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JOHN DEERE

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TECHNICAL MANUAL

POWERTECH® 4.5 L & 6.8 L Diesel Engines—Level 12 Electronic Fuel System with DE10 Pump

CTM331 05APR06 (ENGLISH)

[redacted]

POWERTECH® 4.5L & 6.8L Diesel Engines

Level 12 Electronic Fuel System With Stanadyne DE10 Pump

TECHNICAL MANUAL

POWERTECH® 4.5 L & 6.8 L Diesel Engines—Level 12 Electronic Fuel System with DE10 Pump

CTM331 05APR0[illegible] (ENGLISH)

For complete service information also see:

POWERTECH® 4.5 L and 6.8 L Diesel Engines—Base Engine	CTM104
Alternators and Starter Motors	CTM77
OEM Engine Accessories	CTM67 (English Only)

John Deere Power Systems

LITHO IN U.S.A.

Introduction

Forward

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

This manual (CTM331) covers only Level 12 Electronic Fuel System with the Stanadyne DE10 injection pump. It is one of five volumes on 4.5 L and 6.8 L engines. The following four companion manuals cover the base engine, mechanical fuel system, level 4 electronic fuel system and level 1 electronic fuel system repair, operation and diagnostics:

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

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

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. 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. Section 05 summarizes all applicable essential tools, service equipment and tools, other materials needed to do the job, and service parts kits. Section 06 summarizes all specifications, wear tolerances, and torque values.

Before beginning diagnosis or repair on the engine, clean the engine.

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

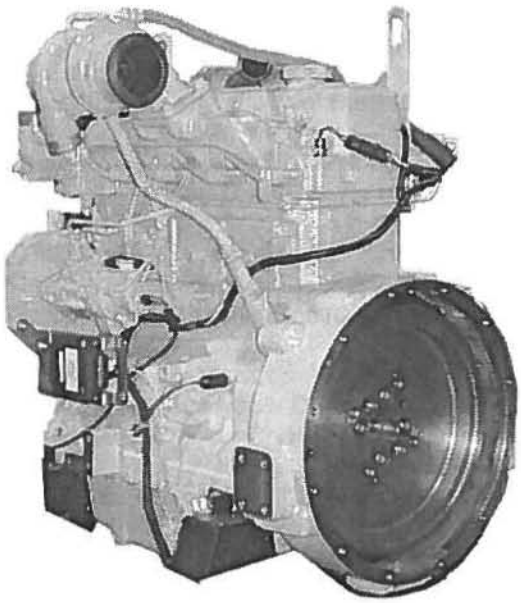
Some components of this engine may be serviced without removing the engine from the machine. Refer to the specific machine technical manual for information on components that can be serviced without removing the engine from the machine and for engine removal and installation procedures.

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.

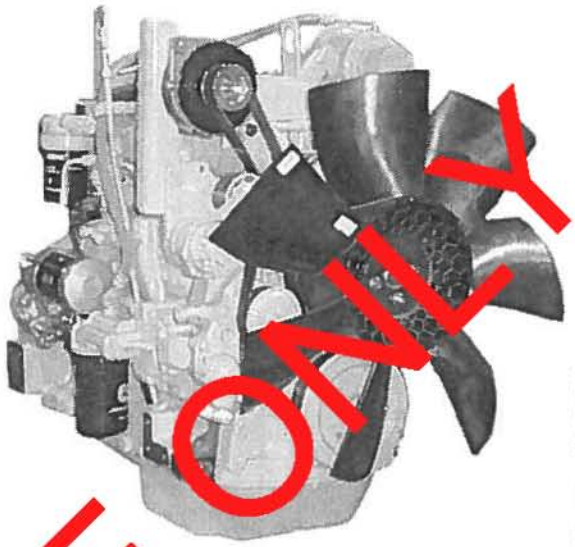
OUO1080,00001FE –19–16NOV01–1/1

POWERTECH® 4.5 L Engine with Level 12 Electronic Fuel System and Stanadyne DE10 Pump



RG11931 –UN–06NOV01

Right Side of Engine



RG11932 –UN–06NOV01

Left Side of Engine

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DPSG,OUO1004,129 –19–15MAY98–1/1

Contents

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

Section 01
General Information

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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.

DX,FLAME –19–29SEP98–1/1

Handle Starting Fluid Safely

Starting fluid is highly flammable.

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

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

Do not incinerate or puncture a starting fluid container.

TS1356 –UN–18MAR92

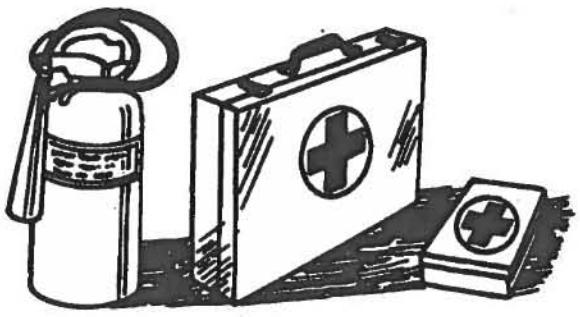
DX,FIRE3 –19–16APR92–1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 –UN–23AUG88

DX,FIRE2 –19–03MAR93–1/1

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Avoid High-Pressure Fluids

X9611 –UN–23AUG88

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.

DX,FLUID –19–03MAR93–1/1

Wear Protective Clothing

TS206 –UN–23AUG88

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.

DX,WEAR –19–10SEP90–1/1

Service Machines Safely

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

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

TS226 –UN–23AUG88

DX,LOC –19–04JUN90–1/1

Work In Ventilated Area

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

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

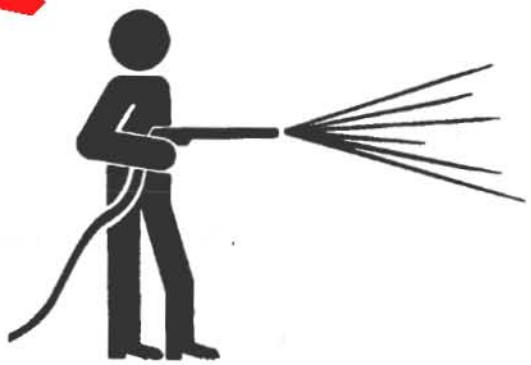
TS220 –UN–23AUG88

DX,AIR –19–17FEB99–1/1

Work in Clean Area

Before starting a job:

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



T6642EJ –UN–18OCT88

DX,CLEAN –19–04JUN90–1/1

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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 100 mm (4 in.) from area to be affected by heating. If paint cannot be removed, wear an approved respirator before heating or welding.
- 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 not use a chlorinated solvent in areas where welding will take place.

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

Dispose of paint and solvent properly.

DX,PAINT –19–24JUL02–1/1

Avoid Heating Near Pressurized Fluid Lines

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

DX,TORCH –19–10DEC04–1/1

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

LIGH –19– UN90–1/1

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.

LX1016749 –UN–01JUL97

DX,SAFE,TOOLS –19–10OCT97–1/1

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Practice Safe Maintenance

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

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

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

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

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

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

TS218 –UN–23AUG88

DX,SERV –19–17FEB99–1/1

Use Proper Tools

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

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.

TS779 –UN–08NOV89

DX,REPAIR –19–17FEB99–1/1

Dispose of Waste Properly

TS1133 –UN–26NOV90

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

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

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

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

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

DX,DRAIN –19–03MAR93–1/1

Live With Safety

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

TS231 –19–07OCT88

DX,LIVE –19–25SEP92–1/1

Engine Model Designation

John Deere Engine Model—4045 and 6068 Engines

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

4045TF275 Engine	
4	Number of cylinders
4.5	Liter displacement
T	Aspiration code
F	User code
275	*POWERTECH*® application code
Aspiration Code	
D	Naturally aspirated
T	Turbocharged, no aftercooling
A	Turbocharged and Air-to-Coolant Aftercooled
H	Turbocharged and Air-to-Air Aftercooled
User Factory Code	
AP	Industries John Deere Mexica S. A de C. V. (Saltillo/Monte[illegible]y, Mexic
AT	Agritalia srl (Vittoria, Sicily, Italy)
BE	Bell Equipment Co. (Richards Bay, South Af[illegible]a)
CQ	John Deere Brazil (Horizontina, Brazil)
DW	John Deere Davenport Works (Davenport, [illegible]wa)
E	John Deere Ottumwa Works (Ottum[illegible]Iowa)
F	OEM (Outside Equipment Manufa[illegible]turers)
FF	Deere-Hitachi (Kernersville, Nor[illegible]Carolina)
FG	Goldoni S.P.A. (Modena, Italy)
FM	Marine Engines
H	John Deere Harvester Works ([illegible]ast M[illegible], Illinois)
KV	John Deere Comm[illegible]l Worksite Products (Knoxville, Tennessee)
L	John Deere Werke M[illegible]nheim ([illegible]any)
LA	John Deere W[illegible]rke Mann[illegible]eim (Germany) (Engines with Bosch VP44 Injection Pump)
LV	John Deer[illegible] Commer[illegible]ial P[illegible]ucts (Augusta, Georgia)
N	John Dee[illegible] Des [illegible]oines Works (Des Moines, Iowa)
P	Industrias Jo[illegible]Deere M[illegible]ico S.A. de C.V. (Saltillo/Monterrey, Mexico)
PY	La[illegible]on [illegible]Toubr[illegible]Ltd[illegible]une, India)
RW	[illegible]ohn De[illegible]e Wate[illegible] Tractor Works (Waterloo, Iowa)
T	[illegible]ohn D[illegible]buque Works (Dubuque, Iowa)
T8	Ca[illegible]co Industries (Thibodaux, Louisiana)
TJ	John[illegible]ere Forestry (Timberjack) (Sweden/Finland/Canada)
YC	John D[illegible]re Jialian Harvester Co. Limited (China)
Z	John[illegible]Deere WERKE Zweibrucken (Germany)
Application Code	
001, etc.	[illegible]ee ENGINE APPLICATION CHARTS, later in this Group

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Engine Serial Number Plate Information

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

Engine Serial Number (B)

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

CD4045T000000

CD	Factory producing engine
4045T	Engine model designation
000000	Sequential serial number
Factory Code (Engine Manufacturer)	
T0	Dubuque, Iowa
CD	Saran, France
PE	Torreon, Mexico
J0	Rosario, Argentina
Engine Model Designation	
4045T	Definition explained previously. See ENGINE MODEL DESIGNATION earlier in this group.
Sequential Number	
000000	6-digit sequential serial number

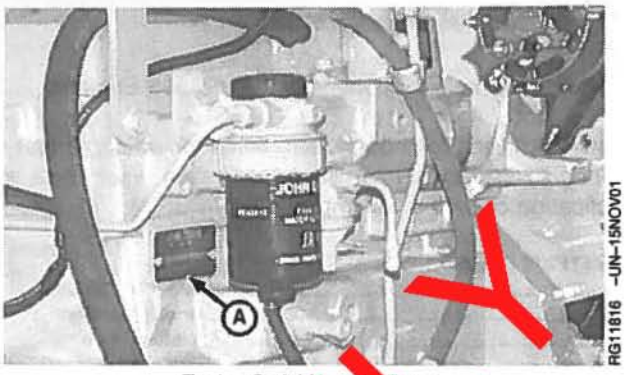
Engine Application Data (C)

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

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

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

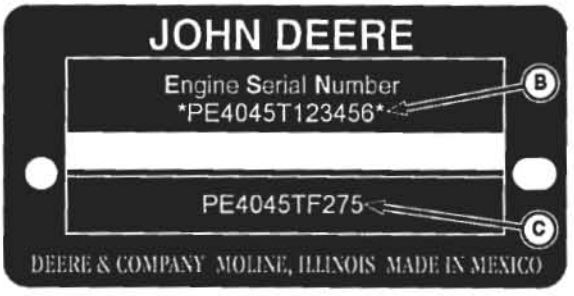
A—Engine Serial Number Plate
B—Engine Serial Number
C—Engine Application Data
D—Coefficient of Absorption (Saran Engines Only)



Engine Serial Number Plate

Dubuque Engine Serial Number Plate

Saran Engine Serial Number Plate



Torreon Engine Serial Number Plate

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OEM Engine Option Code Label

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

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

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

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OUO1080,000020E –19–26NOV01–1/1

Information Relative to Emissions Regulations

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

The regulations prohibit tampering with the emission-related components listed below which would render that component inoperative or to make any adjustment on the engine beyond published specifications. It is also illegal to install a part or component where the principle effect of that component is to bypass, defeat, or render inoperative any engine component or device which would affect the engine's conformance to the emission regulations. **To summarize, it is illegal to do anything except return the engine to its original published specifications.**

List of emission-related components:

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

OUO1080,0000035 –19–29AUG01–1/1

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Engine Application Charts

JOHN DEERE AGRICULTURAL EQUIPMENT

Machine Model	Engine Model
Waterloo - Tractors	
5425 Tractor	PE4045TLV53
5525 Tractor	PE4045TLV54
7220 Tractor	PE6068HRW59
7320 Tractor	PE6068HRW59
7420 Tractor	PE6068HRW60
7520 Tractor	PE6068HRW60
7815 Tractor	PE6068HRW63
Mannheim, Germany	
6020SE Tractor (R2)	CD4045TL270
6120, 6120SE Tractor (R2)	CD4045TL271
6215 Advantage Tractor (NA)	CD4045TL272
6215 Classic Tractor (R2)	CD4045TL272
6220, 6220SE Tractor (R2)	CD4045TL272
6320SE Tractor (R2)	CD4045HL270
6415 Advantage Tractor (NA)	CD4045HL272
6420SE Tractor (R2)	CD4045HL271
6515 Classic Tractor (R2)	CD6068HL270
6520L Tractor (NA)	CD4045HL273
6520SE Tractor (R2)	CD6068TL[illegible]0
6615 Advantage Tractor (NA)	CD6068[illegible]271, CD6068HL271
6620SE Tractor	6068H[illegible]272
6715 Advantage Tractor (NA)	CD6068[illegible], CD60[illegible]HL273
Zweibrucken, Germany	
3215 TeleHandler	CD4045H[illegible]061, CD4045HZ275
3220 TeleHandler	CD4045H[illegible]060, CD4045HZ275
3415 TeleHandler	CD4045[illegible]061, CD4045HZ275
3420 TeleHandler	CD4045HZ060, CD4045HZ275
3700 TeleHandler	CD4045TZ060
3800 TeleHandler	CD4045HZ060

Continued on next page

JOHN DEERE CONSTRUCTION & FORESTRY EQUIPMENT

Application	Engine Model
Dubuque	
310G Backhoe Loader	PE4045DT058, T04045DT058
310G Backhoe Loader (Alt Comp)	PE4045TT088, T04045TT088
310SG Backhoe Loader	PE4045TT089, T04045TT089
315SG Backhoe Loader	PE4045TT089, T04045TT089
710G Backhoe	PE6068TT057
450H Crawler Dozer (Alt Comp)	PE4045TT084, T04045TT084
450H Crawler Dozer (Nat Asp)	PE4045DT058, T04045DT058
450H LGP Crawler Dozer	PE4045TT085, T04045TT085
550H Crawler Dozer	PE4045TT087, T04045TT087
550H LGP Crawler Dozer	PE4045TT086, T04045TT086
650H Crawler Dozer	PE4045HT050
700H Crawler Dozer	PE6068TT060
710G Backhoe Loader	PE6068TT057
Saltillo, Mexico	
120C Excavator	PE4045HP050
160C LC Excavator	PE4045HP051
Deere-Hitachi - Kernersville	
200LC Excavator	PE6068HT059
Forestry	
810 Forwarder	CD4045HT[illegible]
543 DTT Feller Buncher Harvester	PE6068HDW[illegible]
640 DTT Feller Buncher Harvester	PE60[illegible]W62
1010 Forwarder	T0[illegible]45HTJ76, CD[illegible]HTJ76
1110 Forwarder	C[illegible]6068HTJ75
1058 Forwarder	T0[illegible]45HTJ76
1410 Forwarder	CD6[illegible]HTJ7[illegible]
1458 Forwarder	C[illegible]6068HTJ77
770 Harvester	CD[illegible]68HTJ77
770D Wheel Harvester	CD4[illegible]5HTJ77
863 Harvester	CD6068HTJ77
1070 Harvester	CD6068HTJ76
1063 Harvester	CD6068HTJ76
548 Skidder	PE6068HDW59
648DD/648TC Skidder	PE6068HDW60
JOHN DEERE OEM (OUTSIDE EQUIPME[illegible]T M[illegible]NUFA[illegible]URERS)	
CD4045TF275	
CD4045TFM75 Marine Engine	
PE4045HF275	
CD4045TF275	
PE4045TF275	
CD6068HF275	
PE6068HF275	
CD6068TF275	
PE6068TF27[illegible]	

Lubricants and Coolant

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

DPSG,OC[illegible]004,27[illegible]–19–[illegible]MAY00–1/1

Diesel Fuel

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

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

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

Required fuel properties

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

Cetane number of 45 minimum. Cetane number greater than 50 is preferred, especially for temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).

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

Fuel lubricity should pass a minimum load level of 3100 grams as measured by ASTM D6078 or, maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO12156-1.

Sulfur content:

Diesel fuel quality and fuel sulfur content must comply with all existing regulations for the area in which the engine operates.

- Sulfur content less than 0.05% (500 ppm) is preferred.
- If diesel fuel with sulfur content greater than 0.05% (500 ppm) is used, crankcase oil service intervals may be affected. (See recommendation for Diesel Engine Oil.)
- DO NOT use diesel fuel with sulfur content greater than 1.0%.

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

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Bio-Diesel Fuel

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

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

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

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

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

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

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

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

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

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

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Testing Diesel Fuel

DIESELSCAN™ is a John Deere fuel analysis program that can be used to monitor the quality of your fuel. The DIESELSCAN analysis verifies fuel type, cleanliness, water content, suitability for cold weather operation, and whether the fuel meets specifications.

Check with your John Deere dealer for availability of DIESELSCAN kits.

DIESELSCAN is a trademark of Deere & Company

DX,FUEL6 –19–14NOV05–1/1

Lubricity of Diesel Fuel

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

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

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

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

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

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

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

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

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Section 02
Repair and Adjustments

Contents

Fuel System—General Information

Stanadyne DE10 pumps are static lock-pin timed during installation of the injection pump.

The fuel supply pump is a separate component mounted on upper right-hand side of engine block and is actuated by a pin in block that rides on engine camshaft lobe.

Engines may be equipped with an optional fuel pre-filter/water bowl.

All engines are equipped with a round final fuel filter with water bowl. Hand primer on top of filter element is optional.

All engines use Stanadyne Rate Shaping Nozzles (RSN).

Field-installed options include fuel heater, water bowl and hand fuel primer.

OUO1089,00001F7 –19–06NOV01–1/1

Relieve Fuel System Pressure

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

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

X9811 –UN–23AUG88

High Pressure Fluids

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.

RG,35,JW7625 –19–20NOV97–1/1

Remove and Install Final Fuel Filter/Water Bowl and/or Pre-Filter/Water Bowl Base

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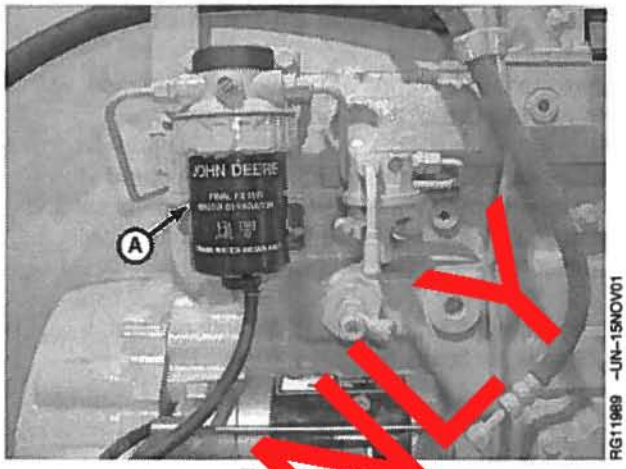
Refer to operator's manual for proper servicing and (hourly) replacement intervals.

Engines are equipped with a final fuel filter/water bowl (A) and may have an optional pre-filter/water bowl.

Final fuel filters/water bowls can be equipped with a transparent (see-through) water collection bowl and/or hand primer on machines equipped with only one filter.

A—Final Fuel Filter/Water Bowl



Final Fuel Filter

Continued on next page

OUO1089,00001F6 –19–06NOV01–1/3

1. Thoroughly clean fuel filter/pre-filter assemblies 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.

NOTE: The fuel filters are keyed to the filter header. If both pre-filter and final filter are removed, ensure that they are reinstalled in the correct headers.

3. Remove final fuel filter element and pre-filter/water bowl, if desired. See REPLACE FINAL FUEL FILTER/WATER BOWL AND PRE-FILTER/WATER BOWL, in this group.

NOTE: Pre-filter and final filter fuel lines may be connected to different filter inlet and outlet ports depending on engine application. Mark fuel line location to aid during assembly. Refer to markings on fuel filter base for fuel inlet/outlet ports, as they are different between the pre- and final filter bases.

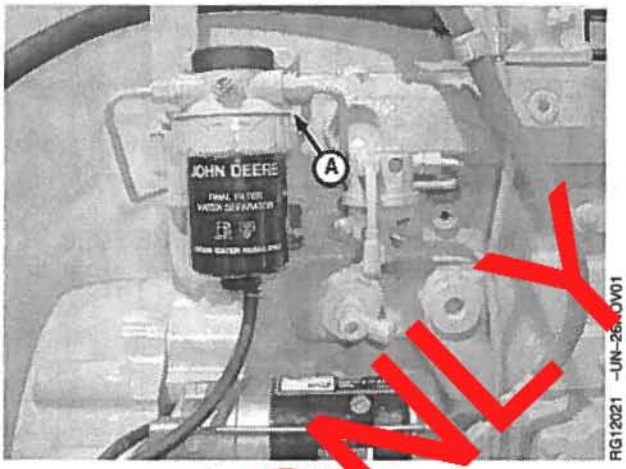
4. Disconnect fuel lines from all ports.

5. Remove final fuel filter base (A).

6. If equipped, remove pre-filter base.

7. Replace parts as necessary.

8. Install mounting brackets and tighten to torque specifications provided below.



RG12021 –UN–26NOV01

Final Fuel Filter Base

A—Final Fuel Filter Base

Specification	
Final Fuel Filter Bracket-to-Cylinder Head—Torque	73 N•m (54 lb-ft)
Final Fuel Filter Mounting Base-to-Bracket—Torque	73 N•m (54 lb-ft)
Fuel Pre-Filter Bracket-to-Cylinder Head and Alternator—Torque	73 N•m (54 lb-ft)
Fuel Pre-Filter/Water Bowl Mounting Base-to-Bracket Torque	50 N•m (36 lb-ft)

Continued on next page

9. Install pre-filter and final filter fuel filter/water bowl elements. See REPLACE FINAL FUEL FILTER/WATER BOWL AND PRE-FILTER/WATER BOWL, in this group.

10. Connect fuel lines to all ports.

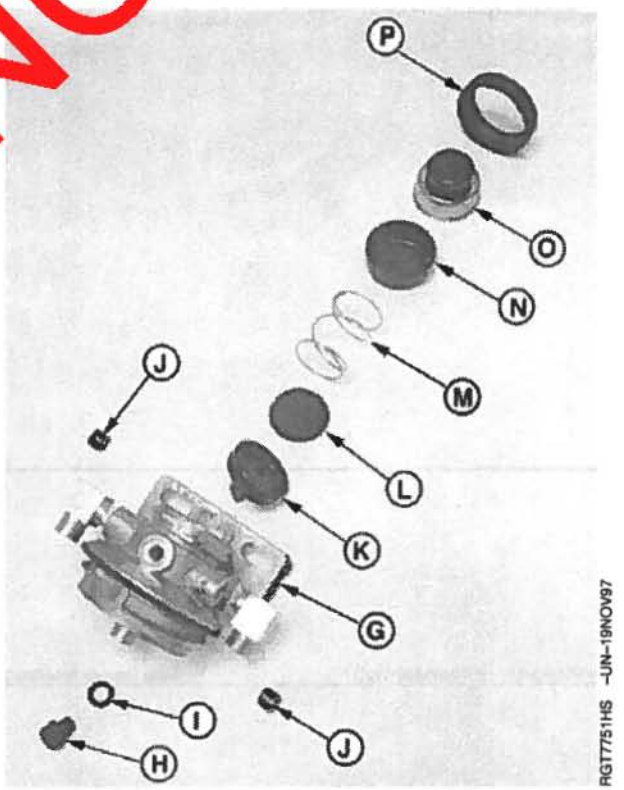
11. Bleed the fuel system. See BLEED THE FUEL SYSTEM in this group.

OU[illegible]89,00001F[illegible]-19-06NOV01-3/3

Fuel Pre-Filter/Water Bowl Assembly (Optional)

A—Drain Adapter
B—Packing
C—Cap Screw
D—Water Bowl
E—Retaining Ring
F—Filter Element
G—Filter Base with Seal Ring
H—Vent Plug
I—Packing
J—Plug (2 used)
K—Diaphragm
L—Spring Seat
M—Spring
N—Spring Cover
O—Pump Knob
P—Retaining Ring

RGT7751HR –UN–19NOV97



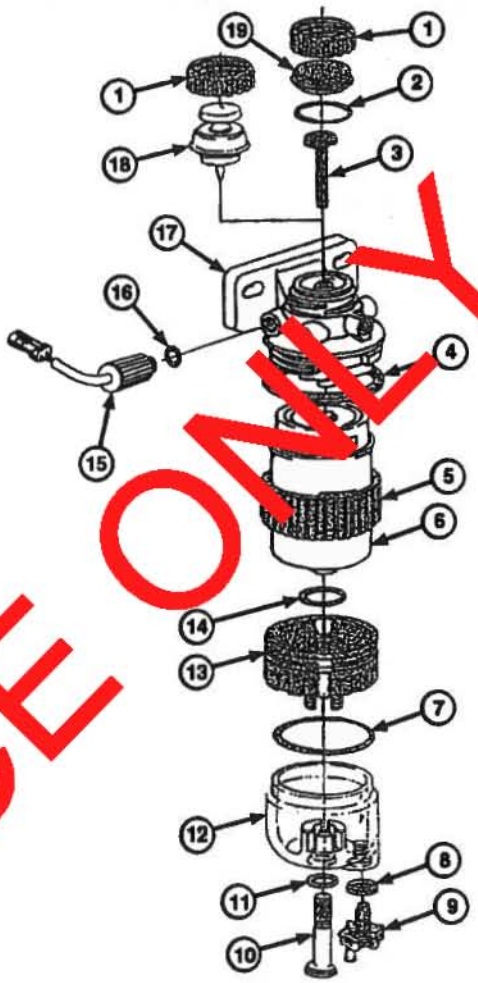
RGT7751HS –UN–19NOV97

Primary Filter/Water Bowl Assembly

RG,35,JW7623 –19–21JAN02–1/1

Final Fuel Filter Assembly

1—Retaining Ring
2—O-Ring
3—Stem
4—O-Ring
5—Retaining Ring
6—Filter
7—O-Ring
8—O-Ring
9—Drain Adapter
10—Screw
11—O-Ring
12—Water Bowl
13—Adapter
14—O-Ring
15—Fuel Heater (Optional)
16—O-Ring
17—Filter Base
18—Primer Assembly (Optional)
19—Cap



RG12015 –UN–16NOV01

Final Fuel Filter

OUO1080,00001FC –19–15NOV01–1/1

Replace Final Fuel Filter/Water Bowl and Pre-Filter/Water Bowl

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

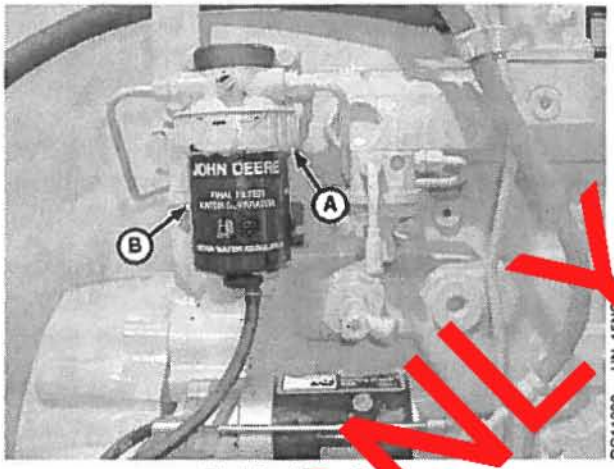
Final fuel filters can be equipped with a transparent (see-through) water bowl and/or hand primer on machines equipped with only one filter.

Replacement of pre- and final fuel filter elements are similar. Differences will be noted. Make sure correct embossments on filter elements match the slots in the mounting header.

1. Thoroughly clean fuel filter/water bowl 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 (A) 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 transparent (see-through) water bowl, if equipped. Drain and clean water bowl. Dry with compressed air.
6. Install transparent (see-through) water bowl, if equipped, onto new filter element. Make sure O-ring is properly installed in the top groove of bowl.
7. Thoroughly inspect filter base dust seal ring. Replace as needed.



Final Fuel Filter Shown

A—Retaining Ring
B—Filter Element

Continued on next page

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

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

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

10. Bleed fuel system. See BLEED THE FUEL SYSTEM, in this group.

OUO1089,00001F5 -19-06NOV01-2/2

Remove Fuel Supply Pump

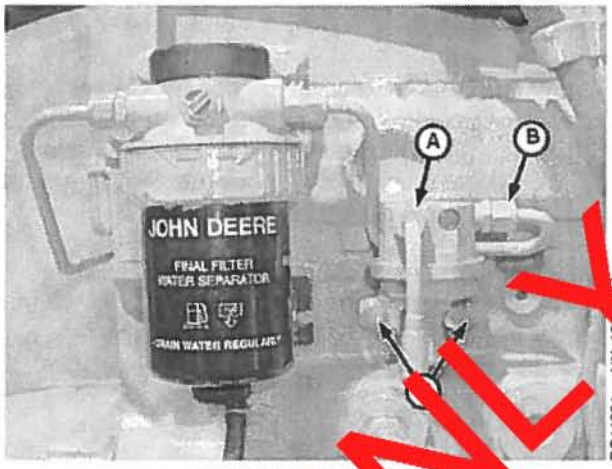
IMPORTANT: A backup wrench must always be used when disconnecting fittings or fuel lines from supply pump to avoid damage to fittings.

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

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

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

A—Supply Pump Inlet from Fuel Tank
B—Supply Pump Outlet to Final Fuel Filter
C—Cap Screws
D—Push Rod

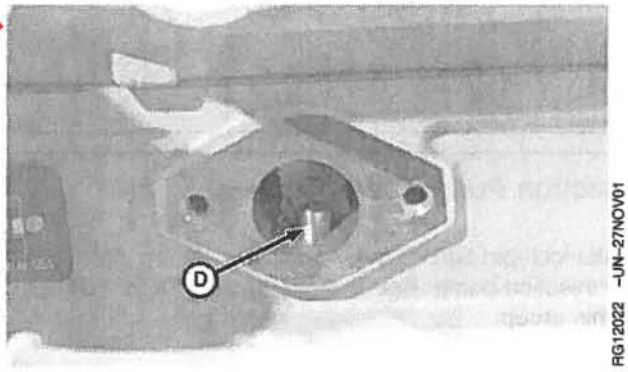


RG11991 –UN–1[illegible]V01

Fuel Supply Pump [illegible]es

RG9051 –UN–16MAR98

Remove Fuel Supply Pump



RG12022 –UN–27NOV01

Fuel Supply Pump Push Rod

OUO1089,00001F8 –19–06NOV01–1/1

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Install Fuel Supply Pump

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

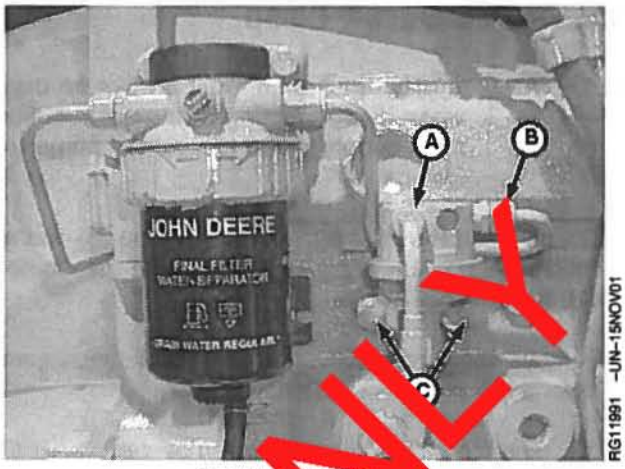
1. Install the fuel supply pump to cylinder block with pumping lever resting on top of push rod, using a new O-ring. Tighten cap screws (C) to specifications.

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

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

2. Connect supply pump inlet line (A) and outlet line (B) and tighten securely.

3. Bleed fuel system. See BLEED THE FUEL SYSTEM i this group.



Fuel Supp Pump Lines

A—Supply ump Inle rom uel Tank
B—Supply Pump Outle o Final Fuel Filter
C—Cap Sc ws

OUO1089,00001FA –19–06NOV01–1/1

Injection Pump Stat Tim g

Static lock-pin timing i ac mplished during installation of the injection pum . See STAL INJECTION PUMP later in this group.

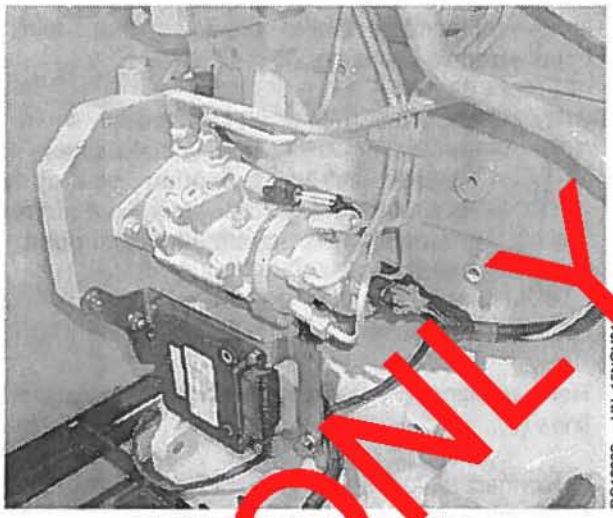
OUO1089,00001FB –19–06NOV01–1/1

Remove Injection 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.

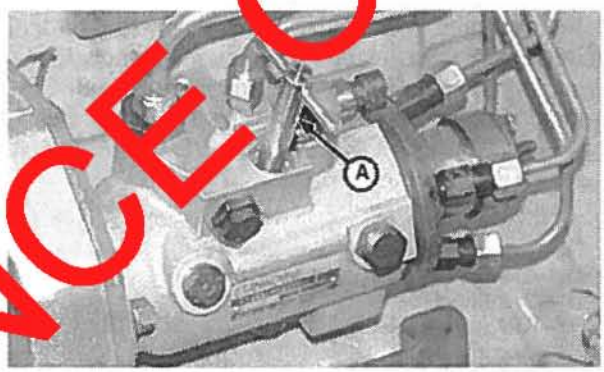
1. Clean the fuel injection pump, lines and area around the pump with cleaning solvent or a steam cleaner.
2. Rotate engine to TDC of number 1 cylinder compression stroke and install JDG1571 Timing Pin in flywheel.
3. Before removing injection pump from engine, install JDG1559 Injection Pump Timing Pin (A) into pump timing pin bore.
4. Remove injection pump drive gear cover (shown removed). Remove drive gear retaining nut and washer from end of pump shaft. Be careful not to let washer fall inside timing gear cover.
5. Attach JDG1560 Drive Gear Puller to injection pump drive gear (B) using two screws (C).
6. Evenly tighten the two screws (C) and snugly tighten center forcing screw (D) against end of pump shaft.
7. Tighten center forcing screw (D) until pump drive gear is free from tapered shaft. Remove JDG1560 Puller from drive gear.

A—JDG1559 Timing Pin
B—Injection Pump Drive Gear
C—Screws (2 used)
D—Center Forcing Screw



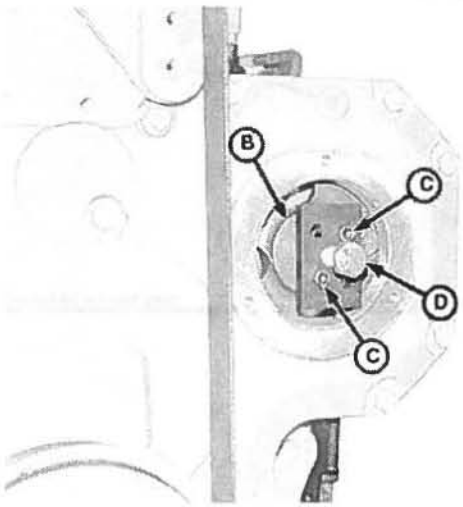
RG12002 –UN–16NOV01

Stanadyne DE10 Fuel Injection Pump



RG12036 –UN–21JAN02

JDG1559 Injection Pump Timing Pin



RG12000 –UN–21JAN02

Injection Pump Drive Gear Removal

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8. Remove temperature sensor connector (A) and fuel control solenoid connector (B).

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.

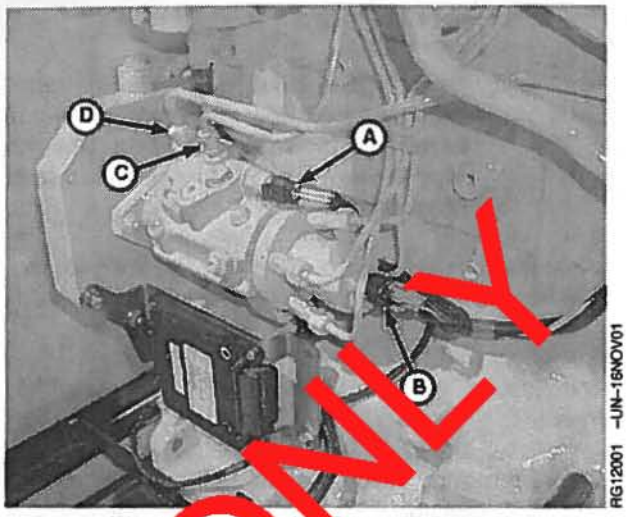
9. Disconnect fuel supply line (D) and return line (C).

10. Remove clamp (E) retaining fuel delivery (pressure) lines (F).

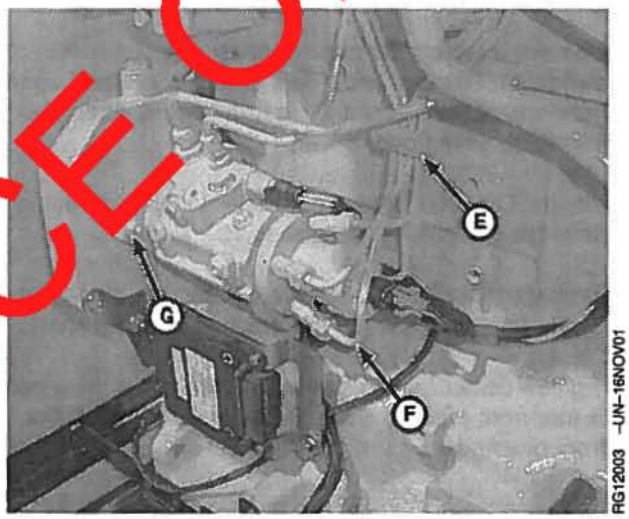
11. Disconnect all fuel delivery lines (F) from injection pump and install protective caps.

12. Remove three injection pump mounting stud nuts (G). Remove injection pump from mounting studs. Place pump on a clean flat surface and inspect shaft OD and drive gear as outlined later in this group. See INSPECT INJECTION PUMP DRIVE GEAR ID AND SHAFT OD later in this group.

A—Temperature Sensor Connector
B—Fuel Control Solenoid Connector
C—Fuel Return Line
D—Fuel Supply Line
E—Clamp
F—Fuel Delivery Lines
G—Nut (3 used)



Injecto ump E trica onnector Removal



Disconnect Fuel Delivery Lines

OUO1089,00001FE –19–07NOV01–2/2

Inspect Injection Pump Drive Gear ID and Shaft OD

IMPORTANT: Use a good light source to thoroughly inspect gear ID and shaft OD.

1. Inspect injection pump drive gear ID full 360° for metal transfer as a result of slippage on shaft.
2. Inspect injection pump drive shaft OD full 360° for presence of metal transfer from gear slippage. If there is clear evidence of metal transfer on pump shaft OD or in drive gear ID, injection pump and drive gear MUST BE replaced.

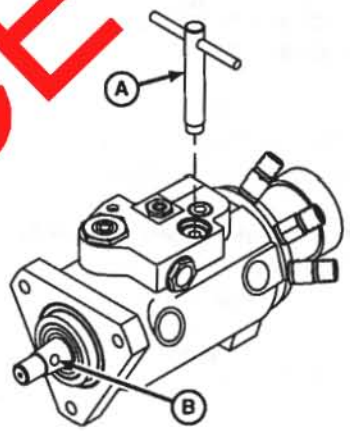
IMPORTANT: When replacing injection pump drive gear or installing a new pump, the tapered surfaces of the pump drive shaft OD and drive gear ID MUST BE cleaned to remove protective coatings and oily residue. Use a suitable cleaner that does not leave a residue. Mating surfaces MUST BE ASSEMBLED DRY and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

OUO1089,00001FC –19–06NOV01–1/1

Install Injection Pump

1. Before installing injection pump on engine, install JDG1559 Injection Pump Timing Pin (A) into pump timing pin bore. Install a small punch or screwdriver into hole in pump drive shaft (B) and turn shaft until timing pin drops into recess in injection pump drive shaft.

A—JDG1559 Timing Pin
B—Hole in Drive Shaft



RG12019 –UN–19NOV01

Install Timing Pin

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OUO1089,0000204 –19–08NOV01–1/3

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NOTE: When rotating engine to TDC of compression stroke on number 1 cylinder, turn engine only in direction of rotation to prevent gear backlash. Backlash of gears is enough to throw the injection pump timing off by several degrees, resulting in poor engine performance.

2. Make sure that number 1 cylinder is locked at TDC of compression stroke and install JDG1571 Timing Pin in flywheel.

NOTE: Retain JDG1559 Timing Pin (B) in pump during installation.

3. Install injection pump onto mounting studs and tighten three pump mounting stud nuts (A) to specification. Position drive gear while installing pump.

Specification
Injection Pump Mounting Stud Nuts—Torque ..... 25 N•m (19 lb-ft)

4. Install injection pump gear (D) on drive shaft. Install, but do not tighten, injection pump gear mounting nut (C).

NOTE: Hold the injection pump gear while applying torque to prevent the gear from rotating.

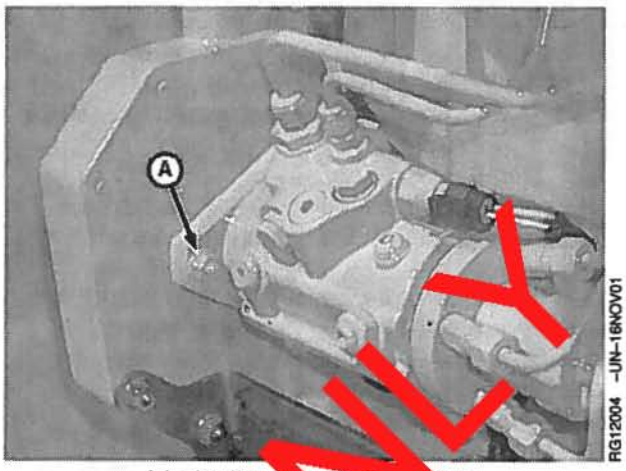
5. Rotate gear counterclockwise (viewed from [illegible] engine) to remove any backlash, and tighten gear mounting nut to specification.

Specification
Injection Pump Gear Mounting Nut—Torque ..... 19[illegible] N•m (145 lb-ft)

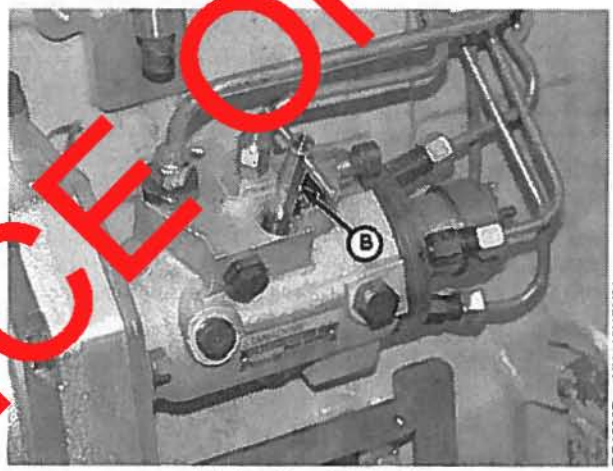
6. Install injection pump gear access plate and remove timing pin (B) from pump. Install plug in injection pump timing pin hole and tighten to specification.

Specification
Injection Pump Timing Pin Plug—Torque ..... 9.5 N•m (7.5 lb-ft)

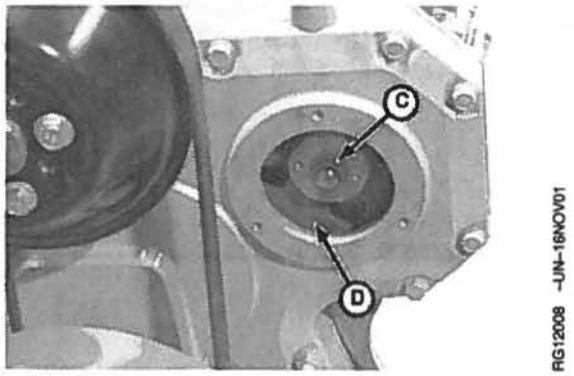
7. Remove JDG1571 Timing Pin from flywheel.



Injection Pump Mounting Stud Nuts



Injection Pump Timing Pin



Injection Pump Gear Installation

A—Injection Pump Mounting Stud Nut (3 used)
B—JDG1559 Injection Pump Lock Timing Pin
C—Gear Mounting Nut
D—Pump Gear

Continued on next page

8. Connect injection pump fuel delivery (pressure) lines (F). Beginning with outlet (I) 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).

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.

9. Tighten fuel delivery lines at pump to specification.

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

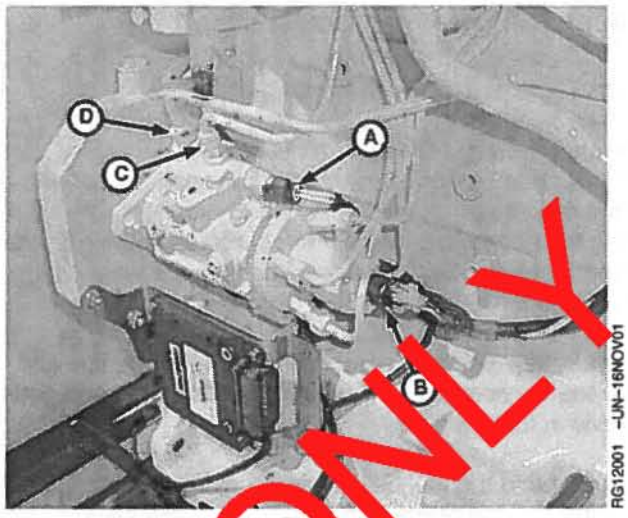
10. Install clamp (E).

11. Connect fuel supply line (D) and fuel return line (C).

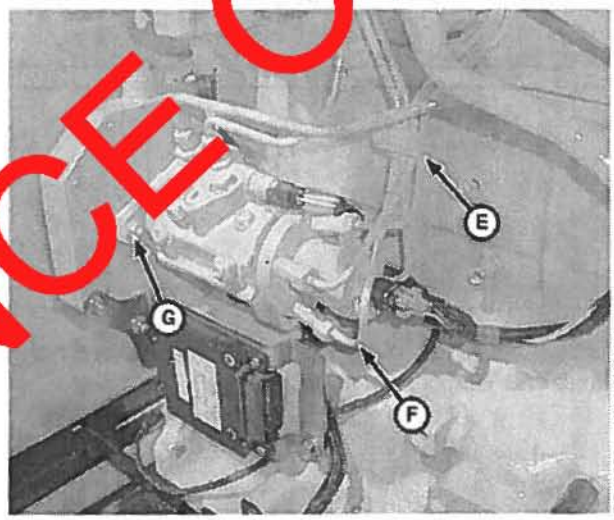
12. Install temperature sensor connector (A) and fuel control solenoid connector (B).

13. Bleed air from fuel system as outlined in this grou See BLEED THE FUEL SYSTEM in this group. Sta engine, run for several minutes and check e fuel system for leaks.

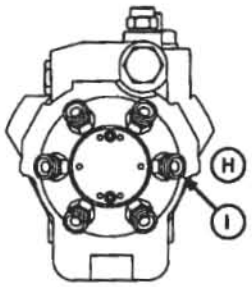
A—Temperature Sensor Connector
B—Fuel Control Solenoid Connector
C—Fuel Return Line
D—Fuel Supply Line
E—Clamp
F—Fuel Delivery Lines
G—Nut (3 used)
H—Engine Block Si
I—Outlet Connecti o N Cylinde



Injector ump Elec al C nectors



Connect Fuel Delivery Lines



OUO1089,0000204 –19–08NOV01–3/3

Remove Fuel Injection Nozzles

General Nozzle Service Precautions

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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.

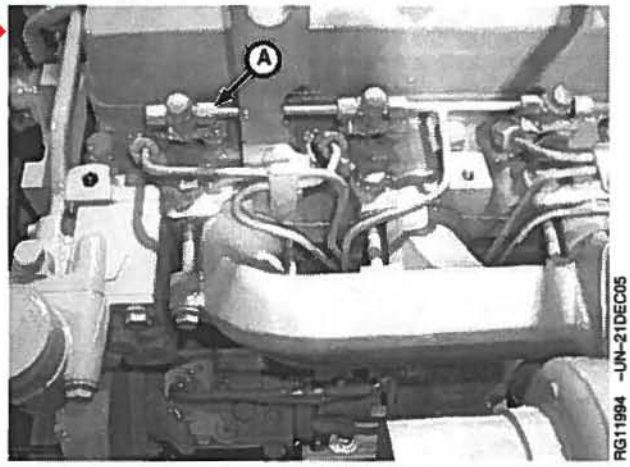
RG11993 –UN–15NOV01

Fuel Injection Nozzle

OUO1089,00001FF –19–07NOV01–1/4

1. Loosen tube nuts (A) at each nozzle to remove fuel lines and T-fittings as an assembly.

A—Tube Nuts



RG11994 –UN–21DEC05

Fuel Leak-Off Lines

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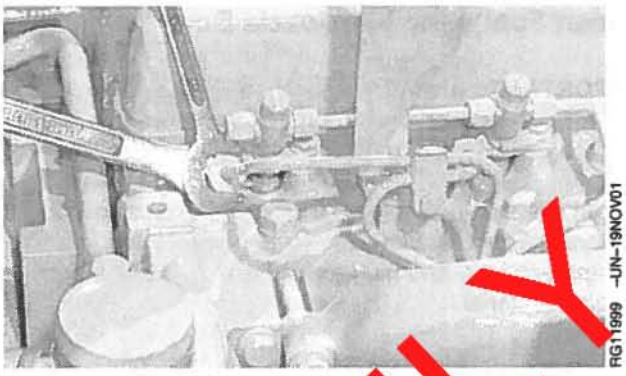
OUO1089,00001FF –19–07NOV01–2/4

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.



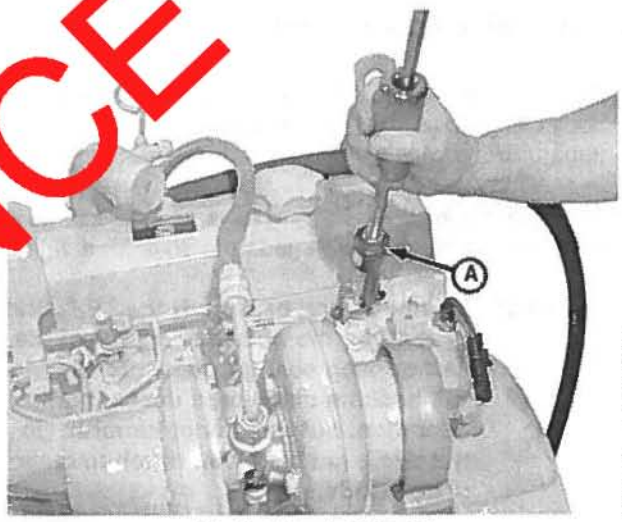
Fuel Injection Line at Nozzle

OUO1089,00001FF –19–07NOV01–3/4

4. Pull injection nozzle out of cylinder head using JDG1515-1 Nozzle Puller (A).

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

A—JDG1515-1 Nozzle Puller



Injection Nozzle Puller Set

OUO1089,00001FF –19–07NOV01–4/4

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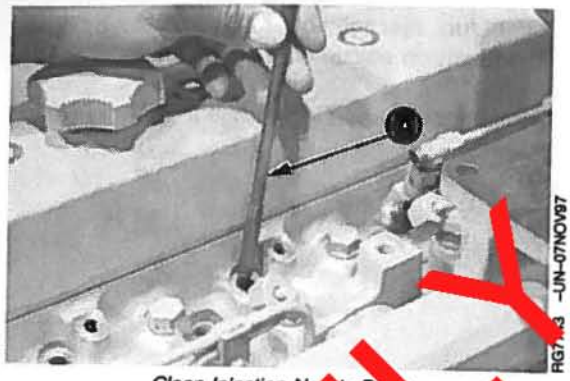
Clean Fuel Injection Nozzle Bore

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



RG7...3 –UN–07NOV97

Clean Injection Nozzle Bo...

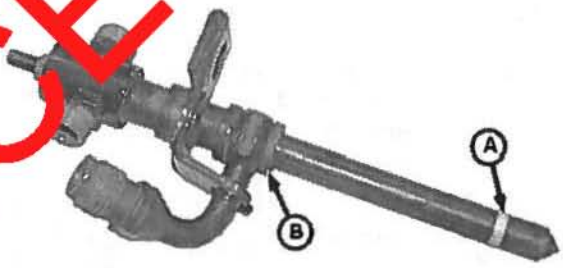
RG,35,JW7596 –19–20NOV97–1/1

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 carb... stop seal groove is submerged, and soak f... hile.

IMPORTANT: Do not scrape or distur... the TEFL...N® coating on the nozzle ...ody ...bove the carbon stop seal groov... his co...ting will become dis...lor...d du...g normal operation, but ...his is ...ot harmful. Do not use a moto...dr...ven brush to clean nozzle b...y.

3. After soaking, cl...an ...zzle tip w...th brass wire brush. Never use a s...el wire ...ush ...r scraper.



RG11995 –UN–15NOV01

Clean Fuel Injection Nozzle

A—Carbon Stop Seal
B—Upper Sealing Washer

TEFLON is a registered trademark of the DuPont Co.

OUO1080,00001FD –19–15NOV01–1/1

Fuel Injection Nozzle Test

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.

NOTE: Testing the performance of a nozzle while the engine is running is just a rough test. To obtain a true check of nozzle performance, use a nozzle tester JT25510 (1) and pressure line KJD10109 (2).

Use only carefully filtered diesel fuel for testing the injection nozzles, since dirty fuel will s... damage the precision parts of a nozzl...

Connect the nozzle to the tester so that th... axis of the nozzle forms an angle of approximate... 30° t... he ve...cal and the spray of fuel is directed do...nwa...s. Ch... all connections for leaks. Close the g...uge ...t off valve and flush (bleed) the nozzle by op...rating ...st pump rapidly.

X98...–UN–23AUG88

High Pressure Flui...

L30741 –UN–08AUG89

Fuel Injection Nozzle Test

1—Nozzle Tester
2—Pressure Line

Continued on next page

02 090 20

Spray Pattern Test

Close gauge shut-off valve and operate the pump lever at 60 strokes per minute. If the fuel injection nozzle is working properly, the fuel should issue through all nozzle orifices in a fine, evenly shaped spray cone. This spray cone is inclined from the centerline of the nozzle body, but should be distributed. For a better check, place a piece of paper or cardboard at a suitable distance below the nozzle and check the appearance of the damp circular spots made by the fuel. Deviations from the regular spray pattern or angle may be due to the complete or partial clogging of a nozzle orifice. In this case the fuel issues in a jet rather than in a fine spray.

Checking Valve Stem and Guide Wear

Connect fuel injection nozzle to the nozzle tester with the tip raised a little higher than its opposite end. Cover the tip and pump the tester to a pressure of 10 300 kPa (103 bar) (1500 psi). Keep the pressure constant and observe how much fuel leaks out of the nozzle return end. After the first drop has formed, count the drops for 30 seconds and compare with specification.

Fuel Injection Nozzle—Specification

Nozzle—Return Leakage at
10 300 kPa (103 bar) (1500 psi)..... 1 to 14 drops (maximum with 30 seconds

Checking Valve Seat

Connect the nozzle to tester in horizontal position. Operate the pump lever rapidly to bleed the nozzle and allow the valve to seat. Dry the tip of the nozzle thoroughly. Now operate the pump lever slowly until the indicated pressure is approximately 2800 to 3500 kPa (28 to 35 bar) (400 to 500 psi) below opening pressure (see specification for opening pressure). Keep watching the nozzle. Under these conditions the fluid should not drip out of the nozzle tip. However some weeping or light moisture on the tip is considered acceptable. Work the pump lever quickly several times in succession to make the nozzle spray in the normal way. After the last stroke of the pump, observe again. If the nozzle is not quite leakproof, disassemble for servicing.

Continued on next page

Opening Pressure Test

NOTE: Absolute opening pressure is less important than equal opening pressure of all nozzles.

Close gauge shut-off valve and actuate the pump several times to allow the nozzle valve to seat properly. Open gauge shut-off valve. Pump the pressure up to the point where the pressure gauge needle falls rapidly. This point (take reading) is the nozzle valve opening pressure.

Fuel Injection Nozzle—Specification

Rate Shaping Nozzle—Opening Pressure for Setting (New or Reconditioned)	24 400—24 900 kPa (244—249 bar) (3540—3620 psi)
Opening Pressure for Checking (New or Reconditioned)	24 100 kPa (241 bar) (3500 psi) Min
Opening Pressure for Setting (Used)	23 000—23 600 kPa (230—236 bar) (3340—3420 psi)
Opening Pressure for Checking (Used)	21 800 kPa (218 bar) (3170 psi) Min
Rate Shaping Nozzle—Opening pressure difference between cylinders	700 kPa (7 bar) (100 psi) Max

If spray pattern, leakage test, and valve wear test are good but the opening pressure test is unsatisfactory, adjust opening pressure.

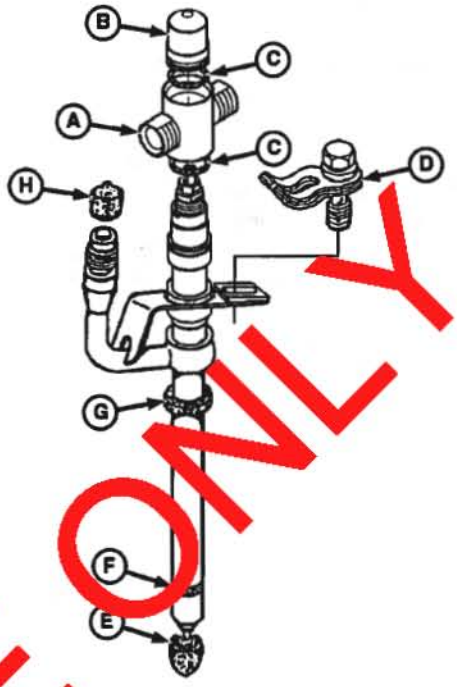
OUO1089,0000200 –19–07NOV01–3/3

Disassemble Fuel Injection Nozzles

NOTE: If all tests prove that the nozzle performs properly, no further service is necessary and the nozzle can be reinstalled. If an injection nozzle is not operating properly and must be disassembled for cleaning and/or reconditioning, see your "Stanadyne" dealer.

02
090
22

A—T-Fitting
B—Cap
C—O-Ring (2 used)
D—Retainer
E—Protection Cap
F—Carbon Stop Seal
G—Seal Washer
H—Protection Cap



RG11996 –UN–15NOV01

RSN Nozzle Disassembly

OUO1089,0000201 –19–07NOV01–1/1

Adjust Fuel Injection Nozzle

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.

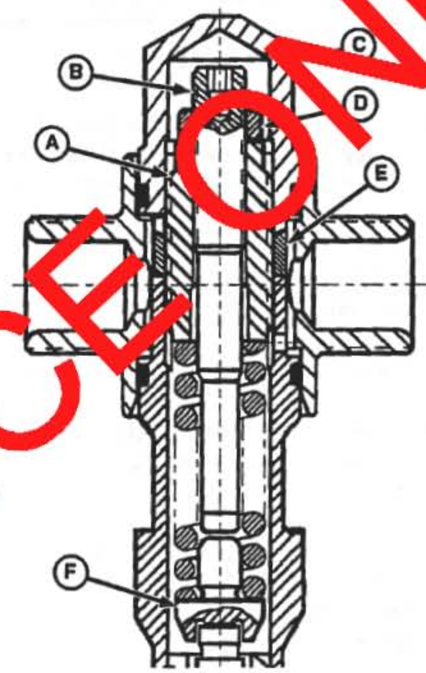
Before applying pressure to nozzle tester, be sure all connections are tight, and fittings are not damaged. Fluid escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.

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.

High Pressure Fluids

X9811 -UN-23AUG88

1. Unscrew spring chamber cap (C) using JDG1521 Spring Chamber Cap Wrench.
2. Loosen and remove lift adjusting screw lock nut (D).
3. Loosen pressure adjusting screw lock nut (E) using JDG1515-2 Special Wrench.
4. Connect nozzle to tester, then adjust opening pressure to specifications by turning the pressure adjusting screw (A). Use JDG1522 Pressure Adjusting Screw Tool.
5. Tighten pressure adjusting screw lock nut (E) to specification, then recheck opening pressure.
6. Carefully screw lift adjusting screw (B) until it bottoms on spring seat (F).
7. Unscrew lift adjusting screw with 7/8 turn.
8. Tighten lift adjusting screw lock nut (D) to specification.



RSN Nozzle Adjust

RG11997 -UN-15NOV01

A—Pressure Adjusting Screw
B—Lift Adjusting Screw
C—Spring Chamber Cap
D—Lift Adjusting Screw Lock Nut
E—Pressure Adjusting Screw Lock Nut
F—Spring Seat

Continued on next page OUO1089,0000202 -19-07NOV01-1/2

9. Recheck opening pressure.

Fuel Injection Nozzle—Specification

Pressure Adjusting Screw Lock Nut—Torque	10 N•m (7 lb-ft)
Lift Adjusting Screw Lock Nut—Torque	5 N•m (3.5 lb-ft)

D1089,00202 -19-27NOV01-2/2

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.

RG9096 -UN-27MAR98

Fuel Injection Nozzle Seals

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

RG,35,JW7586 -19-20NOV97-1/1

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.

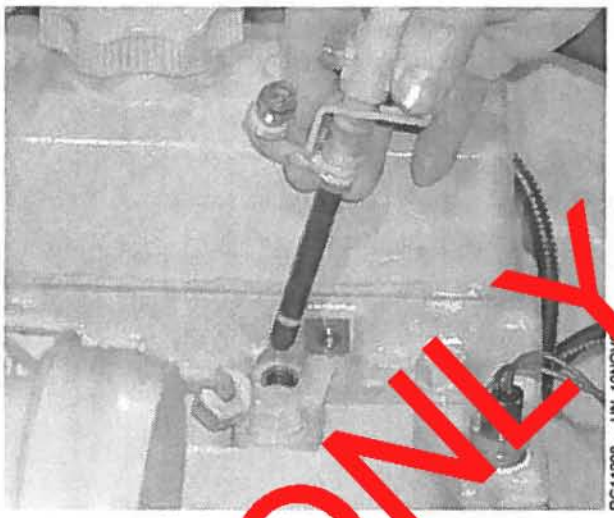
4. Connect fuel pressure line to nozzle. Leave connection slightly loose until air is bled from system.

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



RG11998 –UN–19NOV

Injection Nozzle in Cylinder Head

Continued on next page

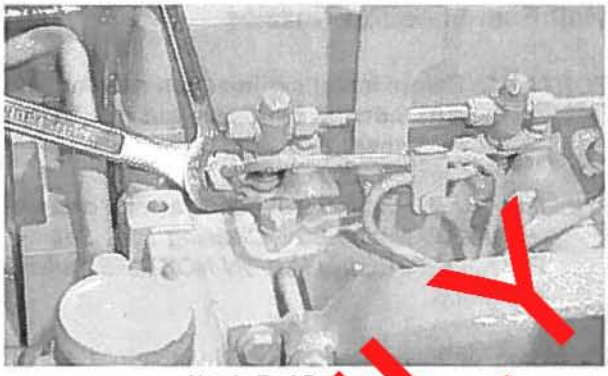
7. Bleed air from loose injection line connection. Tighten connection using two wrenches to the following specifications.

Specification

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

02 090 26

See BLEED THE FUEL SYSTEM in this group.



RG11999 –UN–19NOV01

Nozzle Fuel Pressure Line

OUO1080,0000200 –19–16NOV01–2/2

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.

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.

X9811 –UN–23AUG88

High Pressure Fluids

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.

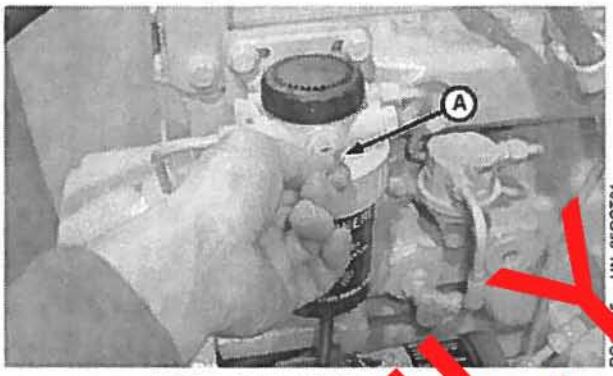
The fuel system may be bled at one of several locations. On some engine applications it may be necessary to consult your operator's manual and choose the best location for your engine/machine application.

Continued on next page

OUO1089,0000203 –19–07NOV01–1/5

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

A—Bleed Vent Screw



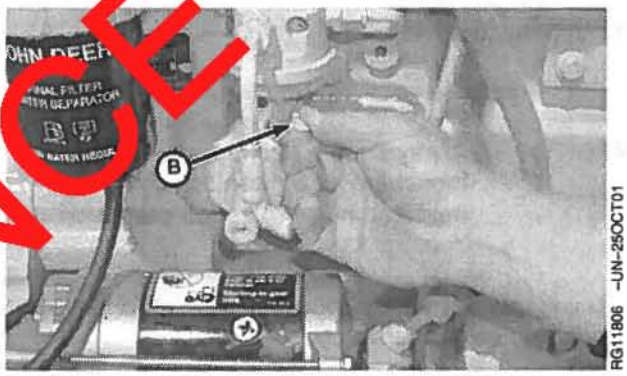
Final Fuel Filter Bleed Ve[illegible] Screw

OUO1089,0000203 –19–07NOV01–2/5

2. Operate fuel supply pump prime lever (B) or primer button on fuel filter base (if equipped).
3. Tighten bleed plug securely; continue operating primer until pumping action is not felt.
4. Start engine and check for leaks.

   If engine will not start, it may be necessary to bleed air from fuel system at fuel injection pump or injection nozzles as explained next.

B—Primer Lever



Fuel Supply Pump Primer Lever

Continued on next page

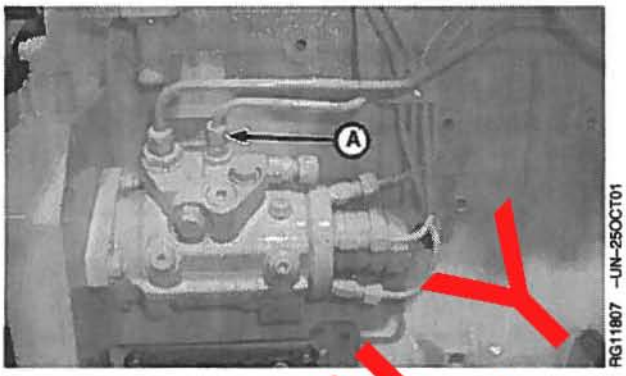
OUO1089,0000203 –19–07NOV01–3/5

At Fuel Injection Pump

1. Loosen fuel return line (A) at fuel injection pump.
2. Operate fuel supply pump primer lever or primer button on fuel filter base (if equipped).
3. As soon as fuel flow is free from air bubbles, tighten fuel return line to specifications. Primer lever is spring-loaded and will return to normal position.

Specification

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



Fuel Injection Pump Return Line

A—Fuel Return Line

OUO1089,0000203 –19–07NOV01–4/5

At Fuel Injection Nozzles

1. Place throttle lever in half-throttle position.

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

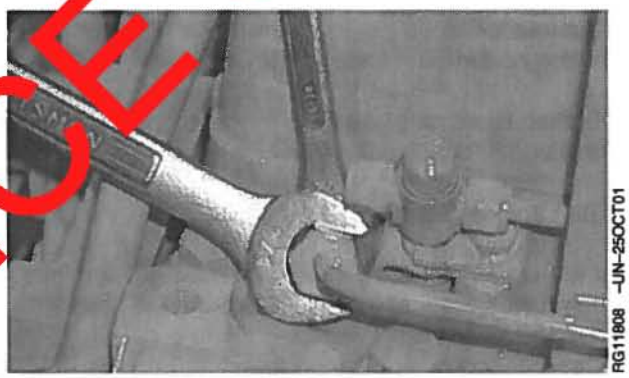
2. Using **two** open-end wrenches, loosen two fuel line connections at injection nozzles.
3. Crank engine over with starter motor for 15 seconds (but do not start engine) until fuel without any air bubbles flows out of loosened connection. Retighten connection to specifications.

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.

If engine still will not start, see your authorized servicing dealer or engine distributor.



Nozzle Fuel Pressure Line

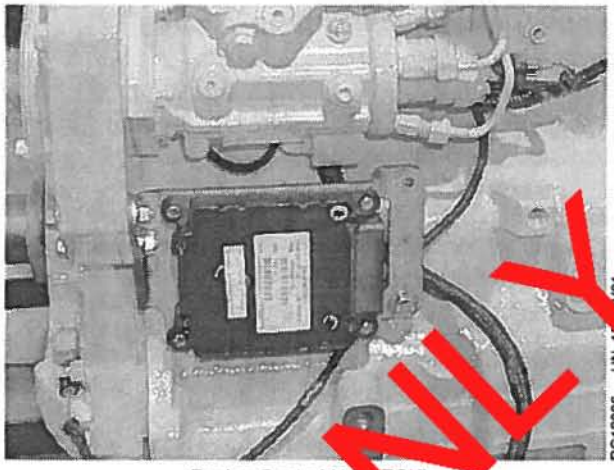
OUO1089,0000203 –19–07NOV01–5/5

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.**



Engine Control Unit (ECU)

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. Provide the 13-digit engine serial number when ordering a new ECU.

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

OUO1080,0000201 –19–16NOV01–1/1

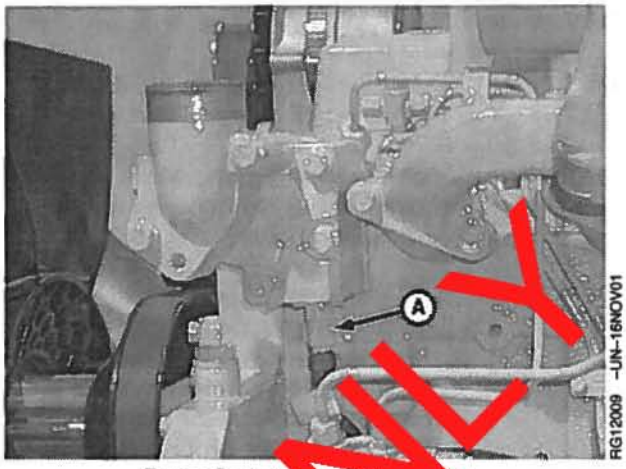
Remove and Install Engine Coolant Temperature Sensor

1. Disconnect engine coolant temperature sensor wiring connector and remove sensor.
2. Coat sensor O-ring with JDT405 High Temperature Grease and install sensor in thermostat housing. Tighten to specifications.

Specification

Engine Coolant Temperature Sensor—Torque ..... 15 N•m (11 lb-ft)

3. Install sensor wiring connector.



Engine Coolant Temperature Sensor

A—Engine Coolant Temperature Sensor

OUO1080,0000202 –19–16NOV01–1/1

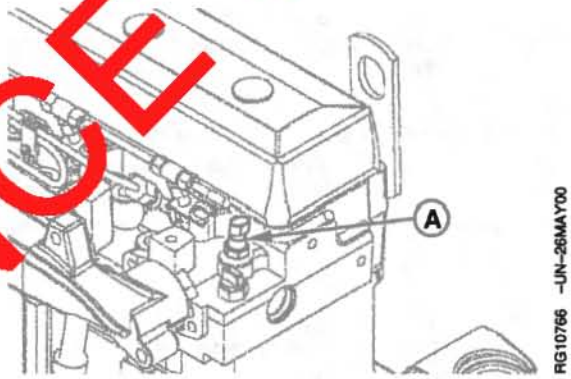
Remove and Install Loss of Coolant Temperature Sensor

1. Disconnect loss of coolant temperature 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

Loss of Coolant Temperature Sensor—Torque ..... 35 N•m (26 lb-ft)

3. Install sensor wiring connector.



Loss of Coolant Temperature (Rear of Cylinder Head)

A—Loss of Coolant Temperature Sensor

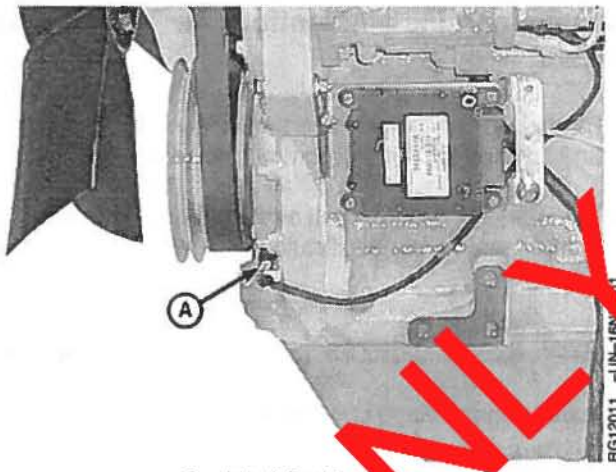
RG40854,000014A –19–11FEB02–1/1

Replace Crankshaft Position Sensor

1. Disconnect sensor wiring connector.
2. Using a deep well socket, remove crankshaft position sensor (A).
3. Replace sensor and O-ring in timing gear cover. Tighten sensor to specifications.

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

4. Install sensor wiring connector.



Crankshaft Position Sensor

A—Crankshaft Position Sensor

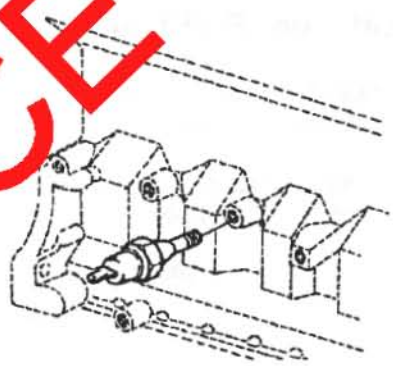
OUO1080,0000203 –19–16NOV01–1/1

Remove and Install Oil Pressure Sensor

1. Disconnect oil pressure sensor wiring connector (shown disconnected) and remove sensor from cylinder block.
2. Coat threads of sensor with LOCTITE® 592 Pipe Sealant with TEFLON®. Install sensor in oil cooler housing and tighten to specifications.

Specification	
Oil Pressure Sensor—Torque	15 N•m (11 lb-ft)

3. Install sensor wiring connector.



Oil Pressure Sensor

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

OUO1080,0000204 –19–16NOV01–1/1

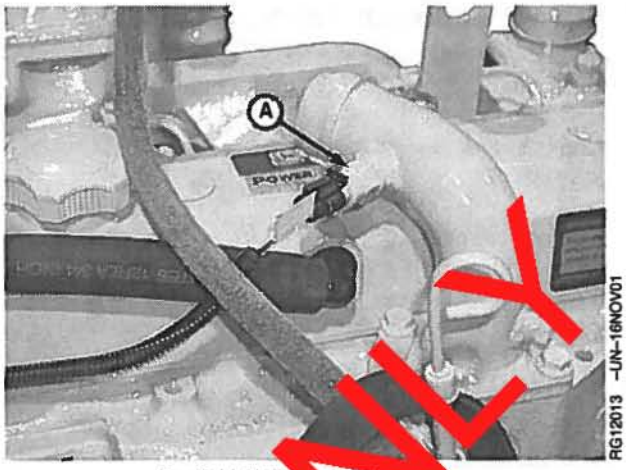
Remove and Install Manifold Air Temperature Sensor

1. Disconnect air temperature sensor wiring connector and remove sensor (A) from air intake line.
2. Replace O-ring and install sensor in air intake line. Tighten sensor to specifications.

Specification

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

3. Install sensor wiring connector.



Manifold Air Temperature Sensor

A—Manifold Air Temperature Sensor

OUO1080,00001F5 –19–09NOV01–1/1

Remove and Install Fuel Temperature Sensor

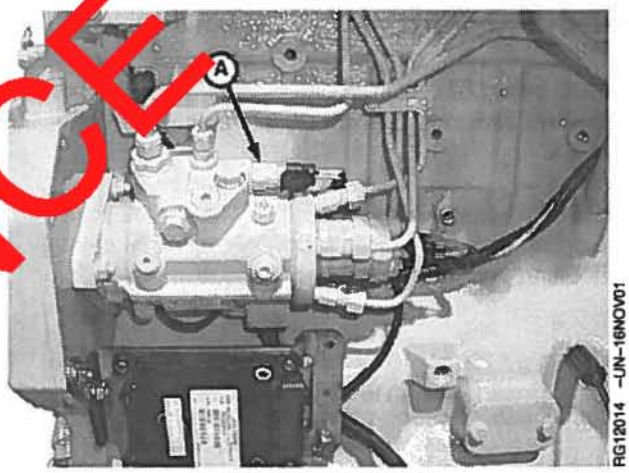
1. Disconnect fuel temperature sensor wiring connector and remove sensor (A) from fuel injection pump.
2. Replace O-ring and install sensor into fuel injection pump and tighten to specifications.

Specification

Fuel Temperature Sensor—Torque ..... 13–18 N•m (10—13 lb-ft)

3. Install sensor wiring connector.

A— Fuel Temperature Sensor



Fuel Temperature Sensor

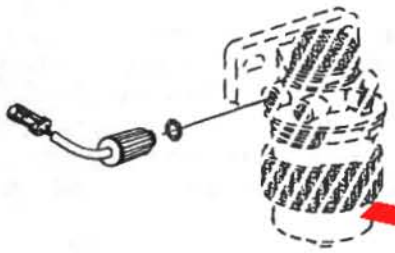
OUO1080,00001F6 –19–12NOV01–1/1

Remove and Install Fuel Heater

1. Disconnect fuel heater wiring connector and remove heater from filter base.
2. Replace O-ring and install fuel heater in primary fuel filter inlet port to specifications.

Specification	
Fuel Heater—Torque	9 N•m (7 lb-ft)

3. Install heater wiring connector.



RG12016 –UN–16NOV01

Fuel Heater

OUO1080,00001F7 –19–12NOV01–1/1

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5

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.

RG,RG34710,1328 –19–23OCT97–1/1

Use Electrical Insulating Compound

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

RG,RG34710,1335 –19–23OCT97–1/1

Using High-Pressure Washer

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

T6642EJ –18OCT88

Using High-Pressure Washer

RG,RG34710,1329 –19–23OCT97–1/1

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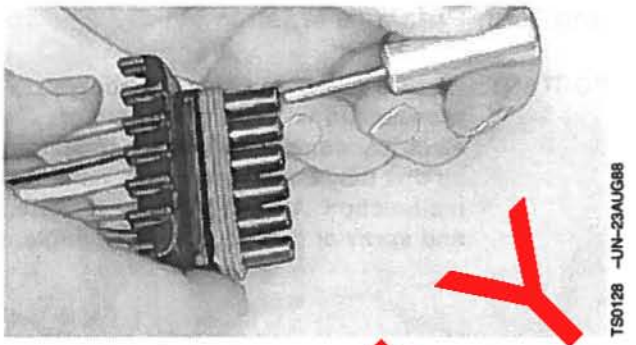
7

Repair WEATHERPACK™ Connector


TS0128 –UN–23AUG88

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

WEATHERPACK is a trademark of Packard Electric

[1] Included in JT07195B Electrical Repair Kit

[2]Included in JDG155 Electrical Repair Tool Kit

Continued on next page

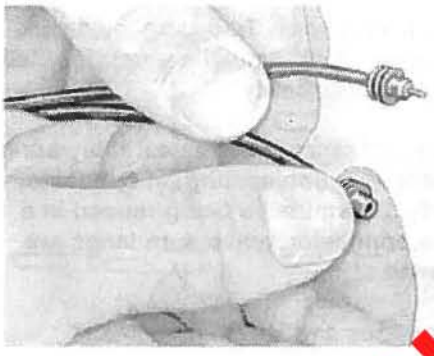
AG,OUOD008,295 –19–06MAR02–1/4

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

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

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

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



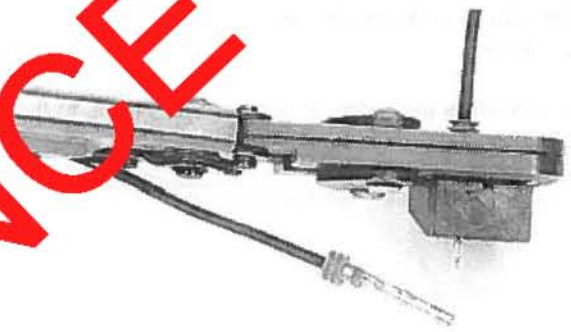
TS136 –UN–23AUG88

AG,OUOD008,296 –19–05MAR02–2/4

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

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

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



TS1623 –UN–02NOV94

WEATHER PACK is a trademark of Packard Electric

Continued on next page

AG,OUOD008,296 –19–05MAR02–3/4

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

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

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

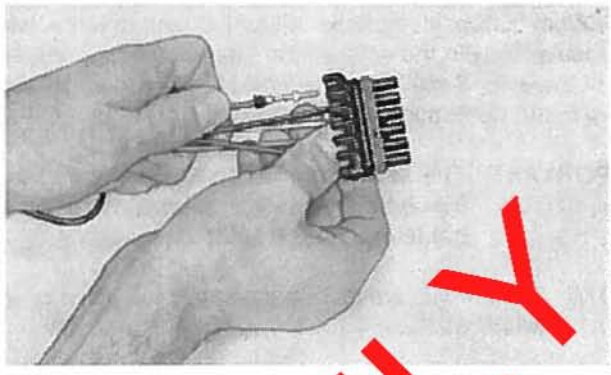
Correct terminal installation for sleeve (A) and pin (B) is illustrated.

