PowerTech Plus™ 9.0L Diesel Engines

Level 14 Electronic Fuel System With Denso HPCR

TECHNICAL MANUAL

POWERTECH Plus™ 9.0L Diesel Engines—Level 14 Electronic Fuel System with Denso HPCR

CTM385 26MAY06 (ENGLISH)

For complete service information also see:

PowerTech Plus™ 9.0L Diesel Engines—
Base Engine. CTM400
Alternators and Starter Motors. CTM77
OEM Engine Accessories . . . . . CTM67 (English Only)

TP-6459 5/06
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 (CTM385) covers only Level 14 Electronic Fuel System with the Denso High Pressure Common Rail (HPCR). The following manual covers the base engine.

- CTM400—Base Engine

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

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

Before beginning repair on an engine, clean the engine.

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

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

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

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

RG41183,00000EA –19–03APR05–1/1

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

Contents

Handle Fluids Safely—Avoid Fires

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

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

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

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

TS227 –UN–23AUG88

DX,FLAME –19–29SEP98–1/1

Handle Fuel Safely—Avoid Fires

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

Always stop engine before refueling machine. Fill fuel tank outdoors.

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

TS202 –UN–23AUG88

DX,FIRE1 –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

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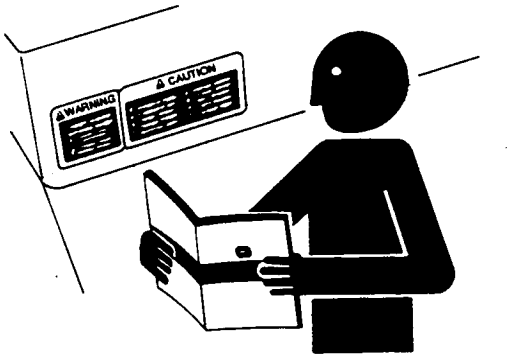
Replace Safety Signs

Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.



TS201 –UN–23AUG88

DX,SIGNS1 –19–04JUN90–1/1

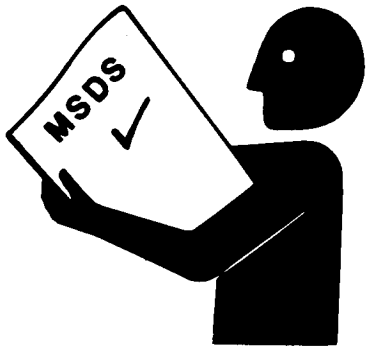
Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)



TS1132 –UN–26NOV90

DX,MSDS,NA –19–03MAR93–1/1

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

Protect Against High Pressure Spray

Spray from high pressure nozzles can penetrate the skin and cause serious injury. Keep spray from contacting hands or body.

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

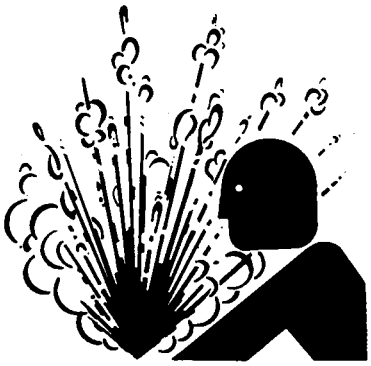
TS1343 –UN–18MAR92

DX,SPRAY –19–16APR92–1/1

Service Cooling System Safely

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

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



TS281 –UN–23AUG88

DX,RCAP –19–04JUN90–1/1

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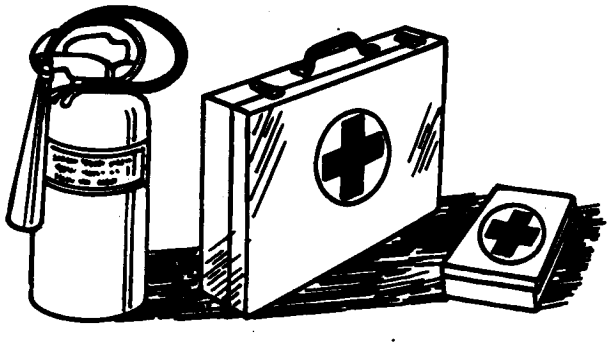
Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 –UN–23AUG88

DX,FIRE2 –19–03MAR93–1/1

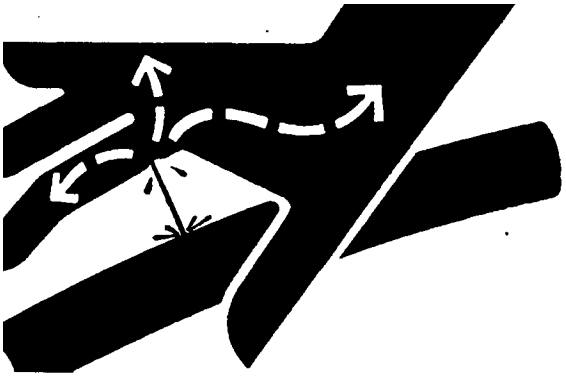
Avoid High-Pressure Fluids

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

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

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

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



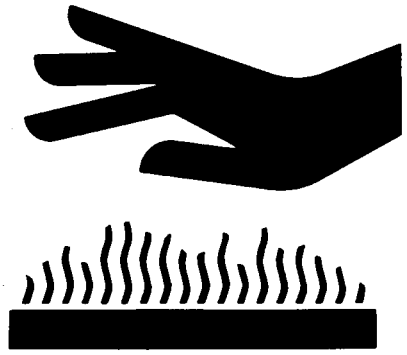
X9811 –UN–23AUG88

DX,FLUID –19–03MAR93–1/1

Avoid Hot Parts

Avoid skin contact with exhaust manifolds, turbochargers and mufflers. Keep flammable materials clear of the turbocharger.

External dry exhaust parts become very hot during operation. Turbochargers and exhaust manifolds may reach temperatures as high as 600°C (1112°F) under full load. This may ignite paper, cloth or wooden materials. Parts on engines that have been at full load and reduced to no load idle will maintain approximately 150°C (302°F).



TS271 –UN–23AUG88

Hot Surface

OURGP12,0000135 –19–19JUL05–1/1

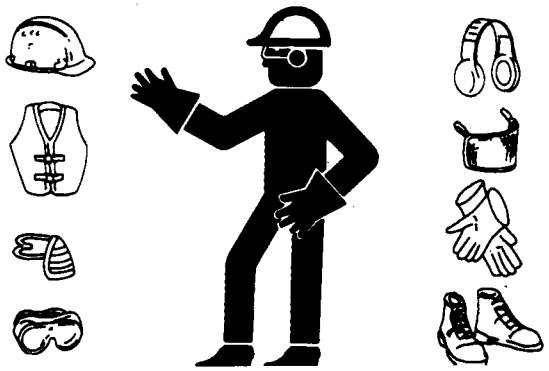
Wear Protective Clothing

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

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

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

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



TS206 –UN–23AUG88

DX,WEAR –19–10SEP90–1/1

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

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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.

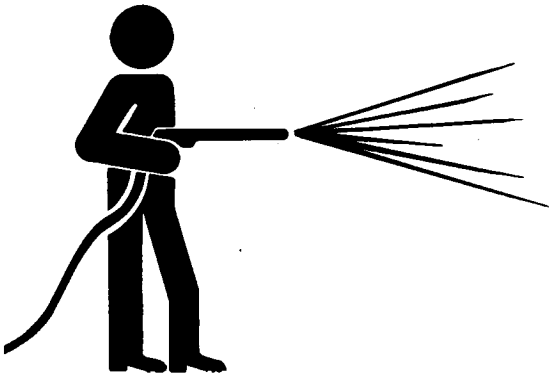
TS218 –UN–23AUG88

DX,SERV –19–17FEB99–1/1

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.

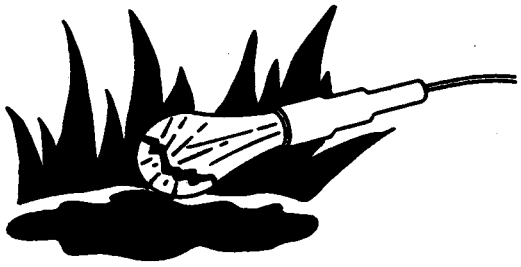


T6642EJ –UN–18OCT88

DX,CLEAN –19–04JUN90–1/1

Illuminate Work Area Safely

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



TS223 –UN–23AUG88

DX,LIGHT –19–04JUN90–1/1

Use Proper 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.

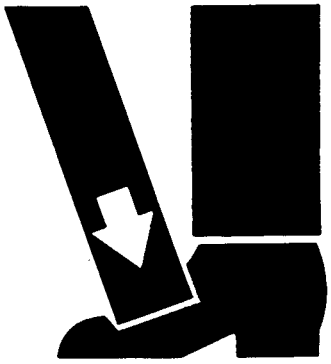
TS779 –UN–08NOV89

DX,REPAIR –19–17FEB99–1/1

Use Proper Lifting Equipment

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

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



TS226 –UN–23AUG88

DX,LIFT –19–04JUN90–1/1

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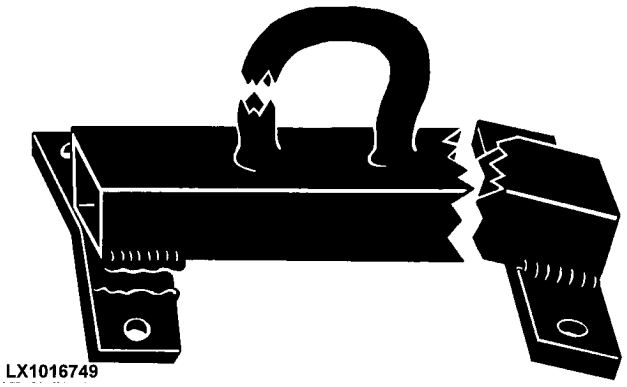
Construct Dealer-Made Tools Safely

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

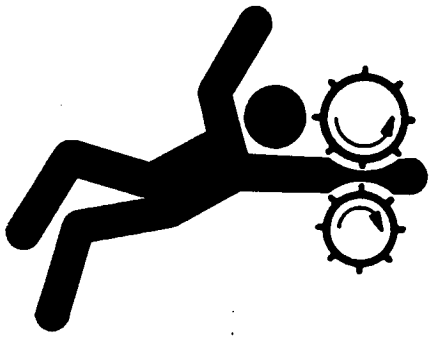
Construct Dealer-Made Tools Safely

DPSG,OUO1004,899 –19–19MAY99–1/1

Service Machines Safely

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

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



TS228 –UN–23AUG88

DX,LOOSE –19–04JUN90–1/1

Prevent Bypass Starting

Avoid possible injury or death from engine runaway.

Do not start engine by shorting across starter terminal. Engine will start with PTO engaged if normal circuitry is bypassed.

Start engine only from operator's station with PTO disengaged or in neutral.

RG5419 –UN–28FEB89

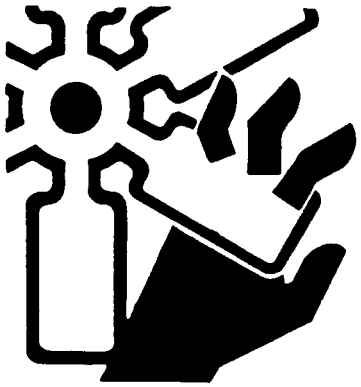
Prevent Bypass Starting

RG,RG34710,7508 –19–30JUN97–1/1

Install Fan Guards

Rotating cooling system fans can cause serious injury.

Keep fan guards in place at all times during engine operation. Wear close fitting clothes. Stop the engine and be sure fan is stopped before making adjustments or connections, or cleaning near the front of the engine.



TS677 –UN–21SEP89

Rotating Fan

OUOD006,000009D –19–04DEC02–1/1

Stay Clear of Rotating Drivelines

Entanglement in rotating driveline can cause serious injury or death.

Keep master shield and driveline shields in place at all times. Make sure rotating shields turn freely.

Wear close-fitting clothing. Stop the engine and be sure PTO driveline is stopped before making adjustments, connections, or performing any type of service on the engine or PTO-driven equipment.

TS1644 –UN–22AUG95

Rotating Drivelines

OUO1004,0000BD8 –19–03NOV00–1/1

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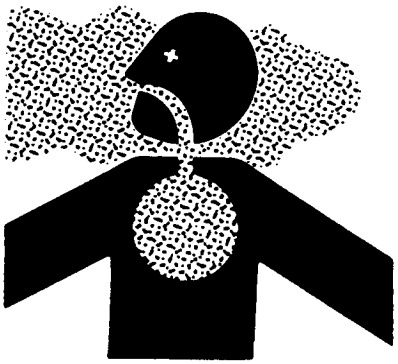
Remove Paint Before Welding or Heating



TS220 –UN–23AUG88

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

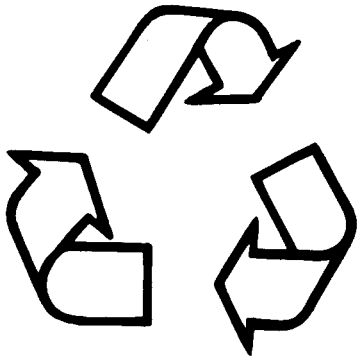
Avoid Heating Near Pressurized Fluid Lines

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.

TS953 –UN–15MAY90

DX,TORCH –19–10DEC04–1/1

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

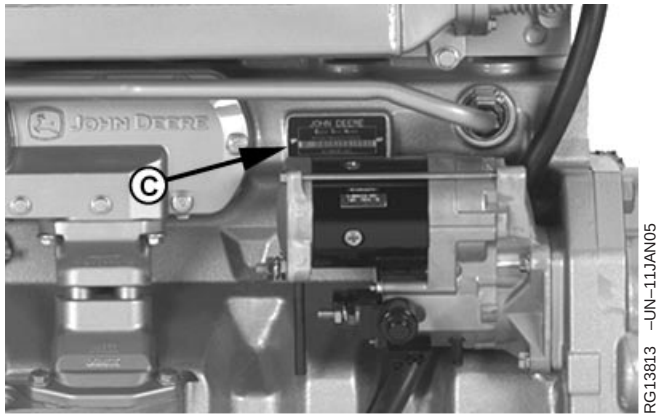
Engine Serial Number Plate Information

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

Example Engine Serial Number (A)

Each engine has a 13-digit John Deere engine serial number identifying the producing factory, engine displacement, emission tier level and sequential engine number. The following is an example:

Engine Serial Number/Application Data



Serial Number Plate

A—Engine Serial Number
B—Application Data or Type
C—Engine Serial Number Plate

RG6090L123456

RG	Factory producing engine
6	Number of Cylinders
090	Liter displacement
L	Emission Tier Level
123456	6-digit sequential engine number

Factory Producing Engine

CD	Saran, France
JO	Rosario, Argentina
PE	Torreon, Mexico
RG	Waterloo, Iowa
TO	Dubuque, Iowa

Emission Tier Level

B, C or E	Non-certified engines
F	Tier 1/Stage I emission certified engine
G, J or K	Tier 2/Stage II emission certified engine
L, M or N	Tier 3/Stage IIIA emission certified engine

Engine Application Data (B)

This information identifies the engine displacement, aspiration code, user code and application code. The following is an example:

Continued on next page

6090HF485

6	Number of Cylinders
090	Liter displacement
H	Aspiration code
F	User factory code
485	Application code

Aspiration code

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

User Factory Code

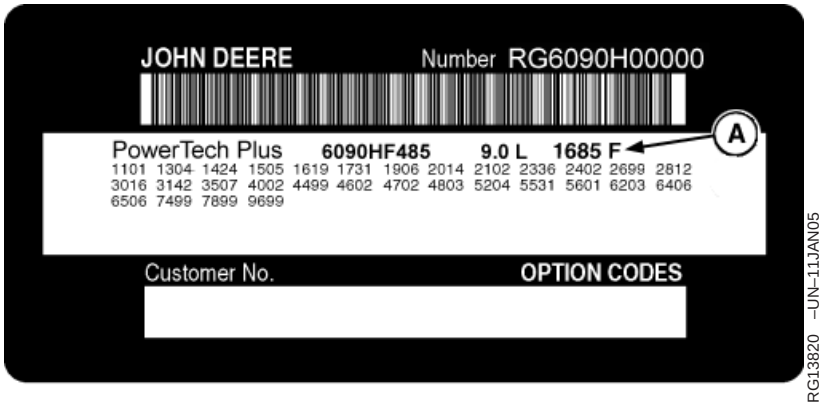
AP	Industries JohnDeere Mexico S.A. de C.V. (Saltillo/Monterrey, Mexico)
AT	Agritalia srl (Vittoria, Sicily, Italy)
BE	Bell EquipmnetCo. (Richards Bay, South Africa)
CQ	John Deere Brazil (Horizontina, Brazil)
DW	John Deere Davenport Works (Davenport, Iowa)
E	John Deere Ottumwa Works (Ottumwa, Iowa)
F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

Application Code

485 etc.	This is the specific engine model for a given application

DN22556,0000058 –19–31MAR06–2/2

OEM Engine Option Code Label



OEM Engine Label

A—Engine Base Code

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. See Engine Option Codes in Operators Manual for this engine model

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

DN22556,0000059 –19–31MAR06–1/1

Information Relative to Emissions Regulations

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

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

List of emission-related components:

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

RG40854,0000007 –19–10APR02–1/1

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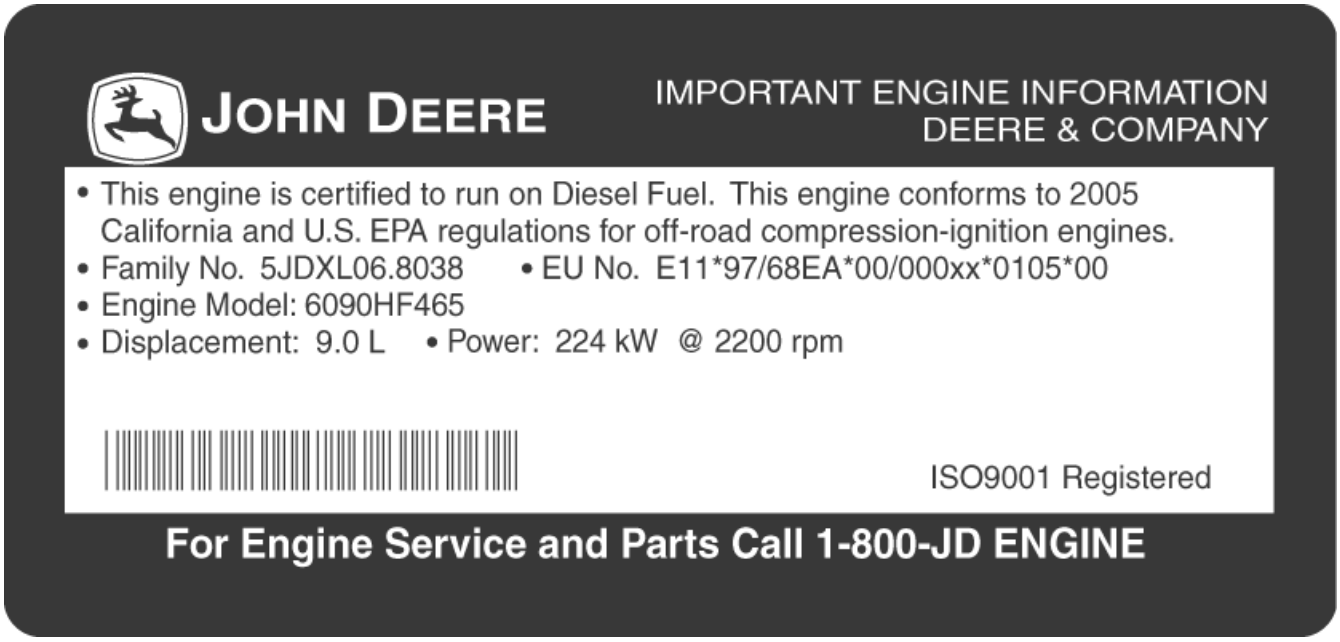
Emissions Control System Certification Label



9.0L Engine Emissions Label

CAUTION: Statutes providing severe penalties for tampering with emissions controls may apply at the user's location.

The emissions warranty described below applies only to those engines marketed by John Deere that have been certified by the United States Environmental Protection Agency (EPA) and/or California Air Resources Board (CARB); and used in the United States and Canada in non-road mobile (self-propelled or portable/transportable[1]) equipment. The presence of an emissions label like the one shown signifies that the engine has been certified with the EPA and/or CARB. The EPA and CARB warranties only apply to new engines having the certification label affixed to the engine and sold as stated above in the geographic areas. The presence of an EU number in the third line of the label signifies that the engine has been certified with the European Union countries per Directive 97/68/EC. The emissions warranty does not apply to the EU countries.

NOTE: The hp/kW rating on the engine emissions certification label specifies the gross engine hp/kW, which is flywheel power without fan. In most applications this will not be the same rating as the advertised vehicle hp/kW rating.

[1]Equipment moved at least once every 12 months.

OMRGP15,0000146 –19–20JAN05–1/1

Engine Application Charts

JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)
RG6090HF485

RG40854,0000009 –19–11APR03–1/1

Minimizing the Effect of Cold Weather on Diesel Engines

John Deere diesel engines are designed to operate effectively in cold weather.

However, for effective starting and cold weather operation, a little extra care is necessary. The information below outlines steps that can minimize the effect that cold weather may have on starting and operation of your engine. See your John Deere dealer for additional information and local availability of cold weather aids

Use Winter Grade Fuel

When temperatures fall below 5°C (40°F), winter grade fuel (Grade No. 1-D fuel in North America) is best suited for cold weather operation. Winter grade fuel has a lower cloud point and a lower pour point.

Cloud point is the temperature at which wax will begin to form in the fuel and this wax causes fuel filters to plug. **Pour point** is the temperature at which fuel begins to thicken and becomes more resistant to flow through fuel pumps and lines.

NOTE: On an average, winter grade fuel has a lower BTU (heat content) rating. Using winter grade fuel may reduce power and fuel efficiency, but should not cause any other engine performance effects. Check the grade of fuel being used before troubleshooting for low power complaints in cold weather operation.

Air Intake Heater

An air intake heater is an available option to aid cold weather starting.

CAUTION: Do not use any starting fluid with an air intake heater.

Starting Fluid

A starting fluid port on the intake is available to aid cold weather starting.

CAUTION: Do not use any starting fluid with an engine equipped with glow plugs

Coolant Heater

An engine block heater (coolant heater) is an available option to aid cold weather starting.

Seasonal Viscosity Oil and Proper Coolant Concentration

Use seasonal grade viscosity engine oil based ion the expected air temperature range between oil changes and proper concentration of low silicate antifreeze as recommended. (See DIESEL ENGINE OIL and ENGINE COOLANT requirements this section.)

Diesel Fuel Flow Additive

Use John Deere Premium Diesel Fuel Conditioner (Winter) or equivalent to treat fuel during the cold weather season. This winter formulation is a combination diesel fuel conditioner and anti-gel additive.

IMPORTANT: Treat fuel when outside temperature drops below 0°C (32°F). For best results, use with untreated fuel. Follow all recommended instructions on label.

Winterfronts

Use of fabric, cardboard , or solid winterfronts is not recommended with any John Deere engine. Their use can result in excessive engine coolant, oil, and charge air temperatures. This can lead to reduced engine life, loss of power and poor fuel economy. Winterfronts may also put abnormal stress on fan and fan drive components potentially causing premature failures.

Continued on next page

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If winterfronts are used, they should never totally close off the grill frontal area. Approximately 25% area in the center of the grill should remain open at all times. At no time should the air blockage device be applied directly to the radiator core.

Radiator Shutters

If equipped with a thermostatically controlled radiator shutter system, this system should be regulated in such a way that the shutters are completely open by the time the coolant reaches 93°C (200°F) to prevent excessive intake manifold temperatures. Manually controlled systems are not recommended.

If air-to-air aftercooling is used, the shutters must be completely open by the time the intake manifold air temperature reaches the maximum allowable temperature out of the charge air cooler.

For more information, see your John Deere dealer.

DX,FUEL10 –19–16DEC05–2/2

Diesel Engine Oil

Use oil viscosity base on the expected air temperature range during the period between oil changes.

John Deere PLUS-50™ oil is preferred.

Oil meeting one of the following specifications are also recommended:

- ACEA Oil Sequence E7
- ACEA Oil Sequence E6

Extended service intervals may apply when John Deere PLUS-50™, ACEA E7, or ACEA E6 engine oils are used. Consult your John Deere dealer for more information.

