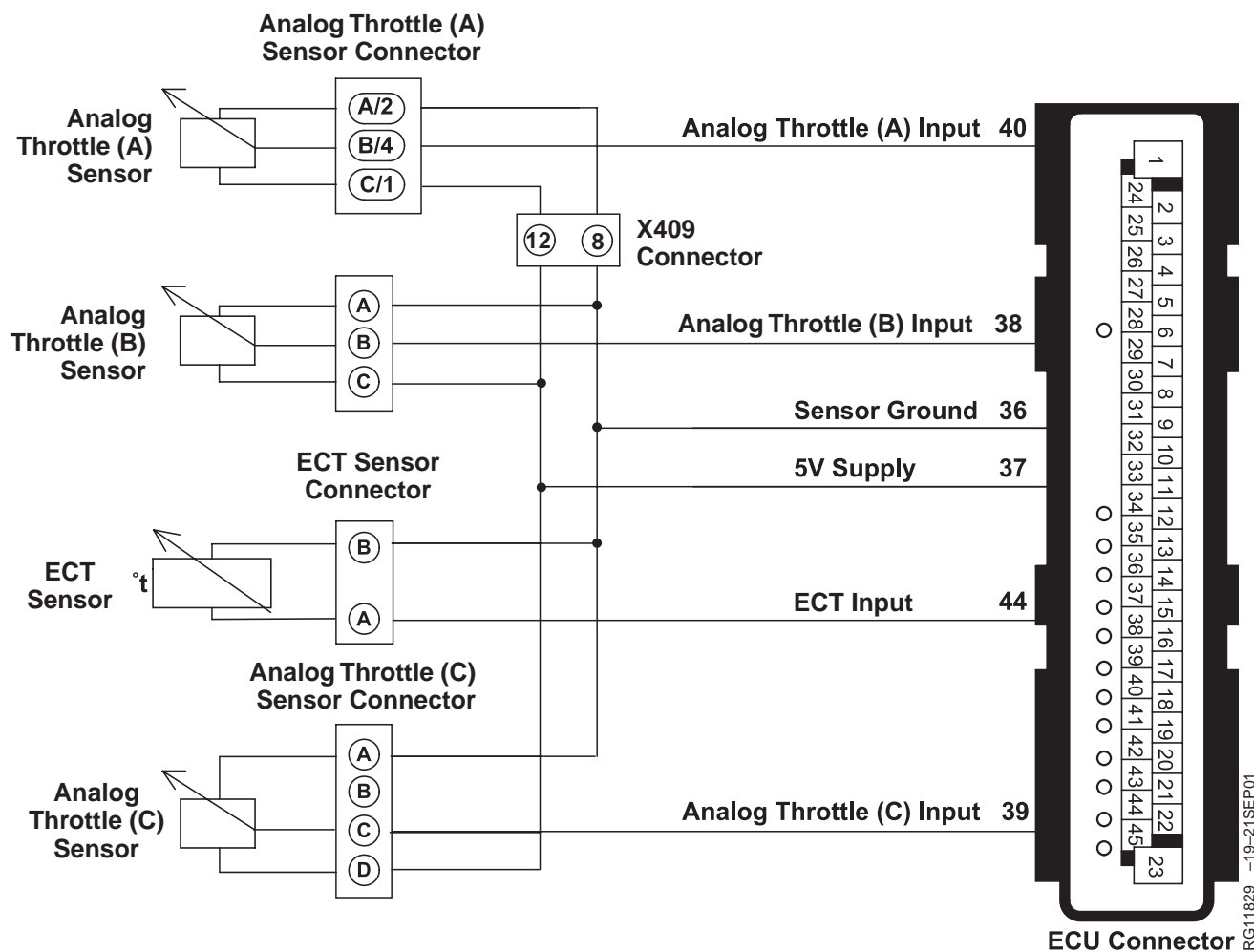
**001069.02 reoccurs:**  
Reprogram tire size on vehicle.

**001069.02 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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### 001079.03 — Sensor Supply Voltage High



**NOTE:** Wiring diagram shows 6020 and 7020 Series Tractors. For wiring information on 6010 Tractors, see *ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM FOR 6010 SERIES TRACTORS* in Section 06, Group 210 of this manual. For wiring information on other applications, refer to machine manual.

#### Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on the application. The ECU monitors the drop in voltage that the sensor causes and compares that drop to preprogrammed values in the

ECU's memory to determine the value of the parameter the sensor was measuring. In addition, the ECU monitors the exact voltage on the 5 volt supply circuit in order to ensure accurate readings.

#### DTC 001079.03 will set if:

- The ECU detects a voltage that is higher than 5.5 volts on the ECU 5 volt sensor supply circuit.

#### If DTC 001079.03 sets, the following will occur:

- The ECU will use default values for the sensors that use sensor supply input voltage.

### 001079.03 — Sensor Supply Voltage High

The ECU detects a voltage that is higher than 5.5 volts on the ECU 5 volt sensor supply circuit.

RG40854,00000DB -19-06SEP01-1/1

#### 001079.03 Sensor Supply Voltage High Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:** Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector looking for dirty, damaged, or poorly positioned terminals.

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160  
,123

<p><b>1 Intermittent Fault Test</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001079.03 Sensor Supply Voltage High supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Warm engine</li> <li>2. Ignition ON, engine OFF</li> <li>3. If available, connect to and start the DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</i></p> <ol style="list-style-type: none"> <li>4. Monitor DTCs on:             <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• Service ADVISOR</li> <li>• Vehicle code display</li> </ul> </li> </ol> <p><i>NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU in Group 160 of this manual.</i></p> <ol style="list-style-type: none"> <li>5. Make note of DTCs and clear all DTCs</li> <li>6. Ignition ON, engine running</li> <li>7. Monitor DTCs</li> </ol>	<p><b>001079.03 reoccur:</b> GO TO <b>2</b></p> <p><b>001079.03 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*

**② Sensor Supply Wire  
Check for Short**

*NOTE: For wiring and theory of operation information, see DTC 001079.03 Sensor Supply Voltage High supporting information.*

1. Ignition OFF
2. Disconnect ECU connector
3. Using a multimeter, measure resistance between terminal 37 at the harness end of the ECU connector and all other terminals in the harness end of the ECU connector

*NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.*

**Greater than 20k ohms:**  
Faulty ECU connector  
OR  
Faulty ECU

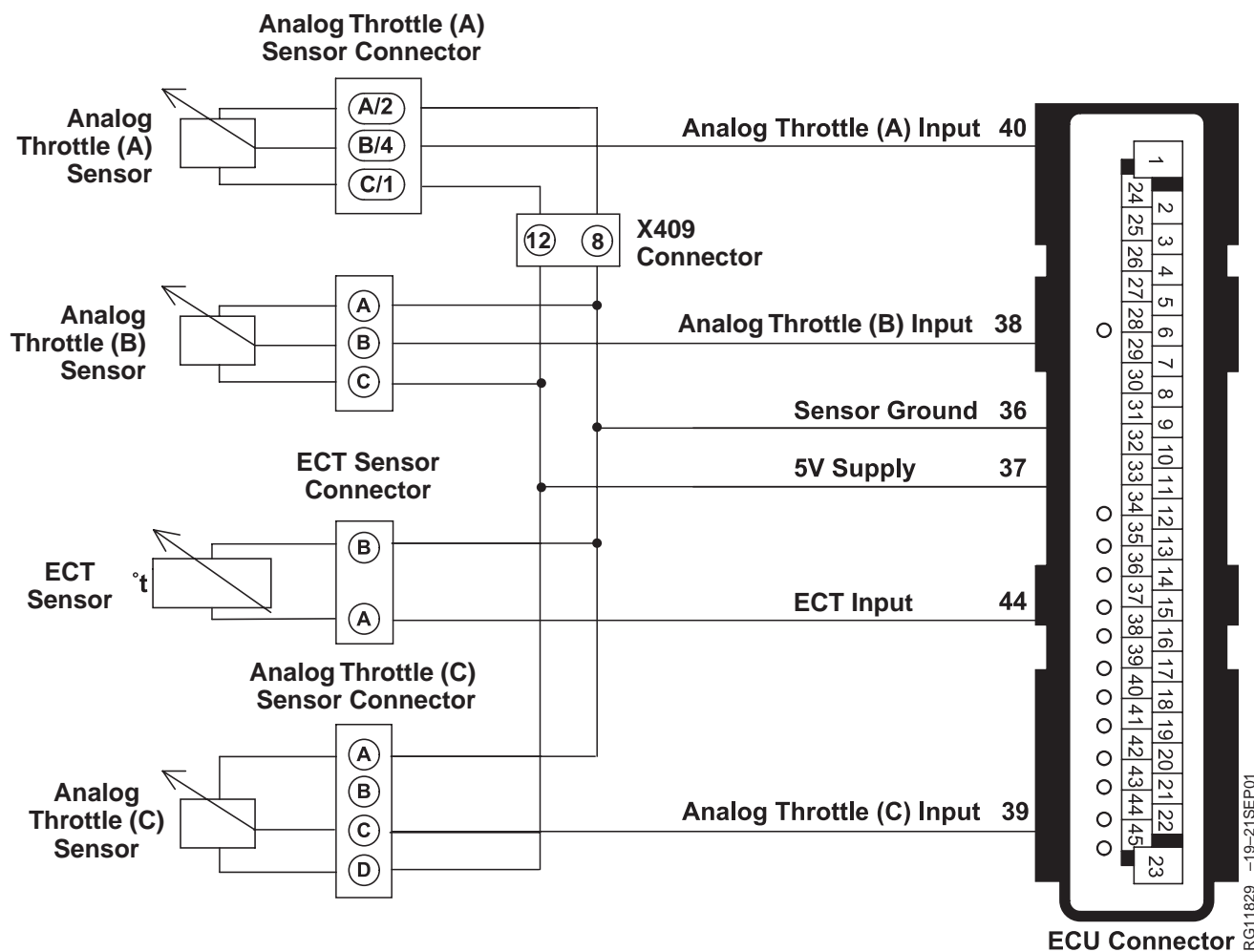
**Less than 20k ohms:**  
Short to voltage in sensor  
supply wire

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04  
160  
,124

04  
160  
,125

### 001079.04 — Sensor Supply Voltage Low



**NOTE:** Wiring diagram shows 6020 and 7020 Series Tractors. For wiring information on 6010 Tractors, see *ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM FOR 6010 SERIES TRACTORS* in Section 06, Group 210 of this manual. For wiring information on other applications, refer to machine manual.

#### Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on the application. The ECU monitors the drop in voltage that the sensor causes and compares that drop to preprogrammed values in the

ECU's memory to determine the value of the parameter the sensor was measuring. In addition, the ECU monitors the exact voltage on the 5 volt supply circuit in order to ensure accurate readings.

#### DTC 001079.04 will set if:

- The ECU detects a voltage that is lower than 4.44 volts on the ECU 5 volt sensor supply circuit.

#### If DTC 001079.04 sets, the following will occur:

- The ECU will use default values for the sensors that use sensor supply 1 input voltage.

## 001079.04 — Sensor Supply Voltage Low

*The ECU detects a voltage that is lower than 4.44 volts on the ECU 5 volt sensor supply circuit.*

RG40854,00000DE -19-06SEP01-1/1

### 001079.04 Sensor Supply Voltage Low Diagnostic Procedure

**IMPORTANT:** Do not force probes into connector terminals 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:* Before using this diagnostic procedure, perform a preliminary inspection of the ECU connector looking for dirty, damaged, or poorly positioned terminals.