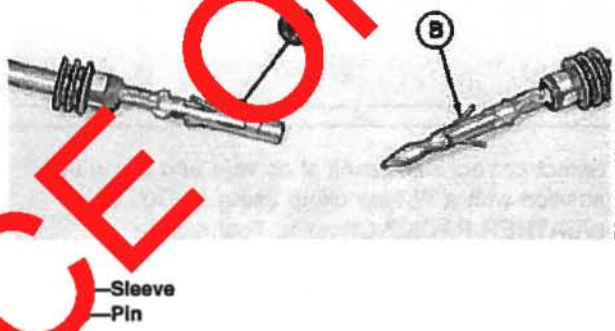
10. Gently pull on wire to insure that the terminal is locked in position.

11. Repair or transfer remaining wires.

12. Close the secondary lock on the back of the connector.

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



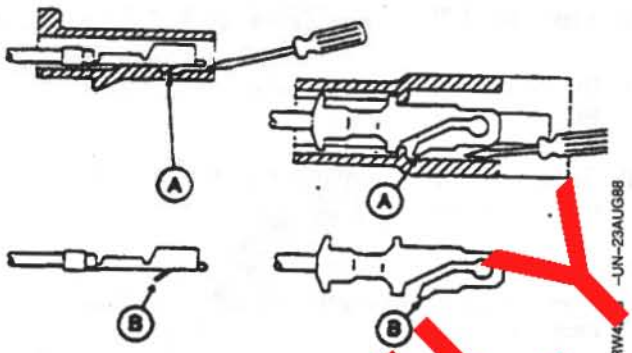


AG,OUOD008,296 –19–06MAR02–4/4

Remove Blade Terminals from Connector Body

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

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



A—Locking Tang
B—Original Position

[1]*Included in JT07195B Electrical Repair Kit*

AG,OUOD008,297 -19-06MAR02-1/1

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

02
110
12

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

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

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

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

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

METRI-PACK is a trademark of Delphi Packard Electric Systems

[1] *Included JT07195B Electrical Repair Kit*

Continued on next page

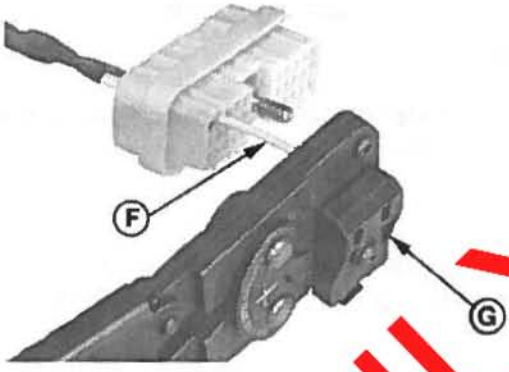
9. Using JDG145 Universal Electrical Pliers[1], cut off wire directly behind the terminal.

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

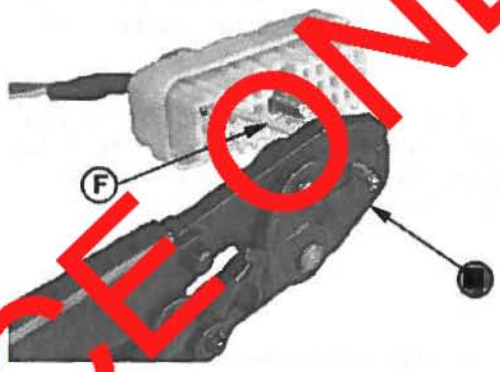
10. Using JDG145 Universal Electrical Pliers[1], strip 6 mm (1/4 in.) insulation from end of wire.
11. If wire has been removed from the connector, make sure the wire is fed through the connector (F) and in the correct cavity.
12. Using either JDG783 (G) or JDG707 (H) Crimping Pliers, crimp a new terminal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

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

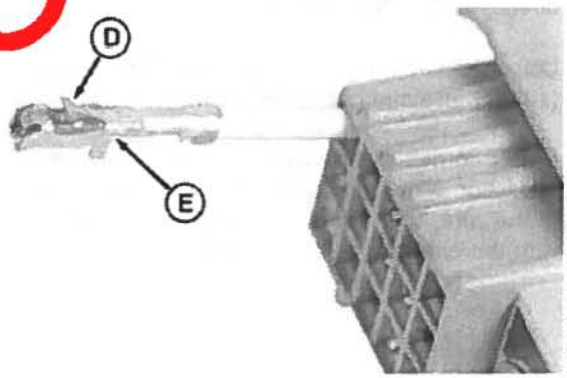
14. Push on the wire to make sure terminal is locked into the connector.
15. Slide the connector seal back into the connector. Make sure seal is in it's original position.
16. Retape the wires and add the required tie bands to the harness.



RG12234 –UN–13MAR02



RG12233A –UN–13MAR02



RW16935A –UN–05AUG98

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

[1]Included in JDG155 Electrical Repair Tool Kit

AG,OUOD008,298 –19–06MAR02–2/2

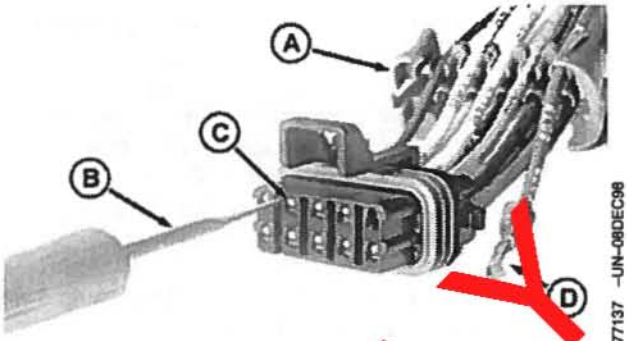
Repair *(Push Type)* METRI-PACK™ Connectors

02
110
14

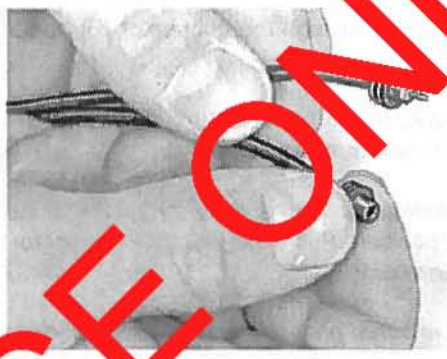
1. Disconnect the METRI-PACK connector. Remove the tie bands and tape.
2. Remove secondary lock (A).
3. Identify wire color/number to the connector cavity. Make sure each wire goes back to the correct cavity location.
4. Insert JDG776 or JDG777 Terminal Extraction Tool[1] (B) into connector cavity (C)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

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

5. Remove extraction tool and pull wire from the back of the connector.
6. Using JDG145 Universal Electrical Pliers[2], cut off wire directly behind the terminal.
7. Using JDG145 Universal Electrical Pliers[2] strip 6 mm (1/4 in.) insulation from end of wire.
8. Select correct size of seal. Slide the seal over the wire insulation with the smaller diameter side facing the end of the wire. Small diameter side of seal should line up with the outer edge of the insulation.



RW77137 –UN–08DEC98



TS0136 –UN–23AUG88

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

METRI-PACK is a trademark of Delphi Packard Electric Systems

[1]Included in JDG7195B Electrical Repair Kit

[2]Included in JDG776 Electrical Repair Tool Kit

Continued on next page

AG,OUOD008,299 –19–06MAR02–1/3

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

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

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

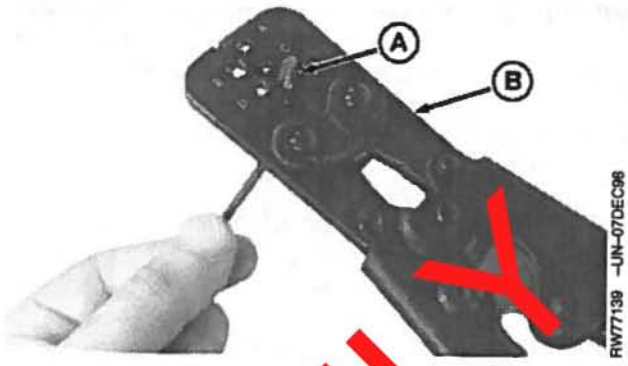
9. Select correct size contact for wire.

Continued on next page

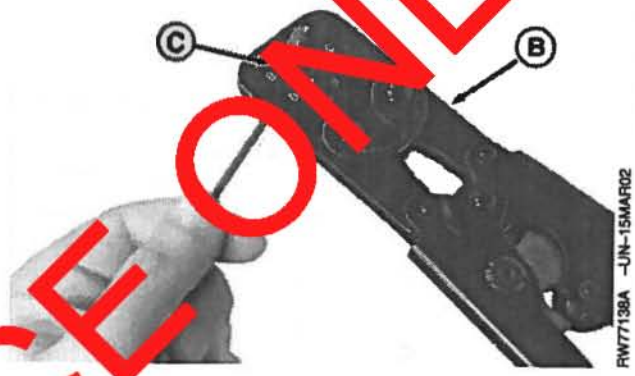
AG,OUOD008,299 -19-06MAR02-2/3

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

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



RW77139 –UN–07DEC98



RW77138A –UN–15MAR02

RW77140A –UN–15MAR02

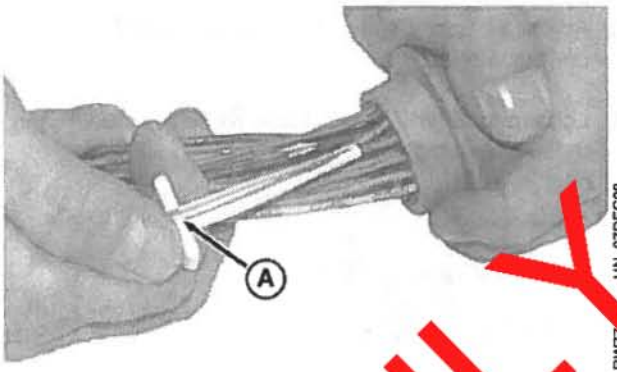
AG,OUOD008,299 –19–06MAR02–3/3

Repair DEUTSCH™ Connectors

1. Disconnect the Deutsch connector. Remove the tie bands and tape.
2. Identify wire color/number to the connector cavity. Make sure each wire goes back to the correct cavity location.
3. Select correct size extractor tool for size of wire to be removed:
   - JDG361 Extractor Tool - 12—14 Gauge Wire[1]
   - JDG362 Extractor Tool - 16—18 Gauge Wire[1]
   - JDG363 Extractor Tool - 20 Gauge Wire[2]
   - JDG785 Extractor Tool - 6-8 Gauge Wire[3]
4. Start inserting the wire into the handle end (A) of the correct size extraction tool.
5. Slide extraction tool rearward along wire until tool tip snaps onto wire.

IMPORTANT: DO NOT twist tool when inserting in connector.

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



A—Handle

02 110 17

DEUTSCH is a trademark of Deutsch Company

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

[2]Included in JDG359 DEUTSCH Electrical Repair Kit

[3]Included in JT07195B Electrical Repair Tool Kit

[4]Included in JDG155 Electrical Repair Tool Kit

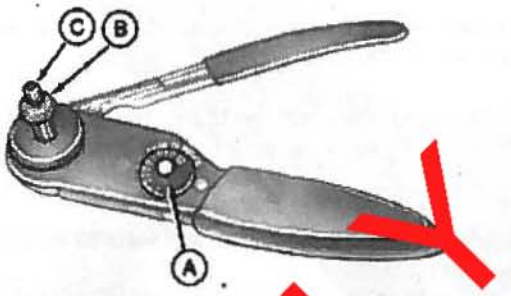
Continued on next page

AG,OUOD008,304 –19–03NOV99–1/4

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

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

A—Selector
B—Lock Nut
C—Adjusting Screw



TS117 –UN–23AUG88

[1]*Included in JDG359 Electrical Repair Kit*

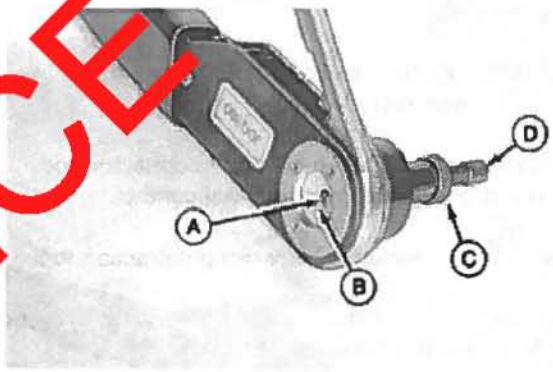
AG,OUOD008,304 –19–03NOV99–2/4

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

IMPORTANT: Select correct size terminal to fit connector body.

13. Tighten lock nut (C).

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



TS0134 –UN–23AUG88

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AG,OUOD008,304 –19–03NOV99–3/4

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

IMPORTANT: Terminal must remain centered between indenters while crimping.

15. Release handle and remove terminal.

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

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

NOTE: Readjust crimping tool for each crimping procedure.

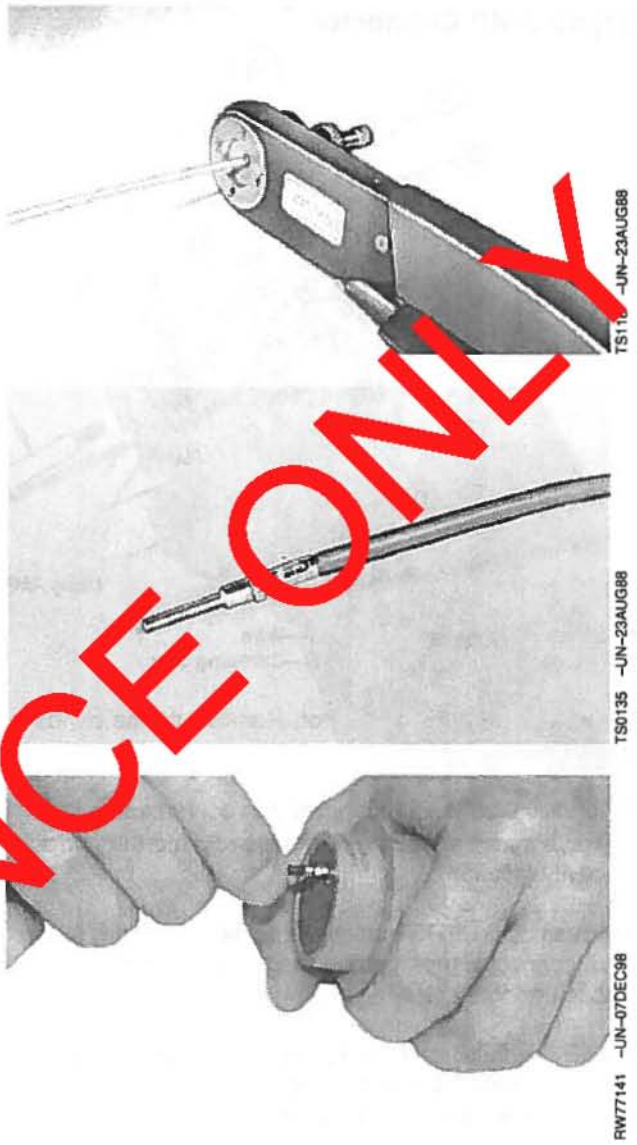
17. Push terminal straight into correct connector cavity until positive stop is felt.

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

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

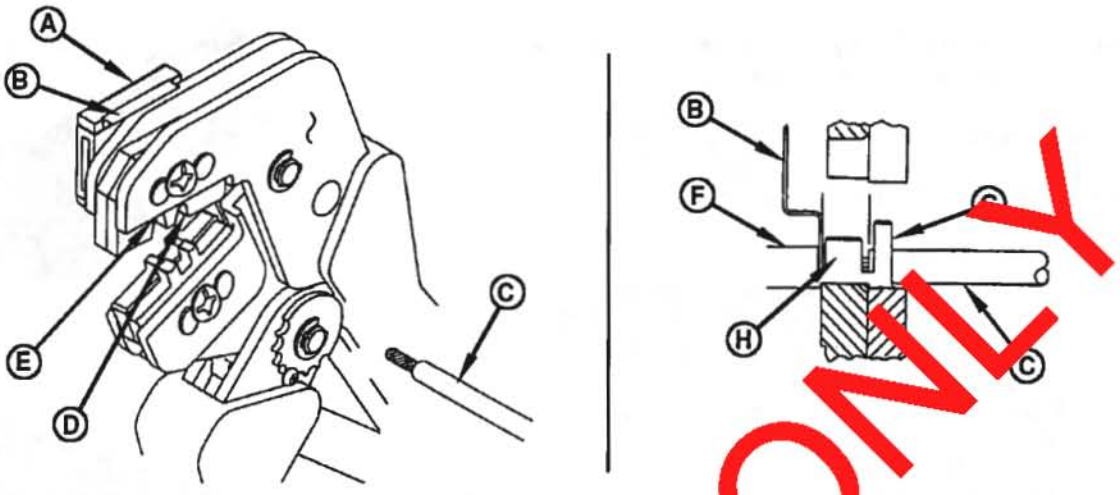
19. Transfer remaining wires to correct cavity in r connector.

20. Retape the wires and add the require ie ba ds to the harness.



AG,OUOD008,304 –19–03NOV99–4/4

Repair AMP Connector



Using AMP Crimping Tool

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

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

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

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

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

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

5. Hold JDG7084 AMP Crimping Tool so that the back (wire side) is facing you. Squeeze tool handles together and allow them to open fully.

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

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

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

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

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

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

Continued on next page

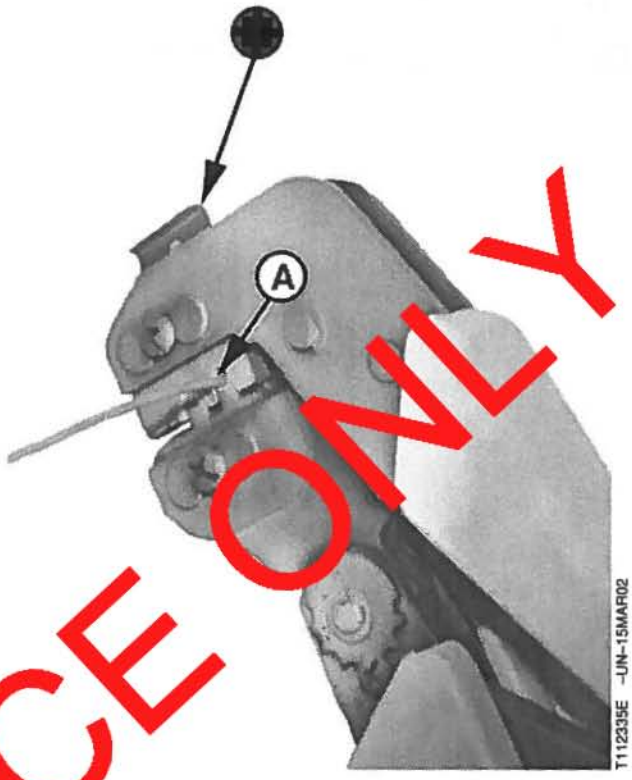
10. Hold the wire and terminal (A) in place. Squeeze tool handles together until ratchet releases. Allow tool handles to open and remove crimped terminal.

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

11. Install wire in correct connector cavity.

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

A—Wire and Terminal
B—Locator



DPSG,OUO1004,2867 –19–06MAR02–2/2

Section 03
Theory of Operation

Contents

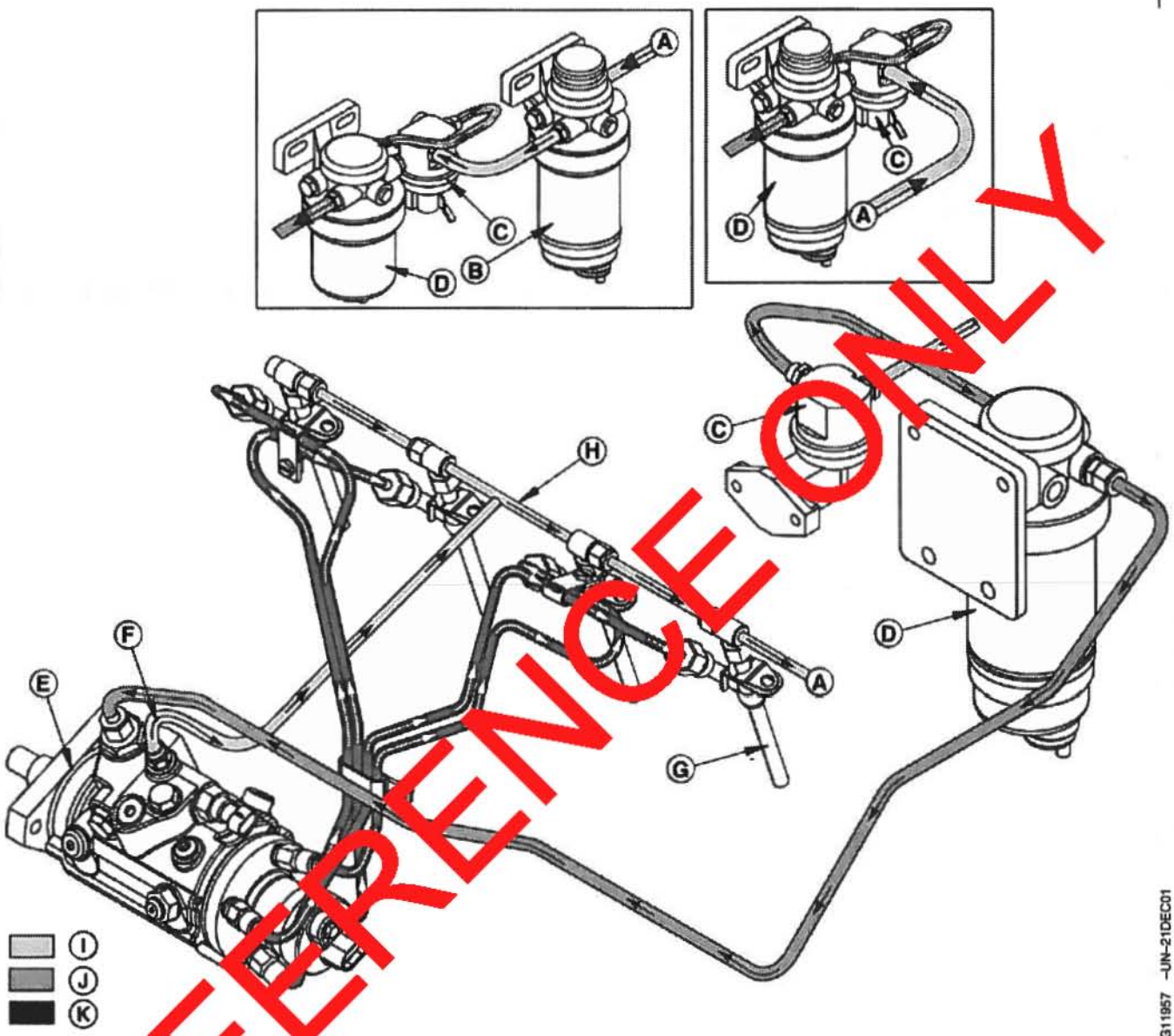
About this Group

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

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

RG4085 000001 -19-0 EC01-1/1

Fuel System Operation



RG11957 –UN–21DEC01

A—Fuel Tank
B—Prefilter
C—Fuel Supply Pump
D—Final Fuel Filter
E—Fuel Injection Pump
F—Overflow Valve
G—Fuel Injection Nozzle
H—Fuel Leak-off Line
I—Tank Pressure Fuel
J—Supply Pump Pressure Fuel
K—Injection Pump Pressure Fuel

The fuel supply pump (C) draws fuel from the tank (A) by pressurizing the fuel. Once the fuel is pressurized in the fuel supply pump, it travels through the final fuel filter (D) to the fuel injection pump (E). On some applications, fuel is routed through a prefilter (B) prior to the fuel supply pump. A water bowl can be included with either the prefilter or final fuel filters. Typically, the water bowl is located at the first filter in the system.

Continued on next page

RG40854,000001D –19–03DEC01–1/2

The fuel injection pump raises the required fuel pressure for injection. This high pressure fuel is routed through the delivery (pressure) lines to the fuel injection nozzles (G). If there is excess fuel in the injection pump, it is released through an overflow valve (F) and returned to tank through the fuel leak-off line (H).

Once the pressure of the fuel inside the injection nozzle (G) overcomes the nozzle valve, fuel is forced out a small orifice in the nozzle tip. This allows for fuel to atomize as it enters the combustion chamber. Excess fuel from the nozzles is routed through the fuel return leak-off line and returns to the fuel tank. On some applications, the fuel goes through a fuel cooler before returning to the fuel tank.

RG40854[illegible]0001D[illegible]19-[illegible]EC01-2/2

03
130
3

Fuel Supply Pump Operation

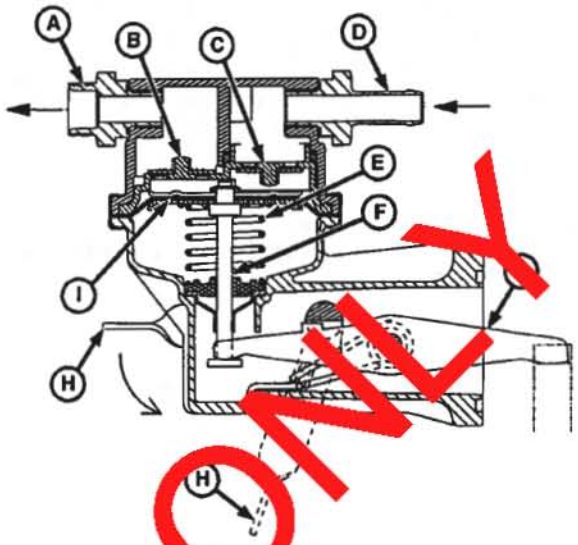
The Sofabex fuel supply pump uses an eccentric lobe on the engine camshaft to operate the lever (G) on supply pump to pressurize fuel system.

Fuel is drawn by the diaphragm-type pump from the fuel tank into the inlet side (D) of this pump.

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

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

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



RG9119 –UN–17APR96

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

RG40854,0000110 –19–28SEP05–1/1

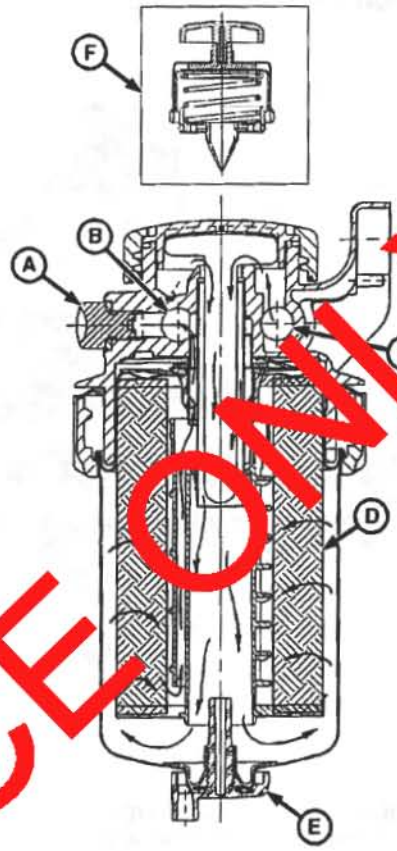
Final Fuel Filter Operation

Fuel enters the filter at inlet (C), flows through filter element (D) and exits through outlet (B) to the fuel injection pump. The 5 micron 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. On some options, a water bowl is attached to the bottom of the sediment bowl.

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.

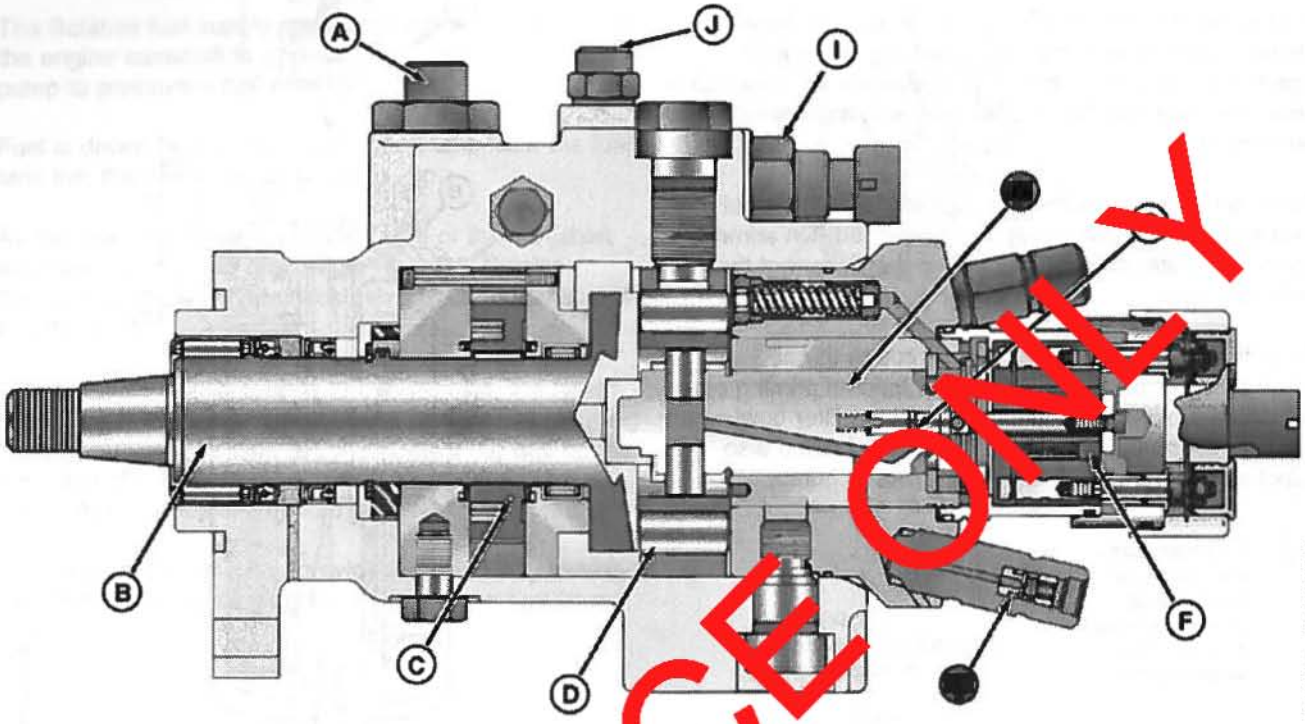
A—Bleed Screw
B—Fuel Outlet
C—Fuel Inlet
D—Filter Element
E—Drain Plug
F—Primer Pump



RG9090 –UN–27MAR98

RG40854,0000111 –19–16JAN02–1/1

Fuel Injection Pump Operation



RG11958 –UN–20DEC01

A—Fuel Inlet Fitting
B—Heavy Duty Driveshaft
C—Transfer Pump
D—Cam Ring
E—Discharge Fitting
F—Fuel Control So
—Pump Control Valve
H—Distributor Rotor
—Fuel Temperature Sensor
J—Fuel Return Fitting/Housing Pressure Regulator

NOTE: The above illustration has been reprinted with permission from Stanadyne Automotive Corporation.

The main components of the Stanadyne DE10 fuel injection pump are the driveshaft (B), the transfer pump (C), cam ring (D), shoe and distributor rotor (H), pump control valve (G), and fuel control solenoid (F). The crankshaft of the engine drives the driveshaft of the pump using gears between the two components. The rotation of the driveshaft moves the transfer pump, cam shoes and rollers, and distributor shaft since all of these components are engaged.

The fuel transfer pump (inside the injection pump) draws fuel from the final filter through the fuel inlet fitting (A). With each revolution, it pressurizes fuel between 0—1100 kPa (0—11 bar) (0—160 psi) depending on the rotational speed of the pump. Once the fuel has been pressurized by the transfer pump, it can travel to three locations: inside the plungers of the cam ring (D), into the injection pump housing cavities, and recirculated back to the fuel inlet passage.

When the pump control valve is open, it allows the transfer pump pressurized fuel to enter the high pressure chamber. The Engine Control Unit (ECU) energizes the fuel control solenoid which causes the pump control valve to close. When the pump control valve is closed, the plungers in the high pressure chamber create injection pressure because they are forced inward by the rotation of the cam ring. High pressure fuel is forced through the discharge fittings to the injection nozzles. When the fuel control solenoid is de-energized, the pump control valve opens. The fuel in the high pressure chamber is spilled out of the high pressure chamber into the transfer pump fuel.

Continued on next page

RG40854,0000112 –19–16JAN02–1/2

Some of the transfer pump pressure fuel is released through a port that contains a vent wire into injection pump housing cavities. The purpose of housing pressure fuel is to keep the injection pump components cooled and lubricated. The amount of fuel that is released into the housing is determined by the size of the vent wire. The pressure of the housing is controlled by the fuel return fitting/pressure regulator (J). If the pressure exceeds the regulator, it will return fuel to the fuel tank. The ECU monitors the fuel temperature of the housing through a fuel temperature sensor (I). For more information on the fuel temperature sensor, see MEASURING TEMPERATURE in Group 140 of this Section.

The remaining transfer pump pressure fuel travels through a transfer pump regulating valve. This allows for fuel to return to injection pump inlet pressure. It circulates the fuel back through the transfer pump.

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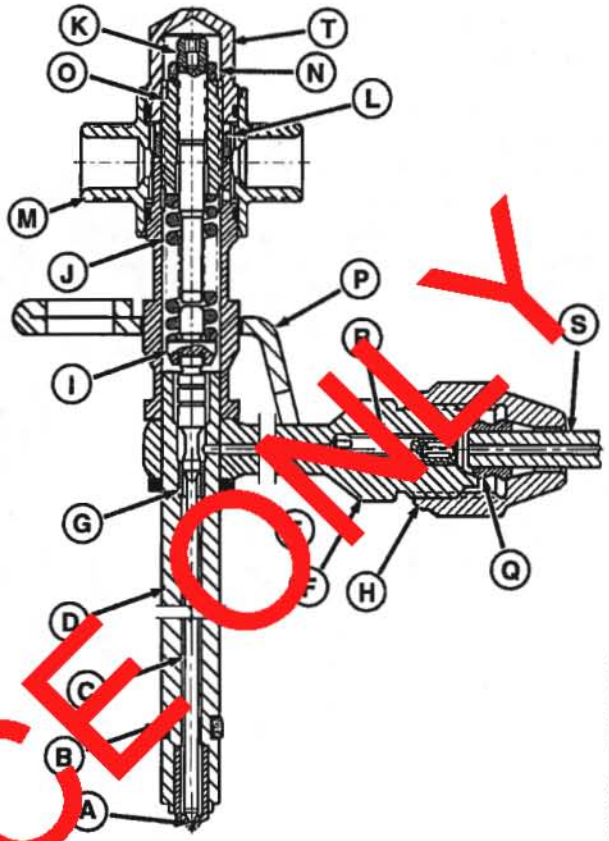
Fuel Injection Nozzle Operation



The nozzle spray tip (A) forms an integral unit with nozzle body (D) from which it cannot be separated. The injection nozzle is secured in the cylinder head by three superimposed spring clamps which press on a location clamp and a cap screw. The contact pressure is limited by a spacer ring. The nozzle is sealed in the cylinder head at its lower end with a carbon stop seal (B). The top end is sealed with seal washer (D). Clamp (P) ensures correct position of the complete fuel injection nozzle in the cylinder head. The leak-off line is connected by T-fitting (M), which is fitted on the nozzle body and secured a cap with O-ring seal (T).

03 130 8

The fuel injection nozzle works basically in the same way as a normal spray type nozzle. Its opening pressure is adjusted by the pressure adjusting screw (O). The lift of nozzle valve (C) is adjusted by screw (K) located in pressure adjusting screw.

The carbon stop seal (B) prevents carbon from collecting around nozzle in cylinder head. The fuel injection nozzles have four orifices.

A—Spray tip
B—Carbon stop seal
C—Nozzle valve
D—Nozzle body
E—Seal washer
F—Connection for injection line
G—Nozzle valve guide
H—Union nut
I—Spring seat
J—Adjustable pressure spring
K—Lift adjusting screw
L—Lock nut for pressure adjusting screw
M—T-fitting
N—Lock nut for lift adjusting screw
O—Pressure adjusting screw
P—Location clamp
Q—Nipple
R—Filter screen
S—Fuel pressure line
T—O-ring

RG40854,0000020 –19–03DEC01–1/1

About This Group

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

- Electronic Control System Terminology
- Electronic Control System Operation
- Monitoring Engine Parameters
- Electronic Control System
- Measuring Temperature
  - ECT (Engine Coolant Temperature) Sensor
  - MAT (Manifold Air Temperature) Sensor
  - Loss of Coolant Temperature Sensor
  - Fuel Temperature Sensor
- Measuring Pressure
  - Oil Pressure Sensor
- Measuring Throttle Position
- Measuring Engine Speed
  - Crank Position Sensor
- Marine Throttle Control Options
  - Engine Synchronization Throttle Control
  - Throttle Control Location Control
- Pump Solenoid
- Water in Fuel (WIF) Sensor
- Engine Control Unit (ECU)
- Controller Area Network (CAN)
- Cruise Control Operation
- Intake Air Heater Operation
- Engine Protection
- Derate Programs
- Multiple Torque Curves Selection
- Governor Droop Mode Selection
- Engine Control Unit (ECU) Self Diagnosis

RG40854,0000021 -19-04OCT05-1/1

Electronic Control System Terminology

Actuator	A device controlled by the (ECU) to perform a certain function.
Analog	Signal which has a continuous range of possible voltages. Usually 0 to 5 volt or 0 to 12 volt signals.
Boost	Air charge pressure in the intake manifold.
CAN	Controller Area Network. The electronic pathway network on vehicles that allows communication between controllers.
DTC	Diagnostic Trouble Code. A code which is stored in the ECU's memory when the ECU detects a problem in the electronic control system.
Digital	A signal which consists of only two-volt levels — usually 0 volts and +5 volts.
ECT	Engine Coolant Temperature (sensor). Measures the temperature of the engine coolant. See MEASURING TEMPERATURE later in this Group for details.
ECU	Engine Control Unit. The computer which controls the fuel, air, and ignition system on the engine. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
FMI	Failure Mode Identifier. The second part of a two-part code that identifies control system trouble codes according to the SAE J1939 standard. The FMI identifies the type of failure that occurred. The first half of the code is the Suspect Parameter Number (SPN).
J1587/J1708	The Society of Automotive Engineers (SAE) standard for the electronic components of heavy duty vehicles. J1587 is the software standard. J1708 is the hardware standard.
MAT	Manifold Air Temperature (sensor). Measures the temperature of the air in the intake manifold. See MEASURING TEMPERATURE later in this Group for details.
PROM	Programmable, Read-Only Memory. The computer chip which contains the calibration information for the engine control system. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
PWM	Pulse Width Modulation. A digital signal (not analog) which consists of a pulse generated at a fixed frequency. When an actuator is controlled by a PWM signal, the on time of the signal is increased or decreased (modulated) to increase or decrease the output of the actuator.
RAM	Random Access Memory. The portion of computer memory within the ECU which changes as the engine is running and is stored while the engine is off. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
SAE	Society of Automotive Engineers. Working with society to promote vehicle safety and maintenance and energy resource conservation.
Sensor	Device used by the ECU to monitor various engine parameters.
SPN	Suspect Parameter Number. The first half of a two-part code that identifies control system fault codes according to the SAE 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).
VBAT	Battery voltage or unswitched voltage.
VSW	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 Engine Control Unit (ECU). This energizes the ECU and allows it to "boot-up" and ready itself for engine start.

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

As soon as the ECU receives an input from the crankshaft position sensor that the engine is cranking, it will move the pump control valve to the "pressure" position, which will allow injection pressure to be developed. The fuel is delivered to all of the cylinders. To provide cold temperature enrichment, the amount of fuel injected is based on the temperature measured by the Engine Coolant Temperature (ECT) sensor. At this point, the engine will start and the ECU will go into the running mode.

Engine Running Mode

In the running mode, the ECU monitors inf[illegible] from the various sensors, then determines the optimum amount of fuel to inject and the optimum injection timing in order to allow the engine to develop high power while maintaining low exhaust emission output. The ECU controls fuel delivery by energizing and de-energizing the pump control solenoid. When the ECU energizes the solenoid, the pump control valve closes and injection begins. When the correct amount of fuel has been injected, the ECU de-energizes the solenoid, causing the pump control valve to open and fuel injection to stop.

RG40854,0000022 -19-03DEC01-1/1

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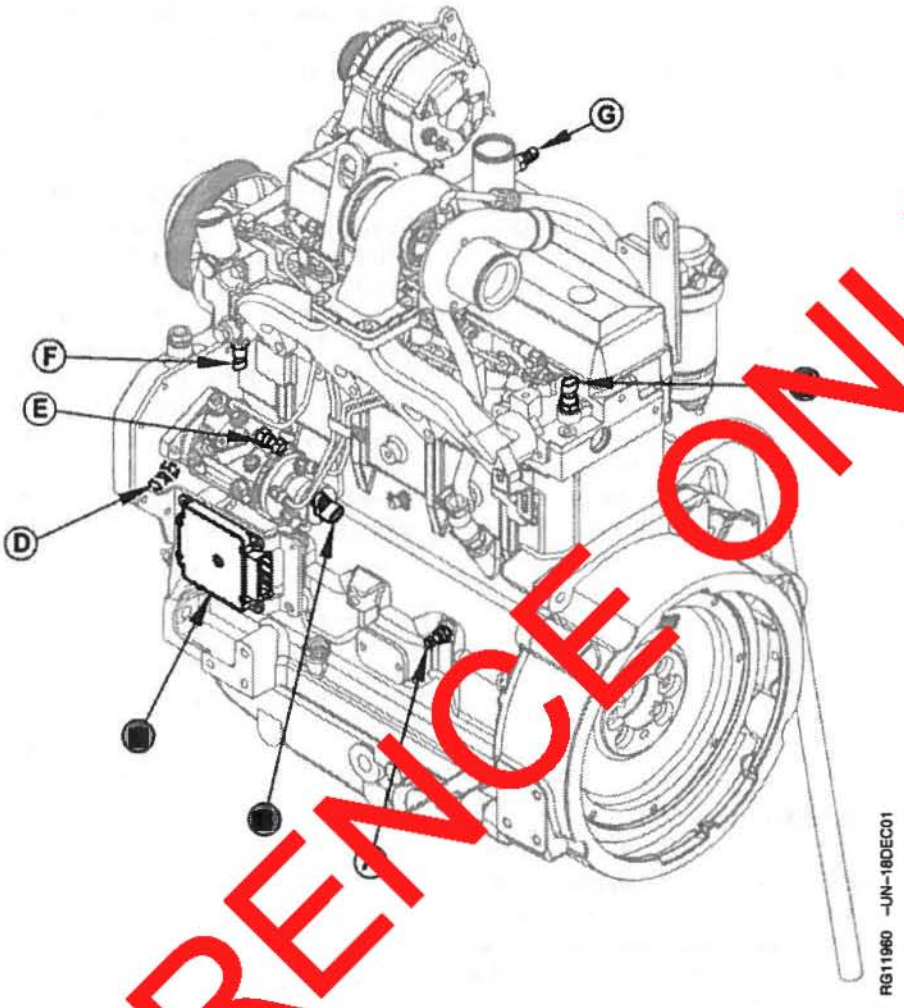
Monitoring Engine Parameters

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)
- Loss of Coolant Temperature
- Manifold Air Temperature (MAT)
- Oil Pressure
- Fuel Temperature
- Throttle Position
- Crankshaft Position Sensor

RG40854,0000026 -19-03DEC01-1/1

Electronic Control System Overview



A—Oil Pressure Sensor
B—Pump Control Solenoid
C—Engine Control Unit (EC
D—Cra Position Sensor
E—Fuel T perature Sensor
F—ECT Sensor
G—Manifold Air Temperature (MAT) Sensor
H—Loss of Coolant Temperature Sensor

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

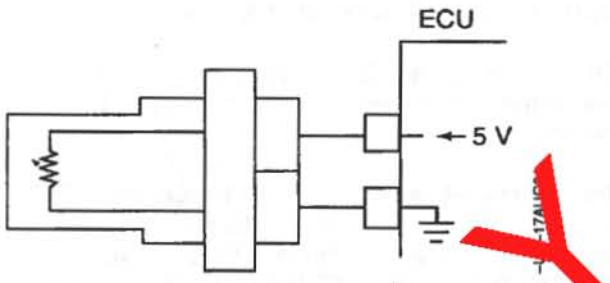
The elect nic control stem serves as an engine governo by controlling the pump control valve through a sol noid that fuel is delivered according to a given s of e ine conditions, in precise amounts, and t a pr ise time in relation to piston position. In order to achieve this, the engine control system performs the following functions:

- Constantly monitors engine operating conditions
- Delivery an optimum amount of fuel for operating conditions
- Provides multiple control modes
- Performs self-diagnosis

RG40854,0000024 –19–03DEC01–1/1

Measuring Temperature

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



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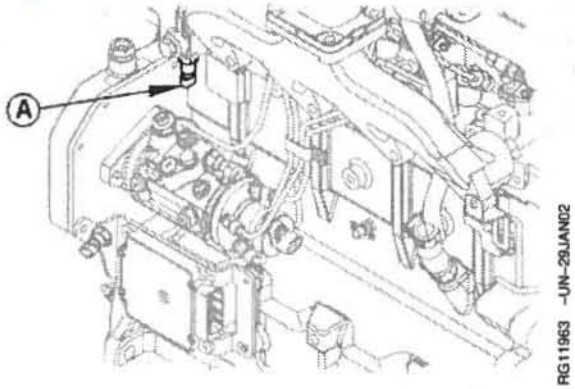
Engine Coolant Temperature (ECT) Sensor

On most applications, the Engine Coolant Temperature (ECT) sensor is located in the thermostat housing (A). On other applications, it may be located at the rear of the cylinder head.

The ECU monitors coolant temperature for:

- Engine protection purposes. For more information on engine protection and derate programs see, ENGINE PROTECTION or DERATE PROGRAMS later in this Group.
- Starting fuel quantity determination — The ECU will adjust the amount of fuel delivered during start-up based on 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.



A—ECT Sensor

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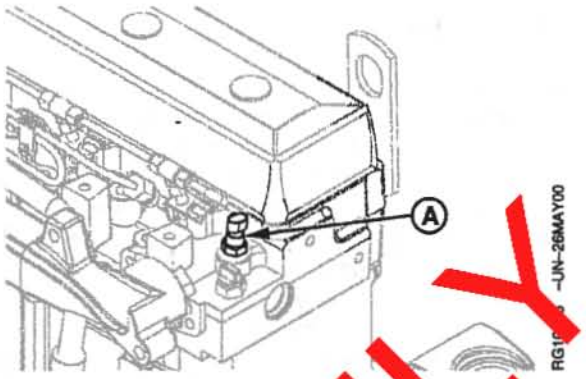
RG40854,0000025 –19–03DEC01–2/5

Loss of Coolant Temperature Sensor

The Loss of Coolant Temperature sensor is located in the rear of the cylinder head (A) on some applications using this engine.

The ECU monitors loss of coolant temperature for engine protection purposes. For more information on engine protection and derate programs see, ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

A—Loss of Coolant Temperature Sensor

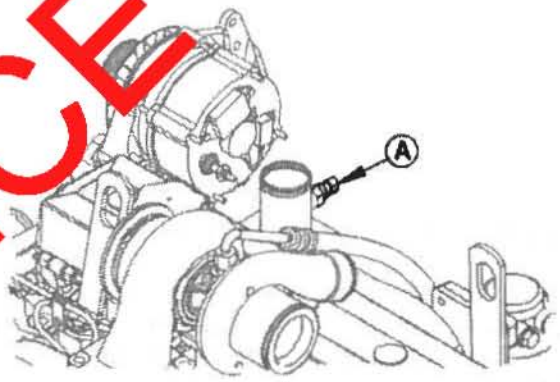


RG40854,0000025 –19–03DEC01–3/5

Manifold Air Temperature (MAT) Sensor

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

A—MAT Sensor



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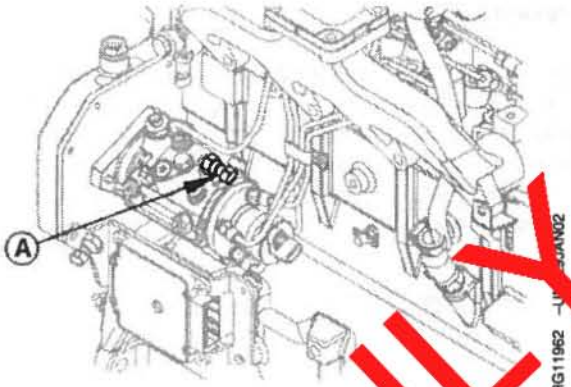
RG40854,0000025 –19–03DEC01–4/5

Fuel Temperature Sensor

The fuel temperature sensor (A) is located on top of the injection pump. It measures the temperature of the fuel in the injection pump that is going through the overflow valve. The temperature is used to help the ECU to calculate the correct amount of fueling rENGINE PROTECTION or DERATE PROGRAMS laster in this Group.

A—Fuel Temperature Sensor



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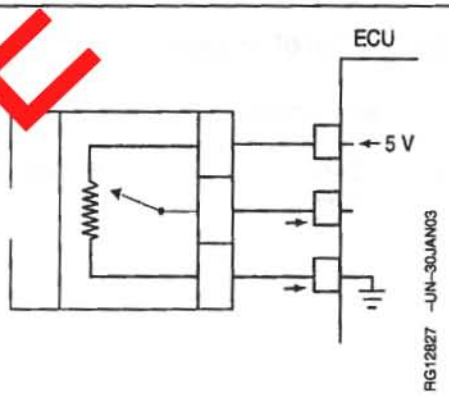
Measuring Pressure

The system's pressure sensors are 3 wire variable resistors. As the pressure changes, sensor resistance changes. The ECU sends a 5 volt reference voltage to the sensor, monitors the voltage returning on the sensor signal wire, and compares the voltage drop to preprogrammed values in the ECU's memory to determine pressure. In addition to pressure sensors, some applications use pressure switches. Pressure switches close when a specific pressure is reached.



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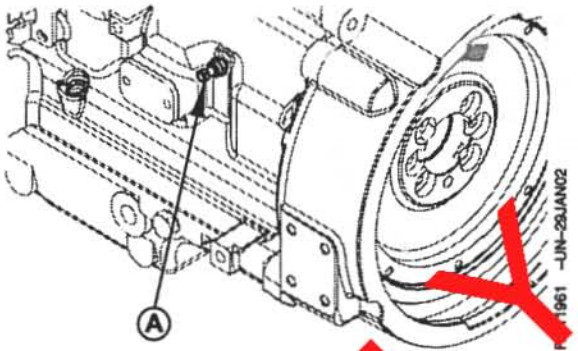
Oil Pressure Sensor

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

A—Oil Pressure Sensor



RG40854,0000027 –19–03DEC01–2/2

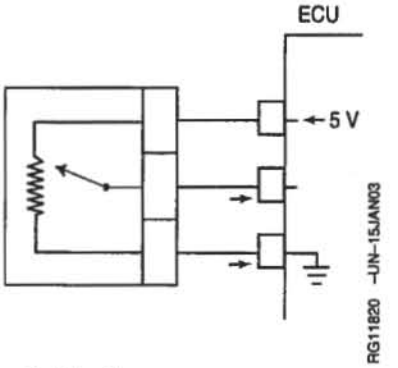
Measuring Throttle Position

The 4.5L & 6.8L engines have the option of operating with an analog throttle position sensor output signal, multi-state throttle, or a CAN throttle. On some applications, multiple throttles are used.

RG40854,0000031 –19–05DEC01–1/7

Analog Throttle

An analog throttle uses a variable resistor (potentiometer) sensor to measure the position of the throttle. The ECU sends a 5 volt reference voltage to the sensor, monitors the voltage drop across the resistor, and compares the voltage drop to preprogrammed values in the ECU's memory. The analog throttle input voltage normally varies between 1.0 volts and 4.0 depending on throttle position. Analog throttle voltage at low idle is approximately 1.0 volts and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.



Position Sensor

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RG40854,0000031 –19–05DEC01–2/7

Multi-state Throttle

The multi-state throttle is used when a few fixed engine speeds are desired. There are three types of multi-state throttles; Dual-state, Tri-state, and Ramp. All of these throttles are wired exactly the same. The only difference is the actual switch that is used to control the engine speed. For information on each of these throttles, see DUAL STATE THROTTLE, TRI-STATE THROTTLE, or RAMP THROTTLE later in this Measuring Throttle Position section.

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

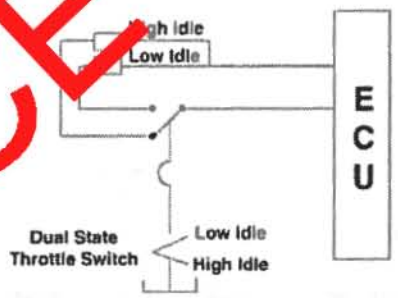
RG12348

Multi-state Throttle Schematic

RG40854,0000031 –19–05DEC01–3/7

Dual State Throttle

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



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Dual State Throttle

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RG40854,0000031 –19–05DEC01–4/7

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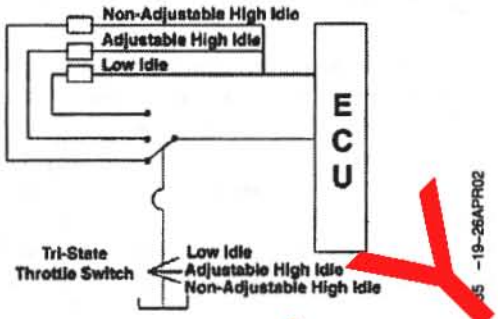
Tri-State Throttle

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

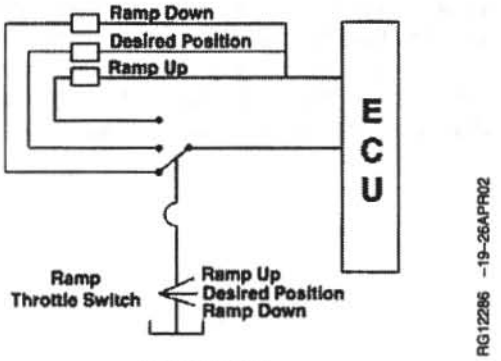


Tri-State Thro

RG40854,0000031 -19-05DEC01-5/7

Ramp Throttle

The ramp throttle allows the operator s wly in ease r decrease the engine speed through a t e osition momentary (spring back to center ition, witch If the switch is held in the upward po ion, e eng speed will increase in small increme . If t itch is held in the downward position, th engi speed will decrease. Once the desired spee is selected, release the switch into the center positio The witch uses three different resistors to chan the v age re rned to the ECU. When the switc is in the d d position (center), the current is route thr gh a 1300 ohm resistor. When changing ngine s ed, a 390 ohm resistor to reduce the engine peed nd a 3000 ohm resistor to ramp up the engine ee . Speed will remain the same until key cycle or rato chan .



Ramp Throttle

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RG40854,0000031 -19-05DEC01-6/7

CAN Throttle

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

CAN Throttle Schematic

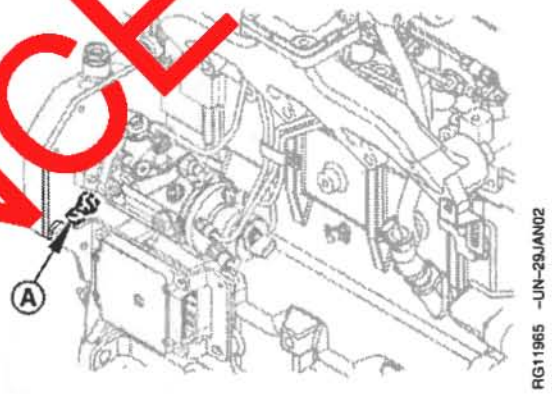
RG40854,0000031 –19–05DEC01–7/7

Measuring Engine Speed

Crank Position Sensor

The crank position sensor operates by detecting notches on their respective timing wheels. When a notch on the timing wheel is directly under the sensor, a voltage is induced. The ECU monitors this voltage signal to determine the position of the timing wheel. The sensor is located on the front of the crankshaft, behind the pressed-on crank gear.

The crank position sensor (A) is located at the front of the crankshaft. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The ECU uses the crank position input to determine engine speed.



A—Crank Position Sensor

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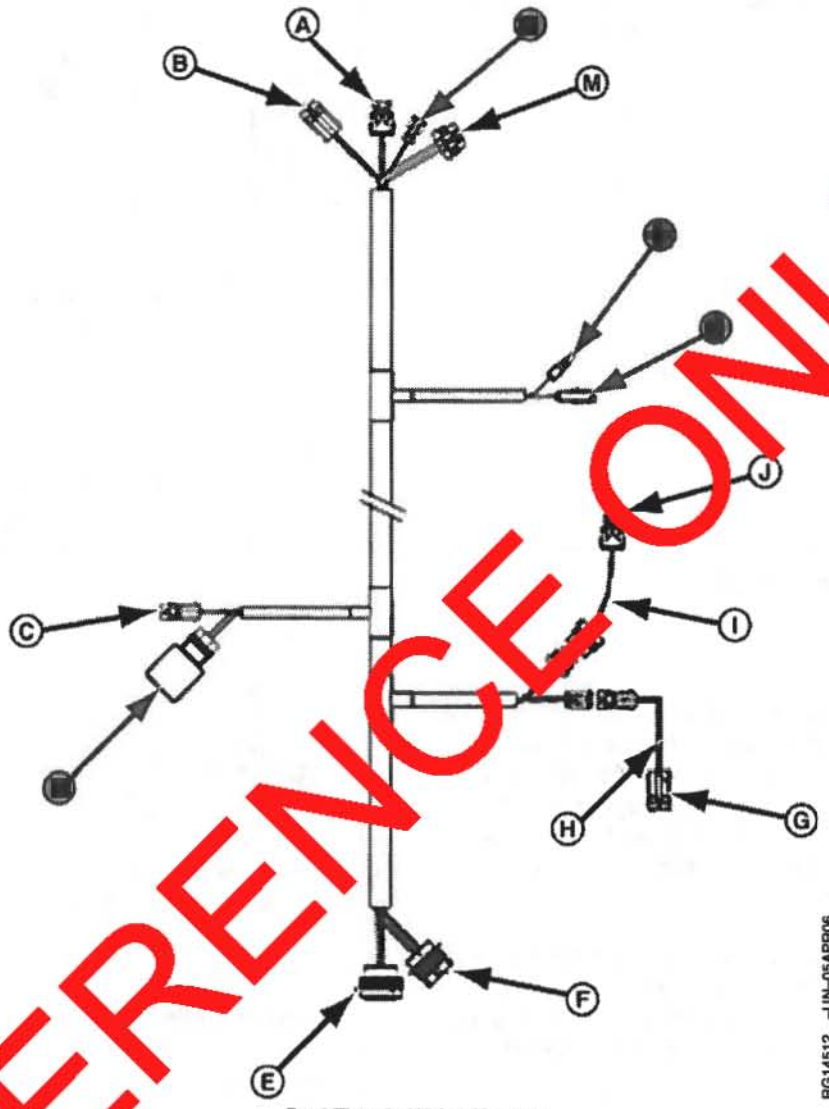
Marine Throttle Control Options



Dual Throttle Wiring Harness

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

The 4.5 and 6.8 marine engines have two, dual-throttle options: 1. Dual throttles with transfer of control station, and 2. Engine synchronization control.

To operate either option requires a variation of the marine transition harness (shown above). Which harness variation depends on whether one or the other, or both options were purchased. Both options cannot be operated simultaneously. Descriptions of operation of each option follow.

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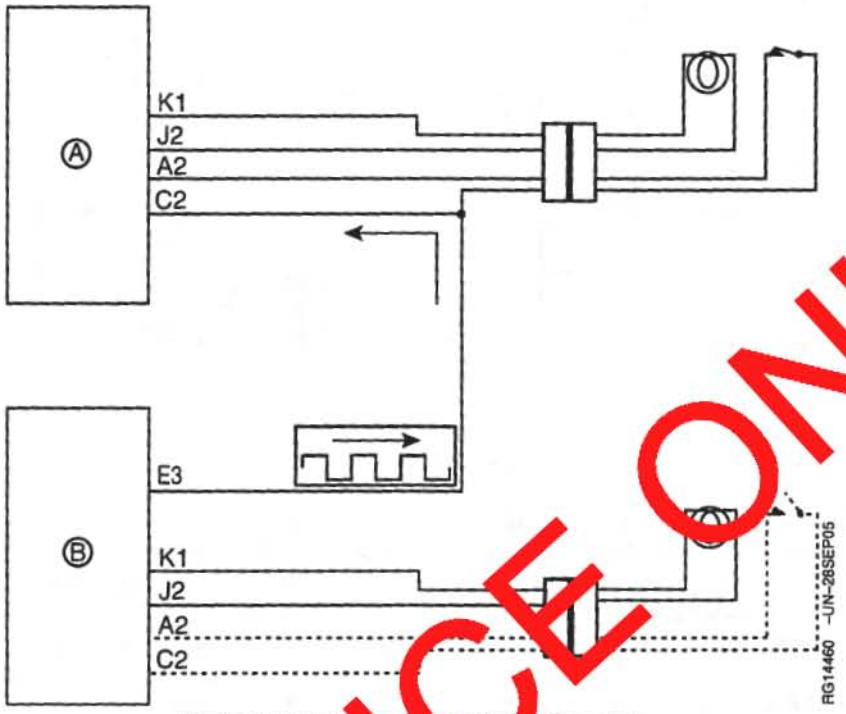
Engine Synchronization Throttle Control



Engine Synchronization Throttle Control Schematic

Two marine engines, having separate ECUs, are configured such that their speeds can be matched one to the other. The ECU of either engine may be designated as lead ECU through the Trip Options page.

IMPORTANT: Both ECUs must not be programmed to be lead, nor both ECUs programmed to be follower.

Synchronized engine operation is enabled when the Synchronize Enable switch in the Follower ECU (A) is closed. This provides the path for system voltage (switched) (A2) to command follower ECU to enable synchronized engine operation (C2).

Once the operation is enabled, ECUs provide potential (G2) and ground (A2) for Synchronize Enable lights, which come on, and remain on. Follower engine ECU tachometer output is disabled. It no longer responds to its throttle. It continuously receives lead-engine (B) tachometer output (E3), which it uses to cause the follower engine to match the speed of the lead engine.

In order to achieve and maintain synchronous engine speed operation:

- Both engine speeds must be within 100 rpm, or less, of each other.
- Individual throttle command values must be within 5% of each other.
- Both engine speed signal values must be 975 rpm, or more.

When attempting Synchronous engine operation, if one or more of the above conditions are not met, Synchronize Enable lights continuously flash on and off, until the failing condition(s) has (have) been corrected.

Synchronize Enable lights test occurs at key ON – lights briefly come on. For this test to happen, ignition key must have been OFF for at least thirty seconds, prior to turning it back on

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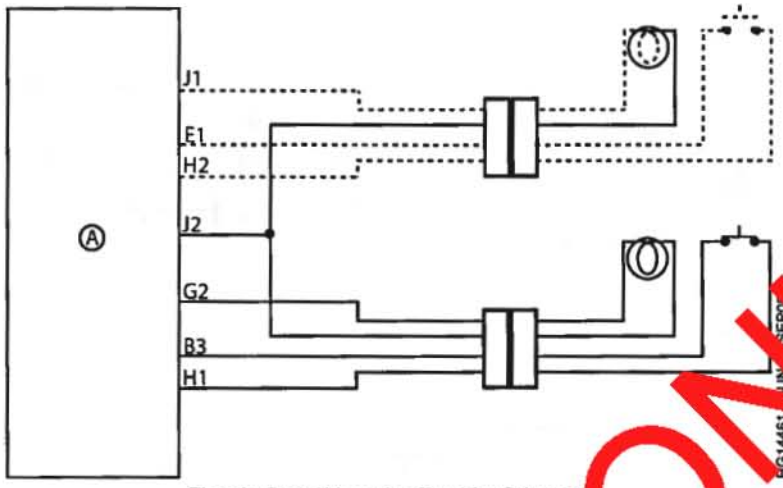
Throttle Control Location Transfer



Throttle Control Location Transfer Schemati

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

To change throttle control location during engine operation, the station select pushbutton switch at th requesting throttle is held engaged until that station's lamp is continuously lit, indicating that throttle ontro transfer has been successful. At this poi , the s itch can be released without interrupting th ottle c ntrol at that station.

In the case depicted in the ab ve fig re, Th le Transfer Switch at the auxilia thr trol station has been pushed ON. T s con cts Auxiliary Throttle Input (B3) to Auxilian hrottle Tra fer Switch Input (H1), informing ECU) of he transfer initiation. ECU provides Auxilia Throt Lam Drive potential (G2) through the l p to ower ound (J2), causing it to light. ECU sim ta eously stops Wheelhouse Throttle Lamp D ve pote ial (J1), causing the wheelhouse thrott contr lamp to go out. Throttle control is now at the x iary lo ation, and no longer at the w lhou e lo tion, from Wheelhouse Throttle Input (E1) o Whe house Throttle Transfer Switch Input (H2).

For tra sfer of thr ntrol to be successful, the posit n of the requested throttle must be within 2% of th active hrottle position. If the requesting throttle is not it n the quired 2%, upon initiation attempt of contro ran er, the lamp flashes on and off. If the statio se ect pushbutton switch is held engaged and the o erator moves the requesting throttle to within the req ed 2%, transfer will occur, The lamp will go from flashing to solid, and the switch at the requesting throttle can be released.

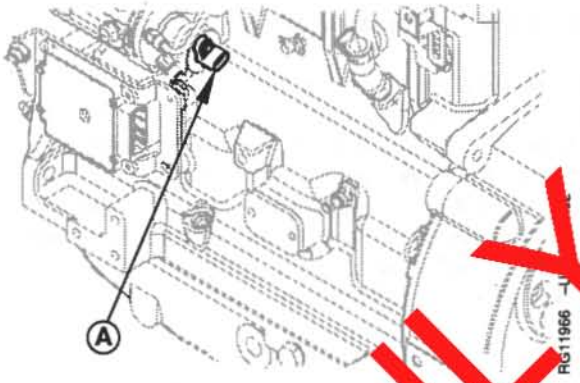
If the requesting throttle position is outside normal operating range (that is, out of normal signal range: 0-0.5 volts low and 4.5-5.0 volts high), its lamp momentarily lights, then shuts off and remains off. If the switch contacts of both throttles are simultaneously closed, the ECU selects the "highest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

At key ON, a test of the lamps at both throttle stations will occur. Any lamp that does not come on during this test is bad, and should be replaced. For this test to happen, ignition key must have been OFF for at least thirty seconds.

Normal throttle operating voltage is from 0.5 to 4.5 volts.

Pump Solenoid

Located on the end of the injection pump, the pump solenoid (A) controls the movement of the pump control valve. This controls the quantity of fuel delivered to the engine. When the Engine Control Unit (ECU) supplies no current to the solenoid, the valve does not move. Thus, the injection pump delivers no fuel. When the ECU supplies current to the solenoid, the pump control valve closes off the high injection chamber, which allows the fuel in the chamber to reach injection pressure. The quantity of fuel is determined by various sensors in the control system and messages sent to the ECU.



A—Pump Solenoid Conn

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Water in Fuel (WIF) Sensor

Two-Wire Sensor

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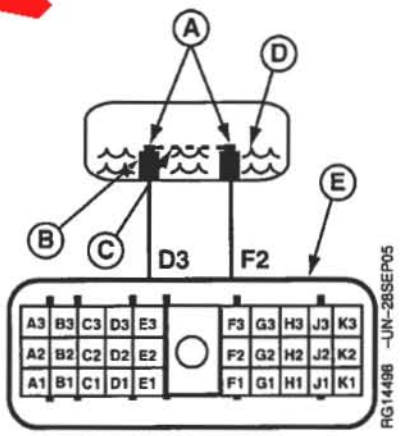
The water in fuel sensor consists of two electrodes (A) in the bottom of the bowl of the final fuel filter and a 200-kilohm resistor, in parallel with the electrodes. Diesel fuel is a very poor conductor of electricity compared to water, and while only fuel is present in the bowl, virtually all current passes through the resistor. This causes ECU (E) to sense only a nominal constant current demand. But when water (D) displaces fuel at the bottom of the bowl, Beyond the electrode insulator (B) resistance across the electrodes becomes significantly less than across the resistor, and additional current passes from D3, WIF signal supply, through the water across the electrodes (C) to F2, WIF circuit return. This causes ECU to detect a greater current demand, which derates or shuts down the engine. For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.



Two-Wire WIF Sensor Schematic

Continued on next page

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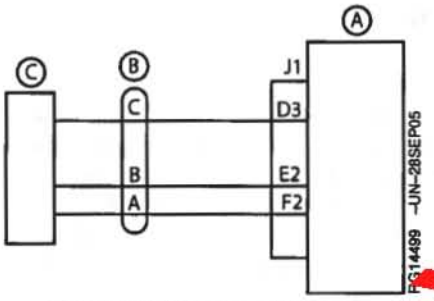
Three-Wire Sensor (Marine Only)

With no water in the bowl at the bottom of the filter canister, the WIF circuit switch (internal to the ECU) pulls the circuit to +5 volts. When water is in the bowl, WIF sensor causes the WIF circuit to pull to ground, setting DTC 97.00, and engine operation to derate or shut down. For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.



Three-Wire WIF Sensor Schematic

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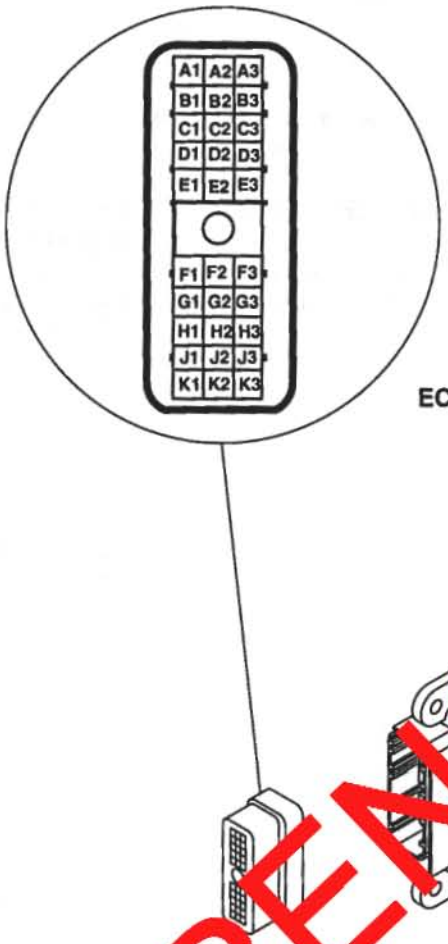
Engine Control Unit (ECU)



ECU Connector

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 and timing based on information from various sensors
- Limits maximum fuel for operation on multiple power curves
- Controls pump control valve solenoid for desired fuel delivery
- Provides all-speed governing
- Performs self diagnosis on the control system
- Stores trouble codes in memory

The ECU is composed of the following subsystems:

Analog/Digital Converters

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

Central Processing Unit (CPU)

The central processing unit performs the mathematical computations and logical functions that are necessary in controlling injection fuel quantity and injection timing. The CPU controls the pump control solenoid for desired fuel quantity and timing. It also controls the self diagnostic system.

Continued on next page

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.

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— 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, various information such as throttle position, derate requests, shutdown requests, and diagnostic trouble codes are communicated over this network. CAN also allows diagnostic software like the SERVICE ADVISOR™ to communicate with our engine controller. All of the information viewed through the software is transferred via the CAN Bus.

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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 [illegible] 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" [illegible] of gear. Both locations have the normal cruise control functions.

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Intake Air Heater Operation

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

The air heater relay will in turn energize the air heater coils located in the intake manifold. The ECU will keep the air heater relay energized for an amount of time that is determined by the measured temperatures. When the ECU has determined that the preheat time is adequate, it will turn off the "Air Heater Indicator" light and de-energize the air heater relay. If the operator turns the ignition from "ON" to "START" at this time, the engine will crank and start.

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

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

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Engine Protection

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

- **No Protection** — The ECU does not have the software to derate or shut the engine down. It is the responsibility of the operator to react to warning light(s) on their application. Derating or shutting the engine down may be necessary depending on the Diagnostic Trouble Code (DTC) that is set. Refer to the operator's manual to identify this information for a given application.
- **Engine Protection WITHOUT Shutdown** — The ECU has the capability to derate an engine. It is the responsibility of the operator to react to warning light(s) on their application to identify if it is necessary to shut the engine down. Refer to the operator's manual to retrieve this information for a given application.
- **Engine Protection with Shutdown**— The ECU will derate the engine for given DTCs. If a DTC that requires shutdown is set, the ECU will severely derate the engine and shut the engine down in 30 seconds. If the problem is corrected within the 30 second delay period, the power will increase at a particular rate until full power is reached.

Shutdown Override Feature

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

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

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Derate Programs

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

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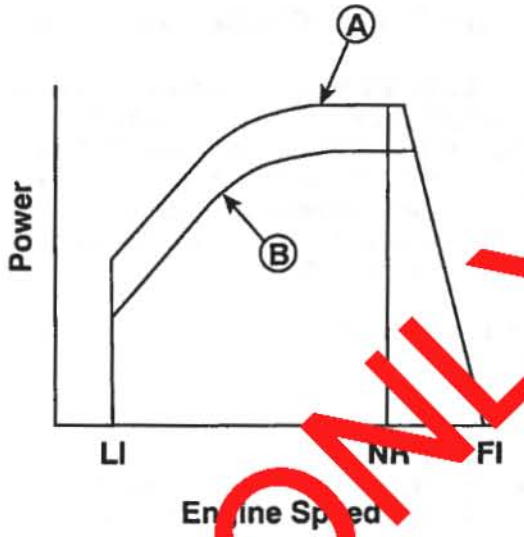
Multiple Torque Curve Selection

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

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



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

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Governor Droop Mode Selection

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

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

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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.

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

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

SPN/FMI CODE

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. A code 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 12 Engine Control Unit (ECU), the ECU transmits SPN/FMI codes over the Controller Area Network (CAN). This allows for service tools such as SERVICE ADVISOR™ and the Diagnostic Gauge to display active and stored DTCs. When using SERVICE ADVISOR™ the codes will be displayed in a 000000.00 format. For example, SPN 110 FMI 3 will be displayed as 000110.03.

OTHER CODES

If codes are not displayed as SPN/FMI or as 2-digit codes, there may be another format that the application is using. For example on some applications, the code F455 is displayed for engine coolant temperature input voltage high. This may be seen on some applications within SERVICE ADVISOR™. In this manual, it is necessary to convert this format of code into an SPN/FMI code to ensure that the correct diagnostic procedure is followed. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU

WARNING LAMP

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On some applications, there is a warning lamp that is used when a code becomes active. Typically, a solid light indicates that the ECU is taking extreme measures to protect the engine, and a blinking light indicates that the ECU has detected a fault and engine performance may be affected. Refer to Operator's Manual for a given application for more detailed information.

CLEARING STORED DTCS

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

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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 smoke
  - E6 - Engine will not crank
  - E7 - Engine idles poorly
  - E8 - Abnormal engine noise
  - E9 - Analog Throttle (B) Does Not Respond
- **(F)** Diagnosing Fuel System Malfunctions:
  - F1 - Fuel supply system check
  - F2 - Excessive fuel consumption
  - F3 - Fuel in oil
  - F5 - Fuel injector nozzle check
- **(D)** Diagnosing Diagnostic Software Malfunctions:
  - D1 - ECU does not communicate with the DST orSERVICE ADVISOR™
  - D2 - Diagnostic Gauge Does Not Communicate With ECU
- **(A)** Diagnosing Intake Air Heater Malfunctions:
  - A1 - Intake Air Heater Check

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

- Fuel System Testing Procedures:
  - Check Fuel Supply Quality
  - Test for Fuel Drain Back
  - Test for Air in Fuel
  - Check Fuel Supply Pressure
  - Bleed the Fuel System
  - Test For Cylinder Misfire (Engine Running)

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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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❶ 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 [illegible] 4. Verify air heater operation in cold temperatures. See A1 - INTAKE AIR HEATER CHECK DIAGNOSTIC PROCEDURE in this Group. 5. Verify that the unswitched voltage to the ECU remains above 6 volts during cranking.	**No problems found:** GO TO ❷ **Problem found:** Repair and retest

– – –1/1

❷ **Active DTC Test**	1. Connect the DST orSERVICE ADVISOR™. 2. Ignition ON, engine OFF 3. Start the ECU Communication Software *NOTE: In order for this step to be successfully performed on all HL and TL engines, the 4-way Hazard switch must be ON, prior to and during cranking.* 4. Crank engine for 15 seconds, and verify that the DST or SERVICE ADVISOR shows an RPM reading while cranking. 5. Read DTCs using the DST orSERVICE ADVISOR™.	**No active DTCs present:** GO TO ❸ **Active DTC(s) present:** Diagnose DTCs. If any of the DTCs have a SPN 637, diagnose them first. **Cannot communicate with ECM:** See D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR DIAGNOSTIC PROCEDURE later in this Group. No RPM reading shown during cranking: GO TO ❹

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❸ **Crank Position Sensor Indicator Test**	1. Start cranking engine 2. Using the DST or SERVICE ADVISOR, read the Crank Position Noise parameter while cranking. *NOTE: For an explanation of this parameter, see DATA PARAMETER DESCRIPTION in Group 160.*	**Crank Position Noise above 0:** GO TO ❹ **Crank Position Noise is 0:** GO TO ❺

---1/1

❹ **Vehicle Wiring Inspection Check**	Inspect the vehicle for possible failures that can cause any of the following conditions: 1. Bad electrical connections 2. Damaged engine speed sensor 3. EMI from improperly installed radio equipment, or other electronic devices	**Problem found:** Repair and retest. Engine starts, problem solved. **Problem not found:** GO TO ❺

---1/1

❺ Fuel Present at Injection Nozzles Check	Perform following procedure to check for fuel at injection nozzle: **CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Keep hands and body away from pinholes and nozzles which could inject fluids under high pressure.** **If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere and Company Medical Department in Moline, Illinois, or other knowledgeable medical source.** 1. Using two open-end wrenches, loosen all fuel line connections at pump end. 2. Crank engine while monitoring loosened connections for consistent, sequential squirts of fuel. 3. Retighten connection at nozzle to specification. **Specification** Fuel Injection Nozzle Delivery Lines— Torque ..... 27•m (20 lb-ft)	**Consistent and sequential squirts of fuel observed:** GO TO ❼ **No fuel present at any pump discharge:** GO TO ❻ **Squirts of fuel from only one discharge, or fuel only drizzles from one or more discharges:** Damaged pump rotor. Replace pump. **Note: Upon replacing pump, all injectors must be checked. REPLACE any faulty injectors to prevent damaging the new pump.** GO TO ❽ ---1/1
❻ Fuel Supply System Check	Check the fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.	**Fuel supply system problem found:** Repair problem and retest. **Note: If system is equipped with a primary filter/hand pump assembly, ensure that there is no reverse flow due to umbrella valve displacement in the primer pump. (If there is, the injection pump has lost its prime: Test the pressure between the transfer pump and the DE10.)** Engine starts, problem resolved. **No fuel supply system problem found:** GO TO ❼. ---1/1
❼ Known Good ECU Swap	If a known, good ECU is available, connect it to the system, and see if the engine will start.	**Engine starts:** Problem solved **Engine doesn't start:** GO TO ❽ ---1/1

8 Fuel Injection Nozzles Check	Test fuel injection nozzles. See F5 - FUEL INJECTION NOZZLE CHECK later in this Group.	**Faulty fuel injection nozzles found:** Repair or replace, and retest. Engine starts, problem resolved. **No faulty fuel injection nozzles found:** GO TO 9 ---1/1
9 Timing Wheel Check	Insert a screwdriver into the speed sensor hole, and verify that the timing wheel is not loose on the crankshaft.	**Timing wheel loose on crankshaft:** Replace timing wheel and retest. Engine starts. problem resolved. **Timing wheel not loose on crankshaft:** GO TO 10 ---1/1
10 Pump High Pressure Check	**CAUTION: Escaping fluid under pressure can penetrate the skin, causing serious injury. Keep hands and body away from pinholes and nozzles, which could inject fluids under high pressure** **If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury, or gangrene could result. Doctors unfamiliar with this type of injury may call the Deere and Company Medical Department in Moline, Illinois, or other knowledgeable medical source.** Using a suitable injection line, connect a known, good nozzle to one of the pump discharges. Crank the engine, and verify that fuel is atomized from the nozzle tip.	**No fuel passes from the nozzle tip:** Replace the pump, and retest. Engine starts, problem resolved. **Fuel is atomized from the nozzle tip:** GO TO 11 ---1/1
11 Intake and Exhaust Restrictions Test	Check for intake and exhaust restrictions. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	**All components operating correctly:** GO TO 12 **Restrictions are found:** Repair faulty component and retest. Engine starts, problem resolved. ---1/1

⑫ Compression Test	Check compression pressure. See TEST ENGINE COMPRESSION PRESSURE in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM104).	**Compression pressure is within specification:** GO TO ⑬ **Compression pressure is not within specification:** GO TO ⑯ ---1/1
⑬ Piston Ring Check	*NOTE: DO NOT use too much oil. DO NOT get oil on the valves.* 1. Apply oil to ring area of piston through injection nozzle bore. S[illegible] INJECTION NOZZLES in Section 02, Group 090 of this manual. 2. Retest the compression pressure.	**Compression pressure is within specification:** GO TO ⑯ **Compression pressure is not within specification:** GO TO ⑭ ---1/1
⑭ Valve Lash Check	Check valve lash. See CH[illegible]ST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L & [illegible]8 L D[illegible]el Engines Base Engine Manual (CTM104).	**Valve lash is within specification:** GO TO ⑮ **Valve lash on one or more valves out of specification:** Adjust valve lash and retest. Engine starts, problem resolved. ---1/1

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15 Valve Lift Check	Check valve lift. See MEASURE VALVE LIFT in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).	**Lift on all valves within specification:** GO TO 16 **Valve lift on one or more valves is out of specification:** Reset clearance to specification after measuring lift. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104). Engine starts, problem resolved. ---1/1

16 Pistons, Rings, Cylinder Liners Check	At this point, the most likely cause of the low engine compression pressure is one of the following failures in the pistons, rings, and/or cylinder liners or 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. ---1/1

E2 - Engine Misfires/Runs Irregularly

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E2 - Engine Misfires/Runs Irregularly Diagnostic Procedure

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❶ **E2 - Preliminary Check**	Before using this diagnostic procedure, make the following checks that could cause be mistaken as miss/rough running: 1. Check for intake manifold air leaks 2. Check for mechanical problems 3. Check for transmission problems 4. Check engine accessories, such as A/C, cycling [illegible] and c[illegible] 5. Check for electromagnetic interference (EM[illegible] from improperly installed radios, etc.	**No problems found:** GO TO ❷ **Problem found:** Repair and retest. Engines runs normally, problem resolved. ---1/1
❷ **Active DTC Test**	1. Connect the DST or SERVICE ADVISOR™ 2. Ignition ON, engine OFF 3. Start the ECU Communication Software 4. Ignition ON, engine idling 5. Read DTCs using the DST or SERVICE ADVISOR™. 6. Verify PSU serial number, engine serial number, software version, and check pump serial number, if available. 7. Install updated software, if required.	**No active DTCs:** GO TO ❸. **Active DTCs present:** Diagnose DTCs. If any of the DTCs have a SPN 637, diagnose them first.