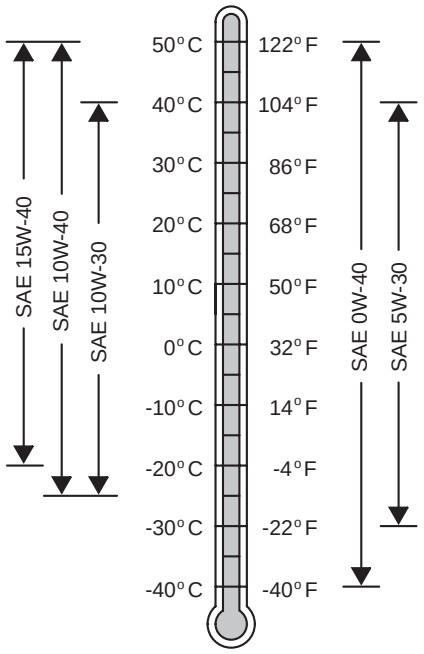
Other oils may be used if they meet one or more of the following:

- John Deere TORQ-GARD SUPREME™
- API Service Category CI-4 PLUS
- API Service Category CI-4
- ACEA Oil Sequence E5
- ACEA Oil Sequence E4

Multi-viscosity diesel engine oils are preferred.

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

DO NOT use diesel fuel with sulfur content greater than 1.0% (10 000 ppm).



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Diesel Engine Oil and Filter Service Intervals

The oil and filter service intervals in the table below should be used as guidelines. Actual service intervals also depend on operation and maintenance practices. It is suggested to use oil analysis to determine the actual useful life of the oil and to aid in selection of the proper oil and filter service interval.

Oil and filter service intervals are based on a combination of oil pan capacity, type of engine oil and filter used, and sulfur content of the diesel fuel.

Engine Oil and Filter Service Intervals		
	Standard Drain Oil Pan	**Extended Drain Oil Pan**
Fuel Sulfur	Less than 0.05% (500 ppm)	
Standard Oil	250 hours	250 hours
Premium Oil	375 hours	500 hours
Fuel Sulfur	0.05 to 0.50% (500 to 5000 ppm)	
Standard Oil	150 hours	150 hours
Premium Oil	275 hours	400 hours
Fuel Sulfur	0.50% to 1.00% (5000 ppm to 10 000 ppm)	
Standard Oil	125 hours	125 hours
Premium Oil	187 hours	250 hours

Diesel fuel sulfur level will affect engine oil and filter service intervals. Higher fuel sulfur levels reduce oil and filter service intervals as shown in the table.

- Use of diesel fuel with sulfur content less than 0.10% (1000 ppm is strongly recommended.)
- Use of diesel fuel with sulfur content 0.10% (1000 ppm) to 0.50% (5000 ppm) may result in REDUCED oil and filter change intervals as shown in the table.
- BEFORE using diesel fuel with sulfur content greater than 0.50% (5000 ppm), contact your John Deere dealer.

Oil types (premium or standard) in the table include:

- “Premium Oils” include John Deere PLUS-50™, ACEA E7, or ACEA E6 oils.
- “Standard Oils” include John DeereTORQ-GARD SUPREME™, API CI-4 PLUS, API CI-4, API CH-4, ACEA E5, or ACEA E4, or ACEA E3 oils.

The 500 hour extended oil and filter change interval is only allowed if all of the following conditions are met:

- Engine equipped with an extended drain interval oil pan
- Use of diesel fuel with sulfur content less than 0.05% (500 ppm)
- Use of premium oil John Deere PLUS-50, ACEA E7 or ACEA E6 and approved John Deere oil filter

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DX,ENOIL12 –19–19DEC05–1/1

Diesel Engine Oil and Filter Service Intervals

The oil and filter service intervals in the table below should be used as guidelines. Actual service intervals also depend on operation and maintenance practices. It is suggested to use oil analysis to determine the actual useful life of the oil and to aid in selection of the proper oil and filter service interval. Oil and filter service intervals are based on a combination of oil pan capacity, type of engine oil and filter used, and sulfur content of the diesel fuel.

Diesel fuel sulfur level will affect engine oil and filter service intervals. Higher fuel sulfur levels reduce oil and filter service intervals as shown in the table:

- Use of diesel fuel with sulfur content less than 0.10% (1000 ppm) is strongly recommended.
- Use of diesel fuel with sulfur content 0.10% (1000 ppm) to 0.50% (5000 ppm) may result in REDUCED oil and filter change intervals as shown in the table.
- BEFORE using diesel fuel with sulfur content greater than 0.50% (5000 ppm), contact your John Deere dealer.
- DO NOT use diesel fuel with sulfur content greater than 1.00% (10 000 ppm).

Oil types (premium or standard) in the table include:

- “Premium Oils” include John Deere PLUS-50™, ACEA E7, or ACEA E6 oils.
- “Standard Oils” include John Deere TORQ-GARD SUPREME™, API CI-4 PLUS, API CI-4, ACEA E5, or ACEA E4 oils.

Use of lower specification oils in U.S. Tier 3 and EU Stage III A engines may result in premature engine failure. The 500 hour extended oil and filter change interval is allowed if the following conditions are met:

- Engine with an extended drain interval oil pan
- Use of diesel fuel with sulfur content less than 0.20% (2000 ppm)
- Use of premium oil John Deere PLUS-50, ACEA E7 or ACEA E6 and approved John Deere oil filter

	U.S. Tier 3 and EU Stage III A - PowerTechPlus™				**U.S. Tier 3 and EU Stage III A - PowerTech™**		
	Oil Pan Size (L/kW)				Oil Pan Size (L/kW)		
Oil pan Capacity	Greater than or equal to 0.10	Greater than or equal to 0.12	Greater than or equal to 0.14	Greater than or equal to 0.22	Greater than or equal to 0.10	Greater than or equal to 0.12	Greater than or equal to 0.14
Fuel Sulfur	Less than 0.10% (1000 ppm)				Less than 0.10% (1000 ppm)		
Standard Oil	250 hours	250 hours	250 hours	250 hours	250 hours	250 hours	250 hours
Premium Oil	375 hours	500 hours	500 hours	500 hours	375 hours	500 hours	500 hours
Fuel Sulfur	0.10 to 0.20% (1000 to 2000 ppm)				0.10 to 0.20% (1000 to 2000 ppm)		
Standard Oil	200 hours	200 hours	250 hours	250 hours	200 hours	200 hours	250 hours
Premium Oil	300 hours	300 hours	500 hours	500 hours	300 hours	400 hours	500 hours
Fuel Sulfur	0.20 to 0.50% (2000 to 5000 ppm)				0.20 to 0.50% (2000 to 5000 ppm)		
Standard Oil	150 hours	150 hours	200 hours	250 hours	150 hours	175 hours	250 hours
Premium Oil	250 hours	250 hours	300 hours	500 hours	275 hours	350 hours	500 hours
Fuel Sulfur	0.50% to 1.00% (5000 ppm to 10 000 ppm)				0.50% to 1.00% (5000 ppm to 10 000 ppm)		
Standard Oil	Contact John Deere Dealer (dealer refers to DTAC solutions)				125 hours	125 hours	125 hours
Premium Oil	Contact John Deere Dealer (dealer refers to DTAC solutions)				187 hours	250 hours	250 hours

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Diesel Fuel

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

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

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

Required fuel properties

In all cases, the fuel shall 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 level of 3100 grams as measured by ASTM D6078 or maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO 12156-1.

Sulfur content:

- Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.
- Use of diesel fuel with sulfur content less than 0.10% (1000 ppm) is STRONGLY recommended.
- Use of diesel fuel with sulfur content 0.10% (1000 ppm to 0.50% (5000 ppm) may result in REDUCED oil and filter change intervals.
- BEFORE using diesel fuel with sulfur content greater than 0.50% (5000 ppm), contact your John Deere dealer.
- DO NOT use diesel fuel with sulfur content greater than 1.0%.

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

IMPORTANT: Improper fuel additive usage may cause damage on fuel injection equipment of diesel engines.

DX,FUEL1 –19–17NOV05–1/1

Lubricity of Diesel Fuel

Most diesel fuels manufactured in the United States, Canada, and the European Union have adequate lubricity to ensure proper operation and durability of fuel injection system components. However, diesel fuels manufactured in some areas of the world may lack the necessary lubricity.

IMPORTANT: Make sure the diesel fuel used in your machine demonstrates good lubricity characteristics.

Fuel lubricity should pass a minimum load level of 3100 grams as measured by ASTM D6078 or a maximum scar diameter of 0.45 mm as measured by ASTM D6079 or ISO 12156-1.

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

DX,FUEL5 –19–27OCT05–1/1

Handling and Storing Diesel Fuel

CAUTION: Handle fuel carefully. Do not fill the fuel tank when engine is running.

DO NOT smoke while you fill the fuel tank or service the fuel system.

Fill the fuel tank at the end of each day's operation to prevent water condensation and freezing during cold weather.

Keep all storage tanks as full as practicable to minimize condensation.

Ensure that all fuel tank caps and covers are installed properly to prevent moisture from entering.

Monitor water content of the fuel regularly.

When using bio-diesel fuel, the fuel filter may require more frequent replacement due to premature plugging.

Check engine oil level daily prior to starting engine. A rising oil level may indicate fuel dilution of the engine oil.

IMPORTANT: The fuel tank is vented through the filler cap. If a new filler cap is required, always replace it with an original vented cap.

When fuel is stored for an extended period or if there is a slow turnover of fuel, add a fuel conditioner to stabilize the fuel and prevent water condensation. Contact your fuel supplier for recommendations.

DX,FUEL4 –19–19DEC03–1/1

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.

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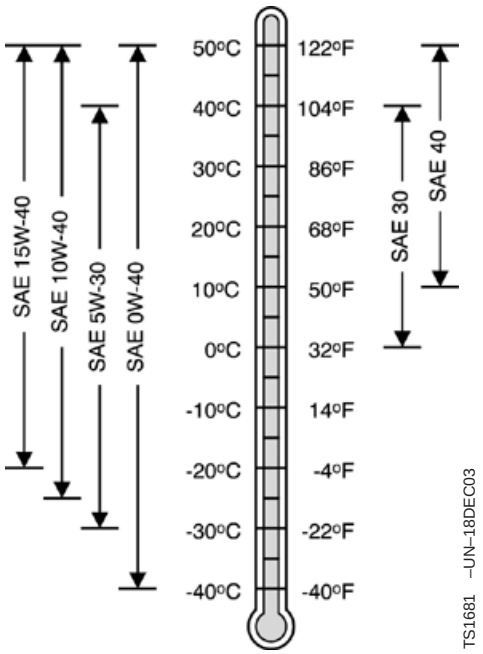
Diesel Engine Oil



Use oil viscosity based on the expected air temperature range during the period between oil changes.

John Deere PLUS-50™ oil is preferred

Oils meeting one of the following specifications are also recommended:

- ACEA Oil Sequence E7
- ACEA Oil Sequence E6
- ACEA Oil Sequence E5
- ACEA Oil Sequence E4

Extended service intervals may apply when John Deere PLUS-50, ACEA E7, ACEA E6, ACEA E5, or ACEA E4 engine oils are used. Consult your John Deere dealer for more information.

Other oils may be used if they meet one or more of the following:

- John Deere TORQ-GARD SUPREME™
- API Service Category CI-4 PLUS
- API Service Category CI-4
- API Service Category CH-4
- API Service Category CG-4
- API Service Category CF-4
- ACEA Oil Sequence E3
- ACEA Oil Sequence E2

If oils meeting API CG-4, API CF-4, or ACEA E2 are used, reduce the service interval by 50%.

Multi-viscosity diesel engine oils are preferred.

Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates. If diesel fuel with sulfur content greater than 0.50% (5000 ppm) is used, reduce the service interval by 50%. DO NOT use diesel fuel with sulfur content greater than 1.00% (10 000 ppm).

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DX,ENOIL –19–23NOV05–1/1

Extended Diesel Engine Oil Service Intervals

When John Deere PLUS-50™, ACEA E7, ACEA E6, ACEA E5, or ACEA E4 oils are used with specified John Deere filter, the service interval for engine oil and filter changes may be increased by 50% but not to exceed a maximum of 500 hours.

If John Deere PLUS-50, ACEA E7, ACEA E6, ACEA E5, or ACEA E4 oils are used with other than the specified John Deere filter, change the engine oil and filter at the normal service interval.

If John Deere TORQ-GARD SUPREME™, API CI-4 PLUS, API CI-4, API CH-4, or ACEA E3 oils are used, change the engine oil and filter at the normal service interval.

If API CG-4, API CF-4, or ACEA E2 oils are used, change the engine oil and filter at 50% of the normal service interval.

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DX,ENOIL6 –19–19DEC05–1/1

Diesel Engine Break-In Oil

New engines are filled at the factory with John Deere ENGINE BREAK-IN OIL. During the break-in period, add John Deere ENGINE BREAK-IN OIL as needed to maintain the specified oil level.

Change the oil and filter after the first 100 hours of operation of a new or rebuilt engine.

After engine overhaul, fill the engine with John Deere ENGINE BREAK-IN OIL.

If John Deere ENGINE BREAK-IN OIL is not available, use a diesel engine oil meeting one of the following during the first 100 hours of operation:

- API Service Classification CE
- API Service Classification CD
- API Service Classification CC
- ACEA Oil Sequence E2
- ACEA Oil Sequence E1

After the break-in period, use John Deere PLUS-50™ or other diesel engine oil as recommended in this manual.

IMPORTANT: Do not use PLUS-50 oil or engine oils meeting any of the following during the first 100 hours of operation of a new or rebuilt engine:

API CI-4 PLUS	**API CF**
API CI-4	**ACEA E7**
API CH-4	**ACEA E6**
API CG-4	**ACEA E5**
API CF-4	**ACEA E4**
API CF-2	**ACEA E3**

These oils will not allow the engine to break-in properly.

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DX,ENOIL4 –19–19DEC05–1/1

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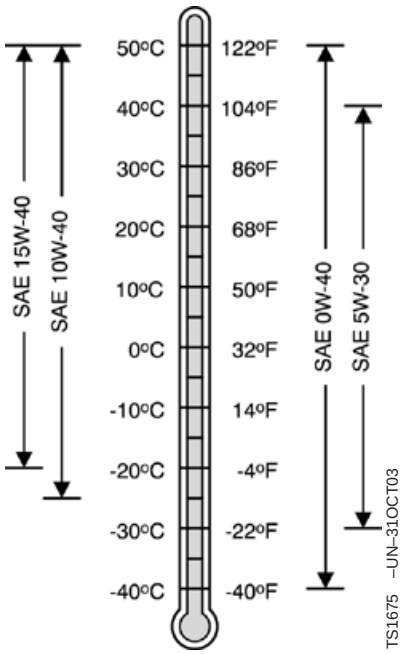
Diesel Engine Oil



Use oil viscosity base on the expected air temperature range during the period between oil changes.

John Deere PLUS-50™ oil is preferred.

Oil meeting one of the following specifications are also recommended:

- ACEA Oil Sequence E7
- ACEA Oil Sequence E6
- ACEA Oil Sequence E5
- ACEA Oil Sequence E4

Extended service intervals may apply when John Deere PLUS-50™, ACEA E7, ACEA E6, ACEA E5, or ACEA E4 engine oils are used. Consult your John Deere dealer for more information.

Other oils may be used if they meet one or more of the following:

- John Deere TORQ-GARD SUPREME™
- API Service Category CI-4 PLUS
- API Service Category CI-4
- API Service Category CH-4
- ACEA Oil Sequence E3

Multi-viscosity diesel engine oils are preferred.

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

DO NOT use diesel fuel with sulfur content greater than 1.0% (10 000 ppm).

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DX,ENOIL7 –19–23NOV05–1/1

Bio-Diesel Fuel

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

Bio-diesel fuels may be used ONLY if the bio-diesel fuel properties meet the latest edition of ASTM D6751, EN 14214, or equivalent specification.

It is recommended to purchase bio-diesel fuel blended with B100 from a BQ-9000 Accredited Producer or a BQ-9000 Certified Marketer as recommended by the National Bio-diesel Board.

The maximum allowable bio-diesel concentration is a 5% blend (also known as B5) in petroleum diesel fuel. It has been found that bio-diesel fuels may improve lubricity in concentrations up to this 5% blend.

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 oil becomes diluted with fuel, shorten oil change intervals accordingly.

IMPORTANT: Raw pressed vegetable oils are NOT acceptable for use as 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

Consult your fuel supplier for additives to improve storage and performance of bio-diesel fuels.

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Diesel Engine Coolant

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37°C (-34°F). If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

John Deere COOL-GARD™ Prediluted Coolant is preferred for service.

John Deere COOL-GARD Prediluted Coolant is available in a concentration of either 50% ethylene glycol or 55% propylene glycol.

Additional recommended coolants

The following engine coolant is also recommended:

- John Deere COOL-GARD Coolant Concentrate in a 40% to 60% mixture of concentrate with quality water.

John Deere COOL-GARD coolants do not require use of supplemental coolant additives, except for periodic replenishment of additives during the drain interval.

Other fully formulated coolants

Other fully formulated low silicate ethylene or propylene glycol base coolants for heavy-duty engines may be used if they meet one of the following specifications:

- ASTM D6210 prediluted (50%) coolant
- ASTM D6210 coolant concentrate in a 40% to 60% mixture of concentrate with quality water

Coolants meeting ASTM D6210 do not require use of supplemental coolant additives, except for periodic replenishment of additives during the drain interval.

Coolants requiring supplemental coolant additives

Other low silicate ethylene glycol base coolants for heavy-duty engines may also be used if they meet one of the following specifications:

- ASTM D4985 ethylene glycol base prediluted (50%) coolant
- ASTM D4985 ethylene glycol base coolant concentrate in a 40% to 60% mixture of concentrate with quality water

Coolants meeting ASTM D4985 require an initial charge of supplemental coolant additives, formulated for protection of heavy duty diesel engines against corrosion and cylinder liner erosion and pitting. They also require periodic replenishment of additives during the drain interval.

Other coolants

It is possible that neither John Deere COOL-GARD nor coolants meeting one of the coolant standards listed above is available in the geographical area where service is performed. If these coolants are unavailable, use a coolant concentrate or prediluted coolant with a quality additive package that provides cylinder liner cavitation protection and protects the cooling system metals (cast iron, aluminum alloys, and copper alloys such as brass) from corrosion.

The additive package must be part of one of the following coolant mixtures:

- ethylene glycol or propylene glycol base prediluted (40% to 60%) coolant
- ethylene glycol or propylene glycol base coolant concentrate in a 40% to 60% mixture of concentrate with quality water

Water quality

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Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol and propylene glycol base engine coolant concentrate.

IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.

IMPORTANT: Do not mix ethylene glycol and propylene glycol base coolants.

DX,COOL3 –19–27OCT05–2/2

Section 02
Repair and Adjustments

Contents

Fuel System - General Information

The Level 14 Engine Control Unit (ECU) is used control the High Pressure Common Rail (HPCR) fuel system. The HPCR fuel system includes the high pressure fuel pump, high pressure common rail, and electronic injectors.

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

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

When servicing injectors it is important to complete the injector calibration procedure. Each injector has a specific calibration and this information can be obtained by scanning the bar code on the service injector box and downloading the injector information from the John Deere Custom Performance™ web site. An alternative is to enter the injector serial number, part number, and QR code listed on the injector. If the ECU is not programmed with the correct information for each injector and the correct cylinder that it is in then engine performance and emissions will be affected.

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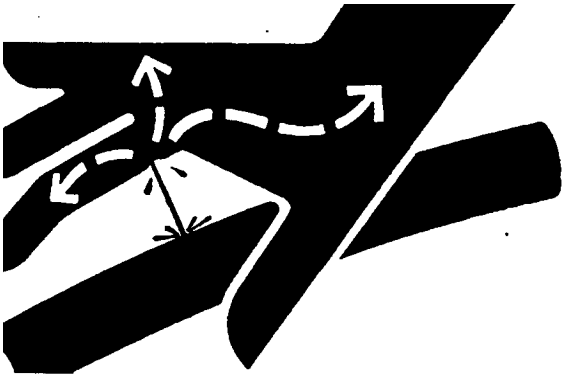
Relieve Fuel System Pressure

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

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



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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 Section 04, Group 150 in this manual.

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Remove and Install Fuel Filters

NOTE: Both primary and secondary filters must be replaced at the same time.

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Remove and Install Primary Fuel Filter Element

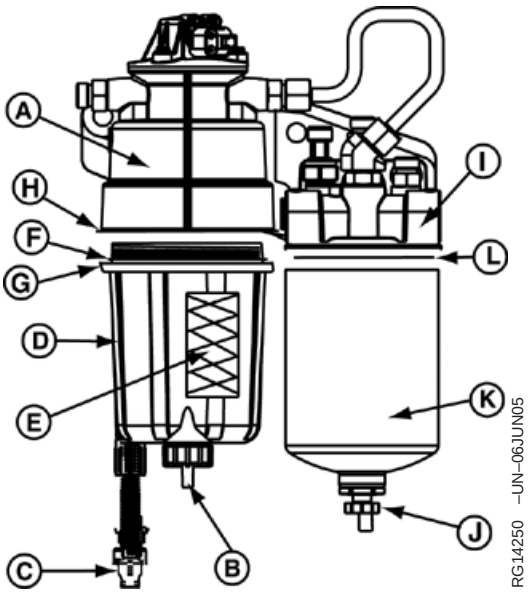
NOTE: For applications other than OEM, refer to operator's manual for proper servicing, hourly replacement intervals, and filter locations.

NOTE: Do not pre-fill filter with fuel. This may introduce debris into the fuel system.

1. Thoroughly clean filter header (A) and surrounding area to keep from getting dirt and debris into fuel system.
2. Connect a fuel drain line to filter drain valve (B) on bottom of filter and drain all fuel from the filter canister (D).
3. Disconnect water-in-fuel sensor connector (C).
4. Turn filter canister (D) counter-clockwise (CCW) to remove.
5. Once filter canister is removed, pull filter element (E) down to remove from filter header (A).
6. Inspect filter header and filter canister sealing surfaces. Clean as required.
7. Place new packing on filter canister).
8. Place thin film of fuel on filter packing.
9. Place filter element in canister with tangs on bottom going into canister.
10. Screw canister into filter header and turn clockwise (CW). Tighten until canister lip (G) just mates with header lip (H), then tighen to specification:

Specification	
Primary Fuel Filter Canister to Filter Header—Torque	14 Nm (120 lb-in)

11. Connect water-in-fuel sensor connector.



Primary and Secondary Filter Parts Kit

A—Primary Filter Header
B—Primary Filter Canister Drain Valve
C—Water In Fuel Sensor Connector
D—Primary Filter Canister
E—Primary Filter Element
F—Primary Filter Packing
G—Primary Filter Canister Lip
H—Primary Filter Header Lip
I—Secondary Fuel Filter Header
J—Secondary Filter Drain Valve
K—Secondary Fuel Filter
L—Secondary Filter Packing

Continued on next page

Remove and Install Secondary (Final) Fuel Filter

NOTE: For applications other than OEM, refer to operator's manual for proper servicing, hourly replacement intervals, and filter locations.

NOTE: Do not pre-fill filter with fuel. This may introduce debris into the fuel system.

NOTE: Filter replacement instructions are printed on the new filter.

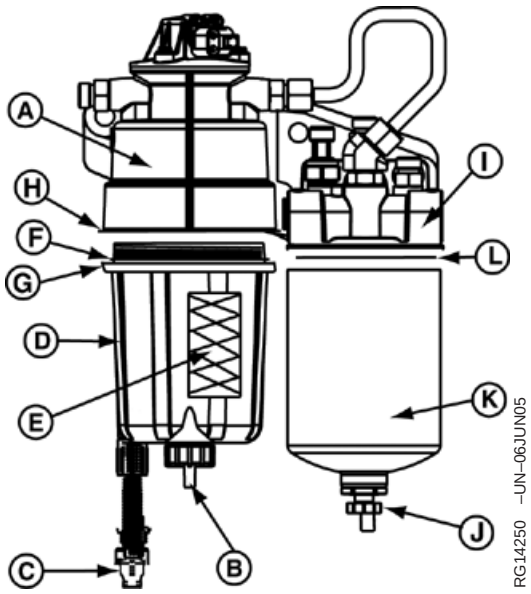
1. Thoroughly clean filter header (I) and surrounding area to keep from getting dirt and debris into fuel system.
2. Connect a fuel drain line to filter drain valve (J) on bottom of filter and drain all fuel from the filter.
3. Turn filter (K) counter clockwise (CCW) to remove.
4. Inspect filter header sealing surface. Clean as required.
5. Install new filter fuel drain valve and tighten to specification.