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04  
160  
,127

## Trouble Code Diagnostics and Tests

<b>① Sensor Check</b>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001079.04 Sensor Supply Voltage Low supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Warm engine</li> <li>2. Ignition ON, engine OFF</li> <li>3. If available, connect to and start the DST or SERVICE ADVISOR™.</li> </ol> <p><i>NOTE: For connection instructions, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group.</i></p> <ol style="list-style-type: none"> <li>4. Monitor DTCs on: <ul style="list-style-type: none"> <li>• DST (Not available on 6010 Tractors)</li> <li>• Service ADVISOR</li> <li>• Vehicle code display</li> </ul> </li> </ol> <p><i>NOTE: Codes may be displayed in 2-digits. In order to use the diagnostic procedures in this manual, it is necessary to convert the 2-digit code to an SPN/FMI code. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) ON ECU in Group 160 of this manual.</i></p> <ol style="list-style-type: none"> <li>5. Make note of DTCs and clear all DTCs</li> <li>6. Ignition OFF</li> <li>7. Disconnect all of the sensors that receive their 5V supply from terminal 37 in the ECU connector.</li> <li>8. Ignition ON, engine running</li> <li>9. Monitor DTCs</li> </ol>	<p><b>001079.04 reoccurs:</b> GO TO ④</p> <p><b>001079.04 doesn't reoccur:</b> GO TO ②</p>
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<b>② Intermittent Fault Test</b>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001079.04 Sensor Supply Voltage Low supporting information.</i></p> <ol style="list-style-type: none"> <li>1. Ignition ON</li> <li>2. Monitor DTCs while reconnecting each of the sensors one at a time</li> </ol>	<p><b>001079.04 reoccurs:</b> Sensor that reset the DTC is faulty Replace and retest</p> <p><b>001079.04 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>⊗ Sensor Supply Short to Ground Check</b></p>	<p><i>NOTE: For wiring and theory of operation information, see DTC 001079.04 Sensor Supply Voltage Low supporting information.</i></p> <ol style="list-style-type: none"><li>1. Ignition OFF</li><li>2. Disconnect ECU connector</li><li>3. Using a multimeter, measure resistance individually between terminal 37 in the harness end of the ECU connector and:<ul style="list-style-type: none"><li>• A good chassis ground</li><li>• Terminal 24 in the harness end of the ECU connector</li><li>• Terminal 36 in the harness end of the ECU connector</li></ul></li></ol> <p><i>NOTE: 6010 Tractors ONLY: If a faulty ECU is found, calibration of new ECU is required. See DIAGNOSTICS PROGRAM in Section 230 Group 15 of TM 4552.</i></p>	<p><b>Greater than 20k ohms:</b> Faulty ECU connector OR Faulty ECU</p> <p><b>Less than 20k ohms:</b> Sensor 5 volt supply circuit shorted to a ground</p>
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04  
160  
,129

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## 002000.13 — Security Violation

*The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.*

### Security Violation

- When the ignition switch is first turned on, all of the controllers on the machine communicate with each other to make sure that all controllers are correct for the particular machine.

### DTC 002000.13 will set if:

- The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

### If DTC 002000.13 sets, the following will occur:

- The ECU will allow the engine to start, but will only allow low idle engine speed.

### If DTC 002000.13 sets:

- If one of the controllers on the machine has just been replaced, make sure the correct controller was installed.
- If all controllers on the machine are the correct part numbers, check to see if any controllers have active or stored CAN related DTCs. If they do, go to the appropriate diagnostic procedure.

RG40854,00000DF -19-06SEP01-1/1

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,130

# Section 05 Tools and Other Materials

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*Contents*

05

Fuel System Repair and Adjustment  
Essential Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

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RG40854,00000E0 -19-07SEP01-1/11

RG5068 -UN-05DEC97

Timing Pin . . . . . JDE81-4

Used to lock flywheel at No. 1 TDC for injection pump timing.



Timing Pin

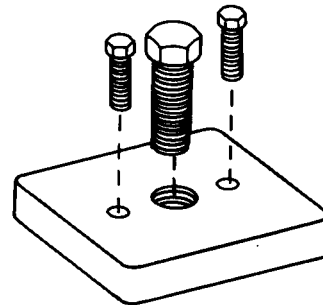
RG5068

05  
170  
1

RG40854,00000E0 -19-07SEP01-2/11

Injection Pump Drive Gear Puller . . . . . JDG670A

Remove drive gear from tapered shaft on injection pump.



JDG670A

RG6032 -UN-13JAN92

Continued on next page

RG40854,00000E0 -19-07SEP01-3/11

RG5288 -UN-23AUG88

Crowsfoot Wrench . . . . . JDF22

Used to loosen and tighten fuel pipes at injection nozzles and at injection pump.

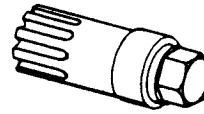


JDF22

RG40854,00000E0 -19-07SEP01-4/11

Flywheel Turning Tool . . . . . JDE83

Used to rotate flywheel on engines with 142-tooth flywheel ring gear and a 26.5 mm (1.04 in.) ID flywheel housing guide bore diameter.



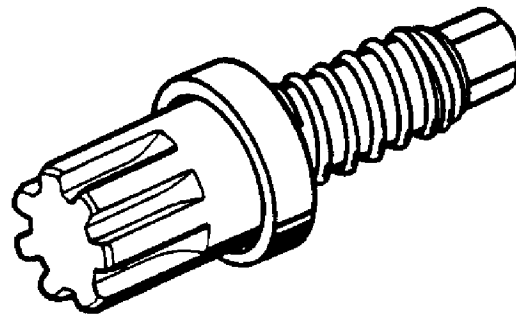
JDE83

RG6251 -UN-22JUL92

RG40854,00000E0 -19-07SEP01-5/11

Flywheel Turning Tool . . . . . JDG820

Used to rotate flywheel on engine to check damper radial runout and time engine. JDE81-1 may be used also if JDG820 is not available.



JDG820

RG7056 -UN-05DEC97  
RG7056

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RG40854,00000E0 -19-07SEP01-6/11

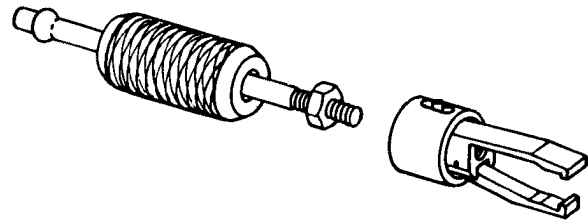
05  
170  
2

Injection Nozzle Puller . . . . . JDE38B

Remove injection nozzles.

If JDE38B is not available, JDE38A Nozzle Puller with JDG716 Adapter can be used. JDG716 can be used with slide handle adapter from JDE38 or JDE38A to remove 9.5 mm nozzles without removing the rocker arm cover.

JDG716-1 Repair Kit is available if leg of JDG716 Adapter is damaged.



JDE38B

RG9478 -UN-12NOV98

RG40854.00000E0 -19-07SEP01-7/11

Nozzle Bore Cleaning Tool . . . . . JDE39

Clean injection nozzle bore in cylinder head.



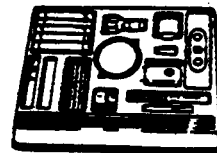
JDE39

RG5084 -UN-23AUG88

RG40854.00000E0 -19-07SEP01-8/11

Nozzle Cleaning Kit . . . . . JDF13B

Clean injection nozzles.



JDF13B

RG5224 -UN-23AUG88

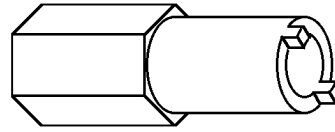
Continued on next page

RG40854.00000E0 -19-07SEP01-9/11

05  
170  
3

Injection Nozzle Wrench . . . . . JDG949

Used to loosen or tighten lift adjusting screws on injection nozzles.