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❸ **Recreate Conditions**	1. Operate engine under conditions where the miss/running complaint occurs. 2. With ignition ON and engine idling, read DTCs, using SA. 1.	**Not running rough:**No problem found, verify complaint, and try to reproduce conditions of complaint. **Running rough, with active DTCs present:**Diagnose DTCs. If any active DTCs have SPN 637, diagnose them first. **Running rough with no active DTCs:**GO TO ❹
❹ **Low Pressure Fuel System Check**	1. Check low pressure fuel system performance per the Fuel Supply System Check Diagnostic Procedure. See F1 - FUEL SUPPLY SYSTEM CHECK in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engine Mechanical System Fuel Check (CTM207). 2. Inspect the fuel return line for restrictions, kinks, air ingestion (using a piece of clear line). Also, be sure to check any coolers for plugging. *NOTE: If system is equipped with a primary filter/hand ;pump assembly, ensure that there is no reverse flow, due to umbrella valve displacement in the primer pump* 3. Test the pressure between transfer pump and injection pump.	**Problems are found:**Repair as necessary, and retest. Engine operates normally, problem resolved. **No problems are found:**GO TO ❺.
❺ **High Pressure Fuel Line Check**	Determine if fuel delivery lines are restricted: 1. Disconnect the suspected fuel delivery line on the injection nozzle end, and injection pump end. 2. Inspect for obvious signs of blockage, or bent, deformed, or pinched lines. 3. Force air through one end of the delivery line.	**Lines not restricted:**Air flows freely out other side of delivery line. GO TO ❻ **Lines are restricted:**Air does not flow freely out other side of delivery line. Repair/replace lines and retest. Engine runs normally, problem resolved.

❻ Fuel Injection Nozzle Check	1. Test fuel injection nozzles. See F5 - FUEL INJECTION NOZZLE CHECK later in this group. ⚠ **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 survgically removed within a few hours by a doctor familiar with this type of injury, or gangrene could result. Doctors unfamiliar with this type of injury may call the Deere and Company Medical Department in Moline, Illinois, or other knowledgeable medical source.** 2.To help identify which nozzle is bad, perform the following procedure to determine which injector makes the least difference when its line is cracked: a. Using two open-end wrenches, loosen fuel line connection at the injection nozzle one at a time. b. Listen to which nozzle makes less difference in engine smoothness. This is the bad nozzle. c. Retighten the connection at each nozzle to specification, before proceeding to the next nozzle. **Specification** Fuel Line Connection—Torque ..... 27 N•m (20 ft-lb)	**Injection nozzles test OK:**GO TO ❼ **Faulty injection nozzle(s) found.**Repair/replace, and retest. Engine runs smoothly, problem resolved. ---1/1
❼ Timing Wheel Check	Insert screwdriver into the sp... and determine whether or not the timing wheel is loose on the crankshaft. (The timing wheel is keyed to, and pressfit onto the crankshaft. It should not be loose, and should turn only when the crankshaft is turned.)	**Timing wheel is not loose:**GO TO ❽ **Timing wheel is loose:**Replace wheel and retest. Engine runs normally, problem resolved. ---1/1
❽ Check Wiring	1. Inspect the connections and wiring for problems, including a visual inspection of the wiring for corrosion. 2. Check connection between the harness and a sensor, or the harness and the ECU, using JT07328 Connector adapter Test Kit and inserting the male end of the corresponding test adapter into the female end of the ECU or sensor connector terminal.	**Faulty wiring/connector pins not found:**GO TO ❾ **Faulty wiring/connector pins found:**Repair and retest. Engine runs smoothly, problem resolved. ---1/1

9 Check ECU	If available, substitute ECU with known, good, same-model ECU.	**Condition not resolved:** Reinsert original ECU, and GO TO 10. **Condition resolved:** Reinsert original ECU. **Condition remains resolved:** Connection problem, retest 8. **Original, fault returns:** Replace ECU, Engine runs normally, problem resolved. ---1/1
10 Injection Pump Check	**Note: Take DST or Service ADVISOR recordings while the engine is operating in its rough condition - also while it is running smooth if the condition is intermittent - in order that the recordings can be sent via TAC advisor, if requested.** 1. If possible, do stall tests to check for overpower from the engine. 2. Do a detailed check of the electrical connections. 3. Inspect the pump solenoid cap contacts, and determine whether or not they are burned, or the contact studs are broken.	**Electrical problems not found:** Replace injector pump, and download payload designated for new pump. **Electrical problems found:** Repair and retest. Engine runs normally, problem resolved ---1/1
11 Head Gasket Failure Check	Check for head gasket joint failures. See CHECK FOR HEAD GASKET FAILURES in section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).	**No sign of head gasket failure:** GO TO 12 **Signs of head gasket failure found:** Replace head gasket and retest. Engine runs normally, problem resolved. ---1/1

⑫ 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 ⑭ **Compression pressure is not within specification:** GO TO ⑬ ---1/1
⑬ Piston Ring Check	*NOTE: DO NOT use too much oil. DO NOT get oil on the valves.* 1. Apply oil to ring area of piston through injection nozzle bore. See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual. 2. Retest the compression pressure.	**Compression pressure is within specification:** GO TO ⑭ **Compression pressure is not within specification:** GO TO ⑯ ---1/1
⑭ Valve Lash Check	Check valve lash. See CHECK/ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).	**Valve lash is within specification:** GO TO ⑮ **Valve lash on one or more valves out of specification:** Adjust valve lash and retest. Engine runs normally, problem resolved. ---1/1

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15 Valve Lift Check	Check valve lift. See MEASURE VALVE LIFT in Group 020 in Section 02 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM104).	**Lift on all valves within specification:** GO TO 16 **Valve lift on one or more valves is out of specification:** Reset clearance to specification after measuring lift. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104). Retest. If engine runs normally, problem resolved. ---1/1
16 Pistons, Rings, Cylinder Liners Check	At this point, the most likely cause of the low engine compression pressure is one of the following failures in the pistons, rings, and/or cylinder liners or in the valve guides. Check the most likely items as needed. • Oil control rings worn or broken • Scored cylinder liners or pistons • Piston ring grooves excessively worn • Piston rings sticking in ring groove • Insufficient piston ring tension • Piston ring gaps not staggered • Cylinder liners glazed (insufficient load during engine break-in) • Worn valve guides or stem • Cylinder head may need reconditioning	**Problem found with pistons, rings, and/or liners or valve guides:** Repair problem as necessary, and retest. ---1/1

E3 - Engine Does Not Develop Full Power

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E3 - Engine Does Not Develop Full Power Diagnostic Procedure

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❶ **E3 - Preliminary Check**	Before using this diagnostic procedure, ensure that: • There are no problems with transmission • There are no engine mechanical problems • There is not an excessive load on the engine • There is no unbalanced ballast • The air and fuel filters are not restricted or plugged • Fuel quality is OK	**No problems found:** GO TO ❷ **Problem found:** Repair and retest
❷ **Active DTC Test**	1. Connect the DST or SERVICE ADVISOR™ 2. Ignition ON, engine OFF 3. Start the ECU Communication Software 4. Ignition ON, engine OFF 5. Read DTC using the DST or SERVICE ADVISOR™. *NOTE: On some DTCs, the ECU derates fuel in order to protect the engine.*	**No DTCs present:** GO TO ❸ **DTCs present:** Go to appropriate diagnostic procedure.

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❸ **Exhaust Emission Test**	1. Operate engine at full load rated speed. 2. Under these conditions, determine type of exhaust emitted.	**Small amount or no exhaust smoke:** GO TO ❹ **Heavy white exhaust smoke:** See E4 - ENGINE EMITS EXCESSIVE WHITE EXHAUST SMOKE DIAGNOSTIC PROCEDURE later in this Group. **Heavy black or gray exhaust smoke:** See E5 - ENGINE EMITS EXCESSIVE BLACK or GRAY EXHAUST SMOKE DIAGNOSTIC PROCEDURE later in this Group. ---1/1
❹ **Torque Curve Selection Check**	The ECU on 4.5L & 6.8L diesel engines has the ability to operate on multiple torque curves. To check that the engine is operating on the correct torque curve under the operating conditions where there is a low power complaint: 1. Recreate the conditions of the low power complaint. 2. Read the Torque Curve parameter on the DST or SERVICE ADVISOR. *NOTE: For an explanation of this parameter, see DATA PARAMETER DESCRIPTION in Group 160.* 3. Compare the Torque Curve Parameter to the appropriate torque curve chart. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual and refer to the corresponding torque curve for your application.	**Correct torque curve number displayed for corresponding operating conditions:** GO TO ❺ **Incorrect torque curve number displayed for corresponding operating conditions:** 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 ---1/1
❺ **Governor Droop Mode Selection Check**	1. Operate engine and attempt to recreate the low power condition. 2. Read the Desired Speed Governor parameter and the Maximum Speed Governor parameter using the DST or SERVICE ADVISOR. *NOTE: For an explanation of this parameter, see DATA PARAMETER DESCRIPTION in Group 160.* 3. Compare governor selection to the appropriate governor mode chart. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual and refer to the corresponding maximum speed and desired speed governor curves for your application.	**Correct governor selection:** GO TO ❻ **Incorrect governor selection:** Refer to machine manual to determine components that if faulty could prevent the correct governor from being selected OR Faulty governor select wiring ---1/1

❻ **Throttle Test**	1. Operate engine at full load rated speed. 2. Read the Percent Throttle parameter using the DST or SERVICE ADVISOR. *NOTE: For an explanation of this parameter, see DATA PARAMETER DESCRIPTION in Group 160.*	**97% or above:** GO TO ❼ **Below 97%:** Refer to machine manual and perform the throttle calibration procedure; then retest. ---1/1
❼ **Turbocharger Boost Pressure Check**	Check the Turbo Boost pressure. See MEASURE INTAKE MANIFOLD PRESS[illegible] (TURBOCHARGER BOOST/POWER CHECK) in Section 04, Group 150 of 4.5 L [illegible]6.8 L Diesel Engines Base Engine Manual (CTM 104).	**Intake manifold pressure within range or above, compared to boost specification:** GO TO ❽ **Intake manifold pressure below range compared to boost specification:** GO TO ❾ ---1/1
❽ **Fuel Supply System Check with Normal Boost Pressure**	Check the fuel supply system. S[illegible]UPPLY SYSTEM CHECK DIAGNOSTIC PROCEDUR[illegible]later [illegible]this Group.	**Fuel supply system is OK:** Engine appears to be delivering full power. Check for vehicle problems that could cause an excessive load on the engine. **Fuel supply system problem found:** Repair fuel supply system problem and retest. ---1/1
❾ **Compre[illegible]ion Pressur[illegible]he**	[illegible]eck 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 ❿ **Compression pressure is not within specification:** GO TO ⓭ ---1/1

10 Checking Potential Causes of Low Boost Pressure	**Check for the following that can cause reduced boost pressure:** 1. Restricted air cleaner 2. Intake air leak 3. Exhaust air leak 4. Restriction in exhaust 5. Faulty turbocharger. See TURBOCHARGER INSPECTION in Section 02, Group 080 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	**None of the above problems found:** GO TO 11 **Problem found:** Repair problem and retest. ---1/1
11 Fuel Supply System Check with Low Boost Pressure	Check the fuel supply system. F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.	**Fuel supply system is OK:** GO TO 12 **Fuel supply system problem found:** Repair fuel supply system problem and retest. ---1/1
12 Fuel Injection Nozzles Test	Test fuel injection nozzles. See F5 - FUEL INJECTION NOZZLE CHECK later in this Group.	**Injection nozzles test OK:** Faulty injection pump OR Faulty ECU **Faulty injection nozzle(s) found:** Repair or replace faulty injection nozzles. ---1/1
13 Piston Ring Check	*NOTE: DO NOT use too much oil. DO NOT get oil on the valves.* 1. Apply oil to ring area of piston through injection nozzle bore. See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual. 2. Retest the compression pressure.	**Compression pressure is within specification:** GO TO 16 **Compression pressure is not within specification:** GO TO 14 ---1/1

⓮ Valve Lash Check	1. Ensure there are no engine mechanical problems and that there isn't something drawing excessive engine power 2. Ensure that valve lash is correctly adjusted. 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).	**Valve clearance within specification:** GO TO ⓯ **Valve clearance out of specification:** Adjust valves to specification and retest. ---1/1
⓯ Valve Lift Check	Check valve lift. See MEASURE VALVE LIFT in Group 020 in Section 02 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).	**Lift on all valves within specification:** GO TO ⓰ **Valve lift on one or more valves is out of specification:** Reset clearance to specification after measuring lift. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104). ---1/1
⓰ 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. ---1/1

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E4 - Engine Emits Excessive White Exhaust Smoke

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E4 - Engine Emits Excessive White Exhaust Smoke Diagnostic Procedure

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

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❶ **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 ❷ **Problem found:** Repair and retest
		–––1/1
❷ **Head Gasket Failure Test**	Check for a failed head gasket. See CHECK FOR HEAD GASKET FAILURES in Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	**No signs of head gasket failure:** GO TO ❸ **Signs of head gasket failure are found:** See CHECK FOR HEAD GASKET FAILURES in Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).
		–––1/1
❸ **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 ❹ **Compression pressure is not within specification:** GO TO ❻
		–––1/1

❹ **Fuel Supply Pressure Check**	Check fuel pressure. See CHECK FUEL SUPPLY PRESSURE later in this Group.	**Fuel pressure within specification:** GO TO ❺ **Fuel pressure below specification:** Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group. ---1/1
❺ **Fuel Injection Nozzle Check**	Test fuel injection nozzles. See F5 - FUEL INJECTION NOZZLE CHECK later in this Group.	**Injection nozzles test good:** Faulty injection pump **Faulty injection nozzle(s) found:** Repair or replace injection nozzles ---1/1
❻ **Piston Ring Check**	*NOTE: DO NOT use too much oil on the valves.* 1. Apply oil to ring area of piston through injection nozzle bore. See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual. 2. Retest the compression pressure.	**Compression pressure is within specification:** GO TO ❾ **Compression pressure is not within specification:** GO TO ❼ ---1/1
❼ **Valve Lash Check**	1. Ensure there are no engine mechanical problems and that there isn't something drawing excessive engine power 2. Ensure that valve lash is correctly adjusted. 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).	**Valve clearance within specification:** GO TO ❽ **Valve clearance out of specification:** Adjust valves to specification and retest. ---1/1

8 Valve Lift Check	Check valve lift. See MEASURE VALVE LIFT in Group 020 in Section 02 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).	**Lift on all valves within specification:** GO TO 9 **Valve lift on one or more valves is out of specification:** Reset clearance to specification after measuring lift. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104). ---1/1
9 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 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 • 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. ---1/1

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E5 - Engine Emits Excessive Black Or Gray Smoke

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E5 - Engine Emits Excessive Black Or Gray Smoke Diagnostic Procedure

NOTE: This procedure should be used if the engine emits excessive black or gray smoke. If engine emits a lea heavy, bluish exhaust smoke see 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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❶ **E5 - Preliminary Check**	Before using this diagnostic procedure, check the following: • Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. • Ensure engine is not excessively loaded • Ensure air filter is not restricted or plugged	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.
		---1/1
❷ **Torque Curve Check**	*NOTE: This check is only required for [illegible]. For all other applications, GO TO ❸.* 1. Connect the DST or SERVICE ADVISOR™. 2. With the engine running, read the Torque Curve parameter using the DST or SERVICE ADVISOR. *NOTE: For an explanation of this parameter, see DATA PARAMETER DESCRIPTIONS in Group 160.* 3. Compare the Torque Curve Parameter to the appropriate torque curve chart. See EXCAVATORS - TORQUE CURVE SELECTION in Section 06, Group 210 of this manual.	**Correct torque curve number displayed:** GO TO ❸ **Incorrect torque curve number displayed:** Adjust torque curve using the DST or SERVICE ADVISOR. See ENGINE TEST INSTRUCTIONS - EXCAVATOR TORQUE CURVE CHANGE TEST in Section 4, Group 160 of this manual.

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❸ **Air Intake and Exhaust Test**	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 & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	**No restrictions or leaks found:** GO TO ❹ **Restrictions or leaks found:** Repair or replace components as necessary. ---1/1
❹ **Turbocharger Check**	Check for turbocharger failure. See TURBOCHARGER INSPECTION in Section [illegible] Group 080 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM[illegible]).	**No turbocharger failure found:** GO TO ❺ **Turbocharger failure found:** Follow appropriate repair procedure in Group 080 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104). ---1/1
❺ **Valve Lash Check**	Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Group 020 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM104).	**Valve lash on all valves within specification:** GO TO ❻ **Valve lash on one or more valves out of specification:** Adjust valve lash and retest ---1/1
❻ **Fuel Return Line** [illegible]	Check for restricted fuel return line and fitting.	**No restriction found:** GO TO ❼ **Restriction found:** Repair and retest. ---1/1

❼ **Fuel Injection Nozzle Check**	Test fuel injection nozzles. See F5 - FUEL INJECTION NOZZLE CHECK later in this Group.	**Injection nozzles test good:** Faulty injection pump **Faulty injection nozzle(s) found:** Repair or replace injection nozzles ---1/1

E6 - Engine Will Not Crank

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

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E7 - Engine Idles Poorly

Symptom	Problem	Solution
E7 - Engine Idles Poorly	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Air leak on suction side of air intake system	Check hose and pipe connections for tightness; repair as required. 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
E8 - Abnormal Engine Noise	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 Engine 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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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 INSPECTION in Section 02, Group 080 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).

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E9 - Analog Throttle (B) Does Not Respond

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

Symptom	Problem	Solution
E9 - Analog Throttle (B) Does Not Respond	Active DTC Check	Read DTCs on the DST or SERVICE ADVISOR™. Go to the diagnostic procedure for the corresponding DTC.
	Analog Throttle (B) Check	See E3 - ANALOG THROTTLE (B) INPUT LOW DIAGNOSTIC PROCEDURE in Group 160 of this manual.

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F1 - Fuel Supply System Check

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F1 - Fuel Supply System Check Diagnostic Procedure

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❶ **F1 - Preliminary Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Before using this diagnostic procedure: • Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY after this Group. • Inspect all fuel lines and fittings for ruptures or leaks. • If fuel system has recently been opened, bleed fuel system. See BLEED THE FUEL SYSTEM later in this Group.	**No problem found:** GO TO ❷ **Problem found:** Repair and retest.
❷ **Air In Fuel Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Check for air in the fuel. See TEST FOR AIR IN FUEL later in this Group.	**No air found in fuel system:** GO TO ❸ **Air found in fuel system:** Bleed fuel system. See BLEED THE FUEL SYSTEM later in this Group.
❸ **Fuel Supply Pressure Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Check fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE later in this Group.	**Pressure within specification:** GO TO ❼ **Pressure is below specification:** GO TO ❹

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❹ **Fuel Filter Test**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Replace final fuel filter and retest. 2. Replace prefilter (if equipped) and retest. 3. Check fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE later in this Group.	**Pressure within specification:** Problem resolved **Pressure below specification:** GO TO ❺ ---1/1
❺ **Fuel Supply Lines Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Remove fuel supply lines and determine if there are any internal restrictions.	**No restrictions found:** GO TO ❻ **Restrictions found:** Repair or replace components as needed. ---1/1
❻ **Fuel Supply Pump Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* At this point, the most likely cause for low fuel pressure is a failure in the fuel supply pump. See BENCH TEST FUEL SUPPLY PUMP later in this Group.	---1/1
❼ **Return Fuel Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Disconnect fuel line from injection pump overflow valve. 2. Loosen overflow valve on injection pump. 3. Turn ignition switch to "ON" position. 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.	**Good fuel flow out of loose overflow valve:** No fuel supply problem found. **NOT good fuel flow or no flow out of loose overflow valve:** GO TO ❽ ---1/1

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8 Restricted Pre-Injection Fuel Line Check	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* This check will help determine if the pre-injection fuel line is restricted. • Disconnect fuel line from the final filter to the injection pump. • Force air through the fuel line.	**No restrictions found:** No fuel supply problems found. Return to diagnostic procedure earlier in this Group for: E1 - ENGINE CRANKS/WON'T START DIAGNOSTIC PROCEDURE OR E3 - ENGINE DOES NOT DEVELOP FULL POWER DIAGNOSTIC PROCEDURE **Restrictions found:** Repair or replace components as needed. ---1/1

F2 - Excessive Fuel Consumption

Symptom	Problem	Solution
F2 - Excessive Fuel Consumption	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Engine overloaded	Reduce engine load
	Air cleaner restricted or dirty	Replace air cleaner element as required.
	Compression too low	Determine cause of low compression and repair as required.
	Leaks in fuel supply system	Locate source of leak and repair as required.

RG40854,00000DE -19-02JAN02-1/1

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F3 - Fuel in Oil

Symptom	Problem	Solution
F3 - Fuel in Oil	Faulty injection pump front seal	Replace front seal.

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F5 - Fuel Injection Nozzle Check

The F5 - Fuel Injection Nozzle Check provides a list of possible failures and there solutions. This list below provides references to assist in the diagnosis and repair of the nozzle.

- Operation - See FUEL INJECTION NOZZLE OPERATION in Section 03, Group 130 of this manual.
- Removal - See REMOVE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.
- Cleaning - See CLEAN FUEL INJECTION NOZZLES and CLEAN FUEL INJECTION NOZZLE BORE in Section 02, Group 090 of this manual.
- Performance Tests - See FUEL INJECTION NOZZLE TEST in Section 02, Group 090 of this manual.
- Disassembly - See DISASSEMBLE FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.
- Adjusting - See ADJUST FUEL INJECTION NOZZLE in Section 02, Group 090 of this manual.
- Installing Seals - See INSTALL SEALS ON FUEL INJECTION NOZZLE in Section 02, Group 090 of this manual.
- Installation - See INSTALL FUEL INJECTION NOZZLES in Section 02, Group 090 of this manual.

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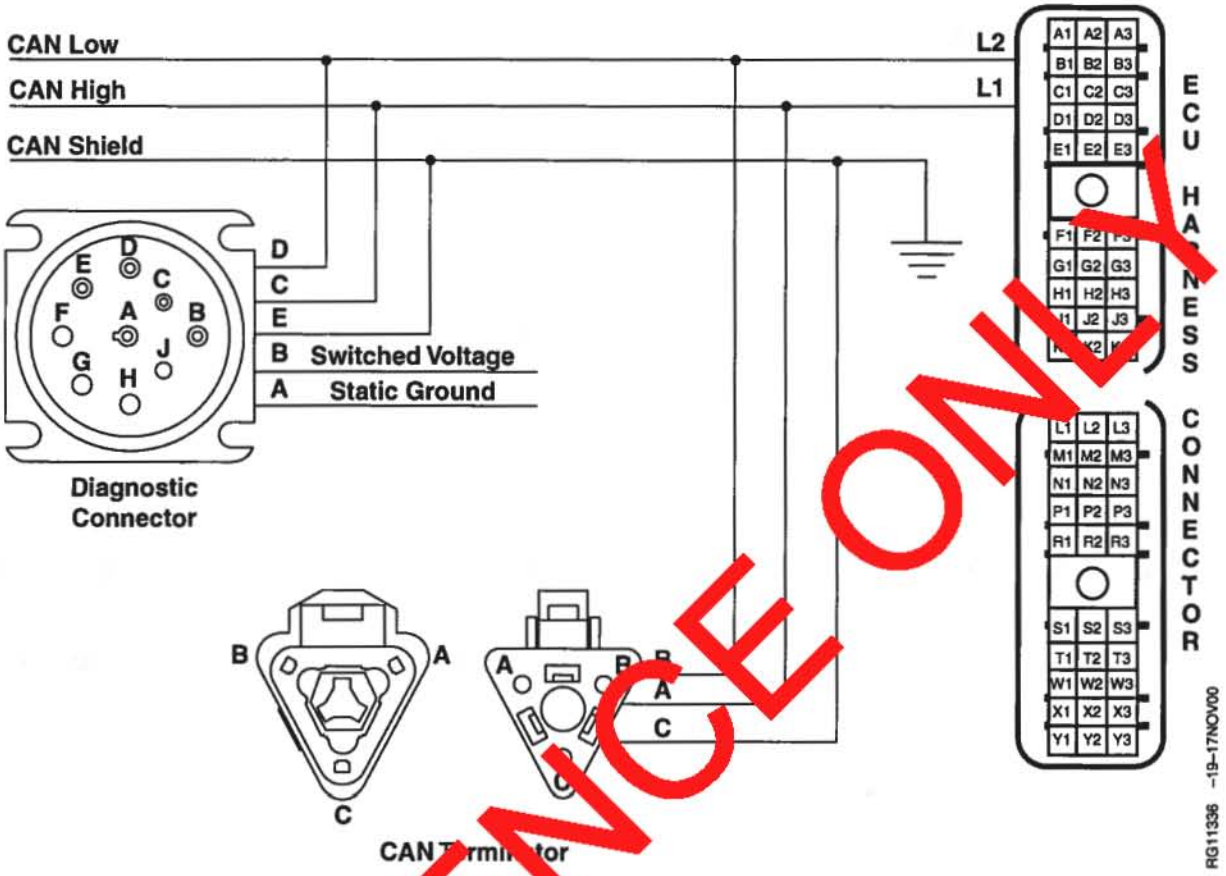
Symptom	Problem	Solution
Failed Carbon Stop Seal Washer	Nozzle replaced without using new seal or washer	Clean groove and install new seal and washer.
	Carbon stop seal groove not clean when new seal was installed.	Clean groove and install new seal.
Incorrect Opening Pressure	Improper adjustment	Adjust opening pressure. See FUEL INJECTION NOZZLE TEST in Section 02, Group 090 of this manual.
	Broken spring	Replace spring
Nozzle Will Not Open	Plugged orifices	Clean orifices.
	Chipped orifices	Replace injection nozzle
	Bottomed lift screw	Adjust lift screw.
Poor Spray Pattern	Plugged orifices	Clean orifices.
	Chipped orifices	Replace injection nozzle
	Cracked nozzle tip	Replace injection nozzle.
Poor Atomization	Plugged orifice	Clean orifice.
	Chipped orifice	Replace injection nozzle

Continued on next page

Symptom	Problem	Solution
	Cracked nozzle tip	Replace injection nozzle.
Seat Leakage	Deposits in seat area	Clean seat.
	Valve seat eroded or pitted	Lap valve to seat. Replace nozzle as necessary.
	Tip seat pitted	Lap tip to seat. Replace nozzle as necessary.
	Valve not free	See FUEL INJECTION NOZZLE TEST in Section 04 Group 090 of this manual.
	Distorted body	Replace injection nozzle
	Cracked tip	Replace injection nozzle
High Leak-Off	Wear or scratched at guide	Lap valve to guide. Replace nozzle as necessary.
Low Leak-Off	Varnish on valve	Clean Guide Area
	Insufficient clearance	Clean nozzle. Lap valve to guide. Replace injection nozzle as necessary.

RG40854,0000001 –19–06MAR02–2/2

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



This diagnostic procedure should be used if communication between the DST or SERVICE ADVISOR™ and the Engine Control Unit (ECU) cannot be established. For more information on CAN, see CONTROLLED AREA NETWORK (CAN) in Section 03, Group 130 earlier in this manual.

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D1 - ECU Does Not Communicate With the DST orSERVICE ADVISOR™

SERVICE ADVISOR is a trademark of Deere & Company

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

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connector. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR supporting information* Perform a preliminary inspection of the ECU connector, the diagnostic connector, and all connections in between. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR supporting information* 1. Connect the DST or SERVICE ADVISOR. 2. Make sure all communication cables are properly connected 3. Ignition ON, engine OFF Start the ECU Communication Software	**DST or Service ADVISOR does not communicate with ECU:** GO TO ❸ **The DST or Service ADVISOR communicates with ECU:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. ---1/1
❸ **Sensor Voltage Test**	*NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR supporting information* 1. Ignition OFF 2. Disconnect ECT sensor 3. Ignition ON 4. Using a multimeter, measure the voltage between both terminals of the selected sensor harness connector	**4.5 V or above:** GO TO ❺ **Below 4.5 V:** GO TO ❹ ---1/1

❹ **Power Supply Test**	*NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR supporting information* 1. Ignition OFF 2. Disconnect ECU connector 3. Ignition ON 4. Using a multimeter, measure the voltage between a good ground and terminal A2 in the harness end of the ECU connector	**10.0 V or above:** Faulty ECU power fuse OR Faulty ECU power wiring OR Faulty ECU **Below 10.0 V:** Key-on signal wire open or shorted to ground OR Faulty ignition switch OR Faulty key-on power fuse ---1/1
❺ **PDM Power Light Test**	*NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR supporting information* 1. Ignition ON 2. Observe the power light on the Parallel Data Module (PDM)	**Green power light ON:** GO TO ❽ **Red power light or power light OFF:** GO TO ❺ ---1/1
❻ **Open In Diagnostic Ground Connector Wire Test**	*NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR supporting information* 1. Ignition OFF 2. Disconnect the diagnostic cable from the diagnostic connector 3. Ignition ON 4. Using a multimeter, measure voltage between switched voltage terminal and ground terminal of the harness end of the diagnostic connector	**Substantially less than battery voltage:** GO TO ❼ **At or near battery voltage:** Faulty diagnostic connector OR Faulty diagnostic cable OR Faulty Parallel Port Data Module (PDM) ---1/1
❼ **Harness Power/Ground Wire Checks**	*NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR supporting information* 1. Ignition OFF 2. Disconnect the diagnostic cable from the diagnostic connector 3. Probe the ground terminal in the harness side of the diagnostic connector with a test light connected to battery voltage.	**Light ON:** Faulty diagnostic connector OR Open or short in power wire **Light OFF:** Faulty diagnostic connector OR Open ground wire ---1/1

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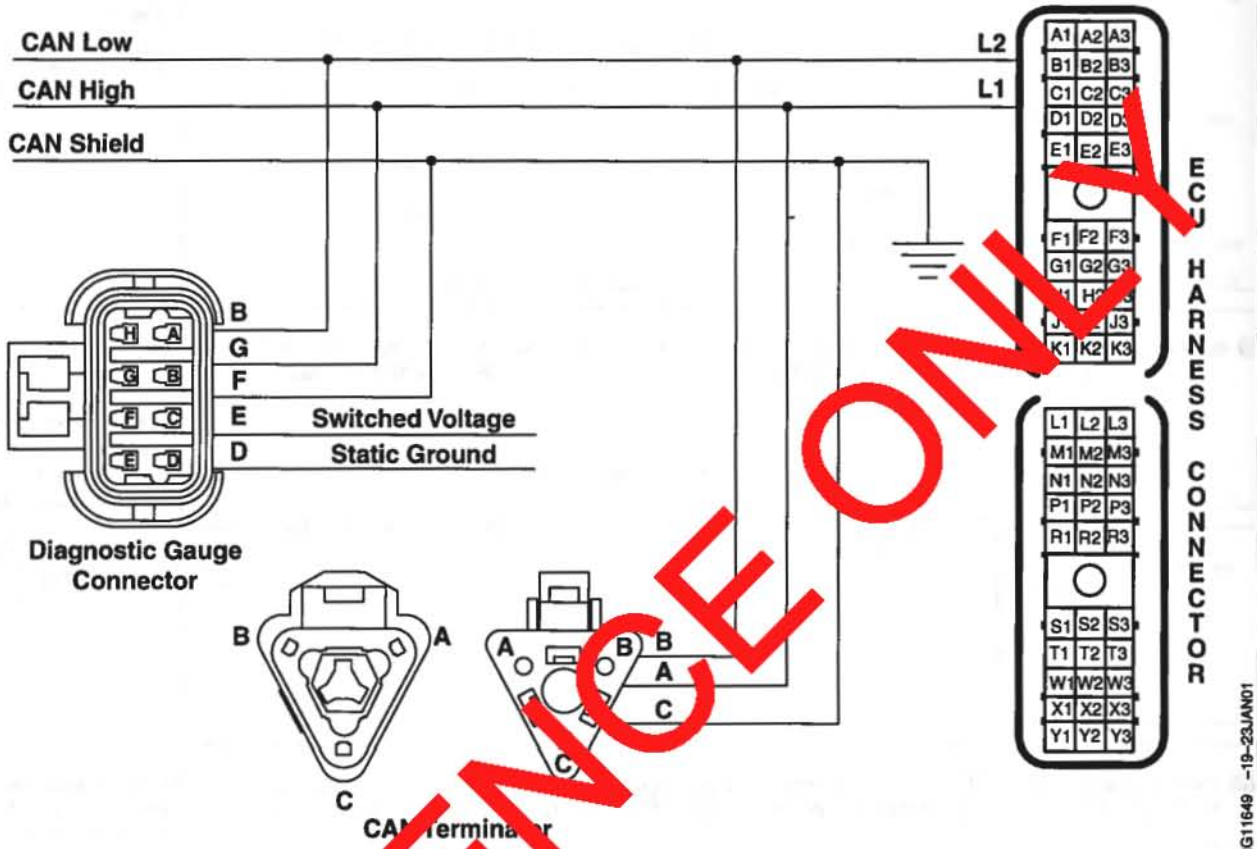
8 Open in Harness Circuit Test	*NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR supporting information* 1. Ignition OFF 2. Disconnect ECU connector and diagnostic cable from the diagnostic connector 3. Using a multimeter, measure resistance on the harness end of both connectors between: • CAN low terminal D in the diagnostic connector and terminal F1 in the ECU connector • CAN high terminal C in the diagnostic connector and terminal G1 in the ECU connector	**Both measurements 5 ohms or less:** GO TO 9 **One or more measurements greater than 5 ohms:** Open in harness circuit ---1/1
9 CAN Resistance Test	*NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR supporting information* 1. Ignition OFF 2. ECU and diagnostic connector still disconnected. 3. Using a multimeter, measure resistance between terminals C and D in the harness end of the diagnostic connector.	**Between 45 - 75 ohms:** GO TO 10 **Less than 45 or greater than 75 ohms:** Faulty or missing CAN terminator connector OR Open or short in CAN wiring harness ---1/1
10 CAN High and Low Voltage Test	*NOTE: For wiring and theory of operation information, see D1 - ECU DOES NOT COMMUNICATE WITH the DST or SERVICE ADVISOR supporting information* 1. Ignition OFF 2. Reconnect ECU connector 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between a good chassis ground and : • Terminal C in the diagnostic connector • Terminal D in the diagnostic connector	**Both measurements between 1.5 - 3.5 volts:** Faulty ECU/Cab Harness connection OR Faulty diagnostic cable OR Faulty diagnostic connector OR Faulty Parallel Port Data Module (PDM) OR Faulty diagnostic software/computer configuration OR Faulty ECU **Either measurement less than 1.5 or greater than 3.5 volts:** CAN wiring shorted to ground or voltage OR Faulty ECU ---1/1

D2 - Diagnostic Gauge Does Not Communicate With ECU



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

Internal Diagnostic Gauge Errors

- The D2 - Diagnostic Gauge Does Not Communicate With ECU diagnostic procedure should be followed if the diagnostic gauge shows the following error codes or it can not communicate with the ECU:
  - EE-error
  - ACP-Err/No Addr
  - ACP-Err/Bus EP
  - ACP-Err/Bus Error

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D2 - Diagnostic Gauge Does Not Communicate With ECU

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D2 - Diagnostic Gauge Does Not Communicate With ECU Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* Perform a preliminary inspection of the ECU connector, the diagnostic gauge connector, and all connections in between. Look for damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF 2. Ignition ON	**Error or no power found in diagnostic gauge:** GO TO ❸ **No error found and power present in diagnostic gauge:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. ---1/1

❸ **Sensor Voltage Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF 2. Disconnect any of the following: • Fuel temperature sensor • MAT sensor • ECT sensor 3. Ignition ON 4. Using a multimeter, measure the voltage between both terminals of the selected sensor harness connector.	**4.5 V or above:** GO TO ❺ **Below 4.5 V:** GO TO ❹ ---1/1
❹ **Power Supply Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Ignition ON 4. Using a multimeter, measure the voltage between a good ground and terminal A2 in the harness end of the ECU connector.	**10.0 V or above:** Faulty ECU power fuse OR Faulty ECU power wiring OR Faulty ECU **Below 10.0 V:** Key-on signal wire open or short to ground OR Faulty ignition switch OR Faulty key-on power fuse ---1/1
❺ **Diagnostic Gauge Power Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition ON 2. View diagnostic gauge	**Gauge has power:** GO TO ❽ **Gauge does not have power:** GO TO ❻ ---1/1
❻ **Open in Diagnostic Ground Connector Wire Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU DIAGNOSTIC PROCEDURE supporting information.* 1. Ignition OFF 2. Disconnect the diagnostic cable from the diagnostic connector 3. Ignition ON 4. Using a multimeter, measure voltage between switched voltage terminal and ground terminal of the harness end of the diagnostic connector	**Substantially less than battery voltage:** GO TO ❼ **At or near battery voltage:** Faulty diagnostic connector OR Faulty diagnostic cable OR Faulty Parallel Port Data Module (PDM) ---1/1

❼ **Open In Diagnostic Gauge Connector Power Wire Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF 2. Disconnect the diagnostic gauge connector 3. Probe terminal D in the diagnostic gauge connector with a test light connected to battery voltage.	**Light ON:** Open or short to ground in diagnostic gauge switched power wire. **Light OFF:** Open in diagnostic gauge connector ground wire. ---1/1
❽ **Open In Harness Circuit Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF 2. Disconnect the ECU connector and the diagnostic cable from the diagnostic connector. 3. Using a multimeter, measure resistance on the harness end of both connectors between: • Terminal B in the diagnostic gauge connector and terminal F1 in the ECU connector. • Terminal G in the diagnostic gauge connector and terminal G1 in the ECU connector.	**All measurements 5 ohms or less:** GO TO ❾ **One or more measurements greater than 5 ohms:** Open in harness circuit OR Connector terminals in wrong position ---1/1
❾ **CAN Resistance Test**	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF 2. ECU and diagnostic connectors still disconnected. 3. Using a multimeter, measure resistance between terminals B and G in the harness end of the diagnostic connector.	**Between 45-75 ohms:** GO TO ❿ **Less than 45 or greater than 75 ohms:** Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness ---1/1

10 CAN High and Low Voltage Test	*NOTE: For wiring information, see D2 - DIAGNOSTIC GAUGE DOES NOT COMMUNICATE WITH ECU supporting information.* 1. Ignition OFF 2. Reconnect ECU connector 3. Ignition ON 4. Using a multimeter, measure voltage between a good chassis ground and: • Terminal B in the diagnostic gauge connector • Terminal G in the diagnostic gauge connector	**Both measurements between 1.5 - 3.5 V:** Faulty ECU connection OR Faulty diagnostic gauge connection OR Faulty diagnostic software/compute configuration OR Faulty ECU **E r measurement less an 1.5 V or ate an 3 V:** CA wirin orted to r power OR Faulty ECU ---1/1

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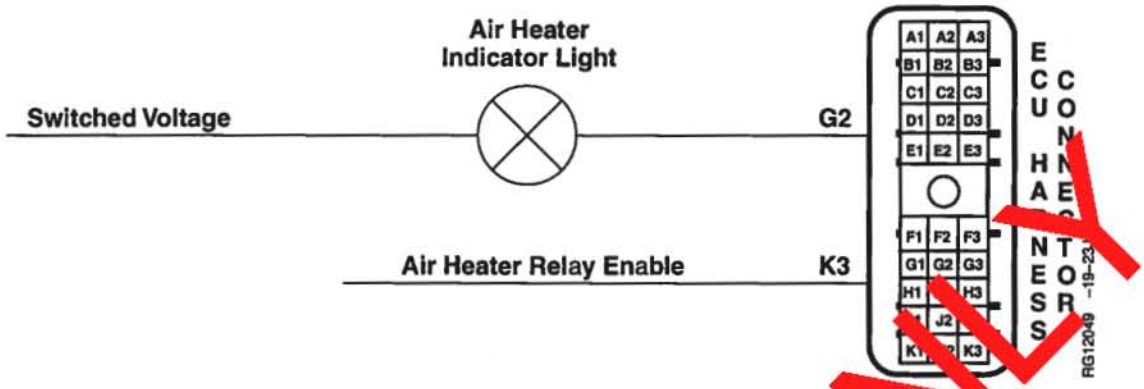
A1 - Intake Air Heater Check



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

Intake Air Heater

The intake air heater is located between the intake pipe and intake manifold. Its function is to heat the intake air during cold starting conditions. Its operation time is dependent on the fuel temperature that the ECU detects at key-on. The table on the corresponding page explains this relationship.

When the ECU sends battery voltage to the air heater relay, the solenoid in the relay activates, and the air heater turns ON. At this time, the ECU will illuminate the air heater indicator light. When the ECU stops sending battery voltage, the solenoid deactivates, and the air heater turns OFF. At this time, the ECU will turn the air heater indicator light OFF.

To ensure full utilization of the intake air heater, the operator should wait until the light goes out before starting the engine. Anytime the engine cranks but does not start, a key-off/key-on cycle will be required before preheating is allowed again.

RG40854,00000E6 -19-03JAN02-1/1

A1 - Intake Air Heater Check - Continued

NOTE: The table below is for OEM applications ONLY. For specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Intake Air Heater Operating Conditions - OEM engines
Intake Air Heater Operation - OEM Engines

Fuel Temperature	Operation Time
-5°C (23°F)	5 seconds
-10°C (14°F)	15 seconds
-15°C (5°F)	20 seconds
-20°C (-4°F)	30 seconds
-25°C (-13°F) and below	30 seconds

Intake Air Heater Operating Conditions - Telehandler engines
Intake Air Heater Operation - Telehandler Engines

Fuel Temperature	Operation Time
-1°C (30°F)	2 seconds
-2°C (28°F)	4 seconds
-3°C (26°F)	6 seconds
-4°C (25°F)	8 seconds
-5°C (23°F)	10 seconds
-10°C (14°F)	15 seconds
-15°C (5°F)	20 seconds
-20°C (-4°F) and below	30 seconds

Intake Air Heater Operating Conditions - 6020 Tractors engines
Intake Air Heater Operation - 6020 Tractors Engines

Fuel Temperature	Operation Time
-1°C (30°F)	seconds
-2°C (28°F)	seconds
-3°C (26°F)	6 seconds
-4°C (25°F)	8 seconds
-5°C (23°F)	10 seconds
-10°C (14°F)	15 seconds
-15°C (5°F)	20 seconds
-20°C (-4°F) and below	30 seconds

Intake Air Heater Operating Conditions - 7020 Tractors engines
Intake Air Heater Operation - 7020 Tractors Engines

Fuel Temperature	Operation Time
-1°C (30°F)	2 seconds
-2°C (28°F)	4 seconds
-3°C (26°F)	6 seconds
-4°C (25°F)	8 seconds
-5°C (23°F)	seconds
-10°C (14°F)	15 seconds
-15°C (5°F)	seconds
-20°C (-4°F) and below	30 seconds

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A1 - Intake Air Heater Check

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A1 - Intake Air Heater Check Diagnostic Procedure

NOTE: The air heater indicator light is the same light that trouble codes are displayed on. If the light stays on past 25 seconds, check for trouble codes or a short to ground in the air heater indicator light wire.

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage wires. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see A1 - INTAKE AIR HEATER CHECK supporting information* Perform a preliminary inspection of the ECU connector, air heater relay connector, air heater connector, and all connections in between. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Air Heater Indicator Light Check**	*NOTE: Do not run engine during this diagnostic procedure.* *NOTE: For wiring and theory of operation information, see A1 - INTAKE AIR HEATER CHECK supporting information* 1. Key ON, engine OFF 2. Verify that the air heater indicator light is working	**Light works:** GO TO ❸ **Light does not work:** Faulty air heater indicator light wiring OR Faulty air heater indicator light ---1/1
❸ **Active DTC Test**	*NOTE: For wiring and theory of operation information, see A1 - INTAKE AIR HEATER CHECK supporting information* 1. Connect theDST orSERVICE ADVISOR™. 2. Ignition ON, engine OFF 3. Start the ECU Communication Software 4. Key ON, engine OFF 5. Read DTCs using the DST or SERVICE ADVISOR.	**No active DTC(s) present:** GO TO ❹ **Active DTC(s) present:** Go to appropriate diagnostic procedure

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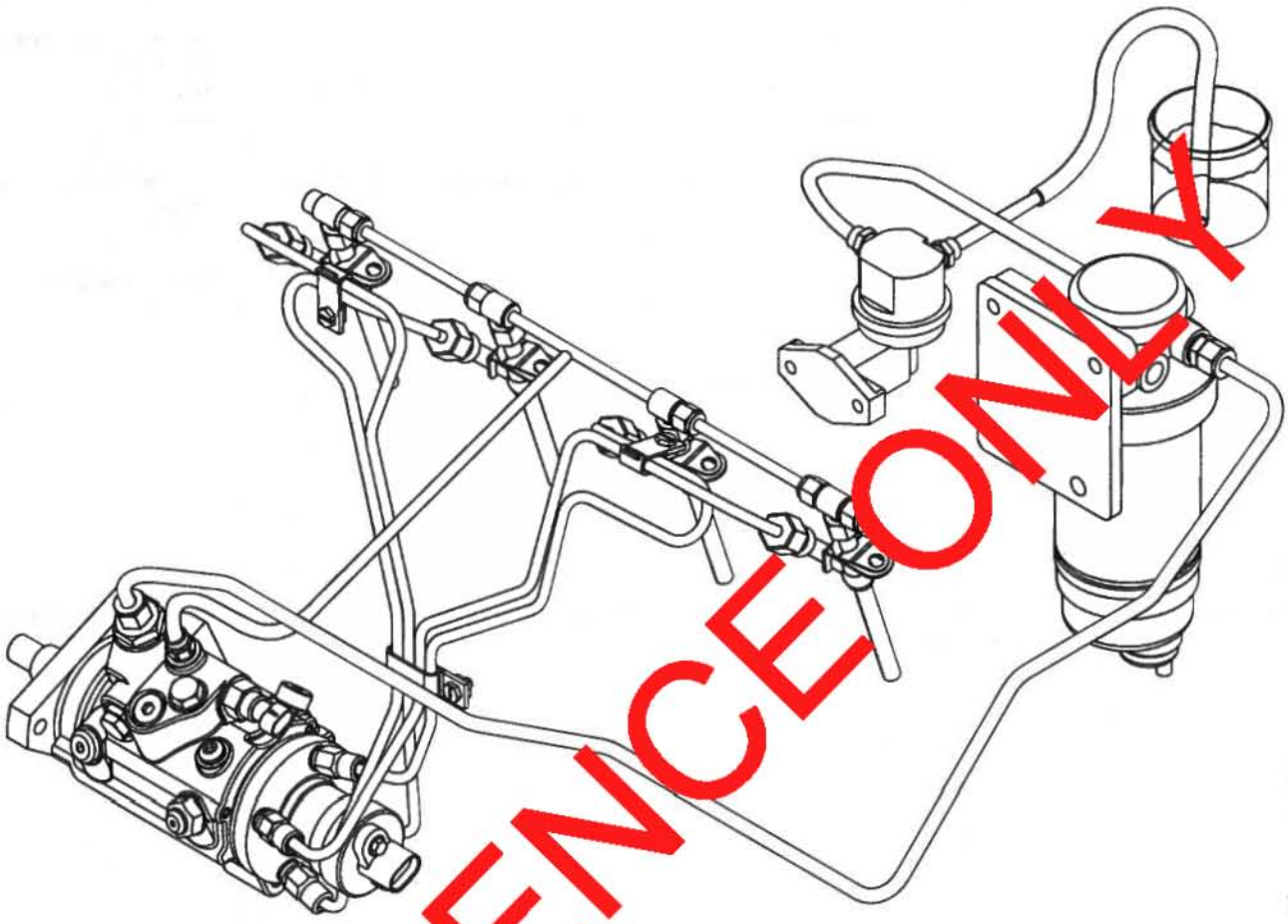
❹ **Fuel Temperature Check**	*NOTE: For wiring and theory of operation information, see LEVEL 12 - A1 - INTAKE AIR HEATER CHECK supporting information* 1. Key ON, engine OFF 2. Read the Fuel Temperature parameter using the DST or SERVICE ADVISOR.	**Below -5°C (23°F):** GO TO ❺ **At or above -5°C (23°F):** No air heater-related problem found ---1/1
❺ **Voltage at Air Heater Check**	*NOTE: For wiring and theory of operation information, see LEVEL 12 - A1 - INTAKE AIR HEATER CHECK supporting information* 1. Key OFF 2. Using a multimeter, measure the voltage between the air heater power stud and a good chassis ground while turning key ON (engine OFF) *NOTE: Voltage must be read as key is turned ON*	**At or near battery voltage:** GO TO ❻ **No voltage detected:** GO TO ❼ ---1/1
❻ **Air Heater Check**	*NOTE: For wiring and theory of operation information, see A1 - INTAKE AIR HEATER CHECK supporting information* 1. Key OFF 2. Using a multimeter, measure the temperature of air heater housing 3. Key ON, engine OFF 4. Continue to monitor temperature of air heater housing	**Temperature increases:** No air heater related problem found **Temperature does not increase** Faulty air heater ---1/1
❼ **Air Heater Relay Check**	*NOTE: For wiring and theory of operation information, see A1 - INTAKE AIR HEATER CHECK supporting information* 1. Key OFF 2. Listen for air heater relay to click while turning key ON (engine OFF)	**Relay clicks:** Faulty power wire to relay OR Faulty wire between relay and heater OR Faulty air heater relay **Relay does not click:** Faulty air heater enable wire OR Faulty relay ground OR Faulty relay ---1/1

Check Fuel Supply Quality



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

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

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

1. Check prefilter (if equipped) and final fuel filter for serviceability. If filter is equipped with a water bowl, empty and clean water bowl.
2. Start engine and operate under load, observing engine performance.
3. Ignition OFF, engine off
4. Disconnect fuel line from inlet side of prefilter (if equipped) or inlet side of final filter on engines without prefilter.
5. Connect a hose to inlet port.
6. Submerge hose in a container of clean, good quality fuel meeting engine specifications.
7. Operate engine under load and observe performance.

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

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Test for Fuel Drain Back

Fuel draining back through the fuel system may cause hard starting. This procedure will determine if air is entering the system 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 supply pump, fuel injection pump, fuel filters, and water bowl (if equipped).
3. Securely plug off the end of the fuel return pipe.

CAUTION: Maximum air pressure should be 100 kPa (1 bar) (14.5 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.

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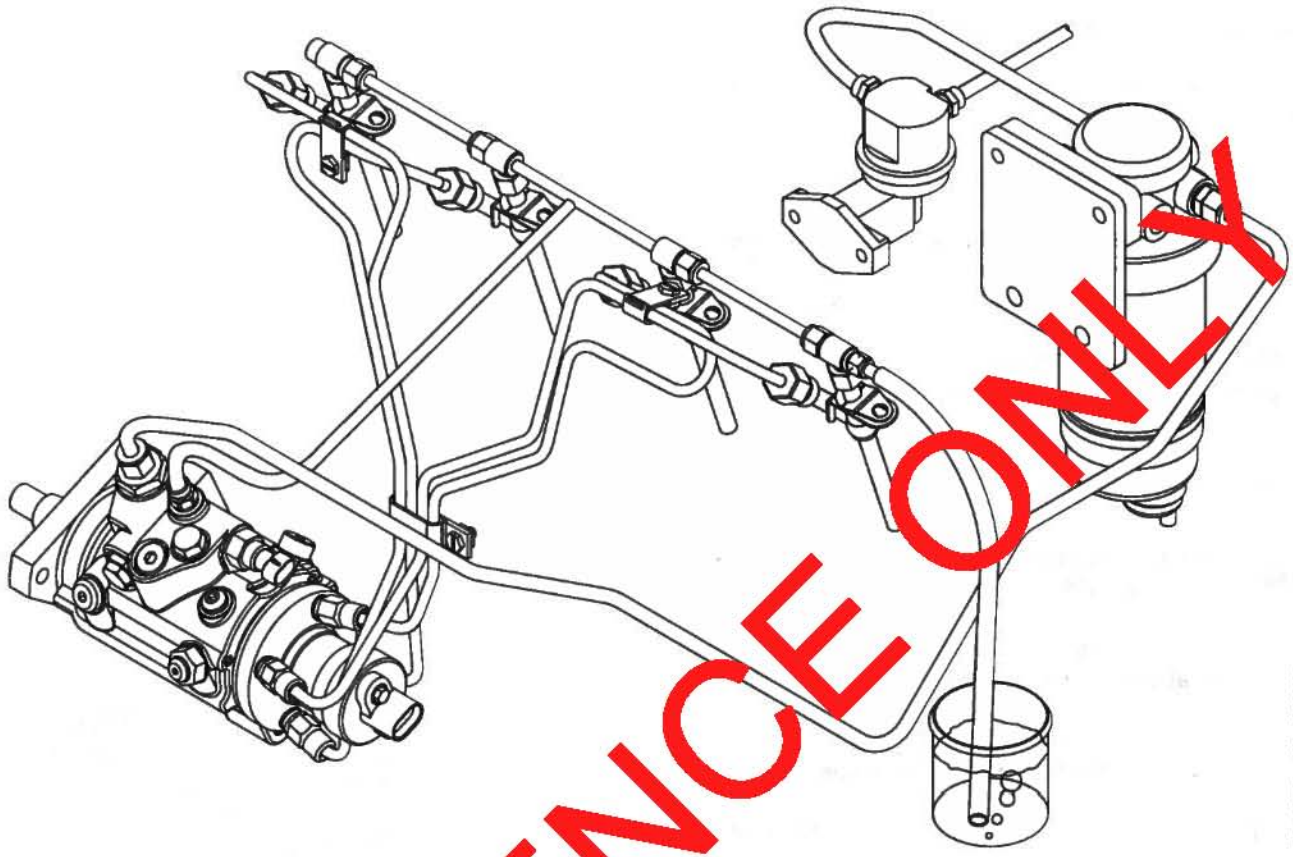
Test for Air in Fuel



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 start, run rough, misfire or produce low power. Additionally, it can cause excessive white 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 clear plastic 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 later in this Group.
3. If bubbles are still present, check the following:

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

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

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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. Remove plug on final fuel filter base.
2. Install test equipment as shown.
3. Start engine. Fuel pump should maintain minimum positive pressure listed below. If pressure is low, replace filter element and recheck pressure.

Specification	
Fuel Supply Pump—Static Pressure	25—30 kPa (0.25—0.30 bar) (3.5—4.5 psi)
Fuel Supply Pump—Minimum Static Pressure at 850 rpm Engine Speed	15 kPa (0.15 bar) (2.0 psi)
Fuel Supply Pump—Minimum Positive Pressure at 2400 rpm Engine Speed	21—34 kPa (0.21—0.34 bar) (3—5 psi)
Fuel Supply Pump—Minimum Flow at 2400 rpm Engine Speed	1.5 L/min (0.42 [illegible]m)

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Bench Test Fuel Supply Pump

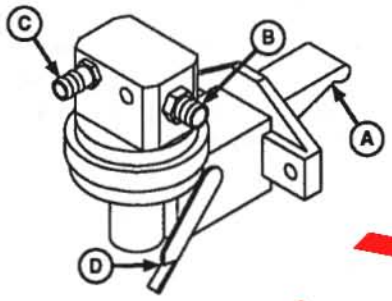
The following bench tests can be performed on a supply pump installed on the engine when the pump is suspected to be defective. See CHECK FUEL SUPPLY PRESSURE in Section 04, Group 150.

Perform the Vacuum/Pressure Test and Leakage Test, listed below. Replace the supply pump if either test shows the pump to be defective. There is no repair procedure.

Vacuum/Pressure Test

NOTE: This test will give a good indication of condition of both the inlet and outlet valves, as well as the diaphragm. The numerical values obtained on both the vacuum and pressure sides are not important; rather it is the needle movement that is important (very slow for a good pump; very fast or not at all for a defective pump).

1. Remove inlet and outlet fittings.
2. Install vacuum/pressure gauge to inlet side of pump (C).
3. Move primer lever (D) all the way downward. Release lever and at the same time observe gauge:
   - The gauge needle should read the same value each time, and then very slowly return to "0". This indicates that the inlet valve and diaphragm are in good condition. Proceed to next step.
   - If the gauge needle does not move at all, or if the needle rapidly returns to "0", the pump is defective and must be replaced.
4. Remove vacuum/pressure gauge and install onto outlet side of pump (B).
5. Move primer lever all the way to upward position. Release lever and at same time observe gauge reading:



RG9052 –UN–16MAR98

Fuel Supply Pump with Metal Cover

A—Lever
B—Outlet Side of Pump
C—Inlet Side of Pump
D—Primer Lever

Continued on next page

RG40854,0000146 –19–11FEB02–1/3

- The gauge needle should initially read 28—41 kPa (0.28—0.41 bar) (4—6 psi), then return to "0" very slowly. This indicates that the outlet valve and diaphragm are in good condition. Supply pump is operating properly and should be reinstalled on engine.

Specification

Fuel Supply Pump—Pressure ..... 28—41 kPa (0.28—0.41 bar) (4—6 psi)

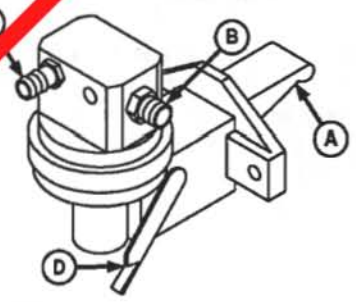
- If the gauge needle initially reads same value as above and then returns immediately back to "0", the pump is defective and must be replaced.

RG40854,0000146 –19–11FEB02–2/3

Leakage Test

The leakage test should be performed if a supply pump is suspected of leaking fuel externally, or internally into the engine crankcase.

1. Install an air line on inlet side of pump (C) and apply 140 kPa (1.4 bar) (20 psi) pressure.
2. Hold finger over outlet side of pump (B) or install a plug. Submerge pump into a container of clean diesel fuel.
   - If air bubbles occur around bolted connection holding the two halves of pump together (indicating leakage), replace pump.
   - If the diaphragm is bad, there will be leakage through vent holes (if equipped) and around the rocker arm. Replace pump as necessary.



RG9052 –UN–16MAR98

Fuel Supply Pump with Metal Cover

A—Lever
B—Outlet Side of Pump
C—Inlet Side of Pump
D—Primer Lever

RG40854,0000146 –19–11FEB02–3/3

Bleed the Fuel System


X9811 –UN–23AUG88

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.

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.

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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.

RG40854,00000F0 –19–04OCT05–1/5

1. Loosen the air bleed ve screw (two full turns by hand on fuel filter ba

A—Bleed Ven Screw

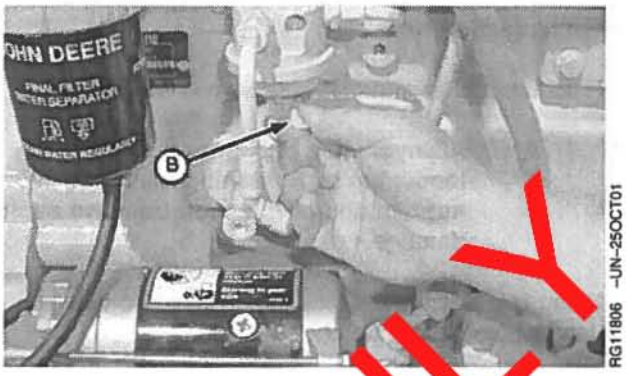
RG11805 –UN–25OCT01

Continued on next page

RG40854,00000F0 –19–04OCT05–2/5

2. Operate fuel supply pump prime lever (B) or primer button on fuel filter base (if equipped).
3. Tighten bleed plug securely; continue operating primer until pumping action is not felt.
4. Start engine and check for leaks.

   If engine will not start, it may be necessary to bleed air from fuel system at fuel injection pump or injection nozzles as explained next.



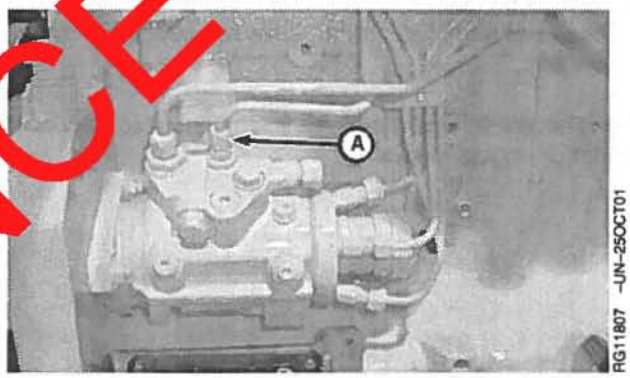
B—Primer Lever

RG40854,00000F0 -19-04OCT05-3/5

At Fuel Injection Pump

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

1. Loosen fuel return line (A) at fuel injection pump.
2. Operate fuel supply pump primer lever or primer button on fuel filter base (if equipped).
3. As soon as fuel flow is free from air bubbles, tighten fuel return line to specifications. Primer lever is spring-loaded and will return to normal position.



A—Fuel Return Line

Specification

Fuel Injection Pump Return Line—Torque	27 N•m (20 lb-ft)

Continued on next page

RG40854,00000F0 -19-04OCT05-4/5

At Fuel Injection Nozzles

1. Place throttle lever in half-throttle position.

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 starter motor for 15 seconds (but do not start engine) until fuel free from bubbles flows out of loosened connection. Retighten connection to specifications.

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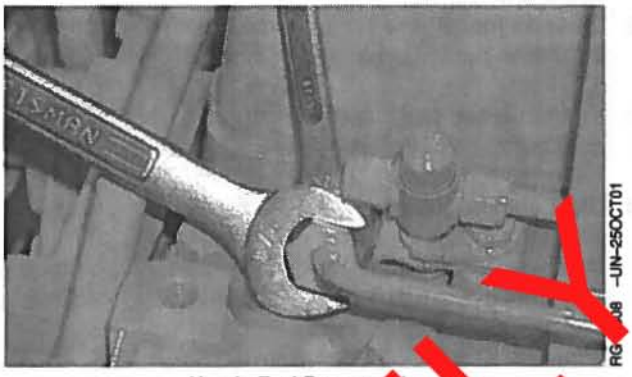
Specification

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.

If engine still will not start, see your authorized servicing dealer or engine distributor.



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Nozzle Fuel Pressure Line

RG40854,00000F0 –19–04OCT05–5/5

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. Tighten fuel lines to specifications.

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

5. Repeat test for each remaining cylinder.
6. Remove faulty injection nozzles and repair as required. See F5 - FUEL INJECTION NOZZLE CHECK earlier in this Group.

RG40854,00000F1 –19–04JAN02–1/1

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: Under NO 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.

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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

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Using a Digital Multimeter

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

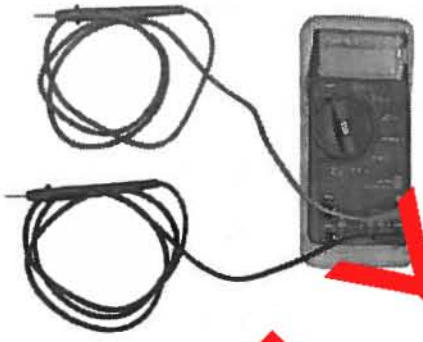
Instructions for measuring voltages take the following form:

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

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

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

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



RG11126 –UN–19JUN00

Digital Multimeter

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Electrical Circuit Malfunctions

Circuit Malfunctions

There are four major circuit malfunctions. They are:

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

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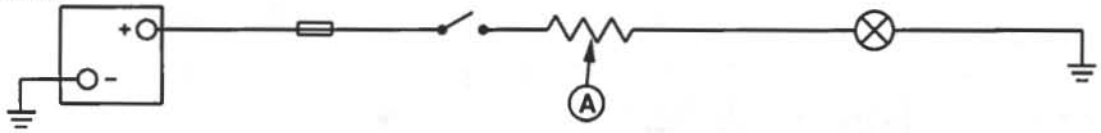

High Resistance Circuit

A—Unwanted Resistance

Definition of Circuit Malfunctions

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

1. **High Resistance Circuit:**

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Open Circuit

A—Break or Separation in Circuit

2. **Open Circuit:**
A circuit having a break or a separation (A) that prevents current from flowing in the circuit.

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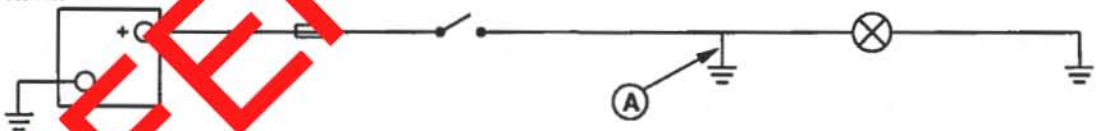

Grounded Circuit

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.

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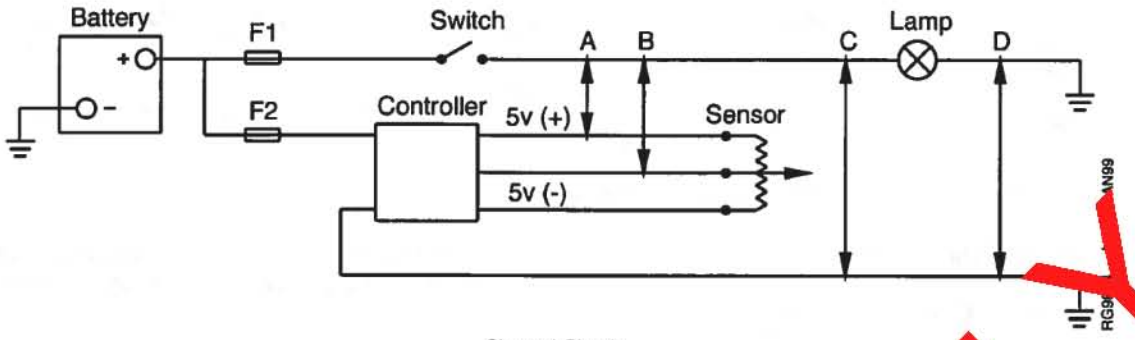

Shorted Circuit

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

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

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Locations of Circuit Malfunctions

A—Controlling Switch B—Load

Locations of Circuit Malfunctions:

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

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

Electrical components can become faulty with the same four circuit malfunctions. Sometimes component malfunctions can easily be confused with circuit malfunctions. Therefore, care must be exercised when isolating the cause of the problem.

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

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

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Troubleshooting Circuit Malfunctions

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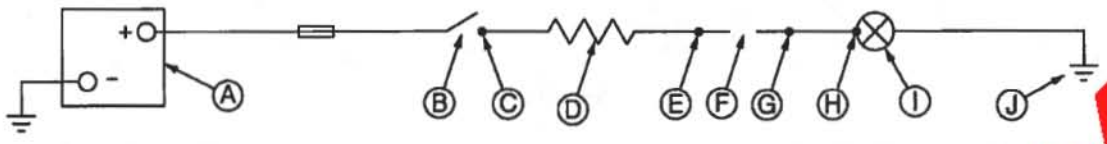

Troubleshooting Circuit Malfunctions

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

1. **High Resistance Circuit:**

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

2. **Open Circuit:**

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

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

   a. With the controlling switch (B) closed (on) and the load (I) connected into the circuit, check for proper voltage at a location 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 present, move toward the load (I) and ground terminal (J) to locate the voltage drop.

      NOTE: This 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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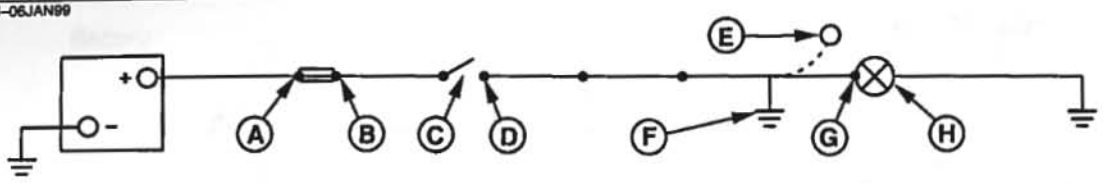

Ground Circuit

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

3. **Ground Circuit:**

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

   Do the following to isolate the location of a "Grounded" circuit:

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

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

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

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

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

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

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

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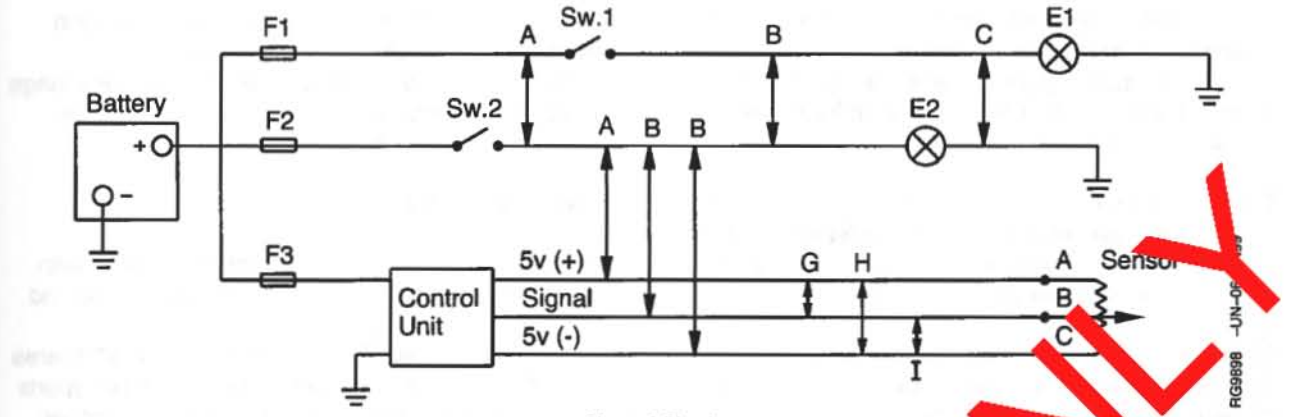

Shorted Circuit

4. **Shorted Circuit:**

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

1. Battery wire from fuse (F1) is shorted at (A) to another battery wire after switch (Sw.2).
   - Result: Lamp (E1) is on all of the time.

2. Battery wire from fuse (F1) is shorted at (B) to another battery wire after switches (Sw.1 & 2).
   - Result: Both lamps (E1 & E2) operate on either switch (Sw. 1 or 2).

3. Battery wire from fuse (F1) is shorted at (C) to a ground wire.
   - Result: Fuse (F1) opens after closing switch (Sw. 1)

4. Battery wire from switch (Sw. 2) is shorted at (D) to a regulated voltage wire.
   - Result: The sensor signal voltage is distorted.[1]

5. Battery wire from switch (Sw. 2) is shorted at (E) to the sensor signal voltage wire.
   - Result: The sensor signal is distorted.[1]

6. Battery wire from switch (Sw. 2) is shorted at (F) to the sensor ground wire.
   - Result: Fuse (F2) opens after closing switch (Sw. 2) and the sensor signal is distorted.[1]

7. Controller regulated voltage wire is shorted at (G) to the sensor signal voltage wire.
   - Result: The sensor signal is distorted.

Controller regulated voltage wire is shorted at (H) to the sensor ground wire.
- Result: The sensor signal is distorted.[1]

Sensor voltage wire is shorted at (I) to the sensor ground wire.
- Result: The sensor signal is distorted.[1]

Do the following to isolate a "Shorted Circuit:"

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

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

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

[1]The sensor signal voltage goes out of range and a fault code may be restored. The controller may shut down or provide limited operation for its function.

Continued on next page

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

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

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

f. Alternate Method to Check for Shorted Circuit.

   With the components disconnected at each end of the suspected circuits, turn the key switch on.

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

g. Repair the "Shorted Circuit" as follows:

   - Wires not in a loom: Wrap individual wires with electrical tape or replace the damaged wire and band as required.
   - Wires in a loom: If hot spots exist in shorted area of the harness, replace the harness. If hot sports are not noticeable, install a new wire of proper gauge between the two connections. Use tie bands to secure the wire to outside of the harness.

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

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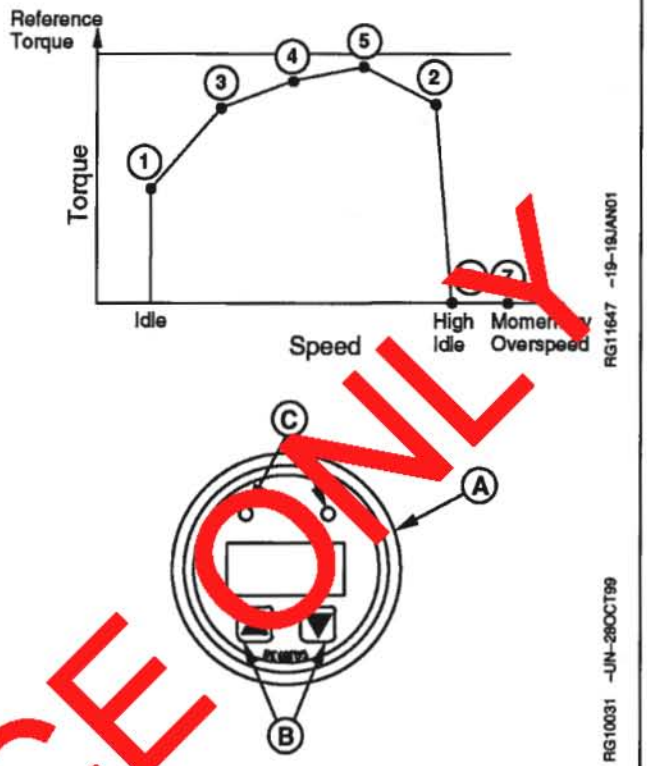
Engine Configuration Data Parameters on Diagnostic Gauge



Accessing Engine Configuration Data Parameters:

1. Scroll through the main menu of engine parameters by pressing ***either*** the right or the left touch switch
2. Select "E-Config" sub-menu by ***simultaneously*** pressing the right and the left touch switch.
3. Scroll through the "E-Config"sub-menu to view Engine Configuration Parameters by pressing ***either*** the right or the left touch switch until desired parameter is found. The numbers next to the parameters correspond to the number on the graph.
4. In order to exit "E-Config" sub-menu, ***simultaneously*** press the right and left touch switch

A—Diagnostic Gauge
B—Touch Switches
C—Lights

Continued on next page

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Engine Configuration Parameter Description		
Parameter Displayed on Diagnostic Gauge	**Units**	**Description**
Speed 1	RPM	Stationary low idle speed of engine which includes influences due to engine temperature and other stationary changes. This is point 1 on the engine configuration map.
Torque 1	%	Torque 1 equals the desired torque of the ECU divided by the reference to ue.
Speed 2	RPM	Engine speed at point 2 of the engine configuration map. This is defined as e kick-in point for which torque is reduced to zero.
Torque 2	%	Torque 2 equals the desired torque of the ECU divided by the reference torque.
Speed 3	RPM	Engine speed at point 3 of the engine configuration map. Po s 3, 4, and 5 are optional and can be located anywhere between points 1 nd 2.
Torque 3	%	Torque 3 equals the desired torque of the ECU divided by t refe torque.
Speed 4	RPM	Engine speed at point 4 of the engine configurati map 4, and 5 are optional and can be located anywhere between poi 1 and 2.
Torque 4	%	Torque 4 equals the desired torque of t ECU d ed the reference torque.
Speed 5	RPM	Engine speed at point 5 of the configu ion map. P nts 3, 4, and 5 are optional and can be located anywhere between ints 1 and .
Torque 5	%	Torque 5 equals the desired rque of the ided by the reference torque.
Speed 6	RPM	Engine speed of high idl
Torque 6	%	Torque 6 equals the de ed to ue of the ECU divided by the reference torque.
Gov Gain	%	Equals the chang orqu etwe points 2 and 6 divided by the change of engine speed tween points 6.
Ref Torque	Nm (ft-lbs)	This parame is the 100 reference value for all defined indicated engine torque para s. It only defi d once and doesn't change if a difference engine torque map bec s va
Speed 7	RPM	T aximum ngine speed above point 6 allowed by the engine control during a mo antary e override. This duration is limited by the maximum momentary overr time limit.
Time Limit	sec	T e maxi m time limit allowed to override the engine's high idle speed.
Lo Limit	RPM	The m mum engine speed that the engine will allow when operating in a speed con /limit mode
Hi Limit	RPM	e maximum engine speed that the engine will allow when operating in a speed control/limit mode.
Low Limit		The minimum engine torque that the engine will allow when operating in a torque control/limit mode.
Hi Limit	%	The maximum engine torque that the engine will allow when operating in a torque control/limit mode.

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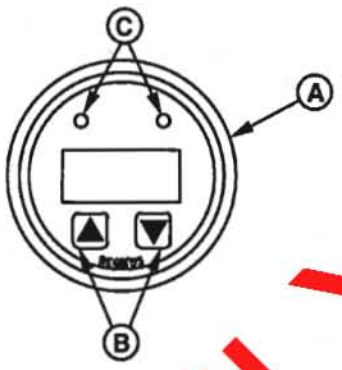
Viewing Active DTCs on Diagnostic Gauge

Accessing Active Diagnostic Trouble Codes (DTCs):

1. Scroll through the main menu of engine parameters by pressing ***either*** the right or the left touch switch
2. Select "SrvcCode" sub-menu by ***simultaneously*** pressing the right and the left touch switch.
3. Scroll through the "SrvcCode "sub-menu to view active DTCs by pressing ***either*** the right or the left touch switch until all codes are found.
4. In order to exit "SrvcCode" sub menu, ***simultaneously*** press the right and left touch switch



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A—Diagnostic Gauge
B—Touch Switches
C—Lights

RG40854,0000100 –19–15JAN02–1/1

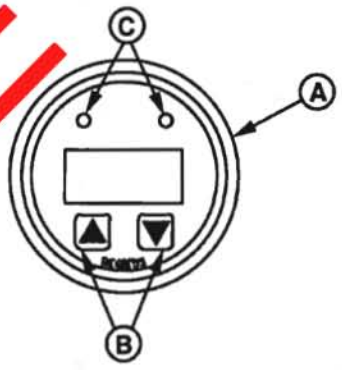
Viewing Stored DTCs on Diagnostic Gauge

Accessing Stored Diagnostic Trouble Codes (DTCs):

1. Scroll through the main menu of engine parameters by pressing ***either*** the right or the left touch switch
2. Select "StorCode" sub-menu by ***simultaneous*** pressing the right and the left touch switch
3. Scroll through the "StorCode"sub-menu to view stored DTCs by pressing ***either*** the right or the left touch switch until all codes are found

NOTE: If "No Data" is on the gauge, there are no stored codes.

4. In order to exit "StorCode" sub menu, ***simultaneously*** press the right and left touch switch



RG10031 –UN–28OCT99

A—Diagnostic Gauge
B—Touch Switches
C—Lights

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Clearing Stored DTCs on Diagnostic Gauge

Clearing Stored Diagnostic Trouble Codes (DTCs):

1. Scroll through the main menu of engine parameters by pressing ***either*** the right or the left touch switch
2. Select "StorCode" sub-menu by ***simultaneously*** pressing the right and the left touch switch.
3. Scroll through the "StorCode"sub-menu to view stored DTCs by pressing ***either*** the right or the left touch switch until all codes are found.