Specification

Secondary Fuel Filter Drain Valve—Torque ..... 3.4 - 4 Nm (30 - 35 lb-in)

6. Place new filter packing (L) on filter.
7. Place thin film of fuel on packing.
8. Screw fuel filter into fuel filer header, turning clockwise (CW). Tighten until fuel filter snugly mates with fuel filter header (I).
9. Turn filter 1/2 to 3/4 turn further (CW).

NOTE: To prime the fuel system before starting engine, turn ignition key to ON for 60 seconds.



Primary and Secondary Filter Parts Kit

A—Primary Filter Header
B—Primary Filter Canister Drain Valve
C—Water In Fuel Sensor Connector
D—Primary Filter Canister
E—Primary Filter Element
F—Primary Filter Packing
G—Primary Filter Canister Lip
H—Primary Filter Header Lip
I—Secondary Fuel Filter Header
J—Secondary Filter Drain Valve
K—Secondary Fuel Filter
L—Secondary Filter Packing

RG41183,0000102 –19–12SEP05–2/2

Remove and Install Fuel Transfer Pump Assembly

NOTE: For applications other than OEM, refer to vehicle manual for transfer pump information.

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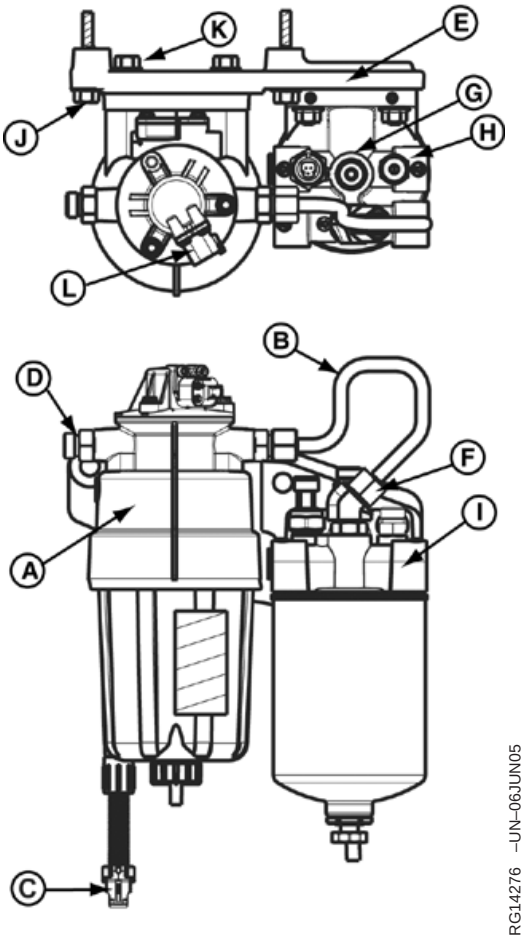
IMPORTANT: ALWAYS use a backup wrench when removing and/or installing fittings and/or fuel lines to avoid damage.

Remove Fuel Transfer Pump Assembly

1. Disconnect fuel lines from (B), (D), (F), (G) and (H). Cap connections on fuel lines to keep debris out of fuel system.
2. Disconnect fuel transfer pump connector (L).
3. Disconnect water in fuel sensor connector (C)
4. Remove filter assembly bracket cap screws (J) and remove filter assembly bracket (E) from engine.
5. Remove transfer pump header cap screws (K) from back of fuel filter assembly bracket. Remove transfer pump header (A) from fuel filter assembly bracket.



Filter Assembly

A—Primary Filter/Fuel Transfer Pump Header
B—Primary Fuel Filter Outlet
C—Water In Fuel Sensor Connector
D—Primary Fuel Filter Inlet
E—Filter Assembly Bracket
F—Secondary Fuel Filter Inlet
G—Air Bleed Valve
H—Secondary Filter Outlet
I—Secondary Filter Header
J—Filter Assembly Bracket Cap Screws
K—Fuel Transfer Pump Header Cap Screws
L—Fuel Transfer Pump Connector

Continued on next page

Install Fuel Transfer Pump Assembly

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

1. Place transfer pump header (A) on fuel filter assembly bracket (E). Install fuel transfer pump header cap screws (K) and tighten to specification.

Specification

Fuel Transfer Pump Cap Screws—Torque ..... 35 ± 7 Nm (26 ± 5 lb-ft)

2. Install the fuel filter assembly bracket to cylinder block. Tighten filter assembly bracket cap screws (J) to specification.

Specification

Filter Assembly Bracket Cap Screws—Torque ..... 68 ± 13 Nm (50 ± 10 lb-ft)

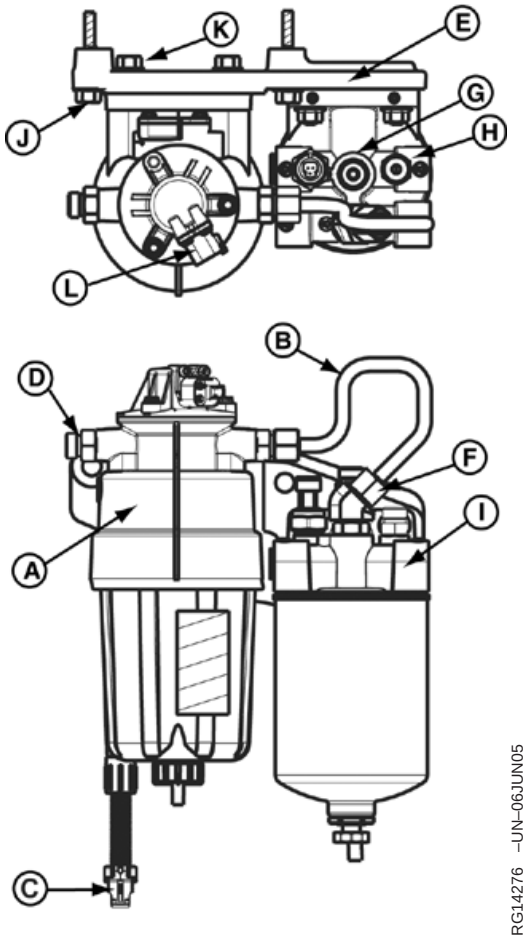
3. Connect fuel lines to fuel transfer pump inlet (D), outlet (B), secondary filter inlet (F), air bleed valve (G), and secondary fuel outlet (H) and tighten to specification.

Specification

Fuel Line Fittings—Torque ..... 20 ± 4 Nm (15 ± 3 lb-ft)

4. Reconnect fuel transfer pump connector (L) and water in fuel connector (C).

NOTE: Turn ignition key to ON for 60 seconds to prime the fuel system before starting enine.



Filter Assembly

A—Primary Filter/Fuel Transfer Pump Header
B—Primary Fuel Filter Inlet
C—Water In Fuel Sensor Connector
D—Primary Fuel Filter Outlet
E—Filter Assembly Bracket
F—Secondary Fuel Filter Inlet
G—Air Bleed Valve
H—Secondary Filter Outlet
I—Secondary Filter Header
J—Filter Assembly Bracket Cap Screws
K—Fuel Transfer Pump Header Cap Screws
L—Fuel Transfer Pump Connector

RG41183,0000103 –19–22SEP05–2/2

Remove and Install High Pressure Fuel Pump Assembly

Remove High Pressure Fuel Pump

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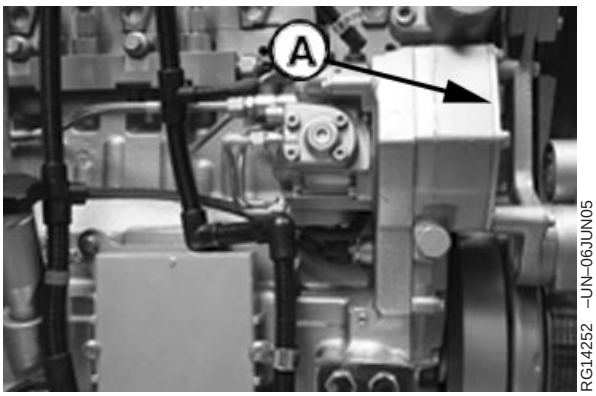
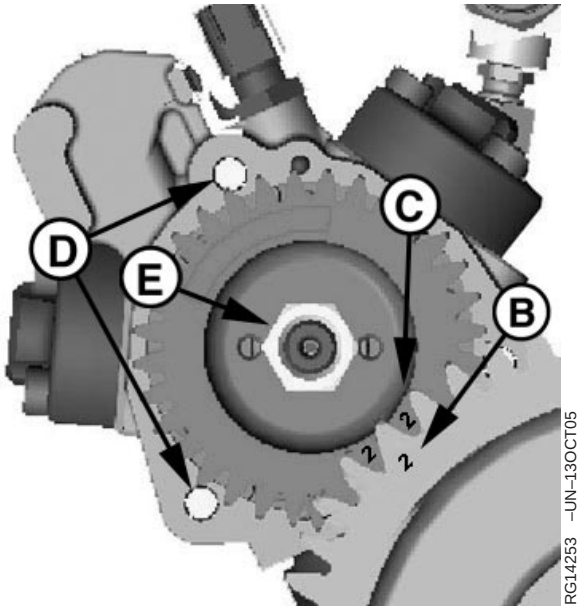
NOTE: For applications other than OEM, refer to vehicle manual for high pressure pump information.

1. Remove cover (A) for access to injection pump gear.
2. Remove plugs in engine block and install JDG820 Flywheel Turning Tool. Rotate engine flywheel in normal running direction until No. 1 piston is at “TDC” of its compression stroke.
3. Install JDE81-4 Timing Pin into hole in flywheel.
4. Verify that timing marks (B and C) on the pump gear and cam gear are positioned as shown in the drawing.

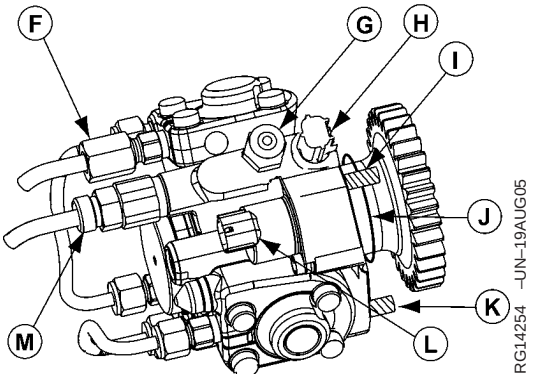
A—Gear Housing Cover
B—Cam Gear Timing Mark
C—High Pressure Pump Gear Timing Mark
D—High Pressure Pump Mounting Holes
E—High Pressure Pump Gear Nut
F—Fuel Outlet Line
G—Overflow Port
H—Fuel Temperature Sensor Connector
I—Mounting Socket Screw
J—O-ring
K—Mounting Cap Screw (2)
L—PCV Power Connector
M—Fuel Inlet Line



Timing Gear Housing Cover



Gears and Timing Marks



High Pressure Fuel Pump Components

Continued on next page

IMPORTANT: If timing marks are not correctly positioned, engine may be at No. 6 "TDC-Compression." Rotate engine one full revolution in running direction until JDE81-4 Timing Pin engages in flywheel again.

CAUTION: Let the engine sit for 5 minutes to allow rail pressure to lower.

CAUTION: Open high pressure fuel lines slowly to insure the pressure has been relieved. High pressure fuel is dangerous.

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

5. Remove fuel lines (F), (M), and (G). Cap all fuel lines to keep debris out of fuel system.

6. Disconnect PCV power connector (L) and fuel temperature connector (H).

IMPORTANT: Before the pump gear can be removed, the pump mounting screws must be loosened. The Gear Removal Tool will push the pump shaft out of the gear.

7. Loosen top pump mounting socket screw (I).

8. Using JDG10025, loosen pump mounting cap screws (K).

Continued on next page

9. Remove pump gear nut (E).

10. Using JDG10015, push the pump shaft out of the pump gear. Make sure the pump mounting screws are sufficiently loosened to allow the pump to be moved away from the mounting holes.

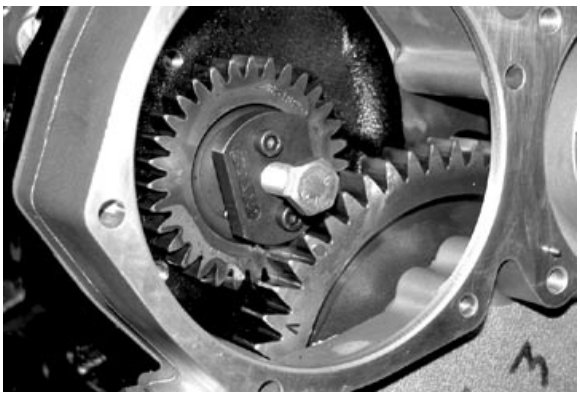
11. Remove pump gear and removal tool from gear housing.

12. Using JDG10025, remove top pump mounting socket screw (I).

13. Remove pump mounting cap screws (K).

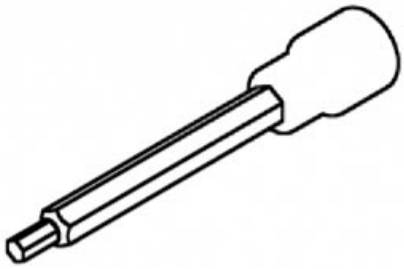
14. Remove pump from engine.

15. If waiting on receipt of pump, replace gear housing cover (A).



RG14256 –UN–06JUN05

Pump Gear Removal Tool "JDG10015"



RG14255 –UN–06JUN05

Pump Socket Screw Installation/Removal Tool "JDG10025"

Continued on next page

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Install High Pressure Fuel Pump

1. Engine is at No.1 “TDC-Compression” per pump Removal procedure.
2. Remove pump gear cover (A).
3. Put pump gear into position behind cam gear with timing marks on cam gear and pump gear positioned as shown.

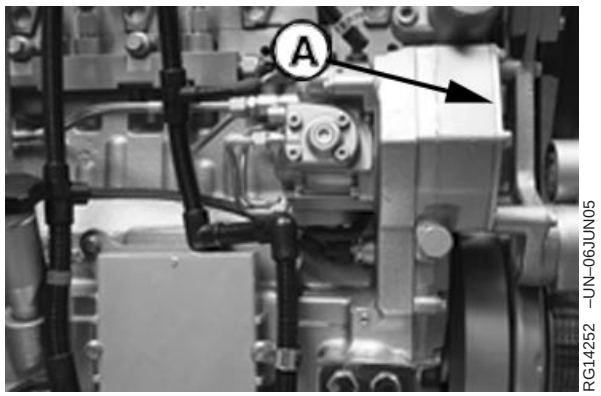
NOTE: Pump gear timing mark is only on one side and must face engine gear train.

4. Place new o-ring (J) on pump and lubricate with JDT 308 (liquid oil coconut soap).
5. Install pump into block, aligning key on pump shaft with slot on pump gear.

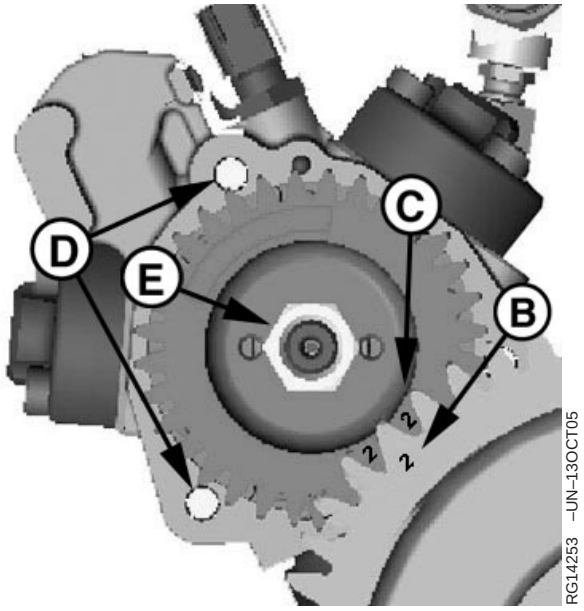
NOTE: While installing pump, make sure that the timing marks on the cam and pump gear remain positioned as shown in the drawing.

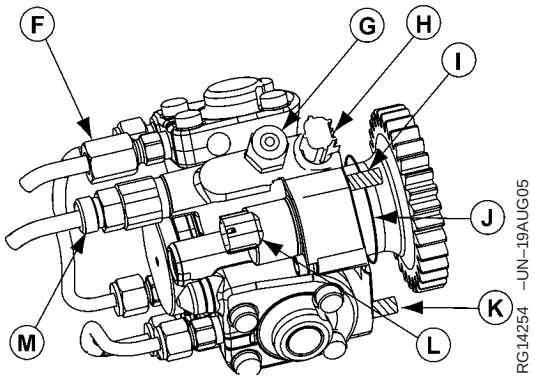
6. Apply PM37418 (medium-strength thread lock/sealant) to pump mounting screws.
7. Loosely install top pump mounting socket screw (I).
8. Loosely install pump cap screws (K).
9. Apply PM37418 (medium-strength thread lock/sealant) to pump shaft threads.
10. Install nut (E) onto pump shaft and tighten to specification.

A—Gear Housing Cover
B—Cam Gear Timing Mark
C—High Pressure Pump Gear Timing Mark
D—High Pressure Pump Mounting Holes
E—High Pressure Pump Gear Nut
F—Fuel Outlet Line
G—Fuel Overflow Port
H—Fuel Temperature Sensor Connector
I—Mounting Socket Screw
J—O-ring
K—Mounting Cap Screw (2)
L—PCV Power Connector
M—Fuel Inlet Line



Timing Gear Housing Cover





High Pressure Fuel Pump Components

Continued on next page

Specification

Pump Gear Nut—Torque ..... 64 ± 5 Nm (47 ± 4 lb-ft)

11. Tighten pump cap screws (K).

Specification

Pump Mounting Screws—Torque ..... 35 ± 7 Nm (26 ± 5 lb-ft)

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

12. Connect fuel supply line (M) and tighten to specification.

Specification

Fuel Supply Line—Torque..... 24 ± 5 Nm (18 ± 4 lb-ft)

13. Connect high pressure fuel line (F) and tighten to specification.

Specification

High Pressure Fuel Line—Torque..... 40 ± 4 Nm (32 ± 3 lb-ft)

14. Install leak-off line to the overflow port (G). Tighten to specification.

Specification

Fuel Leak-Off Line—Torque..... 12 ± 2 Nm (9 ± 1 lb-ft)

15. Install gear housing cover with new gasket.

Specification

Pump Gear Housing Cover—
Torque ..... 31 Nm (23 lb-ft)

16. Remove JDG820 Flywheel Turning Tool and JDE81-4 Timing Pin. Install plugs back into engine block.

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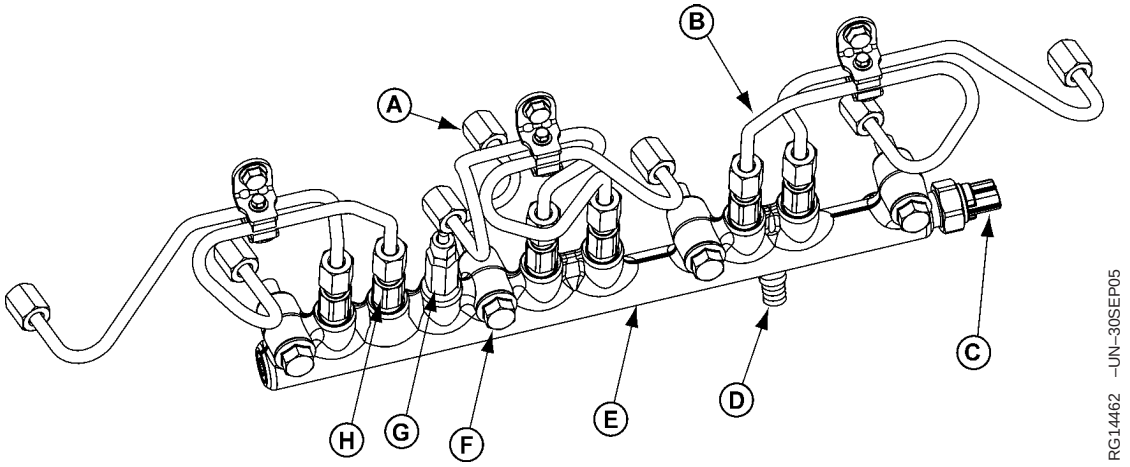
Remove and Install High Pressure Common Rail



High Pressure Common Rail (HPCR)

A—HPCR Leak-off Line Fitting
B—Injector Delivery Line Fitting (6)
C—Fuel Pressure Sensor
D—HPCR Fuel Inlet Line Fitting
E—High Pressure Common Rail (HPCR)
F—Cap Screw (4)
G—Pressure Limiter
H—Flow Damper (6)

Remove High Pressure Common Rail

CAUTION: Let the engine sit for 5 minutes to allow rail pressure to lower.

CAUTION: Open first line slowly to insure the pressure has been relieved. High pressure fuel is dangerous.

1. Disconnect fuel pressure sensor (C) connector.
2. If necessary, remove the pressure sensor. See REMOVE AND INSTALL FUEL RAIL PRESSURE SENSOR in Group 110 of this Section. Plug the opening.
3. Disconnect leak-off line fitting (A) from the pressure limiter (G).
4. Disconnect fuel inlet line fitting (D) and loosen high pressure pump outlet line fitting.
5. Disconnect the fuel lines from the flow dampers.

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

a. Using a backup wrench on the inlet connector flats, loosen the fuel line fittings from the inlet connectors. The lines do not need to be removed.

IMPORTANT: While removing the fuel line fitting, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.

b. Using a backup wrench on flow dampers, remove the fittings that connect the fuel lines to the flow dampers.

c. Remove the fuel line clamp screws and discard. Retain the isolators in a protected location.

Continued on next page

IMPORTANT: Inspect the clamp isolators. If cracked or otherwise damaged, replace them or damage to the fuel lines will result.

IMPORTANT: Always use a new clamp screw. The screw threads are deformed when turned into the clamp's lock nut and should not be reused.

d. Swing the fuel lines out of the way.

IMPORTANT: Immediately plug or cover fuel lines to prevent dirt from entering the fuel system.

6. If necessary, remove the flow dampers. See REMOVE AND INSTALL FLOW DAMPERS in this Group.

7. If necessary, remove the pressure limiter. See REMOVE AND INSTALL PRESSURE LIMITER in this Group.

8. Remove HPCR cap screws (F) and slide HPCR down and out to remove.

Install High Pressure Common Rail (HPCR)

1. Install HPCR (E) and tighten cap screws (F) to specification.

Specification

High Pressure Common Rail
Capscrews—Torque ..... 70 ± 14 N•m (52 ± 10 lb-ft)

2. If removed, install flow dampers according to REMOVE AND INSTALL FLOW DAMPERS in this Group.

3. If removed, install pressure limiter according to REMOVE AND INSTALL PRESSURE LIMITER in this Group.

4. Connect leak off line (A) and tighten to specification.

Specification

High Pressure Common Rail
Leak-off Line Fittings—Torque ..... 15 ± 3 N•m (11 ± 2 lb-ft)

5. Install the fuel inlet line (D) to the HPCR and fuel pump.

Specification

Fuel Inlet Line Fittings—Torque ..... 40 ± 4 Nm (30 ± 3 lb-ft)

6. Install and finger-start fuel lines to inlet connectors and flow dampers.

7. Assemble the fuel line clamps and clamp isolators with a new clamp screws to the fuel lines.

IMPORTANT: Inspect the clamp isolators. If cracked or otherwise damaged, replace them or damage to the fuel lines will result.

IMPORTANT: Always use a new clamp screw. The screw threads are deformed when turned into the clamp's lock nut and should not be reused.

8. Tighten the fuel line clamp screws to specification.

Specification

Fuel Line Clamp Screw—
Torque..... 8.5 Nm (75 lb-in or 6 lb-ft)

IMPORTANT: While tightening the fuel delivery line fitting, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.