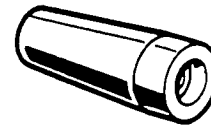
JDG949

RG7644 -UN-23NOV97

RG40854,00000E0 -19-07SEP01-10/11

Nozzle Carbon Stop Seal Installer . . . . . JD258 (JD-258)

Used to install carbon stop seal in injection nozzle groove.



JD258 (JD-258)

RG6254 -UN-22JUL92

RG40854,00000E0 -19-07SEP01-11/11

## Fuel System Repair and Adjustment Service Equipment and Tools

*NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.*

*SERVICEGARD is a trademark of Deere & Company*

RG40854,00000E1 -19-07SEP01-1/5

Bosch Bench Mounted Nozzle Tester . . . . . JT25510

Check nozzle opening pressure.

Continued on next page

RG40854,00000E1 -19-07SEP01-2/5

Electronic Fuel/Control System Repair Tools and Other Materials

Fuel Line . . . . .KJD10109

Use with JT25510 Nozzle Tester to check nozzle opening pressure.

RG40854,00000E1 -19-07SEP01-3/5

Fuel Injection Nozzle Tester Adapter Set . . . . D01110AA

Check nozzle opening pressure.

RG40854,00000E1 -19-07SEP01-4/5

OTC Portable Nozzle Tester . . . . . D01109AA

Check nozzle opening pressure.

RG40854,00000E1 -19-07SEP01-5/5

**Fuel System Repair and Adjustment Other Materials**

05  
170  
5

Number	Name	Use
T43512 (U.S.) TY9473 (Canadian) 242 (LOCTITE®)	Thread Lock and Sealer (Medium Strength)	Apply to fuel line fittings and injection pump front access plate cap screws.
AR54749 (U.S.)	Soap Lubricant	Injection pump mounting flange O-ring.

LOCTITE is a registered trademark of Loctite Corp.

RG40854,00000E2 -19-07SEP01-1/1

### Control System Repair and Adjustment Essential Tools

*NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).*

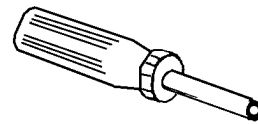
*SERVICEGARD is a trademark of Deere & Company*

RG40854,00000E4 -19-07SEP01-1/15

RW25539 -UN-28AUG96

Extraction Tool . . . . . JDG364

Extract wire from connectors.

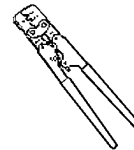


RG40854,00000E4 -19-07SEP01-2/15

RW25542 -UN-20AUG96

WEATHER PACK™ Crimping Tool . . . . . JDG783

Crimp contacts to wires.

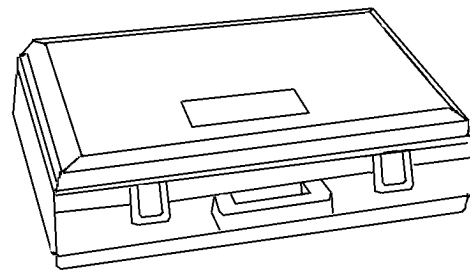


*WEATHER PACK is a trademark of Packard Electric*

RG40854,00000E4 -19-07SEP01-3/15

Technician's Electrical Repair Kit . . . . . JT07195B

Repair wire connectors.



Continued on next page

RG40854,00000E4 -19-07SEP01-4/15

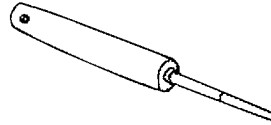
RW25558 -UN-29AUG96

05  
170  
6

RW25541 -UN-20AUG96

WEATHER PACK™ Extractor (Wide). . . . . JDG776

Remove terminals from METRI-PACK™ connectors.



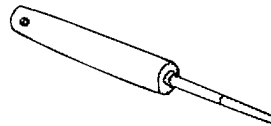
*WEATHER PACK is a trademark of Packard Electric  
METRI-PACK is a trademark of AMP Incorporated*

RG40854.00000E4 -19-07SEP01-5/15

RW25541 -UN-20AUG96

WEATHER PACK™ Extractor (Narrow) . . . . . JDG777

Remove terminals from METRI-PACK™ connectors.



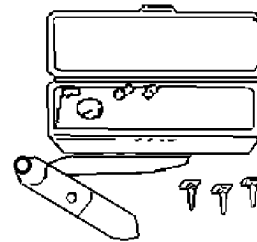
*WEATHER PACK is a trademark of Packard Electric  
METRI-PACK is a trademark of AMP Incorporated*

RG40854.00000E4 -19-07SEP01-6/15

05  
170  
7

DEUTSCH™ Electrical Repair Tool Kit. . . . . JDG359

Repair DEUTSCH™ electrical connector bodies.



RW25540 -UN-06SEP96

*DEUTSCH is a trademark of Deutsch Co.*

RG40854.00000E4 -19-07SEP01-7/15

12—14 Gauge Extractor (Set of Two) . . . . . JDG361

Extracts wire.

RG40854.00000E4 -19-07SEP01-8/15

16—18 Gauge Extractor (Set of Two) . . . . . JDG362

Extracts wire.

Continued on next page

RG40854.00000E4 -19-07SEP01-9/15

Electronic Fuel/Control System Repair Tools and Other Materials

20—24 Gauge Extractor (Set of Two) . . . . . JDG363

Extracts wire.

RG40854,00000E4 -19-07SEP01-10/15

Crimping Tool . . . . . JDG360

Install DEUTSCH™ contacts.

DEUTSCH is a trademark of Deutsch Co.

RG40854,00000E4 -19-07SEP01-11/15

Terminal Extraction Tool . . . . . FKM10457

Used to extract terminals from ECU connector.

RG10740 -UN-31MAY00



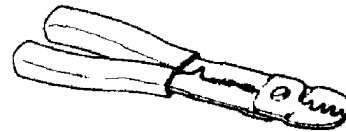
FKM10457

RG40854,00000E4 -19-07SEP01-12/15

Crimping Pliers . . . . . JDG144

Used to crimp wire terminal ends for ECU connector.

RG10739 -UN-26MAY00



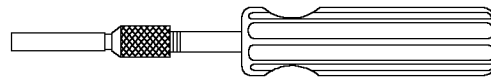
JDG144

RG40854,00000E4 -19-07SEP01-13/15

Terminal Extractor Tool . . . . . JDG1369

Used to extract terminals from injection pump connector.