NOTE: If "No Data" is on the gauge, there are no stored codes.

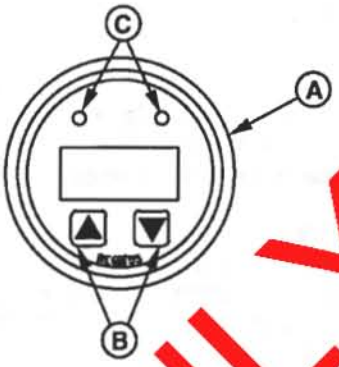
4. In order to clear codes, ***simultaneously*** press the right and left switch for at least 8 seconds

NOTE: If the switches are held for less than 8 seconds, the sub menu will be exited.

5. If display reads "**********", press the right switch for at least 8 seconds.

NOTE: If the switch is held for less than 8 seconds, the sub menu will be exited.

6. If the display reads "*Send* **DM3 *" the codes are now cleared. In order to exit "StorCode" sub menu, ***simultaneously*** press the right and left touch switch



RG10031 –UN–28OCT99

A—Diagnostic Gauge
B—Touch Switches
C—Lights

RG40854,000006A –19–23JAN01–1/1

Blinking DTCs

On OEM applications that have a Fault Lamp, the ECU has the ability to display DTCs using blinking sequence of the fault lamp. To retrieve DTCs from the ECU using the "blink code" method:

NOTE: The ECU blinks the codes in 2-digit codes only. In order to convert the codes to SPN/FMI codes, see LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU later in this Group.

1. Turn the ignition switch "ON".
2. Hold Override Shutdown Switch for a few seconds
3. The Fault Lamp will begin to flash a code number. For example, flash three times...short pause...flash two times...long pause. This example is code 32.
4. The ECU begins the flashing sequence by flashing a code 32, this indicates the start of blinking active codes. If there are any active DTCs, the ECU will flash it's 2–digit number. If there is more than one active DTC, the ECU will flash each code in numerical order. If there are no active DTCs, the Fault Lamp will flash a code 88.
5. Following the active codes, the Fault Lamp will flash a code 33, this indicates the start of blinking stored codes. If there are any stored DTCs, the Fault Lamp will flash it's 2–digit number. If there is more than one stored DTC, the ECU will flash each code in numerical order. If there are no stored DTCs, the Fault Lamp will flash a code 88.
6. Once complete, the above sequence will be repeated.
7. When complete, turn ignition "OFF"

As an example, if an engine had an active DTC 18 and stored DTC 53 the flashing sequence would be:

- flash three times...short pause
- flash two times...long pause
- flash one time...short pause
- flash eight times...long pause
- flash three times...short pause
- flash three times...long pause
- flash five times...short pause
- flash three times

RG40854,0000102 –19–15JAN02–1/1

Data Parameter Description

Following is a list of the data parameters that can be read on the DST orService ADVISOR™. 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
Air Heater Time Remaining	sec	Amount of time the air heater will continue to heat the air prior to start
Analog Throttle (A) Input Voltage (OEM)	volts	Voltage from analog throttle (A) position sensor (potentiometer) on OEM applications ONLY.
Analog Throttle (A) Input Voltage	volts	Voltage from analog throttle (A) position sensor (potentiometer) on non-OEM applications.
Analog Throttle (B) Input Voltage (OEM)	volts	Voltage from analog throttle (B) position sensor (potentiometer) on OEM applications ONLY.
Analog Throttle (B) Input Voltage	volts	Voltage from analog throttle (B) position sensor (potentiometer) on non-OEM applications.
Analog Throttle (C) Input Voltage (OEM)	volts	Voltage from analog throttle (C) position sensor (potentiometer) on OEM applications ONLY.
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
Crank Position Input Noise Indicator	%	"0" reading means there is no noise. Between 0—100, the noise on the crank sensor signal becomes progressively worse. When 100 is reached, a trouble code is thrown.
Crank Position Sensor Speed	rpm	The speed of the crank timing wheel.
Desired Speed Governor Curve	N/A*	The code selected is dependent on the application. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual and refer to the corresponding desired speed governor curve for your application.
ECU Boot Block Part Number	N/A*	Part number for the Engine Control Unit (ECU) boot block.
ECU Configuration File Part Number	N/A*	Part number for the configuration file in the ECU.
ECU EOL Data Part Number	N/A*	Part number for the data programmed into the ECU at the end of the assembly line. EOL = End of Line
*N/A = Not Applicable		

Continued on next page

Parameter	Units	Description
ECU Part Number	N/A*	Part number for the Engine Control Unit (ECU) hardware.
ECU Serial Number	N/A*	Serial number for the Engine Control Unit (ECU).
ECU Software Assembly Part Number	N/A*	Part number for the Engine Control Unit (ECU) software assembly.
ECU Software Part Number	N/A*	Part number for the Engine Control Unit (ECU) operating software.
Engine Coolant Temperature	°C (°F)	Engine Coolant Temperature value. *NOTE: If there is an active fault for the ECT circuit, the ECT will be displayed as NA*
Engine Coolant Temperature Input Voltage	volts	Engine Coolant Temperature sensor input voltage to the ECU
Engine Hourmeter	hr -min- sec	Total hours the ECU has run on an engine.
Engine Load at Current Speed	%	Percentage of load on the engine at a given speed.
Engine Model Number	N/A*	The model number for the engine.
Engine Oil Pressure	kPa (psi)	Engine Oil pressure value
Engine Serial Number	N/A*	Serial number for the engine.
Engine Speed	rpm	The speed that the crank sensor detects the crank timing wheel to be moving at.
Fuel Mode	N/A*	This code explains the operating mode of the engine.
Fuel System Part Number	N/A*	The part number for the fuel system used on the engine.
Fuel System Serial Number	N/A*	The serial number for the fuel system used on the engine.
Fuel Temperature	°C (°F)	Fuel temperature value. *NOTE: If there is an active fault for the fuel temperature circuit, the fuel temperature will be displayed as NA*
Fuel Temperature Input Voltage	volts	Fuel temperature sensor input voltage to the ECU.
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.
Manifold Air Temperature	(°F)	Manifold Air Temperature value. *NOTE: If there is an active fault for the MAT circuit, MAT will be displayed as NA*
*N/A = Not Applicable		

Continued on next page

Parameter	Units	Description
Manifold Air Temperature Input Voltage	volts	Manifold Air Temperature sensor input voltage to the ECU.
Maximum Speed Governor Curve	N/A[a]	The mode selected is dependent on the application. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual and refer to the corresponding maximum speed governor curve for your application.
Oil Pressure	kPa (psi)	Oil pressure value. *NOTE: If there is an active fault for the oil pressure circuit, the oil pressu will be displayed as NA*
Oil Pressure Input Voltage	volts	Oil Pressure sensor input voltage to the ECU
Option Assembly Part Number	N/A[a]	Part number that describes all of the options on the entire vehicle. This includes the Performance Option Part Number and the V icle Option Part Number.
Performance Option Part Number	N/A[a]	These are the engine performance specific options relat to pow and torque.
Sensor Supply Voltage	volts	Voltage that ECU supplies sensors on voltage su ly #1
Throttle Type	N/A[a]	Type of throttle(s) active
Throttle Position	%	Percentage of throttle
Torque Curve Number	N/A[a]	On some applications, the ECU limits e max fue on multiple torque curves. This displays the torque curve the ECU curre y using to limit maximum fuel. See APPLICATION ECIFICATIONS in Section 06, Group 210 of this manual and refer to th corresponding torque curve for your application.
Vehicle Option Part Number	N/A[a]	These are the vehicle ecif options for the engine like fuel derates, shutdowns, sen thres ds, ect
Vehicle Serial Number	N/A[a]	The serial n nber of the ve that this engine is located in.
[a]N/A = Not Applicable		

RG40854,0000103 –19–15JAN02–3/3

Engine Test Instructions - Excavator Torque Curve Change Test

Torque curve adjustment may be necessary for excavators operating in high altitude areas. By selecting the altitude derate option, undesired observable symptoms such as excessive black smoke can be significantly reduced or eliminated. Torque curve adjustment can only be accomplished with the DST orSERVICE ADVISOR™.

Performing the Torque Curve High-altitude Adjustment

1. Ignition ON, engine off.
2. Select Excavator Torque Curve Change Test on the DST orSERVICE ADVISOR™.
3. Select the option that corresponds to the desired operation.

   1. Normal operation
   2. Altitude derate

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Reprogramming Engine Control Unit (ECU)

The ECU may be reprogrammed using the DST orSERVICE ADVISOR™. Refer to the training material provided with your Service Advisor training course. All authorized Service Advisor users have received this training. Also, online training is available at John Deere University which is an internet-based distance-learning application.

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Diagnostic Trouble Codes (DTCs)

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

SPN/FMI CODES

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

On all applications with the Level 12 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 orSERVICE ADVISOR™ and the Diagnostic Gauge to display active and stored DTCs. When using the DST orSERVICE ADVISOR™ the codes will be displayed in a 000000.00 format. For example, SPN 110 FMI 3 will be displayed as 000110.03.

2-DIGIT CODES

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

OTHER CODES

If codes are not displayed as SPN/FMI or as 2-digit codes, there may be another format that the application is using. For example, on some applications, the code F455 is displayed for engine coolant temperature input voltage high. This may be seen on some applications within the DST orSERVICE ADVISOR™. In this manual, it is necessary to convert this format of code into an SPN/FMI code to ensure that the correct diagnostic procedure is followed. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU

WARNING LAMP

On some applications, there is a warning lamp that is used when a code becomes active. When a code is active, this lamp will either blink or stay on solid. Typically, a solid light indicates that the ECU is taking extreme measures to protect the engine, and a blinking light indicates that the ECU has detected a fault and engine performance may be affected. Refer to Operator's Manual for a given application for more detailed information.

CLEARING STORED DTCS

Stored DTCs can be cleared through the OEM instrument panel, through the DST orSERVICE ADVISOR™. For more information on clearing DTCs using the diagnostic code reader on the instrument panel, see CLEARING STORED DTCS ON DIAGNOSTIC GAUGE earlier in this Group.

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Listing of Diagnostic Trouble Codes (DTCs) on ECU

Ascending SPN/FMI Codes

DTC's Listing in Ascending SPN/FMI Codes

SPN	FMI	Definition
000028	03	Throttle Voltage High
	04	Throttle Voltage Low
000029	03	Throttle Voltage High
	04	Throttle Voltage Low
	14	Throttle Voltage Out of Range
000091	03	Throttle Voltage High
	04	Throttle Voltage Low
	07	Throttle Calibration Invalid
	09	Accelerator Pedal Position CAN Message Missing, Late, or Invalid
	10	Throttle Voltage Low
	13	Throttle Calibration Aborted
	14	Throttle Voltage Out of Range
000097	00	Water In Fuel, above Normal, Most Severe
	03	Water in Fuel Signal Voltage High
	04	Water in Fuel Signal Voltage Low
	16	Water in Fuel Detected
	31	Water In Fuel Detected, Condition Exists
000100	01	Engine Oil Pressure Extremely Low
	03	Engine Oil Pressure Input Voltage High
	04	Engine Oil Pressure Input Voltage Low
	16	Engine Oil Pressure, Reading Incorre
	18	Engine Oil Pressure Moderately Lo
000105	03	Manifold Air Temperature Input Vol ge High
	04	Manifold Air Temperature Inp Volta Low
	16	Manifold Air Temperature Mode ly
000107	00	Air Filter Restricted
000110	00	Engine Coolant Tempe High
	03	Engine Coolant T perat Input Voltage High
	04	Engine Coolant emperature put Voltage Low
	15	Engine Cool Temp ature Hi Least Severe
	16	Engine Coolan pperatur Moderately High
000111	00	Loss o ant T pera e Extremely High
	03	Los of Co nt Tem ture Input Voltage High
	04	L of Co Temperature Input Voltage Low
000158	17	ECU er Down Error
000171	03	Ambien Air Temperature, Voltage OOR, High
	04	A bient Temperature, Voltage OOR, Low
000174	03	uel Temperature Input Voltage High
	04	Fuel T perature Input Voltage Low
	16	Fu Temperature High Moderately Severe
000189	00	E gine Speed Derate
000190		Engine Overspeed Extreme
		Engine Speed, Below Normal, Most Severe
	16	Engine Overspeed Moderate
00052	09	Current Gear Not Received or Invalid
	18	Engine Speed, Below Normal, Moderately Severe
000 0	03	Sensor Supply Voltage High

Continued on next page

	04	Sensor Supply Voltage Low
000627	04	ECU Unswitched Power Missing
000629	13	ECU Error
000636	02	Engine Position Sensor Noise Detected
	08	Engine Position Sensor Signal Missing
	10	Engine Position Sensor Pattern Error Detected
000637	01	Timing (Crank) Sensor, Signal Pattern Error
	02	Crank Position Input Noise
	10	Crank Position Input Pattern Error
000639	13	CAN Bus Error
000644	02	External Speed Command Input, Data Erratic, Intermittent, or Incorrect
000729	03	Inlet Air Heater Signal High
000729	05	Inlet Air Heater Signal Low
000898	09	Vehicle Speed Invalid/Missing
000970	31	Auxiliary Engine Shutdown Switch Active
000971	31	External Engine Derate Switch Active
001076	00	Pump Control Valve Closure Too Long
	01	Pump Control Valve Closure Too Short
	03	Pump Solenoid Current High
	05	Pump Solenoid Circuit Open
	06	Pump Solenoid Circuit Severely Shorted
	07	Pump Control Valve Closure Not Detected
	10	Pump Solenoid Circuit Moderately Shorted
	13	Pump Current Decay Time Invalid
001079	03	Sensor Supply Voltage High
	04	Sensor Supply Voltage Low
001109	31	Engine Shutdown Warning
001110	31	Engine Shutdown
001568	04	Torque Curve Selection Input Voltage Low
001569	31	Fuel Derate
002000	06	Internal ECU Failure
	13	Security Violation

Continued on next page

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Ascending 2-Digit/Other Codes

DTC's Listing In Ascending 2-Digit Codes

2-Digit/Other Code	SPN	FMI	Definition
11	000091	03	Throttle Voltage High
12	000091	04	Throttle Voltage Low
13	000028	03	Throttle Voltage High
14	000028	04	Throttle Voltage Low
15	000029	03	Throttle Voltage High
16	000029	04	Throttle Voltage Low
18	000110	03	Engine Coolant Temperature Input Voltage High
19	000110	04	Engine Coolant Temperature Input Voltage Low
21	000620	03	Sensor Supply Voltage High
	001079	03	Sensor Supply Voltage High
22	000620	04	Sensor Supply Voltage Low
	001079	04	Sensor Supply Voltage Low
23	000100	03	Engine Oil Pressure Input Voltage High
24	000100	04	Engine Oil Pressure Input Voltage Low
25	000105	03	Manifold Air Temperature Input Voltage High
26	000105	04	Manifold Air Temperature Input Voltage Low
28	000629	13	ECU Error
32	N/A*	N/A*	When reading blink codes, signifies start of active fault codes.
33	N/A*	N/A*	When reading blink codes, signifies start of previously active codes.
37	000174	03	Fuel Temperature Input Voltage High
38	000174	04	Fuel Temperature Input Voltage Low
39	000637	02	Crank Position Input Noise
		10	Crank Position Input Pattern Error
42	000190	00	Engine Overspeed Extreme
		16	Engine Overspeed Moderate
54	000158	17	ECU Power Down Error
55	000639	13	CAN Bus Error
62	000110	15	Engine Coolant Temperature High Severe
63	000110	16	Engine Coolant Temperature Moderately High
64	000100	18	Engine Oil Pressure Moderately Low
65	000100	01	Engine Oil Pressure Extremely Low
66	000105	16	Manifold Air Temperature Moderately High
68	001569	31	Fuel Derate
69	000110	00	Engine Coolant Temperature Extremely High
71	001076	00	Pump Control Valve Closure Too Long
72	001076	01	Pump Control Valve Closure Too Short
73	001076	05	Pump Solenoid Circuit Open
74	001076	01	Pump Solenoid Circuit Severely Shorted
75	001076	07	Pump Control Valve Closure Not Detected
76	001076	10	Pump Solenoid Circuit Moderately Shorted
77	001076	03	Pump Solenoid Current High
78	002000	13	Security Violation
79	002000	06	Internal ECU Error
81	000174	16	Fuel Temperature High Moderately Severe
82	001110	31	Engine Protection Shutdown
83	000970	31	Auxiliary Engine Shutdown Switch Active
84	000168	17	ECU Power Down Error
	000971	31	External Engine Derate Switch Active

*N/A = Not Applicable

Continued on next page

88	N/A[a]	N/A[a]	When reading blink codes, signifies that no fault codes are in buffer.
F400	000029	03	Multi-state Throttle Input High
F401	000029	04	Multi-state Throttle Input Low
F402	000029	14	Multi-state Throttle Input Voltage Out of Range
F411	000620	04	Sensor Supply Voltage Low
F414	000620	03	Sensor Supply Voltage High
F415	000100	04	Engine Oil Pressure Input Voltage Low
F418	000105	16	Manifold Air Temperatrue Moderately High
F420	000091	04	Analog Throttle (A) Input Low
F421	000091	10	Throttle Input Voltage Below Lower Calibration
F422	000110	16	Engine Coolant Temperature Moderately High
F423	000091	09	Throttle Calibration Aborted
F425	000091	03	Analog Throttle (A) Input High
F474	000174	16	Fuel Temperature High Moderately Severe
F428	000091	07	Throttle Not Calibrated Properly
F42A	000091	14	Analog Throttle (A) Input Voltage Out of Range
	000639	13	Skidders ONLY - CAN Bus Error
F445	000100	03	Engine Oil Pressure Input Voltage High
F446	000100	01	Engine Oil Pressure Extremely Low
F450	000110	04	Engine Coolant Temperature Input Voltage Low
F455	000110	03	Engine Coolant Temperature Input Voltage High
F457	000110	00	Engine Coolant Temperature Extremely High
F460	000105	04	Manifold Air Temperature Input Voltage Low
F465	000105	03	Manifold Air Temperature Input Voltage High
F49A	001076	10	Pump Solenoid Circuit Moderately Shorted
F497	001076	13	Pump Current Decay Time Invalid
F474	000174	16	Fuel Temperature High Moderately Severe
F475	000174	03	Fuel Temperature Input Voltage High
	001569	31	Fuel Derate
F478	001076	13	Pump Current Decay Time Invalid
F48A	000637	10	Crank Position Input Pattern Error
F48b	000637	02	Crank Position Input Noise
F490	001076	06	Pump Solenoid Circuit Severely Shorted
F491	001076	01	Pump Control Valve Closure Too Short
F492	001076	03	Pump Solenoid Current High
F493	001076	07	Pump Control Valve Closure Not Detected
F494	001076	00	Pump Control Valve Closure Too Long
F495	001076	05	Pump Solenoid Circuit Open
F49A	001076	10	Pump Solenoid Circuit Moderately Shorted
F4A0	000111	04	Loss of Coolant Temperature Input Voltage Low
F4A5	000111	03	Loss of Coolant Temperature Input Voltage High
F4A7	000111	00	Loss of Coolant Temperature Extremely High
F4E0	002000	06	Internal ECU Failure
F4E3	000629	12	ECU Error
F4EA	000158	17	ECU Power Down Error
F4Ed	0020	13	Security Violation

[a]N/A = Not Applicable

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Diagnostic Procedure

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

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly.
2. Read and record DTC(s). If an SPN/FMI code is not used, convert the code to SPN/FMI. See LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU earlier in this Group.
3. Go to the diagnostic procedure 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 orSERVICE ADVISOR™, always replace the dust cap 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.

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Intermittent Fault Diagnostics

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

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

Suggestions for diagnosing intermittent faults:

- If diagnostic chart indicates that the problem is intermittent, try to reproduce the operating conditions that were present when the DTC set. The DST orSERVICE 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 as the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the DST orSERVICE 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.

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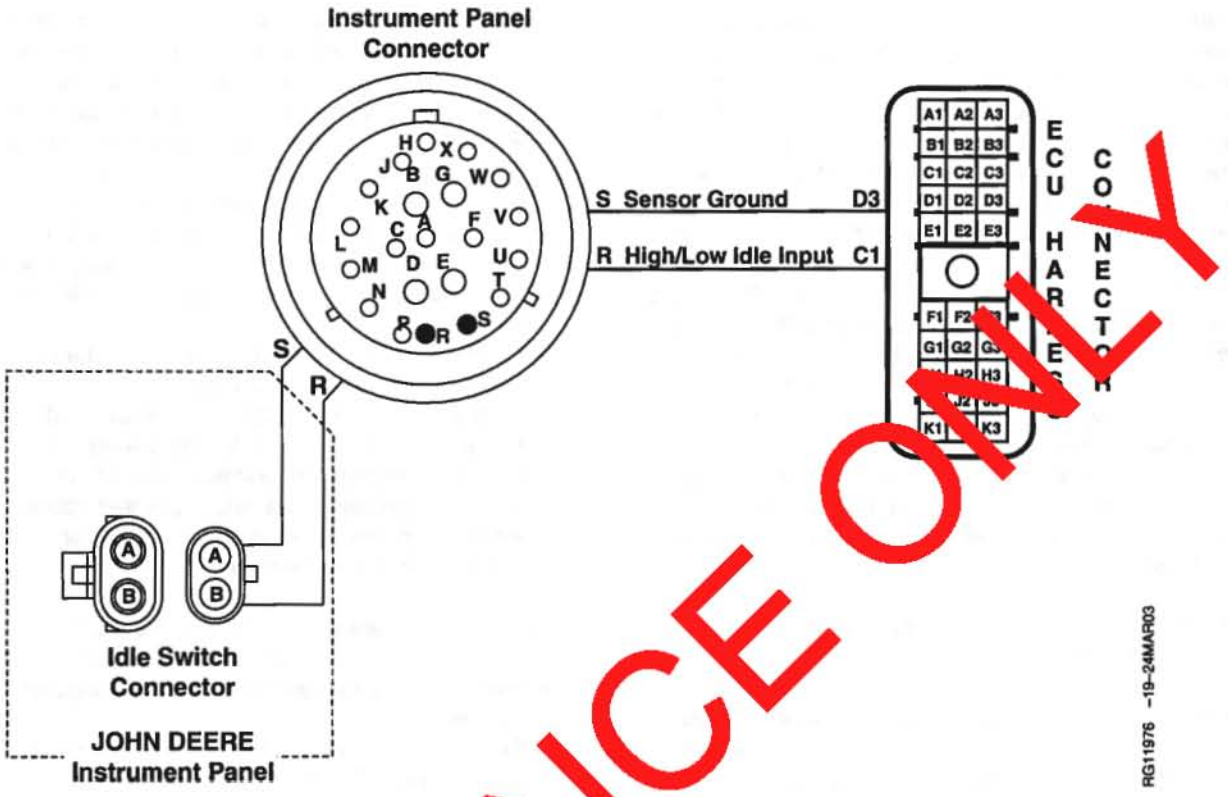
T1 - Multi-state Throttle Input High



Multi-state Throttle Switch

- Multi-state throttle is composed of an idle switch that allows engine speed to be at high or low idle. On some applications, there is a bump up and a bump down feature. This allows for high and low idle to be controlled.
- On certain applications, an additional throttle is used in addition to the multi-state throttle. If the desired engine speed of the additional throttle is greater than the multi-state throttle, the multi-state throttle will be overridden. When the desired engine speed of the multi-state throttle is greater than the additional throttle, the multi-state throttle will be in total control.

This code will set if

- The multi-state throttle input voltage exceeds the maximum threshold. The voltage is higher than what is physically possible for the throttle lever to achieve.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the multi-state throttle, and will use the input values from another throttle.
- If the multi-state throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,00000A2 –19–07DEC01–1/1

T1 - Multi-state Throttle Input High

RG40854,00000A1 -19-23SEP05-1/1

T1 - Multi-State Throttle Input High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage wi result. Use JT07328 Connector Adapter Test Kit to make measurement nec s. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T1 - MULTI-STATE THROTTLE NPUT HIGH supporting information.* Perform a preliminary inspection of the ECU conne r and the multi-state throttle connector. Look for dirty, damaged, or poorly pos ned t minals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and heory o peration, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting in mation* 1. Connect to the D rSERVI E ADVISOR. 2. Ignit ON, gine O 3. tart t CU communication software 4. R d DTCs sing the DST orSERVICE ADVISOR™ 5. Make e of any DTCs, then clear all DTCs. 6. Ignition ON, engine OFF 7. Move the multi-state switch through all the positions. 8. Read DTCs using the DST orSERVICE ADVISOR™. *NOTE: Skidder applications use a different SPN for multi-state throttle than other applications.*	**000091.03 (Skidders: 000029.03) reoccurs:** GO TO ❸ **000091.03 (Skidders: 000029.03) does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see T1 - MULTI-STATE THROTTLE INPUT HIGH supporting information.* 1. Ignition OFF 2. Disconnect multi-state throttle switch at two wire connector behind instrument panel. 3. Install a jumper wire between both terminals of the switch harness connector. 4. Read DTCs using the DST or SERVICE ADVISOR 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine OFF 7. Read DTCs using the DST or SERVICE ADVISOR. *NOTE: Skidder applications use a different SPN for multi-state throttle than o applications.*	**000091.03 (Skidders: 000029.03) reoccurs:** GO TO ❹ **000091.04 (Skidders: 000029.03) occurs:** Faulty multi-state throttle switch connecto OR Faulty multi-state hrottle switch – – –1/1

04
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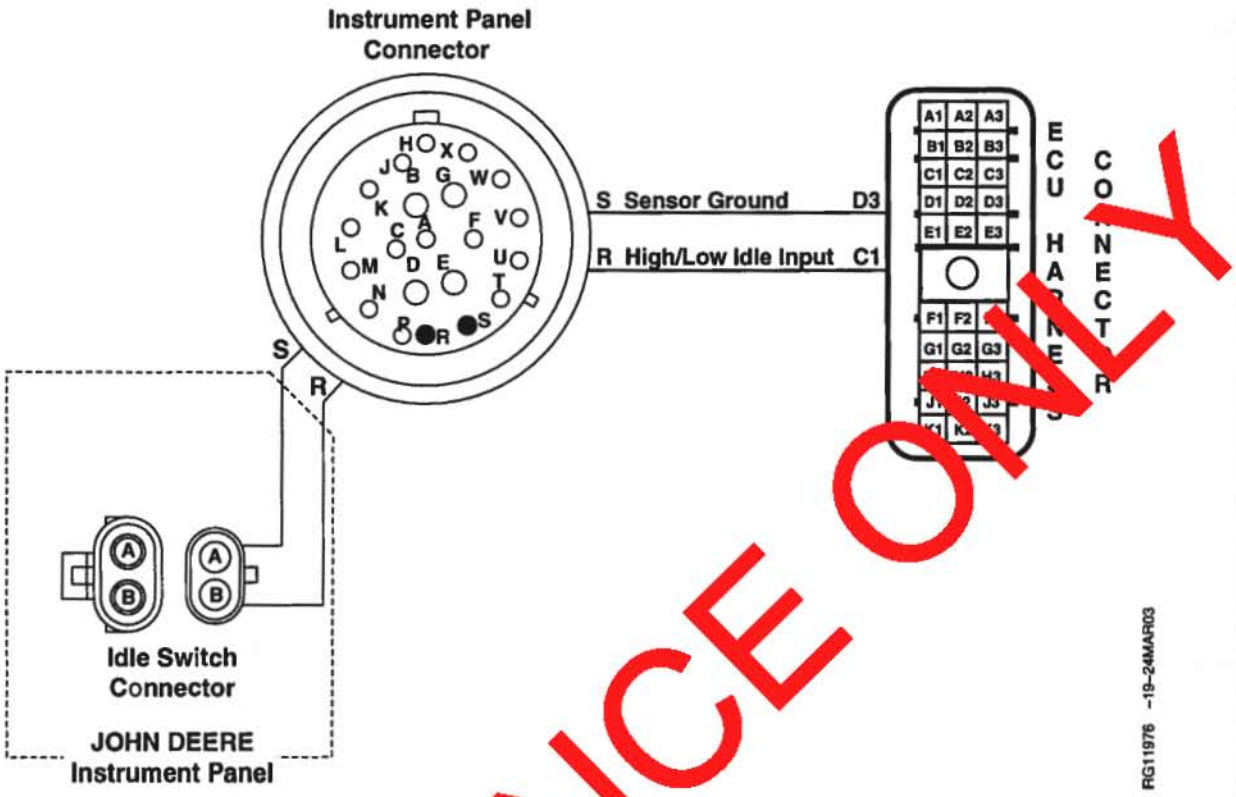
❹ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see T1 - M TI-ST E THROTTLE INPUT HIGH supporting information.* 1. Ignition OFF 2. Remove jumper wire. 3. Ignition ON, engine OFF 4. Using a multimeter, mea re vo e between multi-state switch 5 V input terminal and a good chassis g nd.	**Between 4.0 V and 6.0 V:** Open in multi-state switch ground circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in multi-state switch 5 V input circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

T2 - Multi-state Throttle Input Low



Multi-state Throttle Switch

- Multi-state throttle is composed of an idle switch that allows engine speed to be at high or low idle. On some applications, there is a bump up and a bump down feature. This allows for high and low idle to be controlled.
- On certain applications, an additional throttle is used in addition to the multi-state throttle. If the desired engine speed of the additional throttle is greater than the multi-state throttle, the multi-state throttle will be overridden. When the desired engine speed of the multi-state throttle is greater than the additional throttle, the multi-state throttle will be in total control.

This code will set if:

- The multi-state throttle input voltage drops below the minimum threshold. The voltage is lower than what is physically possible for the throttle lever to achieve.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the multi-state throttle, and will use the input values from another throttle.
- If the multi-state throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,00000A0 –19–07DEC01–1/1

T2 - Multi-state Throttle Input Low

RG40854,00000A3 -19-23SEP05-1/1

T2 - Multi-State Throttle Input Low Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connector. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information.* Perform a preliminary inspection of the ECU connector and the multi-state throttle connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the PC communication software 4. Read DTCs using the DST orSERVICE ADVISOR™ 5. Make note of any DTCs, then clear all DTCs. 6. Ignition ON, engine OFF 7. Move the multi-state switch through all the positions. 8. Read DTCs using the DST orSERVICE ADVISOR™. *NOTE: Skidder applications use a different SPN for multi-state throttle than other applications.*	**000091.04 (Skidders: 000029.04) reoccurs:** GO TO ❸ **000091.04 (Skidders: 000029.04) does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see T2 - MULTI-STATE THROTTLE INPUT LOW supporting information.* 1. Ignition OFF 2. Disconnect multi-state throttle switch at two wire connector behind instrument panel. 3. Read DTCs using the DST or SERVICE ADVISOR. 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine OFF 6. Read DTCs using the DST or SERVICE ADVISOR. *NOTE: Skidder applications use a different SPN for multi-state throttle than other applications.*	**000091.04 (Skidders: 000029.04) reoccurs:** Short to ground in multi-state input circuit OR Open in multi-state input circuit OR Faulty ECU **000091.[illegible] (Skidders: 000029.03) occurs:** Faulty multi-state throttle switch connector OR Faulty multi-state throttle switch. ---1/1

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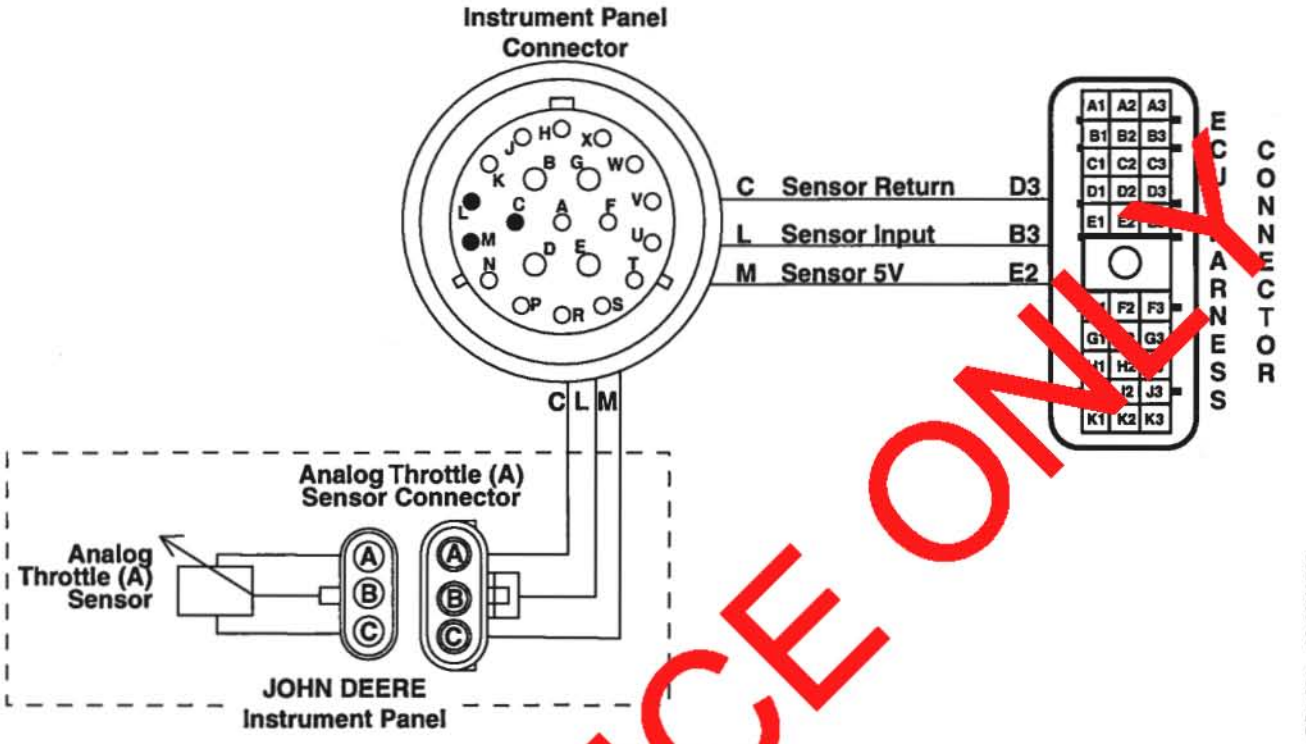
T3 - Analog Throttle (A) Input High



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

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltage range may change per application.

This code will set if:

- The analog throttle (A) input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for the throttle lever to achieve.
  - For OEM applications, the high analog throttle (A) input voltage specification is 4.7 volts.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high analog throttle (A) input voltage specification.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,000009E –19–07DEC01–1/1

T3 - Analog Throttle (A) Input High

RG40854,00000A4 -19-23SEP05-1/1

T3 - Analog Throttle (A) Input High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements by connection. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the analog (A) throttle connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**Faulty connection(s):** GO TO ❷ **Faulty connection:** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* 1. Connect to the DST or SERVICE ADVISOR . 2. Ignition ON, engine OFF. 3. Start the ECU communication software 4. Analog Throttle (A) in the idle position. 5. Using the DST orSERVICE ADVISOR™: • For OEM applications, read Analog Throttle (A) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (A) Input Voltage *NOTE: For OEM applications, the high analog throttle (A) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.7 V or greater:** GO TO ❹ **Below 4.7 V:** GO TO ❸

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❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* While slowly operating analog throttle (A) through its full travel, use the DST or SERVICE ADVISOR for the following: • For OEM applications, read Analog Throttle (A) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (A) Input Voltage *NOTE: For OEM applications, the high analog throttle (A) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Goes above 4.7 V:** Faulty analog throttle (A) sensor connector OR Open in analog throttle (A) sensor ground circuit OR Faulty analog throttle (A) sensor **Never goes above 4.7 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group ---1/1

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❹ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* 1. Ignition OFF 2. Disconnect analog throttle (A) sensor connector behind instrument panel. 3. Ignition ON, Engine OFF 4. Using the DST or SERVICE ADVISOR™: • For OEM applications, read Analog Throttle (A) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (A) Input Voltage *NOTE: For OEM applications, the low analog throttle (A) input voltage specification is 0.3V or less. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or less:** GO TO ❺ **Above 0.3 V:** Short to voltage in analog throttle (A) input circuit OR Faulty ECU

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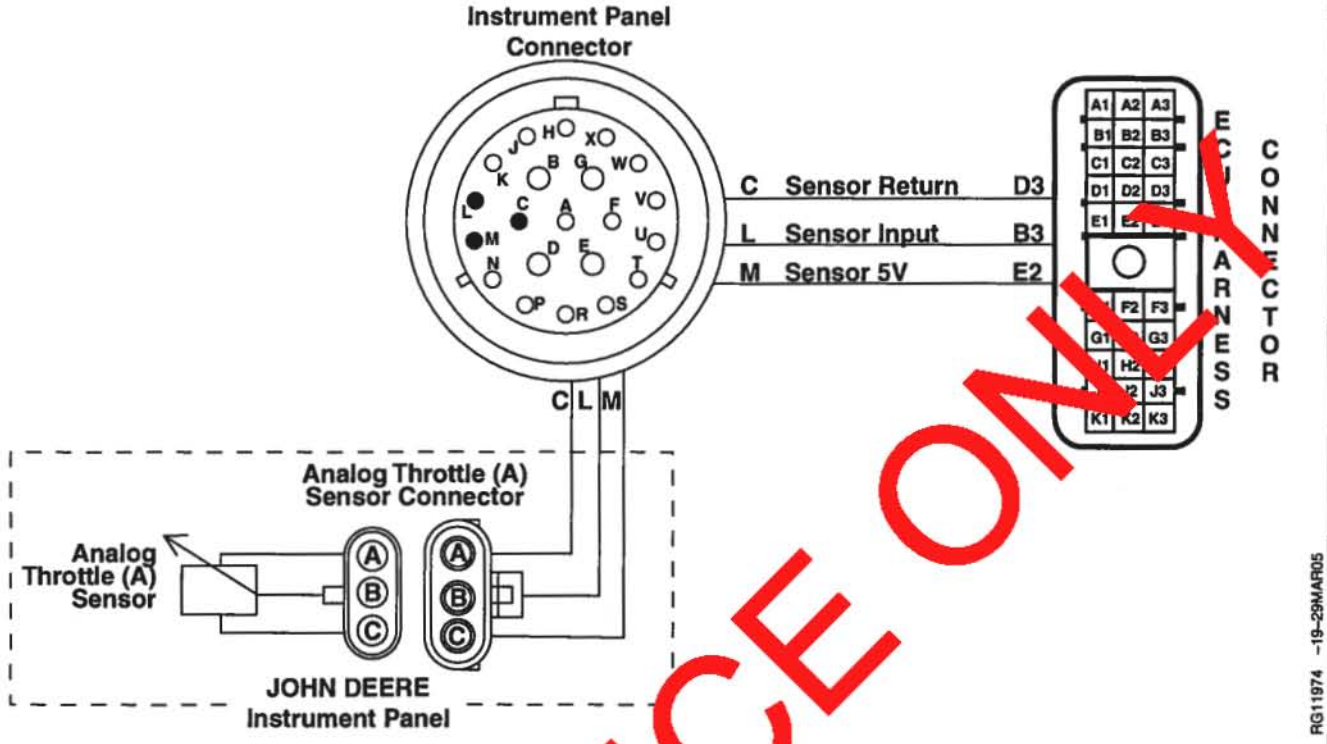
---1/1

❺ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see T3 - ANALOG THROTTLE (A) INPUT HIGH supporting information.* 1. Ignition OFF 2. Analog throttle (A) sensor connector still disconnected. 3. Using a test light connected to battery (+), probe the ground terminal in throttle (A) sensor harness connector.	**Light ON:** Faulty analog throttle (A) sensor connector OR Faulty analog throttle (A) sensor **Light OFF:** Open in analog throttle (A) ground circuit ---1/1

T4 - Analog Throttle (A) Input Low



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

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltage range may change per application.

This code will set if:

- The analog throttle (A) input voltage goes below the sensor's low voltage specification. The voltage is lower than what is physically possible for the throttle lever to achieve.
  - For OEM applications, the low analog throttle (A) input voltage specification is 0.3 volts.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low analog throttle (A) input voltage specification.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,000009C –19–07DEC01–1/1

T4 - Analog Throttle (A) Input Low

RG40854,00000A5 -19-23SEP05-1/1

T4 - Analog Throttle (A) Input Low Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* Perform a preliminary inspection of the ECU connector, the analog (A) throttle connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection:** Repair faulty connection.
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* 1. Connect to the DST or SERVICE ADVISOR . 2. Ignition ON, engine OFF 3. Start the DST or communication software Throttle (A) in the idle position. 5. Using the DST orSERVICE ADVISOR™: • For OEM applications, read Analog Throttle (A) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (A) Input Voltage *NOTE: For OEM applications, the low analog throttle (A) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or less:** GO TO ❹ **Above 0.3 V:** GO TO ❸

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---1/1

❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* While slowly operating analog throttle (A) through its full travel, use the DST or SERVICE ADVISOR for the following: • For OEM applications, read Analog Throttle (A) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (A) Input Voltage *NOTE: For OEM applications, the low analog throttle (A) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Goes below 0.3 V:** Faulty analog throttle (A) sensor connector OR Open in analog throttle (A) sensor ground circuit OR Faulty analog throttle (A) sensor **Never goes above 0.3 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this group ---1/1

❹ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* 1. Ignition OFF 2. Disconnect analog throttle (A) sensor connector. 3. Install a jumper wire between the 5 V Supply terminal and the input terminal in the harness side of the sensor connector. 4. Ignition ON, engine OFF 5. Using the DST or SERVICE ADVISOR: • For OEM applications, read Analog Throttle (A) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (A) Input Voltage *NOTE: For OEM applications, the high analog throttle (A) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.7 V:** GO TO ❺ **4.7 V or greater:** Faulty analog throttle (A) sensor connector OR Faulty analog throttle (A) sensor ---1/1

6 Throttle Position 5V Supply Test	*NOTE: For wiring and theory of operation, see T4 - ANALOG THROTTLE (A) INPUT LOW supporting information.* 1. Ignition OFF 2. Remove jumper wire. 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between the analog throttle (A) ground terminal and the 5 V Supply terminal in the sensor harness connector.	**Between 4.0 V and 6.0 V:** Open in analog throttle (A) input circuit OR Short to ground in analog throttle (A) input circuit OR Faulty ECU connector OR Faulty ECU **Below 4.0 V:** Open in analog throttle (A) 5 V Supply circuit OR Short to ground in analog throttle (A) 5 V Supply circuit OR Faulty ECU connector OR Faulty ECU ---1/1

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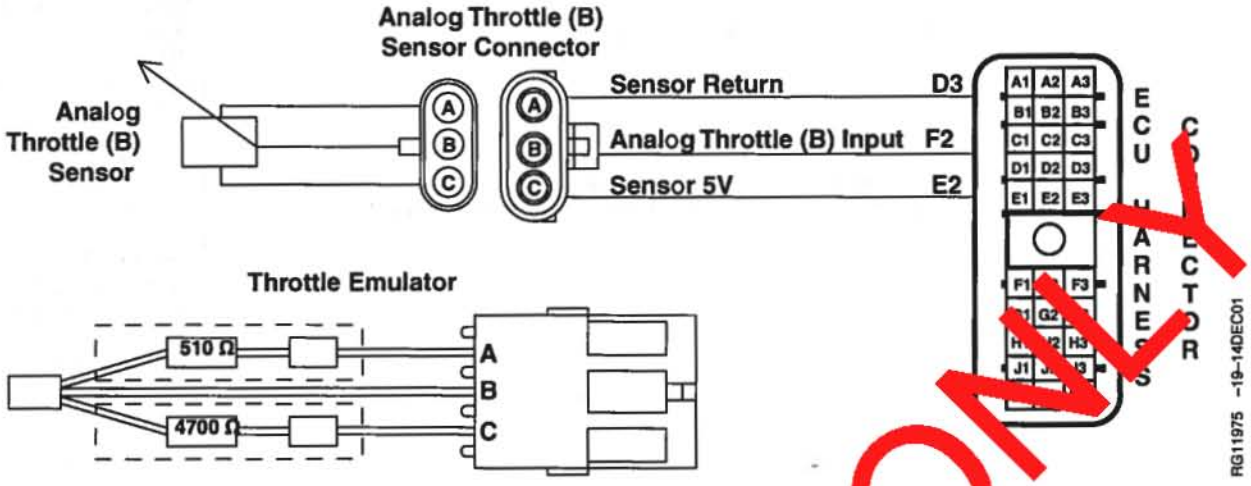
T5 - Analog Throttle (B) Input High



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44

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

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltage range may change per application.

This code will set if:

- The analog throttle (B) input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for the throttle level to achieve.
  - For OEM applications, the high analog throttle (B) input voltage specification is 4.7 volts.
  - For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high analog throttle (B) input voltage specification.

This code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,000009A –19–07DEC01–1/1

T5 - Analog Throttle (B) Input High

RG40854,00000A6 -19-23SEP05-1/1

T5 - Analog Throttle (B) Input High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the analog (B) throttle connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* 1. Connect to the DST via SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the DST communication software Analog throttle (B) in the idle position. 5. Using the DST orSERVICE ADVISOR™: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage *NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.7 V or greater:** GO TO ❹ **Below 4.7 V:** GO TO ❸

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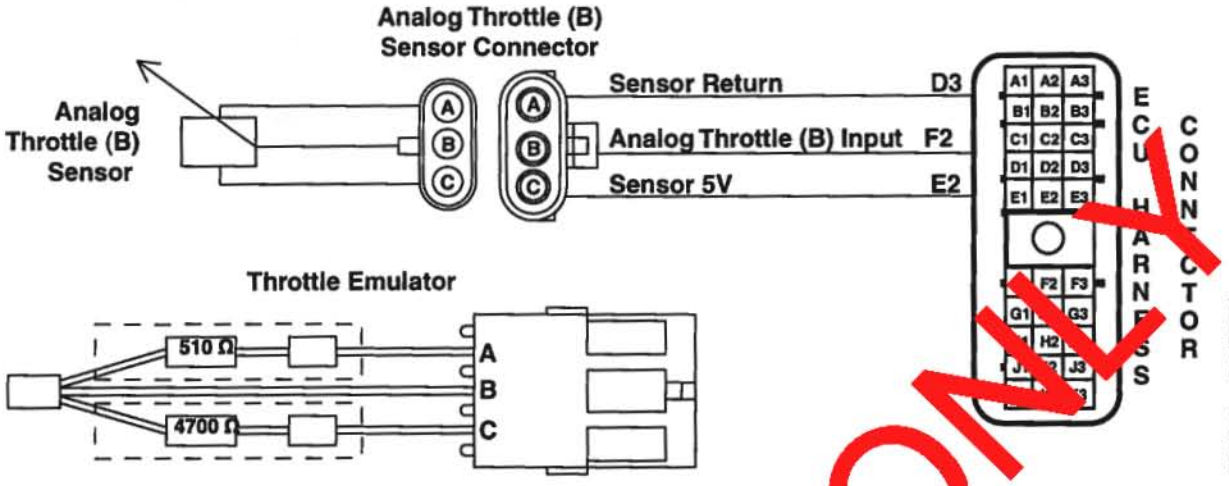
❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* While slowly operating analog throttle (B) through its full travel, use the DST or SERVICE ADVISOR for the following: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage *NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Goes above 4.7 V:** Faulty analog throttle (B) sensor connector OR Open in analog throttle (B) sensor ground circuit OR Faulty analog throttle (B) sensor **Never goes above 4.7 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group ---1/1
❹ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* 1. Ignition OFF 2. Disconnect analog throttle (B) sensor connector behind instrument panel. 3. Ignition ON, Engine OFF 4. Using the DST or SERVICE ADVISOR: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage *NOTE: For OEM applications, the low analog throttle (B) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or less:** GO TO ❺ **Above 0.3 V:** Short to voltage in analog throttle (B) input circuit OR Faulty ECU ---1/1
❺ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see T5 - ANALOG THROTTLE (B) INPUT HIGH supporting information.* 1. Ignition OFF 2. Analog throttle (B) sensor connector disconnected. 3. Using a test light connected to battery (+), probe the ground terminal in throttle (B) sensor harness connector.	**Light ON:** Faulty analog throttle (B) sensor connector OR Faulty analog throttle (B) sensor **Light OFF:** Open in analog throttle (B) ground circuit ---1/1

T6 - Analog Throttle (B) Input Low



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

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage norma varies between 1.0 and 4.0 volts dependi g on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 olts at high idle. The ECU has the ability to le n differ nt voltages for low and high idle, so the oltage ange may change per application.

This code will set if:

- The analog thro le (B) in ut voltage goes below the sensor's low voltag specification. The voltage is lowe than what is physically possible for the throttle le r to a ieve.
  - F OEM a lications, the low analog throttle (B) input olt ge specification is 0.3 volts.
  - Fo non-OEM applications, see APPLICATION SP CIFICATIONS in Section 06, Group 210 of th manual for the low analog throttle (B) input voltage specification.

f this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,0000098 -19-07DEC01-1/1

T6 - Analog Throttle (B) Input Low

RG40854,00000A7 -19-23SEP05-1/1

T6 - Analog Throttle (B) Input Low Diagnostic Procedure

---1/1

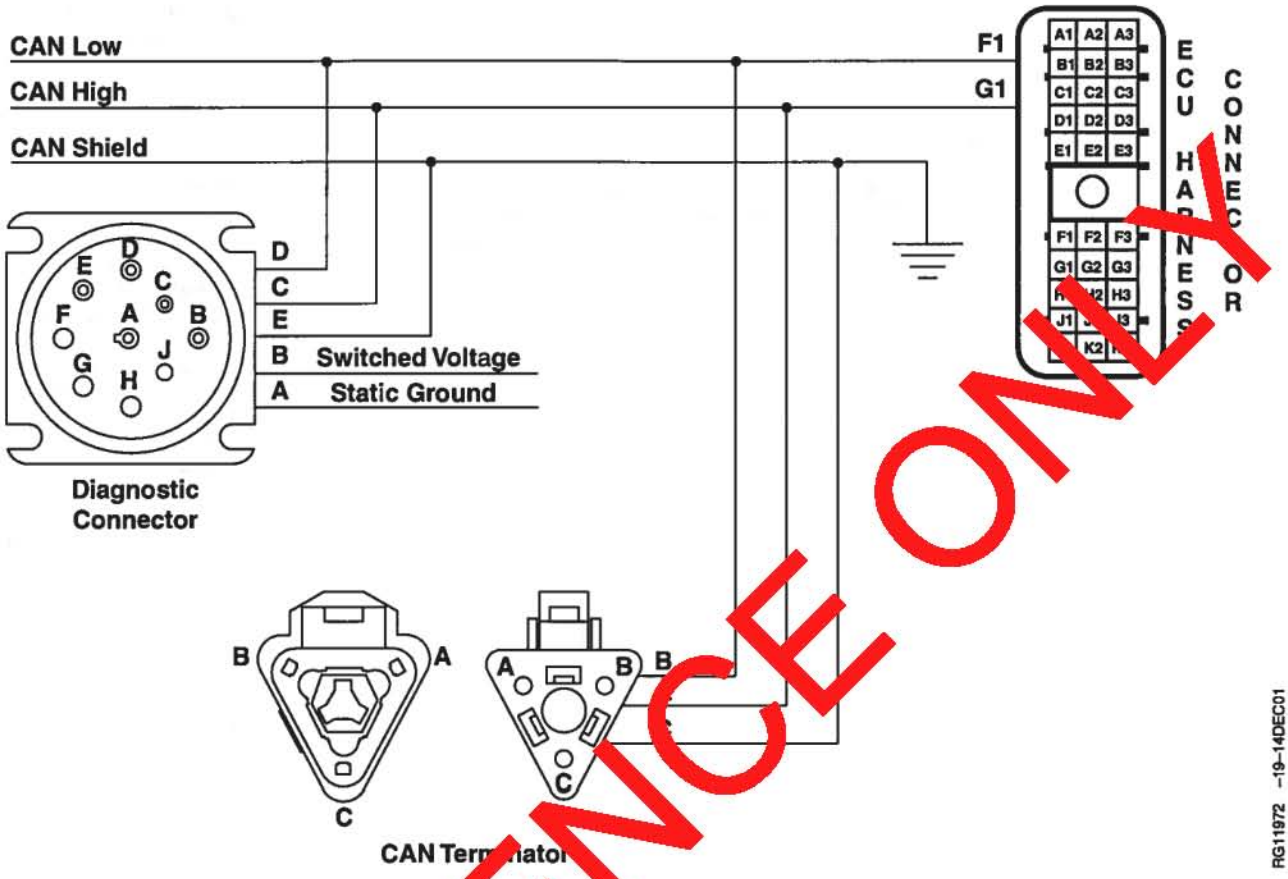
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connector. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* Perform a preliminary inspection of the ECU connector, the analog (B) throttle connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the DST communication software 4. Analog Throttle (B) in the idle position. 5. Using the DST orSERVICE ADVISOR™: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage *NOTE: For OEM applications, the low analog throttle (B) input voltage specification is 0.3V. For the low voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or less:** GO TO ❹ **Above 0.3 V:** GO TO ❸
SERVICE ADVISOR is a trademark of Deere & Company		---1/1

❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* While slowly operating analog throttle (B) through its full travel, use the DST or SERVICE ADVISOR for the following: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage	**Goes below 0.3 V:** Faulty analog throttle (B) sensor connector OR Open in analog throttle (B) sensor ground circuit OR Faulty analog throttle (B) sensor **New ... above 0.3 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this group ---1/1

❹ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* 1. Ignition OFF 2. Disconnect analog throttle (B) sensor connector. 3. Install a jumper wire between the 5 V Supply terminal and the input terminal in the harness side of the sensor connector. 4. Ignition ON, engine OFF 5. Using the DST or SERVICE ADVISOR: • For OEM applications, read Analog Throttle (B) Input Voltage (OEM) • For non-OEM applications, read Analog Throttle (B) Input Voltage *NOTE: For OEM applications, the high analog throttle (B) input voltage specification is 4.7V. For the high voltage specification on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.7 V:** GO TO ❺ **4.7 V or greater:** Faulty analog throttle (B) sensor connector OR Faulty analog throttle (B) sensor ---1/1

5 Throttle Position 5 V Supply Test	*NOTE: For wiring and theory of operation, see T6 - ANALOG THROTTLE (B) INPUT LOW supporting information.* 1. Ignition OFF 2. Remove jumper wire. 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between the analog throttle (B) ground terminal and the 5 V Supply terminal in the sensor harness connector.	**Between 4.0 V and 6.0 V:** Open in analog throttle (B) input circuit OR Short to ground in analog throttle (B) input circuit OR Faulty ECU connector OR Faulty ECU **Below 4.0 V:** Open in analog throttle (B) 5 V Supply circuit OR Short to ground in analog throttle (B) 5 V Supply circuit OR Faulty ECU connector OR Faulty ECU ---1/1

T7 - CAN Throttle Invalid



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52

CAN (Controller Area Network) Throttle

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

This code will set if:

- The ECU either does not receive throttle information over CAN, or the information received is not valid.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the CAN throttle, and will use the input values from another throttle.
- If the CAN throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,0000096 –19–07DEC01–1/1

T7 - CAN Throttle Invalid

RG40854,00000A8 -19-23SEP05-1/1

T7 - CAN Throttle Invalid Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.* Perform a preliminary inspection of the ECU connectors and any connectors associated with the CAN throttle. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the DST communication software 4. Read active DTCs and stored DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs. 6. Ignition ON, engine running 7. Read DTCs using the DST orSERVICE ADVISOR™.	**000091.09 reoccurs:** GO TO ❸ **000091.09 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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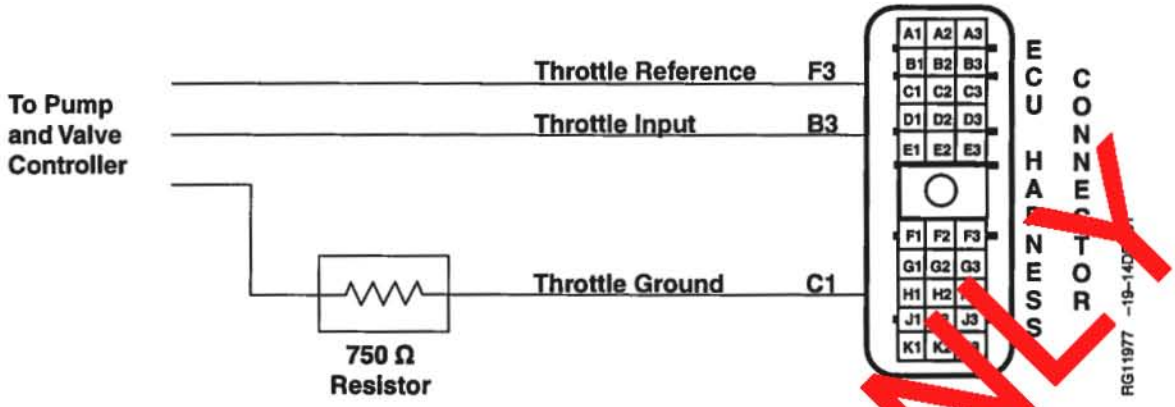
❸ **Application Related DTCs Test**	*NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.* If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs.	**No CAN related DTCs found on other controllers:** GO TO ❹ **Found CAN related DTCs found on other controllers:** Refer to diagnostic procedure for that control ---1/1
❹ **Resistance Between CAN High and Low Test**	*NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.* 1. Ignition OFF 2. Using a multimeter, measure resistance between terminals C and D in the harness end of the diagnostic connector.	**Between 45-75 ohms:** GO TO ❺ **Less than 45 or greater than 75 ohms:** Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness. ---1/1
❺ **CAN Wiring Shorted to Ground or Voltage Test**	*NOTE: For wiring and theory of operation, see T7 - CAN THROTTLE INVALID supporting information.* 1. Ignition OFF 2. Using a multimeter, measure voltage between a good chassis ground and: • Terminal C in the diagnostic connector. • Terminal D in the diagnostic connector.	**Both measurements between 1.5 V and 3.5 V:** Faulty ECU connector OR Other connector in the CAN system OR Faulty ECU. **Either measurement less than 1.5 V or greater than 3.5 V:** CAN wiring shorted to ground or voltage OR Another controller in the CAN system is faulty OR Faulty ECU ---1/1

04 160 54

T11 - Excavator Throttle Reference Voltage High



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Excavator Throttle

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

This code will set if:

- The excavator throttle reference voltage to the ECU exceeds 4.2 volts.

If this code sets, the following will occur:

- The ECU will default excavator reference throttle voltage to 2.75 volts.

RG40854,0000094 –19–07DEC01–1/1

T11 - Excavator Throttle Reference Voltage High

RG40854,00000A9 -19-22SEP05-1/1

T11 - Excavator Throttle Reference Voltage High Diagnostic Procedure

NOTE: This diagnostic procedure is only used to diagnose the Excavator Throttle.

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the DST or communication software 4. Read active DTCs and stored DTCs using the DST orSERVICE ADVISOR™. 5. Make a note of any DTCs, then clear all DTCs using the DST orSERVICE ADVISOR™. *NOTE: If DTCs 000029.03 or 000029.04 are active, follow those DTCs first.* 6. Read DTCs using the DST orSERVICE ADVISOR™. • Ignition ON, engine OFF • Ignition ON, engine running	**000028.03 reoccurs when engine is off and running:** GO TO ❸ **000028.03 reoccurs only when engine is running:** GO TO ❹ **000028.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Throttle Reference Wire Test**	*NOTE: For wiring and theory of operation, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect ECU connector. 3. Using a multimeter, measure voltage between terminal F3 in the harness end of the ECU connector and the ground stud of the Pump and Valve controller.	**3.95 V or less:** GO TO ❹ **Greater than 3.95 V:** Short to power in throttle reference wire OR Faulty Pump and Valve controller connector OR Faulty Pump and Valve controller ---1/1
❹ **Ground Test**	*NOTE: For wiring and theory of operation, see T11 - EXCAVATOR THROTTLE REFERENCE VOLTAGE HIGH supporting information.* There is a difference between grounds of the ECU and Pump and Valve controller. Check for loose ground connections at each controller.	---1/1

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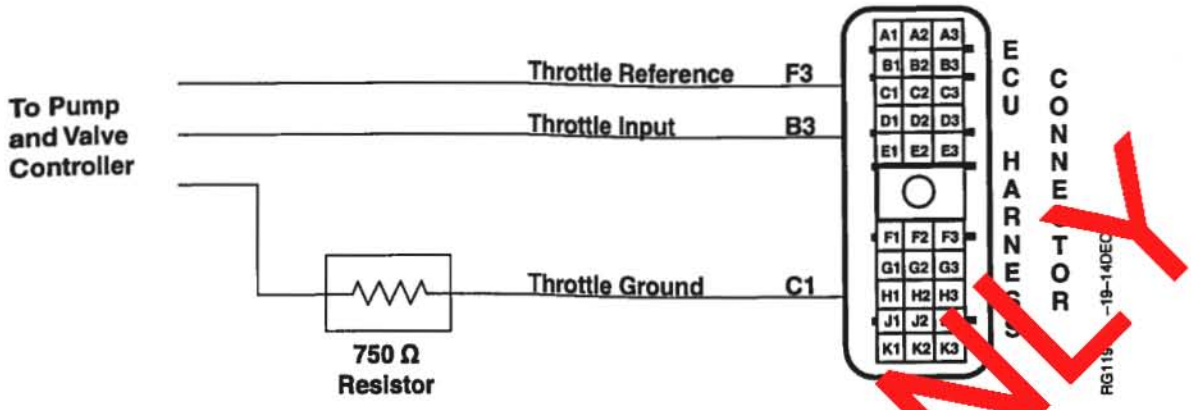
T12 - Excavator Throttle Reference Voltage Low



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Excavator Throttle

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

This code will set if

- The excavator th[illegible]ttle refere[illegible]ce voltage to the ECU goes below 2.7 vo[illegible]

If this [illegible]ode se[illegible]s, the following will occur:

- The EC[illegible] will d[illegible]fault excavator reference throttle voltage to [illegible]5 volts.

RG40854,0000092 -19-07DEC01-1/1

T12 - Excavator Throttle Reference Voltage Low

RG40854,0000091 -19-23SEP05-1/1

T12 - Excavator Throttle Reference Voltage Low Diagnostic Procedure

NOTE: This diagnostic procedure is only used to diagnose the Excavator Throttle.

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF. 3. Start the ECU communication software 4. Read active DTCs and stored DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs. *NOTE: If DTCs 000029.03 or 000029.04 are active, follow those DTCs first.* 6. Read DTCs using the DST orSERVICE ADVISOR™. • Ignition ON, engine OFF • Ignition ON, engine running	**000028.04 reoccurs when engine is off and running:** GO TO ❸ **000028.04 reoccurs only when engine is running:** GO TO ❹ **000028.04 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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---1/1

❸ **Throttle Reference Wire Test**	*NOTE: For wiring and theory of operation, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure voltage between terminal F3 in the harness end of the ECU connector and the ground stud of the Pump and Valve controller.	**3.55 V or greater:** GO TO ❹ **Less than 3.55 V:** Open in throttle reference wire OR Faulty Pump and Valve controller connector OR Faulty Pump and Valve controller ---1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation, see T12 - EXCAVATOR THROTTLE REFERENCE VOLTAGE LOW supporting information.* There is a difference between the grounds of the ECU and Pump and Valve controller. Check for loose ground connections at each controller.	---1/1

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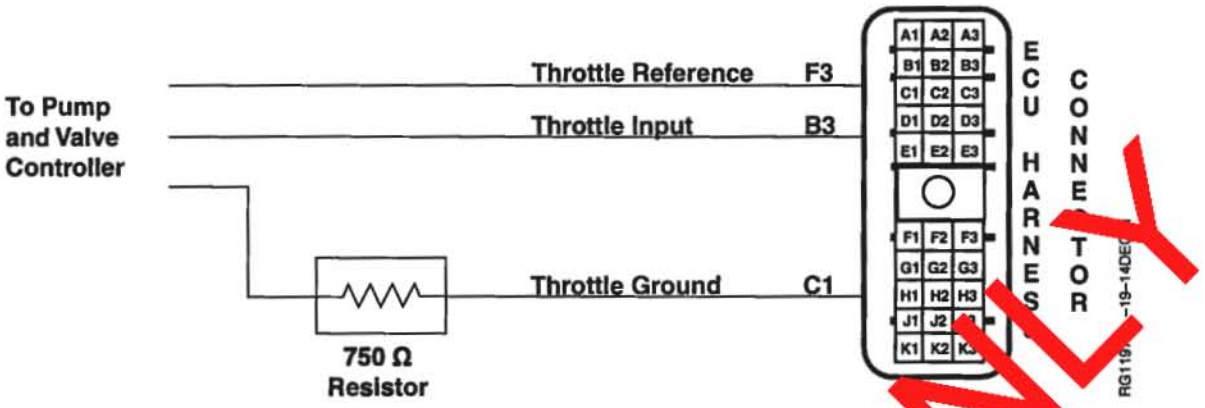
T13 - Excavator Throttle Ground Voltage High



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Excavator Throttle

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

This code will set if

- The excavator th ttle grou l voltage to the ECU exceeds 3.0 volts.

If this c e sets, the following will occur:

- The EC will d ult excavator throttle ground voltage to nts.

RG40854,0000090 –19–07DEC01–1/1

T13 - Excavator Throttle Ground Voltage High

RG40854,00000AA -19-23SEP05-1/1

T13 - Excavator Throttle Ground Voltage High Diagnostic Procedure

NOTE: This diagnostic procedure is only used to diagnose the Excavator Throttle.

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read active DTCs and stored DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs. 6. Read DTCs using the DST orSERVICE ADVISOR™. • Ignition ON, engine OFF • Ignition ON, engine running	**000029.03 reoccurs when engine is off and running:** GO TO ❸ **000029.03 reoccurs only when engine is running:** GO TO ❹ **000029.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.
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❸ **Throttle Ground Wire Test**	*NOTE: For wiring and theory of operation, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Disconnect Pump and Valve controller connector. 4. Using a multimeter, measure resistance between terminal C1 in the harness end of the ECU connector and the corresponding ground terminal of the Pump and Valve controller connector.	**770 ohms or less:** GO TO ❹ **Greater than 770 ohms:** Short to power in throttle ground wire between ECU and 750 ohm resistor OR Open in throt[illegible] ground wire OR Faulty 750 ohm re[illegible]tor OR [illegible]lty ECU connector OR Faulty [illegible]U ---1/1
❹ **Pump and Valve Controller Test**	*NOTE: For wiring and theory of operation, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. ECU connector still disconnected. 3. Using a multimeter, measure resistance between terminal C1 in the harness end of the ECU connector and the [illegible] stud [illegible] the Pump and Valve controller.	**770 ohms or less:** GO TO ❺ **Greater than 770 ohms:** Faulty Pump and Valve controller connector OR Faulty Pump and Valve controller ---1/1
❺ **Ground Test**	*NOTE: For wi[illegible]g and theory of operation, see T13 - EXCAVATOR THROTTLE GROUND VOLTAGE HIGH supporting information.* Th[illegible]s a diffe[illegible]nce between grounds of the ECU and Pump and Valve controller. Chec[illegible]or lo[illegible]e ground connection at each controller.	---1/1

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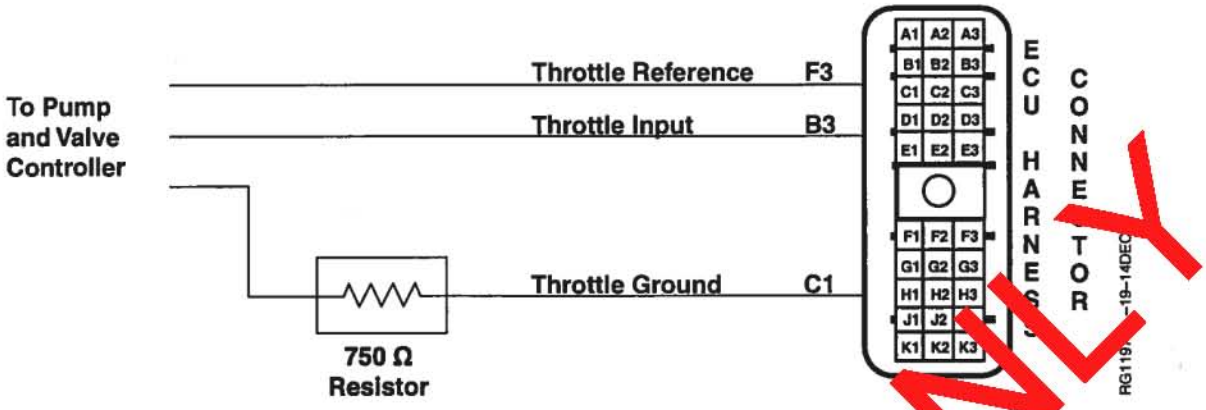
T14 - Excavator Throttle Ground Voltage Low



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Excavator Throttle

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

This code will set if

- The excavator th ttle grou voltage to the ECU goes below 2.0 vo

If this de se s, the following will occur:

- The EC will d fault excavator throttle ground voltage to olts.

RG40854,000008E –19–07DEC01–1/1

T14 - Excavator Throttle Ground Voltage Low

RG40854,00000AB -19-23SEP05-1/1

T14 - Excavator Throttle Ground Voltage Low Diagnostic Procedure

NOTE: This diagnostic procedure is only used to diagnose the Excavator Throttle.

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connector. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read active DTCs and stored DTCs using the DST orSERVICE ADVISOR™. 5. Make notes of any DTCs, then clear all DTCs. 6. Read DTCs using the DST orSERVICE ADVISOR™. • Ignition ON, engine OFF • Ignition ON, engine running	**000029.04 reoccurs when engine is off and running:** GO TO ❸ **000029.04 reoccurs only when engine is running:** GO TO ❹ **000029.04 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Throttle Ground Test**	*NOTE: For wiring and theory of operation, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure resistance between terminal C1 in the harness end of the ECU connector and the corresponding ground terminal of the Pump and Valve controller connector.	**730 ohms or greater:** GO TO ❹ **Less than 730 ohms:** Short to ground in throttle ground wire between ECU and resistor OR Faulty ECU connector OR Faulty ECU ---1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation, see T14 - EXCAVATOR THROTTLE GROUND VOLTAGE LOW supporting information.* There is a difference between grounds of the ECU and Pump and Valve control. Check for loose ground connection at each controller.	---1/1

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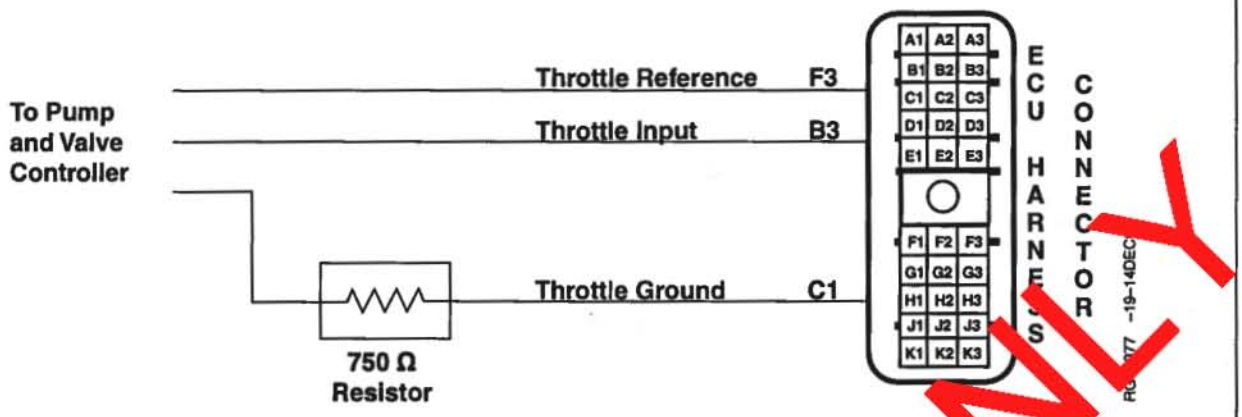
T15 - Excavator Throttle Input Voltage High



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Excavator Throttle

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

This code will set if:

- The excavator throt[illegible] input vo[illegible]age to the ECU exceeds 4.9 volts.

If this cod[illegible] sets, the following will occur:

- The ECU [illegible] use[illegible] default "limp-home" throttle [illegible]lue that wi[illegible]y allow idle engine speed.

RG40854,0000089 -19-07DEC01-1/1

T15 - Excavator Throttle Input Voltage High

RG40854,00000AC -19-23SEP05-1/1

T15 - Excavator Throttle Input Voltage High Diagnostic Procedure

NOTE: This diagnostic procedure is only used to diagnose the Excavator Throttle.

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connector. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the DST communication software Read active DTCs and stored DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs. *NOTE: If DTCs 000029.03 or 000029.04 are active, follow those DTCs first.* 6. Read DTCs using the DST orSERVICE ADVISOR™. • Ignition ON, engine OFF • Ignition ON, engine running	**000091.03 reoccurs when engine is off and running:** GO TO ❸ **000091.03 reoccurs only when engine is running:** GO TO ❹ **000091.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Throttle Signal Wire Test**	*NOTE: For wiring and theory of operation, see T15 - EXCAVATOR THROTTLE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure voltage between terminal B3 in the harness end of the ECU connector and the ground pin of the Pump and Valve controller.	**4.0 V or less:** GO TO ❹ **Greater than 4.0 V:** Short to power in throttle signal wire OR Faulty Pump and Valve controller connecto OR Faulty Pum[illegible] Va[illegible]e controller – –1/1
❹ **Ground Test**	*NOTE: For wiring and theory of operation, see T15 - EXCAVATOR THROTTLE INP[illegible] VOLTAGE HIGH supporting information.* There is a difference between grounds of the ECU and Pump and Valve c[illegible]ntroller. Check for loose ground connection at each controller.	– – –1/1

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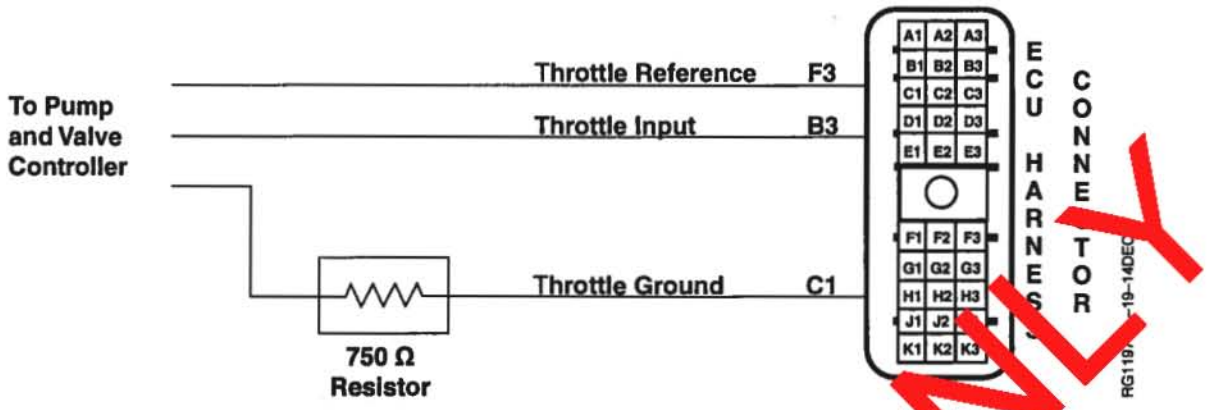
T16 - Excavator Throttle Input Voltage Low



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Excavator Throttle

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

This code will set if

- The excavator th ttle input oltage to the ECU goes below 0.1 volts.

If this de s s, the following will occur:

- The EC will e a default "limp-home" throttle value that only allow idle engine speed.

RG40854,0000088 –19–07DEC01–1/1

T16 - Excavator Throttle Input Voltage Low

RG40854,00000AD -19-23SEP05-1/1

T16 - Excavator Throttle Input Voltage Low Diagnostic Procedure

NOTE: This diagnostic procedure is only used to diagnose the Excavator Throttle.

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connector. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector, throttle sensor connector, and any connectors in between them. Look for dirty, damaged or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		--1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs *NOTE: If DTCs 000029.03 or 000029.04 are active, follow those DTCs first.* 6. Read DTCs using the DST orSERVICE ADVISOR™. • Ignition ON, engine OFF • Ignition ON, engine running	**000091.04 reoccurs when engine is off and running:** GO TO ❸ **000091.04 reoccurs only when engine is running:** GO TO ❹ **000091.04 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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---1/1

❸ **Throttle Signal Wire Test**	*NOTE: For wiring and theory of operation, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure voltage between terminal B3 in the harness end of the ECU connector and the ground pin of the Pump and Valve controller.	**1.0 V or greater:** GO TO ❹ **Less than 1.0 V:** Open in throttle signal wire OR Faulty Pump and Valve controller connector OR Faulty Pump and Valve controller ---1/1

❹ **Ground Test**	*NOTE: For wiring and theory of operation, see T16 - EXCAVATOR THROTTLE INPUT VOLTAGE LOW supporting information.* There is a difference between grounds of the ECU and Pump and Valve controller. Check for loose ground connection at each controller.	---1/1

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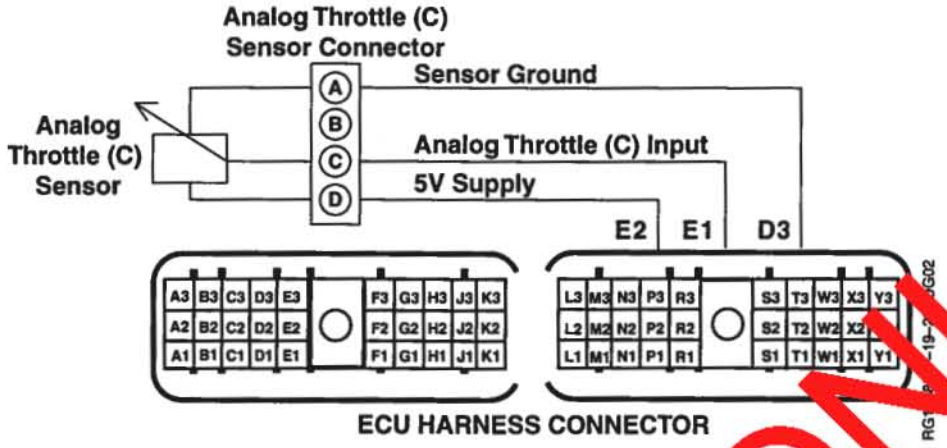
T17 - Analog Throttle (C) Input High



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Analog Throttle (C) Position Sensor

- The analog throttle (C) position sensor is a variable resistor (potentiometer) used to measure the position of the cruise throttle for Tractor applications. The throttle input voltage normally varies between 0.75 and 4.25 volts depending on throttle position.

This code will set if:

- The analog throttle (C) input voltage exceeds the 4.7 volts. The voltage is higher than what is physically possible for the cruise analog throttle to achieve.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,0000110 –19–12AUG02–1/1

T17 - Analog Throttle (C) Input High

RG40854,0000111 -19-23SEP05-1/1

T17 - Analog Throttle (C) Input High Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connector. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.* Perform a preliminary inspection of ECU connectors and the analog throttle (C) sensor connector looking for dirty, damaged, or poorly positioned terminals.	**No faulty connections:** GO TO ❷ **Faulty connections:** Repair faulty connection(s).
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the diagnostic communication software 4. Throttle (C) in the idle position 5. Read the analog throttle (C) voltage parameter on the DST orSERVICE ADVISOR™.	**4.7 V or greater:** GO TO ❹ **Below 4.7 V:** GO TO ❸

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❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.* Read the analog throttle (C) voltage parameter while slowly operating the analog throttle (C) through full travel	**Goes above 4.7 V:** Faulty analog throttle (C) sensor connector OR Open in analog throttle (C) sensor ground circuit OR Faulty analog throttle (C) sensor **Never goes above 4.7 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group ---1/1
❹ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.* 1. Ignition OFF 2. Disconnect analog throttle sensor connector 3. Ignition ON, engine OFF 4. Read the analog throttle (C) voltage parameter	**0.3 V or less:** GO TO ❺ **Above 0.3 V:** Short to voltage in analog throttle input circuit OR Faulty ECU ---1/1
❺ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see T17 - ANALOG THROTTLE (C) INPUT HIGH supporting information.* 1. Ignition OFF 2. Analog throttle (C) sensor connector disconnected 3. Using a test light connected to battery (+), probe the ground terminal in analog throttle (C) sensor harness connector	**Light ON:** Faulty analog throttle (C) sensor connector OR Faulty analog throttle (C) sensor **Light OFF:** Open in analog throttle (C) ground circuit ---1/1

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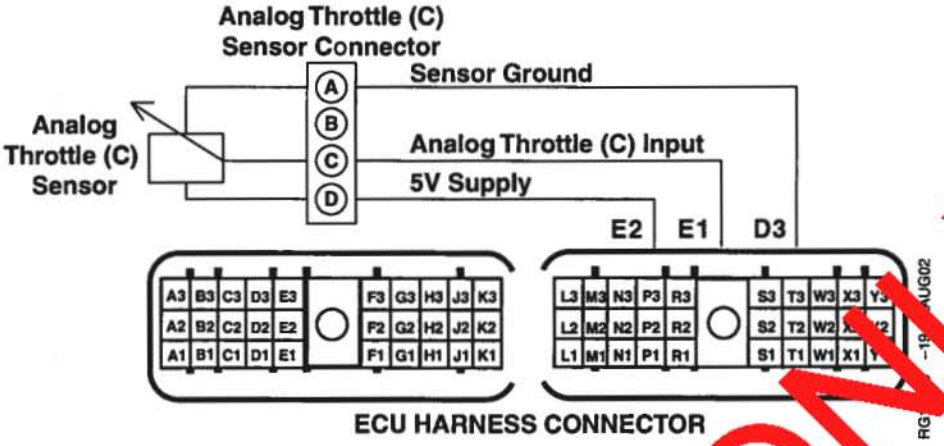
T18 - Analog Throttle (C) Input Low



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Analog Throttle (C) Position Sensor

- The analog throttle (C) position sensor is a variable resistor (potentiometer) used to measure the position of the cruise throttle for Tractor applications. The throttle input voltage normally varies between 0.75 and 4.25 volts depending on throttle position.