9. Using a backup wrench, tighten the fuel line fittings to the inlet connectors and to the flow dampers.

Specification

Fuel Line Fittings—Torque ..... 40 ± 4 Nm (30 ± 3 lb-ft)

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10. If removed, install the pressure sensor. See REMOVE AND INSTALL FUEL RAIL PRESSURE SENSOR in Group 110 of this Section.

11. Connect fuel pressure sensor (C) connector.

RG41183,0000105 –19–26OCT05–3/3

Remove and Install Flow Dampers

Remove Flow Dampers

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

1. Before removing flow damper, turn engine OFF and let sit for 5 minutes. This will relieve fuel pressure from the high pressure common rail.

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

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

3. Disconnect the fuel line attached to the damper to be removed.

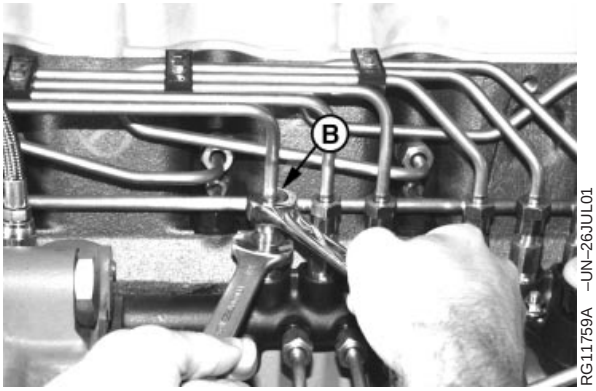
IMPORTANT: Do not bend or force lines out of the way.

   a. Using a wrench on the inlet connector flats, loosen the fuel line fitting from the inlet connector. The line does not need to be removed.

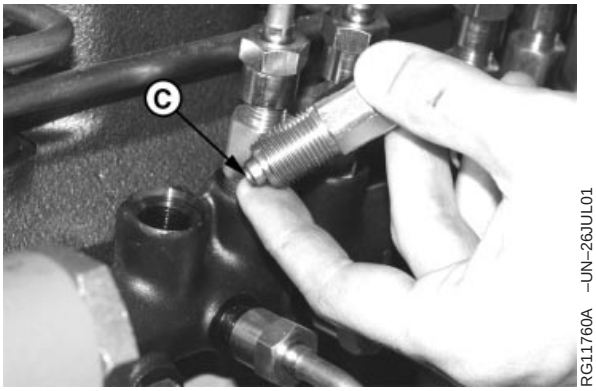
IMPORTANT: While removing the fuel line fitting, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.

   b. Using a backup wrench on flow damper, remove the fitting that connects the fuel line to the flow damper.

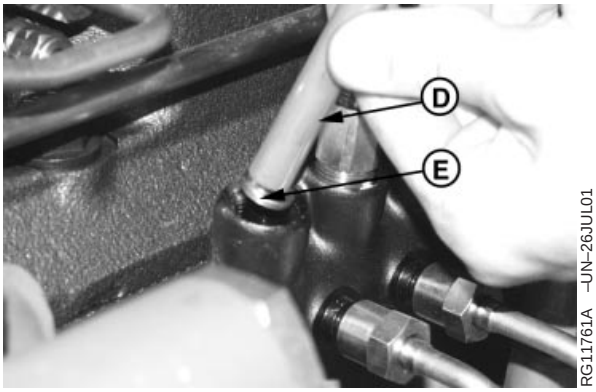
   c. Remove the fuel line clamp screw and discard. Retain the isolators in a protected location.



Removing Fuel Line Fitting (Typical)



Keeping Flow Damper Internal Components Together (Typical)



Removing Orifice Plate (Typical)

B—Fuel Line Fitting
C—Internal Components
D—Magnet
E—Orifice Plate

Continued on next page

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IMPORTANT: Inspect the clamp isolators. If cracked or otherwise damaged, replace them or damage to the fuel lines will result.

IMPORTANT: Always use a new clamp screw. The screw threads are deformed when turned into the clamp's lock nut and should not be reused.

d. Swing the fuel line out of the way.

IMPORTANT: Immediately plug or cover fuel lines to prevent dirt from entering the fuel system.

4. Remove flow damper, keeping internal components (C) together.

IMPORTANT: Make sure magnet is clean before using.

5. Using a magnet (D), remove orifice plate (E) from inside flow damper bore on high pressure common rail.

6. Replace complete flow damper as an assembly.

Continued on next page

Install Flow Dampers

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

Specification

Flow Damper—Torque ..... 176 Nm (130 lb-ft)

3. Install and finger-start fuel line to inlet connector and flow damper.
4. Assemble the fuel line clamp and clamp isolators with a new clamp screw to the fuel line.

IMPORTANT: Inspect the clamp isolators. If cracked or otherwise damaged, replace them or damage to the fuel lines will result.

IMPORTANT: Always use a new clamp screw. The screw threads are deformed when turned into the clamp's lock nut and should not be reused.

5. Tighten the fuel line clamp screw to specification.

Specification

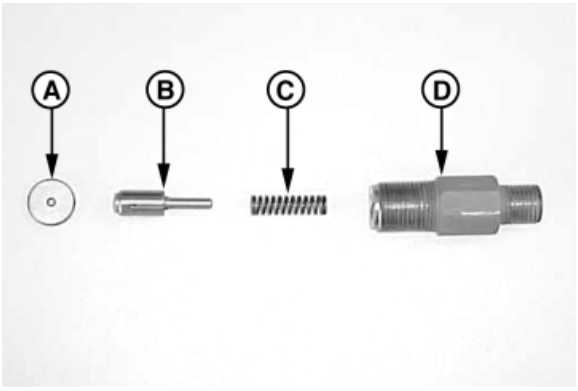
Fuel Line Clamp Screw—Torque ..... 8.5 Nm (75 lb-in or 6 lb-ft)

IMPORTANT: While tightening the fuel delivery line fitting, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.

6. Tighten the fuel line fittings to the inlet connector and to the flow damper.

Specification

Fuel Line Fittings—Torque ..... 40 ± 4 Nm (30 ± 3 lb-ft)



Flow Damper Exploded View

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

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Remove and Install Pressure Limiter

Remove Pressure Limiter

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

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

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

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

3. Disconnect HPCR leak-off line fitting (C) from pressure limiter (B) using a backup wrench on the pressure limiter.

IMPORTANT: Clean magnet prior to removing pressure limiter.

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

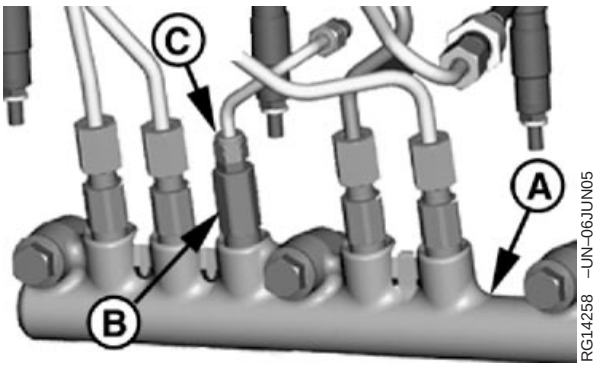
5. Remove seal and replace with new seal. Do not reuse seals.

Install Pressure Limiter

1. Install pressure limiter into HPCR. Tighten to specification.

Specification	
Pressure Limiter—Torque	176.5 Nm (130 lb-ft)

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



High Pressure Common Rail (HPCR)

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

Continued on next page

Specification	
High Pressure Common Rail	
Leak-off Line Fitting—Torque	15 ± 3 Nm (12 ± 2 lb-ft)

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Remove and Install Leak-off Lines

There are three leak-off lines. They are located between the:

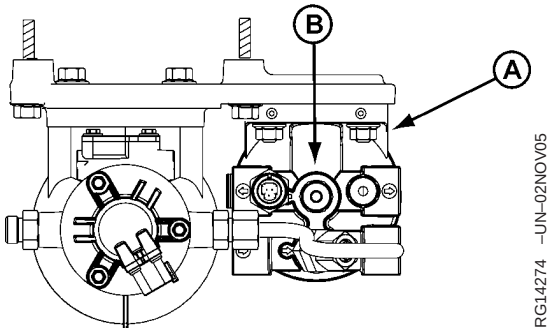
- Secondary filter and tee fitting on cylinder head, rear end
- High pressure fuel pump and tee fitting on cylinder head, front end
- High pressure common rail and cylinder head

The return-to-tank line will be connected to one of the two tee fittings on the cylinder head, depending on the application.

WL30140,000003F –19–02NOV05–1/5

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

IMPORTANT: Immediately plug or cover ports to prevent dirt from entering the fuel system. If any dirt, paint chips, or debris enters the fuel system, component failure will occur!



Fuel Filter Assembly, Top View

A—Secondary Filter Head
B—Secondary Fuel Filter Air Leak-Off Port

Remove Filter Leak-off Line

1. Disconnect leak off line from the air bleed/check valve located on the secondary filter head (A).
2. Disconnect leak-off line from the tee fitting on the cylinder head.

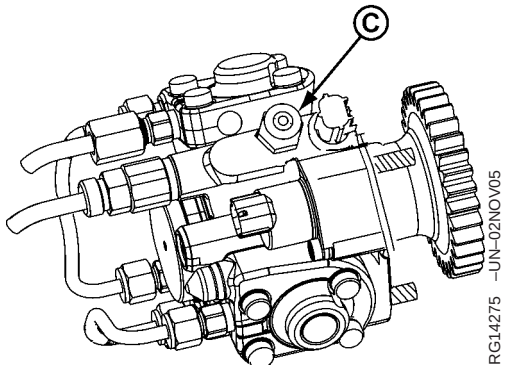
Continued on next page

WL30140,000003F –19–02NOV05–2/5

Remove HP Fuel Pump Fuel Leak-Off Line

1. Disconnect the leak-off line from the leak-off port (C) on high pressure pump.
2. Disconnect the leak-off line from the tee fitting on the cylinder head.

C—HP Fuel Pump Fuel Leak-Off Port



High Pressure Fuel Pump

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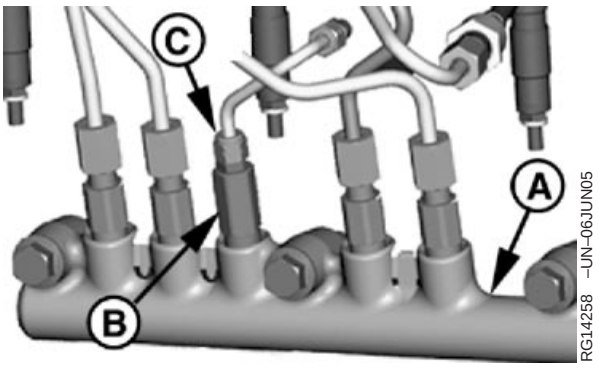
WL30140,000003F –19–02NOV05–3/5

Remove Common Rail Leak-Off Line

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

1. By letting the engine sit for at least 5 minutes, fuel pressure in the HPCR (A) will be relieved.
2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure limiter.
3. Disconnect the leak-off line (C) from the pressure limiter (B).
4. Disconnect the leak-off line from the fitting in the cylinder head.



High Pressure Common Rail

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

Install Filter Leak-off Line

1. Install leak-off line to the tee fitting on the cylinder head.
2. Install leak-off line to the air bleed/check valve located on the secondary filter head (A).
3. Tighten leak-off line fittings to specification.

Specification	
Secondary Filter Leak-Off Line—	
Torque	24 ± 5 Nm (18 ± 4 lb-ft)

4. tighten to specification.

Install HP Fuel Pump Fuel Leak-Off Line

1. Install leak-off line to the tee fitting on the cylinder head.
2. Install leak-off line to the high pressure pump leak-off port.
3. Tighten fittings to specification.

Specification	
Fuel Pump Leak-Off Line—	
Torque	12 ± 2 Nm (9 ± 1 lb-ft)

Continued on next page

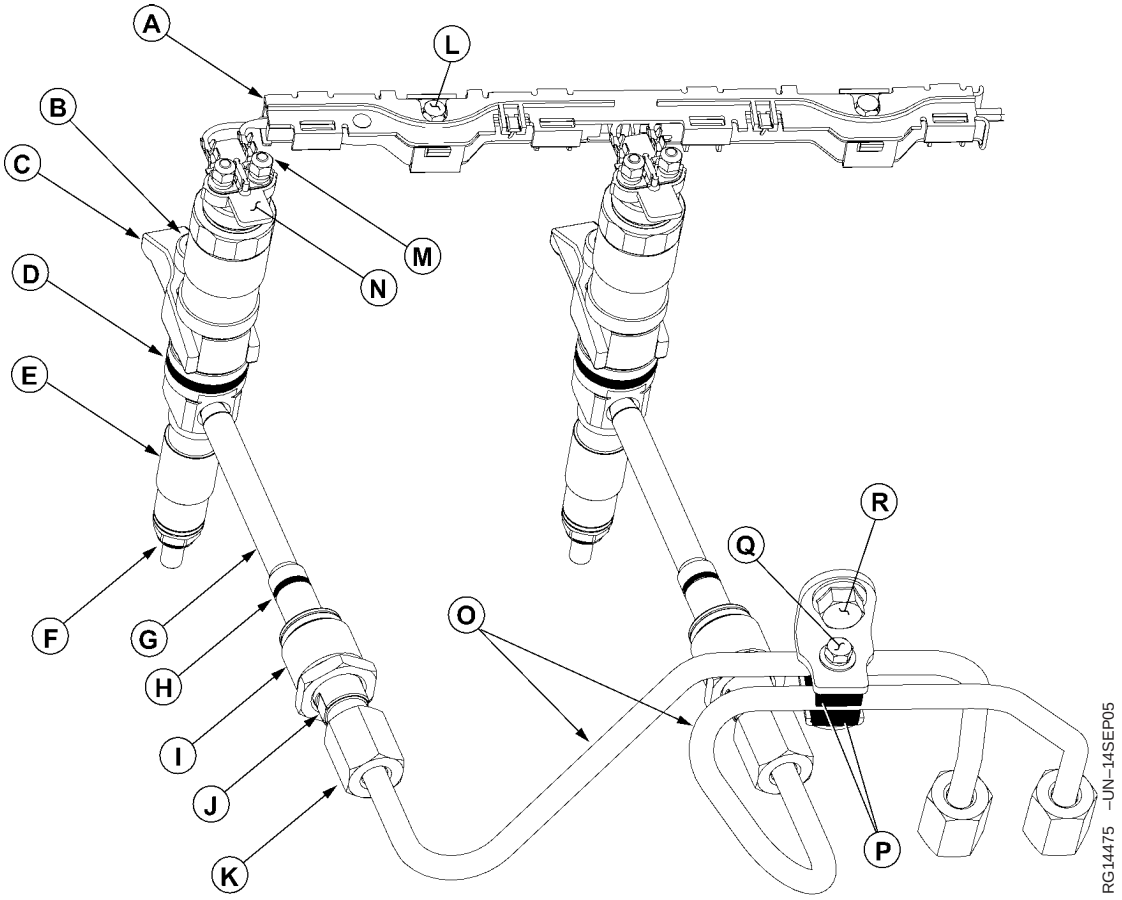
Install Common Rail Leak-Off Line

1. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure limiter.
2. Connect the leak-off line to the pressure limiter.
3. Connect the leak-off line to the fitting in the cylinder head.
4. Tighten fittings to specification.

Specification	
Common Rail Leak-Off Line—	
Torque	15 ± 3 Nm (12 ± 2 lb-ft)

WL30140,000003F –19–02NOV05–5/5

Remove and Install Electronic Injectors (EIs)



A—Injector Wiring Harness Carrier
B—Injector Clamp Screw
C—Injector Clamp
D—O-ring
E—Electronic Injector
F—Combustion Sealing Washer
G—Inlet Connector
H—Inlet Connector O-ring
I—Inlet Connector Nut
J—Lands on Connector Nut
K—Fuel Delivery Line Nut
L—Harness Carrier Screw
M—Terminal Nut
N—QR Code
O—Fuel Delivery Line Set
P—Isolators
Q—Line Clamp Screw
R—Line Clamp-to-Intake Manifold Screw

Remove Injectors

1. Remove rocker arm cover with vent tube. Disconnect engine wiring harness connectors as necessary.

NOTE: Some applications may require removal of the turbocharger. The turbo actuator assembly may be blocking some screws. Refer to Remove Turbocharger in Section 2 Group 80 of CTM 400.

2. Disconnect the main injector harness connector.

NOTE: There are three delivery line sets, each set comprised of two fuel lines sharing a fuel line clamp.

3. Remove the clamp-to-intake manifold screw (R) of the fuel delivery line set (O) of the injector(s) to be removed.

4. Remove the fuel line nuts (K) of the fuel delivery line set of the injector(s) to be removed.

   a. Using a wrench on the inlet connector flats (J), remove the fuel line nut.

Continued on next page

IMPORTANT: While removing the fuel line nut, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.

b. Loosen or remove the nuts that connect the same fuel lines to the flow dampers.

c. Remove the clamp screw (Q) and discard. Retain the isolators (P) in a protected location.

IMPORTANT: Inspect the clamp isolators. If cracked or otherwise damaged, replace them or damage to the fuel lines will result.

IMPORTANT: Always use a new clamp screw. The screw threads are deformed when turned into the clamp's lock nut and should not be reused.

d. Swing the fuel lines away from the inlet connectors or remove the fuel lines.

IMPORTANT: Immediately plug or cover fuel lines to prevent dirt from entering the fuel system.

5. To ensure that injectors are replaced into the cylinders from which they are to be removed, record the part number or QR code (N) of each injector to be removed and note in which cylinder each injector to be removed is located. If only one injector is to be removed, this step may be disregarded.

6. Remove inlet connector nut (I), using a wrench on the flats of the inlet connector to keep the inlet connector from rotating. Use a thin-profile wrench on the connector nut. Remove inlet connector (G) and discard.

IMPORTANT: While removing the inlet connector nut, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.

IMPORTANT: Inlet connector and o-ring must be replaced whenever the inlet connector nut is loosened. The tip of the connector is comparatively soft and form-fits into the injector. Once deformed, the connector will not re-seal properly.

IMPORTANT: To provide better access and to prevent damage to the wiring harness carrier assembly that might be caused by removing injector(s), the harness carrier assembly should be removed.

7. Loosen terminal nuts (M) of all the injectors.

8. Remove the wire harness carrier screws (L).

9. Lift out the wire harness carrier. Retain the spacers.

10. Remove screw from injector clamp (C) and remove clamp.

11. At this point, the intake manifold may be removed. See REMOVE, INSPECT, AND INSTALL INTAKE MANIFOLD in Section 2, Group 80 of the 9.0L Base Engine manual (CTM 400).

12. Hand-pull injector from the cylinder head.

IMPORTANT: When removing an injector, do not twist the top of the injector. This will cause the calibration to be changed.

Immediately cover injector bore to prevent dirt from entering the fuel system.

Store injector in a clean location.

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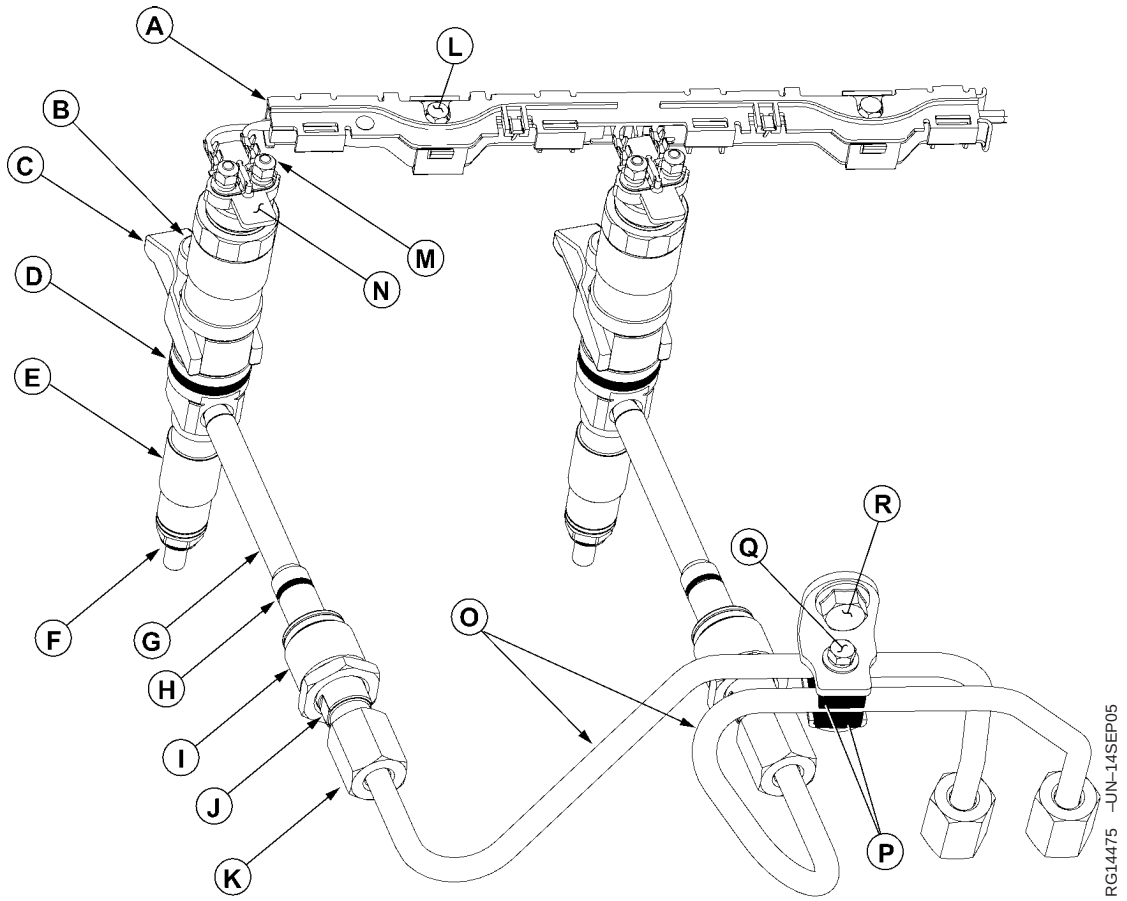

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O—Fuel Delivery Line Set
P—Isolators
Q—Line Clamp Screw
R—Line Clamp-to-Intake Manifold Screw

Install Injectors

1. See CLEAN INJECTOR BORE later in this section.
2. See CLEAN INJECTOR later in this section.
3. See INSPECT INJECTOR later in this section.
4. If removed, install the intake manifold. See REMOVE, INSPECT, AND INSTALL INTAKE MANIFOLD in Section 2, Group 80 of the 9.0L Base Engine manual (CTM 400).
5. Make sure the o-ring (D) and combustion sealing washer (F) are installed on injector.

IMPORTANT: Use a new sealing washer any time that an injector is to be installed.

6. Lubricate o-ring with AMOGELL 51455 (or equivalent) petroleum grease and put a small amount of grease on sealing washer to hold it in place.
7. If installing a new injector, record the injector QR code or part number information and the cylinder in which the injector is being installed. If reinstalling injectors, make sure they are placed in the same cylinder from which they were removed.

Continued on next page

8. Position injector clamp (C) with clamp screw (B) on injector, then install injector in cylinder head.

IMPORTANT: Make sure that you have the fuel feed hole on the side of the injector positioned toward the inlet connector.

IMPORTANT: When installing the injector, do not twist the top of the injector. This will cause the calibration to be changed.

9. Tighten injector clamp screw to about 5 Nm (4 lb-ft), then loosen slightly.

IMPORTANT: Inlet connector and o-ring must be replaced whenever the inlet connector nut is loosened. The tip of the connector is comparatively soft and form-fits into the injector. Once deformed, the connector will not re-seal properly.

10. Place o-ring (H) on inlet connector.

11. Lubricate o-ring with AMOGELL 51455 (or equivalent) petroleum grease and insert inlet connector into cylinder head until seated on injector.

IMPORTANT: While tightening the inlet connector nut, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.

12. Install inlet connector nut (I). To prevent connector rotation, hold inlet connector on flats with a wrench. Use a thin-profile wrench on the connector nut. Tighten inlet connector nut to specification.