RG10741 -UN-31MAY00



JDG1369

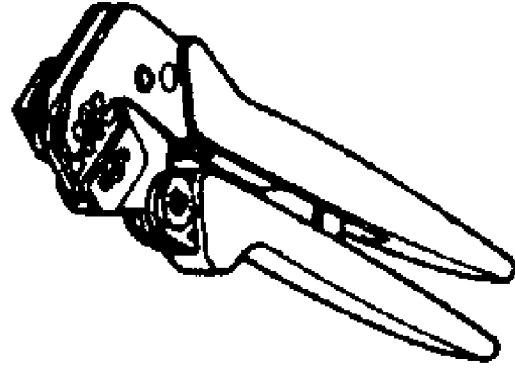
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RG40854,00000E4 -19-07SEP01-14/15

05  
170  
8

AMP Crimping Tool . . . . .JDG708

Used to crimp wire terminal ends for injection pump connector.



JDG708

RG10737 -JUN-25MAY00

RG40854,00000E4 -19-07SEP01-15/15

### Control Repair and Adjustment Other Materials

Number	Name	Use
JDT405 (U.S.)	High Temperature Grease	Sensor O-rings.
AT66865 (U.S.)	Lubricant	Insulate electrical connectors.

RG40854,00000E3 -19-07SEP01-1/1

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9

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170  
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**Engine Diagnostics and Testing Procedure Tools**

*NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or in the*

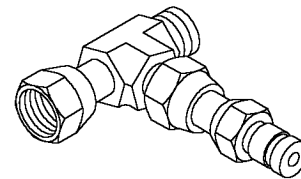
*European Microfiche Tool Catalog (MTC) unless otherwise noted.*

*SERVICEGARD is a trademark of Deere & Company.*

RG40854.00000E5 -19-07SEP01-1/10

Fuel Pressure Test Fitting . . . . . JT03526

Fuel Pressure Test Fitting is used with JT05412 Universal Pressure Test Kit to measure fuel transfer pump pressure.



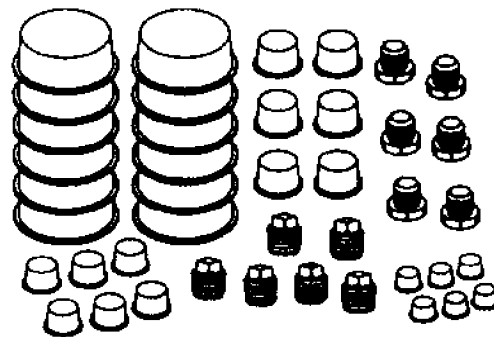
RG11125 -UN-16JUN00

05  
180  
1

RG40854.00000E5 -19-07SEP01-2/10

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

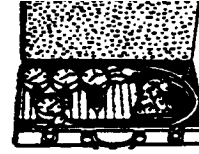
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RG40854.00000E5 -19-07SEP01-3/10

RG5162 -UN-23AUG88

Universal Pressure Test Kit . . . . . JT05412

Used for testing engine oil pressure, intake manifold pressure (turbo boost), and fuel transfer pump pressure.

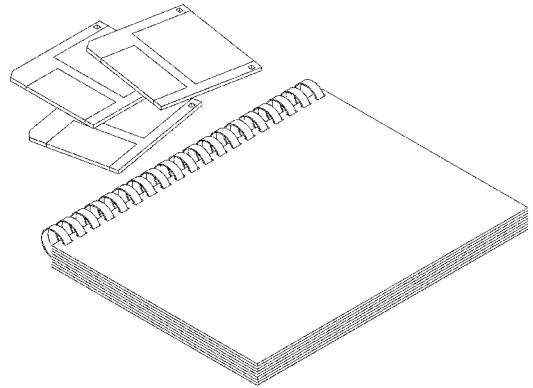


JT05412

RG40854,00000E5 -19-07SEP01-4/10

ECU Communication Software Kit . . . . .

Please refer to your John Deere Dealer website for information on obtaining the latest version of software.

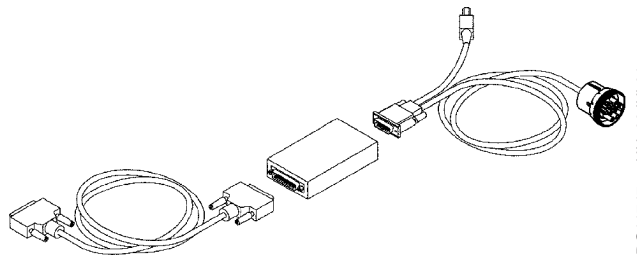


RG8554 -UN-26NOV97

RG40854,00000E5 -19-07SEP01-5/10

ECU Communication Hardware Kit . . . . . JDIS121

Used with ECU Communication Software Kit. Together, the kits enable a Windows ('95, '98, 2000, ME, and XP) or NT compatible computer to read information from the Engine Control Unit (ECU). The computer must be at least a 486/66 with 8 MB of RAM and an IEEE 1284 compliant parallel port. This kit allows communication with all John Deere applications that use one of the following diagnostic connectors: black 9-pin Deutsch diagnostic connector, gray 9-pin Deutsch diagnostic connector (early 8000 series tractors), or the flat 6-pin Weatherpack diagnostic connector (Lucas controllers). Not all of the components in this kit are shown to the right.



RG11747 -UN-09JUL01

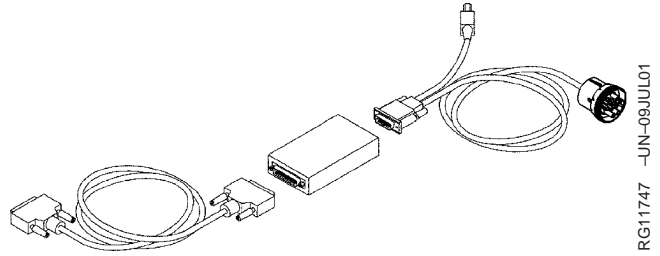
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RG40854,00000E5 -19-07SEP01-6/10

05  
180  
2

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

RG40854,00000E5 -19-07SEP01-7/10

**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.**

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RG40854,00000E5 -19-07SEP01-8/10