This code will set if:

- The analog throttle (C) input voltage exceeds the 4.7 volts. The voltage is higher than what is physically possible for the cruise analog throttle to achieve.

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the analog throttle, and will use the input values from another throttle.
- If the analog throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

RG40854,0000112 –19–12AUG02–1/1

T18 - Analog Throttle (C) Input Low

RG40854,0000113 -19-23SEP05-1/1

T18 - Analog Throttle (C) Input Low Diagnostic Procedure

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connector. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.* Perform a preliminary inspection of ECU connectors and the analog throttle (C) sensor connector looking for dirty, damaged, or poorly positioned terminals.	**No faulty connections:** GO TO ❷ **Faulty connections:** Repair faulty connection(s).
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.* 1. Connect to the DST SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Throttle (C) in the idle position 5. Read the analog throttle (C) voltage parameter	**0.3 V or less:** GO TO ❹ **Above 0.3 V:** GO TO ❸
		---1/1

❸ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.* Read the analog throttle (C) voltage parameter while slowly operating the analog throttle (C) through full travel	**Goes below 0.3 V:** Faulty analog throttle (C) sensor connector OR Open in analog throttle (C) sensor ground circuit OR Faulty analog throttle (C) sensor **Never goes below 0.3 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this group ---1/1
❹ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.* 1. Ignition OFF 2. Disconnect analog throttle (C) sensor connector 3. Install a jumper wire between the 5 V supply terminal and the input terminal in the harness side of the sensor connector 4. Ignition ON, engine OFF 5. Read the analog throttle (C) voltage parameter	**Below 4.7 V:** GO TO ❺ **4.7 V or greater:** Faulty analog throttle (C) sensor connector OR Faulty analog throttle sensor ---1/1
❺ **Throttle Position 5 V Supply Test**	*NOTE: For wiring and theory of operation, see T18 - ANALOG THROTTLE (C) INPUT LOW supporting information.* 1. Ignition OFF 2. Remove jumper wire between the two terminals 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between the throttle ground terminal and the 5 V supply terminal in the sensor harness connector	**4.0 - 6.0 V:** Open in analog throttle (C) input circuit OR Short to ground in analog throttle (C) input circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** 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 ---1/1

T19 - Throttle Not Calibrated Properly

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.

This code will set if:

- The ECU detects an improper throttle calibration range.

If this code sets, the following will occur:

- Throttle position will not match percent throttle.

If this code sets:

- Diagnose other DTCs first.
- If no other DTCs are found, perform throttle sensor diagnostics.
  - **For 310G Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1885.
  - **For 310SG/315SG Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1883.

RG40854,0000118 -19-28JAN02-1/1

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T20 - Throttle Input Voltage Below Lower Calibration Limit

Throttle Calibration

Throttle calibration is necessary to allow the ECU to learn the range of the throttle. It is performed when a new ECU or a new throttle has been installed.

This code will set if:

- The ECU detects a throttle input voltage lower than the defined low calibration limit.

If this code sets, the following will occur:

- Throttle position will not match percent throttle.

If this code sets:

- Diagnose other DTCs first.
- If no other DTCs are found, perform throttle sens diagnostics.
  - **For 310G Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM18
  - **For 310SG/315SG Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9 Group 20 of TM1883.

RG40854,000011F -19-28JAN02-1/1

T21 - Throttle Calibration Aborted

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.

This code will set if:

- Throttle calibration mode was enabled but was aborted before it was completed.

If this code sets, the following will occur:

- Throttle position will not match percent throttle.

If this code sets:

- Diagnose other DTCs first.
- If no other DTCs are found, perform throttle sensor diagnostics.
  - **For 310G Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1125.
  - **For 310SG/315SG Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1883.

RG40854,000011E -19-28JAN02-1/1

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T22 - Analog Throttle (A) Input Voltage Out of Range

Analog Throttle Sensor

The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle. The ECU has the ability to learn different voltages for low and high idle, so the voltage range may change per application.

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This code will set if:

- The ECU detects a high or low out of range analog throttle (A) input voltage.

If this code sets, the following will occur:

- For engines with only one throttle, the ECU will not read the input of the throttle and run the engine at low idle.
- For engine with multiple throttles, the ECU will not read the input of the faulty throttle, so the ECU run entirely off of the other throttle.

If this code sets:

- Diagnose other DTCs first.
- If no other DTCs are found, perform throttle sensor diagnostics.
  - **For 310G Backhoe Loader**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1885.
  - **For 310SG/315SG Backhoe Loaders**, see THROTTLE POSITION SENSOR TEST (S.N. XXXXXX—) in Section 9015, Group 120 of TM1883.
- Check for other throttle DTCs. Diagnose those first.
- Return throttle to 0% throttle position
- Some applications require key OFF/restart cycle to clear the code.

RG40854,000011D -19-28JAN02-1/1

T23 - Multi-state Throttle Input Voltage Out of Range

Multi-state Throttle Switch

- Multi-state throttle is composed of an idle switch that allows engine speed to be at high or low idle. On some applications, there is a bump up and a bump down feature. This allows for high and low idle to be controlled.
- On certain applications, an additional throttle is used in addition to the multi-state throttle. If the desired engine speed of the additional throttle is greater than the multi-state throttle, the multi-state throttle will be overridden. When the desired engine speed of the multi-state throttle is greater than the additional throttle, the multi-state throttle will be in total control.

This code will set if:

- The ECU detects a high or low out of range multi-state throttle input voltage.

If this code sets, the following will occur:

- The engine will not run if this code is active.

If this code sets:

- Check to see if DTC 000091.03 or 4 is active. Diagnose those first.
- Return throttle to 0% throttle position

RG40854,000011C –19–28JAN02–1/1

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000028.03 — Throttle Voltage High

Throttle voltage is above the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Excavator	T11 - Excavator Throttle Reference Voltage High
OEM	T5 - Analog Throttle (B) Input High
Tractors	T17 - Analog Throttle (C) Input High

RG41221,00000CE –19–22JAN03–1/1

000028.04 — Throttle Voltage Low

Throttle voltage is below the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Excavator	T12 - Excavator Throttle Reference Voltage Low
Tractor	T18 - Analog Throttle (C) Input Low

RG41221,00000CF –19–22JAN03–1/1

000029.03 — Throttle Voltage High

Throttle voltage is above the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Excavator	T13 - Excavator Throttle Ground Voltage High
Forwarder	T5 - Analog Throttle (B) Input High
OEM	T3 - Analog Throttle (A) Input High
Skidder	T1 - Multi-state Throttle Input High
Tractor	T5 - Analog Throttle (B) Input High

RG41221,00000D0 –19–22JAN03–1/1

000029.04 — Throttle Voltage Low

Throttle voltage is below the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Excavator	T14 - Excavator Throttle Ground Voltage Low
Forwarder	T6 - Analog Throttle (B) Input Low
OEM	T4 - Analog Throttle (A) Input Low
Skidder	T2 - Multi-state Throttle Input Low
Tractor	T6 - Analog Throttle (B) Input Low

RG41221,00000D1 –19–22JAN03–1/1

000029.14 — Throttle Voltage Out of Rang

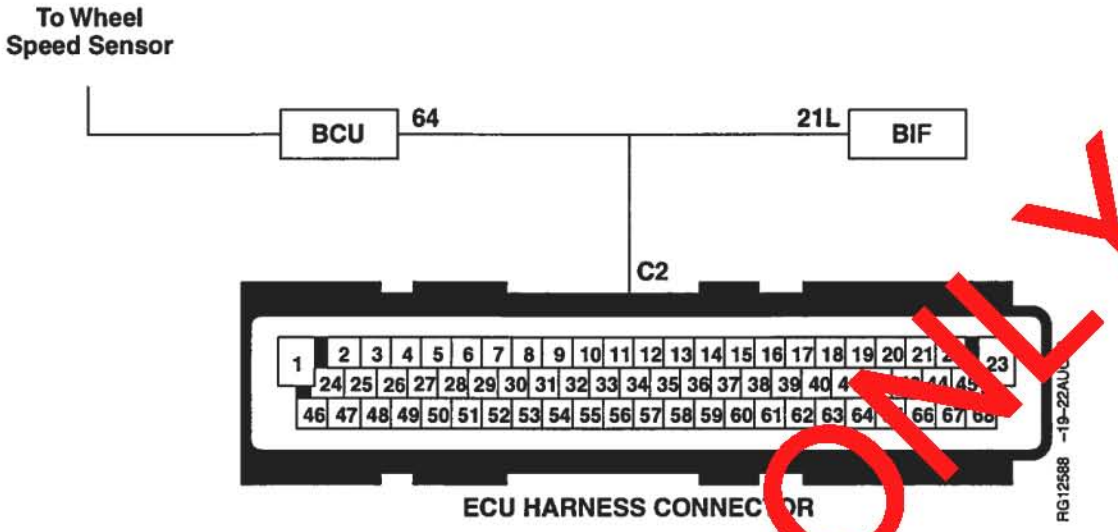
Throttle voltage is out of range.

Diagnostic Trouble Codes (DTCs) as[illegible]d to t[illegible]ttles change per application. Choos[illegible]the app[illegible]cation from the list below and go to the cor[illegible]spond[illegible]g dia[illegible]ostic procedure.

Application	Diag[illegible]tic Procedure
Skidder	T23 - Multi-state Throttle Input Voltage Out of Range

RG41221,00000D2 –19–22JAN03–1/1

000084.31 — Vehicle Speed Mismatch



ECU HARNESS CONNECTOR

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NOTE: Wiring schematic shows limited information. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Vehicle Speed

- The wheel speed sensor is an inductive type sensor that is mounted on the rear axle. As teeth on t 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). Th

BCU sends a Pulse Width Modulated (PWM) signal to the Basic Informator (BIF) and ECU. Wheel speed is also delivered to the ECU over CAN from the BIF. Both inputs to the ECU must be the same.

DTC 000084.31 will set if:

The wheel speed from the BCU (PWM signal) and the BIF (CAN) do not match at the ECU.

If DTC 000084.31 sets, the following will occur:

- Engine performance may be affected slightly.

RG40854,0000114 –19–12AUG02–1/1

000084.31 — Vehicle Speed Mismatch

The wheel speed from the BCU (PWM signal) and the BIF (CAN) do not match at the ECU.

000084.31 Vehicle Speed Mismatch Diagnostic Procedure

NOTE: If DTC 001069.31 occurs with DTC 000084.31, diagnose DTC 001069.31 first.

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❶ **Connection Check**	*NOTE: For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH supporting information.* Perform a preliminary inspection of ECU connectors, BIF, and BCU connectors looking for dirty, damaged, or poorly positioned terminals.	**No faulty connections:** GO TO ❷ **Faulty connections:** Repair faulty connection(s). ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of all DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**000084.31 reoccurs:** GO TO ❸ **000084.31 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **CAN Vehicle Speed Check**	*NOTE: For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH supporting information.* 1. Drive vehicle under normal operating conditions 2. Read the CAN vehicle speed parameter	**Greater than 0 km/hr (0 mph):** GO TO ❺ **0 km/hr (0 mph):** GO TO ❹ ---1/1

❹ **BCU to BIF PWM Wire Check**	*NOTE: For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH supporting information.* 1. Ignition OFF 2. Disconnect BCU connector and BIF connector. 3. Using multimeter, measure resistance between terminal 64 on the BCU connector and terminal 21L on the BIF connector.	**5 ohms or less:** Possible CAN error - follow vehicle CAN diagnostic procedure **Greater than 5 ohms:** Open in wheel speed sensor wire between BCU and BIF wire. ---1/1
❺ **Calculated Vehicle Speed Check**	*NOTE: For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH supporting information.* 1. Drive vehicle under normal operating conditions 2. Read the calculated vehicle speed parameter	**Greater than 0 rpm:** Tire size misprogrammed in BIF **0 rpm:** GO TO ❻ ---1/1
❻ **BCU to ECU PWM Wire Check**	*NOTE: For wiring and theory of operation, see DTC 000084.31 VEHICLE SPEED MISMATCH supporting information.* 1. Ignition OFF 2. Disconnect ECU connector and BCU connector. 3. Using multimeter, measure resistance between terminal D2 of ECU connector and terminal 64 of BCU connector.	**5 ohms or less:** Faulty ECU connector OR Faulty ECU **Greater than 5 ohms:** Open in wheel speed sensor wire between ECU and BCU. ---1/1

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000091.03 — Throttle Voltage High

Throttle voltage is above the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Backhoe	T3 - Analog Throttle (A) Input High
Crawler	T3 - Analog Throttle (A) Input High
Excavator	T15 - Excavator Throttle Signal Voltage High
Forwarder	T3 - Analog Throttle (A) Input High
OEM	T1 - Multi-state Throttle Input High
Skidder	T3 - Analog Throttle (A) Input High
Telehandler	T3 - Analog Throttle (A) Input High
Tractor	T3 - Analog Throttle (A) Input High

RG41221,00000D3 -19-22JAN03-1/1

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000091.04 — Throttle Voltage Low

Throttle voltage is below the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Backhoe	T4 - Analog Throttle (A) Input Low
Crawler	T4 - Analog Throttle (A) Input Low
Excavator	T16 - Excavator Throttle Signal Voltage Low
Forwarder	T4 - Analog Throttle (A) Input Low
OEM	T2 - Multi-state Throttle Input Low
Skidder	T4 - Analog Throttle (A) Input Low
Telehandler	T4 - Analog Throttle (A) Input Low
Tractor	T4 - Analog Throttle (A) Input Low

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160
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RG41221,00000D4 –19–22JAN03–1/1

000091.07 — Throttle Calibration Invalid

The ECU detects an improper throttle calibration range.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Crawler	T19 - Throttle Not Calibrated Properly

RG41221,00000D5 –19–22JAN03–1/1

000091.10 — Throttle Voltage Low

The throttle voltage is below the defined low calibration limit.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Crawler	T20 - Throttle Input Voltage Below Lower Calibration Limit

RG41221,00000D6 –19–22JAN03–1/1

000091.13 — Throttle Calibration Aborted

Throttle calibration aborted before it was completed.

Diagnostic Trouble Codes (DTCs) assigned to t[illegible] change per application. Choose the applic[illegible]on fro[illegible] the list below and go to the corresponding d[illegible]gnost[illegible] procedure.

Application	Di[illegible]gnosti[illegible] Proce[illegible]
Crawler	[illegible] - Th[illegible]libration Aborted

RG41221,00000D7 –19–22JAN03–1/1

000091.14 — Throttle Voltage Out of Range

Throttle voltage is above or below the specification.

Diagnostic Trouble Codes (DTCs) assigned to throttles change per application. Choose the application from the list below and go to the corresponding diagnostic procedure.

Application	Diagnostic Procedure
Backhoe	T22 - Analog Throttle (A) Input Voltage Out of Range
Crawler	T22 - Analog Throttle (A) Input Voltage Out of Range
Skidder	T22 - Analog Throttle (A) Input Voltage Out of Range

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RG41221,00000D8 –19–22JAN03–1/1

000097.00 — Water in Fuel Continuou... Detected

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

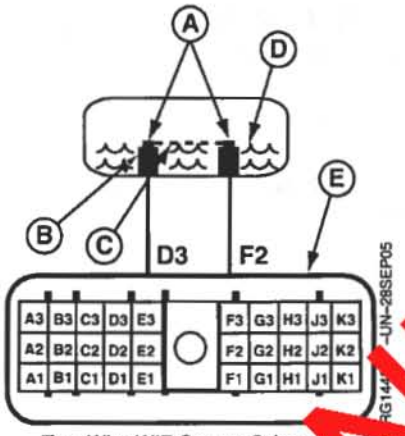
Water in Fuel (WIF) Sensor

Continued on next page

DB92450,000001A –19–04OCT05–1/3

- **Two-Wire**

The water in fuel sensor consists of two electrodes (A) (in the bottom of the bowl of the final fuel filter) and a resistor (internal to the ECU (E)) in parallel with the electrodes. Diesel fuel is a very poor conductor of electricity, compared to water, and while only fuel is present in the bowl, WIF analog signal passes through the resistor. While in a no-WIF state, ECU senses only normal WIF analog signal (F2) demand. When water displaces fuel at the bottom of the bowl, above the level (D) of the WIF electrode insulation (B), current passes across WIF sensor electrodes (C), ECU senses a greater WIF analog signal demand (from across ECU contacts F2 and D3), and ECU causes either engine derate or shut down.



Two-Wire WIF Sensor Schema

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DB92450,000001A -19-04OCT05-2/3

- **Three-Wire (OEM Marine Only)**

With no water in the bowl at the bottom of the filter canister, the WIF circuit switch (internal to the ECU) pulls the circuit to +5 volts. When water is in the bowl, WIF sensor causes the WIF circuit to pull to ground.

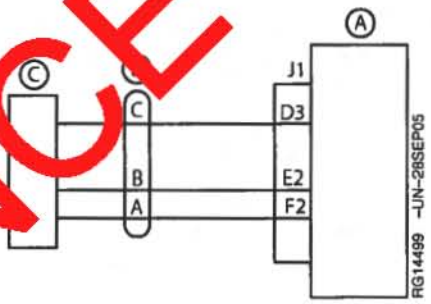
DTC 000097.00 will set it:

- water is present in the bottom of the bowl of the final fuel filter, up to the level of the uninsulated WIF sensor electrodes.

If DTC 000097.00 sets, the following occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.

- With Derate Feature: The engine is derated to 80% of total power. The rate at which the engine is derated varies between applications.
- Other: Engine is shut down.



Three-Wire WIF Sensor Schematic

D3—Signal Return
E2—Excitation Voltage
F2—WIF Signal Input
J1—ECU Harness Connector
A—ECU
B—WIF Sensor Connector
C—WIF Sensor

DB92450,000001A -19-04OCT05-3/3

000097.00 — Water in Fuel Continuously Detected Diagnostic Procedure

The WIF limit is above a predetermined quantity for an extended period of time..

Water in Fuel Continuously Detected Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes in to connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information.* Perform a preliminary inspection of the ECM connectors and the WIF sensor connector looking for dirty, damaged, or pushed out terminals.	**No faulty connection(s):**GO TO ❷. **Faulty Connection(s):**Repair faulty connection(s). ---1/1
❷ **Moisture Buildup Test**	*NOTE: For wiring and theory of operation, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, entine OFF 3. Start the ECU diagnostic software 4. Drain sediment bowl on the bottom of the primary fuel filter, until all the water is out. 5. Operate engine in normal use 6. Read DTCs on the DST or SERVICE ADVISOR	**000097.00 reoccurs:**GO TO ❸ **000097.00 doesn't reoccur:**Problem most likely caused by moisture build up over time. Monitor the seciment bowl for moisture periodically, drain as needed. ---1/1

❸ **Water in Fuel (WIF) Circuit and Sensor Test**	*NOTE: For wiring and theory of operation, see DTC 000097.00 WATER IN FUEL CONTINUOUSLY DETECTED supporting information.* **Check the following items that can cause water in the fuel:** • Poor fuel quality or water in fuel storage tank • Loose fuel tank cap • Missing or damaged fuel tank cap seal • Excessive condensation buildup in fuel tank • Loose or damaged fuel filter or sediment bowl	**Cause of water in fuel located:** Repair problem, drain sediment bowl, and retest **No cause of water in fuel located:** Verify that WIF sensor input and ground circuits are OK. If WIF sensor circuits are OK, replace WIF sensor and retest. ---1/1

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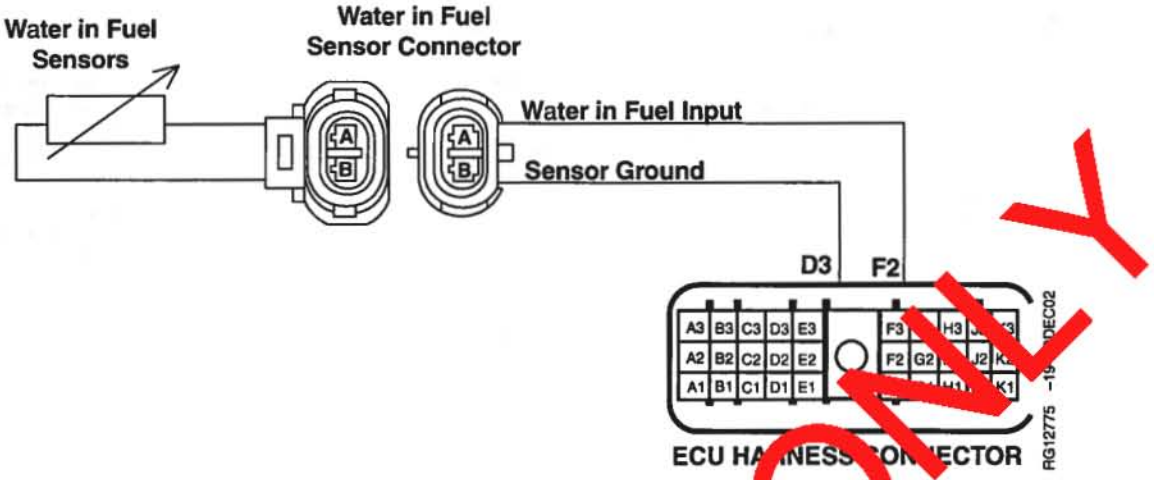
000097.03 — Water in Fuel Signal Voltage High



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Water in Fuel (WIF) Sensor

- The water in fuel sensor consists of two electrodes in the bottom of the bowl of the final fuel filter and a 200-kilohm resistor, in parallel with the electrodes. Diesel fuel is a very poor conductor of electricity, compared to water, and while only fuel is present in the bowl, virtually all current passes through the resistor. This causes ECU to sense only a nominal, constant current demand. But when water displaces fuel at the bottom of the bowl, resistance across the electrodes becomes significantly less than across the resistor, and additional current passes through the water across the electrodes. This causes ECU to detect a greater current demand, which denotes a shuts down the engine.

DTC 000097.03 will set if:

- The WIF input voltage exceeds the sensor's high voltage specification. This voltage corresponds to an amount of water in fuel that is not possible.
  - For OEM applications, the high WIF input voltage specification is 5.6 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for the high WIF input voltage specification.

DTC 000097.03 sets, the following will occur:

- ECU's WIF engine protection feature disabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.

RG40854,0000002 –19–27JUL05–1/1

000097.03 — Water in Fuel Signal Voltage High

The WIF input voltage exceeds the sensor's high voltage specification. The voltage corresponds to an amount of water in fuel that is not possible.

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000097.03 Water In Fuel Signal Voltage High Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information.* Perform a preliminary inspection of ECU connectors and the WIF sensor connector looking for dirty, damaged or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty Connections:** Repair faulty connection(s).
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information.* 1. Connect the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine OFF 6. Read DTCs using the DST orSERVICE ADVISOR™.	**000097.03 reoccurs:** GO TO ❸ **000097.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **WIF Sensor Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect WIF sensor connector. 3. Install a jumper wire between both terminals in the WIF sensor connector on the engine harness. 4. Make note of all DTCs, then clear all DTCs 5. Ignition ON, engine OFF 6. Using the ECU diagnostic software, read DTCs	**000097.03 reoccurs:** GO TO ❹ **000097.04 occurs:** Faulty WIF sensor connector OR Faulty WIF sensor ---1/1

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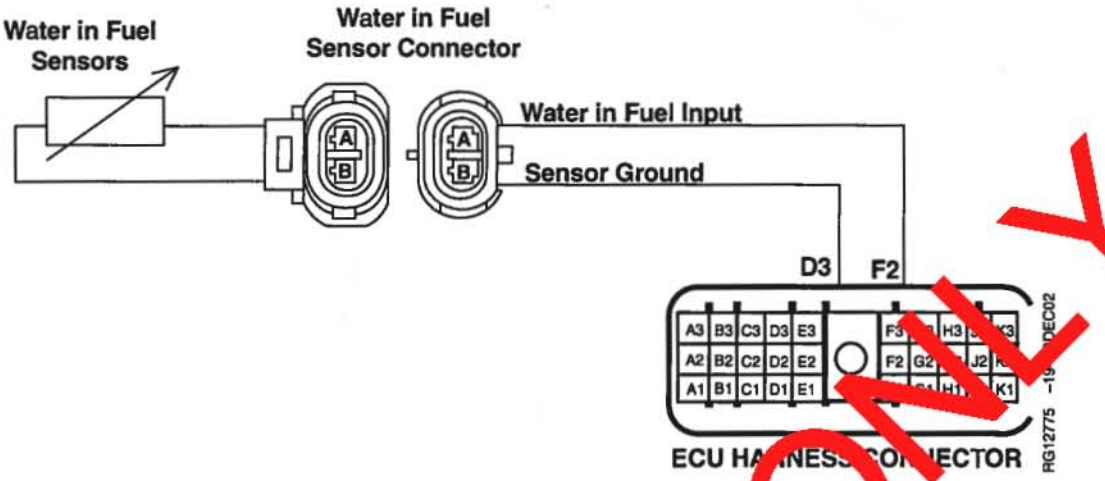
❹ **WIF Input Open Test**	*NOTE: For wiring and theory of operation, see DTC 000097.03 WATER IN FUEL SIGNAL VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Remove jumper wire between both terminals. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between WIF input terminal (terminal A) in the sensor connector on the engine harness and a good chassis ground.	**4.0 - 6.0 volts:** Open in WIF sensor ground circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 volts:** Open in WIF sensor input circuit OR Faulty ECU connection OR Faulty ECU ---1/1

000097.04 — Water in Fuel Signal Voltage Low



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Water in Fuel (WIF) Sensor

- The water in fuel sensor consists of two electrodes in the bottom of the bowl of the final fuel filter and a 200-kilohm resistor, in parallel with the electrodes. Diesel fuel is a very poor conductor of electricity, compared to water, and while only fuel is present in the bowl, virtually all current passes through the resistor. This causes ECU to sense only a nominal, constant current demand. But when water displaces fuel at the bottom of the bowl, resistance across the electrodes becomes significantly less than across the resistor, and additional current passes through the water across the electrodes. This causes ECU to detect a greater current demand, which dictates ECU shuts down the engine.

DTC 000097.04 will set if:

- The WIF input voltage drops below the sensor's low voltage specification. The voltage corresponds to an amount of water in fuel that is not possible.
  - For OEM applications, the low WIF input voltage specification is 0.5 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for the low WIF input voltage specification.

If DTC 000097.04 sets, the following will occur:

- ECU's WIF engine protection feature disabled.

RG40854,0000004 –19–04SEP02–1/1

000097.04 — Water in Fuel Signal Voltage Low

The WIF input voltage drops below the sensor's low voltage specification. The voltage corresponds to an amount of water in fuel that is not possible.

000097.04 Water In Fuel Signal Voltage Low Diagnostic Procedure

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL SIGNAL VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connectors and the WIF sensor connector looking for dirty, damaged or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty Connections:** Repair faulty connection(s).
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL SIGNAL VOLTAGE LOW supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine OFF 6. Read DTCs using the DST orSERVICE ADVISOR™.	**000097.04 reoccurs:** GO TO ❸ **000097.04 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **WIF Sensor Test**	*NOTE: For wiring and theory of operation, see DTC 000097.04 WATER IN FUEL SIGNAL VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect WIF sensor connector. 3. Make note of all DTCs, then clear all DTCs. 4. Ignition ON engine OFF 5. Using the ECU diagnostic software, read DTCs	**000097.04 reoccurs:** Short to ground in WIF sensor input circuit OR Faulty ECU **000097.03 occurs:** Faulty WIF sensor ---1/1

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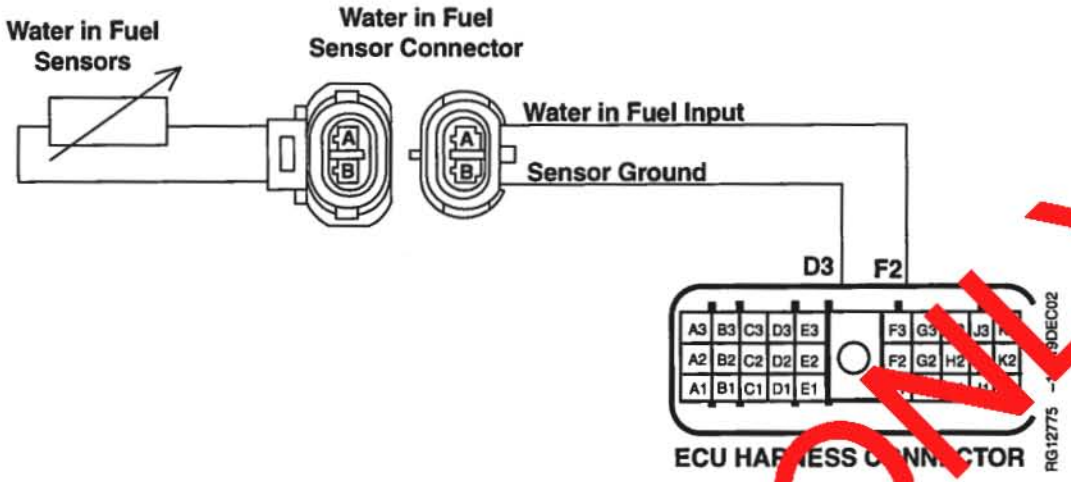
000097.16 — Water in Fuel Detected



Water in Fuel (WIF) Sensor

- The water in fuel sensor consists of two electrodes in the bottom of the bowl of the final fuel filter and a 200-kilohm resistor, in parallel with the electrodes. Diesel fuel is a very poor conductor of electricity, compared to water, and while only fuel is present in the bowl, virtually all current passes through the resistor. This causes ECU to sense only a nominal, constant current demand. But when water displaces fuel at the bottom of the bowl, resistance across the electrodes becomes significantly less than across the resistor, and additional current passes through the water across the electrodes. This causes ECU to detect a greater current demand, which derates or shuts down the engine.

DTC 000097.16 will set if:

- The WIF sensor above a predetermined quantity at any given time.

If DTC 000097.16 sets, the following will occur:

- Engine protection be enabled.

RG40854,0000006 -19-04SEP02-1/1

000097.16 — Water in Fuel Detected

The WIF is above a predetermined quantity at any given time.

000097.16 Water In Fuel Detected Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see DTC 000097.16 WATER IN FUEL DETECTED supporting information.* Perform a preliminary inspection of ECU connectors and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty Connections:** Repair faulty connection(s).
❷ **Moisture Buildup Test**	*NOTE: For wiring and theory of operation, see DTC 000097.16 WATER IN FUEL DETECTED supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of all DTCs, then clear all DTCs. 5. Drain sediment bowl on the bottom of the primary fuel filter until all the water is out. 6. Operate engine in normal use. 7. Read DTCs using the DST orSERVICE ADVISOR™.	**000097.16 reoccurs:** GO TO ❸ **000097.16 does not reoccur:** Problem is was most likely caused by moisture buildup over time. Monitor the sediment bowl for moisture periodically, drain as needed.

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❸ **WIF Circuit and Sensor Test**	*NOTE: For wiring and theory of operation, see DTC 000097.16 WATER IN FUEL DETECTED supporting information.* Check the following items that can cause water in the fuel: • Poor fuel quality or water in fuel storage tank. • Loose fuel tank cap. • Missing or damaged fuel tank cap seal. • Excessive condensation build up in fuel tank. • Loose or damaged fuel filter or sediment bowl.	**Cause of water in fuel located:** Repair problem, drain sediment bowl, and retest. **No cause of water in fuel located:** Verify that WIF sensor input and ground circuits are OK. If WIF sensor circuits are OK, replace WIF sensor and retest. ---1/1

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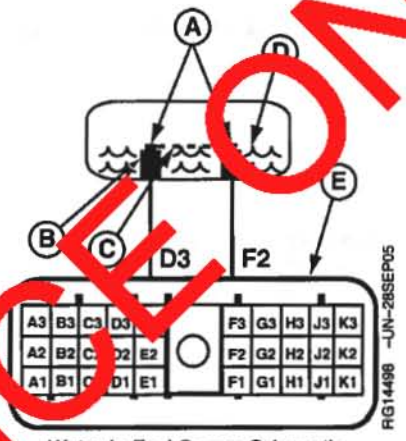
000097.31 — Water in Fuel Detected (750J Crawler Only)

Water in Fuel (WIF) Sensor

- The water in fuel sensor enables ECU (E) to detect water in fuel. When this happens, ECU either derates or shuts down the engine, depending on the option selected. For more WIF information, see Theory of Operation, Section 03, Group 140, earlier in this CTM.



Water In Fuel Sensor Schematic

DTC 000097.31 will set it:

- Water has been detected in the separator bowl.

If DTC 000097.31 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 40 of this manual.

- With Derate Feature: The engine is derated to 40% of total power, at the rate of 20 % per minute. Shutdown and override options are not available with this DTC.

DB92450,000001B –19–04OCT05–1/1

000097.31 — Water in Fuel Detected (750J Crawler Only)

The WIF is above a predetermined quantity at any given time.

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Water in Fuel Detected (750J Crawler Only) Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see DTC 000097.31 WATER IN FUEL DETECTED (750J Crawler Only) supporting information.* Perform a preliminary inspection of the ECU connectors and the WIF sensor connector looking for dirty, damaged or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty Connections:** Repair faulty connection(s).
❷ **Moisture Buildup Test**	*NOTE: For wiring and theory of operation, see DTC 000097.31 WATER IN FUEL DETECTED (750J Crawler Only) supporting information.* 1. Connect to the DST orSERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of all DTCs, then clear all DTCs. 5. Drain sediment bowl on the bottom of the primary fuel filter until all the water is out. 6. Operate engine in normal use. 7. Read DTCs using the DST orSERVICE ADVISOR™.	**000097.31 reoccurs:** GO TO ❸ **000097.31 does not reoccur:** Problem is was most likely caused by moisture buildup over time. Monitor the sediment bowl for moisture periodically, drain as needed.

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❸ **WIF Circuit and Sensor Test**	*NOTE: For wiring and theory of operation, see DTC 000097.31 WATER IN FUEL DETECTED (750J Crawler Only) supporting information.* Check the following items that can cause water in the fuel: • Poor fuel quality or water in fuel storage tank. • Loose fuel tank cap. • Missing or damaged fuel tank cap seal. • Excessive condensation build up in fuel tank. • Loose or damaged fuel filter or sediment bowl.	**Cause of water in fuel located:** Repair problem, drain sediment bowl, and retest. **No cause of water in fuel located:** Verify that WIF sensor input and ground circuits are OK. If WIF sensor circuits are OK, replace WIF sensor and retest. –1/1

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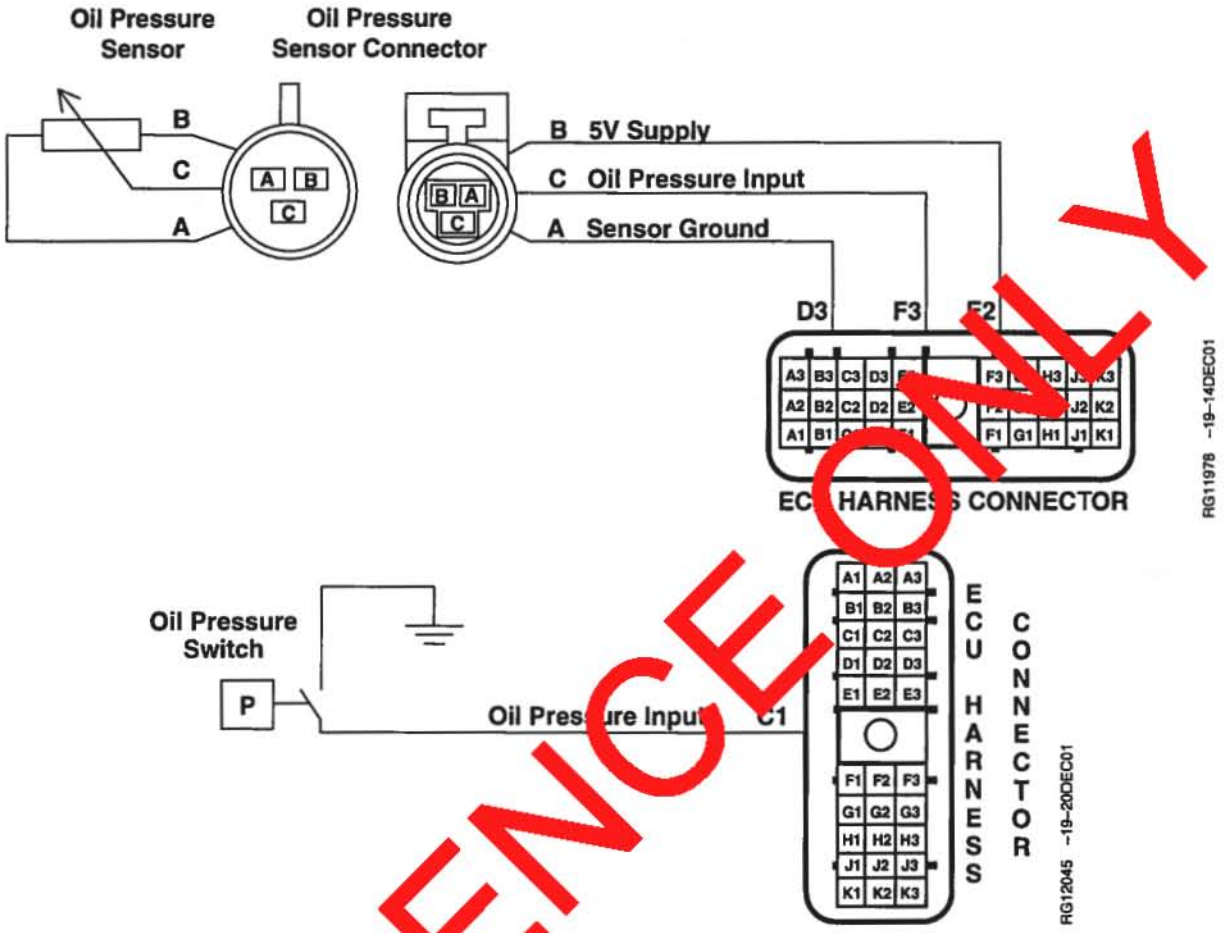
000100.01 — Engine Oil Pressure Extremely Low



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NOTE: Wiring schematics show OEM engine applications for the oil pressure sensor and Telehandler applications for the oil pressure switch. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 010 of this manual.

Oil Pressure Sensor or Switch

- The oil pressure sensor is a pressure transducer connected to the main oil galley. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.
- The oil pressure switch is used to detect a loss of oil pressure. Oil pressure causes the contacts in the switch close when oil pressure drops below the minimum oil pressure threshold. The switch is open when the engine is not running and engine is running with sufficient oil pressure.

DTC 000100.01 will set if:

- For engines with an oil pressure sensor, the ECU senses an extremely low oil pressure.
- For engines with an oil pressure switch, the ECU senses the oil pressure switch is open after the engine is above cranking RPM for several seconds.

If DTC 000100.01 sets, the following will occur:

Continued on next page

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set, and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 60% per minute until the engine is running at 40% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

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000100.01 — Engine Oil Pressure Extremely Low

For engines with an oil pressure sensor, the ECU senses an extremely low oil pressure.
For engines with an oil pressure switch, the ECU senses the oil pressure switch is open after the engine is above cranking RPM for several seconds.

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000100.01 Engine Oil Pressure Extremely Low Diagnostic Procedure

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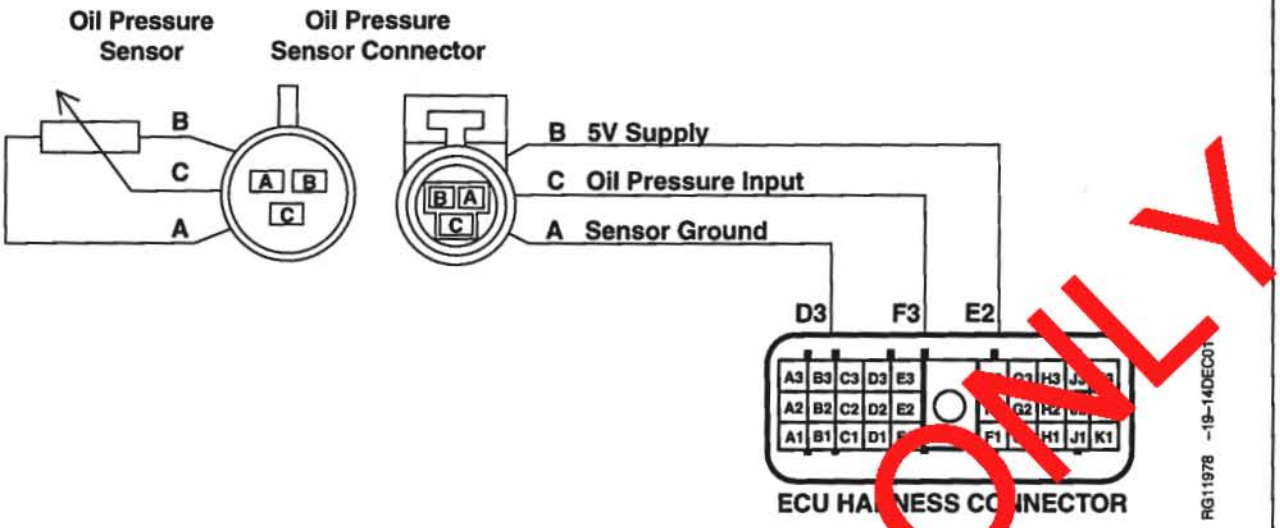
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information* Perform a preliminary inspection of the ECU connector, the oil pressure sensor, and any connectors in between the ECU for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Oil Pressure Check**	*NOTE: For wiring and theory of operation information, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW supporting information* Under the conditions where DTC 000100.01 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	**Oil pressure within specification:** Verify that oil pressure sensor or switch circuits is OK. If oil pressure sensor or switch circuits are OK, replace oil pressure sensor or switch and retest. **Oil pressure below specification:** Low oil pressure problem. See 4.5L/6.8L - L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 4.5 L and 6.8 L Diesel Engines Base Engine Manual (CTM 104). ---1/1

000100.03 — Engine Oil Pressure Input Voltage High



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

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil galley. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of low oil pressure condition. For further oil pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.

DTC 000100.03 will set if:

- The oil pressure input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for oil pressure.
  - For OEM applications, the high oil pressure input voltage specification is 4.5 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high oil pressure input voltage specification.

If DTC 000100.03 sets, the following will occur:

- ECU uses a default oil pressure of 260 kPa (2.6 bar) (37.5 psi).
- ECU's low oil pressure engine protection feature disabled.

RG40854,0000086 –19–07DEC01–1/1

000100.03 — Engine Oil Pressure Input Voltage High

The oil pressure input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for oil pressure.

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000100.03 Engine Oil Pressure Input Voltage High Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information* Perform a preliminary inspection of the ECU connector, the oil pressure sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read Oil Pressure Input Voltage using the the DST orSERVICE ADVISOR™. *NOTE: For OEM applications, the high oil pressure input voltage specification is 4.5V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.5 V or greater:** GO TO ❸ **Below 4.5 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Oil Pressure Input Shorted Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGINE OIL PRESSURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect oil pressure sensor connector 3. Ignition ON, engine OFF 4. Read Oil Pressure Input Voltage using the DST or SERVICE ADVISOR. *NOTE: For OEM applications, the low oil pressure input voltage specification is 0.3V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.3 V or below:** GO TO ❹ **Above 0.3 V:** Short to voltage in oil pressure sensor input circuit OR Faulty ECU ---1/1

❹ **Oil Pressure Ground Circuit Open Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.03 ENGI... OIL PRESSURE INPUT VOLTAGE HIGH supporting information* Probe oil pressure sensor ground (Terminal A) in sensor harness conne...or with a ... light connected to battery voltage.	**...ht ON:** Faulty oil pressure sensor OR ...ulty ECU connection OR Faulty ECU **Light OFF:** Open in oil pressure sensor ground circuit OR Faulty ECU connection OR Faulty ECU ---1/1

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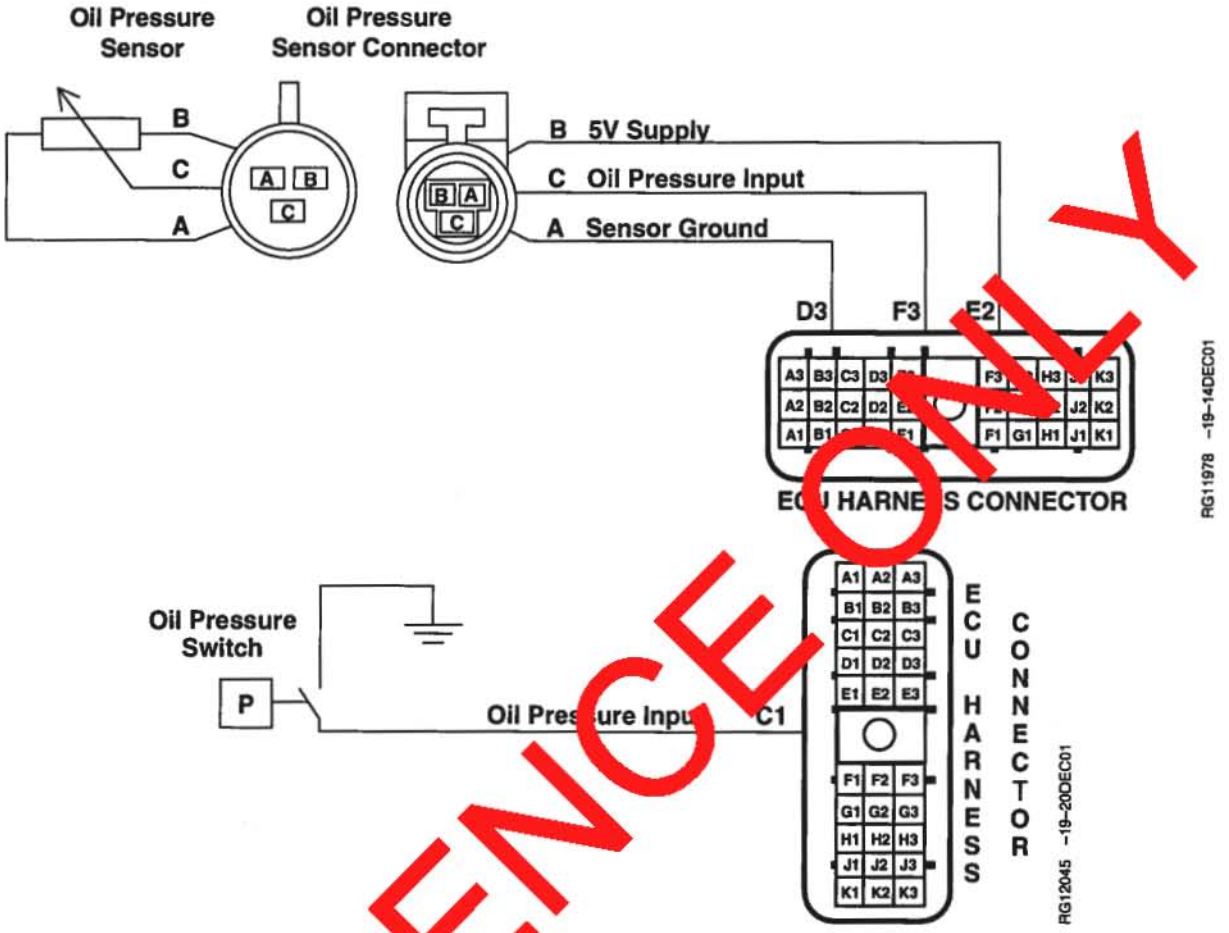
000100.04 — Engine Oil Pressure Input Voltage Low



04 160 ,128

NOTE: Wiring schematics show OEM engine applications for the oil pressure sensor and Telehandler applications for the oil pressure switch. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 010 of this manual.

Oil Pressure Sensor or Switch

- The oil pressure sensor is a pressure transducer connected to the main oil galley. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition. For further oil pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.
- The oil pressure switch is used to detect a loss of oil pressure. A lack of oil pressure causes the contacts in the switch close when oil pressure drops below the minimum oil pressure threshold. The switch is open when the engine is not running and engine is running with sufficient oil pressure.

DTC 000100.04 will set if:

- For oil pressure sensors, the oil pressure input voltage drops below the sensor's low voltage specification. The voltage is lower than what is physically possible for oil pressure.
  - For OEM applications, the low oil pressure input voltage specification is 0.3 volts.

Continued on next page

RG40854,0000084 –19–07DEC01–1/2

  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low oil pressure input voltage specification.
- For oil pressure switches, the oil pressure switch is closed when key is on and there is no engine speed.

If DTC 000100.04 sets, the following will occur:

- ECU uses a default oil pressure of 260 kPa (2.6 bar) (37.5 psi).
- ECU's low oil pressure engine protection feature disabled.

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000100.04 — Engine Oil Pressure Input Voltage Low

For oil pressure sensors, the oil pressure input voltage drops below the sensor's low voltage specification.

For oil pressure switches, the oil pressure switch is closed when key is on and there is no engine speed.

RG406[illegible]0000B4 [illegible]-23SEP05-1/1

000100.04 Engine Oil Pressure Input Voltage Low Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information* Perform a preliminary inspection of the ECU connector, the oil pressure sensor connector, and any connectors between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs using the the DST orSERVICE ADVISOR™.	**000100.04 reoccurs:** GO TO ❸ **000100.04 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Oil Pressure Sensor Check**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* Determine whether an oil pressure sensor or an oil pressure switch is being used.	**Oil pressure sensor being used:** GO TO ❹ **Oil pressure switch being used:** GO TO ❻ ---1/1
❹ **Oil Pressure Sensor Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect oil pressure sensor connector 3. Install a jumper wire between oil pressure 5 V supply and oil pressure input in harness sensor connector 4. Read the Oil Pressure Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM applications, the high oil pressure input voltage specification is 4.5V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.5 V:** GO TO ❺ **4.5 V or greater:** Faulty oil pressure sensor connector OR Faulty oil pressure sensor ---1/1
❺ **Oil Pressure Sensor 5 V Supply Test**	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Remove jumper wire 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between oil pressure 5 V supply terminal and a good chassis ground	**Between 4.0 V and 6.0 V:** Open in oil pressure input circuit OR Short to ground in oil pressure input circuit OR Faulty ECU connector OR Faulty ECU **Below 4.0 V:** Open in oil pressure 5 V supply circuit OR Short to ground in oil pressure 5 V supply circuit OR Faulty ECU connector OR Faulty ECU ---1/1

6 Oil Pressure Switch Short in Wire Check	*NOTE: For wiring and theory of operation information, see DTC 000100.04 ENGINE OIL PRESSURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect oil pressure switch connector and ECU connector 3. Using a multimeter, measure the resistance between terminal C1 in the ECU and: • All other terminals in the ECU connector • A good ground	**All measurements greater than 2000 ohms:** Faulty oil pressure switch OR Faulty ECU **Any measurement less than 2000 ohms:** Short in oil pressu input circuit -1/1

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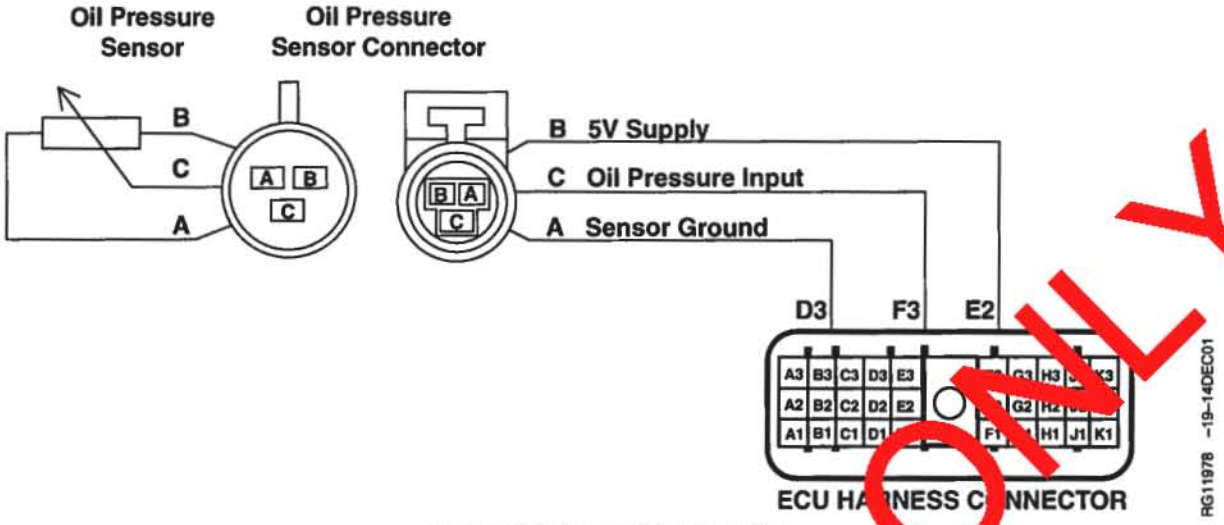
000100.16 - Engine Oil Pressure High, Moderately Severe Level



Engine Oil Pressure Sensor Schematic

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

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil galley. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low pressure condition. For further oil pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.

DTC 000100.16 will set if:

- With the ignition ON and zero engine speed, the ECU senses a moderately-severe, high-level oil pressure.

If DTC 000100.16 sets, the following will occur:

- Engine protection is not enabled.
  - With Shutdown Feature: No shutdown available for this code.
  - With Derate Feature: No derate available for this code.

DB92450,0000015 -19-19JUL05-1/1

000100.16 — Engine Oil Pressure High, Moderately Severe Level Incorrect Reading Diagnostic Procedure

The ECU detects moderately-severe, high-level oil pressure with ignition ON and zero engine speed, caused by open in sensor ground path.

DB92450,0000017 -19-22SEP05-1/1

Electrical Test

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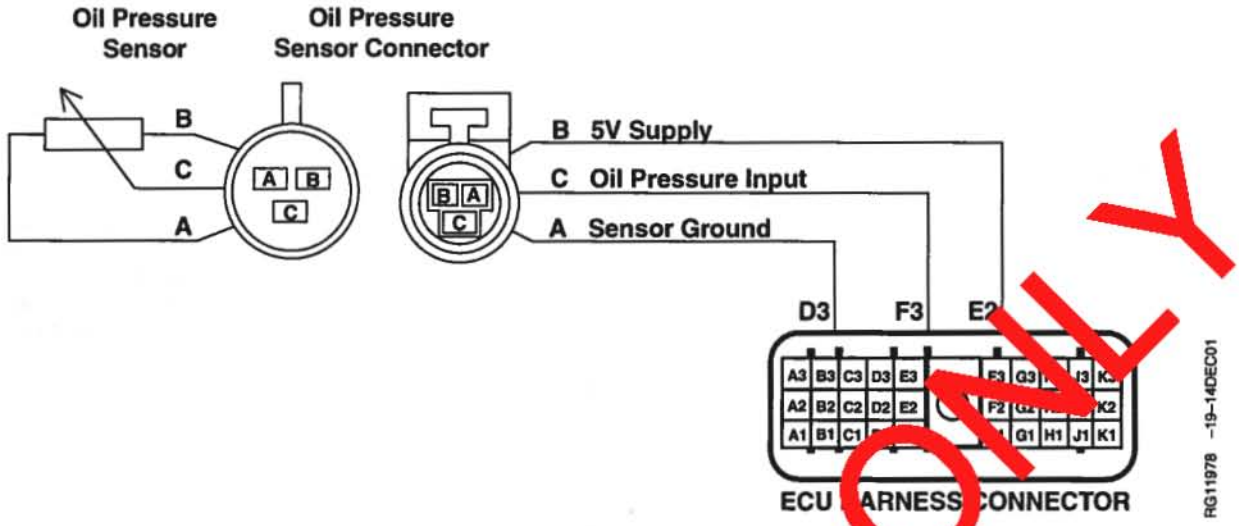
❶ **Connector Check**	Inspect pin D3 of ECU connector J1 and pressure sensor connectors (male and female sides), pins C for bad connection, damaged pin, rust, or corrosion.	**Open not found:** GO TO ❷. **Bad connections, damaged pins, and rust or corrosion found:** Replace faulty component and retest. ---1/1
❷ **Ground Wire Continuity Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000100.16 - ENGINE OIL PRESSURE HIGH, MODERATELY SEVERE LEVEL supporting information* 1. Disconnect ECU connector J1 and pressure sensor connector 2. Using a multimeter, perform a continuity check of ground wire (A) from oil pressure sensor connector to ECU connector J1, pin D3 ---1/1	**Open in wire:** Remove and replace faulty wire, and retest. **No open in wire:** GO TO ❸.
❸ **Pressure Sensor Continuity Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000100.16 - ENGINE OIL PRESSURE HIGH, MODERATELY SEVERE LEVEL supporting information* 1. Disconnect EOP sensor connector 2. Using a multimeter, perform a continuity check between pins A and B oil pressure sensor connector (sensor side). ---1/1	**Open in sensor:** Remove and replace sensor, and retest.

000100.18 — Engine Oil Pressure Moderately Low



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

Oil Pressure Sensor

- The oil pressure sensor is a pressure transduc connected to the main oil galley. As engine il pressure increases, the oil pressure sens input voltage increases. The ECU monitors pres re in order to protect the engine in case of a l il pressure condition. For further oil pres ure s ns information, see MEASURING RESS RE in Section 03, Group 140 earlier in hi manual.

DTC 000100.18 will set i

- For en es with an oil pressure sensor, the ECU sens s a m derately low oil pressure.

If DTC 0 100.1 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROT CTION in Section 03, Group 140 of this al.
  - With Shutdown Feature: No shutdown available for this code.
  - With Derate Feature: On OEM applications, the engine derates 40% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000082 –19–07DEC01–1/1

000100.18 — Engine Oil Pressure Moderately Low

For engines with an oil pressure sensor, the ECU senses a moderately low oil pressure.

RG[illegible]54,00[illegible]B5 -19[illegible]SEP05-1/1

000100.18 Engine Oil Pressure Moderately Low Diagnostic Procedure

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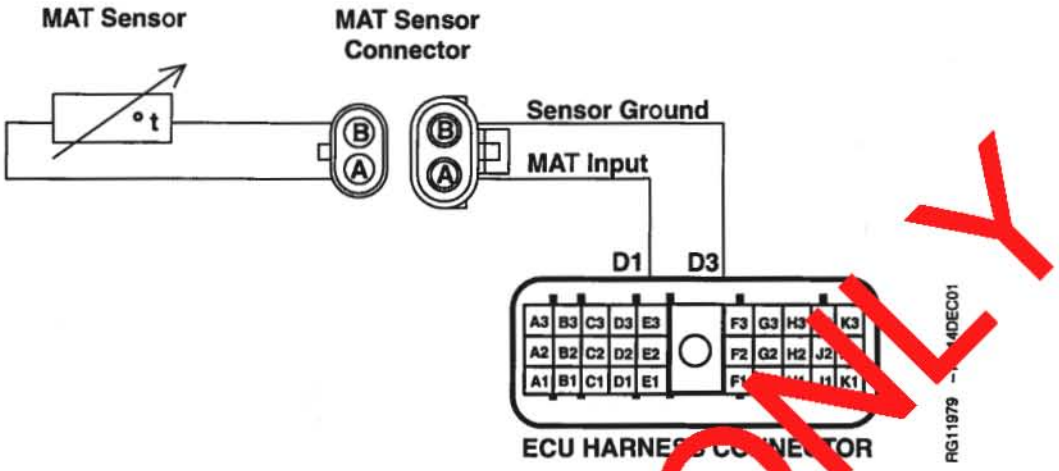
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information* Perform a preliminary inspection of the ECU connector, the oil pressure sensor connector, and any connectors in between. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Oil Pressure Check**	*NOTE: For wiring and theory of operation information, see DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW supporting information* Under the conditions where DTC 000100.18 occurs, measure engine oil pressure. CHECK ENGINE OIL PRESSURE in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	**Oil pressure within specification:** Low oil pressure problem. See 4.5L/6.8L - L2 - ENGINE OIL PRESSURE LOW in Section 04, Group 150 of 4.5 L and 6.8 L Diesel Engines Base Engine Manual (CTM 104). **Oil pressure below specification:** Verify that oil pressure sensor 5 V supply, input, and ground circuits are OK. If oil pressure sensor circuits are OK, replace oil pressure sensor and retest. ---1/1

000105.03 — Manifold Air Temperature Input Voltage High



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

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU. Lower temperatures result in higher voltages. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000105.03 will set if:

- The manifold air temperature input voltage exceeds the sensor's high voltage specification. The voltage is higher than what is physically possible for manifold air.
  - For OEM applications, the high manifold air temperature input voltage specification is 4.9 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high manifold air temperature specification.

If DTC 000105.03 sets, the following will occur:

- ECU uses a default MAT value of 60°C (140°F).
- ECU's high manifold air temperature engine protection feature disabled.

RG40854,0000080 –19–07DEC01–1/1

000105.03 — Manifold Air Temperature Input Voltage High

The manifold air temperature input voltage exceeds the sensor's high voltage specification.

RG[illegible]54,00[illegible]36 -1[illegible]5SEP05-1/1

000105.03 Manifold Air Temperature Input Voltage High Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector t[illegible]min[illegible]s or damage will result. Use JT07328 Connector Adapter Test Kit to make me[illegible]uremen[illegible]in connectors. This will ensure that terminal damage doe[illegible]not occur.** *NOTE: For wiring and theory of operation in[illegible]rmation, se[illegible] DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAG[illegible]HIGH supportin[illegible]information.* Perform a preliminary inspecti[illegible]the ECU[illegible]nnector, the manifold air temperature sensor connector, and any [illegible]onne[illegible]ors in be[illegible]n them. Look for dirty, damaged, or poorly positioned termina[illegible].	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Co[illegible]ect[illegible]the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine OFF 5. Read the Manifold Air Temperature Input Voltage parameter using the DST orSERVICE ADVISOR™. *NOTE: For OEM applications, the high manifold air temperature input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.9 V or greater:** GO TO ❸ **Below 4.9 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **MAT Sensor and Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect MAT sensor connector 3. Install a jumper wire between both terminals in the MAT sensor harness connector 4. Ignition ON, engine OFF 5. Read the Manifold Air Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM applications, the low manifold air temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** GO TO ❹ **0.1 V or below:** Faulty MAT sensor connector OR Faulty MAT sensor ---1/1
❹ **MAT Sensor Open Ground Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.03 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Remove jumper wire between both terminals. 3. Install jumper wire between MAT sensor harness connector input terminal and a good chassis ground. 4. Ignition ON, engine OFF 5. Read the Manifold Air Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM applications, the low manifold air temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** Open in MAT sensor input circuit OR Faulty ECU connection OR Faulty ECU **0.1 V or below:** Open in MAT sensor ground circuit OR Faulty ECU connection OR Faulty ECU ---1/1

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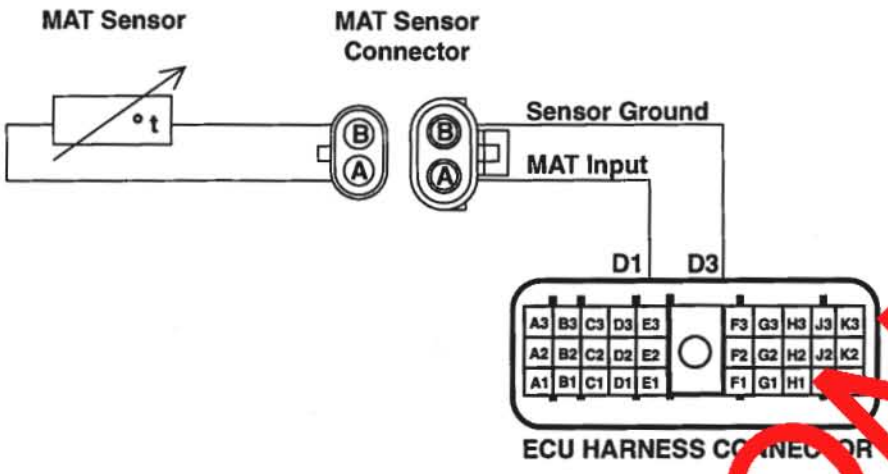
000105.04 — Manifold Air Temperature Input Voltage Low



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

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000105.04 will set if:

- The manifold air temperature input voltage goes below the sensor's low voltage specification. The voltage is lower than what is physically possible manifold air temperature to achieve.
  - For F4 engine applications, the low manifold air temperature input voltage specification is 0.1 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low manifold temperature input voltage specification.

If DTC 000105.04 sets, the following will occur:

- ECU uses a default MAT value of 60°C (140°F) to run engine.
- ECU's high manifold air temperature engine protection feature disabled.

RG40854,000007D -19-07DEC01-1/1

000105.04 — Manifold Air Temperature Input Voltage Low

The manifold air temperature input voltage goes below the sensor's low voltage specification.

RG[illegible]4,000[illegible]7 -19[illegible]EP05-1/1

000105.04 Manifold Air Temperature Input Voltage Low Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector t[illegible]inal[illegible] or damage will result. Use JT07328 Connector Adapter Test Kit to make me[illegible]rement[illegible]n connectors. This will ensure that terminal damage doe[illegible]ot occur.** *NOTE: For wiring and theory of operation in[illegible]rmation, se[illegible]DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting[illegible]nformation.* Perform a preliminary inspectio[illegible]the ECU[illegible]nnector, the manifold air temperature sensor connector, and any conne[illegible]rs in b[illegible] them. Look for dirty, damaged, or poorly positioned termina[illegible]	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Co[illegible]act[illegible] the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine OFF 5. Read the Manifold Air Temperature Input Voltage parameter using SERVICE ADVISOR™. *NOTE: For OEM engine applications, the low manifold air temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.1 V or below:** GO TO ❸ **Above 0.1 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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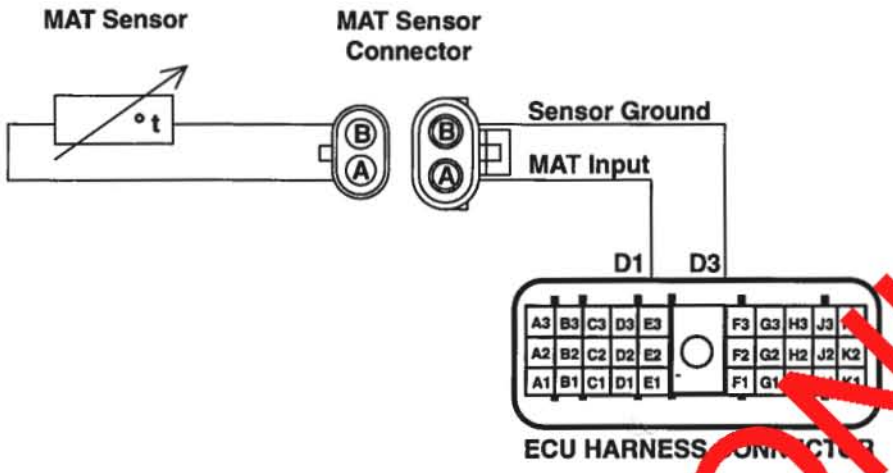
❸ **MAT Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000105.04 MANIFOLD AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect MAT sensor connector. 3. Ignition ON, engine OFF 4. Read the Manifold Air Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM engine applications, the high manifold air temperature input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.9 V:** Short to ground in MAT sensor input circuit OR Faulty ECU connector OR Faulty ECU **4.9 V or greater:** Faulty MAT sensor connector OR Faulty MAT sensor ---1/1

04 160 144

000105.16 — Manifold Air Temperature Moderately High



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

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000105.16 will set if:

- The ECU senses MAT on OEM applications above 100°C (212°F) for "H engines" and 120°C (248°F) for "T engines". For MAT specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000105.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: The ECU does not use shutdown feature with this code.
  - With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,000007B –19–07DEC01–1/1

000105.16 — Manifold Air Temperature Moderately High

The ECU senses MAT on OEM applications above specifications.

RG406[illegible]EC01-1/1

000105.16 Manifold Air Temperature Moderately High Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector ter[illegible]nals or damage will result. Use JT07328 Connector Adapter Test Kit to ma[illegible]easurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation infor[illegible]ation, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the manifold air temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Failures Causing High MAT Check**	*NOTE: For wiring and theory of operation information, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH supporting information.* Check the following items that can cause high intake air temperatures: Excessively high ambient air temperature. Restricted, dirty, or damaged charge air cooler. • Loose cooling fan belt. • Malfunctioning cooling fan. • Restricted or damaged intake air piping. • Damaged cooling fan shroud.	**Cause of high MAT located:** Repair problem and retest. **No cause of high MAT located:** Verify that MAT sensor input and ground circuits are OK. If MAT sensor circuits are OK, replace MAT sensor and retest.

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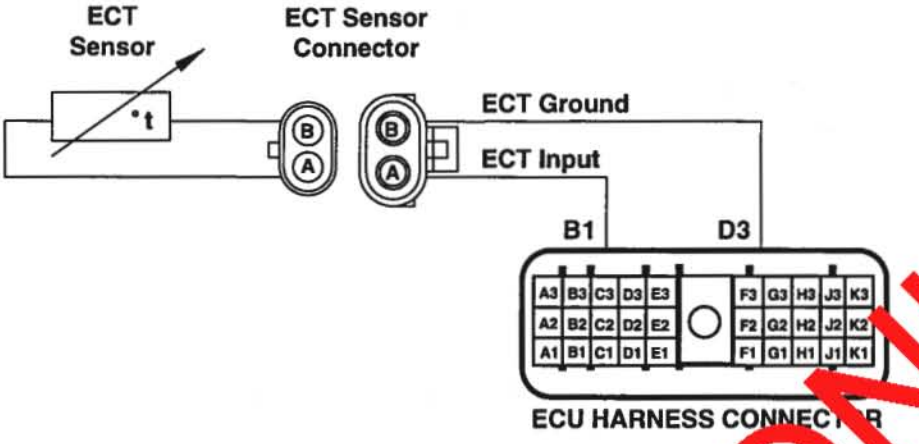
000110.00 — Engine Coolant Temperature Extremely High



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

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing or in the rear of the 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 Engine Control Unit (ECU); lower temperatures result in higher voltages. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000110.00 will set

- The ECU senses ECT on OEM applications above 118°C (244°F). For the most severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000110.00 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: The derate feature will go into effect when the code is set, and the engine will shut down after 30 seconds.
  - With Derate Feature: On OEM applications, the engine derates 60% per minute until the engine is running at 40% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000071 -19-06DEC01-1/1

000110.00 — Engine Coolant Temperature Extremely High

The ECU senses ECT above specification.

RG4085 -0000B -19 -DEC01-1/1

000110.00 Engine Coolant Temperature Extremely High Diagnostic Procedure

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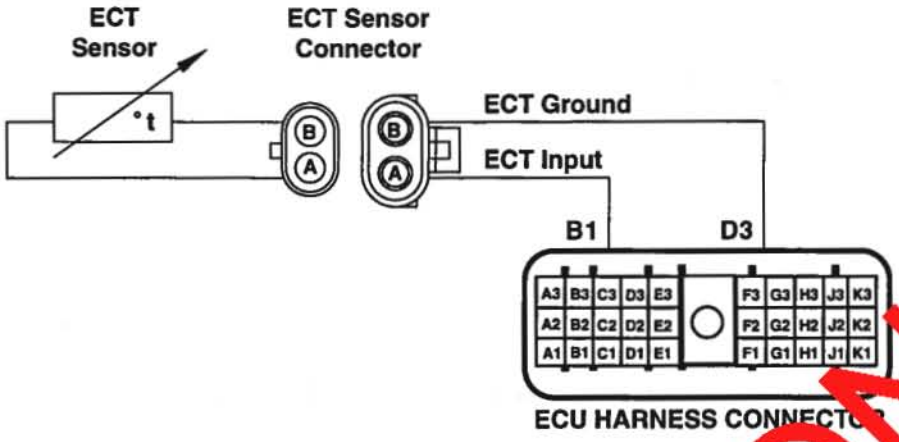
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH supporting information* Perform a preliminary inspection of the ECU connector, the Engine Coolant Temperature (ECT) connector and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **ECT Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH supporting information* Under the conditions where DTC 000110.00 occurs, use a temperature gauge and verify that engine coolant temperature is above the most severe ECT specification. *NOTE: cations, the most severe ECT specification is 118°C (244°F). For the most severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**ECT 118°C (244°F) or above:** Engine overheating problem. See 4.5L/6.8L - C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104). **ECT significantly less than 118°C (244°F):** Verify that ECT input and ground circuits are OK If both circuits are OK, replace ECT sensor and retest
		---1/1

000110.03 — Engine Coolant Temperature Input Voltage High



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

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing or in the rear of the 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 Engine Control Unit (ECU); lower temperatures result in higher voltages. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000110.03 will set if:

- The ECT input voltage rises above the sensor's high voltage specification. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant.
  - For OEM engine applications, the high ECT input voltage specification is 4.9 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high ECT input voltage specification.

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 90°C (194°F).
- ECU's high ECT engine protection feature disabled.

RG40854,0000072 –19–07DEC01–1/1

000110.03 — Engine Coolant Temperature Input Voltage High

The ECT input voltage goes above the sensor's high voltage specification.

RG40854 000BA 19- EP05–1/1

000110.03 Engine Coolant Temperature Input Voltage High Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* Perform a preliminary inspection of the ECU connector, the Engine Coolant Temperature (ECT) connector and all connections between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine running 5. Read the Engine Coolant Temperature Input Voltage parameter using SERVICE ADVISOR™. *NOTE: On OEM applications, the high ECT input voltage specification is 4.9V. For high input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**At or above 4.9 V:** GO TO ❸ **Below 4.9 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Engine Coolant Temperature (ECT) Sensor and Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect ECT sensor connector 3. Install a jumper wire between both terminals in the ECT sensor harness connector 4. Ignition ON, engine OFF 5. Read the Engine Coolant Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: On OEM applications, the low ECT input voltage specification is 0.1 volts and below. For ECT input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** GO TO ❹ **At or below 0.1 V:** Faulty ECT sensor connector OR Faulty ECT sensor ---1/1

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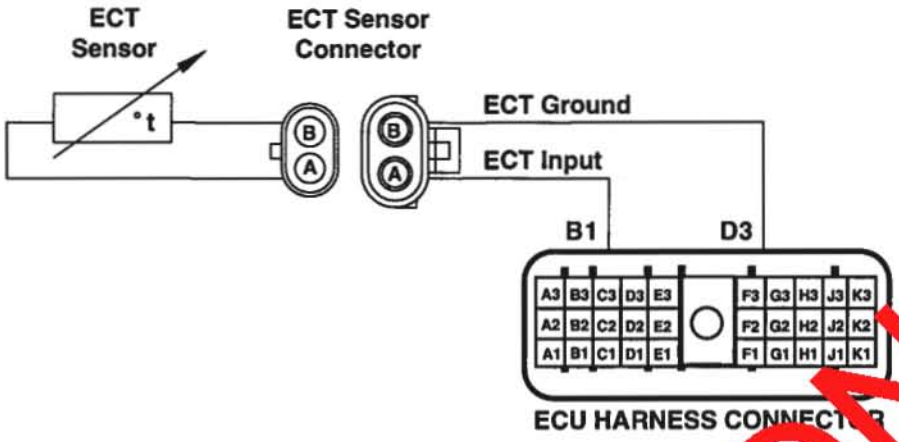
❹ **Engine Coolant Temperature (ECT) Open Ground Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.03 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Remove jumper wire between both terminals 3. Install jumper wire between ECT sensor harness connector input terminal and a good chassis ground 4. Ignition ON, engine OFF 5. Read the Engine Coolant Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: On OEM applications, the low ECT input voltage specification is 0.1 volts and below. For ECT input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** Open in ECT input sensor circuit OR Faulty ECU connection OR Faulty ECU **0.1 V or below:** Open in ECT sensor ground circuit OR Faulty ECU connection OR Faulty ECU ---1/1

000110.04 — Engine Coolant Temperature Input Voltage Low



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

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the ECU; lower temperatures result in higher voltages. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000110.04 will set if:

- The ECT input voltage goes below the sensor's low voltage specification. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.
  - For OEM engine applications, the low ECT input voltage specification is 0.1 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high ECT input voltage specification.

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 90°C (194°F).
- ECU's high ECT engine protection feature disabled.

RG40854,0000074 –19–07DEC01–1/1

000110.04 — Engine Coolant Temperature Input Voltage Low

The ECT input voltage goes below the sensor's low voltage specification.

RG4085[illegible]000056[illegible]-19[illegible]SEP05-1/1

000110.04 Engine Coolant Temperature Input Voltage Low Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* Perform a preliminary inspection of the ECU connector, the Engine Coolant Temperature (ECT) sensor connector and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.04 ENGINE COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* 1. Connect to the DST orSERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine OFF 5. Read the Engine Coolant Temperature Input Voltage parameter using SERVICE ADVISOR™. *NOTE: For OEM engine applications, the low ECT input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.1 V or below:** GO TO ❸ **Above 0.1 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **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. Ignition ON 4. Read the Engine Coolant Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM engine applications, the high ECT input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.9 V:** Short to ground in ECT sensor input circuit OR Faulty ECU **4.9 V or greater:** Faulty ECT sensor ---1/1

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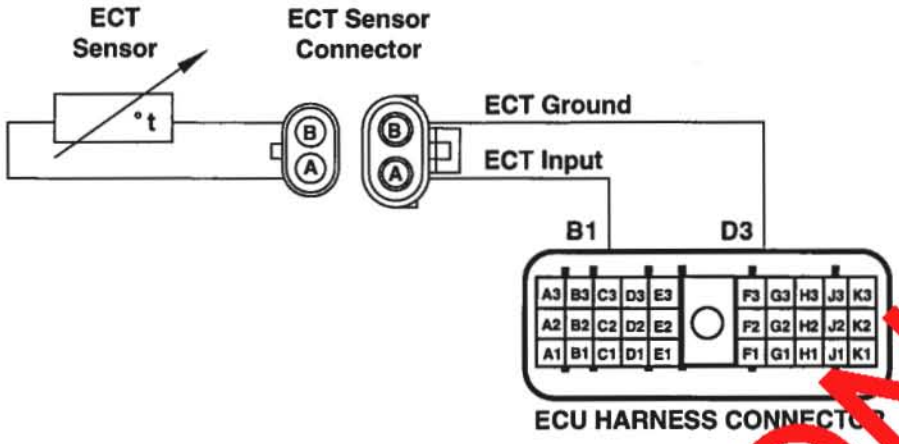
000110.15 — Engine Coolant Temperature High Least Severe



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

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing or at the rear of the 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. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 10 earlier in this manual.

DTC 000110.15 will set if

- The ECU senses ECT on OEM applications above 108°C (226°F). For the least severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000110.15 sets, the following will occur:

Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.

- With Shutdown Feature: No shutdown available for this code.
- With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 95% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000076 –19–07DEC01–1/1

000110.15 — Engine Coolant Temperature High Least Severe

The ECU senses ECT above specification.

RG[illegible]354,00[illegible]BC [illegible]07SEP05-1/1

000110.15 Engine Coolant Temperature High Least Severe Diagnostic Procedure

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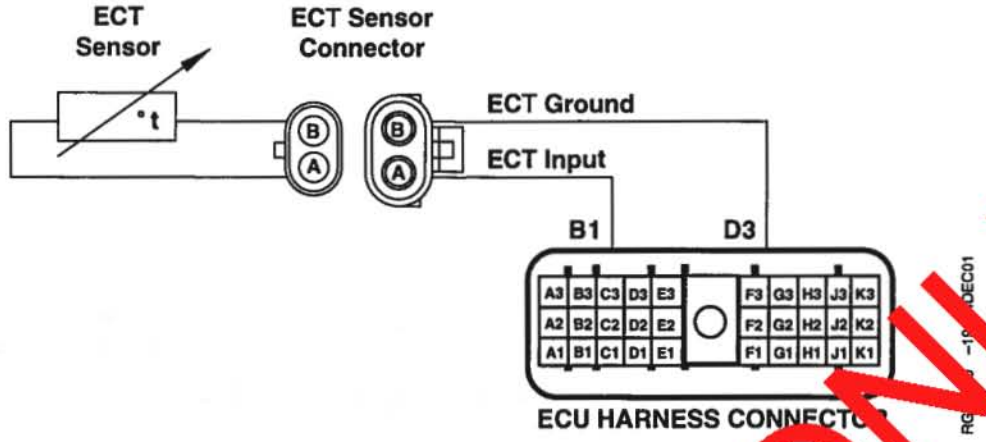
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE supporting information* Perform a preliminary inspection of the ECU connector, the Engine Coolant Temperature (ECT) sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Engine Coolant Temperature (ECT) Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE supporting information* Under the conditions where DTC 000110.15 occurs, using a temperature gauge, verify that engine coolant temperature is above the least severe ECT specification. *NOTE: On OEM applications, the least severe ECT specification is 108°C (226°F). For the least severe ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**ECT above 108°C (226°F):** Engine overheating problem. See 4.5L/6.8L - C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104). **ECT significantly less than 108°C (226°F):** Verify that ECT sensor input and ground circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest ---1/1

000110.16 — Engine Coolant Temperature Moderately High



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

Engine Coolant Temperature (ECT) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing or at the rear of the 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. For further ECT sensor information, see MEASURING TEMPERATURE in Section 03, Group 210 earlier in this manual.

DTC 000110.16 will set if

- The ECU senses ECT on OEM applications above 113°C (235°F). For the moderately ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000110.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
  - With Shutdown Feature: No shutdown available for this code.
  - With Derate Feature: On OEM applications, the engine derates 40% per minute until the engine is running at 60% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000079 -19-07DEC01-1/1

000110.16 — Engine Coolant Temperature Moderately High

The ECU senses ECT above specification.