Specification

Inlet Connector Nut—Torque..... 65 ± 5 Nm (48 ± 4 lb-ft)

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090
25

13. Tighten injector clamp screw to specification.

Specification

Injector Clamp Screw—Torque ..... 47 ± 5 Nm (35 ± 4 lb-ft)

14. Install the wire harness carrier assembly with spacers onto the intake manifold.

Specification

Harness Carrier Screw—
Torque..... 20 ± 4 Nm (15 ± 3 lb-ft)

15. Start the harness screw(s) (L) and tighten to specification.

Specification

Harness Carrier Screw—
Torque..... 20 ± 4 Nm (15 ± 3 lb-ft)

16. Tighten injector terminal nuts (M) to specification.

Specification

Injector Terminal Nut—Torque ..... 2.25 ± 0.5 Nm (27 ± 6 lb-in)

17. Loosely install the line clamp to the intake manifold using clamp-to-intake manifold screw (R).

18. Install and finger-start the fuel lines to inlet connectors and flow dampers.

19. Assemble the clamp isolators (P) and the fuel delivery line set (O) to the line clamp with a new clamp screw (Q).

Continued on next page

IMPORTANT: Inspect the clamp isolators. If cracked or otherwise damaged, replace them or damage to the fuel lines will result.

IMPORTANT: Always use a new clamp screw. The screw threads are deformed when turned into the clamp's lock nut and should not be reused.

20. Tighten the line clamp screw (Q) to specification.

Specification

Fuel Line Clamp Screw—Torque ..... 8.5 Nm (75 lb-in or 6 lb-ft)

IMPORTANT: While tightening the fuel delivery line nut, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.

21. Tighten the fuel delivery line nuts to the inlet connector and to the flow dampers.

Specification

Fuel Line Nut—Torque ..... 40 ± 4 Nm (30 ± 3 lb-ft)

22. Tighten the line clamp screw (R) to the intake manifold.

Specification

Fuel Line Clamp-to-Intake Manifold Screw—Torque ..... 30 ± 6 Nm (22 ± 4 lb-ft)

RG41183,0000108 –19–26OCT05–5/6

23. Install rocker arm cover, new gasket, and vent tube.

Specification

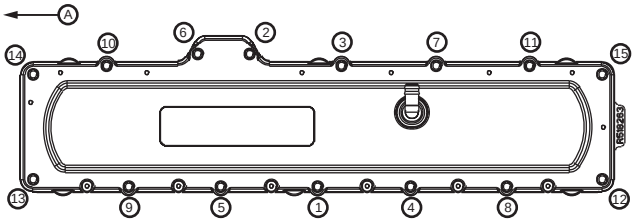
Rocker Arm Cover Cap Screws—Torque ..... 20 Nm (15 lb-ft)

24. Reconnect engine wiring harness connectors.

25. Reinstall the injector harness connector using JDG 1949 Wiring Harness Nut Socket.

NOTE: If the turbo was removed, install turbo. Refer to Install Turbocharger in Section 2 Group 80 of CTM 400.

RG13907 –UN–14JAN05



Rocker Arm Cover Tightening Sequence

RG41183,0000108 –19–26OCT05–6/6

Clean Electronic Injector (EI) Bore

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

IMPORTANT: Be careful not to gouge or nick the sealing surface.

RG41183,0000109 –19–12JUN05–1/1

Clean Electronic Injector (EI) Orifice

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

RG41183,000010A –19–12JUN05–1/1

Clean Electronic Injector (EI) Body

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

1. Clean new or used electronic injectors by washing in diesel fuel.
2. If necessary, use a piece of SCOTCH-BRITE®or use a brass wire brush to remove carbon deposits.

IMPORTANT: Be careful not to gouge or nick the sealing surface.

SCOTCH-BRITE is a trademark of 3M Co.

RG41183,000010B –19–12JUN05–1/1

Inspect Electronic Injector (EI) Body

1. Inspect electronic injector body to see that it is not scratched or scored. Take a close look at the sealing surface where the fuel side feed tube mates with the EI body.
2. If electronic injector is scratched or scored, replace electronic injector.

RG41183,000010C –19–12JUN05–1/1

Remove and Install Exhaust Gas Recirculation (EGR) Valve

1. Remove two, attaching screws (A), disconnect electrical connector, and carefully remove the EGR valve by rotating it slightly and pulling it straight out.
2. Remove gasket and clean mating surfaces. Vacuum loose debris from intake housing.
3. Replace EGR O-rings (B) each time valve is removed.
4. Inspect valve lands (C) for wear and damage. Remove carbon deposits and debris.
5. Carefully install EGR valve and new gasket, with the motor pointing away from the engine. Tighten attaching screws to initial specifications.

Specification

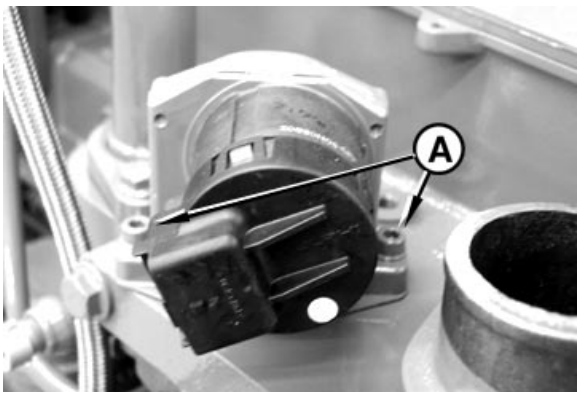
EGR valve - Initial -—Torque ..... 5 N•m (4 lb-ft)

6. Tighten EGR valve to final specifications. Connect wiring lead.

Specification

Screw—Torque ..... 15 N•m (11 lb-ft)

7. Clear the ECU's learned values for the EGR valve position. See EXHAUST GAS RECIRCULATION VALVE LEARN VALUE RESET TEST in Section 04, Group 160 later in this manual.



RG14089 –UN–22MAR05

EGR Valve

RG14076 –UN–01APR05

Inspect EGR Valve

A—Attaching Screws
B—O-Rings
C—EGR Valve Lands

RG41183,0000110 –19–29AUG05–1/1

Engine Control Unit (ECU) Maintenance

IMPORTANT: DO NOT OPEN ENGINE CONTROL UNIT.

IMPORTANT: Do not pressure wash the Engine Control Unit (ECU).

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

1. **Disconnect ECU-to-vehicle frame ground connection.**
2. **Disconnect all other connectors from ECU. Also disconnect module connector at injector pump.**
3. **Connect welder ground close to welding point and make sure ECU and other electrical components are not in the ground path.**

NOTE: For diagnosis and testing of the electronic engine control and sensors, refer to Group 160, TROUBLE CODE DIAGNOSTICS AND TESTS..

NOTE: The sealed ECU assembly is the system component LEAST likely to fail. Before replacing, make sure that it is isolated and identified as the defective component.

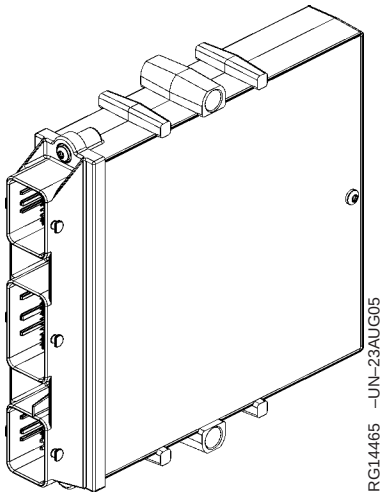
The ECU is not repairable. If it is found to be defective, replace it as a unit.

The wiring connectors for the ECU are repairable. See REPAIR CINCH CONNECTORS later in this Group.

RG40854,00000D3 –19–26AUG05–1/2

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

For theory of operation information on the ECU, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 later in this manual.



Engine Control Unit, Level 14

RG40854,00000D3 –19–26AUG05–2/2

Fuel System Sensors

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

RG40854,00000D4 –19–20MAY02–1/1

Remove and Install Fuel Rail Pressure Sensor

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

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

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

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

3. Disconnect fuel rail pressure sensor wiring connection and remove sensor (A).

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

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

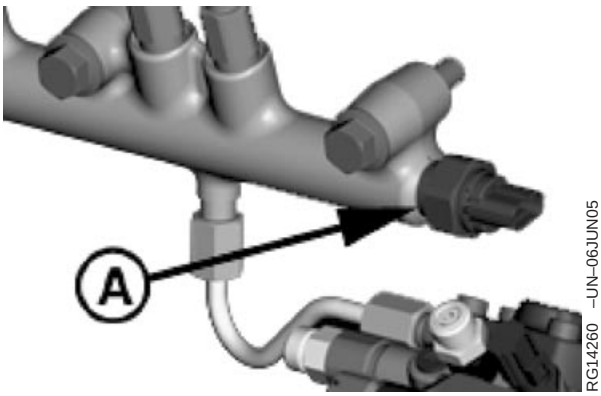
4. Coat new sensor threads with JDT405 High Temperature Grease.

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

Specification

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

6. Reconnect sensor wiring connection.



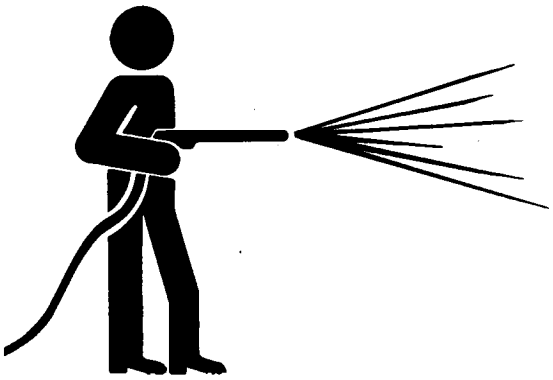
Fuel Rail Pressure Sensor

A—Fuel Rail Pressure Sensor

RG41183,0000116 –19–12JUN05–1/1

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.



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Using High-Pressure Washer

RG40854,00000D0 –19–08AUG05–1/1

Connectors

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

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

IMPORTANT: If for some reason the connectors are not connected it is important to protect the connectors from debris.

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

DB92450,0000045 –19–20FEB06–1/1

Connector Repair

DB92450,0000047 –19–20FEB06–1/1

Repair WEATHERPACK™ Connector


TS0128 –UN–23AUG88

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

WEATHERPACK is a trademark of Packard Electric

[1] Included in JT07195B Electrical Repair Kit

[2]Included in JDG155 Electrical Repair Tool Kit

Continued on next page

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

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

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

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

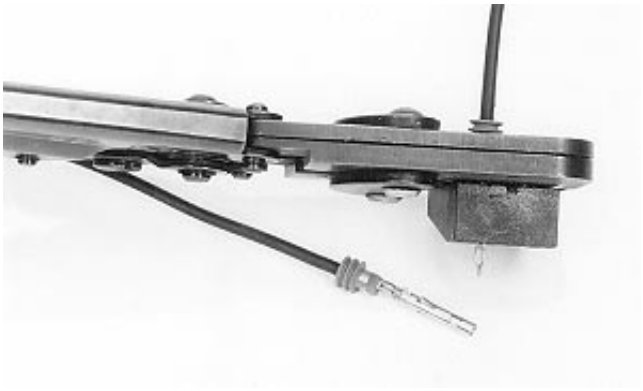
TS0136 –UN–23AUG88

DB92450,0000046 –19–20FEB06–2/4

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

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

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



TS1623 –UN–02NOV94

WEATHER PACK is a trademark of Packard Electric

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DB92450,0000046 –19–20FEB06–3/4

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.

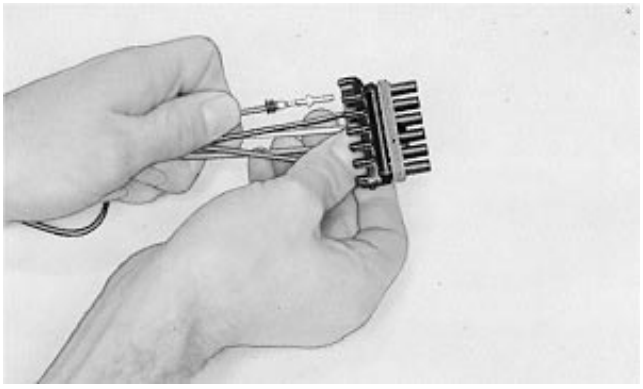
Correct terminal installation for sleeve (A) and pin (B) is illustrated.

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.



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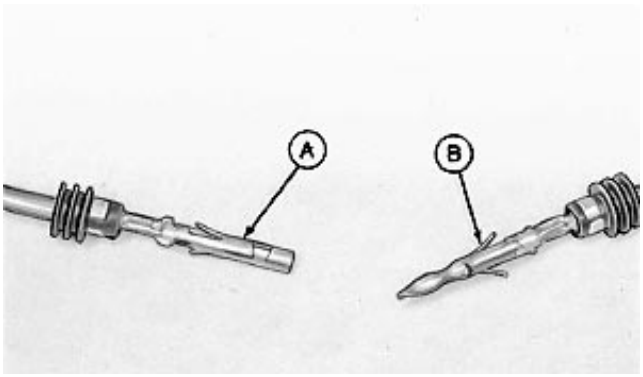


TS0139 –UN–02DEC88

A—Sleeve
B—Pin

DB92450,0000046 –19–20FEB06–4/4

Repair Cinch Flex Box Connector

Tools Required For Repair

- CINCH Crimper Tool JDG1727

RG14578 –UN–21NOV05

CINCH Crimper Tool

Continued on next page

RG41183,00000E9 –19–23FEB06–1/15

RG14579 –UN–21NOV05

- CINCH Terminal Remover Tool JDG 1725
- Wire Stripper JDG145
- Jeweler's screwdriver (or equivalent, narrow, flat-bladed tool)

CINCH Terminal Remover Tool

RG41183,00000E9 –19–23FEB06–2/15

Repair CINCH Connector by Replacing Terminal (0.6 or 1.5 mm)

1. To unlock CINCH connector from ECU connector, press on tab (A), and push on connector lock (B) behind tab, allowing Lock rotation.

RG14580 –UN–21NOV05

Tab and Connector Lock

Continued on next page

RG41183,00000E9 –19–23FEB06–3/15

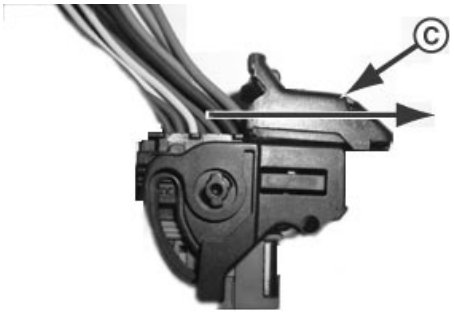
2. Continue pushing on connector lock, until it has been rotated 90° clockwise (clicked into place).
3. Remove CINCH connector from ECU connector.

RG14592 –UN–01DEC05

Rotate lock 90 Degrees

RG41183,00000E9 –19–23FEB06–4/15

4. From wire side of connector, push on wire guard (C), and remove from connector.

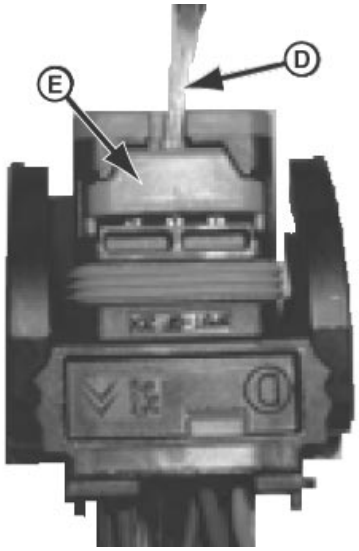


RG14581 –UN–21NOV05

Slide Guard Forward

RG41183,00000E9 –19–23FEB06–5/15

5. Insert thinly bladed tool (D) in the slot at the mating end of the connector and under the green tab (E), as shown.



RG14582 –UN–21NOV05

Insert Thin-Bladed Tool Under Tab

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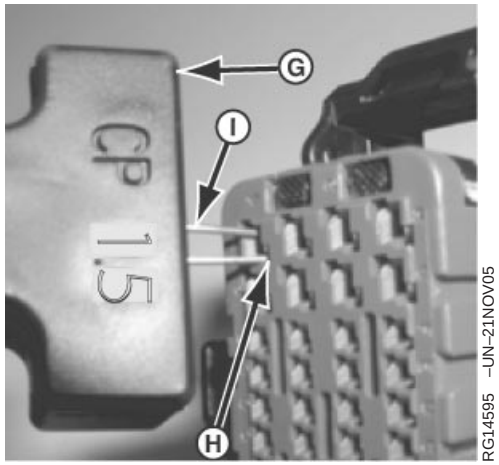
RG41183,00000E9 –19–23FEB06–6/15

6. Gently pry tab out, and pull terminal retainer (F) out, until it can be moved no farther.

Slide Terminal Retainer Out

RG41183,00000E9 –19–23FEB06–7/15

7. Insert CINCH Terminal extraction tool (G), as shown, into offset holes (H) on either side of the terminal to be extracted, tool wire sizes 1.5 mm end for larger wire size, and 0.6 mm end for smaller wire size (I). Press in until tool surface meets with connector surface.



Insert Terminal Extraction Tool

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RG41183,00000E9 –19–23FEB06–8/15

8. With one hand, grasp connector, and with the other, grasp wire of terminal to be extracted (J), firmly pull on wire, until Terminal has been removed from connector.

9. Remove terminal extraction tool from connector. If wire was pulled out during step 8, or if wire was already broken off, leaving terminal inside the connector, do the following:

   a. Insert a 0.813-0.643 mm (20-22 AWG) diameter, single-strand piece of stiff wire into mating-side (opposite wire-side) of connector.

   b. Continue to push on terminal with wire, until terminal is completely ejected from connector, or until terminal is exposed at wire side of connector.

   c. If terminal is only exposed, use long-nose pliers to pull it from the connector.

10. Cut back on insulated portion of wire, close to terminal-end of wire, but beyond any damage to either wire or insulation.

Remove Terminal and Wire

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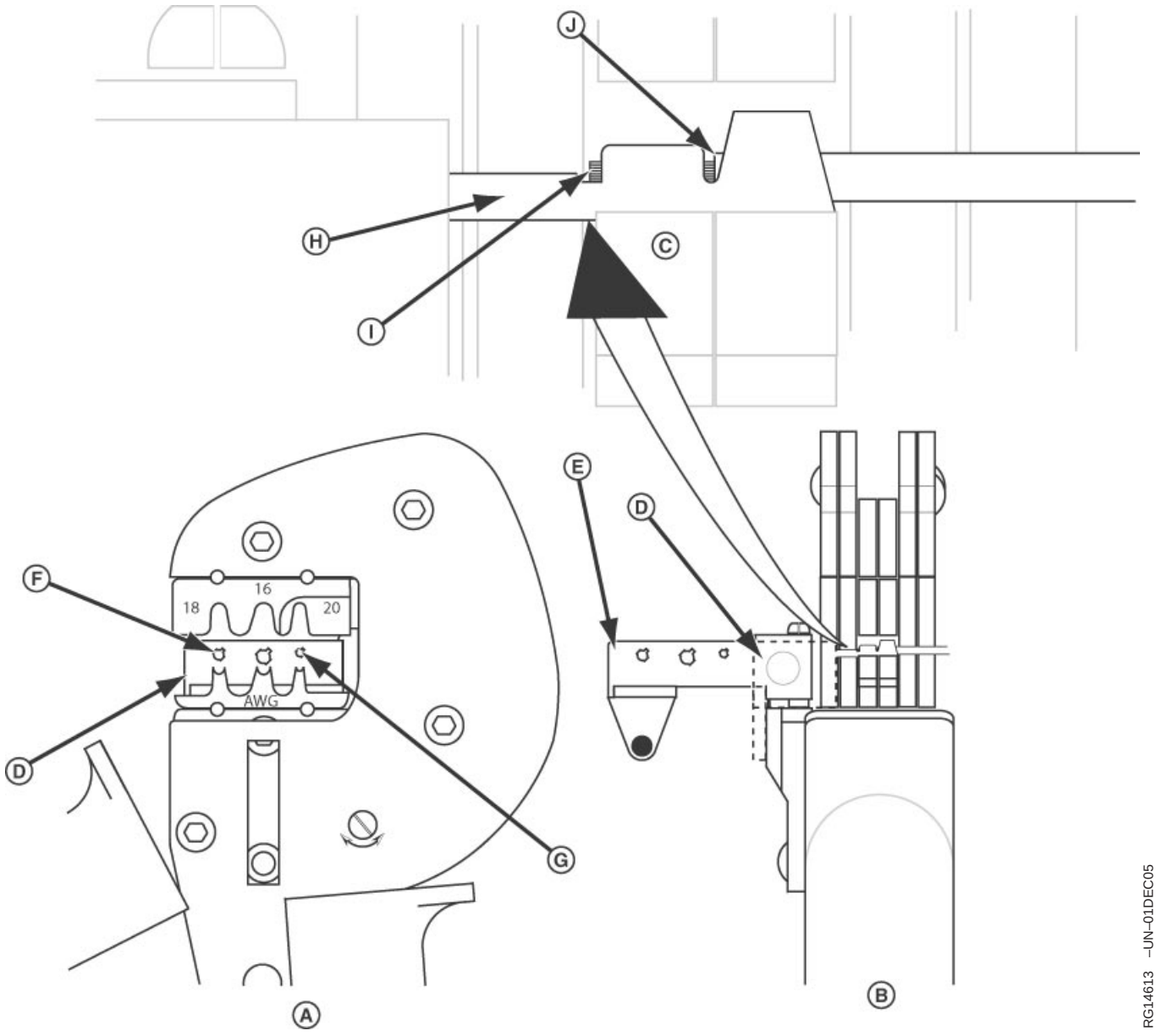
RG41183,00000E9 –19–23FEB06–9/15



CINCH Crimper Elements

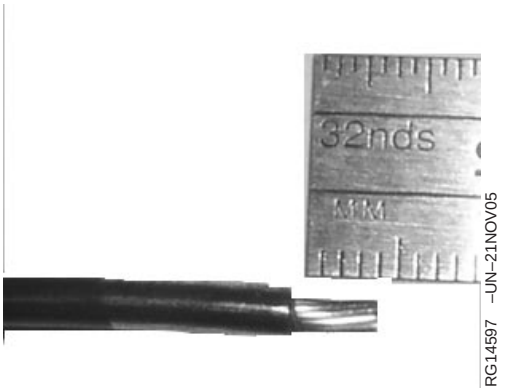
A—Crimper Side View
B—Crimper Front View
C—Wire-in-Terminal Blowup
D—Terminal Block (Closed)
E—Terminal Block (Open)
F—1.5 mm Terminal Recess
G—0.6 mm Terminal Recess
H—Terminal Seated in Block Recess
I—Wire in Terminal (4.0 mm Insulation Stripped)
J—Wire in Terminal (insulation end)

NOTE: The above figure is intended to only illustrate crimper and wire-loading elements. Its callouts relate only to its own legend, and not to the callouts in the procedural steps.

11.

Continued on next page

Using wire strippers, strip insulation from wire to expose approximately 4.0 mm (0.16 in.) length of wire, as shown.

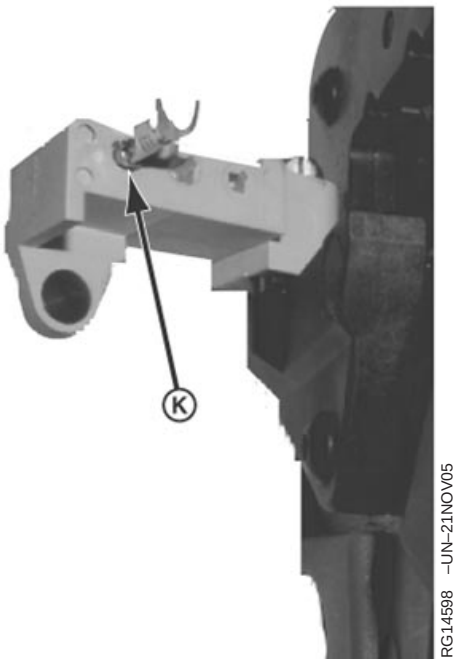


Strip 4.0 mm of Wire Insulation

RG41183,00000E9 –19–23FEB06–11/15

CAUTION: Use only JDG1727 Crimper. Use of another can result in an improper crimp. Attempting to insert an improperly crimped terminal can result in inability to fully seat, and to jam, the terminal inside the connector. This condition requires replacement of the entire connector.