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

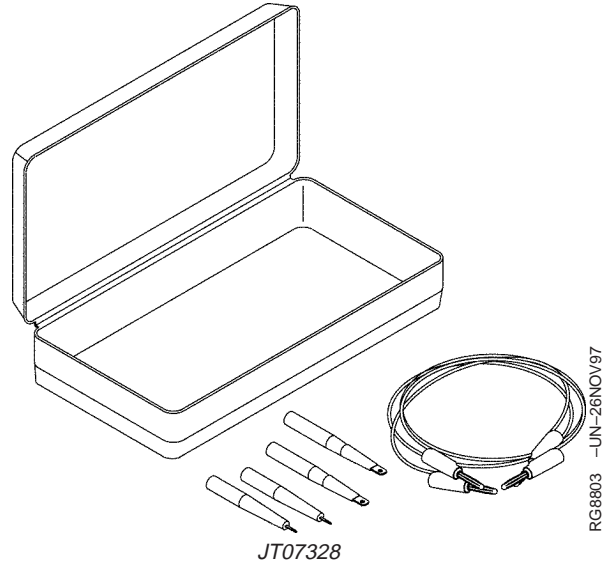
RG11126 -UN-19JUN00

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RG40854,00000E5 -19-07SEP01-9/10

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.



RG40854,00000E5 -19-07SEP01-10/10

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# Section 06 Specifications

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06



### Electronic Fuel System Repair and Adjustment Specifications

Item	Measurement	Specification
Final Fuel Filter Mounting Bracket-to-Cylinder Head	Torque	35 N•m (26 lb-ft)
Final Fuel Filter Base-to-Bracket Cap Screws	Torque	35 N•m (26 lb-ft)
Fuel Injection Pump Drive Gear-to-Shaft Retaining Nut	Torque	81 N•m (60 lb-ft)
Fuel Injection Pump Front Access Plate Cap Screws	Torque	6 N•m (4.5 lb-ft) (54 lb-in)
Fuel Injection Pump Mounting Nuts	Torque	27 N•m (20 lb-ft)
Fuel Injection Pump Delivery Lines	Torque	27 N•m (20 lb-ft)
Fuel Injection Nozzles (4045D and 6068D Engines)		
New or Reconditioned Nozzle with New Internal Parts	Opening Pressure for Setting	23 856—24 407 kPa (238—244 bar) (3460—3540 psi)
	Opening Pressure for Checking (Minimum)	21 856 kPa (218 bar) (3170 psi)
Used Nozzle	Opening Pressure for Checking (Minimum)	19 850 kPa (198 bar) (2880 psi)
Opening Pressure Difference between Cylinders	Pressure Difference (Maximum)	700 kPa (7 bar) (100 psi)
Fuel Injection Nozzles (4045T, 4045H, 6068T, and 6068H Engines)		
New or Reconditioned Nozzle with New Internal Parts	Opening Pressure for Setting	25 511—26 062 kPa (255—260 bar) (3700—3780 psi)
	Opening Pressure for Checking (Minimum)	24 683 kPa (246 bar) (3580 psi)
Used Nozzle	Opening Pressure for Checking (Minimum)	23 511 kPa (235 bar) (3410 psi)

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200  
1

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RG40854,00000E6 -19-07SEP01-1/2

*Repair Specifications*

<b>Item</b>	<b>Measurement</b>	<b>Specification</b>
Opening Pressure Difference between Cylinders	Pressure Difference (Maximum)	700 kPa (7 bar) (100 psi)
Fuel Injection Nozzle Tip	Spray Angle	144°
Nozzle Valve/Seat Tightness Condition at Pressure Test of 2800—3500 kPa (28—35 bar) (400—500 psi)	Leakage	Nozzle tip dry after 5 seconds. (Slight dampness permissible on used nozzles.)
Fuel Injection Nozzle Return Leakage at Pressure Test of 10 300 kPa (103 bar) (1500 psi)	Leakage	3—10 Drops/30 Seconds
Fuel Injection Nozzle Tip Orifice	Number of Orifices per Nozzle	4
Fuel Injection Nozzle Tip Orifice	ID	0.29 mm (0.0116 in.)
Injection Nozzle Pressure Adjusting Screw Lock Nut	Torque	10 N•m (7 lb-ft)
Fuel Injection Nozzle Valve Needle Lift	Needle Lift (Based on Zero Lift)	3/4 Turn Counterclockwise
Fuel Injection Nozzle Lift Adjusting Screw Lock Nut	Torque	5 N•m (3.5 lb-ft) (42 lb-in.)
Fuel Injection Nozzle Hold-Down Clamp Cap Screws	Torque	40 N•m (30 lb-ft)
Fuel Leak-Off Hex Nut	Torque	5 N•m (3.7 lb-ft) (44 lb-in.)
Fuel Injection Nozzle Delivery Lines	Torque	27 N•m (20 lb-ft)

RG40854,00000E6 -19-07SEP01-2/2

06  
200  
2

## Electrical Engine Control Repair and Adjustment Specifications

Item	Measurement	Specification
Coolant Temperature Sensor (In Cylinder Head)	Torque	35 N•m (26 lb-ft)
Engine Speed Sensor	Torque	20 N•m (15 lb-ft)

DPSG,OUO1004,2637 -19-10APR00-1/1

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200  
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## **Fuel Injection Pump Specifications**

The following charts include pumps for John Deere Agricultural Equipment, Construction Equipment, and Commercial and Consumer Equipment, as well as OEM engine applications. They apply to Dubuque, Torreon and Saran-built engines.

Other sources for fuel injection pump timing specifications are as follows:

- Agricultural Equipment–DB1216 Specifications Handbook
- Construction Equipment–SP458 Specifications Handbook

If your pump specifications are not listed in the above sources, refer to DTAC solutions 6717 (Construction Equipment), 33925 (OEM Engines), or 33926 (Agricultural Equipment).

If your rotary pump application is not listed in any of these sources, contact the factory DTAC for assistance.

Continued on next page

RG,115,JW7713 -19-20APR00-1/3

06  
210  
1

Diagnostic Specifications

**NOTE:** Engine speeds are as preset to factory specifications. In most cases, slow idle speed will be reset upon specific vehicle application requirements. Refer to your machine technical manual for engine speeds that are different from those preset at the factory.

**IMPORTANT:** Make sure engine is warmed up to operating temperature and running at full load/rated speed when setting dynamic timing on injection pump.