RG[illegible]154,00[illegible]RD –[illegible]07SEP05-1/1

000110.16 Engine Coolant Temperature Moderately High Diagnostic Procedure

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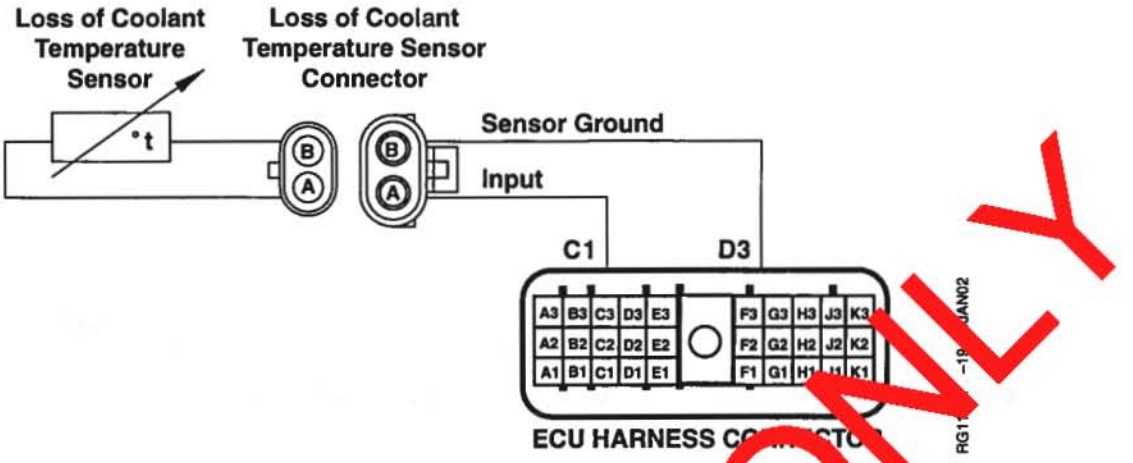
❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH supporting information* Perform a preliminary inspection of the ECU connector, the Engine Coolant Temperature (ECT) sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Engine Coolant Temperature (ECT) Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH supporting information* Under the conditions where DTC 000110.16 occurs, using a temperature gauge, verify that engine coolant temperature is above 113°C (235°F). *NOTE: On OEM applications, the moderately high ECT specification is 113°C (235°F). For the moderately high ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**ECT above 113°C (235°F):** Engine overheating problem. See 4.5L/6.8L - C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104). **ECT significantly less than 113°C (235°F):** Verify that ECT sensor input and ground circuits are OK. If ECT sensor circuits are OK, replace ECT sensor and retest ---1/1

000111.00 — Loss of Coolant Temperature Extremely High



Loss of Coolant Temperature Sensor

- The loss of coolant temperature sensor is a thermistor (temperature sensitive resistor) mounted in the rear of the cylinder head. It is used to measure the coolant temperature to detect whether there is a loss of coolant. The sensor's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower loss of coolant temperature input voltages to the ECU; lower temperatures result in higher voltag For further loss of coolant temperature sens information, see MEASURING TEMPERA URE in Section 03, Group 140 earlier in this m ual.

DTC 000111.00 wi set if:

- The EC senses a coolant temperature above 124°C (255°F).

If DTC 00 11.00 sets, the following will occur:

- The en ine derates 20% per minute until the engine is runn g at 60% of full power. If the temperature below 124°C (255°F), the engine will regain power at 20% per minute.

RG40854,000006F –19–06DEC01–1/1

000111.00 — Loss of Coolant Temperature Extremely High

The ECU senses a coolant temperature above specification.

RG40[illegible]07SEP05-1/1

000111.00 Loss of Coolant Temperature Extremely High Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000111.00 LOSS OF COOLANT TEMPERATURE EXTREMELY HIGH supporting information* Perform a preliminary inspection of the ECU connector, the loss of coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ **Loss of Coolant Temperature Sensor and Circuit Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.00 LOSS OF COOLANT TEMPERATURE EXTREMELY HIGH supporting information* Under the conditions where DTC 000111.00 occurs, using a temperature gauge, verify that loss of coolant temperature is above 124°C (255°F).	**Significantly less than 124°C (255°F):** Verify that loss of coolant temperature sensor input and ground circuits are OK. If loss of coolant temperature sensor circuits are OK, replace loss of coolant temperature sensor and retest **Temperature above 124°C (255°F):** Engine overheating problem, see 4.5L/6.8L - [illegible] ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04, Group 150 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104). ---1/1

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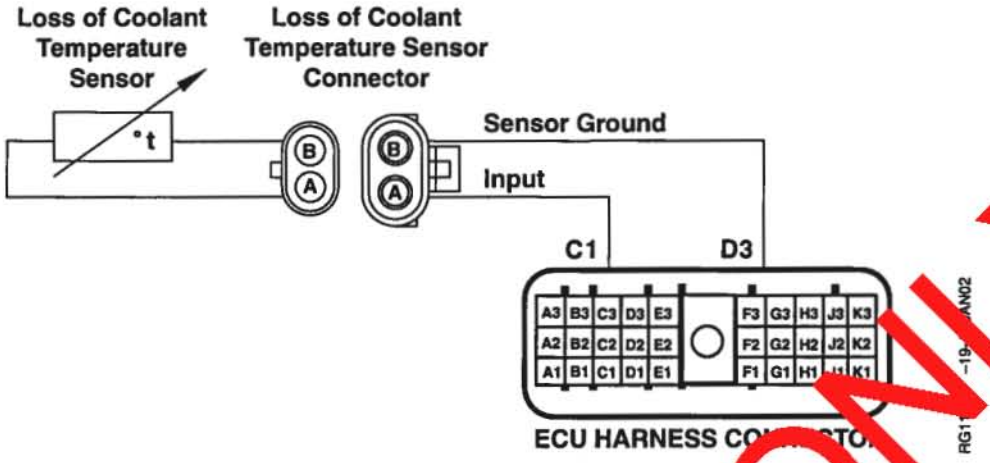
000111.03 — Loss of Coolant Temperature Input Voltage High



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Loss of Coolant Temperature Sensor

- The loss of coolant temperature sensor is a thermistor (temperature sensitive resistor) mounted in the rear of the cylinder head. It is used to measure the coolant temperature to detect whether there is a loss of coolant. The sensor's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower loss of coolant temperature input voltages to the ECU; lower temperatures result in higher voltag For further loss of coolant temperature senso information, see MEASURING TEMPERAT RE in Section 03, Group 140 earlier in this ma al.

DTC 000111.03 wi set if:

- The loss f coolant temperature input voltage exce s 4.9 olts. This voltage corresponds to a temp atu that is lower than what is physically ossibl or eng e coolant.

f DTC 00 111.03 sets, the following will occur:

- E U high loss of coolant temperature engine protection feature disabled.

RG40854,00000C0 –19–19DEC01–1/1

000111.03 — Loss of Coolant Temperature Input Voltage High

The loss of coolant temperature input voltage exceeds 4.9 volts. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant.

RG[illegible]54,005[illegible]C1 [illegible]-23SEP05-1/1

000111.03 Loss of Coolant Temperature Input Voltage High Diagnostic Procedure

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,167

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000111.03 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* Perform a preliminary inspection of the ECU connector, the loss of coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.03 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs using the DST orSERVICE ADVISOR™.	**000111.03 reoccurs:** GO TO ❸ **000111.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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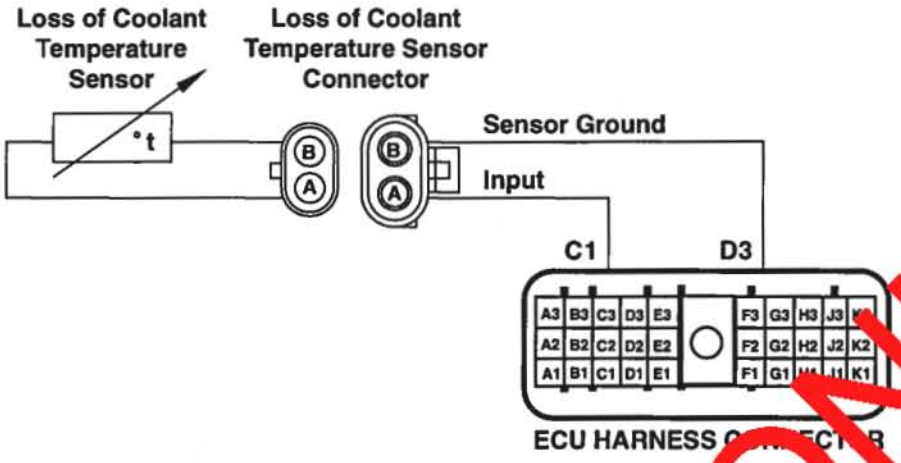
❸ **Loss of Coolant Temperature Sensor and Connector Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.03 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Disconnect loss of coolant temperature sensor connector 3. Install a jumper wire between both terminals in the loss of coolant temperature sensor harness connector 4. Ignition ON, engine OFF 5. Read DTCs using the DST or SERVICE ADVISOR.	**000111.03 reoccurs:** GO TO ❹ **000111.04 occurs:** Faulty loss of coolant temperature sensor connector OR Faulty loss of coolant temperature sensor ---1/1
❹ **Loss of Coolant Temperature Open Ground Test**	*NOTE: For wiring and theory of operation information, see DTC 000111.03 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE HIGH supporting information* 1. Ignition OFF 2. Remove jumper wire between both terminals 3. Install jumper wire between loss of coolant temperature sensor harness connector input terminal and a good chassis ground 4. Ignition ON, engine OFF 5. Using a multimeter, measure voltage between loss of coolant temperature input (5V supply) terminal and a good chassis ground	**Between 4.0 V and 6.0 V:** Open in loss of coolant temperature input sensor circuit OR Faulty ECU connection OR Faulty ECU **Below 4.0 V:** Open in loss of coolant temperature sensor ground circuit OR Faulty ECU connection OR Faulty ECU ---1/1

04 160 168

000111.04 — Loss of Coolant Temperature Input Voltage Low



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Loss of Coolant Temperature Sensor

- The loss of coolant temperature sensor is a thermistor (temperature sensitive resistor) mounted in the rear of the cylinder head. It is used to measure the coolant temperature to detect whether there is a loss of coolant. The sensor's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower loss of coolant temperature input voltages to the ECU; lower temperatures result in higher volta[illegible] For further loss of coolant temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 earlier in this manual.

DTC 000111.04 will set if:

- The loss of coolant temperature input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.

If DTC 000111.04 sets, the following will occur:

- ECU's high loss of coolant temperature engine protection feature disabled.

RG40854,0000069 –19–06DEC01–1/1

000111.04 — Loss of Coolant Temperature Input Voltage Low

The loss of coolant temperature input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.

RG40854,00000C... –19–23SEP05–1/1

000111.04 Loss of Coolant Temperature Input Voltage Low Diagnostic Procedure

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❶ Connection Check	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000111.04 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* Perform a preliminary inspection of the ECU connector, the loss of coolant temperature sensor connector, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

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❷ Intermittent Fault Test	*NOTE: For wiring and theory of operation information, see DTC 000111.04 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine OFF 7. Read DTCs using the DST orSERVICE ADVISOR™.	**000111.04 reoccurs:** GO TO ❸ **000111.04 does not reoccur:** Problem is intermittent. If no other codes are present, INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Loss of Coolant Temperature Sensor Test**	*NOTE: For wiring and theory of operation information, DTC 000111.04 LOSS OF COOLANT TEMPERATURE INPUT VOLTAGE LOW supporting information* 1. Ignition OFF 2. Disconnect loss of coolant temperature sensor connector 3. Ignition ON 4. Read DTCs using the DST or SERVICE ADVISOR.	**000111.04 reoccurs:** Short to ground in loss of coolant temperature sensor input circuit OR Faulty ECU **000111.03 occurs:** Faulty loss of coolant temperature sensor ---1/1

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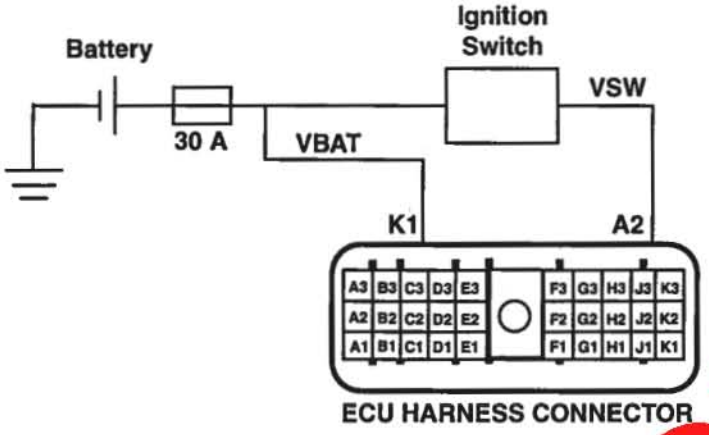
,172

000158.17 — ECU Power Down Error



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

DTC 000158.17 will set if:

- ECU detects voltage is on the switched voltage input wire to the ECU.

If DTC 000158.17 sets, the following will occur:

- Vehicle battery may be drained because ECU will power down.

RG40854,0000066 –19–06DEC01–1/1

000158.17 — ECU Power Down Error

ECU detects voltage is on the switched voltage input wire to the ECU.

RG40[illegible] 0000[illegible] -[illegible]23SEP05-1/1

000158.17 ECU Power Down Error Diagnostic Procedure

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160
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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.* Perform a preliminary inspection of ECU connector, ignition power circuit, and any connectors in between them. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Cycle ignition OFF for 10 seconds, then back ON 7. Read DTCs using the DST orSERVICE ADVISOR™.	**000158.17 reoccurs:** GO TO ❸ **000158.17 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Wiring Test**	*NOTE: For wiring and theory of operation information, see DTC 000158.17 ECU POWER DOWN ERROR supporting information.* 1. Ignition OFF 2. Disconnect the ECU connector 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between terminal A2 the ECU wiring harness connector and a good chassis ground.	**Measurement above 3.0 V:** Faulty ignition switch circuit OR ECU key-on power supply shorted to voltage OR Faulty ignition switch **Measurement below 3.0 V:** Faulty ECU connection OR Faulty ECU ---1/1

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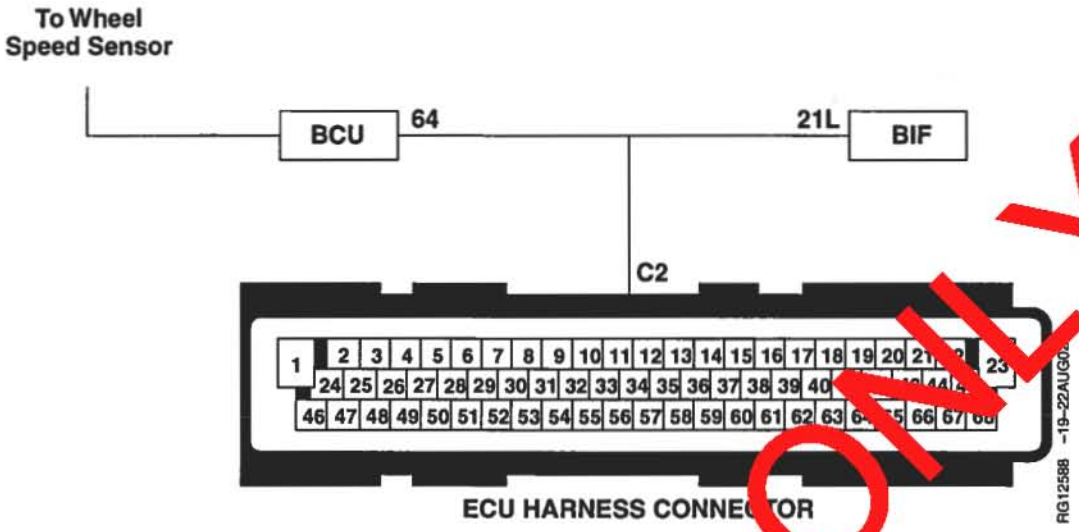
,176

000160.02 — Wheel Speed Input Noise



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.178

NOTE: Wiring schematic shows limited information. For further wiring information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

Wheel Speed Sensor

- The wheel speed sensor is an inductive type sensor that is mounted on the rear axle. As teeth on [illegible] axle rotate past the sensor, AC signals are generated. The frequency of these signals are proportional to the wheel speed.

DTC 000160.02 will set if:

- The ECU detects noise on the wheel speed input.

If DTC 000160.02 sets, the following will occur:

- Road speed limiting function is disabled.

RG40854,0000002CONV1 –19–12AUG02–1/1

000160.02 — Wheel Speed Input Noise

The ECU detects noise on the wheel speed input.

RG40854,000[illegible]03COR[illegible]-19-2[illegible]EP05-1/1

000160.02 Wheel Speed Input Noise Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.* Perform a preliminary inspection of the ECU connectors and BCU connectors looking for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s).
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Warm engine 3. Ignition ON, engine OFF 4. Start ECU communication software 5. Read DTCs using the DST orSERVICE ADVISOR™. 6. Make note of all DTCs, then clear all DTCs 7. Ignition ON, engine running 8. Read DTCs	**000160.02 reoccurs:** GO TO ❸ **000160.02 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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---1/1

❸ **Open Wheel Speed Input Check**	*NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.* 1. Ignition OFF 2. Disconnect ECU connector and BCU connector 3. Using a multimeter, measure resistance between: • Terminal D2 in the ECU connector and corresponding terminal on the BCU connector.	**Measurement 5 ohms or less:** GO TO ❹ **Measurement greater than 5 ohms:** Open in wheel speed input wire ---1/1

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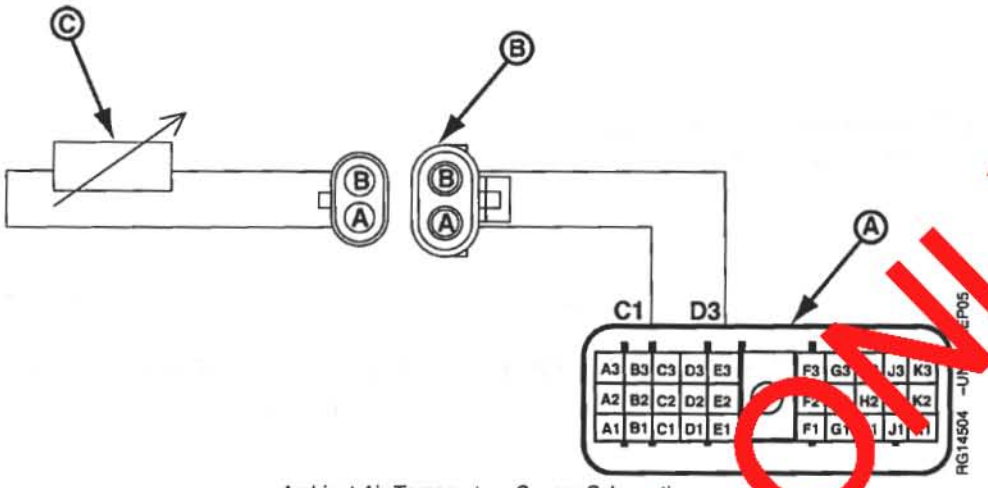
❹ **Short in Wheel Speed Input Check**	*NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.* 1. Ignition OFF 2. Both ECU connectors and BCU connector still disconnected 3. Using a multimeter measure resistance between terminal D2 in the ECU connector on the engine harness and the following: • A good chassis ground. • All other terminals in both ECU connectors.	**All measurements greater than 2000 ohms:** GO TO ❺ **Any measurement less than 2000 ohms:** Faulty wheel speed input wire ---1/1

❺ **Noise Detection Test**	*NOTE: For wiring and theory of operation information, see DTC 000160.02 WHEEL SPEED INPUT NOISE supporting information.* 1. 000160.02 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections anywhere on the machine. Things to check: • All harness connections • Alternator connections • Chassis ground connections, battery ground connection • Corrosion, dirt or paint can cause intermittent and "noisy" connections • Check the wiring for intermittent open and short circuits; particularly the cam sensor wiring 2. Other possible causes of 000160.02: • Electromagnetic interference (EMI) from an incorrectly installed 2-way radio • Interference from some radar source • Possible burrs on the wheel speed timing gear notches, should be clean, square edges	---1/1

000171.03 — Ambient Air Temperature Input Voltage Out Of Range High (750J Crawlers only)



Ambient Air Temperature Sensor Schematic

Ambient Air Temperature (AAT) Sensor

- The AAT sensor (C) is a thermistor (temperature sensitive resistor) mounted in the intake air duct. The AAT sensor's variable resistance causes the input voltage to the ECU (A) to vary. Higher temperatures result in lower AAT input voltages to the ECU; lower temperatures result in higher voltages. The AAT sensor is used by the ECU to control the air heater in applications that use this optional feature.

DTC000171.03 will set if:

- The AAT input voltage exceeds the maximum threshold. This voltage corresponds to a temperature that is lower than what is physically possible for ambient air.

If DTC 000171.03 sets, the following will occur:

- No engine protection measures, nor other reactions, accompany this DTC.

DB92450,000001F –19–03AUG05–1/1

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,181

000171.03 — Ambient Air Temperature Input Voltage Out Of Range High (750J Crawlers only)

The Ambient Air Temperature (AAT) input voltage goes above the sensor's high voltage specification.

DB924[illegible]0000020 [illegible]-26SEP05-1/1

000171.03 AAT Input Voltage Out Of Range High Diagnostic Procedure (750J Cr[illegible]

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,182

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connect[illegible] terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring, theory of operation, and sensor location information, see DTC 000171.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the AAT sensor connector, and any connectors in between the[illegible] for faulty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine cranking or running 6. Read the AAT Input Voltage parameter using the DST orSERVICE ADVISOR™.	**000171.03 reoccurs:** GO TO ❸ **000171.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **AAT Voltage Supply Wiring Test**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring, theory of operation, and sensor location information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect AAT sensor connector 3. Using a multimeter, check for continuity between ECU, pin C1, and pin A of sensor connector.	**Continuity is present:** GO TO ❹ **Continuity is not present:** Isolate to open wire or place, and replace faulty item. ---1/1
❹ **AAT Voltage Return Wiring Test**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring, theory of operation, and sensor location information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect AAT sensor connector 3. Using a multimeter, check for continuity between ECU, pin D3, and pin B of sensor connector.	**Continuity is present:** GO TO ❺ **Continuity is not present:** Isolate to open wire or place, and replace faulty item. ---1/1
❺ **ECU Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Engine OFF, Ignition ON. 2. . Clear DTC 3. . Ignition OFF. 4. Reconnect sensor. 5. Substitute existing ECU with known, good, compatible ECU. 6. . Ignition ON, Engine ON.	**DTC 000171.03 does not reoccur:** Replace Sensor and use DST or Service ADVISOR to download payload. ---1/1

❻ **AAT Sensor Test**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring, theory of operation, and sensor location information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect AAT sensor connector 3. Using a multimeter, check for continuity between pins A and B of sensor side of sensor connector.	**Continuity is present:** GO TO ❻ **Continuity is not present:** AAT sensor faulty. Replace sensor ---1/1
❼ **ECU Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Engine OFF, Ignition ON. 2. . Clear DTC. 3. . Ignition OFF. 4. Reconnect sensor. 5. Substitute existing ECU with known, good, compatible ECU. 6. . Ignition ON, Engine ON.	**DTC 000171.03 does not reoccur:** Replace ECU and use DST or Service ADVISOR to download payload. ---1/1

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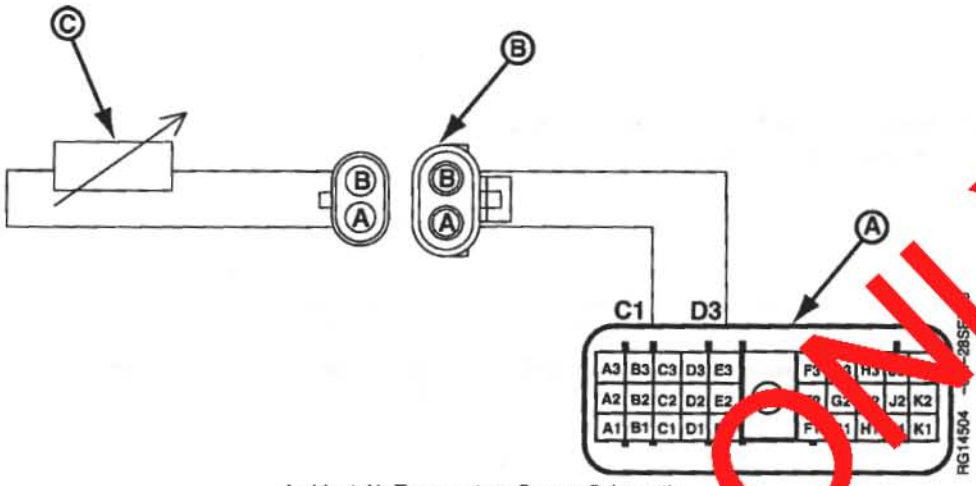
184

000171.04 — Ambient Air Temperature Input Voltage Out Of Range Low (750J Crawlers Only)



Ambient Air Temperature Sensor Schematic

Ambient Air Temperature (AAT) Sensor

- The AAT sensor (C) is a thermistor (temperature sensitive resistor) mounted in the intake air duct. The AAT sensor's variable resistance causes the input voltage to the ECU (C) to vary. Higher temperatures result in lower AAT input voltages to the ECU; lower temperatures result in higher voltages. The AAT sensor is used by the ECU to control the air heater in applications that use this optional feature. For additional theory of operation of temperature sensors, see "Measuring Temperature", in Section 03, Group 140 earlier in this CTM.

DTC000171.04 will set if:

- The AAT input voltage drops below the minimum threshold. This voltage corresponds to a temperature that is higher than what is physically possible for ambient air.

If DTC 000171.04 sets, the following will occur:

- No engine protection measures, nor other reactions, accompany this DTC.

DB92450,0000021 –19–04OCT05–1/1

000171.04 — Ambient Air Temperature Input Voltage Out Of Range Low (750J Crawlers Only)

The Ambient Air Temperature (AAT) input voltage drops below the sensor's low voltage specification.

DB924[illegible]000022 [illegible]-23SEP05-1/1

000171.04 Ambient Air Temperature Input Voltage Out Of Range Low Diagnostic [illegible]

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❶ Connection Check	**IMPORTANT: Do not force probes into connect[illegible] terminal[illegible] or damage will result. Use JT07328 Connector Adapter Test Kit to mak[illegible] measurements in connectors. This will ensure that terminal damage doe[illegible] occ[illegible]** *NOTE: For wiring, theory of operation, an[illegible] sensor loc[illegible]on information, see DTC 000171.04 AMBIENT AIR TEMPERATUR[illegible] INPUT VO[illegible]TAGE LOW supporting information.* Perform a preliminary inspec[illegible] the EC[illegible] connector, the AAT sensor connector, and any connectors in betwee[illegible] ther[illegible] Look for [illegible], damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ Intermittent Fault Test	*NO[illegible]E: For w[illegible]ng, theory of operation, and sensor location information, see DTC [illegible]0171.04 AM[illegible]NT AIR TEMPERATURE INPUT VOLTAGE LOW supporting [illegible]nform[illegible]on.* 1. C[illegible]nec[illegible] to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF. 3. Start the ECU communication software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine cranking or running. 6. Read the Ambient Air Temperature Input Voltage parameter using the DST orSERVICE ADVISOR™	**0.1 V or below:** GO TO ❸ **Above 0.1 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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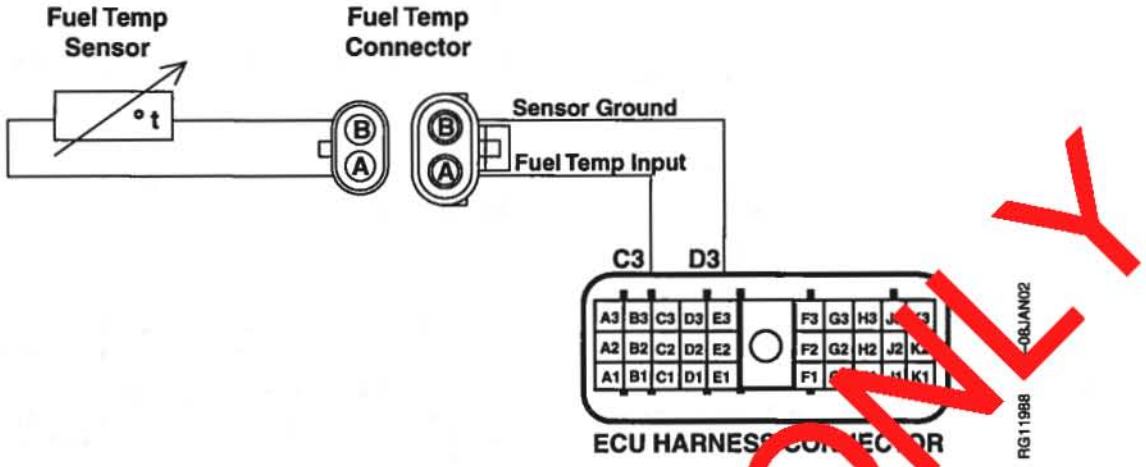
❸ **AAT Voltage Supply Wiring Test**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring, theory of operation, and sensor location information, seeDTC 000171.04 AMBIENT AIR TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF. 2. Disconnect ECU harness connector and AAT sensor connector. 3. Using a multimeter, check for short between pin C1 of ECU harness connector, and pin A of sensor connector.	**Short found:** Replace faulty item **Short found:** GO TO❹ ---1/1
❹ **AAT Sensor Test**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring, theory of operation, and sensor location information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect AAT sensor connector 3. Using a multimeter, across pins A and B of sensor side of sensor connecter, check for short to pin A or sensor.	**short is present:** AAT sensor faulty. Replace sensor **Short is not present:** GO TO❺ ---1/1
❺ **ECU Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000171.03 AMBIENT AIR TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Engine Off, Ignition ON 2. Clear DTC 3. Ignition OFF. 4. Reconnect sensor. 5. Substitute existing ECU with known, good, compatible ECU. 6. Ignition ON, Engine ON.	**DTC 000171.03 does not reoccur:** Replace ECU and use DST or Service ADVISOR to download payload. ---1/1

000174.03 — Fuel Temperature Input Voltage High



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

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the injection pump fuel outlet housing. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for the variations in fuel density caused by varying fuel temperatures. For more fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000174.03 will set if:

- The fuel temperature input voltage goes above the sensor's high voltage specification. This voltage corresponds to a temperature that is lower than what is physically possible for fuel temperature.
  - For OEM engine applications, the high fuel temperature input voltage specification is 4.9 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high fuel temperature input voltage specification.

If DTC 000174.03 sets, the following will occur:

- The ECU will use a "limp-home" fuel temperature value of -20°C (-4°F) during cranking, and 40°C (104°F) during running.
- Engine power will be slightly derated.

RG40854,0000062 -19-07SEP05-1/1

000174.03 — Fuel Temperature Input Voltage High

The fuel temperature input voltage goes above the sensor's high voltage specification.

RG[illegible]54,000[illegible]63 -[illegible]23SEP05-1/1

000174.03 Fuel Temperature Input Voltage High Diagnostic Procedure

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160
,189

---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the fuel temperature sensor connector, and any connectors in between the two. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine running 5. Read the Fuel Temperature Input Voltage parameter using the DST orSERVICE ADVISOR™. *NOTE: On OEM applications, the high fuel temperature input voltage specification is 4.9 volts and above. For fuel temperature input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**4.9 V or greater:** GO TO ❸ **Below 4.9 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Fuel Temperature Sensor and Connector Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect fuel temperature sensor connector 3. Install a jumper wire between both terminals in the fuel temperature sensor harness connector 4. Ignition ON, engine OFF 5. Read the Fuel Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: On OEM applications, the low fuel temperature input voltage specification is 0.1 volts and below. For fuel temperature input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 2[illegible] manual.*	**Above 0.1 V:** GO TO ❹ **At or below 0.1 V:** Faulty fuel temperature sensor connector OR Faulty fuel temperature sensor ---1/1
❹ **Fuel Temperature Open Ground Test**	*NOTE: For wiring, theory of operation, and sensor l[illegible]tion in[illegible]rmation, see DTC 000174.03 FUEL TEMPERATURE INPUT VOLTAGE [illegible] supporti[illegible]g information.* 1. Ignition OFF 2. Remove jumper wire between both terminals 3. Install jumper wire between fuel temperature sensor harness connector input terminal and a good chassis 4. Ignition ON, engine OFF 5. Read the Fuel Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: On OEM applications, the low fuel temperature input voltage specification is 0.1 volts and below. For fuel temperature input voltage specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Above 0.1 V:** Open in fuel temperature input sensor circuit OR Faulty ECU connection OR Faulty ECU **0.1 V or below:** Open in fuel temperature sensor ground circuit OR Faulty ECU connection OR Faulty ECU ---1/1

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160
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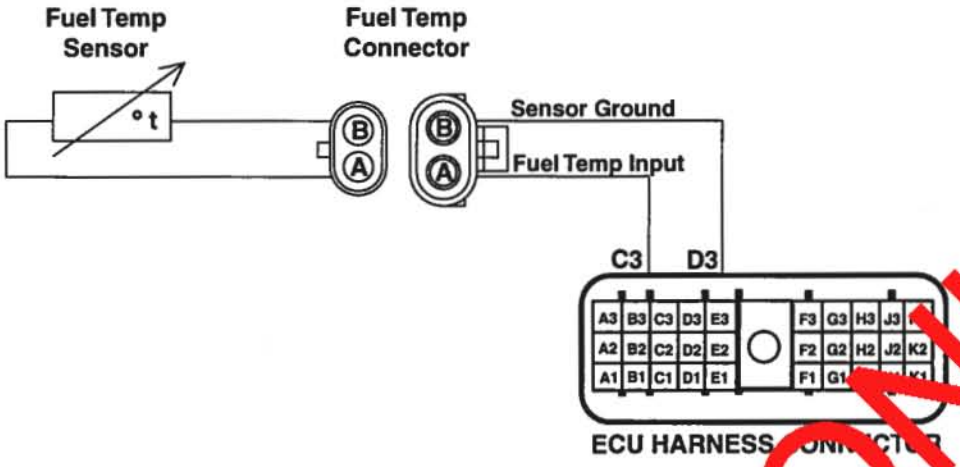
000174.04 — Fuel Temperature Input Voltage Low



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

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the injection pump fuel outlet housing. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for the variations in fuel density caused by varying fuel temperatures. For more fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000174.04 will set if:

- The fuel temperature input voltage goes above the sensor's low voltage specification. This voltage corresponds to a temperature that is higher than what is physically possible for fuel temperature.
  - For OEM engine applications, the low fuel temperature input voltage specification is 0.1 volts.
  - For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the low fuel temperature input voltage specification.

If DTC 000174.04 sets, the following will occur:

- The ECU will use a "limp-home" fuel temperature value of -20°C (-4°F) during cranking, and 40°C (104°F) during running.
- Engine power will be slightly derated.

RG40854,0000064 –19–07SEP05–1/1

000174.04 — Fuel Temperature Input Voltage Low

The fuel temperature input voltage goes above the sensor's low voltage specification.

RG4[illegible]64,000[illegible]2 -19[illegible]SEP05-1/1

000174.04 Fuel Temperature Input Voltage Low Diagnostic Procedure

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160
,193

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector, the fuel temperature sensor connector, and any connectors in between. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring, theory of operation, and sensor location information, see DTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Ignition ON, engine OFF 5. Read the Fuel Temperature Input Voltage parameter using the DST orSERVICE ADVISOR™ *NOTE: For OEM engine applications, the low fuel temperature input voltage specification is 0.1V. For the low voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**0.1 V or below:** GO TO ❸ **Above 0.1 V:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.
		---1/1

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❸ **Fuel Temperature Sensor Test**	*NOTE: For wiring, theory of operation, and sensor location information, seeDTC 000174.04 FUEL TEMPERATURE INPUT VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect fuel temperature sensor connector 3. Ignition ON 4. Read the Fuel Temperature Input Voltage parameter using the DST or SERVICE ADVISOR. *NOTE: For OEM engine applications, the high fuel temperature input voltage specification is 4.9V. For the high voltage specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.*	**Below 4.9 V:** Short to ground in fuel temperature sensor input circuit OR Faulty ECU **4.9 V or greater:** Faulty fuel temperature sensor ---1/1

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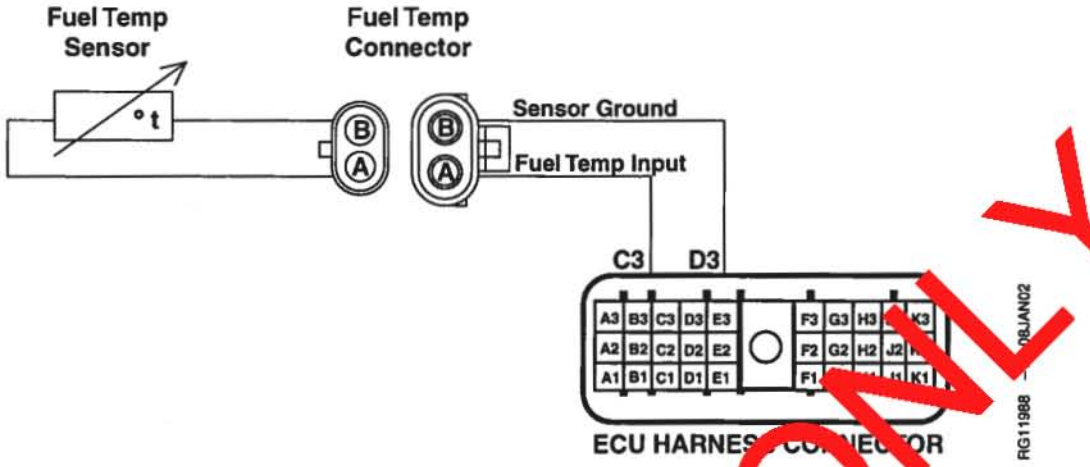
160
,194

000174.16 — Fuel Temperature High Moderately Severe



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

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the injection pump fuel outlet housing. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for the variations in fuel density caused by varying fuel temperatures. For more fuel temperature sensor information, see MEASURING TEMPERATURE in Section 03, Group 140 of this manual.

DTC 000174.16 will set if:

- The ECU senses fuel temperature on OEM applications above 120°C (248°F). For fuel temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000174.16 sets, the following will occur:

Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 of this manual.
- With Shutdown Feature: No shutdown available for this code.
- With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,0000061 –19–07SEP05–1/1

000174.16 — Fuel Temperature High Moderately Severe

The ECU senses fuel temperature above specifications.

000174.16 Fuel Temperature High Moderately Severe Diagnostic Procedure

–––1/1

❶ **DTC 000174.16 Preliminary Check**	Before using this diagnostic procedure: 1. Ensure that the fuel level in the fuel tan...s not extreme... 2. Ensure that fuel cooler is clean	**No problems found:** GO TO ❷ **Problem found:** Repair and retest
❷ **Connection Check**	**IMPORTANT: Do not f...ce prob... into connector terminals or damage will result. Use JT07328 Conn...or Adapter ...t Kit to make measurements in connectors. This will ensure t... termi...al damag... does not occur.** *NOTE: For ...ing ...nd th...y o...peration information, see DTC 000174.16 FUEL TEMPER...URE ...GH MO...RATELY SEVERE supporting information* Per...m a p...minary inspection of the ECU connector, the fuel temperature sensor ...nector, an...y connectors in between them. Look for dirty, damaged, or poorly positio...d termi...s.	**No faulty connection(s):** GO TO ❸ **Faulty connection(s):** Repair faulty connection(s)

–––1/1

❸ **Fuel Supply Pressure Check**	*NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information* Determine fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE in Section 04, Group 150 of this manual.	**Fuel pressure within specification:** GO TO ❹ **Fuel pressure below specification:** Determine cause of low fuel supply pressure. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE in Section 04, Group 150 of this manual. Repair and retest. ---1/1

❹ **Fuel Return Lines Restriction Check**	*NOTE: For wiring and theory of operation information, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE supporting information* Check return fuel lines for restriction between fuel tank and: • Overflow valve on injection pump • Fuel leak off line at injection nozzles	**Fuel return lines NOT restricted:** Faulty fuel cooler OR Faulty injection pump **Restriction found in either fuel return line:** Determine the cause of restriction Repair and retest ---1/1

000189.00 — Engine Speed Derate

The ECU detects a condition that requires an engine speed derate.

Engine Speed Derate

- The engine speed derate trouble code is set to indicate that the ECU has detected a condition or code such as DTC 002000.13 that requires engine speed to be limited.

DTC 000189.00 will set if:

- The ECU detects a condition that requires an engine speed derate.

If DTC 000189.00 sets, the following will occur:

- The ECU will limit engine speed in an attempt to protect the engine.

If DTC 000189.00 sets:

- Check for other stored or active DTCs that indicate the reason for the speed derate.

RG40854,0000001 -19-12AUG02-1/1

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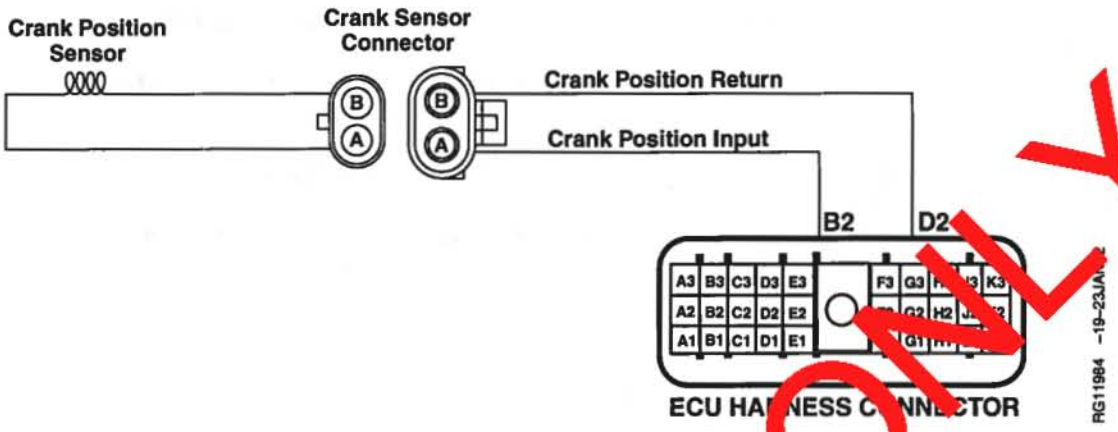
000190.00 — Engine Overspeed Extreme



The ECU detects that engine speed exceeds 3400 rpm.

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

Crank Position Sensor

- The crank position sensor is located on the front of the crankshaft, behind the pressed-on crank gear. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The sensor inputs a square-pulse signal to the ECU. The ECU uses the crank position input signal to determine engine speed and precise piston position in relation to the firing order. The crank timing wheel is composed of 46 evenly spaced teeth and 2 missing teeth. The missing-teeth portion of the sensor input signal is used by the ECU to determine Top-Dead-Center (TDC) crankshaft position.

DTC 000190.00 will set if

- The ECU detects that engine speed exceeds 3400 rpm.

If DTC 000190.00 sets, the following will occur:

- The ECU shuts fuel off until engine speed is below 3400 rpm.

If DTC 000190.00 sets:

- With DTC 000190.00, there may or not be a problem with the electronic control system. Using the DST orSERVICE ADVISOR™, monitor DTCs on the active code display parameter. To find DTC list, see LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU earlier in this Group. If there are other codes, go to the appropriate diagnostic procedure.
- If there are no other stored or active DTCs, clear DTC 000190.00 and monitor codes to see if DTC 000190.00 reoccurs.

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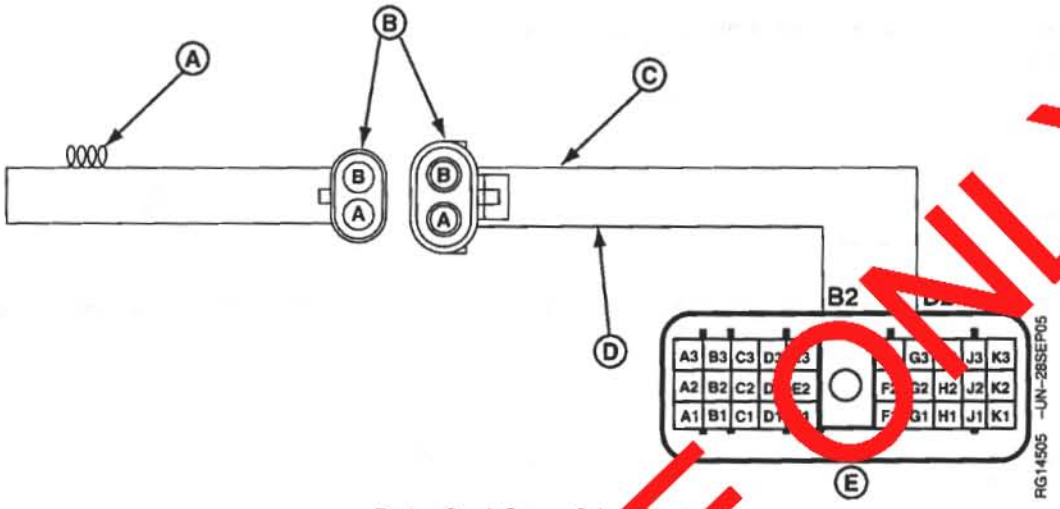
RG40854,0000148 –19–23SEP05–1/1

000190.01 — Engine Speed Below Normal Operational Range, Most Severe Level (OEM Marine Only)



Engine Crank Sensor Schematic

The ECU detects that engine speed is below the specified curve and time.

Crank Position Sensor

- The crank position sensor is located on the front of the crankshaft, behind the pressed-on crank gear. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The sensor inputs a square-pulse signal to the ECU. The ECU uses the crank position input signal to determine engine speed and precise piston position in relation to the firing order. The crank timing wheel is composed of 46 evenly spaced teeth and 2 missing teeth. The missing-teeth portion of the sensor input signal is used by the ECU to determine Top-Dead-Center (TDC) crankshaft position.
For this fault code, from the time ECU sets DTC 000190.1[illegible], ECU will count time incrementally for 120 minutes, while engine operates in this state, and then set DTC 000190.01. If engine speed increases and passes into normal operating speed, before ECU time has incremented to 120 minutes, for the time the engine operates in normal state, ECU will count time decrementally, until counted time is decremented back to zero, or engine speed again lapses back into moderately below normal speed. ECU then resumes counting time incrementally, not from zero, but from the time remainder at which ECU stopped counting decrementally.

DTC000190.01 sets if:

- The ECU detects when the engine speed drops below normal idle into the most severe below-normal-idle range and remains in it for an accumulation of 120 minutes.

If DTC 000190.01 sets, the following occurs:

- CAN white light comes on. Engine stalls out.

DB92450,0000026 –19–04AUG05–1/1

000190.01 — Engine Speed Below Normal Operational Range, Most Severe Level

The ECU detects that engine speed is below the specified curve and time.

92450...0027 –1...3AUG05–1/1

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,202

000190.01 Engine Speed Below Normal Operational Range, Most Severe Level Diagnostic Procedure

– – –1/1

❶ **Fuel Lines and Fittings Check**	Check fuel lines and fittings for damage.	**Damaged fuel line or fitting found:** Replace damaged part, bleed fuel system, and restart engine. **Damaged fuel line or fitting not found:** GO TO ❷

– – –1/1

❷ **Fuel Check, Low Pressure Side**	1. Check final fuel filter for clogging. 2. Check prefilter for clogging.	**Clogging found in one or both filters:** Replace filters, clear contaminants from sediment bowl, remove contaminated fuel and clean any contaminant sediment from fuel tank. Fill fuel tank, and bleed fuel line through far side of final fuel filter, until bleeding fuel is clear. **No clogging found in either filter:** GO TO ❸.

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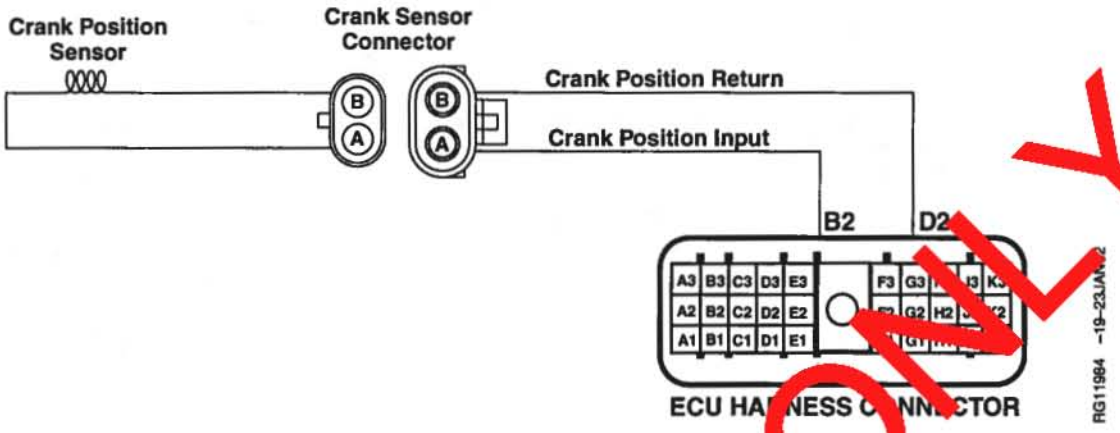
❸ **Transfer Pump Check**	**IMPORTANT: A backup wrench must always be used when loosening and tightening fittings of fuel lines from and to supply pump to avoid damage to fittings.** 1.At fuel line from transfer pump to final fuel filter, loosen tube nut fitting at fuel filter sufficiently to allow fuel to be freely bled from it. Tube Nut—Torque .... 24 N•m (18 lb-ft) 2. Depending on type of transfer pump, electrically or manually operate pump. **IMPORTANT: A backup wrench must always be used when loosening and tightening fittings of fuel lines from and to supply pump to avoid damage to fittings.** 3.Check to see whether or not fuel is steadily bleeding out. Tube Nut—Torque .... 24 N•m (18 lb-ft)	**Fuel is steadily bleeding out:**Close fitting, Tighten to specifications. **Specification** Restart engine. **Fuel is not bleeding out:**Remove and replace pump. Tighten to specifications. **Specification** [illegible] fuel system. Restart engine. - - -1/1

000190.16 — Engine Overspeed Moderate



ECU HARNESS CONNECTOR

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The ECU detects that engine speed is higher than 3000 rpm.

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

Crank Position Sensor

- The crank position sensor is located on the front of the crankshaft, behind the pressed-on crank gear. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The sensor inputs a square-pulse signal to the ECU. The ECU uses the crank position input signal to determine engine speed and precise piston position in relation to the firing order. The crank timing wheel is composed of 46 evenly spaced teeth and 2 missing teeth. The missing-teeth portion of the sensor input signal is used by the ECU to determine Top-Dead-Center (TDC) crankshaft position.

DTC 000190.16 will set if

- The ECU detects that engine speed is higher than 3000 rpm.

If DTC 000190.16 sets, the following will occur:

- The ECU shuts fuel off until engine speed is below 2000 rpm.

If DTC 000190.16 sets:

- With DTC 000190.16, there may or not be a problem with the electronic control system. Using the DST orSERVICE ADVISOR™, monitor DTCs on the active code display parameter. To find DTC list, see LISTING OF DIAGNOSTIC TROUBLE CODES (DTCS) ON ECU earlier in this Group. If there are other codes, go to the appropriate diagnostic procedure.
- If there are no other stored or active DTCs, clear DTC 000190.16 and monitor codes to see if DTC 000190.16 reoccurs.

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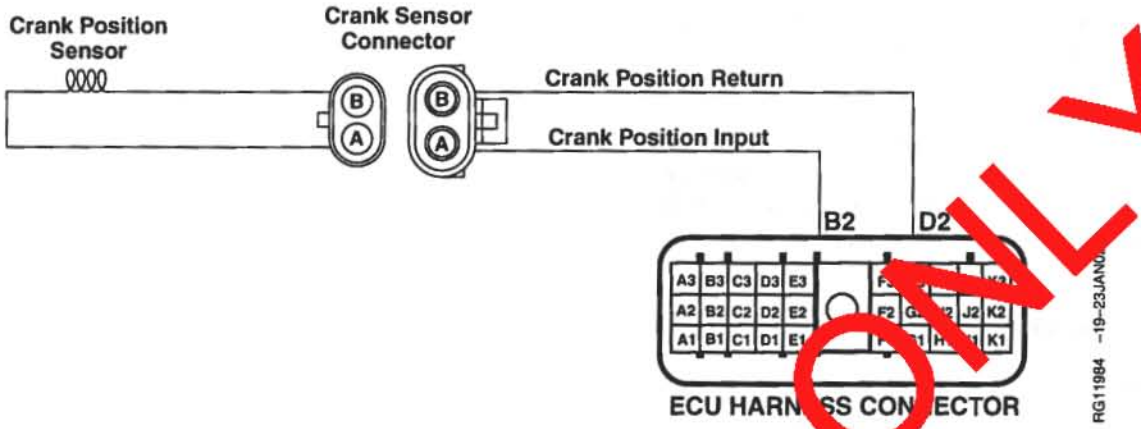
RG40854,0000149 -19-23SEP05-1/1

000190.18 — Engine Speed Below Normal Operational Range, Moderately Severe Level (OEM Marine Only)



The ECU detects that engine speed is moderately below the specified curve and time.

Crank Position Sensor

- The crank position sensor is located on the front of the crankshaft, behind the pressed-on crank gear. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The sensor inputs a square-pulse signal to the ECU. The ECU uses the crank position input signal to determine engine speed and precise piston position in relation to the firing order. The crank timing wheel is composed of 46 evenly spaced teeth and 2 missing teeth. The missing-teeth portion of the sensor input signal is used by the ECU to determine Top Dead-Center (TDC) crankshaft position.
  For this trouble, ECU will count time incrementally for 30 minutes while engine operates in this state, and then set DTC 000190.18. If engine speed increases and passes into normal operating speed, before ECU time has incremented to 30 minutes, for the time the engine operates in normal state, ECU will count time decrementally, until counted time is decremented back to zero, or engine speed again lapses back into moderately below normal speed. ECU then resumes counting time incrementally, not from zero, but from the time remainder at which ECU stopped counting decrementally.

DTC 000190.18 will set if:

- The ECU detects that engine speed has been operating moderately below the specified curve and time for 30 minutes.

If DTC 000190.18 sets, the following will occur:

- The CAN white light comes on. If ECU determines that engine has operated continuously, or cumulatively, in this condition for 30 minutes.

DB92450,0000028 –19–04AUG05–1/1

000523.09 — Current Gear Selection Invalid or Not Received (J-series Loaders Only)

ECU is receiving invalid selection information for current gear, or is receiving no information at all.

Gear Selection

- The Loader controller transmits the vehicle gear selection to the ECU over the CAN bus. The ECU uses this information to select the correct governor curve mode.

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DTC 000523.09 will set if:

- The ECU does not receive vehicle gear selection information, or the information ECU receives is invalid.

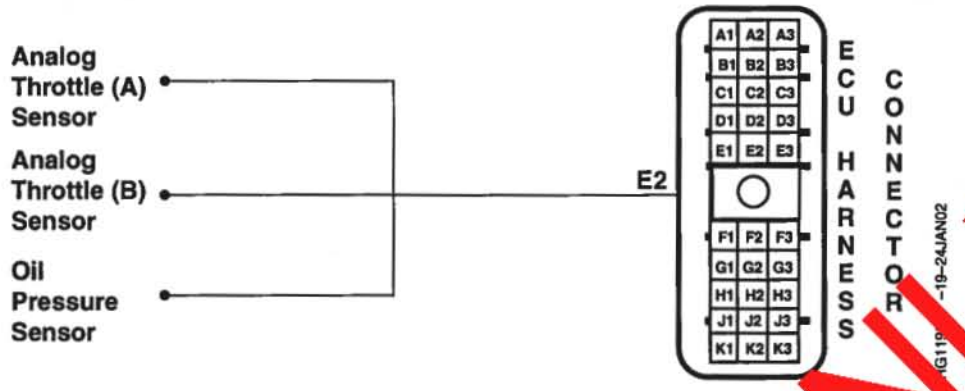
If DTC 000523.09 Sets:

- The ECU does not receive vehicle gear selection information, or it is invalid
- Transport curve cannot be selected. (Only one torque curve is used for this machine. No timers or derate torque curves are used.
- Using the DST or SERVICE ADVISOR, monitor DTCs on the active code display parameter.
- Check to see if any other controllers on the machine have any active or stored CAN or vehicle-related DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN or vehicle related DTCs are found, replace ECU and retest.

NOTE: For diagnostic troubleshooting procedure, refer to the Loader Vehicle Technical Manual.

DB92450,0000029 –19–05AUG05–1/1

000620.03 — Sensor Supply Voltage High



04 160 208

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

Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on the application. The ECU monitors the drop in voltage that the sensor causes and compares that drop to preprogrammed values in the ECU's memory to determine the value of the parameter the sens[illegible]s measuring. In addition, the ECU monitors the exa[illegible] voltage on the 5 volt supply circuit in order to ensure accurate readings.

DTC 000620.03 will set if:

- The ECU detects a voltage that is higher than 5.5 volts on the ECU 5 volt sensor supply circuit.

When DTC 000620.03 sets, the following will occur:

- The ECU will use default values for the sensors that use sensor supply input voltage.

RG40854,000005C -19-06DEC01-1/1

000620.03 — Sensor Supply Voltage High

The ECU detects a voltage that is higher than 5.5 volts on the ECU 5 volt sensor supply circuit.

RG40[illegible]SEP05–1/1

000620.03 Sensor Supply Voltage High Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* Perform a preliminary inspection of ECU connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine OFF 7. Read DTCs using the DST orSERVICE ADVISOR™.	**000620.03 reoccurs:** GO TO ❸ **000620.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

---1/1

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❸ **Sensor Supply Wire Check for Short**	*NOTE: For wiring and theory of operation information, see DTC 000620.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using multimeter, measure resistance between terminal E2 in the harness end of the ECU connector and all other terminals in the harness end of the ECU connector.	**Greater than 20,000 ohms:** Faulty ECU connector OR Faulty ECU **Less than 20,000 ohms:** Short to voltage in sensor supply wire ---1/1

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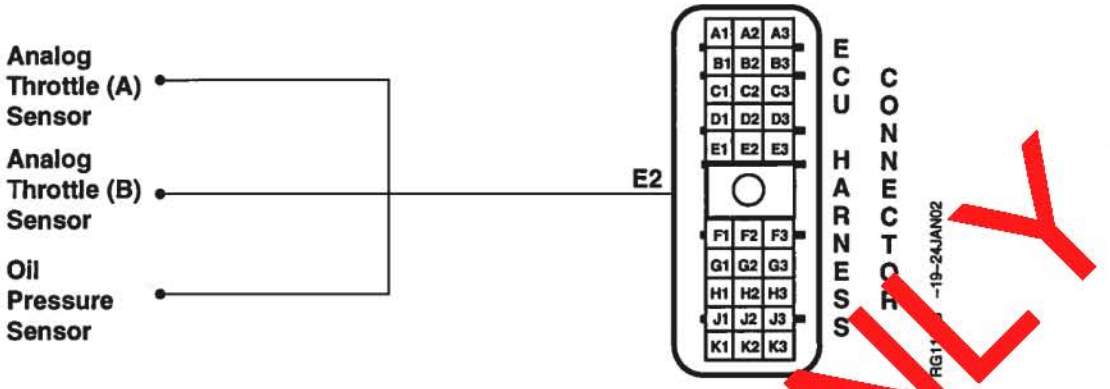
,210

000620.04 — Sensor Supply Voltage Low



04 160 ,212

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

Sensor Supply Voltage

- The ECU supplies voltage to a few different sensors depending on the application. The ECU monitors the drop in voltage that the sensor causes and compares that drop to preprogrammed values in the ECU's memory to determine the value of the parameter the sens[illegible]as measuring. In addition, the ECU monitor[illegible] the ex[illegible]t vo[illegible]age on the 5 volt supply circuit in [illegible]rder to e[illegible]ure accurate readings.

DTC 000620.04 wi[illegible] set if:

- The E[illegible]U detects a voltage that is lower than 4.44 volt[illegible] on th[illegible]ECU 5 volt sensor supply circuit.

[illegible]DTC 00[illegible]20[illegible]4 sets, the following will occur:

- The E[illegible]U will use default values for the sensors that use s[illegible]nsor supply input voltage.

RG40854,000005E -19-06DEC01-1/1

000620.04 — Sensor Supply Voltage Low

The ECU detects a voltage that is lower than 4.44 volts on the ECU 5 volt sensor supply circuit.

RG40[illegible]-23SEP05-1/1

000620.04 Sensor Supply Voltage Low Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Sensor Check**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition OFF 7. Disconnect all sensors that receive their 5V supply from terminal E2 of the ECU 8. Ignition ON, engine running 9. Read DTCs using the DST orSERVICE ADVISOR™.	**000620.04 reoccurs:** GO TO ❹ **000620.04 does not reoccur:** GO TO ❸

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❸ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Ignition ON, engine OFF 2. While reconnecting each sensor one at a time, monitor DTCs using the DST or SERVICE ADVISOR.	**000620.04 reoccurs:** Faulty sensor Replace and retest **000620.04 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group. ---1/1

❹ **Sensor Supply Short to Ground Check**	*NOTE: For wiring and theory of operation information, see DTC 000620.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect the ECU connector 3. Using a multimeter, measure resistance between terminal D3 in the harness end of the ECU connector and: • A good chassis ground • Terminal J2 in the harness end of the ECU connector	**Greater than 20,000 ohms:** Faulty ECU connector OR Faulty ECU **Less than 20,000 ohms:** Sensor 5 volt supply circuit shorted to ground ---1/1

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160
,214

000629.13 — ECU Error

The ECU detects an internal problem.

DTC 000629.13 will set if:

- The ECU detects an internal problem.

If DTC 000629.13 sets, the following will occur:

- The engine will not start or run.

000629.13 ECU Error Diagnostic Procedure

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160
,216

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❶ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation informatio... see DT... 000629.13 ECU ERROR supporting information.* 1. Verify that controllers on vehicle are in co...ect location a... ...nnected to the correct wiring harness 2. Connect to the DST or SERVICE AD...SO... 3. Ignition ON, engine OFF 4. Start the ECU comm...ication so...are 5. Read DTCs using t... DS... orSERVICE ADVISOR™. 6. Make not... of any ...TCs, ...ar... clear all DTCs 7. Ignition O... e...gine ra...ng or cranking for 15 seconds 8. ...ead DTCs us...g the DST orSERVICE ADVISOR™.	**000629.13 reoccurs:** Faulty ECU **000629.13 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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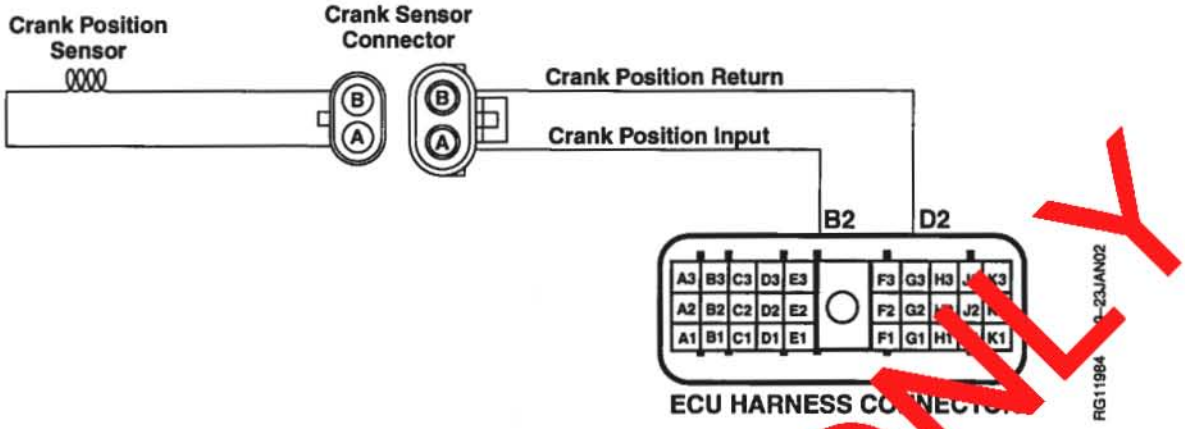
000637.02 — Crank Position Input Noise



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

Crank Position Sensor

- The crank position sensor is located on the front of the crankshaft, behind the pressed-on crank gear. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precise piston position in relation to the firing order. The crank timing wheel is composed of 46 evenly spaced teeth and 1 missing teeth. The missing teeth help the ECU to determine Top-Dead-Center (TDC).

DTC 000637.02 will set if:

- The ECU detects excessive noise (extra pulses) on the crank position input.

When DTC 000637.02 sets, the following will occur:

- Engine probably will not run

RG40854,0000038 –19–06DEC01–1/1

000637.02 — Crank Position Input Noise

The ECU detects excessive noise (extra pulses) on the crank position input.

RG4[illegible] 1.0000[illegible] -[illegible]23SEP05-1/1

000637.02 Crank Position Input Noise Diagnostic Procedure

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160
219

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector te[illegible]s or da[illegible]age will result. Use JT07328 Connector Adapter Test Kit to [illegible] mea[illegible]remen[illegible] in connectors. This will ensure that terminal damage doe[illegible]not occur.** *NOTE: For wiring and theory of operation in[illegible]mation, see DTC 000637.02 CRANK POSITION INPUT NOISE supporting in[illegible]mati[illegible]* Perform a preliminary inspectio[illegible] ECU c[illegible]nector, the crank position sensor connector, and any other co[illegible]necto[illegible] Look for [illegible], damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANK POSITION INPUT NOISE supporting information.* 1. Con[illegible]ct [illegible]the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Warm engine 7. Ignition ON, engine running 8. Read DTCs using the DST orSERVICE ADVISOR™.	**000637.02 reoccurs:** GO TO ❸ **000637.02 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Crank Signal Noise Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.02 CRANK POSITION INPUT NOISE supporting information.* 1. 000637.02 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections anywhere on the machine. Things to check: • All harness connectors • Alternator connections • Chassis ground connections, battery ground connection • Corrosion, dirt, or paint can cause intermittent and "noisy" connections • Check the wiring for intermittent open and short circuits; particularly the crank sensor wiring • Check wiring for proper pin location in the crank sensor and ECU connectors 2. Other possible causes of 000637.02: • Electromagnetic interference (EMI) from an incorrectly installed 2-way radio • Interference from some radar source • Possible broken teeth on the crankshaft timing ring	---1/1

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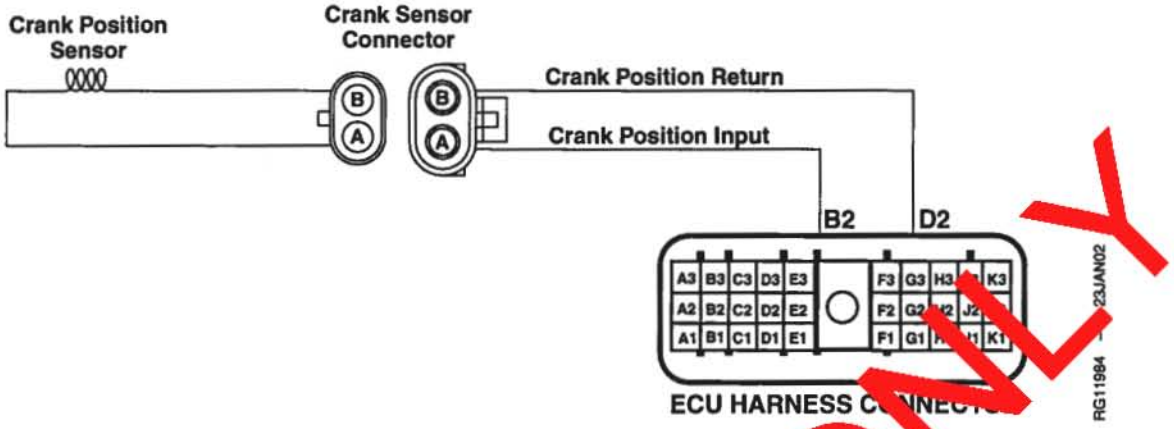
160
,220

000637.10 — Crank Position Input Pattern Error



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

Crank Position Sensor

- The crank position sensor is located on the front of the crankshaft, behind the pressed-on crank gear. It is an inductive type pickup sensor that detects teeth on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precise piston position in relation to the firing order. The crank timing wheel is composed of 46 evenly spaced teeth and 2 missing teeth. The missing teeth help the ECU to determine Top-Dead-Center (TDC).

DTC 000637.10 will set if:

- The ECU detects an improper pattern on the crank position input.

If DTC 000637.10 sets, the following will occur:

- Engine probably will not run.

RG40854,000003A –19–06DEC01–1/1

000637.10 — Crank Position Input Pattern Error

The ECU detects an improper pattern on the crank position input.

RG[illegible]854,00[illegible]10A -19[illegible]SEP05-1/1

000637.10 Crank Position Input Pattern Error Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* Perform a preliminary inspection of the ECU connector, the crank position sensor connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of any DTCs, then clear all DTCs 6. Ignition ON, engine running 7. Read DTCs using the DST orSERVICE ADVISOR™.	**000637.10 reoccurs:** GO TO ❸ **000637.10 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Crank Position Sensor Test**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector 3. Using a multimeter, measure resistance between both terminals of the crank position sensor.	**Between 2500 and 3500 ohms:** GO TO ❹ **Below 2500 ohms or above 3500 ohms:** Faulty crank position sensor ---1/1

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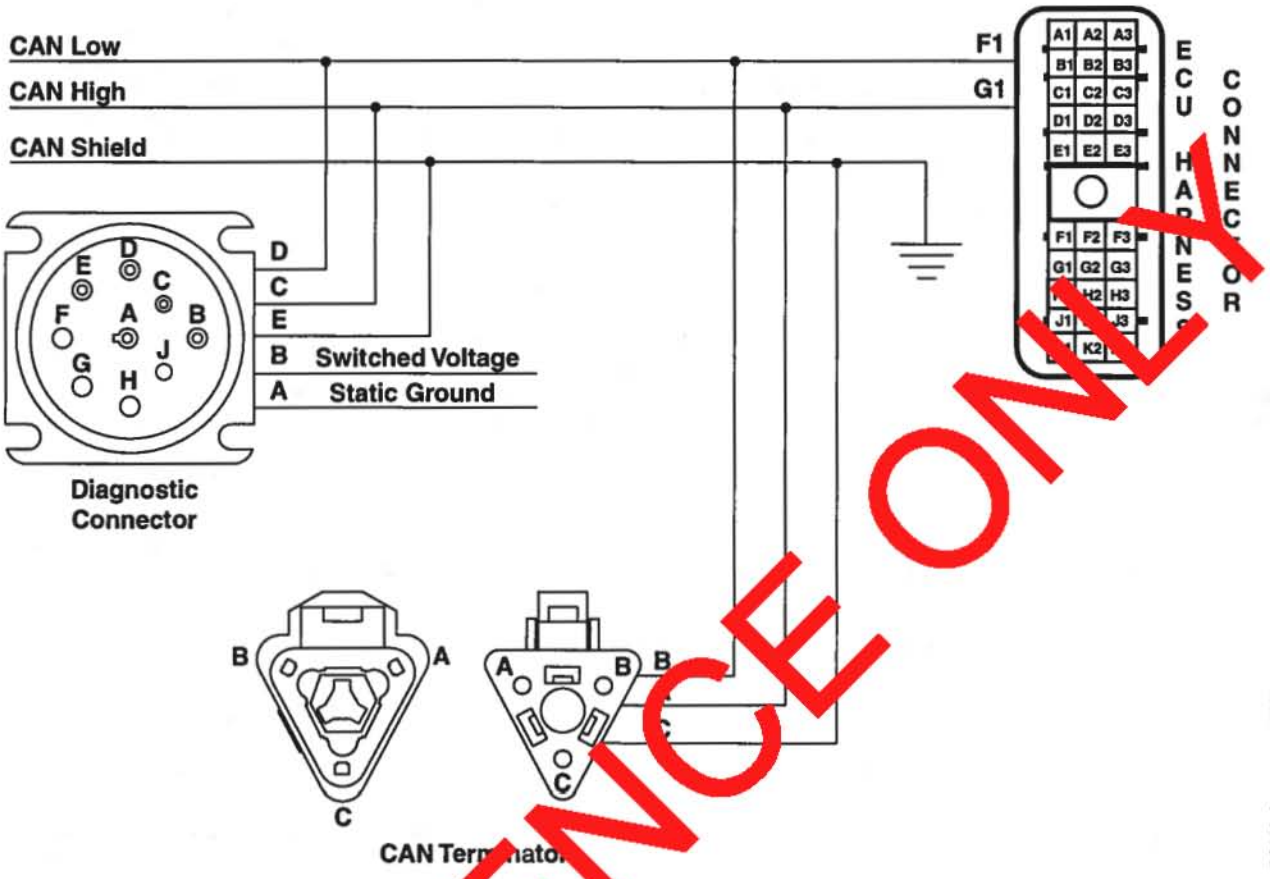
160
,224

❹ **Open in Crank Sensor Input and Return Check**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Disconnect crank position sensor connector 3. Disconnect ECU connector 4. Using a multimeter, measure resistance between • Terminal A of the crank position sensor harness connector and terminal B2 in the harness end of the ECU connector • Terminal B of the crank position sensor harness connector and terminal D2 in the harness end of the ECU connector	**Both measurements 5 ohms or less:** GO TO ❺ **Either measurement greater than 5 ohms:** Open in crank position sensor input wire OR Open in crank position sensor return wire OR Terminals A and B in the crank position sensor harness connector possibly inverted ---1/1

❺ **Crank Sensor Input Wiring Check**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Crank position sensor connector and ECU connector still disconnected 3. Using a multimeter measure resistance between terminal B2 in the harness end of the ECU connector and the following: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2000 ohms:** GO TO ❻ **Any measurement less than 2000 ohms:** Faulty crank position sensor input wiring harness ---1/1

❻ **Crank Sensor Return Wiring Check**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Crank position sensor connector and ECU connector still disconnected 3. Using a multimeter measure resistance between terminal D2 in the harness end of the ECU connector and the following: • A good ground • All other terminals in both ECU connectors	**All measurements greater than 2000 ohms:** GO TO ❼ **Any measurement less than 2000 ohms:** Faulty crank position sensor return wiring harness ---1/1
❼ **Crank Sensor and Timing Wheel Check**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Remove crank position sensor from injection pump 2. Remove crank position sensor 3. Inspect sensor for cracks, corrosion, or any foreign material on the end of the sensor 4. Inspect the crank timing wheel notches for burrs or chips	**All components OK:** GO TO ❽ **Fault found in a component:** Repair or replace component as needed ---1/1
❽ **Gear Timing Check**	*NOTE: For wiring and theory of operation information, see DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR supporting information.* 1. Ignition OFF 2. Remove timing cover 3. Check timing between camshaft, crankshaft, and injection pump gears. See INSTALL CAMSHAFT in Group 050 of 4.5 & 6.8 L Diesel Engines Base Engine Manual (CTM 104).	**All gears in time:** Faulty crank position sensor connector OR Faulty ECU connector OR Faulty ECU **One or more gears out of time:** Make necessary adjustments to ensure correct timing. See INSTALL CAMSHAFT in Section 02, Group 050 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104). ---1/1

000639.13 — CAN Bus Error



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NOTE: Wiring schematic shows OEM engine applications only. For wiring of other applications, see APPLICATION SPECIFICATIONS in Section 01, Group 210 of this manual.

Controller Area Network (CAN)

- CAN is the network in which the individual controllers on a machine communicate with each other. The number of controllers communicating on CAN depends on the application. On some applications, the ECU is the only controller on CAN; on other applications, there are many controllers on CAN.

DTC 000639.13 will set if:

- The ECU detects a problem communicating on CAN.

If DTC 000639.13 sets, the following will occur:

- Depending on the application, engine operation may or may not be affected.

RG40854,0000036 -19-06DEC01-1/1

000639.13 — CAN Bus Error

The ECU detects a problem communicating on CAN.

RG4[illegible]4,000[illegible] -1[illegible]23SEP05-1/1

000639.13 CAN Bus Error Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information* Perform a preliminary inspection of ECU connector, the CAN connections, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start ECU communication software 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Make note of all DTCs, then clear all DTCs 6. Ignition ON 7. Read DTCs using the DST or SERVICE ADVISOR.	**DTC 000639.13 reoccurs:** GO TO ❸ **DTC 000639.13 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Check Other Controllers For CAN Related DTCs**	*NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information* If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs	**No CAN related DTCs found on other controllers:** GO TO ❹ **Found CAN related DTCs on other controllers:** Refer to machine manual to diagnose and repair the CAN related DTC, then determine if DTC 000639.13 reoccurs ---1/1
❹ **CAN Resistance Test**	*NOTE: For wiring and theory of operation information, see DTC 000639.13 CAN BUS ERROR supporting information* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure resistance between terminals F1 and G1 in the harness end of the ECU connector	**Between 55 ohms and 65 ohms:** Faulty ECU connector OR Faulty ECU **Less than 55 ohms or greater than 65 ohms:** Open or short in CAN communication circuit ---1/1

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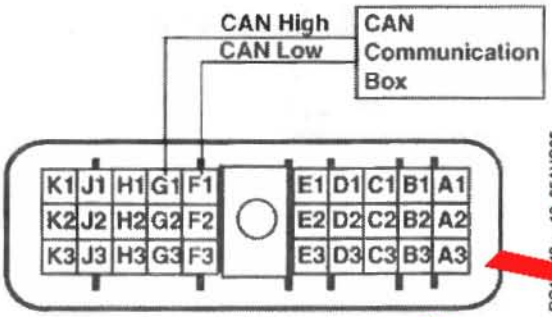
000644.02 — External Speed Command Input (OEM, Marine Only)



CAN Communication Connection

ECU receives erratic or incorrect data from external source

CAN Communication

- 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. It is through CAN that external signals are communicated to ECU. In this case, it is either engine speed or engine torque requirements.

DTC 00644.02 will set if:

- The ECU receives erratic or incorrect data through CAN from external source requiring either engine speed or torque.

If DTC 00644.02 sets, the following will occur:

- CAN white light turns on.

NOTE: When DTC 000644.02 sets, refer to the vehicle technical manual.

DB92450,000002A -19-05AUG05-1/1

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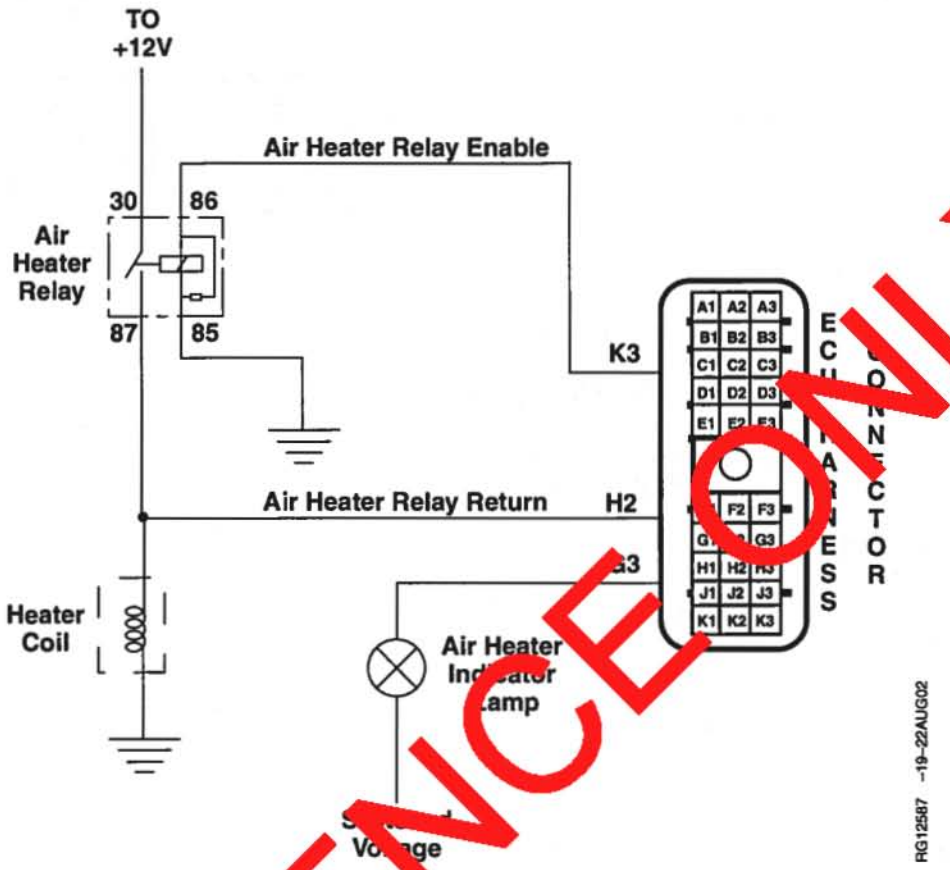
000729.03 — Inlet Air Heater Signal High



Air Heater

- The air heater is used to warm the engine's intake air temperature prior to starting. The ECU reads engine coolant temperature at the Key ON position. If the temperature is below 0°C (32°F) the ECU sends out battery voltage to energize the air heater relay coil. This activates the relay passing 12 volts to the heater coil.

DTC 000729.03 will set if:

- The ECU is not sending current to the air heater relay, but detects 12 volts going to the heater coil.

DTC 000729.03 sets, the following will occur:

- Engine performance will not be effected while running.
- Hard starting may occur
- The ECU will set a BLINKING warning light.

RG40854,0000002CONV2 -19-12AUG02-1/1

000729.03 — Inlet Air Heater Signal High

The ECU is not sending current to the air heater relay, but detects 12 volts going to the heater coil.