12. Place female terminal in the matching recess (K) in crimper terminal block, as shown.



Terminal in Matching Recess of Crimper Terminal Block

Continued on next page

RG41183,00000E9 –19–23FEB06–12/15

13. Lay stripped end of wire onto end of terminal to be crimped, with insulation overlapping, as shown (L).

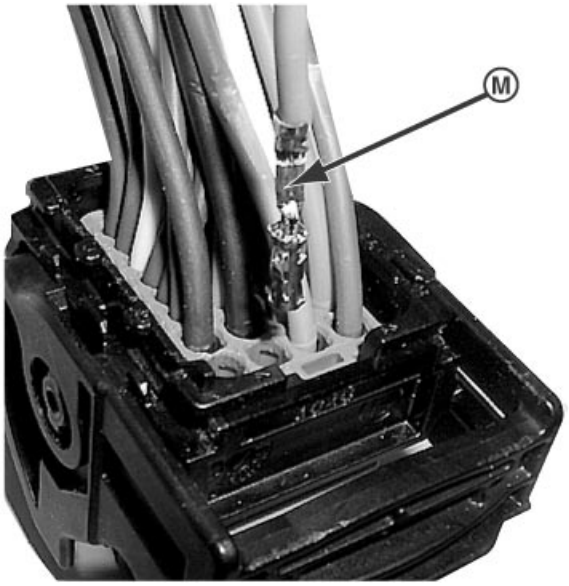
14. Squeeze crimper handles, until they automatically unlock. Remove wire and terminal from crimper.

RG14588 –UN–01DEC05

Wire Onto Terminal in Crimping Pliers

RG41183,00000E9 –19–23FEB06–13/15

15. Fully insert terminal into connector (M), with crimped side of terminal facing away from the terminal retainer side of the connector and tabs on terminal aligned with offsets in connector, terminal hole, as shown.



RG14589 –UN–02DEC05

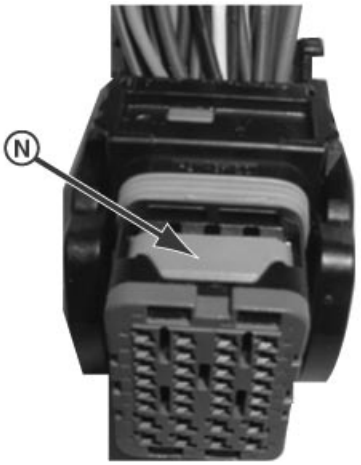
Correct Position For Terminal Insertion

Continued on next page

RG41183,00000E9 –19–23FEB06–14/15

NOTE: If retainer does not slide fully into position, terminal has not been completely seated. Check seating again. Do not force retainer. Retainer slides closed only when all connector terminals are fully seated

16. Close green terminal retainer, until its tab (N) is flush with connector surface.
17. Slide wire guard back onto connector, until it clicks into place.
18. Reconnect CINCH connector to ECU connector.
19. Push on lock toward wire side of connector, and continue rotating it 90 degrees, counter-clockwise, until it clicks into place, behind tab.



RG14599 –UN–01DEC05

Push Tab Flush With Connector

RG41183,00000E9 –19–23FEB06–15/15

TYCO-AMP Super Seal Connectors

The following are the terminal replacement repair procedures for the female (engine Harness side) connector.

Tools Required:

- Terminal removal tool, Deere Part No. JDG10203.

DB92450,0000050 –19–09MAR06–1/14

RG14764 –UN–22FEB06

Terminal Removal Tool, Deere Part No. JDG10203

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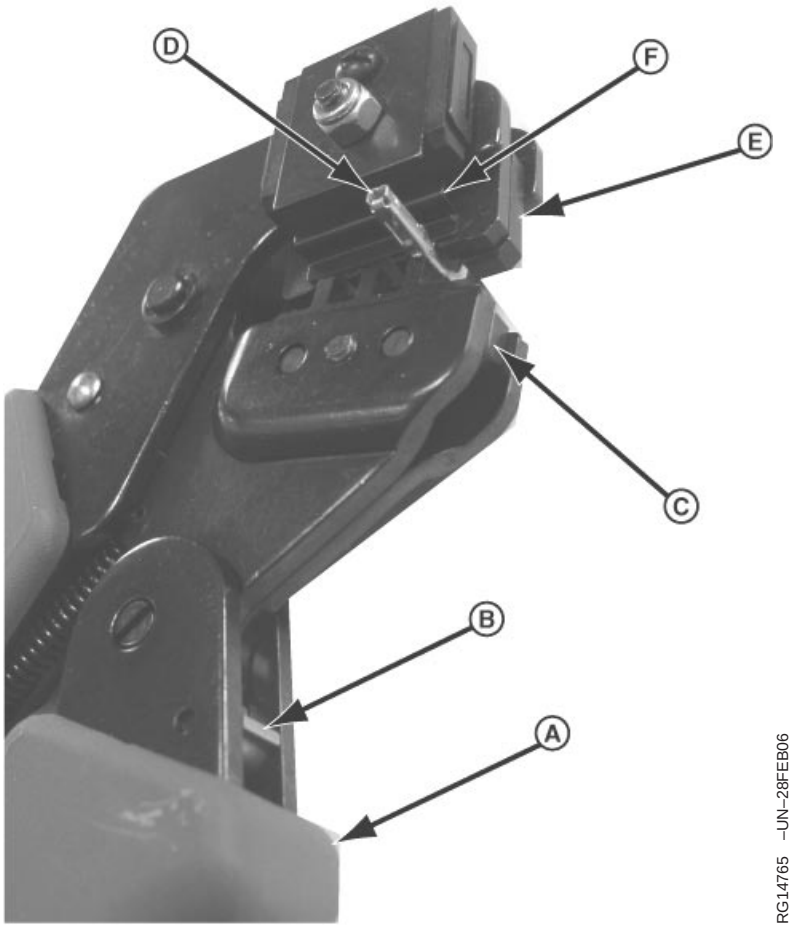
DB92450,0000050 –19–09MAR06–2/14



Terminal Crimp Tool, Deere Part No. JDG10202

a—Crimp Tool
B—Ratchet Release
C—Lower Die
D—Terminal
E—Upper Die
F—Locator

- Terminal crimp Tool, Deere Part No. JDG10202. .

Continued on next page

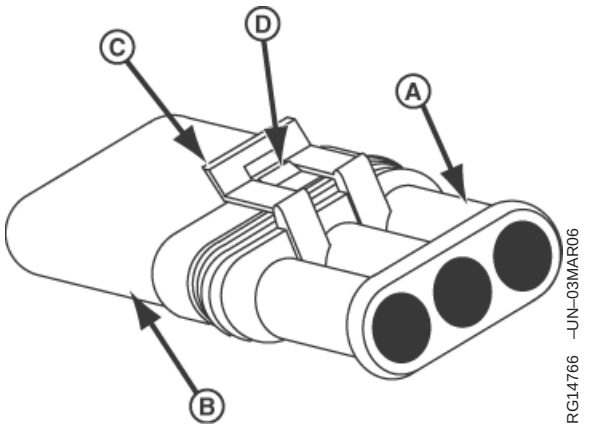
DB92450,0000050 –19–09MAR06–3/14

NOTE: This block provides repair procedures for the female portion (engine-side) of the Amp Super Seal connector.

1. Separate connectors: Holding on to both male and female connectors, lift up on the locking bar of the female connector, until it is clear of the locking tab of the male connector, and pull the two connectors apart.

2. Remove red, secondary lock, using terminal removal tool (or similar tool)

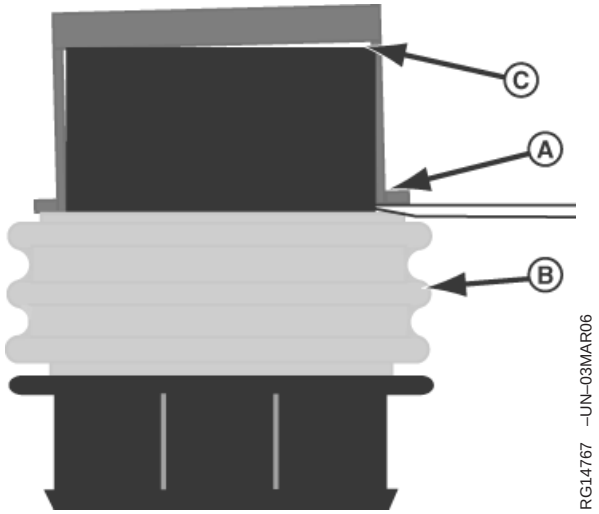
A—Female Connector
B—Male Connector
C—Locking Bar
D—Locking Tab



Separate Connectors

DB92450,0000050 –19–09MAR06–4/14

a. Insert tool under tab on one side of red lock (A), where it meets (yellow) connector seal (B), as shown, and gently pry it up, until there is separation (C) on that side between lock and connector.

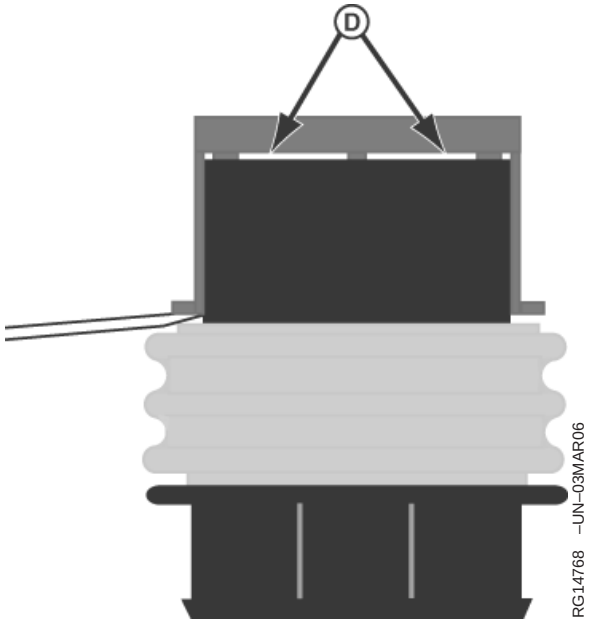


Remove Secondary Lock, Step 1.

Continued on next page

DB92450,0000050 –19–09MAR06–5/14

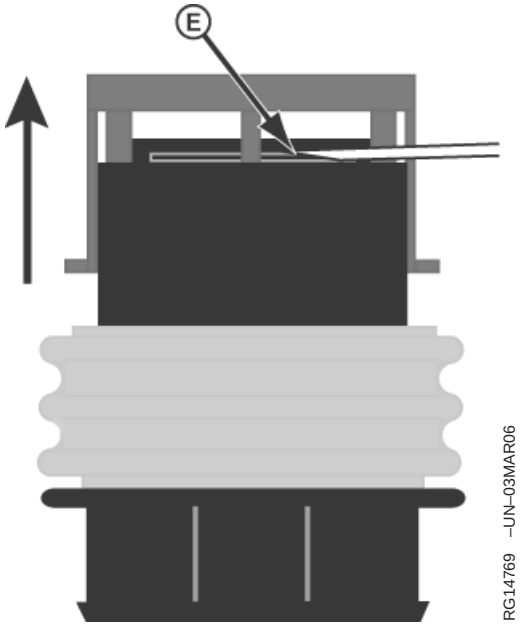
b. Maintaining separation attained in the first step, insert tool under tab at other end of lock, and pry up, until there is separation all along between lock and connector (D), as shown.



Remove Secondary Lock, Step 2.

DB92450,0000050 –19–09MAR06–6/14

c. Insert tool into separation and pry up (E). Lock slides up, as shown. Continue sliding lock upward, until it has been removed from connector.



Remove Secondary Lock, Step 3.

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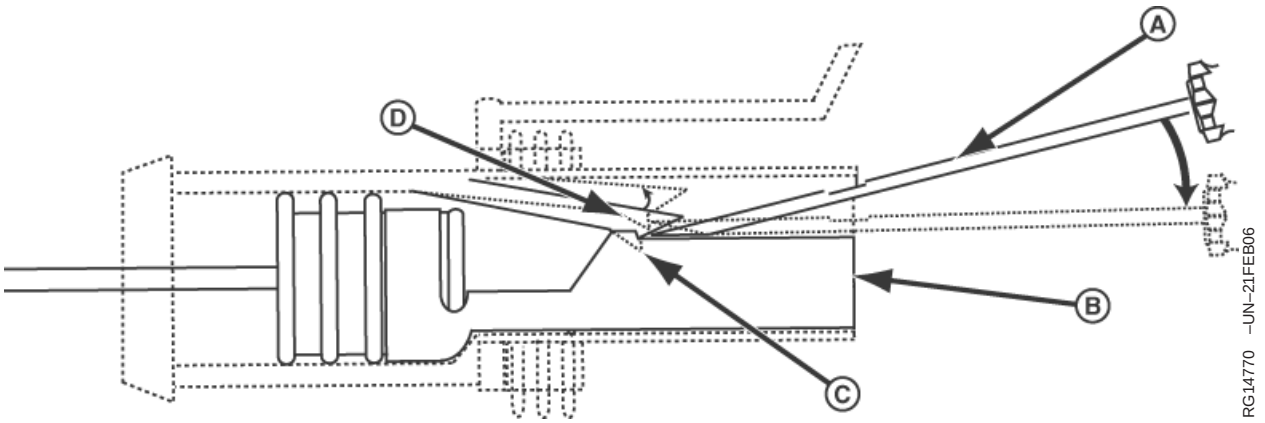
DB92450,0000050 –19–09MAR06–7/14



Unlock Terminal Connector

A—Terminal Removal Tool **B—Terminal** **C—Terminal Locking Tab** **D—Tab Freed From Terminal Slot**

NOTE: Very little force is needed to perform the following steps. Use of excessive force will result in breaking off of the terminal locking tab from the connector.

3. To remove damaged wire and or terminal from connector:

   a. With thumb and forefinger both holding wire of the terminal to be replaced, and pressed against connector, squeeze thumb and forefinger, applying tension on the wire

   b. Insert tool (A) into terminal end of connector (B).

   c. Keeping angled edge on front of tool flush with terminal surface, as shown, continue inserting tool into connector, until it stops at terminal-locking tab (C), as shown.

NOTE: If wire is broken off from terminal, steps c. and d. can be accomplished by pushing on front of terminal using stiff wire, after tab has been freed from terminal slot.

   d. Holding tool in place and , pry lock tab up, until it is freed from terminal slot (D), and terminal begins to move away from terminal edge of connector.

   e. Remove damaged terminal, wire, and seal from connector.

4. Terminal crimping procedure.

   a. Cut back on insulated portion of wire, close to pin-end of wire, but beyond any damage to either wire or insulation.

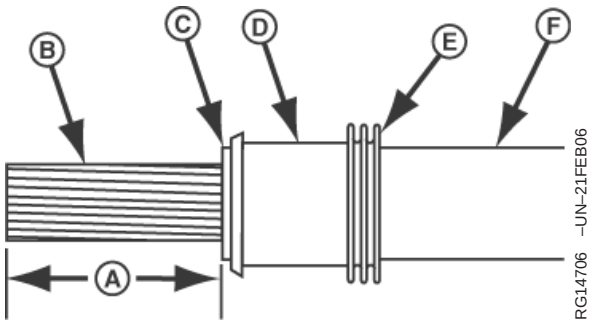
   b. Insert wire into ribbed end of seal (E), and pull seal (D) down insulation (F), until non-ribbed end is well past point where insulation is to be stripped from wire.

   c. Using wire strippers, strip insulation from wire (B) to expose a 3-3.5 mm (0.12-0.14 in.) length of bare wire (A).

Continued on next page

d. Pull seal toward bare wire, until only a small amount of insulation (C) appears beyond non-ribbed end of seal, as shown.

A—3.0-3.5 mm
B—Bare Wire
C—End of Insulation
D—Seal
E—Ribbed End of Seal
F—Insulation



Stripped Wire and Seal

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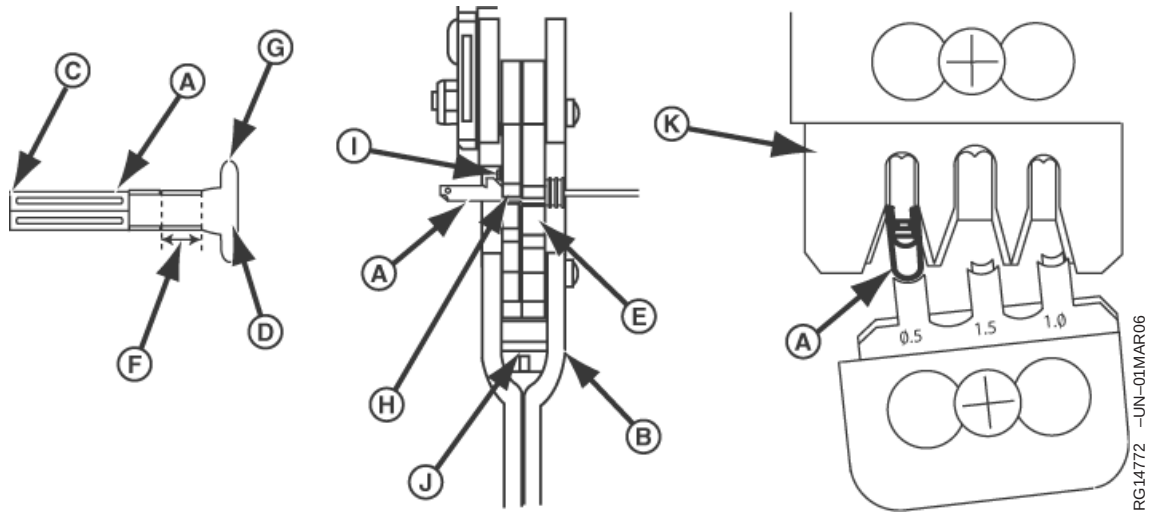
DB92450,0000050 –19–09MAR06–9/14



Terminal and Crimp Tool (Front View)

A—Terminal
B—Crimp Tool
C—Connector end of Terminal
D—Wire End of Terminal
E—Lower Die
F—Crimp Part of Terminal
G—Seal Clasp Part of Terminal
H—Upper Die
I—Locator Assembly
J—Crimper Lock
K—Terminal Set in Crimper (side view)

e. Set terminal (A) in place into crimping pliers, as follows.

NOTE: Placement of terminal into crimper die slots is dependent upon terminal and wire size.

f. Grasp crimp tool (B) in one hand and connector end of terminal (C) in the other hand.

g. Seat wire end of terminal (D) in the matching recess of crimp tool lower die in appropriate size inset (E).

NOTE: It is important that Wire end of terminal be vertically aligned on both sides with upper and lower dies of crimping tool, and that connector side edge of terminal area to be crimped can pass up inside of locator assembly, so that when the lower jaw of crimping tool is moved up, locator holds terminal correctly.

h. Firmly holding terminal in lower die, gently squeeze crimping pliers, ensuring both crimp (F) and seal clasp (G) parts of terminal are fitting into upper die (H).

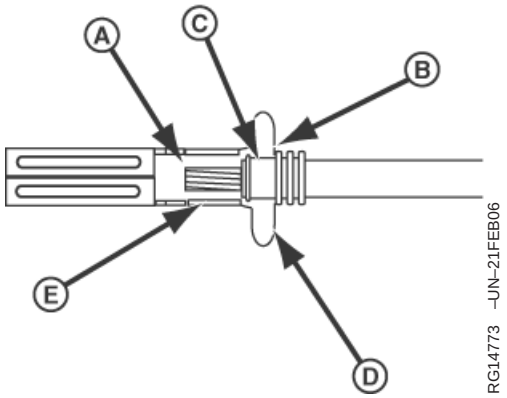
i. Squeeze tool only until the second click is heard, and squeeze no further. Terminal is now held firmly in place against crimper's locater assembly (I), and both crimp and seal clasp portions of terminal fit into upper die, as shown.

NOTE: To release the crimper pliers after any clicks have been heard, slightly squeeze tool handles until ratchet release can be pushed downward. Spring load on tool handles returns pliers to full-open position and releases terminal.

Continued on next page

j. With terminal secured in crimper pliers, lay stripped end of wire (A) onto wire end of terminal (B), with seal (C) aligned with seal clasp part of terminal (D).

A—Stripped End of Wire
B—Wire End of Terminal
C—Seal
D—Seal Clasp Part of Terminal
E—Terminal Crimp Area



Terminal, Seal, and Wire, Top and Front Views

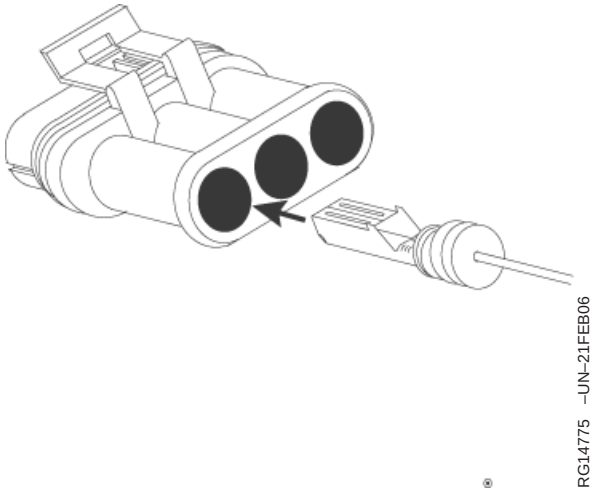
DB92450,0000050 –19–09MAR06–11/14

k. Squeeze crimper pliers steadily, until it will close no more, releasing the handles. Terminal is now crimped to wire and clasped to seal.

Example of Successful Crimp

DB92450,0000050 –19–09MAR06–12/14

5. . Insert new terminal and wire into connector, oriented as shown (crimp side of terminal to lock side of connector), and keep sliding it in, until a click is heard, and face of terminal is almost flush with face of connector.



Insert New Terminal and Wire

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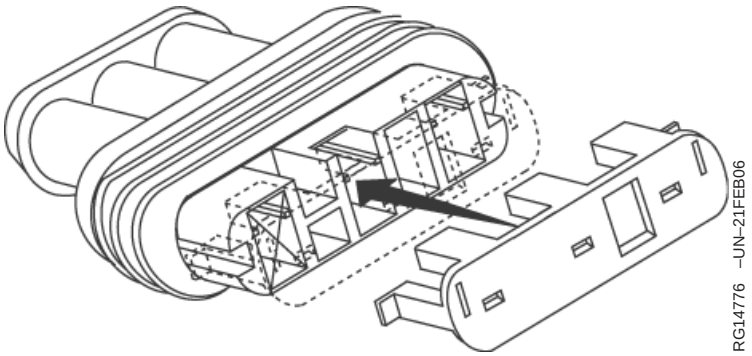
DB92450,0000050 –19–09MAR06–13/14



Reattach secondary Lock

6. Reattach the secondary lock, removed in step 2.

7. Reconnect the repaired, female connector to the male connector.

DB92450,0000050 –19–09MAR06–14/14

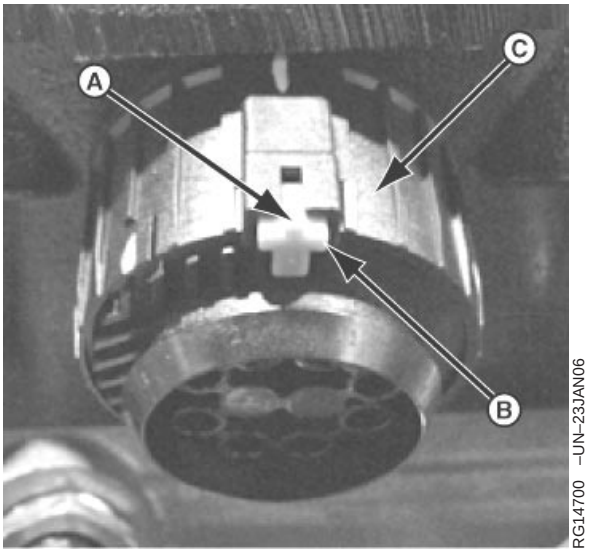
Repair TYCO-AMP Fuel Injector Connector

Disconnect

1. Using a jeweler's screwdriver, or other, similar tool, push tab (A) on red lock (B), away from connector on Receptacle Housing Assembly (C), unlocking it. Lock is shown in the unlocked position.

DB92450,0000040 –19–11MAY06–1/16

2. . Facing side of engine and connector, grasp Collar (D), and turn it counter-clockwise, until Receptacle Housing Assembly (E) has been separated from Coupling Ring (F). The green line on the collar will line up with the green line on the receptacle housing assembly.