FUEL INJECTION PUMP SPECIFICATIONS (AGRICULTURAL APPLICATIONS)								
Machine Model	Engine Model	Original Injection Pump (Part No.)	Replaced By Injection Pump (Part No.)	Slow Idle Speed (rpm)	Rated Speed (rpm)	Fast Idle (rpm)	Dynamic Timing (Degrees Before TDC)	DD Engine Number <sup>a</sup>
<b>Mannheim, Germany (European Market)</b>								
6310 Tractor	CD4045TL052	RE71616	RE501225	850 <sup>b</sup>	2300	2460	6.0	
		RE501225		850 <sup>b</sup>	2300	2460	6.0	
		RE506370		850 <sup>b</sup>	2300	2460	3.0	DD16110 <sup>a</sup>
		RE506370		850 <sup>b</sup>	2300	2460	3.0	DD16121 <sup>a</sup>
		RE506370		850 <sup>b</sup>	2300	2460	3.0	DD16152 <sup>a</sup>
6410 Tractor	CD4045TL053	RE505567		850 <sup>b</sup>	2300	2460	6.0	
		RE71617	RE501227	850 <sup>b</sup>	2300	2460	6.5	
		RE501227		850 <sup>b</sup>	2300	2460	6.5	
		RE506372		850 <sup>b</sup>	2300	2460	4.0	DD16112 <sup>a</sup>
		RE506372		850 <sup>b</sup>	2300	2460	4.0	DD16122 <sup>a</sup>
6510 Tractor	CD6068DL050	RE506372		850 <sup>b</sup>	2300	2460	4.0	DD16153 <sup>a</sup>
		RE505569		850 <sup>b</sup>	2300	2460	6.5	
		RE71618	RE501231	850 <sup>b</sup>	2300	2500	5.5	
		RE501231	RE505578	850 <sup>b</sup>	2300	2460	5.5	
		RE505578		850 <sup>b</sup>	2300	2460	5.5	
6610 Tractor	CD6068TL050	RE505578		850 <sup>b</sup>	2300	2460	5.0	DD16114 <sup>a</sup>
		RE505578		850 <sup>b</sup>	2300	2460	5.0	DD16123 <sup>a</sup>
		RE505578		850 <sup>b</sup>	2300	2460	5.0	DD15154 <sup>a</sup>
		RE501233	RE503888	850 <sup>b</sup>	2300	2460	6.0	
		RE503888	RE505580	850 <sup>b</sup>	2300	2460	6.0	
		RE505580		850 <sup>b</sup>	2300	2460	6.0	
		RE505580		850 <sup>b</sup>	2300	2500	5.5	DD16116 <sup>a</sup>
		RE505580		850 <sup>b</sup>	2300	2500	5.5	DD16124 <sup>a</sup>
		RE505580		850 <sup>b</sup>	2300	2500	5.5	DD16155 <sup>a</sup>

<sup>a</sup>Reference number is listed on label on side of rocker arm cover and represents applications which are certified to European Tier I regulations. The dynamic timing value is different than the non-certified applications.

<sup>b</sup>1050 rpm when engine is cold.

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Diagnostic Specifications

**FUEL INJECTION PUMP SPECIFICATIONS (AGRICULTURAL APPLICATIONS)**

Machine Model	Engine Model	Original Injection Pump (Part No.)	Replaced By Injection Pump (Part No.)	Slow Idle Speed (rpm)	Rated Speed (rpm)	Fast Idle (rpm)	Dynamic Timing (Degrees Before TDC)	DD Engine Number <sup>a</sup>
6810 Tractor	CD6068TL051	RE501235	RE503890	850 <sup>b</sup>	2100	2250	6.0	
		RE503890	RE505582	850 <sup>b</sup>	2100	2250	6.0	
		RE505582		850 <sup>b</sup>	2100	2250	6.0	
		RE505582		850 <sup>b</sup>	2100	2250	5.5	DD16118 <sup>a</sup>
		RE505582		850 <sup>b</sup>	2100	2250	5.5	DD16125 <sup>a</sup>
		RE505582		850 <sup>b</sup>	2100	2250	5.5	DD16156 <sup>a</sup>
6910 Tractor	CD6068TL052	RE501237	RE503892	850 <sup>b</sup>	2100	2250	6.0	
		RE503892	RE505584	850 <sup>b</sup>	2100	2250	6.0	
		RE505584		850 <sup>b</sup>	2100	2250	6.0	
		CD6068TL054	RE502414		850 <sup>b</sup>	2100	2250	5.5
6320 Tractor	CD4045HL072	RE509070		850 <sup>b</sup>	2300	2460	6.5	DD16232 <sup>a</sup>
6420 Tractor	CD6068DL070	RE506312		850 <sup>b</sup>	2300	2460	7.5	DD16077 <sup>a</sup>
6520 Tractor	CD6068DL070	RE506268		850 <sup>b</sup>	2300	2460	6.5	DD16086
<b>Mannheim, Germany (North American Market)</b>								
6310/6310L/6310S Tractor	CD4045TL055	RE503896	RE504324	850 <sup>b</sup>	2300	2460	4.5	
		RE504324		850 <sup>b</sup>	2300	2460	4.5	
		RE503908	RE504325	850 <sup>b</sup>	2300	2460	4.0	
		RE504325		850 <sup>b</sup>	2300	2460	4.0	
6410/6410L/6410S Tractor	CD4045TL056	RE503896	RE504325	850 <sup>b</sup>	2300	2460	4.0	
		RE504325		850 <sup>b</sup>	2300	2460	4.0	
6320 Tractor	CD4045HL073	RE509072		850 <sup>b</sup>	2300	2460	6.5	DD16234 <sup>a</sup>
6420 Tractor	CD4045HL070	RE506312		850 <sup>b</sup>	2300	2460	7.5	DD16077 <sup>a</sup>
<sup>a</sup> Reference number is listed on label on side of rocker arm cover and represents applications which are certified to European Tier I regulations. The dynamic timing value is different than the non-certified applications.								
<sup>b</sup> 1050 rpm when engine is cold.								