RG40854,0[illegible]003CC[illegible] -1[illegible]2AUG02-1/1

000729.03 Inlet Air Heater Signal High Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000729.03 INLET AIR HEATER SIGNAL HIGH supporting information* Perform a preliminary inspection of the ECU connector, air heater relay, and the air heater. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000729.03 INLET AIR HEATER SIGNAL HIGH supporting information* 1. Ignition ON, engine OFF 2. Using a multimeter, measure voltage between the heater coil power stud and a good chassis ground.	**Approximately battery voltage:** GO TO ❸ **Substantially less than battery voltage:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. ---1/1

❸ **Air Heater Relay Return Wire Test**	*NOTE: For wiring and theory of operation information, see DTC 000729.03 INLET AIR HEATER SIGNAL HIGH supporting information* 1. Ignition OFF 2. Disconnect the ECU connector 3. Using a multimeter, measure resistance between terminal H2 in the harness end of the ECU connector and the following: • Terminal 87 on the air heater relay • Heater coil power stud	**All measurements 5 ohms or less:** GO TO ❹ **Either measurement greater than 5 ohms:** Air heater relay return wire shorted to power. ---1/1

❹ **Air Heater Relay Test**	*NOTE: For wiring and theory of operation information, see DTC 000729.03 INLET AIR HEATER SIGNAL HIGH supporting information* 1. Ignition OFF 2. ECU connector still disconnected 3. Using a multimeter, measure resistance between terminal K3 in the harness end of the ECU connector and terminal 86 on the air heater relay	**Measurements 5 ohms or less:** Faulty air heater relay **Measurements greater than 5 ohms:** Air heater relay enable wire shorted to power ---1/1

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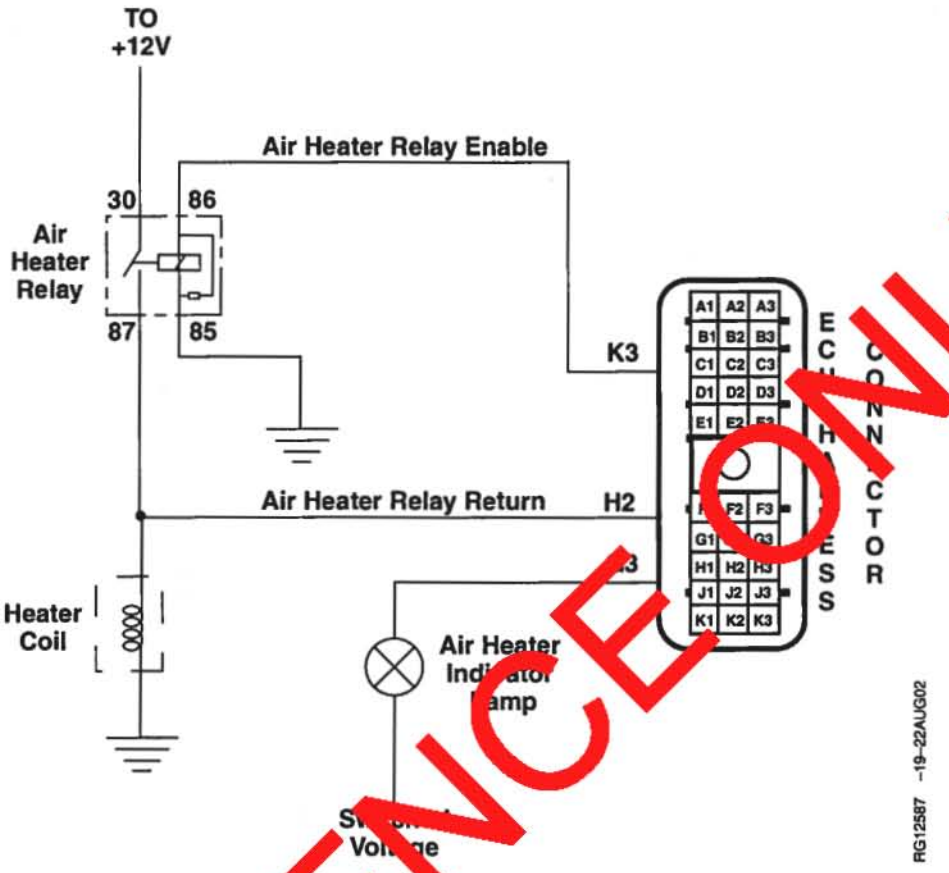
000729.05 — Inlet Air Heater Signal Low



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

Air Heater

- The air heater is used to warm the engine's air temperature prior to starting. The ECU reads engine coolant temperature at the key ON position. If the temperature is below 0°C (32°F) the ECU sends out battery voltage to energize the air heater relay coil. This activates the relay passing 12 volts to the heater coil.

DTC 000729.05 will set if:

- The ECU is sending current to the air heater relay, but does not detect 12 volts going to the heater coil.

DTC 000729.05 sets, the following will occur:

- Engine performance will not be effected while running.
- Hard starting may occur
- The ECU will set a BLINKING warning light.

RG40854,0000004 –19–12AUG02–1/1

000729.05 — Inlet Air Heater Signal Low

The ECU is sending current to the air heater relay, but does not detect 12 volts going to the heater coil.

RG[illegible]54,000[illegible]5 -1[illegible]23SEP05-1/1

000729.05 Inlet Air Heater Signal Low Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000729.05 INLET AIR HEATER SIGNAL LOW supporting information* Perform a preliminary inspection of ECU connector, air heater relay, and the air heater. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000729.05 INLET AIR HEATER SIGNAL LOW supporting information* 1. Connect the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**000729.05 reoccurs:** GO TO ❸ **000729.05 doesn't reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Air Heater Relay Test**	*NOTE: For wiring and theory of operation information, see DTC 000729.05 INLET AIR HEATER SIGNAL LOW supporting information* 1. Cycle ignition from OFF to ON 2. Listen to air heater relay	**Relay clicks:** GO TO ❹ **Relay doesn't click:** Open in air heater relay enable wire OR Open in air heater relay ground OR Faulty relay ---1/1
❹ **Air Heater Relay Voltage Test**	*NOTE: For wiring and theory of operation information, see DTC 000729.05 INLET AIR HEATER SIGNAL LOW supporting information* 1. Ignition ON, engine OFF 2. Using a multimeter, measure voltage between terminal 30 on the air heater relay and a good chassis ground	**Approximately battery voltage:** GO TO ❺ **Substantially less than battery voltage:** Open in battery voltage supply wire OR Short to ground in battery voltage supply wire ---1/1
❺ **Heater Coil Power Test**	*NOTE: For wiring and theory of operation information, see DTC 000729.05 INLET AIR HEATER SIGNAL LOW supporting information* 1. Ignition ON, engine OFF 2. Using a multimeter, measure voltage between the heater coil power stud and a good chassis ground	**Approximately battery voltage:** Open in air heater relay return wire **Substantially less than battery voltage:** Open in wire between air heater relay terminal 87 and the heater coil OR Short to ground in wire between air heater relay terminal 87 and the heater coil ---1/1

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000898.09 — Vehicle Speed or Torque Message Invalid

The ECU does not receive the engine speed or torque message over CAN or it is not valid.

CAN (Controller Area Network) Vehicle Speed or Torque Message

- The CAN (Controller Area Network) transmits the vehicle's desired engine speed or torque to the ECU from another controller.

DTC 000898.09 will set if:

- The ECU does not receive the engine speed or torque message over CAN or it is not valid.

If DTC 000898.09 sets, the following will occur:

- The ECU will default engine speed to low idle.

If DTC 000898.09 sets:

- Connect to the DST or SERVICE ADVISOR.
- With ignition ON and engine OFF, start the ECU communication software
- Read active DTCs and stored DTCs using the DST orSERVICE ADVISOR™. If DTC 000639.12 also occurs, see DTC 000639.12 CAN BUS ERROR DIAGNOSTIC PROCEDURE earlier in this Group.
- If no other stored or active CAN or vehicle related DTCs are found, replace the ECU and retest.

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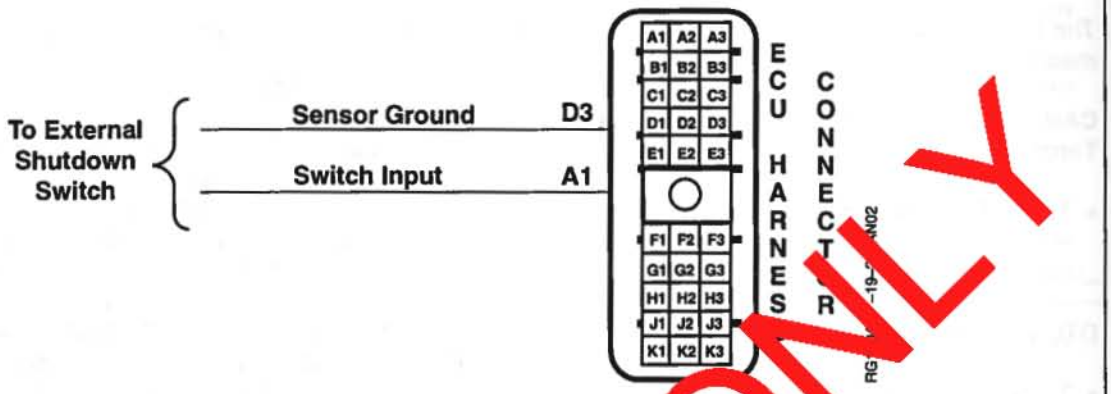
RG40854,0000114 –19–23SEP05–1/1

000970.31 — Auxiliary Engine Shutdown Switch Active



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The ECU does not read an input voltage on the auxiliary engine shutdown input wire.

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

NOTE: Wiring schematic shows OEM engine applications only. For wiring on other applications, see APPLICATION SPECIFICATIONS in Section 04, Group 210 of this manual.

Auxiliary Engine Shutdown Switch

- On OEM applications, the engine shutdown switch is a normally open switch. When the property being measured exceeds a certain value, the switch will close. When the switch is closed, the voltage is grounded which will cause the ECU to shutdown the engine.

DTC 000970.31 will set if:

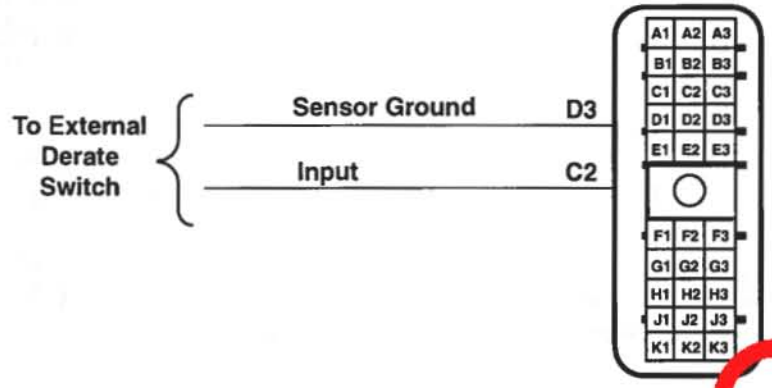
The ECU does not read an input voltage on the auxiliary engine shutdown input wire.

If DTC 000970.31 sets, the following will occur:

- The ECU will shut the engine down immediately.

RG40854,000003E -19-06DEC01-1/1

000971.31 — External Engine Derate Switch Active



The ECU does not read an input voltage.

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

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

External Fuel Derate Switch

- On OEM applications, the external derate switch is a normally open switch. When properly wiring measured exceeds a certain value, the switch will close. When the switch is closed, the voltage is grounded which will cause the ECU to derate the engine.

DTC 000971.31 will set if:

- The ECU does not read an input voltage.

If DTC 000971.31 sets, the following will occur:

- On OEM applications, the ECU will derate the engine 2% per minute until the engine is running at 80% of full power. For derates on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

RG40854,000003F –19–06DEC01–1/1

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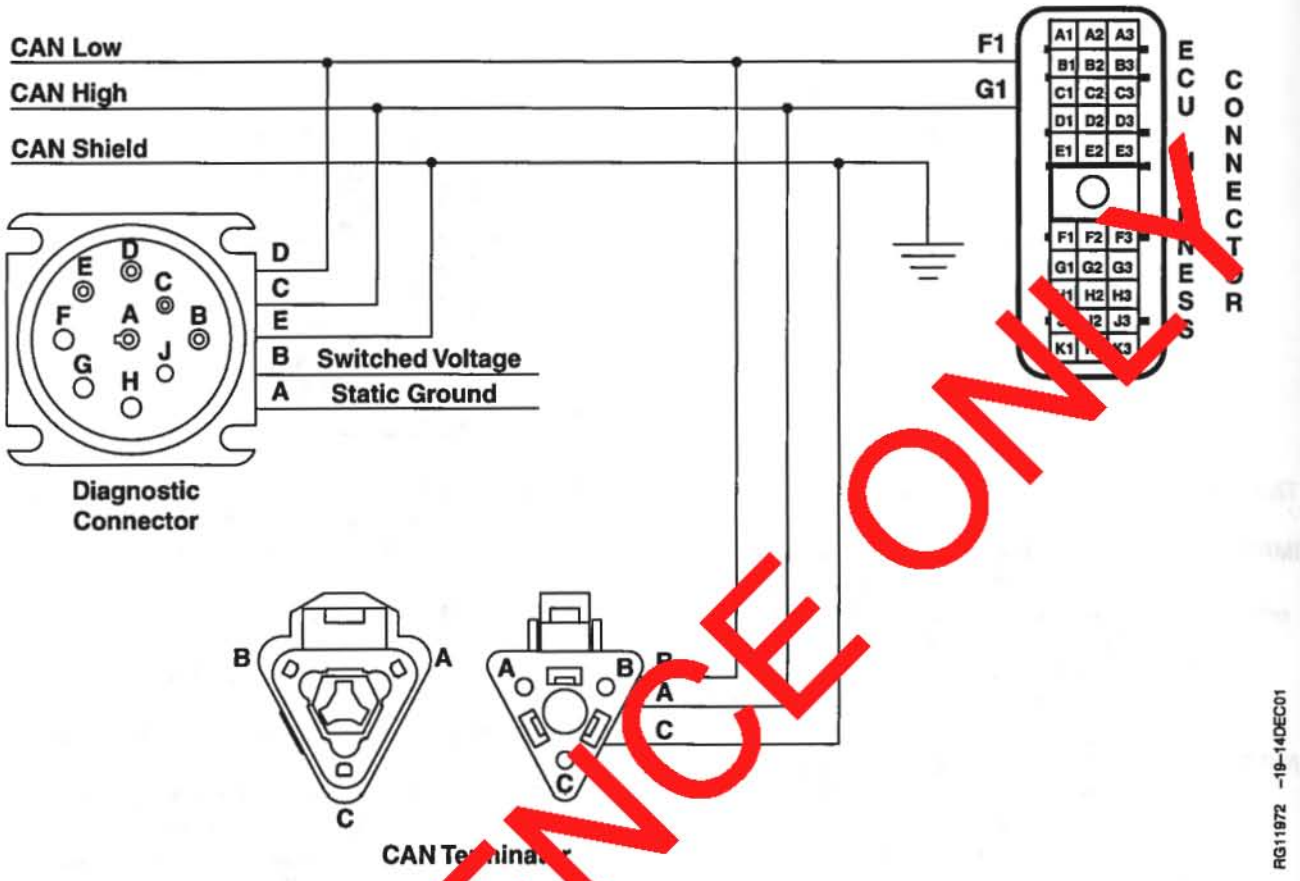
,239

001069.09 — Tire Size Invalid



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NOTE: Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 03, Group 210 of this manual.

Tire Size

- Tire size is input into the vehicle for a given size of tire.

DTC 001069.09 will set if:

- The ECU either does not receive tire size information over CAN, or the information received is not valid.

If DTC 001069.09 sets, the following will occur:

- ECU will assume the largest tire size
- Road speed limiting may occur at a speed that is less than the specified speed.

RG40854,0000006 –19–12AUG02–1/1

001069.09 — Tire Size Invalid

The ECU either does not receive tire size information over CAN, or the information received is not valid.

RG40854,0[illegible]0007 [illegible]SEP05–1/1

001069.09 Tire Size Invalid Diagnostic Procedure

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160
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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector termin[illegible]r dama[illegible] will result. Use JT07328 Connector Adapter Test Kit to ma[illegible]asure[illegible]ents [illegible] connectors. This will ensure that terminal damage does n[illegible] occur.** *NOTE: For wiring and theory of operation, [illegible]ee D[illegible]C 001069.[illegible] TIRE SIZE INVALID supporting information.* Perform a preliminary inspection of [illegible]looking for dirty, damaged, or poorly positioned terminals.	**No faulty connections:** GO TO ❷ **Faulty connections:** Repair faulty connection(s).
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wi[illegible]g and [illegible]ory of operation, see DTC 001069.09 TIRE SIZE INVALID supp[illegible]ng i[illegible]rmation.* 1. Connec[illegible] th[illegible] DST or SERVICE ADVISOR. 2. [illegible]gnition ON, engine OFF 3. S[illegible]t the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**001069.09 reoccurs:** GO TO ❸ **001069.09 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Application Related DTCs Test**	*NOTE: For wiring and theory of operation, see DTC 001069.09 TIRE SIZE INVALID supporting information.* If application has other machine controllers communicating on the CAN bus, check those controllers for CAN related DTCs.	**No CAN related DTCs found on other controllers:** GO TO ❹ **Found CAN related DTCs found on other controllers:** Refer to diagnostic procedure for that controller ---1/1
❹ **Resistance Between CAN High and Low Test**	*NOTE: For wiring and theory of operation, see DTC 001069.09 TIRE SIZE INVALID supporting information.* 1. Ignition OFF 2. Using a multimeter, measure resistance between terminals C and D in the harness end of the diagnostic connector.	**Between 45-75 ohms:** GO TO ❺ **Less than 45 or greater than 75 ohms:** Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness. ---1/1
❺ **CAN Wiring Shorted to Ground or Voltage Test**	*NOTE: For wiring and theory of operation, see DTC 001069.09 TIRE SIZE INVALID supporting information.* 1. Ignition OFF 2. Using a multimeter, measure voltage between a good chassis ground and: • Terminal C in the diagnostic connector. • Terminal D in the diagnostic connector.	**Both measurements between 1.5 and 3.5 volts:** Faulty ECU connector OR Other connector in the CAN system OR Faulty ECU. **Either measurement less than 1.5 or greater than 3.5 volts:** CAN wiring shorted to ground or voltage OR Another controller in the CAN system is faulty OR Faulty ECU ---1/1

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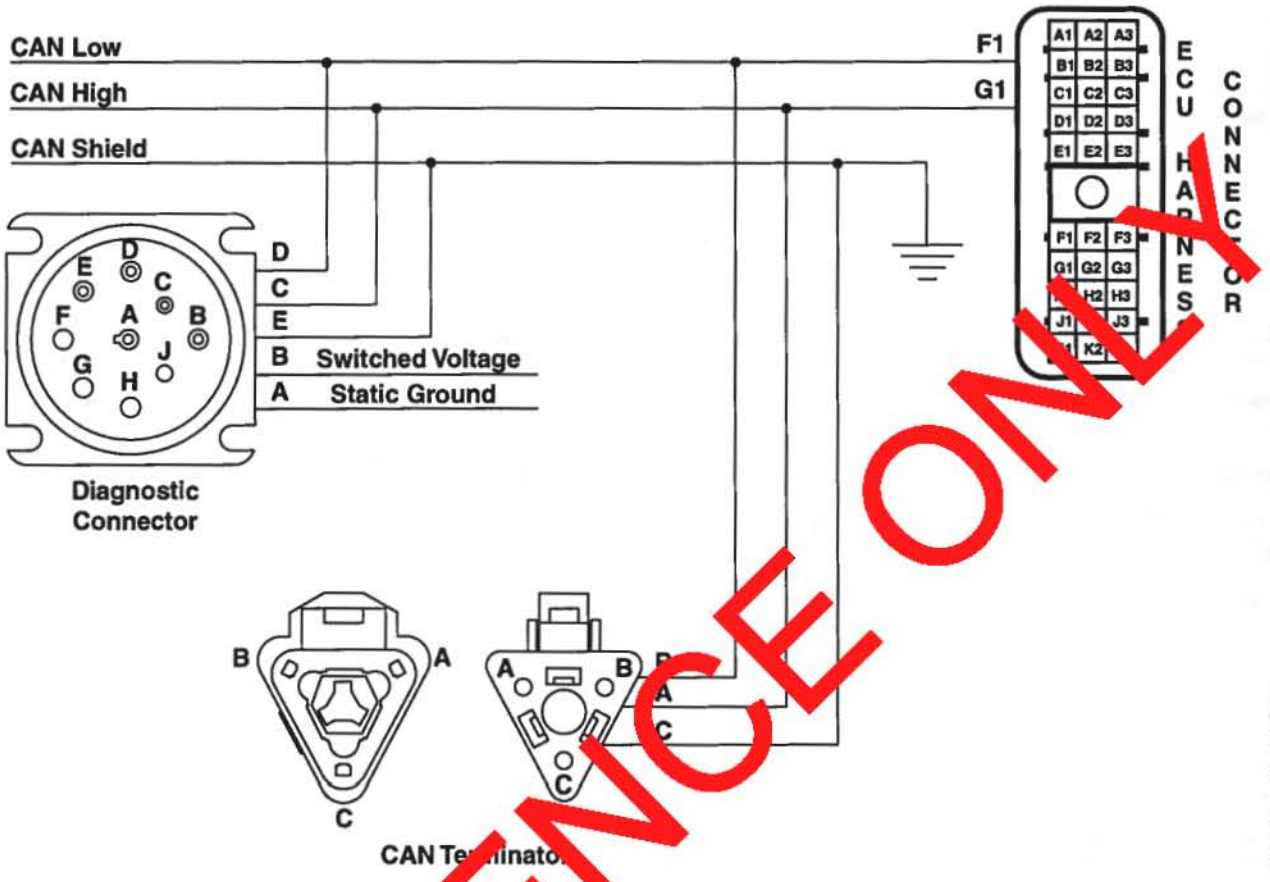
001069.31 — Tire Size Error



NOTE: Wiring schematic shows OEM engine applications only. For wiring information on other applications, see APPLICATION SPECIFICATIONS in Section 00, Group 210 of this manual.

Tire Size

- Tire size is input into the vehicle for a given size of tire.

DTC 001069.31 will set if:

- Tire size has been incorrectly programmed into the vehicle.

If DTC 001069.31 sets, the following will occur:

- ECU will assume the largest tire size
- Road speed limiting may occur at a speed that is less than the specified speed.

RG40854,0000008 –19–12AUG02–1/1

001069.31 — Tire Size Error

Tire size has been incorrectly programmed into the vehicle.

RG40854,[illegible]0009 [illegible]EP05–1/1

001069.31 Tire Size Error Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001069.31 TIRE SIZE ERROR supporting information.* Perform a preliminary inspection of [illegible] and BCU connectors looking for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s).
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001069.31 TIRE SIZE ERROR supporting information.* 1. Connect the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start ECU communication software. 4. Read DTCs using the DST orSERVICE ADVISOR™. 5. Clear all DTCs 6. Engine running, vehicle under normal operating conditions. 7. Read DTCs using the DST or SERVICE ADVISOR.	**001069.31 reoccurs:** Reprogram tire size on vehicle. **001069.31 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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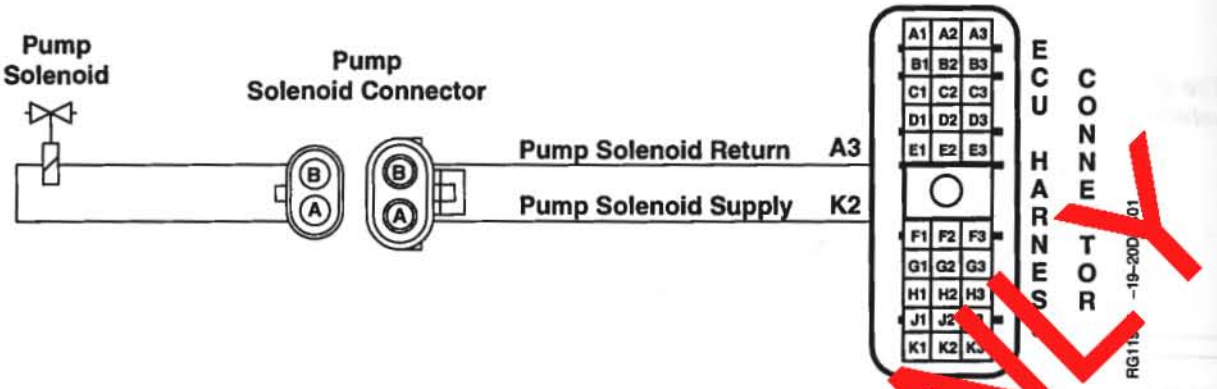
001076.00 — Pump Control Valve Closure Too Long



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Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an fuel control solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.00 will set if:

- The ECU determines that the pump control valve takes too long to close.

When DTC 001076.00 sets, the following will occur:

- Engine performance might be erratic.
- CAN Yellow Warning Lamp comes on.

RG40854,0000040 -19-04OCT05-1/1

001076.00 — Pump Control Valve Closure Too Long

The ECU determines that the pump control valve takes too long to close.

RG4[illegible]1,0000[illegible]–19–2[illegible]EP05–1/1

001076.00 Pump Control Valve Closure Too Long Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.00 PUMP CONTROL VALVE CLOSURE TOO LONG supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or improperly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.00 PUMP CONTROL VALVE CLOSURE TOO LONG supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine cranking or running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**001076.00 reoccurs:** GO TO ❸ **001076.00 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **ECU Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.00 PUMP CONTROL VALVE CLOSURE TOO LONG supporting information.* Substitute existing ECU for Known Good One. Download Payload.	**Problem Resolved:** Replace original ECU. **Problem Not Resolved:** Replace pump. ---1/1

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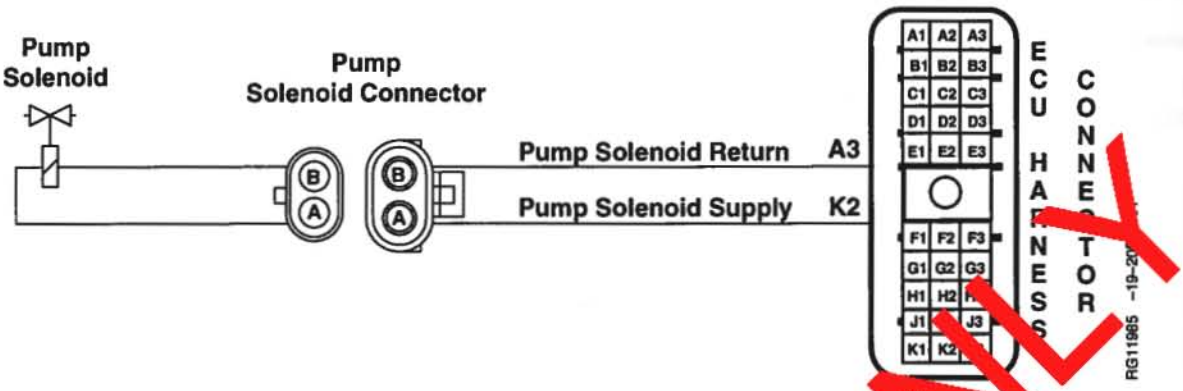
001076.01 — Pump Control Valve Closure Too Short



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Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an fuel control solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.01 will set if:

- The ECU determines that the control valve closes too quickly.

If DTC 001076.01 sets, the following will occur:

Engine performance may be erratic.

RG40854,0000044 –19–06DEC01–1/1

001076.01 — Pump Control Valve Closure Too Short

The ECU determines that the control valve closes too quickly.

RG4[illegible]3SEP05-1/1

001076.01 Pump Control Valve Closure Too Short Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.01 PUMP CONTROL VALVE CLOSURE TOO SHORT supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.01 PUMP CONTROL VALVE CLOSURE TOO SHORT supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**001076.01 reoccurs:** GO TO ❸ **001076.01 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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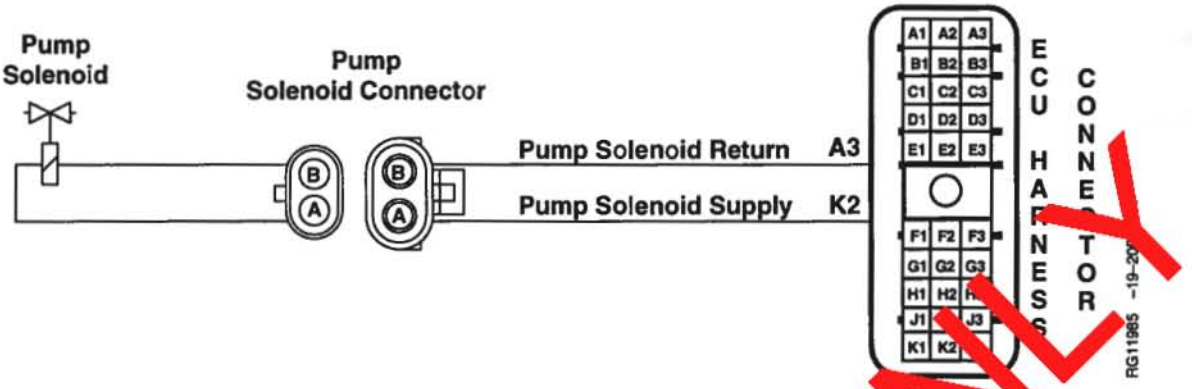
❸ **ECU Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.01 PUMP CONTROL VALVE CLOSURE TOO SHORT supporting information.* Substitute existing ECU for Known Good One. Download Payload.	**Problem Resolved:** Replace original ECU. **Problem Not Resolved:** Replace pump. ---1/1

001076.03 — Pump Solenoid Current High



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Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.03 will set if:

- The ECU determines that pump solenoid current is higher than normal.

If DTC 001076.03 sets, the following will occur:

- Engine performance might be erratic.
- Red stop lamp comes on.

RG40854,0000046 –19–04OCT05–1/1

001076.03 — Pump Solenoid Current High

The ECU determines that pump solenoid current is higher than normal.

RG40[illegible]-19-[illegible]SEP05-1/1

001076.03 Pump Solenoid Current High Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.03 PUMP SOLENOID CURRENT HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.03 PUMP SOLENOID CURRENT HIGH supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**001076.03 reoccurs:** GO TO ❸ **001076.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Pump Solenoid Return Wire Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.03 PUMP SOLENOID CURRENT HIGH supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between Terminal A3 and all other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❹ **Measurement less than 20,000 ohms:** Short to power in pump solenoid return wire ---1/1
❹ **Pump Solenoid Supply Wire Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.03 PUMP SOLENOID CURRENT HIGH supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between Terminal K2 and all other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❺ **Measurement less than 20,000 ohms:** Short to power in pump solenoid supply wire ---1/1
❺ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.03 PUMP SOLENOID CURRENT HIGH supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running. 3. Read DTC using the DST or SERVICE ADVISOR.	**001076.03 reoccurs:** Faulty ECU **001076.03 does not reoccur:** Problem repaired ---1/1

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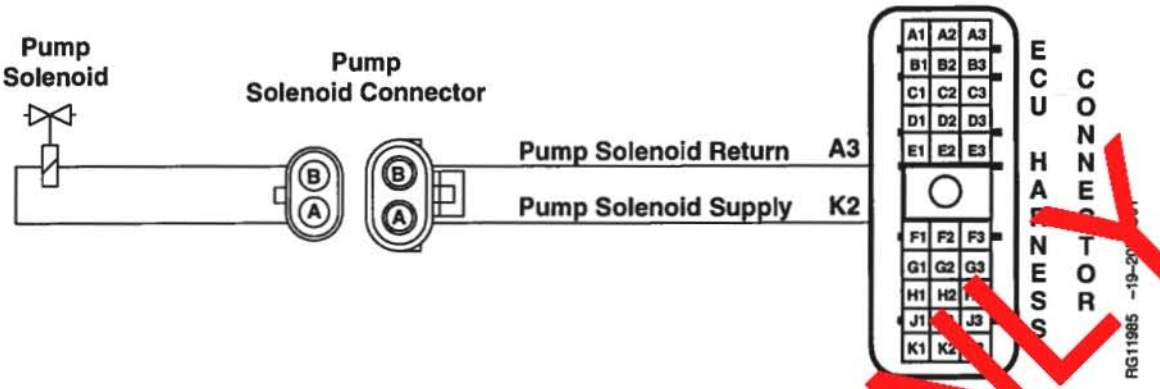
001076.05 — Pump Solenoid Circuit Open



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Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.05 will set if:

- The ECU determines that pump solenoid circuit is open.

If DTC 001076.05 sets, the following will occur:

- Engine does not run.
  Red stop lamp comes on.

RG40854,0000049 –19–04OCT05–1/1

001076.05 — Pump Solenoid Circuit Open

The ECU determines that pump solenoid circuit is open.

RG40854,[illegible]004C [illegible]-22[illegible]P05–1/1

001076.05 Pump Solenoid Circuit Open Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals. Terminal damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.05 PUMP SOLENOID CIRCUIT OPEN supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.05 PUMP SOLENOID CIRCUIT OPEN supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**001076.05 reoccurs:** GO TO ❸ **001076.05 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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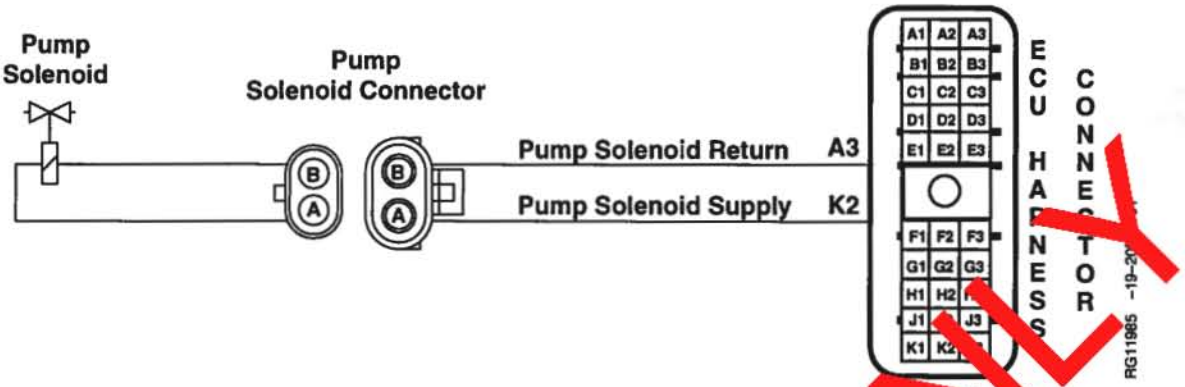
❸ **Pump Solenoid Supply Wire Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.05 PUMP SOLENOID CIRCUIT OPEN supporting information.* 1. Ignition OFF, engine OFF 2. Disconnect ECU connector 3. Disconnect pump solenoid supply wire from solenoid cap on pump. 4. Using a multimeter, measure resistance between terminal K2 of the ECU connector and solenoid-side of solenoid supply wire.	**Multimeter reads infinite, or nominal, ohms:** GO TO ❹ **Multimeter reads zero:** Faulty solenoid supply wire ---1/1
❹ **Pump Solenoid Return Wire Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.05 PUMP SOLENOID CIRCUIT OPEN supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Disconnect pump solenoid return wire from solenoid cap on pump. 4. Using a multimeter, measure resistance between terminal A3 of the ECU connector and solenoid-side of solenoid return wire.	**Multimeter reads infinite, or nominal, ohms:** GO TO ❺ **Multimeter reads zero:** Faulty solenoid supply wire ---1/1
❺ **Pump Solenoid Cap**	*NOTE: For wiring and theory of operation information, see DTC 001076.05 PUMP SOLENOID CIRCUIT OPEN supporting information.* 1. Ignition OFF 2. Remove [illegible] cap from fuel injection pump 3. Using multimeter measure resistance between both ends of each stud on the solenoid cap.	**Multimeter reads infinite ohms:** GO TO ❻ **Multimeter reads zero:** Faulty stud in solenoid cap ---1/1
❻ **ECU-Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.05 PUMP SOLENOID CIRCUIT OPEN supporting information.* 1. Ignition OFF. 2. Substitute current ECU with known, good, equivalent ECU. 3. Download payload. 4. Ignition ON, attempt engine start.	**Engine starts, DTC does not reset:** Faulty ECU. **Engine does not start:** Faulty fuel injection pump. ---1/1

001076.06 — Pump Solenoid Circuit Severely Shorted



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Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.06 will set if:

- The ECU determines that pump solenoid circuit is shorted.

DTC 001076.06 sets, the following will occur:

- ECU will shut engine down immediately. Red stop lamp comes on.

RG40854,000004D –19–04OCT05–1/1

001076.06 — Pump Solenoid Circuit Severely Shorted

The ECU determines that pump solenoid circuit is shorted.

RG40854 00127 SSEP05–1/1

001076.06 Pump Solenoid Circuit Severely Shorted Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements on connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.06 PUMP SOLENOID CIRCUIT SEVERELY SHORTED supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.06 PUMP SOLENOID CIRCUIT SEVERELY SHORTED supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**001076.06 reoccurs:** GO TO ❸ **001076.06 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Pump Solenoid Supply Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.06 PUMP SOLENOID CIRCUIT SEVERELY SHORTED supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal K2 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❹ **Measurement less than 20,000 ohms:** Pump solenoid supply wire shorted ---1/1
❹ **Pump Solenoid Return Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.06 PU... SOLENOID CIRCUIT SEVERELY SHORTED supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between ter...al A3 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connecto...	**...urement greater than 20,000 ohms:** GO TO ❺ **Measurement less than 20,000 ohms:** Pump solenoid return wire shorted ---1/1
❺ **Injection Pump Check**	*NOTE: For wiring and theory o... ...ation, see DTC 001076.06 PUMP SOLENOID CIRCUIT SE...RELY ...ORTED supporting information.* 1. Remove and insta...new in...ction pump. See REMOVE INJECTION PUMP and INSTALL INJECTIO...MP in S...tion 02, Group 090 of this manual. 2. Ignition O..., engi... runnin... 3. Re... DTC...ing the DST or SERVICE ADVISOR.	**001076.06 reoccurs:** Faulty ECU **001076.06 does not reoccur:** Problem repaired ---1/1

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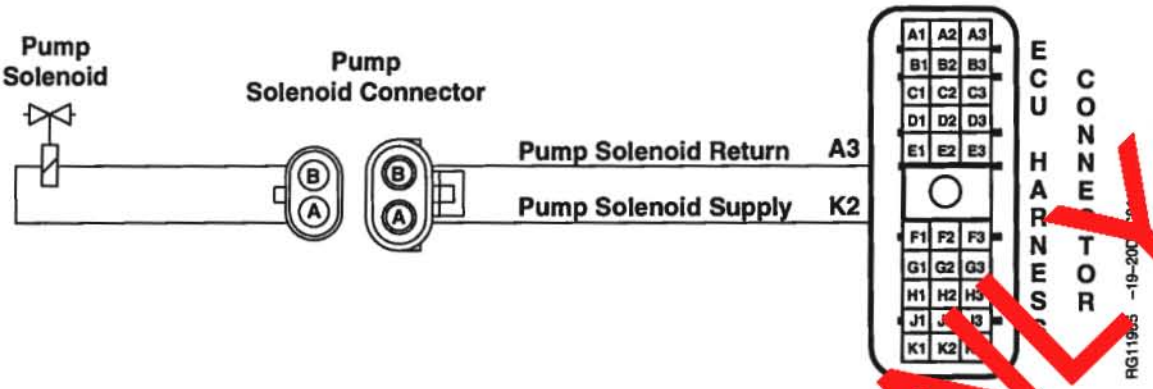
001076.07 — Pump Control Valve Closure Not Detected



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Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.07 will set if:

- The ECU determines that it can not detect the closure of the pump control valve.

If DTC 001076.07 sets, the following will occur:

- Engine performance may be erratic.
- CAN yellow warning lamp comes on.

RG40854,000004F -19-04OCT05-1/1

001076.07 — Pump Control Valve Closure Not Detected

The ECU determines that it can not detect the closure of the pump control valve.

RG40[illegible]-19-23[illegible]05-1/1

001076.07 Pump Control Valve Closure Not Detected Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals. damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.07 PUMP CONTROL VALVE CLOSURE NOT DETECTED supporting information.* Perform a preliminary inspection of the ECU connector, the pump connector, and any other connector. Look for dirty, damaged, or improperly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.07 PUMP CONTROL VALVE CLOSURE NOT DETECTED supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**001076.07 reoccurs:** GO TO ❸ **001076.07 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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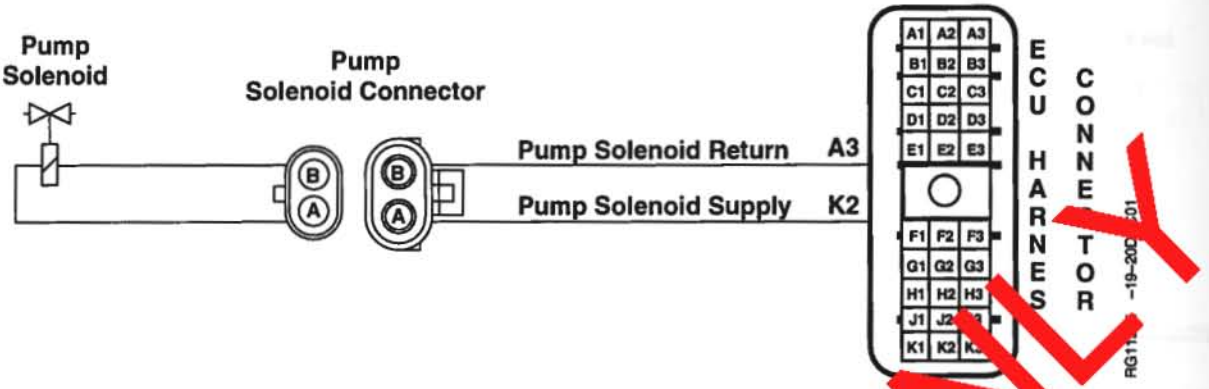
❸ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.07 PUMP CONTROL VALVE CLOSURE NOT DETECTED supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running. 3. Read DTCs using the DST or SERVICE ADVISOR.	**001076.07 reoccurs:** Faulty ECU **001076.07 does not reoccur:** Problem repaired ---1/1

001076.10 — Pump Solenoid Circuit Moderately Shorted



Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 001076.10 will set if:

- Pump solenoid circuit is moderately shorted to power.

If DTC 001076.10 sets, the following will occur:

- ECU derates engine to 50% of full power immediately.
- Red stop light comes on.

RG40854,0000051 -19-04OCT05-1/1

001076.10 — Pump Solenoid Circuit Moderately Shorted

Pump solenoid circuit is moderately shorted to power.

RG41221,0[illegible]0137 [illegible]SEP05–1/1

001076.10 Pump Solenoid Circuit Moderately Shorted Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.10 PUMP SOLENOID CIRCUIT MODERATELY SHORTED supporting information.* Perform a preliminary inspection of the engine harness, the pump connector, and any other connector. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) ---1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.10 PUMP SOLENOID CIRCUIT MODERATELY SHORTED supporting information.* 1. Connect the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**001076.10 reoccurs:** GO TO ❸ **001076.10 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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❸ **Pump Solenoid Supply Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.10 PUMP SOLENOID CIRCUIT MODERATELY SHORTED supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal K2 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❹ **Measurement less than 20,000 ohms:** Pump solenoid supply wire shorted ---1/1

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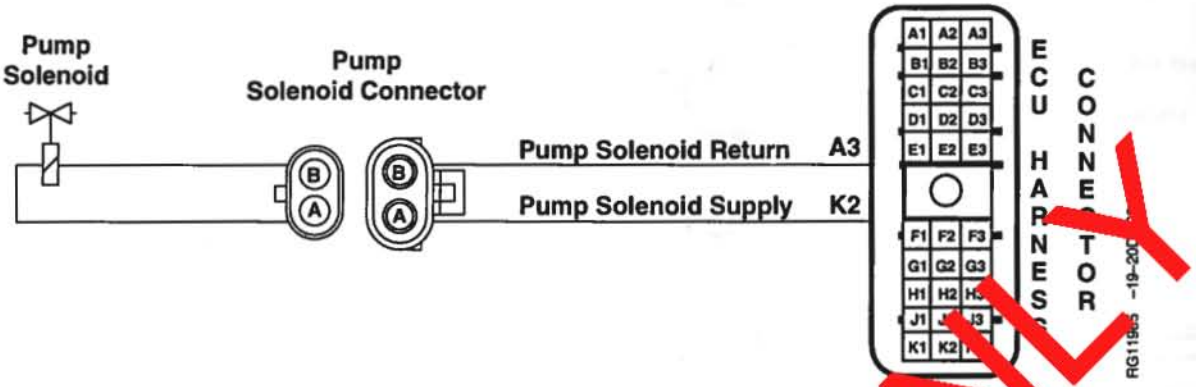
,272

❹ **Pump Solenoid Return Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.10 PUMP SOLENOID CIRCUIT MODERATELY SHORTED supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal A3 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❺ **Measurement less than 20,000 ohms:** Pump solenoid return wire shorted ---1/1

❺ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.10 PUMP SOLENOID CIRCUIT MODERATELY SHORTED supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running 3. Read DTCs using the DST or SERVICE ADVISOR.	**001076.10 reoccurs:** Faulty ECU **001076.10 does not reoccur:** Problem repaired ---1/1

001076.13 — Pump Current Decay Time Invalid



Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal, fuel control solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engi[illegible]

more operation infor[illegible]ee FUEL INJECTION PUMP OPERAT[illegible]N in S[illegible]03, Group 130 of this manual.

DTC 001076.13 w[illegible] set if:

- ECU d[illegible]tects high resistance in the pump solenoid.

If DTC [illegible]76.13 [illegible]sets, the following will occur:

- ECU dera[illegible]s engine to 50% of full power immed[illegible]ately.
  Red s[illegible]op lamp comes on.

RG41221,00000EE –19–04OCT05–1/1

001076.13 — Pump Current Decay Time Invalid

ECU detects high resistance in the pump solenoid.

RG41221 000EF 19- CT05-1/1

001076.13 Pump Current Decay Time Invalid Diagnostic Procedure

- - -1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001076.13 PUMP CURRENT DECAY TIME INVALID supporting information.*	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s) - - -1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001076.13 PUMP CURRENT DECAY TIME INVALID supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition ON, engine cranking or running 6. Read DTCs using the DST orSERVICE ADVISOR™.	**001076.13 reoccurs:** GO TO ❸ **001076.13 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

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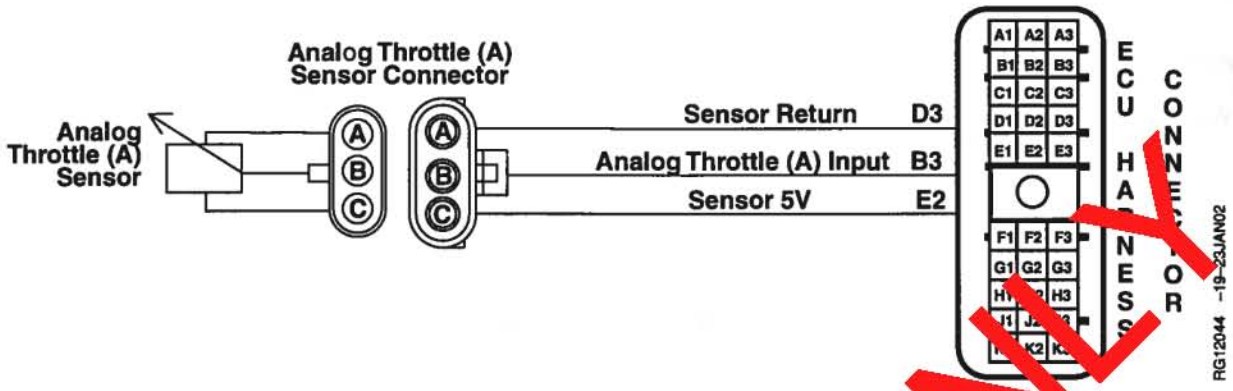
❸ **Pump Solenoid Supply Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.13 PUMP CURRENT DECAY TIME INVALID supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal K2 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❹ **Measurement less than 20,000 ohms:** Pump solenoid supply wire shorted ---1/1
❹ **Pump Solenoid Return Circuit Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.13 PUMP CURRENT DECAY TIME INVALID supporting information.* 1. Ignition OFF 2. Disconnect pump solenoid connector and ECU connector 3. Using a multimeter, measure resistance between terminal A3 of the harness side of the ECU connector and: • A good ground • All other terminals in the ECU connector	**Measurement greater than 20,000 ohms:** GO TO ❺ **Measurement less than 20,000 ohms:** Pump solenoid return wire shorted ---1/1
❺ **Injection Pump Check**	*NOTE: For wiring and theory of operation information, see DTC 001076.13 PUMP CURRENT DECAY TIME INVALID supporting information.* 1. Remove and install new injection pump. See REMOVE INJECTION PUMP and INSTALL INJECTION PUMP in Section 02, Group 090 of this manual. 2. Ignition ON, engine running. 3. Read DTC using the DST or SERVICE ADVISOR.	**001076.13 reoccurs:** Faulty ECU **001076.13 does not reoccur:** Problem repaired ---1/1

04 160 276

001079.03 — Sensor Supply Voltage High



04
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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.

RG40854,0000052 –19–06DEC01–1/1

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,[illegible]010E [illegible]SEP05–1/1

001079.03 Sensor Supply Voltage High Diagnostic Procedure

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❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements at connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* Perform a preliminary inspection of the ECU connector, the analog throttle (A) connector, and any connectors in between. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)

---1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make notes of any DTCs, then clear all DTCs 5. Ignition ON, engine OFF 6. Read DTCs using the DST orSERVICE ADVISOR™.	**001079.03 reoccur:** GO TO ❸ **001079.03 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Sensor Supply Wire Check for Short**	*NOTE: For wiring and theory of operation information, DTC 001079.03 SENSOR SUPPLY VOLTAGE HIGH supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure resistance between terminal E2 the harness end of the ECU connector and all other terminals in the harness end of the ECU connector	**Greater than 20,000 ohms:** Faulty ECU connector OR Faulty ECU **Less than 20,000 ohms:** Short to voltage in sensor supply wire ---1/1

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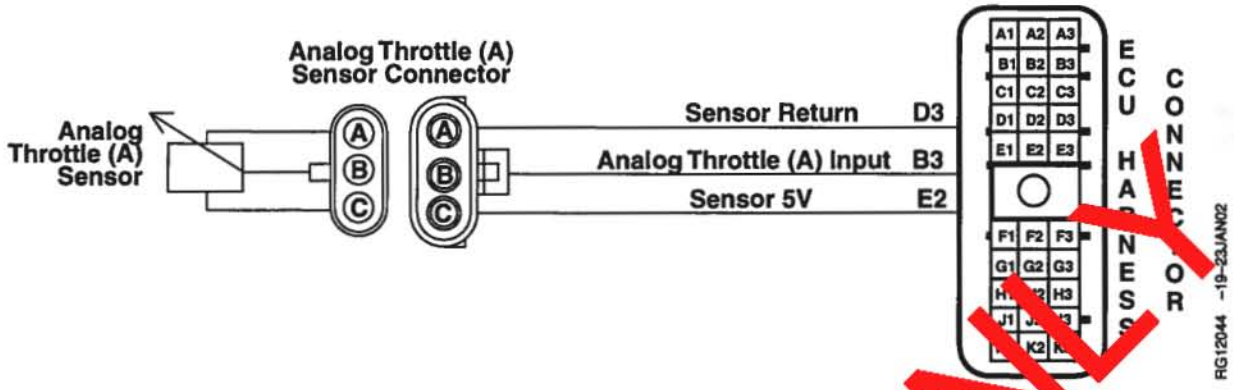
001079.04 — Sensor Supply Voltage Low



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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 input voltage.

RG40854,0000054 –19–06DEC01–1/1

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.

RG4[illegible]14,000[illegible]D -1[illegible]3SEP05-1/1

001079.04 Sensor Supply Voltage Low Diagnostic Procedure

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---1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* Perform a preliminary inspection of the ECU connector, the analog throttle (A) connector, and any connectors in between. Look for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s)
		---1/1
❷ **Sensor Check**	*NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Connect to the DST or SERVICE ADVISOR. 2. Ignition ON, engine OFF 3. Start the ECU communication software 4. Make note of any DTCs, then clear all DTCs 5. Ignition OFF 6. Disconnect all of the sensors that receive their 5 V supply from terminal E2 in the ECU connector. 7. Ignition ON, engine running 8. Read DTCs using the DST orSERVICE ADVISOR™.	**001079.04 reoccurs:** GO TO ❹ **001079.04 does not reoccur:** GO TO ❸

SERVICE ADVISOR is a trademark of Deere & Company

---1/1

❸ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Ignition ON 2. While reconnecting each of the sensors one at a time, read DTCs using the DST or SERVICE ADVISOR.	**001079.04 reoccurs:** Sensor that reset the DTC is faulty Replace and retest **001079.04 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. ---1/1
❹ **Sensor Supply Short to Ground Check**	*NOTE: For wiring and theory of operation information, see DTC 001079.04 SENSOR SUPPLY VOLTAGE LOW supporting information.* 1. Ignition OFF 2. Disconnect ECU connector 3. Using a multimeter, measure resistance individually between terminal E2 in the harness end of the ECU connector and: • A good chassis ground • Terminal J2 in the harness end of the ECU connector • Terminal D3 in the harness end of the ECU connector	**Greater than 20,000 ohms:** Faulty ECU connector OR Faulty ECU **Less than 20,000 ohms:** Sensor 5 volt supply circuit shorted to a ground ---1/1

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,284

001109.31 — Engine Protection Shutdown Warning

The ECU detects low oil pressure, high engine coolant temperature, high loss of coolant temperature, or high fuel temperature.

Engine Shutdown Warning:

- This code informs the operator that the ECU will shut the engine down because it has detected a condition such as low oil pressure, high engine coolant temperature, high loss of coolant temperature, low coolant level, high fuel temperature, or a faulty injection pump. If the ECU is programmed with engine protection with shutdown, the ECU has shut the engine down within 30 seconds. Prior to shutdown, the engine will be derated.

04 160 ,286

DTC 001109.31 will set if:

- The ECU detects low oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects a high loss of coolant temperature.
- The ECU detects a high fuel temperature.

If DTC 001109.31 sets, the following will occ

- If the ECU has engine protection with shutdown, it will derate (according to relating DTC) the engine for 30 seconds and will shut the engine down.

If DTC 001109.31 sets:

- If DTC 000100.01 is active, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000110.00 is active, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000111.00 is active, see DTC 000111.00 LOSS OF COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000174.16 is active, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE DIAGNOSTIC PROCEDURE earlier in this Group of the manual.

RG40854,0000056 –19–06DEC01–1/1

001110.31 — Engine Protection Shutdown

The ECU detects low oil pressure, high engine coolant temperature, high loss of coolant temperature, or high fuel temperature.

Engine Protection Shutdown:

- This code informs the operator that the ECU shut the engine down because it has detected a condition such low oil pressure, high engine coolant temperature, high loss of coolant temperature, or low coolant level. If the ECU is programmed with engine protection with shutdown, the ECU has shut the engine down.

DTC 001110.31 will set if:

- The ECU detects low oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects a high loss of coolant temperature.
- The ECU detects a high fuel temperature.

If DTC 001110.31 sets, the following will occur:

- The ECU will have shut the engine down.

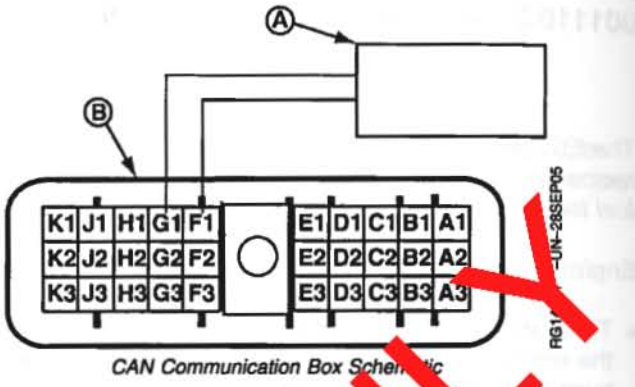
If DTC 001110.31 sets:

- If DTC 000100.01 is active, see DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000110.00 is active, see DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000111.00 is active, see DTC 000111.00 LOSS OF COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000174.16 is active, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE DIAGNOSTIC PROCEDURE earlier in this Group of the manual.

RG40854,0000057 -19-06DEC01-1/1

04 160 ,287

001568.02 — Torque Curve Selection Invalid or Missing (750J Crawler Only)



CAN Communication Box Schematic

CAN (Controller Area Network) Torque Curve Selection

- The ECU (A) has the ability to operate the engine on multiple, different torque curves. Individual curves can be selected based on information sent to the ECU over CAN (Controller Area Network) (B) by another controller.

DTC 001568.02 will set if:

- The ECU either receives no torque curve selection information, or receives torque curve information that is not valid over CAN.

If DTC 001568.02 sets, the following will occur:

- ECU defaults to low power torque curve (TorqParm0).
- If DTC 000639.13 also sets – CAN Bus Error is active, see DTC 000639.13 CAN BUS ERROR DIAGNOSTIC PROCEDURE earlier in this group.
- Check to see if any other controllers on the machine have any active or stored CAN-related DTCs. If they do, go to the appropriate diagnostic procedure.
- If no other stored or active CAN-related DTCs are found, replace the ECU and retest.

DB92450,0000032 –19–05OCT05–1/1

04 160 .288

001569.31 — Fuel Derate

The ECU detects low oil pressure, high manifold air temperature, high engine coolant temperature, high loss of coolant temperature, or high fuel temperature.

Fuel Derate

- The fuel derate trouble code is set to indicate that the ECU has detected a condition such as low oil pressure, high manifold air temperature, high coolant temperature, high loss of coolant temperature, or high fuel temperature. If the ECU detects one of these conditions, it will begin to derate the amount of fuel delivered to the engine.

04
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DTC 001569.31 will set if:

- The ECU detects low oil pressure.
- The ECU detects high manifold air temperature.
- The ECU detects a high engine coolant temperature.
- The ECU detects a high loss of coolant temperature.
- The ECU detects a high fuel temperature.

If DTC 001569.31 sets, the following will occur:

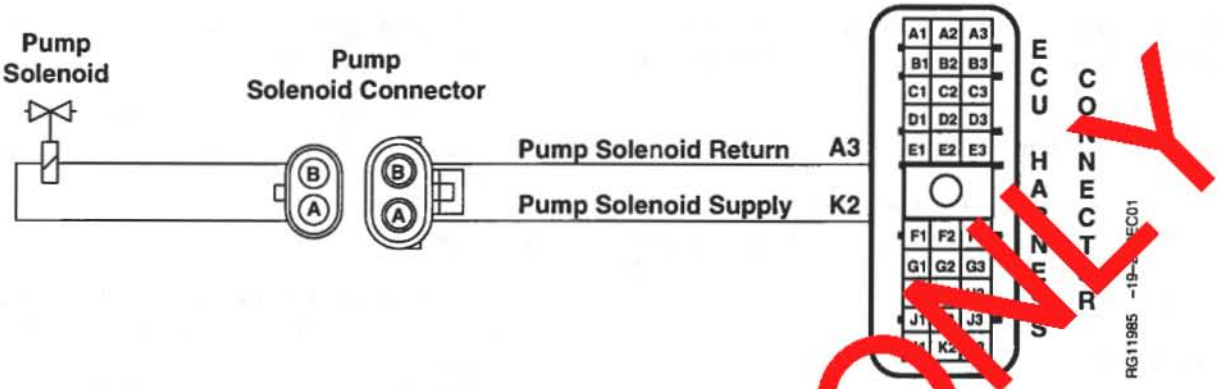
- The ECU will limit the amount of fuel available to the engine in an attempt to protect the engine.

If DTC 001569.31 sets:

- If DTC 000100.01 or DTC 000100.18 is active, see one of the following procedures earlier in this Group of the manual:
  - DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE
  - DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW DIAGNOSTIC PROCEDURE
- If DTC 000105.16 is active, see DTC 000105.16 MANIFOLD AIR TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000110.00, DTC 000110.15, or DTC 000110.16 is active, see one of the following procedures earlier in this Group of the manual:
  - DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE
  - DTC 000110.15 ENGINE COOLANT TEMPERATURE HIGH LEAST SEVERE DIAGNOSTIC PROCEDURE
  - DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE
- If DTC 000111.00 is active, see DTC 000111.00 LOSS OF COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group of the manual.
- If DTC 000174.16 is active, see DTC 000174.16 FUEL TEMPERATURE HIGH MODERATELY SEVERE DIAGNOSTIC PROCEDURE earlier in this Group of the manual.

RG40854,0000058 -19-06DEC01-1/1

002000.06 — Internal ECU Failure



ECU has detected a short in the ECU that causes an extremely high current at the injection pump.

Stanadyne DE10 Injection Pump

- The Stanadyne DE10 injection pump has an internal solenoid that is controlled by the Engine Control Unit (ECU). The ECU switches current on and off in order to charge the solenoid. When the current to the solenoid is increased, it moves a pump control valve into a position that allows for injection pressure to be developed. When the current to the solenoid is decreased, the pump control valve will return to a position that ends injection pressure. By controlling current to the solenoid, the ECU has the ability to manage the quantity and timing of fuel delivery to the engine. For more operation information, see FUEL INJECTION PUMP OPERATION in Section 03, Group 130 of this manual.

DTC 002000.06 will set if:

- ECU has detected a short in the ECU that causes an extremely high current at the injection pump.

If DTC 002000.06 sets, the following will occur:

- Engine shuts down immediately

If DTC 002000.06 sets:

- Replace the ECU and retest.

RG40854,000005A -19-06DEC01-1/1

002000.13 — Security Violation

The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

Security Violation

- When the ignition is first turned on, all of the controllers on the machine communicate with each other to make sure that all controllers are correct for the particular machine.

DTC 002000.13 will set if:

- The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

If DTC 002000.13 sets, the following will occur:

- The ECU will allow the engine to start, but will only allow low idle engine speed.
- For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for the high oil pressure input voltage specification.

If DTC 002000.13 sets:

- If one of the controllers on the machine has just been replaced, make sure the correct controller was installed.
- If all controllers on the machine are the correct part numbers, check to see if any of the controllers have active or stored CAN related DTCs. If they do, go to the appropriate diagnostic procedure.

RG40854,000005B –19–06DEC01–1/1

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Section 05
Tools and Other Materials

Contents

Fuel System Repair and Adjustment Essential Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

SERVICEGARD is a trademark of Deere & Company

OUO1080,0[illegible]20F [illegible]NOV01-1/10

RG12017 -UN-16NOV01

Injection Pump Drive Gear Puller JDG1560

Remove drive gear from tapered shaft of injection pump.

JDG1560

OUO1080,000020F -19-27NOV01-2/10

-UN-19NOV01

DE10 Injection Pump Timing Pin JDG1559

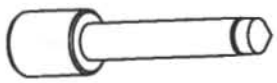
Used for static lock pin timing during installation of injection pump.

JDG1559

OUO1080,000020F -19-27NOV01-3/10

Timing Pin JDG1571

Used to lock flywheel at No. 1 TDC for injection pump timing. This timing pin MUST be used on engine applications using the tapered-nose crankshaft due to the higher torque specification for damper retaining cap screw.



RG12031 -UN-20DEC01

JDG1571

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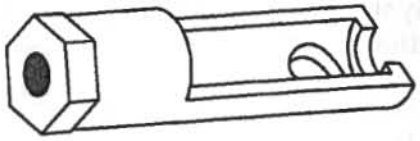
OUO1080,000020F -19-27NOV01-4/10

RG11741 –UN–24MAY01

Injection Nozzle Puller JDG1515-1

Use with slide hammer to remove injection nozzles.



JDG1515-1

OUO1080,000020F –19–27NOV01–5/10

RG5084 –UN–23AUG88

Nozzle Bore Cleaning Tool JDE39

Clean injection nozzle bore in cylinder head.

JDE39

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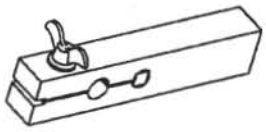
170
2

OUO1080,000020F –19–27NOV01–6/10

RG11742 –UN–24MAY01

Spring Chamber Cap Wrench JDG1521

Used to remove the spring chamber cap on RSN nozzles.



JDG1521

OUO1080,000020F –19–27NOV01–7/10

RG12023 –UN–27NOV01

Pressure Adjusting Screw Tool JDG1522

Used to adjust opening pressure on RSN nozzles.

JDG1522

Continued on next page

OUO1080,000020F –19–27NOV01–8/10

JDG15152 –UN–13JUN01

Pressure Adjusting Screw Lock Nut Wrench JDG1515-2

Used to loosen or tighten lock nut of pressure adjusting screws.

JDG1515-2

OUO1080,0[illegible]20F [illegible]NOV01–9/10

Nozzle Carbon Stop Seal Installer JD258 (JD-258)

Used to install carbon stop seal in injection nozzle groove.

RG6254 –UN–22JUL92

258 (JD-258)

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3

OUO1080,000020F –19–27NOV01–10/10

Fuel System Repair and Adjustment Servic Equipment and Tools

NOTE: Order tools according to infor atio give in e U.S. SERVICEGARD™ Ca log or rom the European Microfiche Tool C alog (MTC). Some tools may be availabl from a l al supplier.

SERVICEGARD is a trademark of Deere & Company

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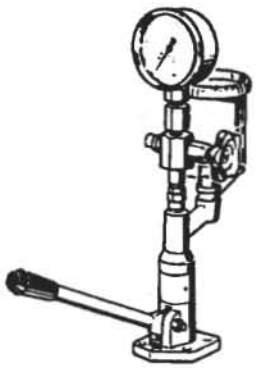
OUO1080,0000210 –19–27NOV01–1/3

Injection Nozzle Tester (R. BOSCH) JT25510

Check nozzle opening pressure.



CD030307 –UN–07MAR95

CD 030307

JT25510

OUO1080,0000210 –19–27NOV01–2/3

CD30308 –UN–08MAR95

05
170
4

Fuel Pressure Line KJD10109

To connect injection nozzle to BOSCH tester.

CD 030308

KJD10109

OUO1080,0000210 –19–27NOV01–3/3

Fuel System Repair and Adjustment Other Materials

Number	Name	Use
T43512 (U.S.) TY9473 (Canadian) 242 (LOCTITE®)	Thread Lock and Sealer (Medium Strength)	Apply to fuel supply pump mounting screws and fuel line fittings.

LOCTITE is a registered trademark of Loctite Corp.

OUO1080,0000211 –19–27NOV01–1/1

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

RG40854,0000003CONV3 -19-12MAR02-1/17

RW25539 -UN-28AUG96

Terminal Extraction Tool JDG364

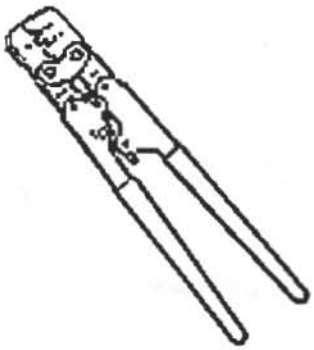
Used to extract WEATHER PACK™ terminals from electrical connectors.

WEATHER PACK is a trademark of Packard Electric

RG40854,0000003CONV3 -19-12MAR02-2/17

WEATHER PACK™ Crimping Tool . . . . . JDG7[illegible]

Used to crimp WEATHER PACK™ male and [illegible]e terminals on 14-20 gauge wires. This t[illegible] crimps both [illegible]e wire and the seal retainer at the sa[illegible] time.



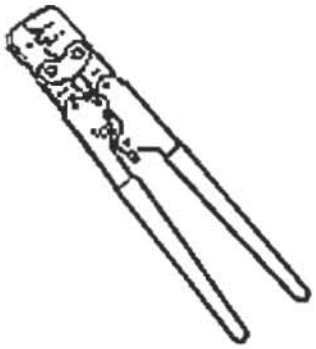
RW25542A -UN-07MAR02

WEATHER PACK[illegible] a trade[illegible]k of Packard Electric

RG40854,0000003CONV3 -19-12MAR02-3/17

METRI-PACK[illegible] Crimping Tool JDG865

Us[illegible] to c[illegible] METRI-PACK™ male and female terminals on 14[illegible] gauge wires.



RW25542A -UN-07MAR02

METRI-PACK is a trademark of Packard Electric Inc.

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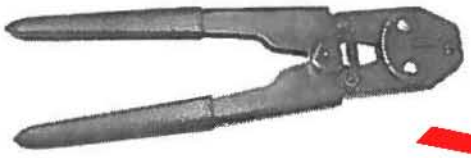
RG40854,0000003CONV3 -19-12MAR02-4/17

Packard Crimper JDG707

Used to crimp WEATHER PACK, METRIPACK, SUMITOMO, and YAZAKI male and female terminals on 12-20 gauge wires. This tool crimps the wire and the seal retainer separately.

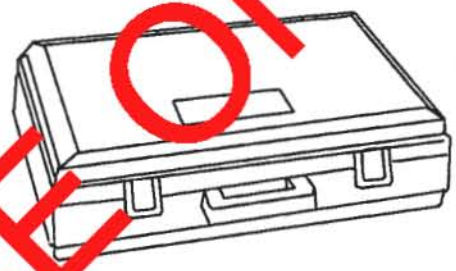


RG11[illegible] –UN–05FEB01

RG4085[illegible]NV3 –1[illegible]2MAR02–5/17

Technician's Electrical Repair Kit JDG155

This kit is assembled with the most commonly used terminal extraction tools used to repair wiring harnesses on John Deere applications. This kit includes the following: **JDG107** - Holding Plate, **JDG139** - Sure-Seal terminal insertion tool, **JDG140** - CPC and Metrimate terminal extraction tool, **JDG141** - CPC Blade Type terminal extraction tool, **JDG142** - Mate-N-Lock terminal extraction tool, **JDG143** - Mate-N-Lock terminal extraction tool, **JDG144** - Universal Crimping Pliers, **JDG145** - Electrician's Pliers, **JDG146** - Carrying Case, and **JDG785** - Deutsch 6-8 gauge terminal extraction/insertion tool.



RW25558 –UN–29AUG96

RG40854,0000003CONV3 –19–12MAR02–6/17

Electrician's Pliers JDG145

Used to cut, strip, and sp[illegible]ires.

RG11686 –UN–13FEB01

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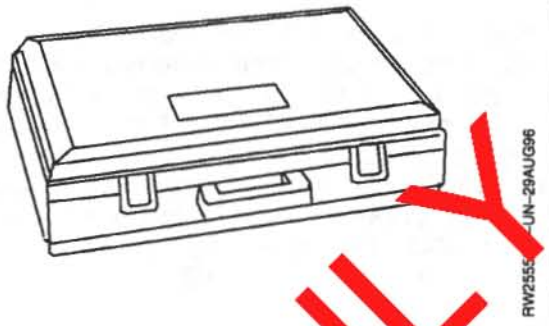
RG40854,0000003CONV3 –19–12MAR02–7/17

Technician's Electrical Repair Kit JT07195B

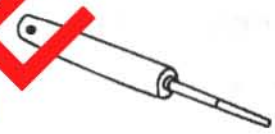


This kit is assembled with the most commonly used terminal extraction tools used to repair wiring harnesses on John Deere applications. This kit includes the following: **JDG140** - CPC and Metrimate terminal extraction tool, **JDG141** - CPC Blade Type terminal extraction tool, **JDG361** - Deutsch 12-14 gauge terminal extraction/insertion tool, **JDG362** - Deutsch 16-18 gauge terminal extraction/insertion tool, **JDG364** - WEATHERPACK terminal extraction tool, **JDG776** - Metripack terminal extraction tool - Wide, **JDG777** - METRI-PACK terminal extraction tool - Narrow, and **JDG785** - Deutsch 6-8 gauge terminal extraction/insertion tool.

RG40854,0000003CONV3 –19–12MAR02–8/17

RW25541 –UN–20AUG96

METRI-PACK™ Extractor (Wide) JDG776



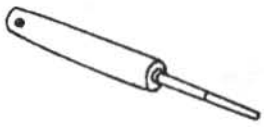
Used to remove terminals from 56-Series, 280-Series, and 630-Series METRI-PACK™ connectors.

METRI-PACK is a trademark of Packard Electric Inc.

RG40854,0000003CONV3 –19–12MAR02–9/17

RW25541 –UN–20AUG96

METRI-PACK™ Extractor (Narrow) JDG777



Used to remove terminals from 150-Series METRI-PACK™, SUMITOMO, and YAZAKI connectors.

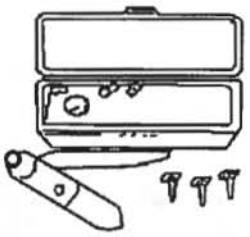
METRI-PACK is a trademark of Packard Electric Inc.

Continued on next page

RG40854,0000003CONV3 –19–12MAR02–10/17

DEUTSCH™ Electrical Repair Tool Kit. JDG359

Used to extract terminals from DEUTSCH™ electrical connectors. A special crimping tool is also included to crimp DEUTSCH terminals on wires. The following tools are included: **JDG360** - Deutsch Terminal Crimping Tool, **JDG361** - Deutsch 12-14 gauge terminal extraction/insertion tool (set of 2), **JDG362** - Deutsch 16-18 gauge terminal extraction/insertion tool (set of 2), and **JDG363** - Deutsch 20-24 gauge terminal extraction/insertion tool (set of 2)



RW25540 –UN–06SEP96

DEUTSCH is a trademark of Deutsch Co.

RG40854,0000003CONV3 –19–12MAR02–11/17

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12—14 Gauge Extractor (Set of Two)[1]. JDG361

Used to remove terminals on 12-14 gauge wires in DEUTSCH connectors.

RG12278 –UN–14OCT05

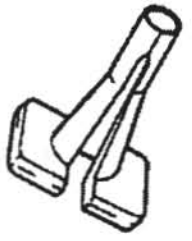
Deutsch Extraction Tool

[1]*Included in DEUTSCH Electrical Repair Kit - JDG359*

RG40854,0000003CONV3 –19–12MAR02–12/17

16—18 Gauge Extractor (Set of Two)[1]. JDG362

Used to remove terminals on 16-18 gauge wires in DEUTSCH connectors.



RG12278 –UN–14OCT05

Deutsch Extraction Tool

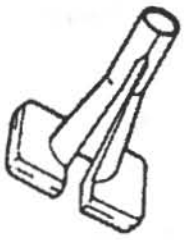
[1]*Included in DEUTSCH Electrical Repair Kit - JDG359*

Continued on next page

RG40854,0000003CONV3 –19–12MAR02–13/17

20—24 Gauge Extractor (Set of Two)[1] JDG363

Used to remove terminals on 20-24 gauge wires in DEUTSCH connectors.



RG12278 –UN–14OCT05

Deutsch Extraction Tool

[1]*Included in DEUTSCH Electrical Repair Kit - JDG359*

RG40854,0000003CONV3 –19–12MAR02–14/17

Crimping Tool[1] JDG360

Used to crimp DEUTSCH closed barrel terminals on 12-24 gauge wires.

RG12235 –UN–15MAR02

[1]*Included in DEUTSCH Electrical Repair Kit - JDG359*

RG40854,0000003CONV3 –19–12MAR02–15/17

40 –UN–31MAY00

Terminal Extraction Tool FKM10457

Used to extract female terminals from Level 3 and Level 4 Engine Control Unit (ECU) using Amp connectors.

FKM10457

RG40854,0000003CONV3 –19–12MAR02–16/17

RG10739 –UN–26MAY00

Crimping Pliers[1] JDG144

Universal crimp tool is used to crimp terminals on wires. It is recommended to use crimp tools specific for the terminal being crimped. If there is not a specified crimp tool, use this tool.

JDG144

[1]*Included in Technician's Electrical Repair Kit - JDG155*

RG40854,0000003CONV3 –19–12MAR02–17/17

Control System Repair and Adjustment Other Materials

Number	Name	Use
JDT405 (U.S.)	High Temperature Grease	Sensor O-rings.
TY9375 (U.S.) TY9480 (Canadian) 592 (LOCTITE®)	Pipe Sealant	Apply to threads of oil pressure sensor.
AT66865 (U.S.)	Lubricant	Insulate electrical connectors

LOCTITE is a registered trademark of Loctite Corp.

DUO1080,0000215 –19–27NOV01–1/1

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10

ic Fuel System Diagnostic Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or in the European Microfiche Tool Catalog (MTC) unless otherwise noted.

SERVICEGARD is a trademark of Deere & Company.

RG40854,0000[illegible]CONV3 -19-19JUL05-1/11

Fuel System Cap Plug Kit JDG998

Used to protect the fuel system from dirt and debris when disconnecting fuel system components during fuel transfer pump pressure check.

RG8518 -UN-09OCT02

JDG998

RG40854,0000002CONV3 -19-19JUL05-2/11

Universal Pressure Test K[illegible] JT05412

Used for testing engine oil pressure, intake manifold pressure (turbo boost), and fuel supply pump pressure.

RG5162 -UN-14OCT05

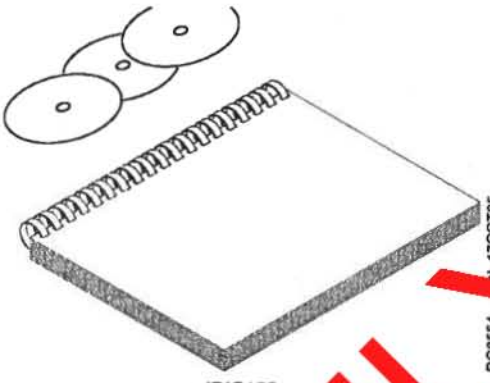
JT05412

Continued on next page

RG40854,0000002CONV3 -19-19JUL05-3/11

ECU Communication Software Kit. JDIS122

Please refer to your John Deere Dealer website for information on obtaining the latest version of software.



JDIS122

RG40854,0000002CONV3 –19–19JUL05–4/11

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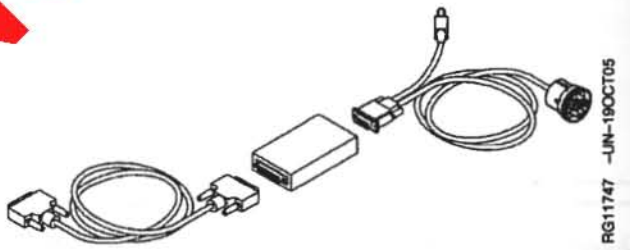
180
2

NOTE: Available from John Deere Distribution Service Center (DSC). **United States and Canadian Agricultural dealers DO NOT ORDER without first contacting your Branch or TAM.**

RG40854,0000002CONV3 –19–19JUL05–5/11

ECU Communication Hardware Kit JDIS12

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 have 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), and the first 6-pin Weatherpack diagnostic connector (Lucas controllers). Not all of the components in this kit are shown to the right.



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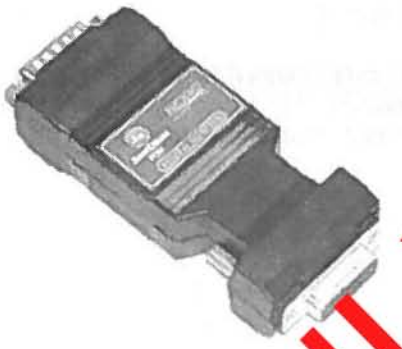
RG40854,0000002CONV3 –19–19JUL05–6/11

Power Adapter DS10037

Used with ECU Communication Hardware Kit. The power adapter connects between the PDM and the 26-pin, MagiKey connector. It is used whenever power is lost to the PDM during cranking the engine for the compression test.

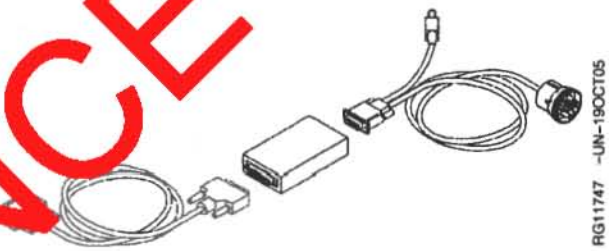


Power Adapter

RG40854,0000002CONV3 –19–19JUL05–7/11

ECU Communication Hardware Kit DS10023

Used with ECU Communication Software Kit. Together, the kits enable a Windows ('95, '98, 2000, ME, and XP) or NT compatible computer to read information from the Engine Control Unit (ECU). The computer must be at least a 486/66 with 8 MB of RAM and an IEEE 1284 compliant parallel port. This kit allows communication with all John Deere applications that use the black 9-pin Deutsch diagnostic connector. All of the components in this kit are shown to the right.



RG40854,0000002CONV3 –19–19JUL05–8/11

NOTE: Available from John Deere Distribution Service Center (DSC). **United States and Canadian Agricultural dealers DO NOT ORDER without first contacting your Branch or TAM.**

Continued on next page

RG40854,0000002CONV3 –19–19JUL05–9/11

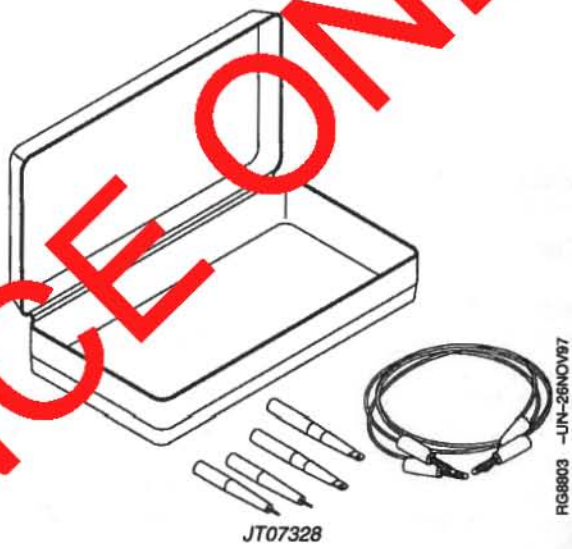
Digital Multimeter JT07306

Test electrical components for voltage, resistance, current flow, or temperature. It is especially good for measuring low voltage or high resistance circuits.