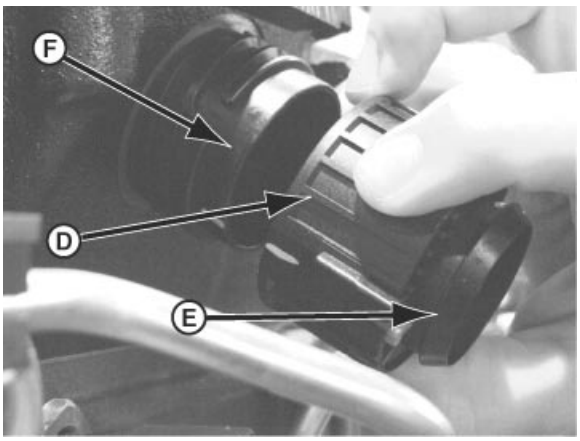


Unlock Receptacle Housing Assembly

Continued on next page

DB92450,0000040 –19–11MAY06–2/16

3. With narrow-bladed screwdriver, or equivalent, push in on tabs (G) on elbow (H) attached to Receptacle Housing Assembly, as shown, and separate elbow halves enough to pull Receptacle Housing Assembly away from elbow, exposing wires and wire end of Receptacle Housing Assembly (I), as shown.

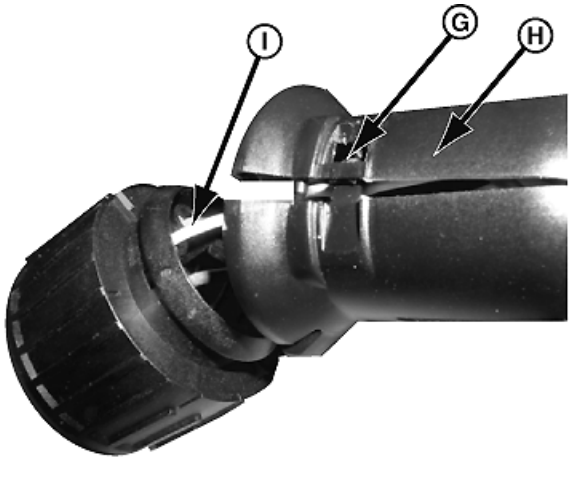


Separate Receptacle Housing Assembly From Coupling Ring

DB92450,0000040 –19–11MAY06–3/16

Repair Connector

1. Using a pick or small screwdriver, push internal, red, secondary lock up, until unlocked position is reached. (A slight click is noticeable.) Secondary lock positions are J1 Locked, J2 Unlocked, as shown.



Detach Receptacle Housing Assembly From Elbow

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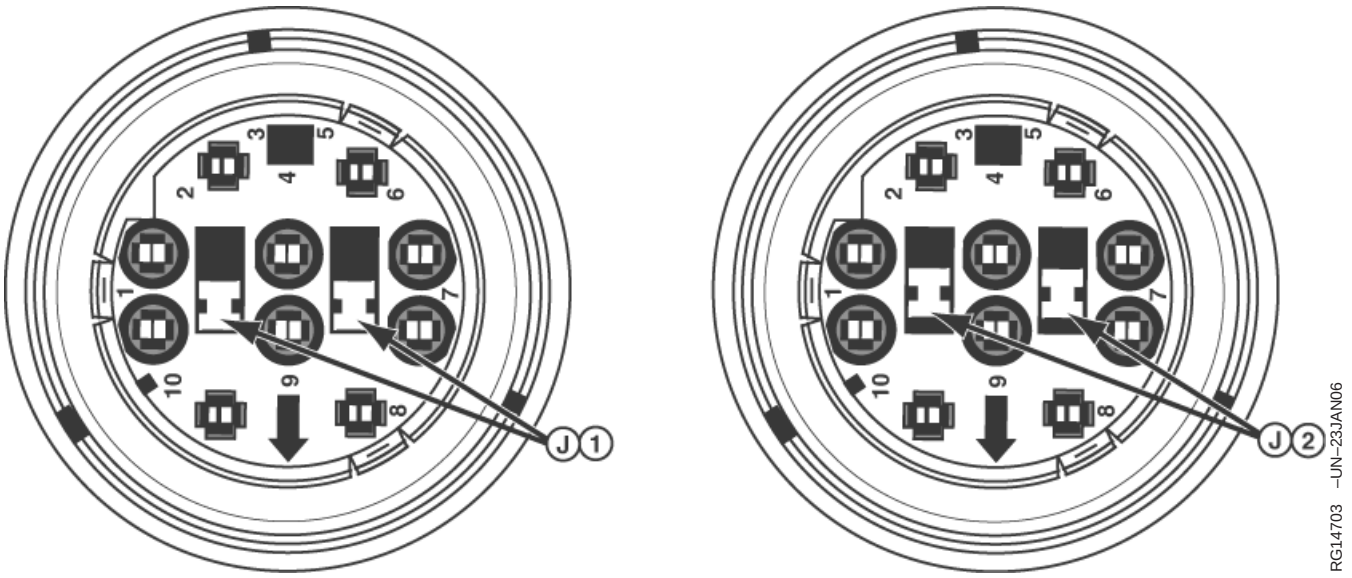
DB92450,0000040 –19–11MAY06–4/16

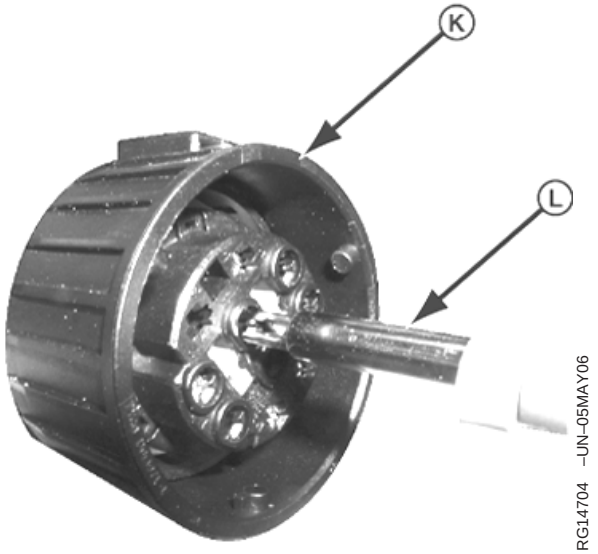


Red, Secondary Lock in Locked and Unlocked Positions

2. . From terminal end of connector insert extractor number JDG10205 (L) into housing (K) of terminal to be replaced, as shown. Push extractor in until it stops. Do not bend or twist extractor.

DB92450,0000040 –19–11MAY06–5/16

3. From wire side of connector, remove terminal by gently pulling on wire attached to it, until terminal is free of connector, as shown. Note position of terminal crimp with respect to connector housing.



Insert Terminal Extractor

Continued on next page

DB92450,0000040 –19–11MAY06–6/16

If wire is pulled free of terminal, or if terminal breaks, leaving part of it in connector, use stiff wire to push terminal enough to expose wire-side terminal end, and pull terminal free, using long-nose pliers.

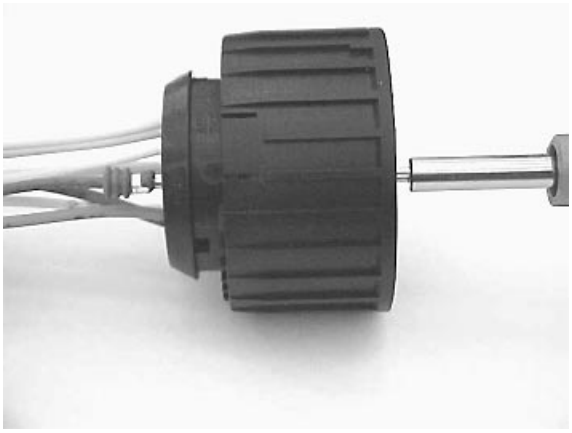
4. Replace terminal, as follows:

   a. Cut back on insulated portion of wire, close to pin-end of wire, but beyond any damage to either wire or insulation.

   b. . Insert wire into ribbed end of seal (E) (blue seal for 18 gage wire and white seal for 16 gage wire), and pull seal (D) down insulation (F), until non-ribbed end is well past point where insulation is to be stripped from wire.

   c. Using wire strippers, strip insulation from wire (B) to expose a 3-3.5 mm (0.12-0.14 in.) length of bare wire (A).

   d. Pull seal toward bare wire, until only a small amount of insulation (C) appears beyond non-ribbed end of seal, as shown.



Terminal Extracted, Side View

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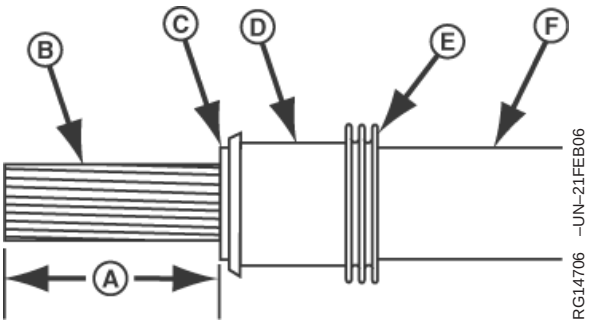
DB92450,0000040 –19–11MAY06–7/16

e. Fix terminal (A) into crimping pliers, JDG10204 as follows:

1. Grasp crimping pliers (B) in one hand and connector end of terminal (C) in the other hand.

NOTE: It is important that Wire end of terminal be vertically aligned on both sides with upper and lower dies of crimping tool, and that connector side edge of terminal area to be crimped can pass up inside of locator assembly, so that when the lower jaw of crimping tool is moved up, locator holds terminal correctly seated.

2. Seat wire end of terminal (D) in the matching recess of crimping pliers lower die (0.5) (E).
3.) Firmly holding terminal seated in lower die, gently squeeze crimping pliers, ensuring both crimp (F) and seal clasp (G) parts of terminal are fitting into upper die (H).
4. Squeeze pliers only until the first click is heard, and squeeze no further. Terminal is now held firmly in place against crimper's locater assembly (I), and both crimp and seal clasp portions of terminal fit into upper die, as shown.



Stripped Wire With Seal in Place

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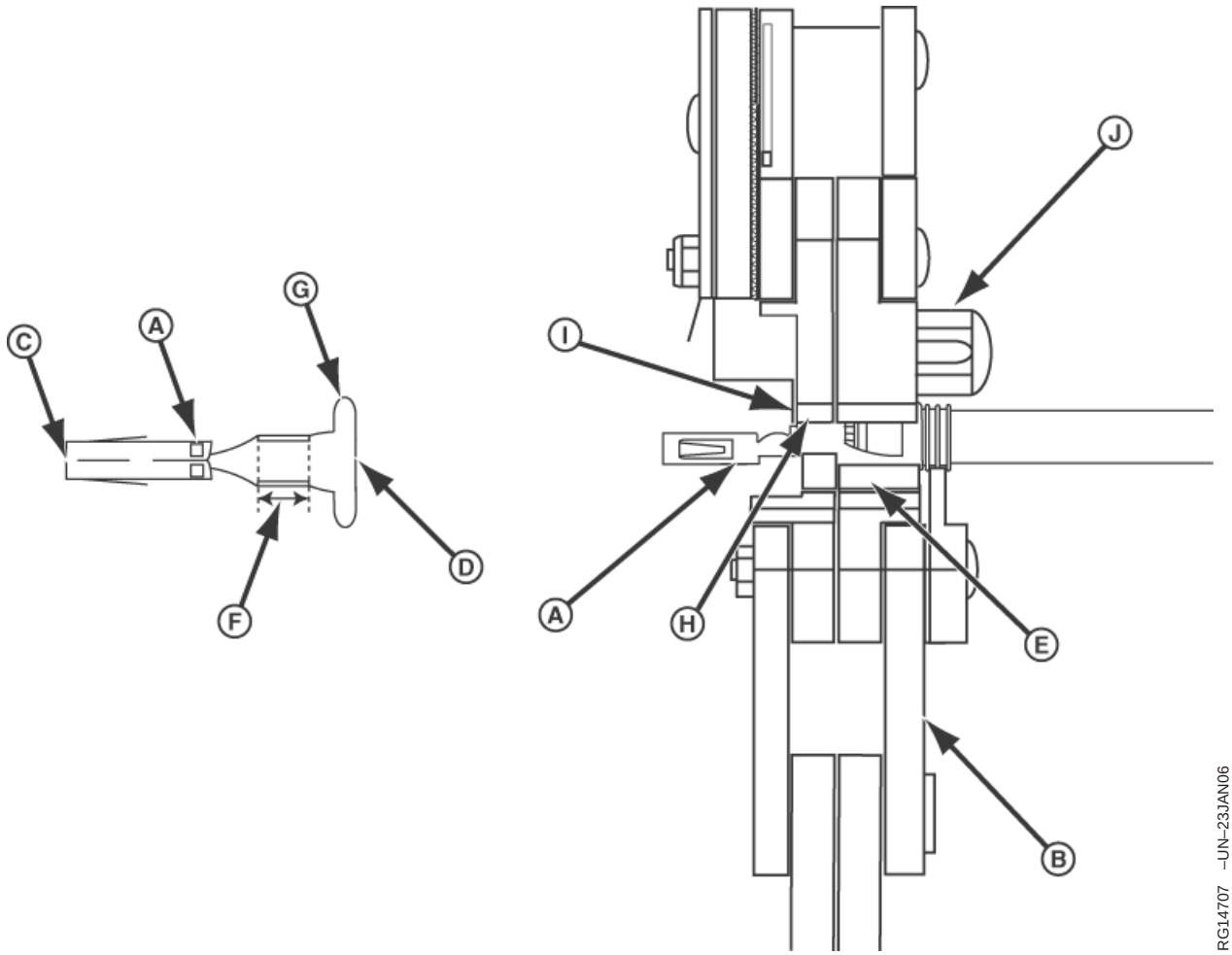
DB92450,0000040 –19–11MAY06–8/16



Terminal and Front View of Crimper Pliers

A—Terminal
B—Crimper Pliers Upper Die
C—Connector end of Terminal
D—Wire End of Terminal
E—Lower Die
F—Crimp Part of Terminal
G—Seal Clasp Part of Terminal
H—Upper Die
I—Locator Assembly
J—Crimper Lock

NOTE: To release the crimper pliers after the first click has been heard, attempt to turn crimper lock (J) clockwise (facing the lock), and slightly squeeze crimper until lock has been released and turns. Spring load on pliers handles returns pliers to full-open position.

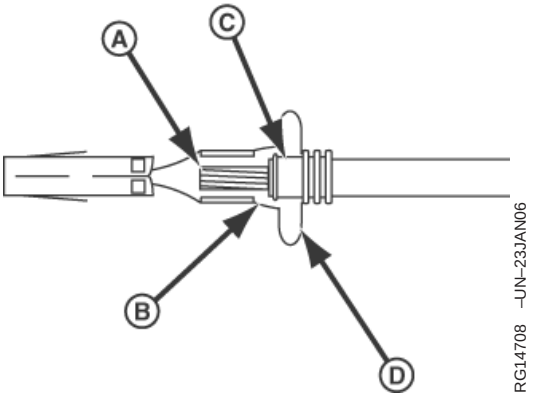
f. With terminal secured in crimper pliers, lay stripped end of wire (A) onto wire end of terminal (B), with seal (C) aligned with seal clasp part of terminal (D), as shown.

Continued on next page

DB92450,0000040 –19–11MAY06–9/16

g. Squeeze crimper pliers steadily, until it will close no more, releasing the handles. Terminal is now crimped to wire and clasped to seal, as shown.

A—Stripped End of Wire
B—Wire End of Terminal
C—Seal
D—Seal Clasp Part of Terminal



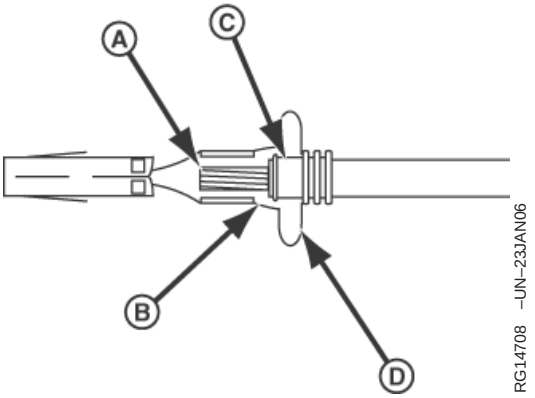
Terminal, Seal, and Wire, Top and Front Views

DB92450,0000040 –19–11MAY06–10/16

5. Install new terminal into connector housing, with terminal crimp in same position, with respect to connector housing position, as when it was removed in step 3. Be sure that terminal has been completely inserted into connector housing.

6. Using a pick or small screwdriver, push internal, red, secondary lock down, until locked position is reached. (A slight click is noticeable.) as shown in step 1, above.

NOTE: All terminals must be fully inserted into connector housing, or secondary lock cannot be placed into locked position.



Terminal Crimped onto Wire

Reattach Connector

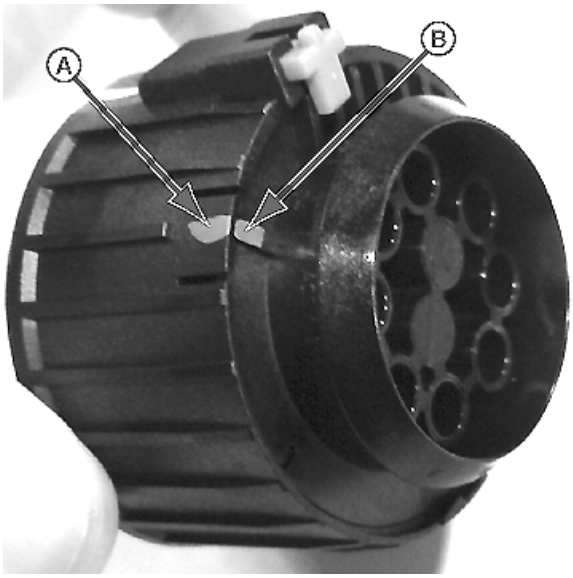
1. . Insert connector back into elbow, and close elbow, until tab(s) clicks (click) into place.

2. Ensure that green line on receptacle collar (A) and green mark on receptacle housing (B) are aligned, as shown.

Continued on next page

DB92450,0000040 –19–11MAY06–11/16

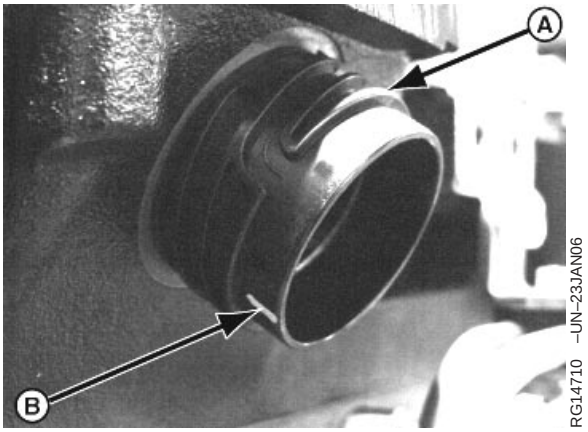
3. Locate orange line (B) on collar (A) from which receptacle was removed in step 2, (Disconnect). Orange line is at approximately 8:00 o'clock on the collar, as shown.



Align Green Lines on Receptacle Collar and Receptacle

DB92450,0000040 –19–11MAY06–12/16

4. With the orange collar's orange line (C) and the receptacle connector's orange line (D) aligned, as shown, place the (B) receptacle connector onto the collar (A), as shown (E).



Collar Mounted on Engine

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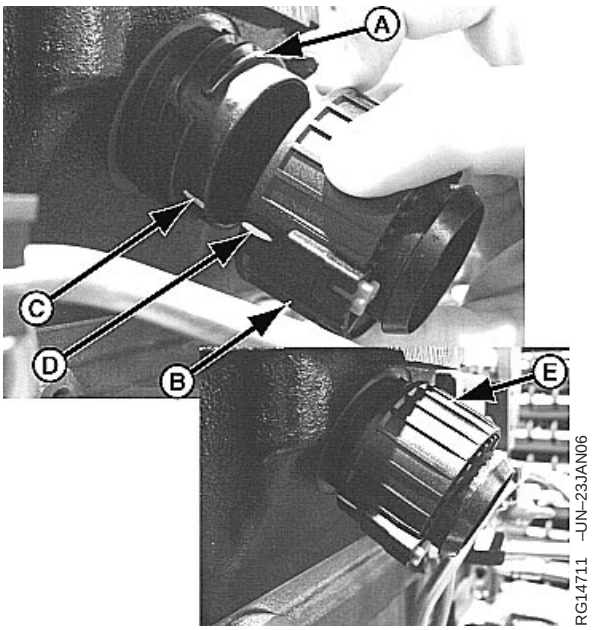
DB92450,0000040 –19–11MAY06–13/16

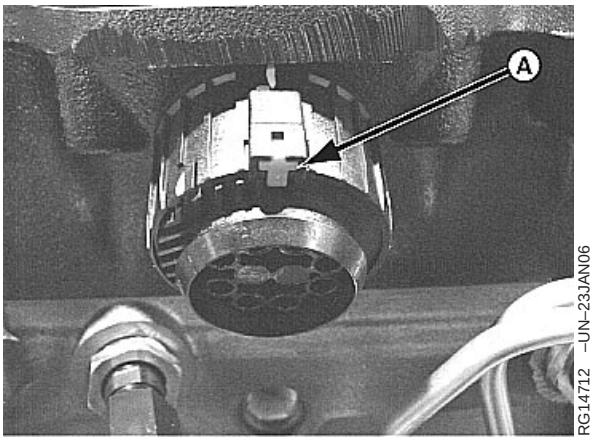
5. Rotate receptacle connector collar clockwise, until the red lock (A) on the receptacle connector collar is in the 12:00 o'clock position, as shown.



Attach Receptacle Connector to Collar

DB92450,0000040 –19–11MAY06–14/16

6. Depress red lock on connector. Locked position is when tab is flush with connector housing, as shown.

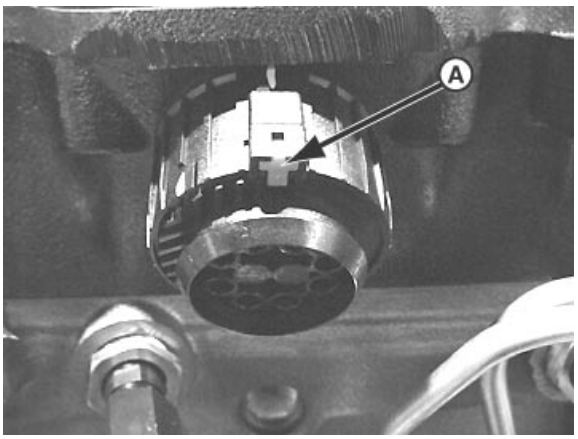


Red Lock Correctly Positioned

Continued on next page

DB92450,0000040 –19–11MAY06–15/16

NOTE: If red lock cannot be depressed, the connector is misaligned. Disassemble Connector, and reassemble, starting with step 1, above.



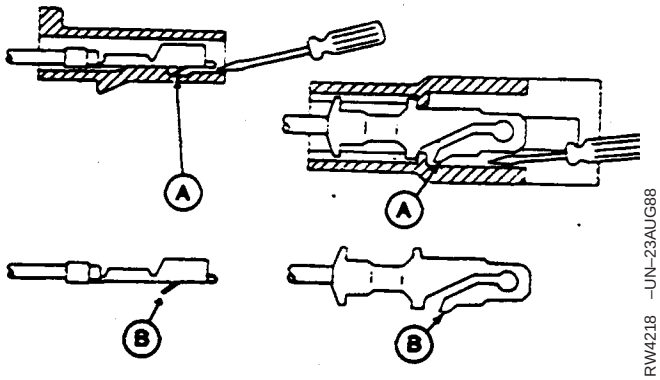
Tab Flush With Connector Housing

DB92450,0000040 –19–11MAY06–16/16

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*

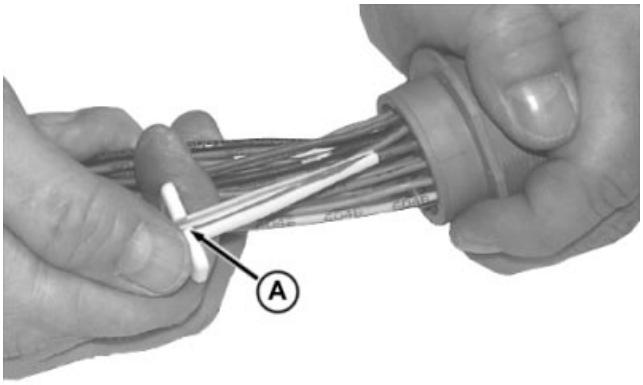
RG40854,00000CE –19–20MAY02–1/1

Repair DEUTSCH™ Connectors

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

IMPORTANT: DO NOT twist tool when inserting in connector.