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## Fuel System Diagnostic Specifications

Item	Measurement	Specification
Fuel Transfer Pump	Static Pressure	25—30 kPa (0.25—0.30 bar) (3.5—4.5 psi)
Fuel Transfer Pump	Minimum Static Pressure at 850 rpm Engine Speed	15 kPa (0.15 bar) (2.0 psi)
Fuel Transfer Pump	Minimum Positive Pressure at 2400 rpm Engine Speed	21—34 kPa (0.21—0.34 bar) (3—5 psi)

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## Torque Curve Selection

*NOTE: 6010, 6020 and 7020 Series Tractors with a Level 1 ECU do not have multiple torque curves*

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## Governor Droop Mode Selection

Desired Speed Governor Selection for 6010, 6020, and 7020 Series Tractors	
Mode Selected on DST or SERVICE ADVISOR™	Conditions
0	Normal droop
1	Field cruise

Max. Speed Governor Selection for 6010, 6020 and 7020 Series Tractors	
Mode Selected on DST or SERVICE ADVISOR™	Conditions:
9	Normal droop
10	Field cruise
13	Road Speed Limiting

*SERVICE ADVISOR is a trademark of Deere & Company*

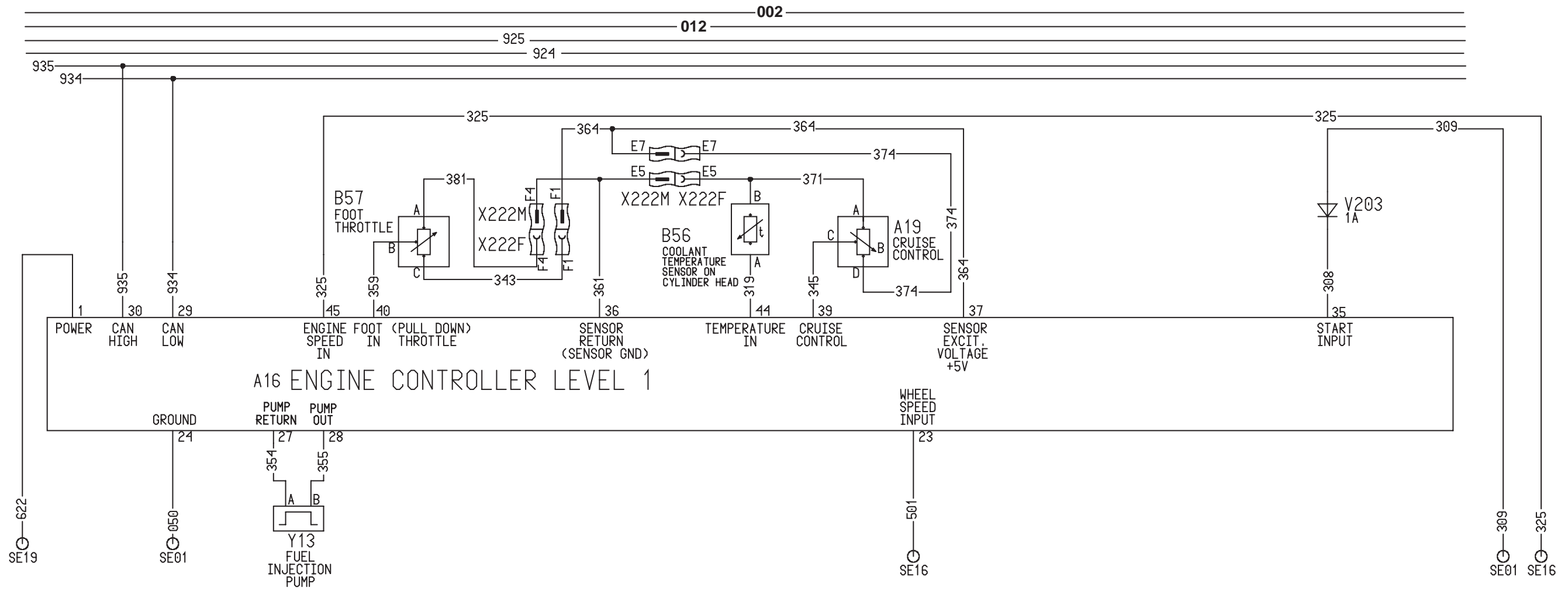
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### Electronic Control System Wiring Diagram for 6010 Series Tractors

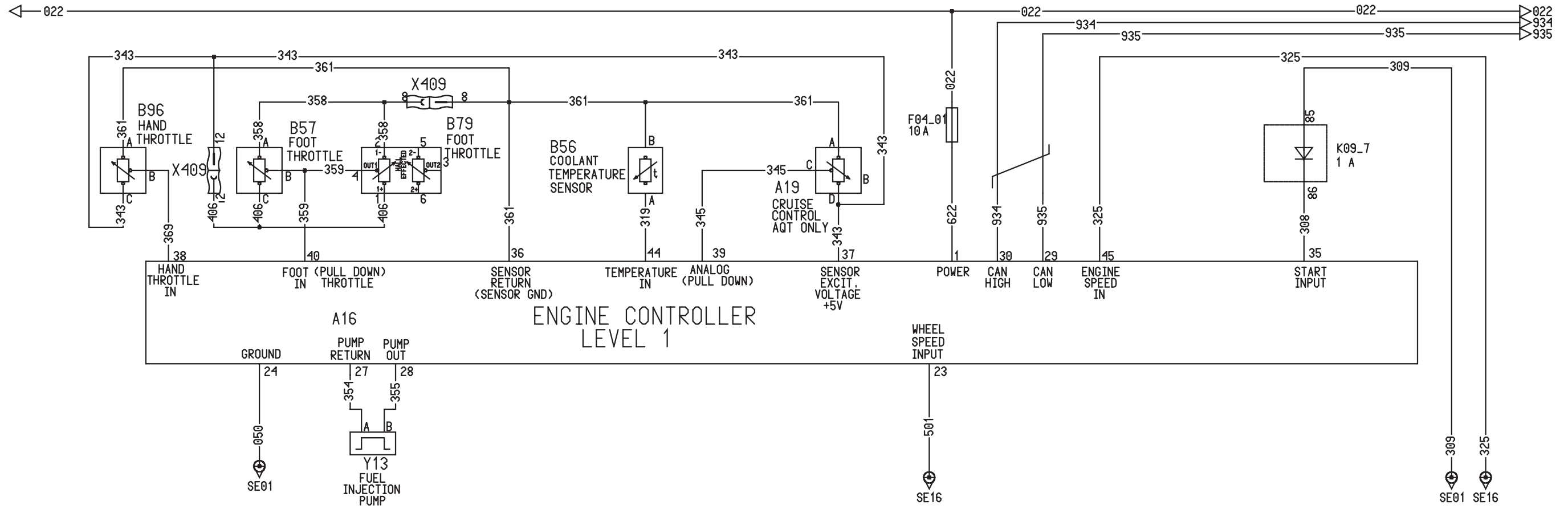
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### Electronic Control System Wiring Diagram for 6020 and 7020 Series Tractors

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