RG40854,0000002CONV3 –19–19JUL05–10/11

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.



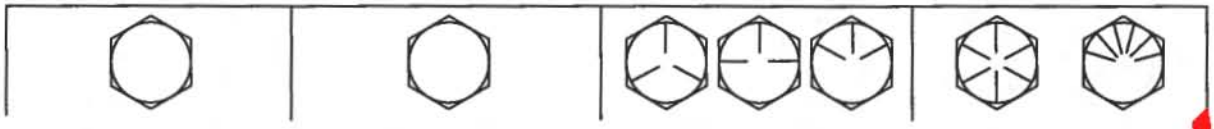
RG40854,0000002CONV3 –19–19JUL05–11/11

Section 06
Specifications

Contents

Unified Inch Bolt and Screw Torque Values

TS1671 –UN–01MAY03



Bolt or	SAE Grade 1				SAE Grade 2[a]				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
Screw	Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry	
Size	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	[illegible]	17	150
													N•m	[illegible]-ft	[illegible]•m	lb-ft
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	[illegible]	20	[illegible]	26
									N•m	lb-ft	N•m	lb-ft				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	4[illegible]	36	63	46
			N•m	lb-ft	N•m	lb-ft	N•m	lb-ft								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	[illegible]0	59	100	74
	N•m	lb-ft														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	[illegible]	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	[illegible]0	[illegible]5	[illegible]5	160	240	175	305	225
3/4	120	88	150	110	190	140	240	17[illegible]	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	17[illegible]	490	[illegible]60	615	455	690	510	870	640
1	285	210	360	265	285	210	360	[illegible]65	[illegible]30	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	[illegible]	3[illegible]	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	[illegible]	[illegible]	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	[illegible]3	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only. [illegible]on t[illegible]stren[illegible] of the bolt or screw. DO NOT use these values if [illegible] differe[illegible] torque[illegible]e or tightening procedure is given for a specifi[illegible]oplica[illegible]. For plastic insert or crimped steel type lock nuts, for stainless ste[illegible]steners, or for nuts on U-bolts, see the tightening instruct[illegible]s for the s[illegible]cific application. Shear bolts are designed to fail under [illegible]edeterm[illegible]ed loa[illegible]. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

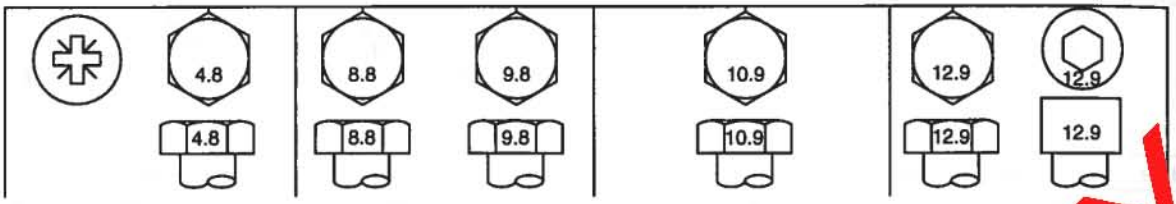
[a]Grade 2 applies for hex [illegible]p screws [illegible]ot he[illegible]olts) up to 6. in (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types [illegible] bolts [illegible]d scre[illegible]f any length.

[b]"Lubricated" mea[illegible] coat[illegible]ith a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C zinc[illegible]ake coatin[illegible]

[c]"Dry" mean[illegible]lain o[illegible]inc plate[illegible] without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B zinc flake coating.

DX,TORQ1 –19–24APR03–1/1

Metric Bolt and Screw Torque Values



TS1670 –UN–01MAY03

Bolt or	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
Screw	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
Size	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in	N•m	lb-in
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	14[illegible]	15.5	[illegible]37	19.5	172
									N•m	lb-ft	N•m	lb-ft	N•m	[illegible]	N•m	lb-ft
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	[illegible]	[illegible]	[illegible]7	27.5	47	35
			N•m	lb-ft	N•m	lb-ft	N•m	lb-ft		-						
M10	23	204	29	21	43	32	55	40	63	46	[illegible]0	59	75	55	95	70
	N•m	lb-ft														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	[illegible]	[illegible]0	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	[illegible]50	255	320	235	400	300
M18	135	100	170	125	265	195	330	[illegible]5	375	[illegible]	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	[illegible]0	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	[illegible]	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	[illegible]0	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	[illegible]00	[illegible]200	[illegible]	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	16[illegible]	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	17[illegible]	13[illegible]	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	[illegible]250	[illegible]650	[illegible]50	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] "Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C zinc flake coating.

[b] "Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B zinc flake coating.

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200
2

DX,TORQ2 –19–24APR03–1/1

General OEM Engine Specifications

ITEM				
	4045TF275	4045HF275	6068TF275	6068HF275
Number of Cylinders	4	4	6	6
Bore	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)	106 mm (4.19 in.)
Stroke	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)	127 mm (5.0 in.)
Displacement	4.5 L (276 cu in.)	4.5 L (276 cu in.)	6.8 L (414 cu in.)	6.8 L (414 cu in.)
Compression Ratio	17.0:1	17.0:1	17.0:1	17.0:1
Max. Crank Pressure	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)	0.5 kPa (2 H_2O)
Governor Regulation (Industrial)	7—10 %	7—10 %	7—10 %	7—10 %
Governor Regulation (Generator)	5 %	5%	5%	5 %
Oil Pressure At Rated Speed, Full Load (± 15 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)	345 kPa (50 psi)
Oil Pressure At Low Idle (Minimum)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)	105 kPa (15 psi)
Length	860 mm (33.9 in.)	860 mm (33.9 in.)	1119 mm (43.9 in.)	1123 mm (44.2 in.)
Width	612 mm (24.1 in.)	612 mm (24.1 in.)	623 mm (24.5 in.)	623 mm (24.5 in.)
Height	994 mm (39.1 in.)	994 mm (39.1 in.)	1012 mm (39.9 in.)	1015 mm (40.0 in.)
Weight	451 kg (993 lb)	451 kg (993 lb)	587 kg (1290 lb)	587 kg (1290 lb)

DPSG,OUO1004,102 –19–19NOV01–1/1

Electronic Fuel System Repair and Adjustment Specifications

Item	Measurement	Specification
Final Fuel Filter Bracket-to-Cylinder Head	Torque	73 N•m (54 lb-ft)
Final Fuel Filter Mounting Base-to-Bracket	Torque	73 N•m (54 lb-ft)
Primary Fuel Filter Bracket-to-Cylinder Head and Alternator	Torque	73 N•m (54 lb-ft)
Primary Fuel Filter/Water Bowl Mounting Base-to-Bracket	Torque	50 N•m (36 lb-ft)
Fuel Supply Pump	Pressure	2 —41 kPa (0.28—0.41 bar) (4- psi)
Fuel Supply Pump Cap Screws	Torque	30 N•m (22 lb-ft)
Fuel line tube nuts	Torque	24 N•m (18 lb-ft)
Injection Pump Mounting Stud Nuts	Torque	25 N•m (19 lb-ft)
Injection Pump Gear Mounting Nut	Torque	195 N•m (145 lb-ft)
Injection Pump Fuel Delivery (Pressure) Lines	Torque	27 N•m (20 lb-ft)
Injection Pump Timing Pin Plug	Torque	9.5 N•m (7.5 lb-ft)
Fuel Injection Nozzle		
Nozzle	Return Leakage at 1500 kPa (103 bar) (1500 psi)	1 to 14 drops (maximum) within 30 seconds

Continued on next page

Item	Measurement	Specification
Fuel Injection Nozzle		
Rate Shaping Nozzle	Opening Pressure for Setting (New or Reconditioned)	24 400—24 900 kPa (244—249 bar) (3540—3620 psi)
	Opening Pressure for Checking (New or Reconditioned)	24 100 kPa (241 bar) (3500 psi) Min
	Opening Pressure for Setting (Used)	23 000—23 600 kPa (230—236 bar) (3340—3420 psi)
	Opening Pressure for Checking (Used)	21 800 kPa (218 bar) (3170 psi) Min
Rate Shaping Nozzle	Opening pressure difference between cylinders	700 kPa (10 psi) Max
Fuel Injection Nozzle		
Pressure Adjusting Screw Lock Nut	Torque	10 N•m (7 lb-ft)
Lift Adjusting Screw Lock Nut	Torque	5 N•m (3.5 lb-ft)
Fuel Injection Nozzle Hold-Down Clamp Cap Screws	Torque	40 N•m (30 lb-ft)
Fuel Leak-Off Line Hex Nut	Torque	5 N•m (3.7 lb-ft) (44 lb-in.)
Fuel Injection Pump Return Line	Torque	27 N•m (20 lb-ft)
Fuel Injection Nozzle Delivery Lines	Torque	27 N•m (20 lb-ft)

OUO1080,0000212 –19–04AUG05–2/2

Electronic Engine Control Repair and Adjustment Specifications

Item	Measurement	Specification
Coolant Temperature Sensor in Thermostat Housing	Torque	15 N•m (11 lb-ft)
Coolant Temperature Sensor in Cylinder Head	Torque	35 N•m (26 lb-ft)
Crankshaft Position Sensor	Torque	14 N•m (10 lb-ft)
Oil Pressure Sensor	Torque	15 N•m (11 lb-ft)
Manifold Air Temperature Sensor	Torque	10 N•m (7 lb-ft)
Fuel Temperature Sensor	Torque	13—18 N•m (10—13 lb-ft)
Fuel Heater	Torque	9 N•m (7 lb-ft)

OUO1080,0000216 –19–27NOV01–1/1

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Group 150/160 Electronic Fuel System Diagnostic Specifications

Item	Measurement	Specification
Fuel Supply Pump	Static Pressure	25—30 kPa (0.25—0.30 bar) (3.5—4.5 psi)
Fuel Supply Pump	Minimum Static Pressure at 850 rpm Engine Speed	15 kPa (0.15 bar) (2.0 psi)
Fuel Supply Pump	Minimum Positive Pressure at 2400 rpm Engine Speed	21—34 kPa (0.21—0.34 bar) (3—5 psi)
Fuel Supply Pump	Minimum Flow at 2400 rpm Engine Speed	1.5 L/min (0.42 gpm)

DPSG,OUO1004,2762 -19-17MAY00-1/1

Application Specifications

Below is an overview of the specfications listed for applications in the next few pages.

- **Backhoes**
  - Sensor Specifications - See BACKHOES - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See BACKHOES - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See BACKHOES - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See BACKHOES - ECU TERMINAL IDENTIFICATION later in this Group.
  - Vehicle Wiring - See Vehicle manual.
- **Crawlers**
  - Sensor Specifications - See CRAWLERS - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See CRAWLERS - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See CRAWLERS - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See CRAWLERS - ECU TERMINAL IDENTIFICATION later in this Group.
  - Vehicle Wiring - See Vehicle manual.
- **Excavators**
  - Sensor Specifications - See EXCAVATORS - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See EXCAVATORS - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See EXCAVATORS - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See EXCAVATORS - ECU TERMINAL IDENTIFICATION later in this Group.
  - Vehicle Wiring - See Vehicle manual.
- **Forwarders**
  - Sensor Specifications - See FORWARDERS - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See FORWARDERS - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See FORWARDERS - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See FORWARDERS - ECU TERMINAL IDENTIFICATION later in this Group.
  - Vehicle Wiring - See Vehicle manual.
- **Harvesters**
  - Sensor Specifications - See HARVESTERS - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See HARVESTERS - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See HARVESTERS - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See HARVESTERS - ECU TERMINAL IDENTIFICATION later in this Group.
  - Vehicle Wiring - See Vehicle manual.
- **OEM Engines**
  - Sensor Specifications - See OEM ENGINES - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See OEM ENGINES - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See OEM ENGINES - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See OEM ENGINES - ECU TERMINAL IDENTIFICATION later in this Group.
  - Electronic Control System Wiring Diagram for Base ECUs - See OEM ENGINES - ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM BASE ECUS later in this Group.

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Continued on next page

  - Electronic Control System Wiring Diagram for Early Extended ECUs - See OEM ENGINES - ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM EXTENDED ECUS (EARLY) later in this Group.
  - Electronic Control System Wiring Diagram for Later Extended ECUs - See OEM ENGINES - ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM EXTENDED ECUS (LATER) later in this Group.
  - 4.5L & 6.8L OEM Application Instrument Panel/Engine Start Components Electrical Wiring Diagram - See OEM ENGINES - 4.5L & 6.8L OEM APPLICATION INSTRUMENT PANEL/ENGINE START COMPONENTS ELECTRICAL WIRING DIAGRAM later in this Group.
- **Skidders**
  - Sensor Specifications - See SKIDDERS - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See SKIDDERS - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See SKIDDERS - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See SKIDDERS - ECU TERMINAL IDENTIFICATION later in this Group.
  - Vehicle Wiring - See Vehicle manual.
- **Telehandlers**
  - Sensor Specifications - See TELEHANDLERS - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See TELEHANDLERS - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See TELEHANDLERS - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See TELEHANDLERS - ECU TERMINAL IDENTIFICATION later in this Group.
  - Vehicle Wiring - See Vehicle manual.
- **Tractors**
  - Sensor Specifications - See TRACTORS - SENSOR SPECIFICATIONS later in this Group.
  - Torque Curve Selection - See TRACTORS - TORQUE CURVE SELECTION later in this Group.
  - Governor Mode Selection - See TRACTORS - GOVERNOR MODE SELECTION later in this Group.
  - ECU Terminal Identification - See TRACTORS - ECU TERMINAL IDENTIFICATION later in this Group.
  - Vehicle Wiring - See Vehicle manual.

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Backhoes - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Sensor Specifications for Backhoes

Sensor	SPN.FMI	Measured Sensor Parameter	Out of Range Value	Derate
Analog Throttle (A)	000091.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000091.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.9 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 113°C (235°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 120°C (248°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Security Violation	002000.13	Security Violation	Security Violation	ECU derates engine 20% per minute until engine runs at 80% of full power.

RG40854,000013A -19-23APR02-1/1

Backhoes - Torque Curve Selection

Torque Curve Selection for Backhoes	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal operation

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Backhoes - Governor Mode Selection

Desired Speed Governor Selection for Backhoes	
Mode Selected on SERVICE ADVISOR™	**Conditions**
0	Normal droop

Max. Speed Governor Selection for Backhoes	
Mode Selected on SERVICE ADVISOR™	**Conditions:**
9	Normal droop

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RG40854,000013E -19-30JAN02-1/1

Backhoes - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Switched Battery	A2	N/A*
Unswitched Battery	K1	N/A*
System Ground	J2	N/A*
CAN High	G1	N/A*
CAN Low	F1	N/A*
5V Sensor Supply	E2	Changes with each sensor
Sensor Ground	D3	Changes with each sensor
Analog Throttle (A) Input	B3	B
Crank Position Input	B2	
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
*N/A = Not Applicable		

RG40854,000013F –19–30JAN02–1/1

Crawlers - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Continued on next page

Sensor Specifications for Crawlers				
Sensor	**SPN.FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Analog Throttle (A)	000091.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000091.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Oil Pressure	000100.01	Extremely Low Pressure	Below an extremely low engine oil pressure. This pressure increases with engine speed.	ECU derates engine 20% per minute until engine runs at 80% of full power.
	000100.03	High Input Voltage	Above 4.5 Volts	Low oil pressure engine protection is disabled.
	000100.04	Low Input Voltage	Below 0.3 Volts	Low oil pressure engine protection is disabled.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.9 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 113°C (235°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
Loss of Coolant Temperature	000111.00	Extreme Temperature	Exceeds 124°C (255°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000111.03	High Input Voltage	Exceeds 4.9 Volts	High loss of coolant temperature engine protection is disabled.
	000111.04	Low Input Voltage	Below 0.05 Volts	High loss of coolant temperature engine protection is disabled.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 120°C (248°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG40854,0000132 –19–23APR02–2/2

Crawlers - Torque Curve Selection

Torque Curve Selection for Crawlers	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal operation

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RG40854,0000135 -19-30JAN02-1/1

Crawlers - Governor Mode Selection

Desired Speed Governor Selection for Crawlers	
Mode Selected on SERVICE ADVISOR™	**Conditions**
0	Normal droop

Max. Speed Governor Selection for Excavators	
Mode Selected on SERVICE ADVISOR™	**Conditions:**
9	Normal droop

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Crawlers - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Switched Battery	A2	N/A*
Unswitched Battery	K1	N/A*
System Ground	J2	N/A*
CAN High	G1	N/A*
CAN Low	F1	N/A*
5V Sensor Supply	E2	Changes with each sensor
Sensor Ground	D3	Changes with each sensor
Analog Throttle (A) Input	B3	B
Crank Position Input	B2	A
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
Oil Pressure Input	F3	B
Loss of Coolant Temperature	C1	A
*N/A = Not Applicable		

RG40854,0000137 -19-30JAN02-1/1

Excavators - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Sensor Specifications for Excavators

Sensor	SPN.FMI	Measured Sensor Parameter	Out of Range Value	Derate
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.9 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 75% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.15	Least Severe Temperature	Exceeds 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 95% of full power.
	000110.16	Moderately Severe Temperature	Exceeds 113°C (235°F)	ECU derates engine 4% per minute until engine runs at 90% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 120°C (248°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG40854,000012E –19–23APR02–1/1

Excavators - Torque Curve Selection

Torque Curve Selection for Excavators	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal operation
2	Altitude Derate

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RG40854,000012F -19-30JAN02-1/1

Excavators - Governor Mode Selection

Desired Speed Governor Selection for Excavators	
Mode Selected on SERVICE ADVISOR™	**Conditions**
0	Normal droop

Max. Speed Governor Selection for Excavators	
Mode Selected on SERVICE ADVISOR™	**Conditions:**
9	Normal droop

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RG40854,0000131 -19-30JAN02-1/1

Excavators - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Switched Battery	A2	N/A*
Unswitched Battery	K1	N/A*
System Ground	J2	N/A*
CAN High	G1	N/A*
CAN Low	F1	NA
Sensor Ground	D3	Changes with each sens
Throttle Reference	F3	N/A*
Throttle Input	B3	N/A*
Throttle Ground	C1	N/
Crank Position Input	B2	A
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
*N/A = Not Applicable		

RG40854,0000130 -19-30JAN02-1/1

Forwarders - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

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Sensor Specifications for Forwarders				
Sensor	**SPN.FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Analog Throttle (A) (1010 Forwarders ONLY)	000091.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000091.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Analog Throttle (B) (1010 Forwarders ONLY)	000029.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000029.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Oil Pressure	000100.01	Extremely Low Pressure	Pressure goes below an engine speed dependent value.	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000100.03	High Input Voltage	Above 4.5 Volts	Low oil pressure engine protection is disabled.
	000100.04	Low Input Voltage	Below 0.3 Volts	Low oil pressure engine protection is disabled.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.9 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.16	Moderately Severe Temperature	Exceeds 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.

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Sensor Specifications for Forwarders				
	000174.16	Moderately High Temperature	Exceeds 120°C (248°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Security Violation	002000.13	Security Violation	Security Violation	ECU derates engine 500% per minute until engine runs at 50% of full power.

RG40854,0000158 –19–03APR02–3/3

Forwarders - Torque Curve Selection

Torque Curve Selection for Forwarders	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal Operation

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Forwarders - Governor Mode Selection

Desired Speed Governor Selection for Forwarders	
Mode Selected on SERVICE ADVISOR™	Conditions
0	Normal droop

Max. Speed Governor Selection for Forwarders	
Mode Selected on SERVICE ADVISOR™	Conditions:
9	Normal droop

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RG40854,000015A –19–21FEB02–1/1

Forwarders - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Switched Battery	A2	N/A*
Unswitched Battery	K1	N/A*
System Ground	J2	N/A*
CAN High	G1	N/A*
CAN Low	F1	NA
5V Sensor Supply	E2	Changes with each
Sensor Ground	D3	Changes with each sensor
Analog Throttle (A) Input (1010 Forwarders ONLY)	E1	
Analog Throttle (B) Input (1010 Forwarders ONLY)	F2	B
Crank Position Input	B2	
Crank Position Return	D2	
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
Oil Pressure Input	F3	B
*N/A = Not Applicable		

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Harvesters - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Sensor Specifications for Harvesters

Sensor	SPN.FMI	Measured Sensor Parameter	Out of Range Value	Derate
Oil Pressure	000100.01	Extremely Low Pressure	Pressure goes below an engine speed dependent value.	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000100.03	High Input Voltage	Above 4.5 Volts	Low oil pressure engine protection is disabled.
	000100.04	Low Input Voltage	Below 0.3 Volts	Low oil pressure engine protection is disabled.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.9 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.16	Moderately Severe Temperature	Exceeds 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 120°C (248°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Security Violation	002000.13	Security Violation	Security Violation	ECU derates engine 500% per minute until engine runs at 50% of full power.

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Harvesters - Torque Curve Selection

Torque Curve Selection for Harvesters	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal operation

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RG40854,0000165 -19-21FEB02-1/1

Harvesters - Governor Mode Selection

Desired Speed Governor Selection for Harvesters	
Mode Selected on SERVICE ADVISOR™	**Conditions**
0	Normal droop

Max. Speed Governor Selection for Harvesters	
Mode Selected on SERVICE ADVISOR™	**Conditions:**
9	Normal droop

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Harvesters - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Switched Battery	A2	N/A*
Unswitched Battery	K1	N/A*
System Ground	J2	N/A*
CAN High	G1	N/A*
CAN Low	F1	NA
5V Sensor Supply	E2	Changes with each sensor
Sensor Ground	D3	Changes with each sensor
Crank Position Input	B2	A
Crank Position Return	D2	
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
Oil Pressure Input	F3	B
*N/A = Not Applicable		

RG40854,0000164 -19-21FEB02-1/1

OEM Engines - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

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Sensor Specifications for OEM Engines				
Sensor	**SPN.FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Analog Throttle (A)	000029.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000029.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Analog Throttle (B)	000028.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000028.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Oil Pressure	000100.00	Extremely Low Pressure	Below an extremely low engine oil pressure. This pressure increases with engine speed.	ECU derates engine 60% per minute until engine runs at 40% of full power.
	000100.03	High Input Voltage	Above 4.5 Volts	Low oil pressure engine protection is disabled.
	000100.04	Low Input Voltage	Below 0.3 Volts	Low oil pressure engine protection is disabled.
	000100.18	Moderately Low Pressure	Below a moderately low engine oil pressure. This pressure increases with engine speed.	ECU derates engine 40% per minute until engine runs at 60% of full power.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.9 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	H engines: Exceeds 100°C (212°F) T engines: Exceeds 120°C (248°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 118°C (244°F)	ECU derates engine 60% per minute until engine runs at 40% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.05 Volts	High ECT engine protection is disabled.
	000110.15	Least Severe Temperature	Exceeds 108°C (226°F)	ECU derates engine 2% per minute until engine runs at 95% of full power.
	000110.16	Moderately Severe Temperature	Exceeds 113°C (235°F)	ECU derates engine 40% per minute until engine runs at 60% of full power.

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Sensor Specifications for OEM Engines				
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 120°C (248°F)	ECU derates engine 2% per minute until engine runs at 80% full power.

RG40854,0000129 –19–23APR02–3/3

OEM Engines - Torque Curve Selection

Torque Curve Selection for OEM Engines	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal Curve

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RG40854,000012A –19–29JAN02–1/1

OEM Engines - Governor Mode Selection With OC03038 Software or Later

Desired Speed Governor Mode Selection for OEM Engines	
Governor Mode	**Conditions**
0	Normal Droop - (Default Gainset)
1	Isochronous Droop- (Default Gainset)
2	Normal Droop - (Selectable Gainset)
3	Isochronous Droop- (Selectable Gainset)
6	Engine Cruise

Desired Speed Governor Mode Selection for OEM Engines	
Governor Mode	**Conditions**
9	Normal Droop - (Default Gainset)
10	Isochronous Droop- (Default Gainset)
11	Normal Droop - (Selectable Gainset)
12	Isochronous Droop- (Selectable Gainset)
15	Absolute Max speed (used for speed derates)

RG40854,000012B -19-29JAN02-1/1

OEM Engines - Governor Mode Selection With OC03033 Software or Earlier

NOTE: To determine the ECU software for this engine, read ECU Software Part Number using the diagnostic software. The earlier the software, the lower the number will be.

Desired Speed Governor Selection for OEM Engines	
Mode Selected on SERVICE ADVISOR™	Conditions
0	Normal Droop
10	Isochronous Droop

Max. Speed Governor Selection for OEM Engines	
Governor Mode	Conditions
0	Normal Droop
9	Gen Sets ONLY: Above 93%throttle at 1800 RPM
10	Isochronous Droop

RG41183,00000DE –19–21MAR03–1/1

OEM Engines - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Switched Battery	A2	N/A*
Unswitched Battery	K1	N/A*
System Ground	J2	N/A*
CAN High	G1	N/A*
CAN Low	F1	NA
5V Sensor Supply	E2	Changes with each sensor
Sensor Ground	D3	Changes with each sensor
Analog Throttle (A) Input	E1	B
Analog Throttle (B) Input	F2	B
Multi-state Throttle Input	C1	B
Crank Position Input	B2	A
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
Oil Pressure Input	F3	B
Auxiliary Engine Shutdown Switch Input	A1	May change by application
External Engine Derate Switch Input	C2	May change by application
*N/A = Not Applicable		

RG40854,000012C –19–29JAN02–1/1

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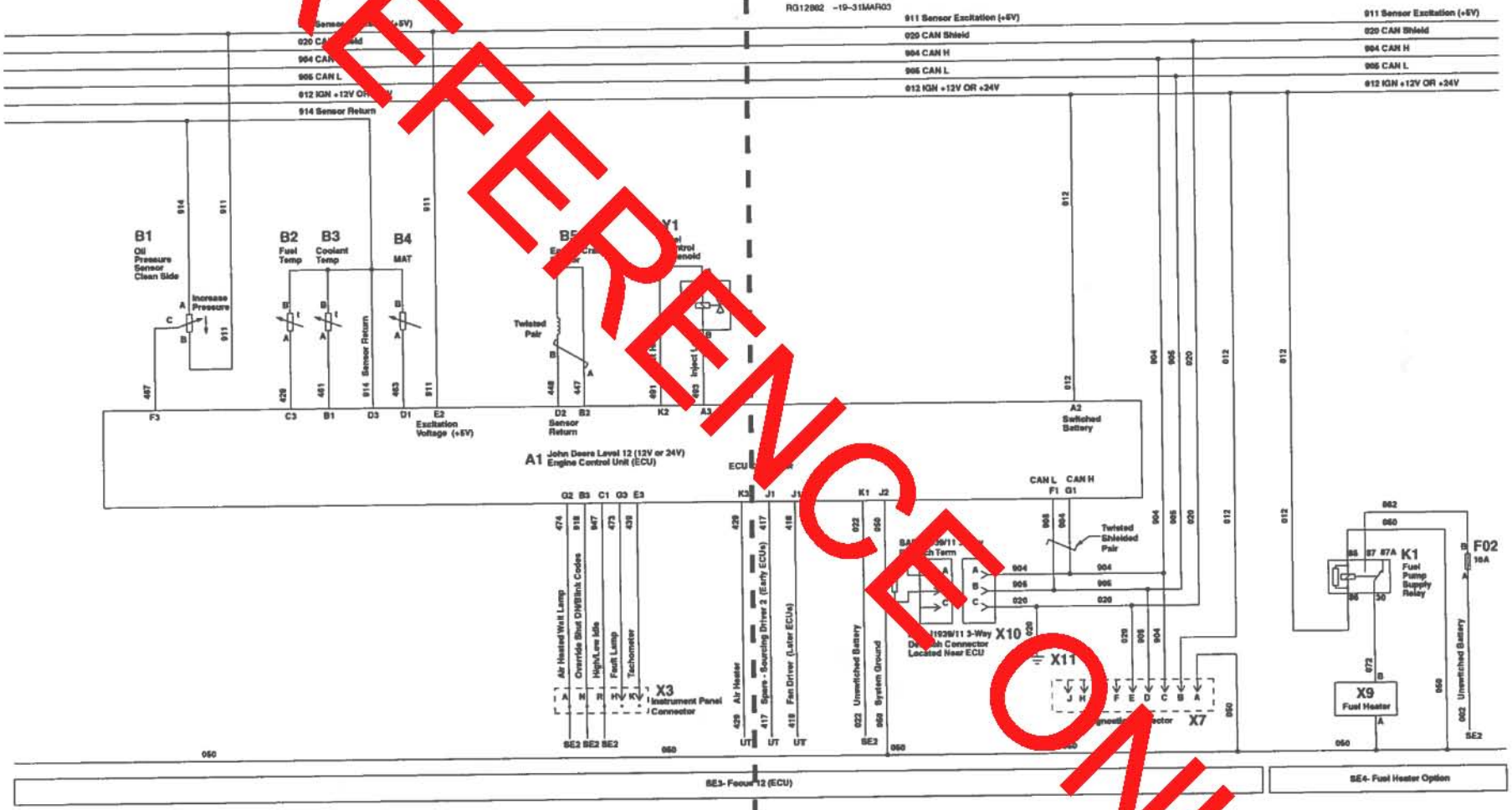
OEM Engines - Electronic Control System Wiring Diagram - Base ECUs

RG12882 –19–31MAR03



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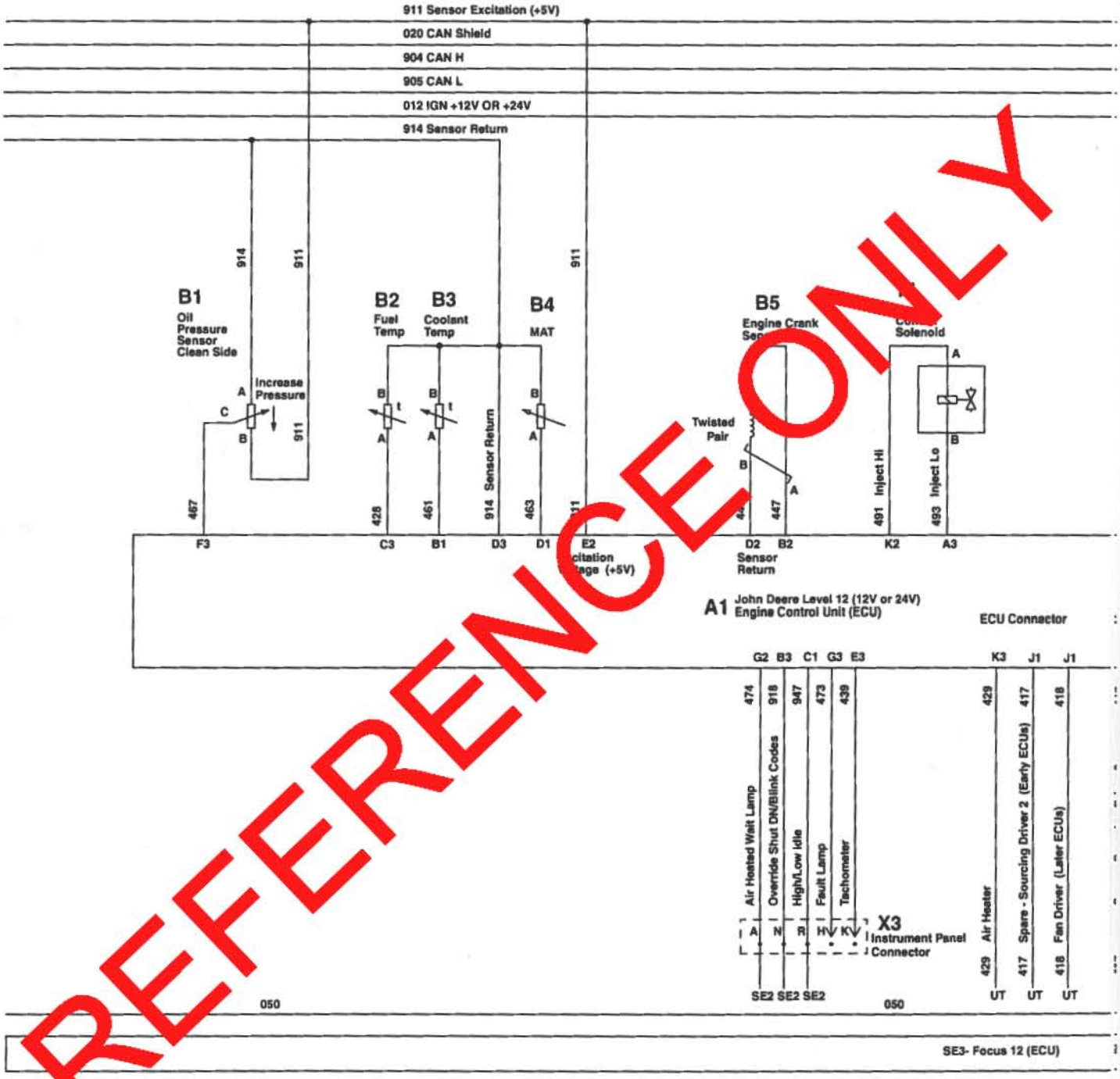

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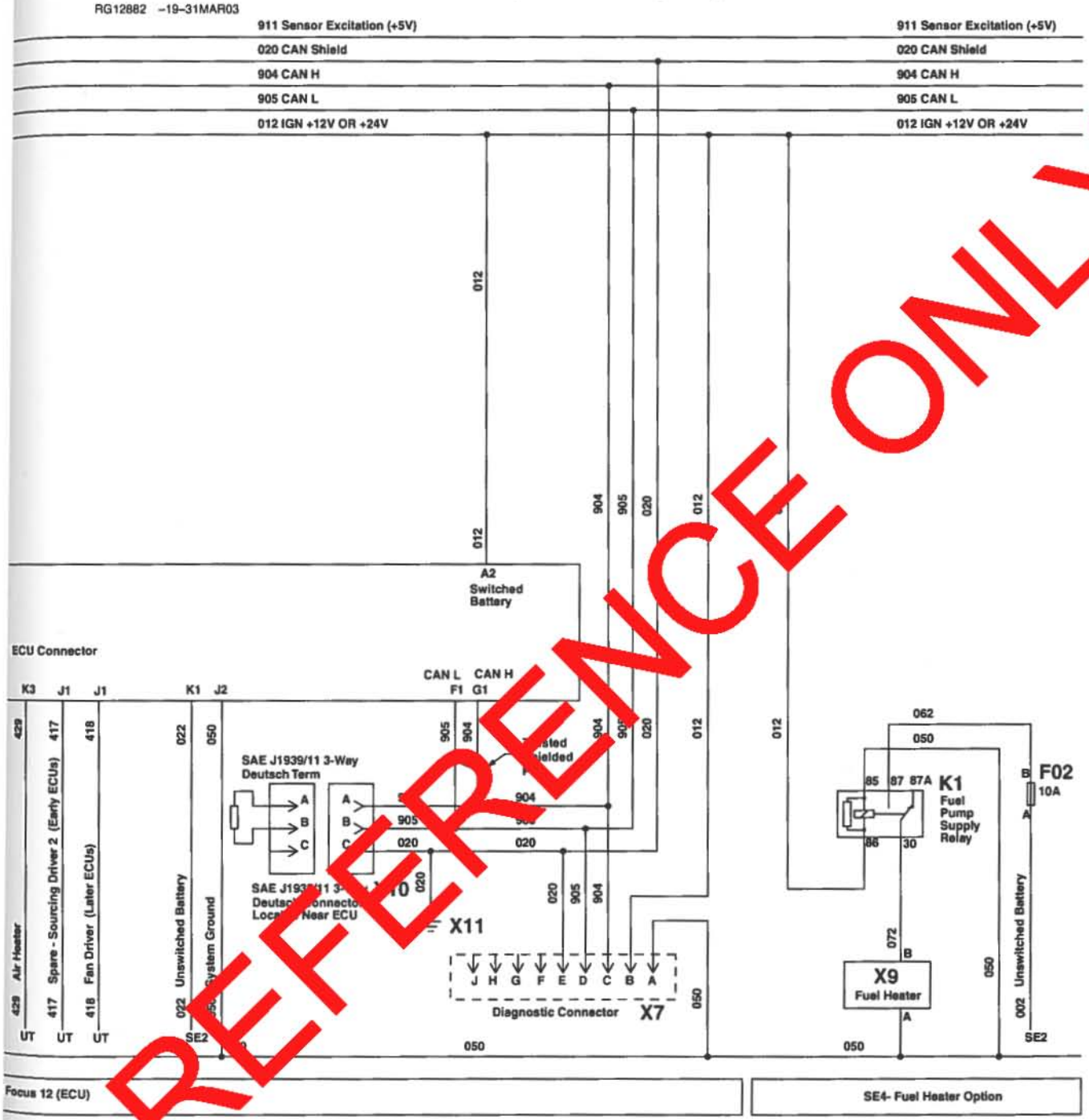
OEM Engines - Electronic Control System Wiring Diagram - Base ECUs

RG12882 –19–31MAR03



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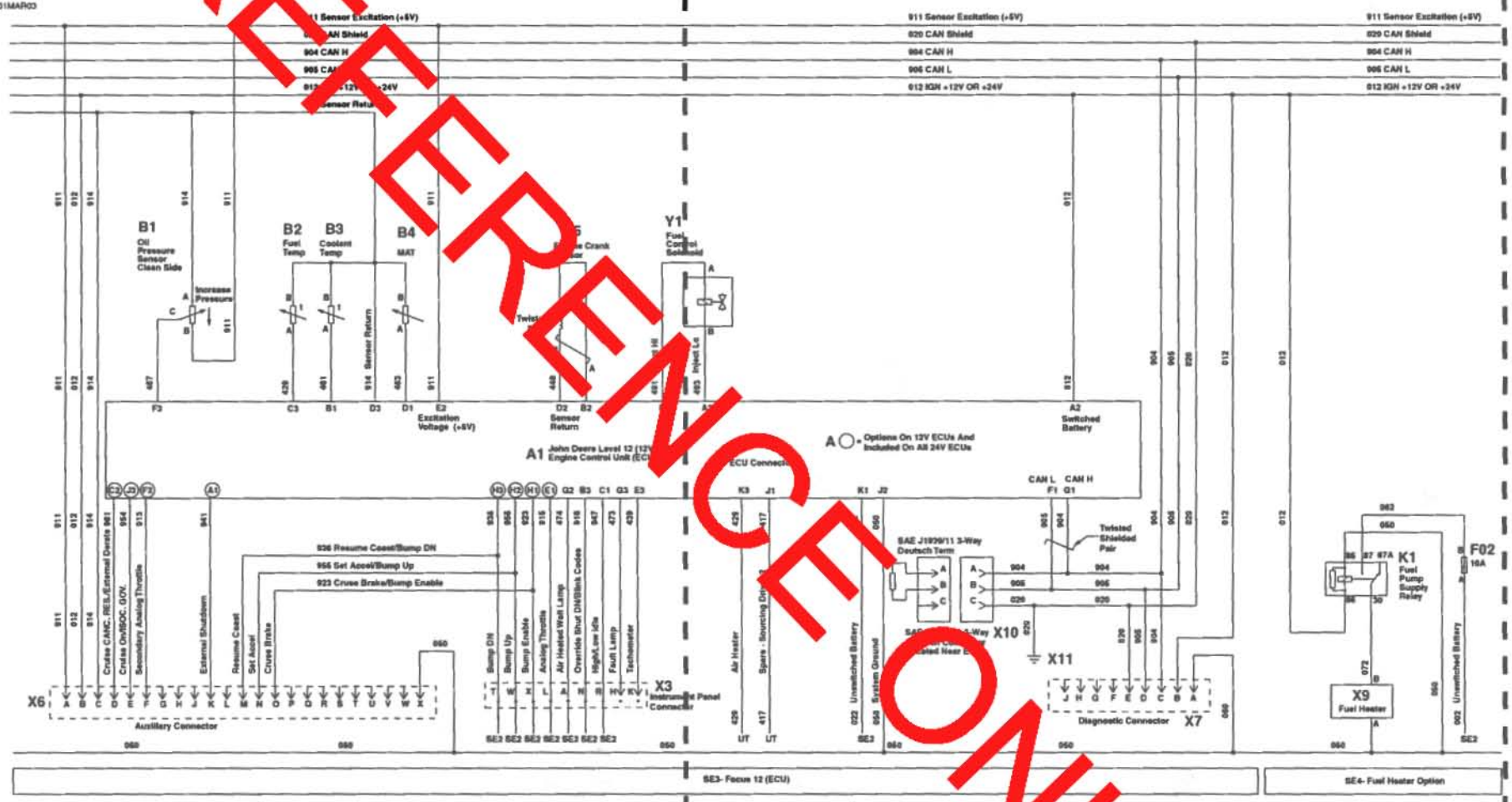
OEM Engines - Electronic Control System Wiring Diagram - Extended ECUs (Early)

RG11986 -19-31MAR03



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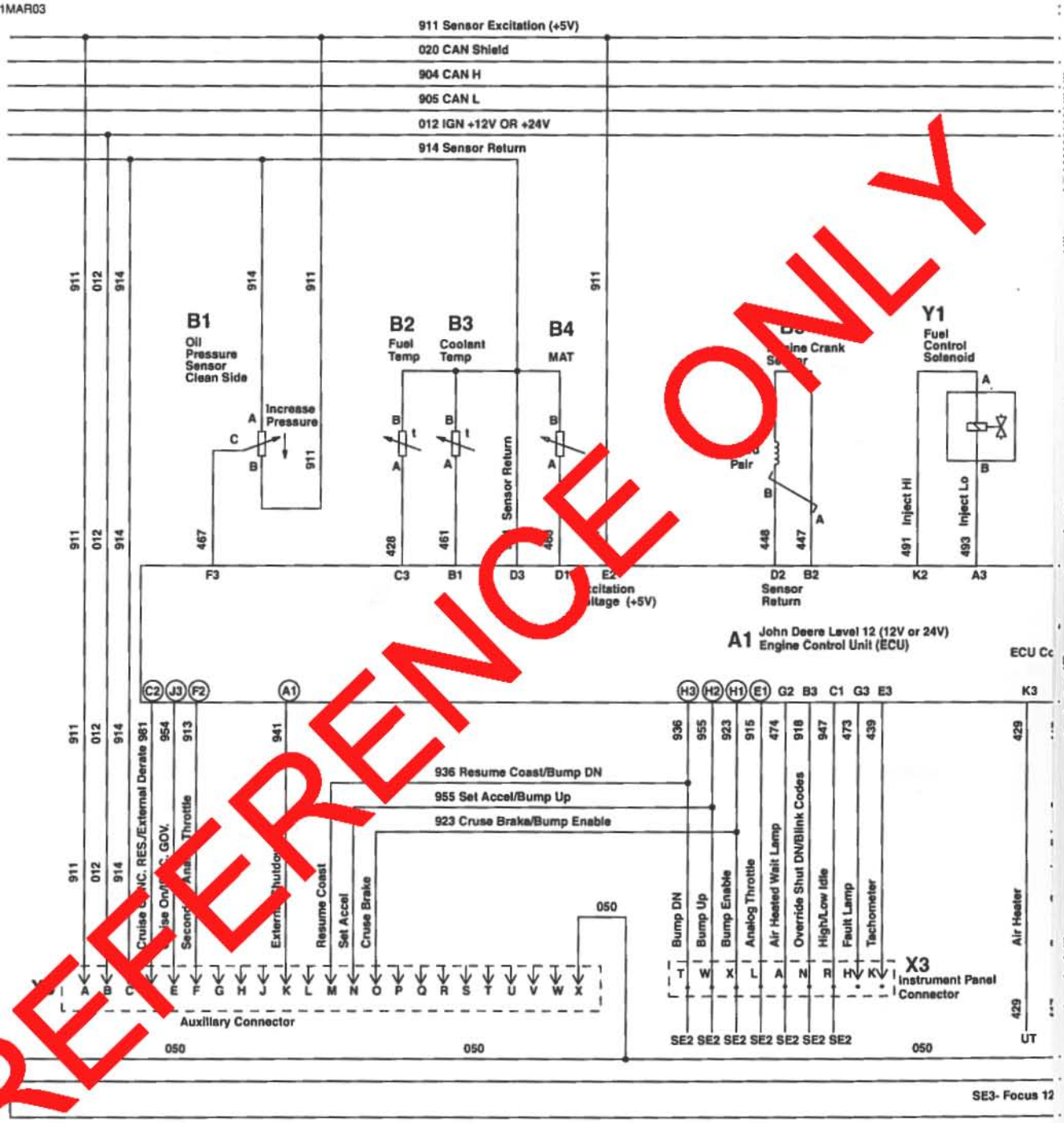
OEM Engines - Electronic Control System Wiring Diagram - Extended ECUs (Early)

RG11986 –19–31MAR03



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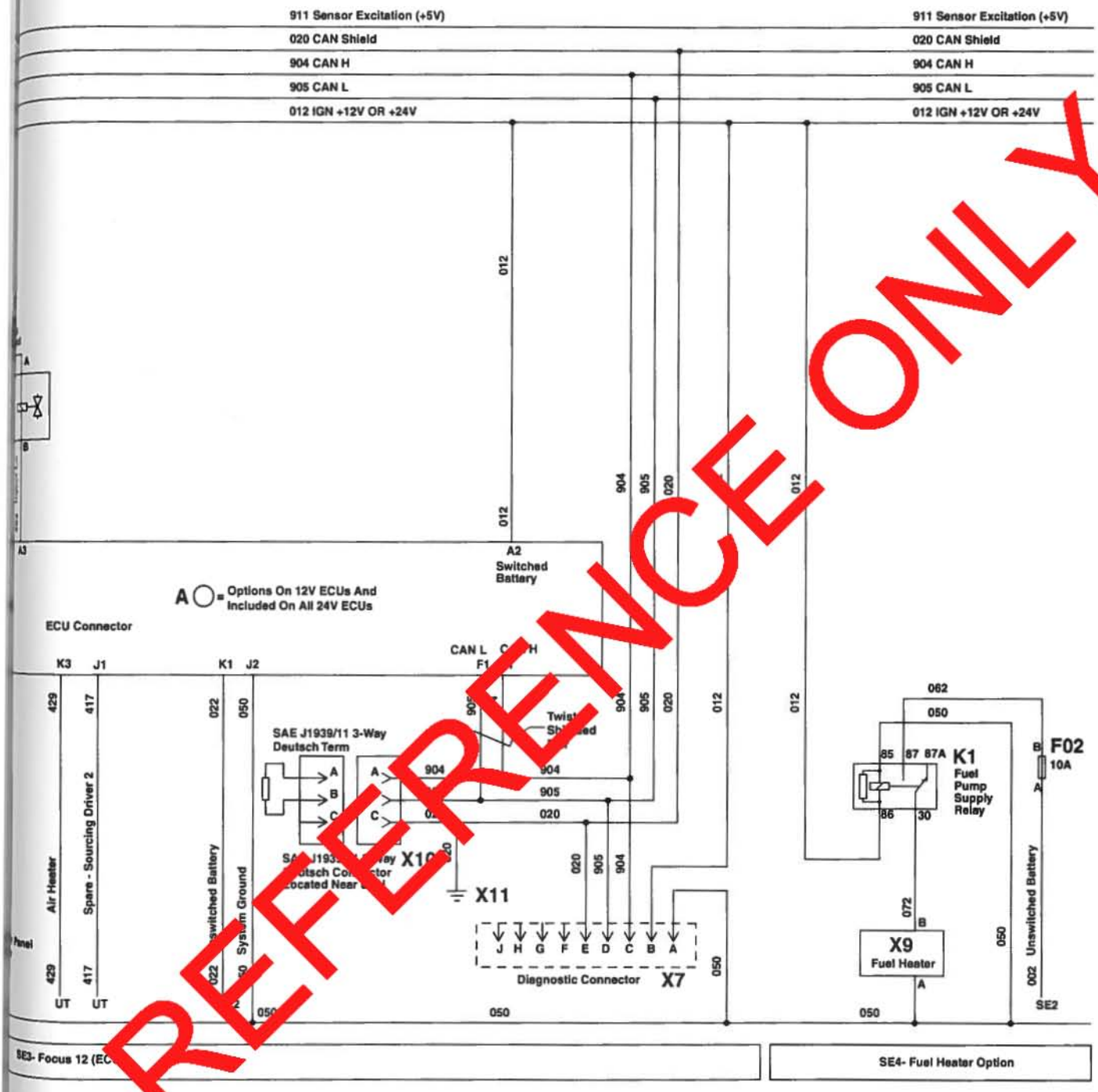

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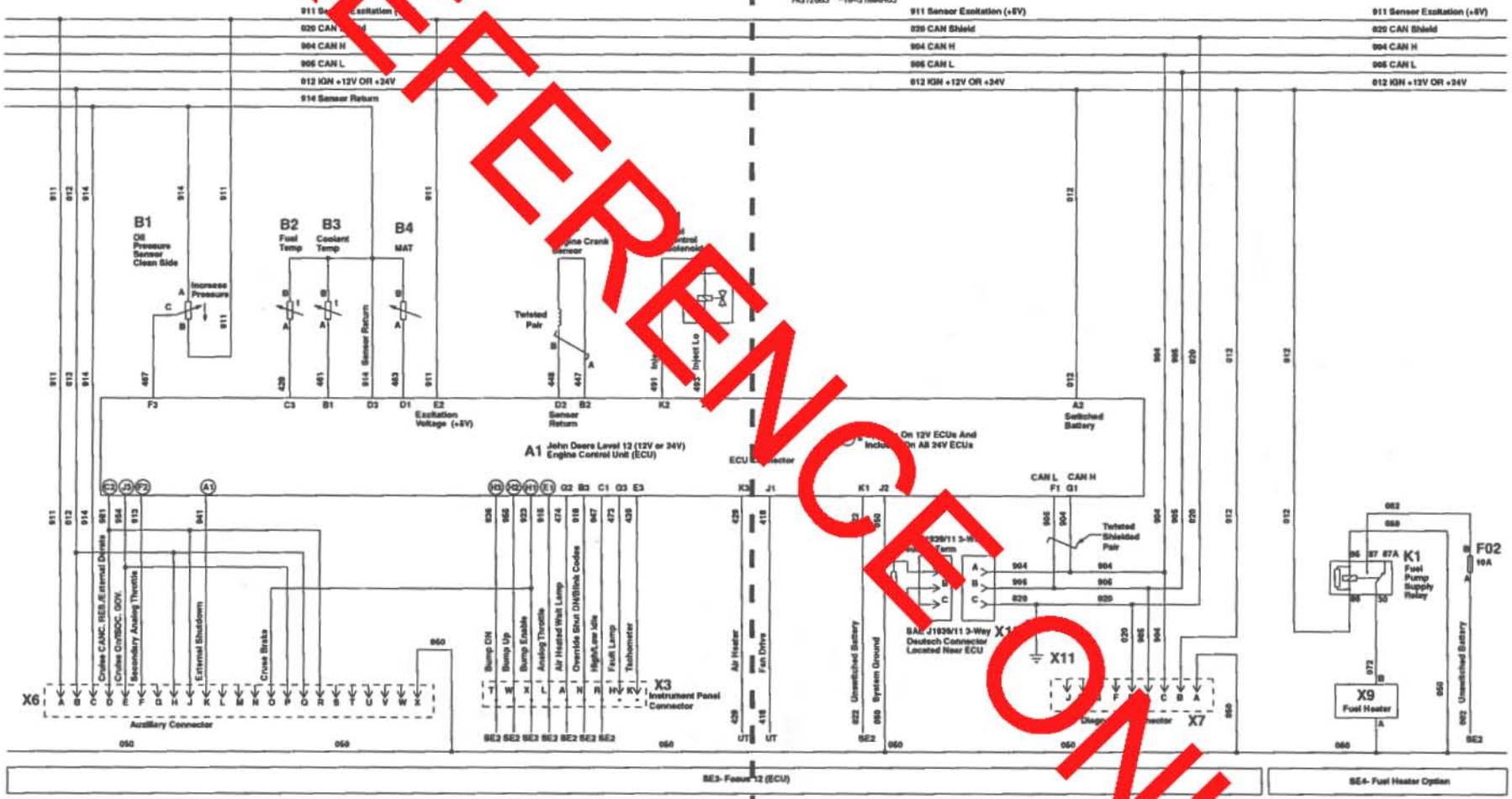
OEM Engines - Electronic Control System Wiring Diagram - Extended ECUs (Later)

RG12883 -19-31MAR03



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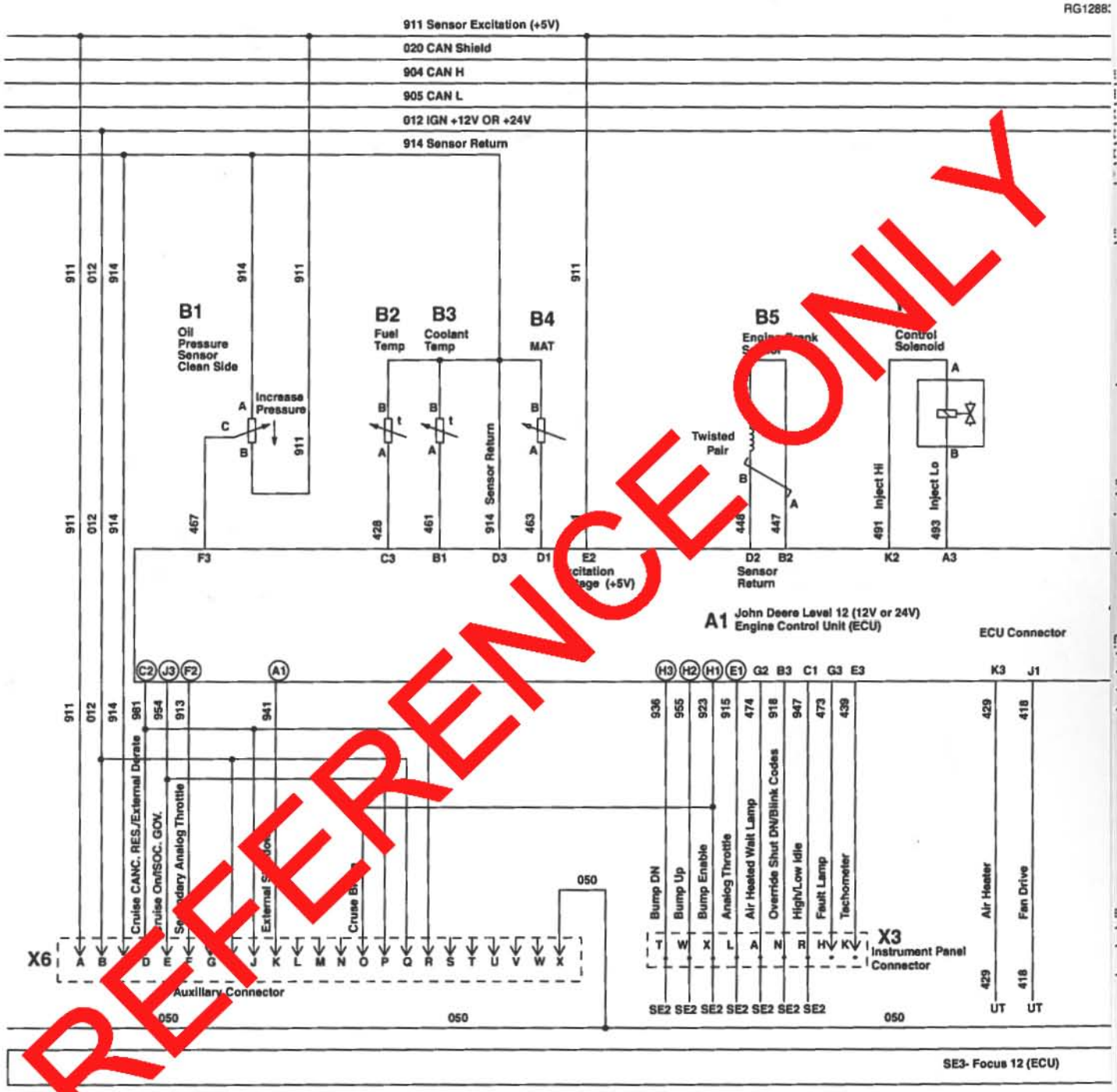

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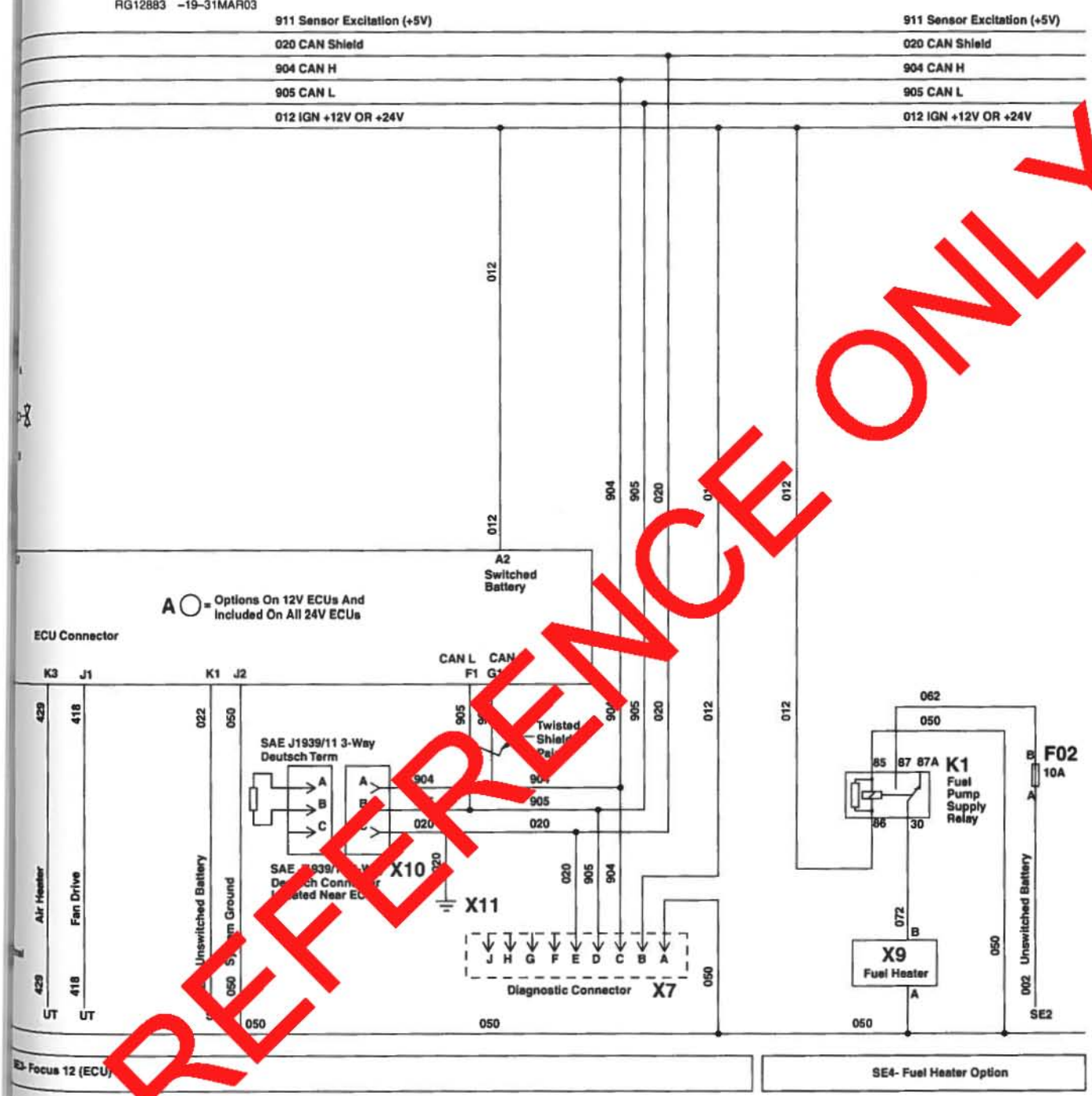
OEM Engines - Electronic Control System Wiring Diagram - Extended ECUs (Later)

RG12883 –19–31MAR03



RG41221,0000105 –19–31MAR03–1/1

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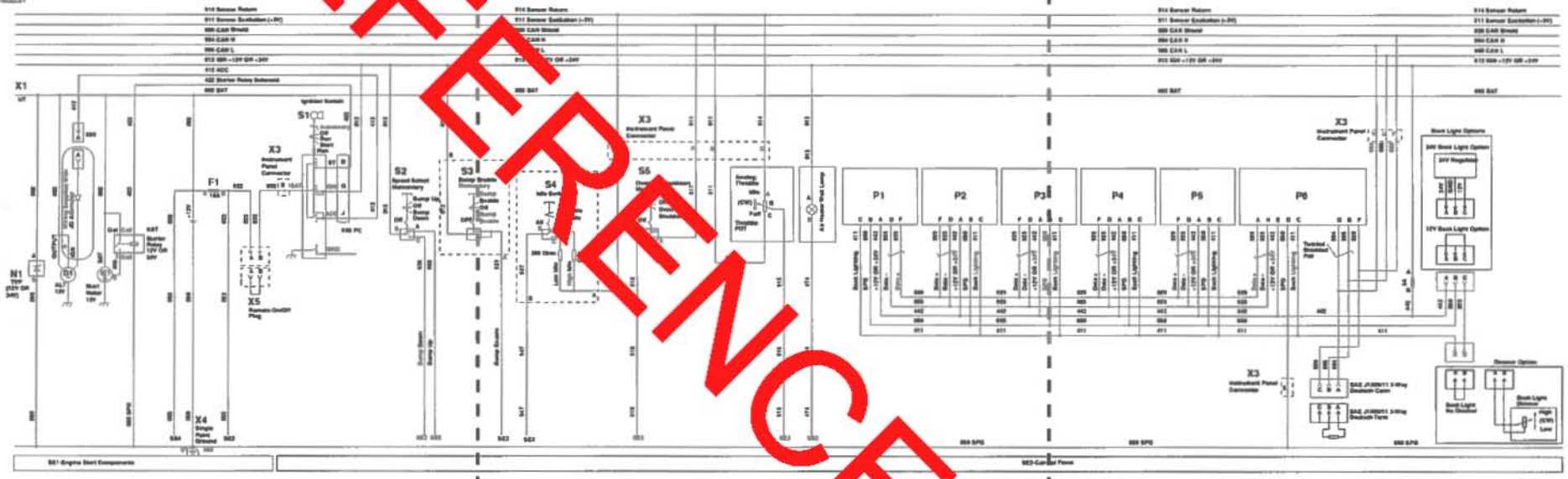
OEM Engines - 4.5L & 6.8L Instrument Panel/Engine Start Components Electrical Wiring Diagram



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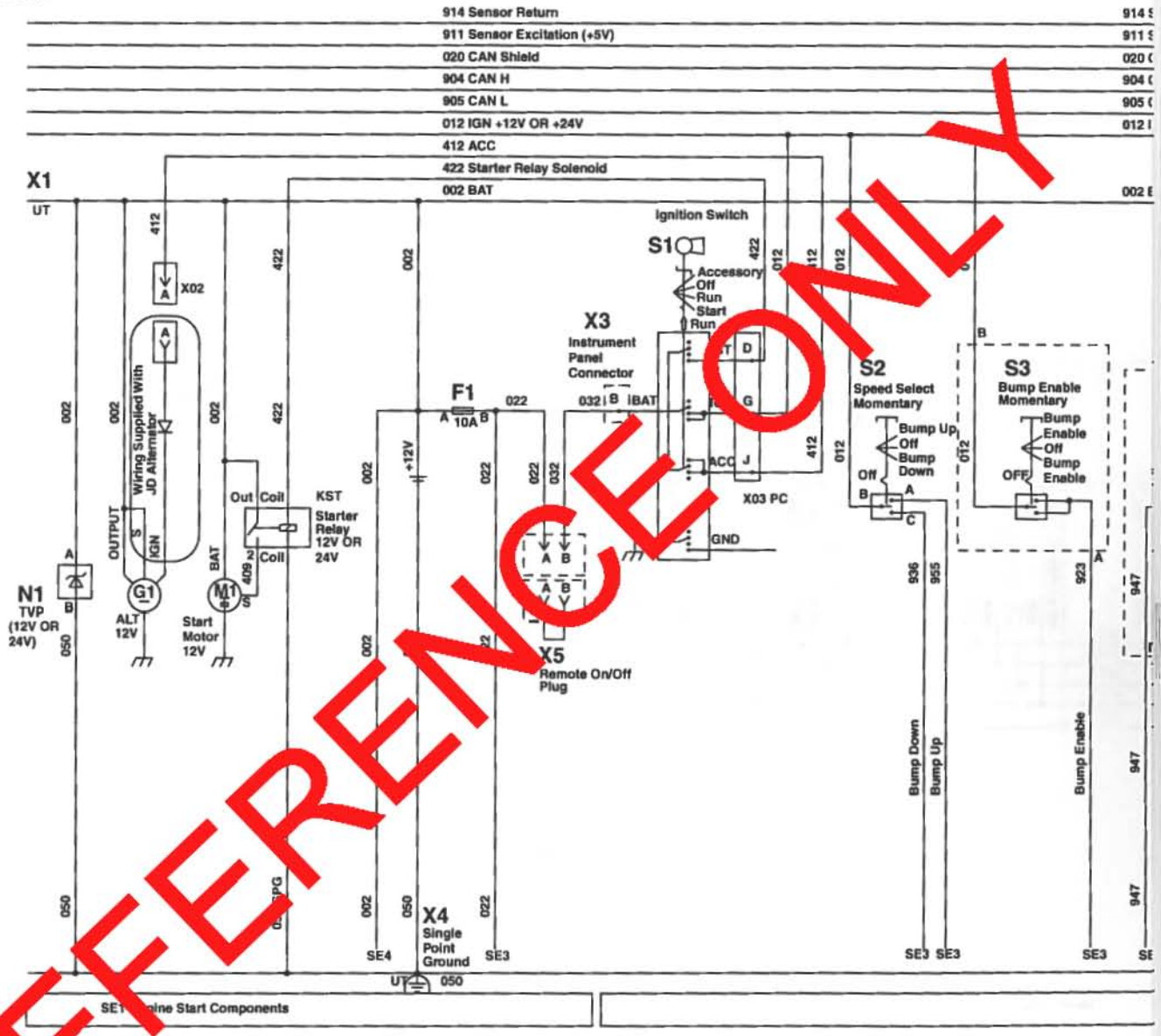
OEM Engines - 4.5L & 6.8L Instrument Panel/Engine Start Components Electrical Wiring Diagram

RG11987 -19-19DEC01



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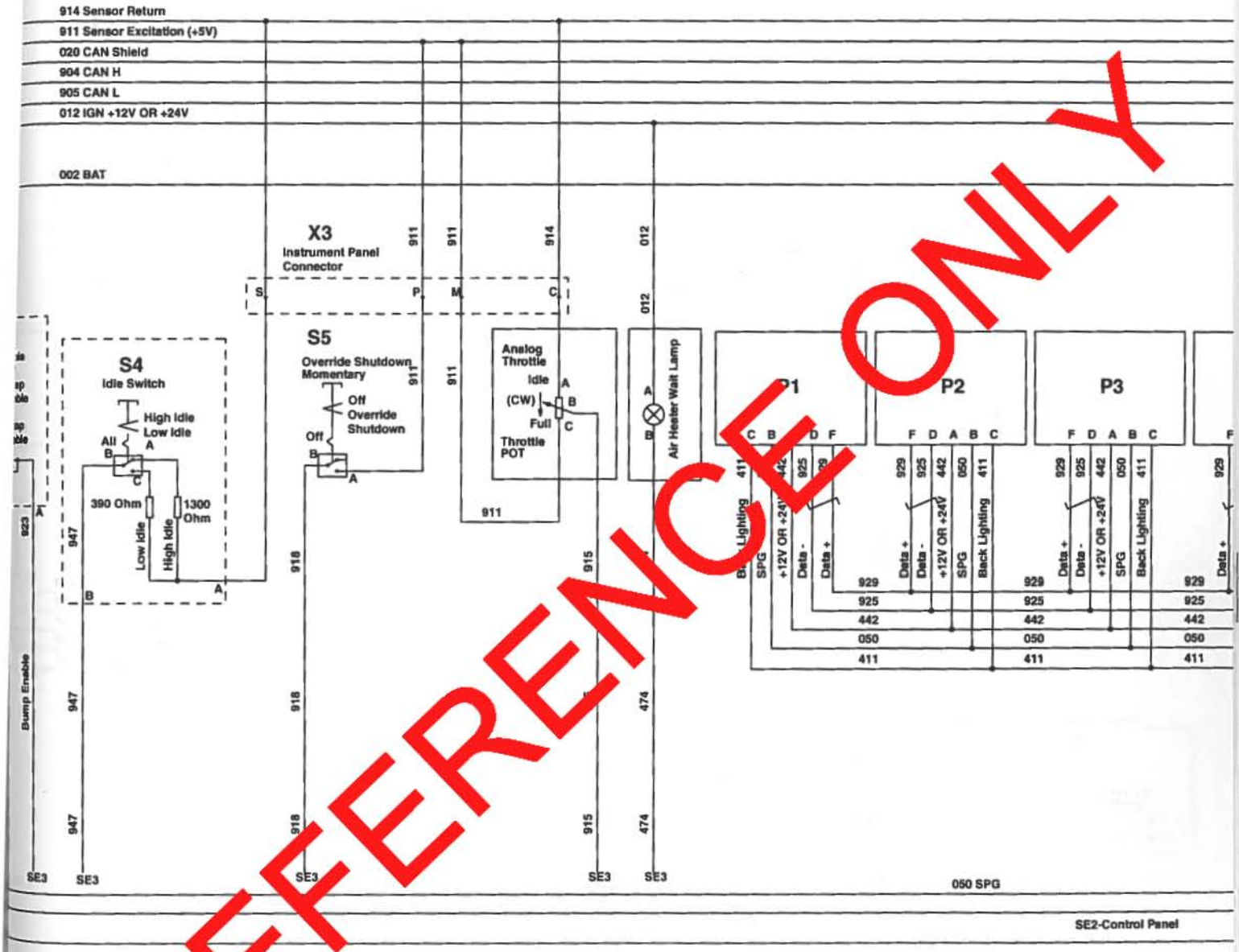

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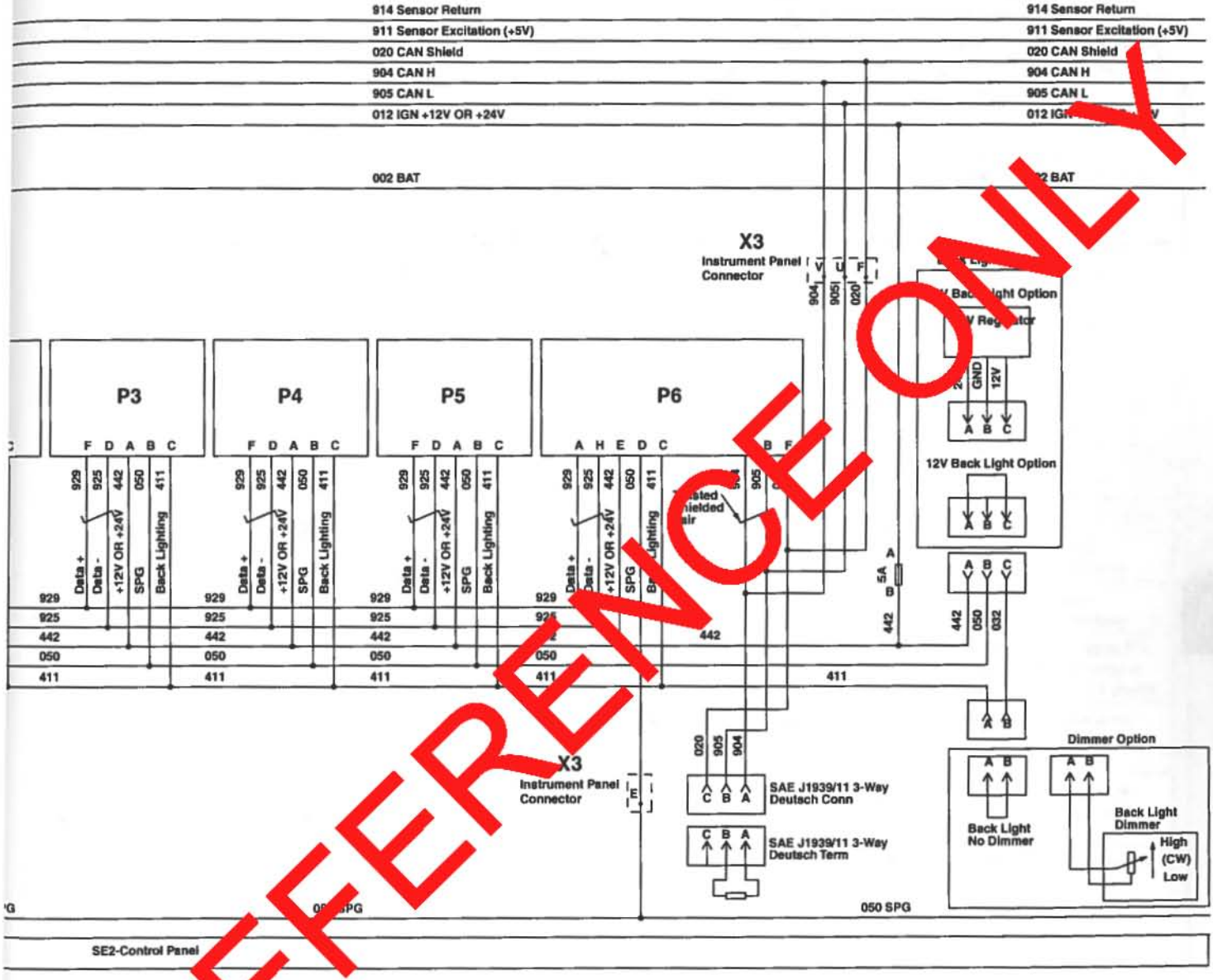

Skidders - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Continued on next page

Sensor Specifications for Skidders				
Sensor	**SPN.FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Analog Throttle (A)	000091.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000091.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will r at idle speed.
Oil Pressure	000100.01	Extremely Low Pressure	Pressure goes below an engine speed dependent value.	ECU derates engine 20% per minute until engine runs at % of full power.
	000100.03	High Input Voltage	Above 4.5 Volts	Low pres re en e protect is d d.
	000100.04	Low Input Voltage	Below 0.3 Volts	ure engine otection is disabled.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.9 Volts	Hig MAT engine rotection is disabled.
	000105.04	Low Input Voltage	Below 0.3 Volts	igh MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Ex eds 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Tempera	Exc ds 11 C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.03	High Input Vo age	Ex eeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low I ltage	Below 0.3 Volts	High ECT engine protection is disabled.
	000110.16	oderately vere Tem ature	Exceeds 110°C (230°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Fuel Temperature	000174.03	H In Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	00174.	Moderately High Temperature	Exceeds 120°C (248°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

Skidders - Torque Curve Selection

Torque Curve Selection for Skidders	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal operation

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RG40854,000016D –19–21FEB02–1/1

Skidders - Governor Mode Selection

Desired Speed Governor Selection for Skidders	
Mode Selected on SERVICE ADVISOR™	**Conditions**
0	Normal droop

Max. Speed Governor Selection for Skidders	
Mode Selected on SERVICE ADVISOR™	**Conditions:**
9	Normal droop

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RG40854,000016F –19–21FEB02–1/1

Skidders - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Switched Battery	A2	N/A[a]
Unswitched Battery	K1	N/A[a]
System Ground	J2	N/A[a]
CAN High	G1	N/A[a]
CAN Low	F1	NA
5V Sensor Supply	E2	Changes with each sensor
Sensor Ground	D3	Changes with each sensor
Analog Throttle (A) Input	E1	[illegible]
Multi-state Throttle Input	C1	B
Crank Position Input	B2	[illegible]
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
Oil Pressure Input	F3	B
[a]N/A = Not Applicable		

RG40854,0000170 –19–21FEB02–1/1

Telehandlers - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

Continued on next page

Sensor Specifications for Telehandlers				
Sensor	**SPN.FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Analog Throttle (A)	000091.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000091.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Oil Pressure Switch	000100.01	Extremely Low Pressure	Input circuit is grounded when engine is running at a minimum engine speed.	No derate
	000100.04	Low Input Voltage	Input circuit is grounded at key ON with no engine speed.	No derate
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.9 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Exceeds 88°C (190°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 120°C (248°F)	ECU derates engine 60% per minute until engine runs at 40% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.15	Less Severe Temperature	Exceeds 108°C (226°F)	ECU derates engine 20% per minute until engine runs at 80% of full power.
	000110.16	Moderately Severe Temperature	Exceeds 115°C (239°F)	ECU derates engine 40% per minute until engine runs at 60% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 120°C (248°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

Telehandlers - Torque Curve Selection

Torque Curve Selection for Telehandlers	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal Operation

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RG40854,0000141 –19–30JAN02–1/1

Telehandlers - Governor Mode Selection

Desired Speed Governor Selection for Telehandlers	
Mode Selected on SERVICE ADVISOR™	**Conditions**
0	Normal Droop

Max. Speed Governor Selection for Telehandlers	
Mode Selected on SERVICE ADVISOR™	**Conditions:**
9	Normal droop

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RG40854,0000142 –19–30JAN02–1/1

Telehandlers - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Switched Battery	A2	N/A*
Unswitched Battery	K1	N/A*
System Ground	J2	N/A*
CAN High	G1	N/A*
CAN Low	F1	NA
5V Sensor Supply	E2	Changes with each sensor
Sensor Ground	D3	Changes with each sensor
Analog Throttle (A) Input	E1	B
Crank Position Input	B2	A
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
Oil Pressure Input	C1	Refer to vehicle manual for this.
*N/A = Not Applicable		

RG40854,0000143 -19-30JAN02-1/1

Tractors - Sensor Specifications

The specifications shown below are voltage, pressure, and temperature parameters that the Engine Control Unit (ECU) uses to determine whether a Diagnostic Trouble Code (DTC) is set for a given sensor.

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Sensor Specifications for Tractors				
Sensor	**SPN.FMI**	**Measured Sensor Parameter**	**Out of Range Value**	**Derate**
Analog Throttle (A)	000091.03	High Input Voltage	Above 4.7 Volts	If no other throttle is available, engine will run at idle speed.
	000091.04	Low Input Voltage	Below 0.3 Volts	If no other throttle is available, engine will run at idle speed.
Analog Throttle (B)	000029.03	High Input Voltage		If no other throttle is available, engine will run at idle speed.
	000029.04	Low Input Voltage		If no other throttle is available, engine will run at idle speed.
Analog Throttle (C)	000028.03	High Input Voltage		If no other throttle is available, engine will run at idle speed.
	000028.04	Low Input Voltage		If no other throttle is available, engine will run at idle speed.
Manifold Air Temperature (MAT)	000105.03	High Input Voltage	Above 4.9 Volts	High MAT engine protection is disabled.
	000105.04	Low Input Voltage	Below 0.1 Volts	High MAT engine protection is disabled.
	000105.16	Moderately High Temperature	Exceeds 100°C (212°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.
Engine Coolant Temperature (ECT)	000110.00	Most Severe Temperature	Exceeds 115°C (239°F)	ECU derates engine 20% per minute until engine runs at 60% of full power.
	000110.03	High Input Voltage	Exceeds 4.9 Volts	High ECT engine protection is disabled.
	000110.04	Low Input Voltage	Below 0.1 Volts	High ECT engine protection is disabled.
	000110.15	Least Severe Temperature	Exceeds 110°C (230°F)	ECU does not derate engine.
	000110.16	Moderately Severe Temperature	Exceeds 112°C (234°F)	ECU derates engine 2% per minute until engine runs at 90% of full power.
Fuel Temperature	000174.03	High Input Voltage	Exceeds 4.9 Volts	High fuel temperature engine protection is disabled.

Continued on next page

Sensor Specifications for Tractors				
	000174.04	Low Input Voltage	Below 0.1 Volts	High fuel temperature engine protection is disabled.
	000174.16	Moderately High Temperature	Exceeds 120°C (248°F)	ECU derates engine 2% per minute until engine runs at 80% of full power.

RG40854,0000014 -19-20AUG02-3/3

Tractors - Torque Curve Selection

Torque Curve Selection for Tractors	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal Operation

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Tractors - Governor Mode Selection

Desired Speed Governor Selection for Tractors	
Mode Selected on SERVICE ADVISOR™	**Conditions**
0	Normal Dro
1	Droop use with

Max. Speed Governor Selection for Tractors	
Mode Selected on SERVICE ADVISOR™	**Conditions:**
9	Normal droop
10	Droop used with field cruise

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RG40854,0000016 -19-20AUG02-1/1

Tractors - ECU Terminal Identification

ECU Terminal Function	ECU Terminal #	Sensor Connector Terminal #
Switched Battery	A2	N/A*
Unswitched Battery	K1	N/A*
System Ground	J2	N/A*
CAN High	G1	N/A*
CAN Low	F1	N/A*
5V Sensor Supply	E2	Changes with each sensor
Sensor Ground	D3	Changes with each sensor
Analog Throttle (A) Input	B3	B
Analog Throttle (B) Input	F3	A
Analog Throttle (C) Input	E1	C
Crank Position Input	B2	A
Crank Position Return	D2	B
Pump Solenoid Return	A3	B
Pump Solenoid Supply	K2	A
Fuel Temperature Input	C3	A
Engine Coolant Temperature Input	B1	A
Manifold Air Temperature Input	D1	A
Wheel Speed Input	C2	Comes from BCU
Air Heater Return	H2	Air Heater Relay
Air Heater Relay Enable	K3	Air Heater Relay
Air Heater Light Indicator	G3	N/A*
*N/A = Not Applicable		

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