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



RW77142 –UN–07DEC98

A—Handle

DEUTSCH is a trademark of Deutsch Company

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

[2]Included in JDG359 DEUTSCH Electrical Repair Kit

[3]Included in JT07195B Electrical Repair Tool Kit

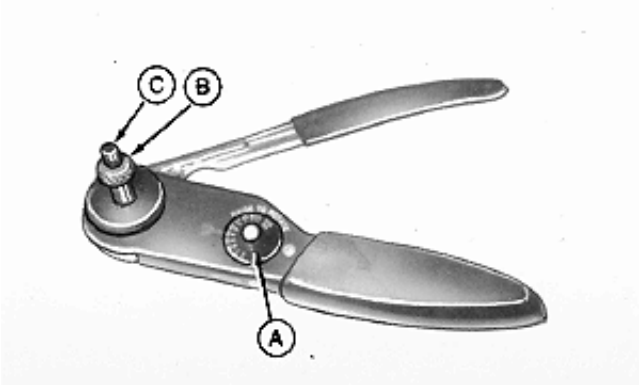
[4]Included in JDG155 Electrical Repair Tool Kit

Continued on next page

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*

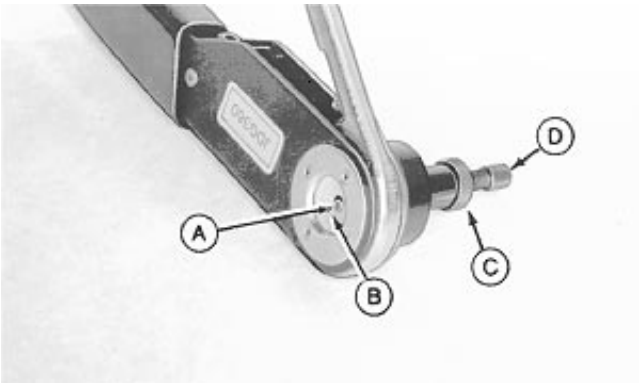
RG40854,00000CB –19–20MAY02–2/4

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

Continued on next page

RG40854,00000CB –19–20MAY02–3/4

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

IMPORTANT: Terminal must remain centered between indenters while crimping.

15. Release handle and remove terminal.

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

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

NOTE: Readjust crimping tool for each crimping procedure.

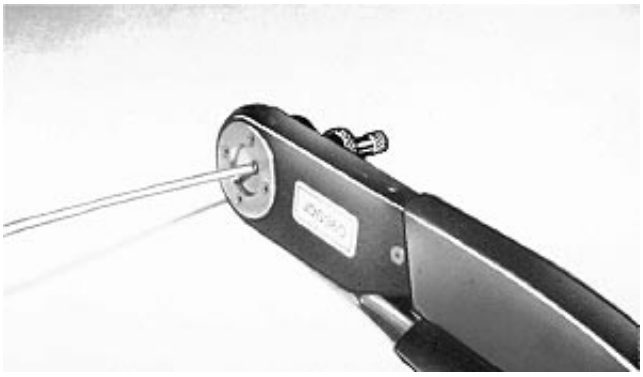
17. Push terminal straight into correct connector cavity until positive stop is felt.

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

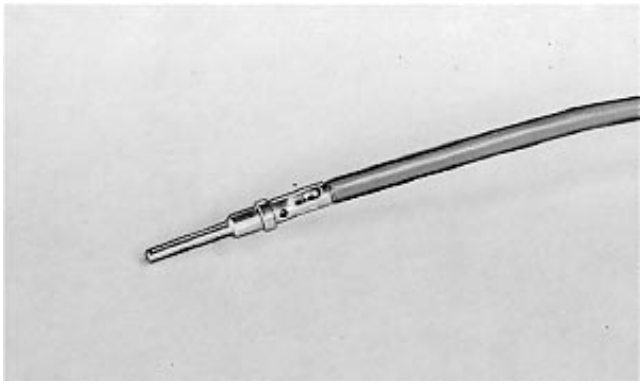
18. Gently pull on wire to verify terminal is locked into the connector.

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

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



TS118 –UN–23AUG88



TS0135 –UN–23AUG88

RW77141 –UN–07DEC98

RG40854,00000CB –19–20MAY02–4/4

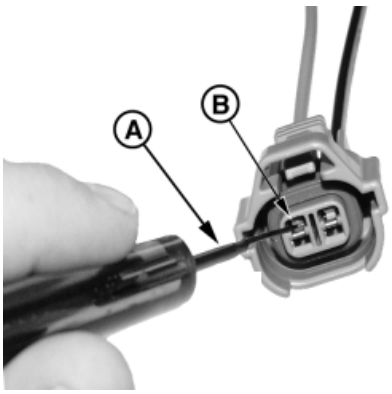
Repair SUMITOMO™ Connectors

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

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

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

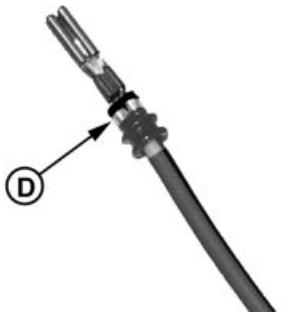
A—Terminal Extraction Tool
B—Connector Locking Tang
C—Terminal Crimping Tool
D—Crimped Cable Seal



RG11676 –UN–05FEB01

TS0136 –UN–23AUG88

RG11678 –UN–05FEB01



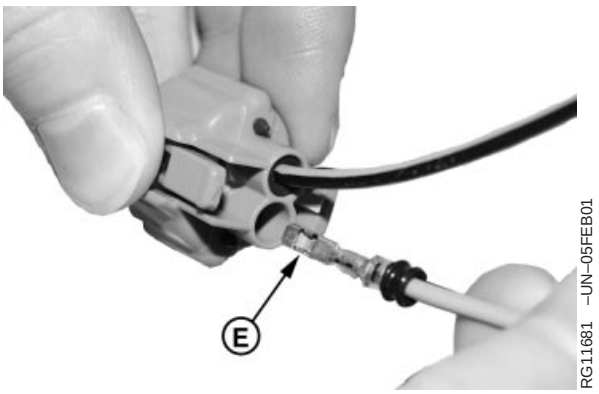
RG11680 –UN–05FEB01

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

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

Continued on next page

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



E—Terminal Orientation

RG40854,00000C9 –19–20MAY02–2/2

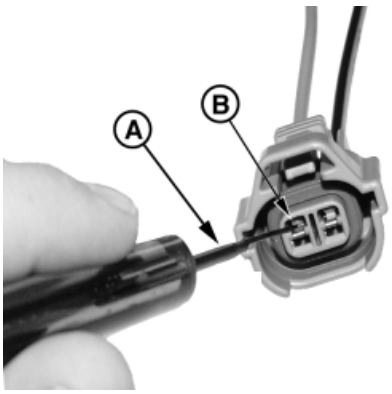
Repair YAZAKI™ Connectors

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

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

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

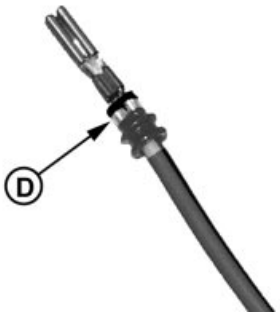
A—Terminal Extraction Tool
B—Connector Locking Tang
C—Terminal Crimping Tool
D—Crimped Cable Seal



RG11676 –UN–05FEB01

TS0136 –UN–23AUG88

RG11678 –UN–05FEB01



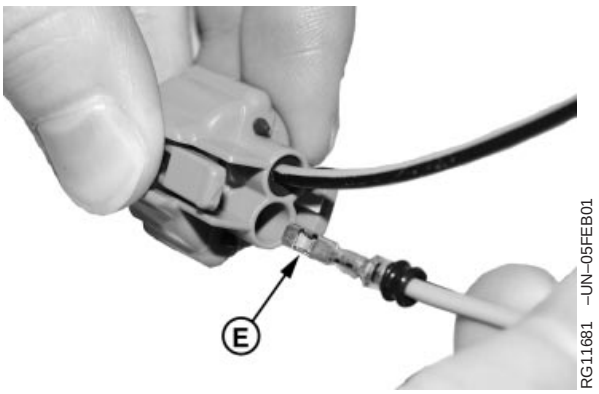
RG11680 –UN–05FEB01

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

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

Continued on next page

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



E—Terminal Orientation

RG40854,00000C8 –19–20MAY02–2/2

Section 03
Theory Of Operation

Contents

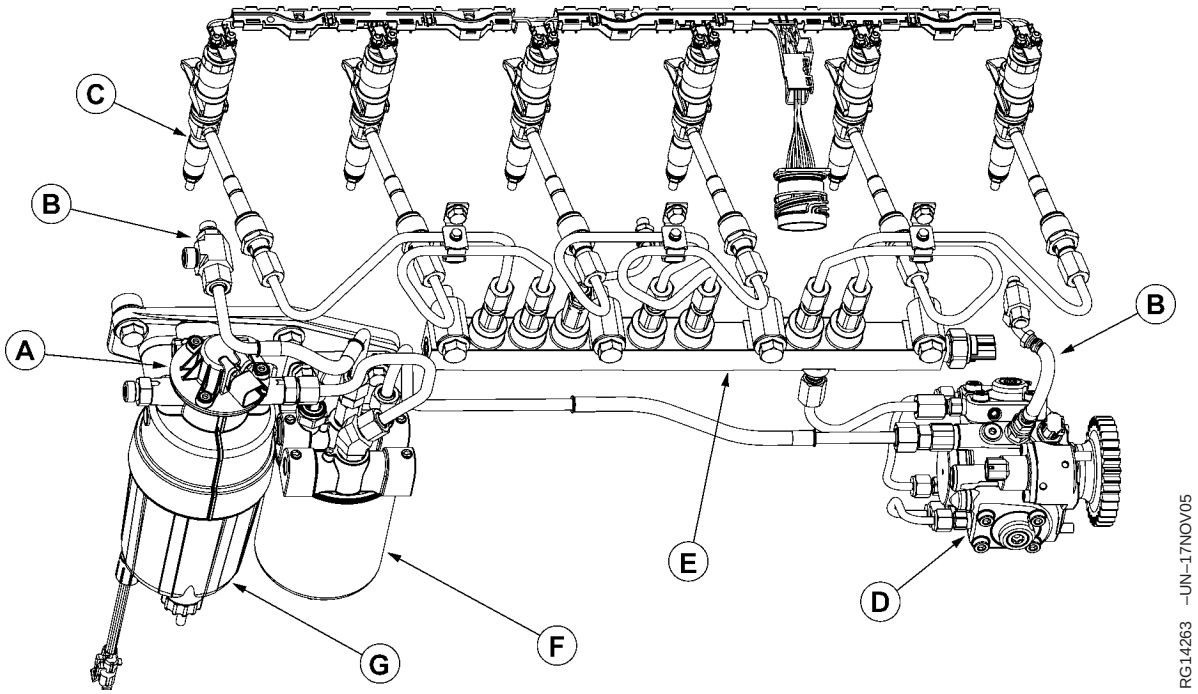
About This Group

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

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

RG40854,0000123 –19–26AUG05–1/1

Fuel System Operation



6090 Fuel System

A—Fuel Transfer Pump
B—Fuel Leak-Off Line
C—Electronic Injector
D—High Pressure Fuel Pump
E—High Pressure Common Rail
F—Secondary Fuel Filter
G—Primary Fuel Filter

The fuel transfer pump (A) draws fuel from the fuel tank through the primary filter (G) and pushes it through the secondary (final) fuel filter (F) to the high pressure fuel pump (D). The high pressure fuel pump raises fuel pressure to a predetermined pressure. This high-pressure fuel is routed into the high pressure common rail (HPCR) (E). The HPCR evenly distributes fuel to the electronic injectors (EIs) (C) which introduce fuel into their respective cylinders.

A passageway in the cylinder head collects the leak-off fuel from the injectors, HPCR, the fuel pump, and the secondary fuel filter. Injector leak-off fuel is collected internally, eliminating the need for external injector leak-off lines. Leak-off lines (B) on the HPCR pressure limiter, high pressure fuel pump overflow port, and the air/fuel bleed valve on the secondary fuel filter, route fuel to ports on the intake manifold which conect to the internal leak-off fuel passageway. A tee fitting at one of these leak-off ports connects the leak-off passageway to the back-to-tank line.

The Engine Control Unit (ECU) sends a current pulse signal in proper sequence to each EI. This signal momentarily enables the EIs to spray fuel into their respective cylinders. The length of time an EI injects fuel is determined by the ECU and the current operating conditions.

For component details, refer to the corresponding remove and install procedure in this Section. Also see Theory of Operation, Section 04.

RG40854,0000122 –19–17NOV05–1/1

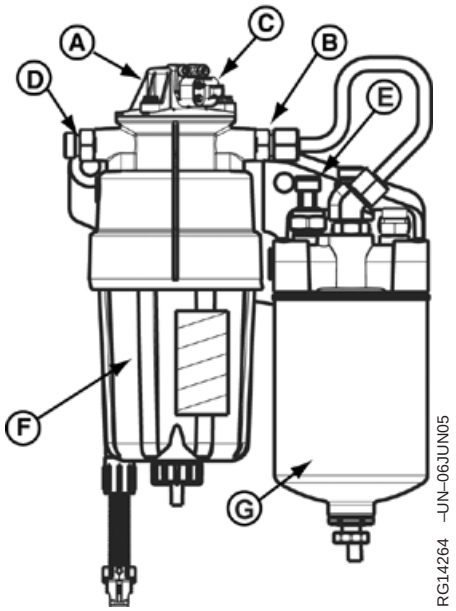
Fuel Transfer Pump Operation

NOTE: This pump is not repairable.

The speed of the fuel transfer pump (A) is controlled by the ECU and varies from 1600 to 4200 rpm. through the fuel transfer pump power connector (C). Suction pulls fuel from the fuel tank through the fuel inlet (D) and through the primary filter (F). The pump pushes fuel through the outlet (B) into the secondary filter (G) and on to the high pressure fuel pump.

To keep the low-pressure fuel error from setting, pump speed is controlled to keep a constant pressure of 20 kPa (2.9 psi) gage at the outlet of the secondary filter (G). The low-fuel-pressure-system fuel pressure sensor (E) is used to indicate a low pressure fuel system problem. It could be a plugged primary filter, secondary filter, an air leak between the fuel tank and the low pressure pump fuel inlet, or a plugged fuel tank screen.

There is a pressure limiter in the pump to protect the filters from damage.



Fuel Transfer Pump Assembly

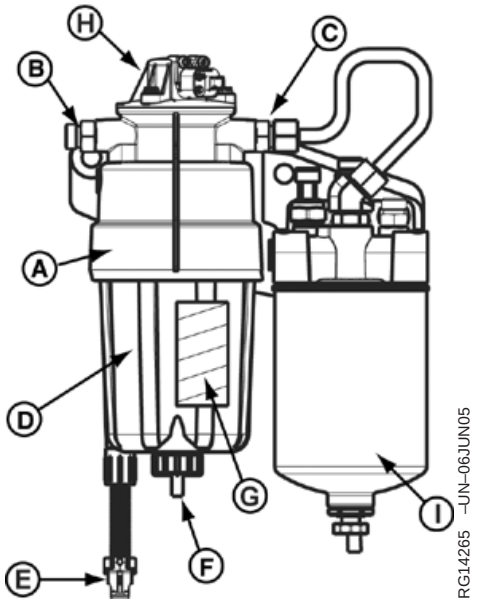
A—Fuel Transfer Pump
B—Fuel Outlet
C—Fuel Transfer Pump Power Connector
D—Fuel Inlet
E—Low Pressure Fuel Pressure Sensor
F—Primary Filter
G—Secondary Filter

RG40854,0000127 –19–04MAR05–1/1

Primary Filter Operation

The primary fuel filter is positioned before the fuel transfer pump (H) to protect the pump from the more coarse contaminants which could damage, clog, or get stuck in the pump diaphragm. Fuel enters the filter through the primary fuel inlet (B) at the primary filter head (A) and flows into the canister (D) and around the outside of the 10-micron filter element (G). Fuel flows up through the center of the filter element to the filter outlet (C) and on to the secondary filter (I).

Water and the heavier fuel contaminants settle to the bottom of the canister. Water and contaminants can be removed by using the fuel drain valve (F). Also incorporated in the assembly is a water-in-fuel sensor (E). This sensor is used to determine the quality of the fuel entering the system.



Primary Fuel Filter Assembly

A—Primary Filter Head
B—Primary Fuel Inlet
C—Primary Fuel Outlet
D—Primary Fuel Canister
E—Water In Fuel Sensor Connector
F—Primary Fuel Canister Drain Valve
G—Primary Fuel Canister Filter Element
H—Fuel Transfer Pump
I—Secondary Filter

RG40854,0000124 –19–04MAR05–1/1

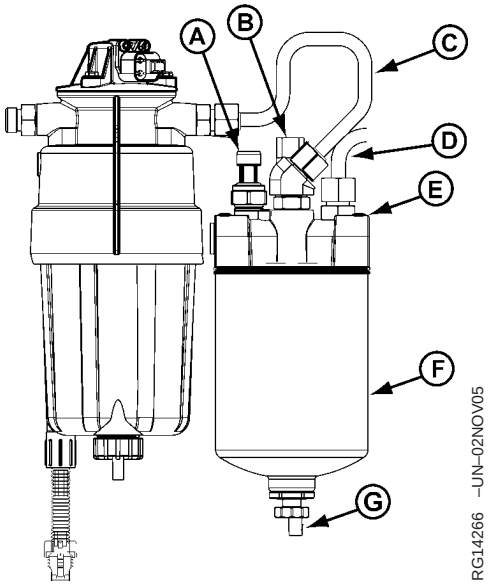
Secondary Fuel Filter Operation

Fuel enters the secondary filter header (E) at the secondary fuel inlet (C), flows through a 2-micron filter (F), exits through the secondary fuel outlet (D), and proceeds to the high pressure fuel pump.

Water and the heavier fuel contaminants settle to the bottom of the canister. Water and contaminants can be removed by using the secondary fuel filter drain valve (G).

The air bleed/check valve (B) opens at 14 kPa (2 psi) to allow a continuous flow of leak-off fuel through a 3 mm orifice. Air is automatically bleed from the low-pressure fuel system through this orifice.

The pressure sensor (A) is on the outlet side of the filter. Signals from this sensor are used by the ECU to maintain fuel pressure to the high pressure fuel pump. Also, if fuel supply pressure drops to -5 kPa (likely due to a clogged filter), the ECU will set a fault code.



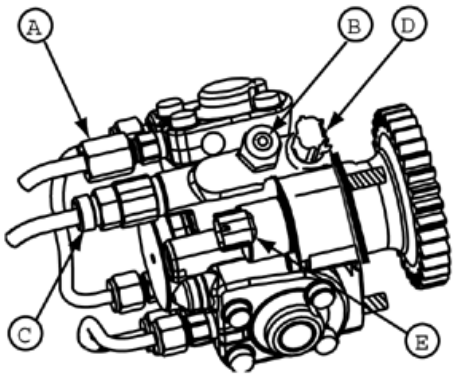
Secondary Fuel Filter Assembly

A—Pressure Sensor
B—Air Bleed/Check Valve
C—Secondary Fuel Inlet
D—Secondary Fuel Outlet
E—Secondary Filter Header
F—Secondary Fuel Filter Element
G—Secondary Fuel Filter Drain Valve

RG40854,0000126 –19–02NOV05–1/1

High Pressure Fuel Pump Operation

The 6090 high pressure common rail engine uses the Denso HP4 high pressure fuel pump. Filtered fuel enters the high pressure pump through the fuel inlet (A). A fuel temperature sensor (D) measures the temperature of the fuel just past the inlet filter. Once fuel passes through the inlet, it goes through an fuel inlet filter and continues through an internal transfer pump. Fuel is then routed either to lubricate the pump crankcase or to the internal fuel control valve. There are three high-pressure plunger chambers on this pump located 120 degrees from one another. Fuel in each chamber is pressurized when the pump drive shaft rotates. Each chamber is pressurized once per complete rotation of the engine. The engine takes two revolutions to fire all 6 injectors so each plunger chamber is pressurized twice for one complete firing of all 6 injectors. The pressurized fuel leave through the high pressure outlet (C). Excess fuel leaves the pump through the overflow port (B) and into the return-to-tank line. The over flow is controlled to a pressure less than 20 kPa (2.9 psi).



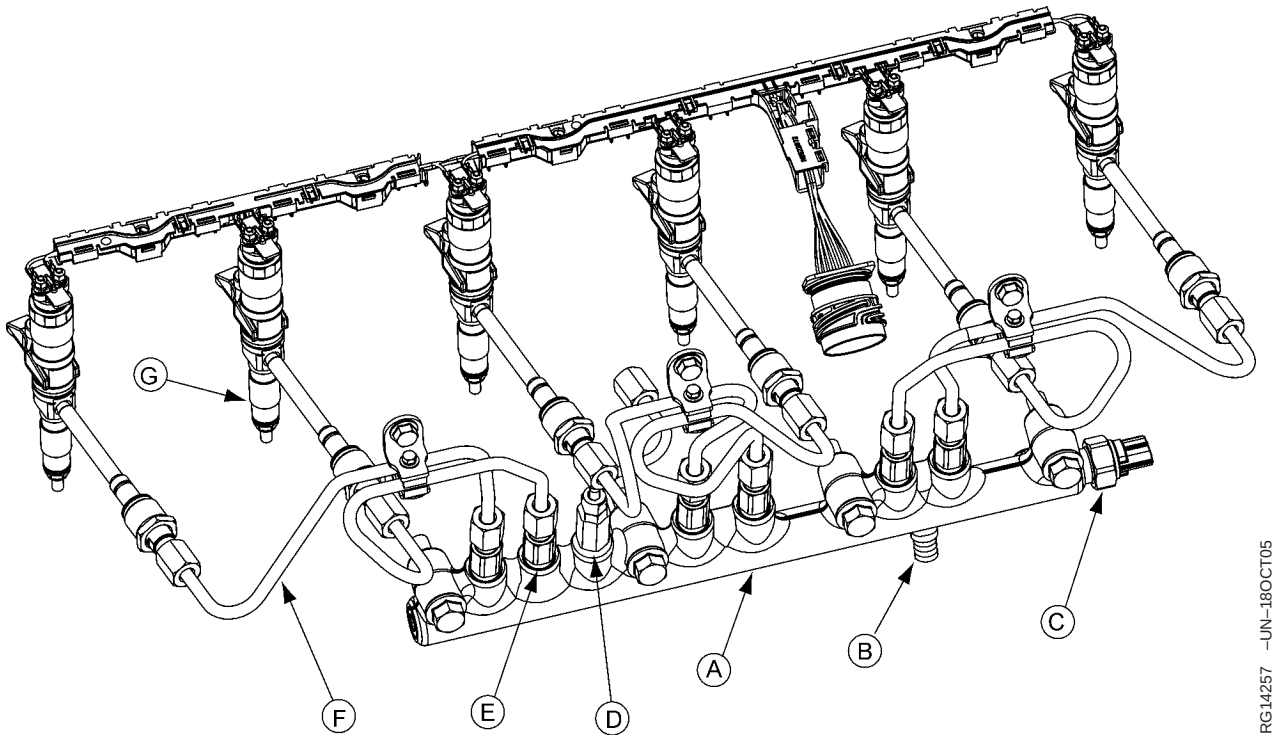
RG14267 –UN–06JUN05

High Pressure Pump Assembly

A—Fuel Inlet
B—Overflow Orifice
C—Fuel Outlet
D—Fuel Temperature Sensor
E—Pump Control Valve (PCV) Solenoid

RG40854,0000154 –19–26AUG05–1/1

High Pressure Common Rail (HPCR) Operation



High Pressure Common Rail Assembly

A—High Pressure Common Rail
B—High Pressure Fuel Inlet
C—Fuel Rail Pressure Sensor
D—Pressure Limiter
E—Flow Dampers
F—High Pressure Common Rail Delivery Lines
G—Electronic Injector (EI)

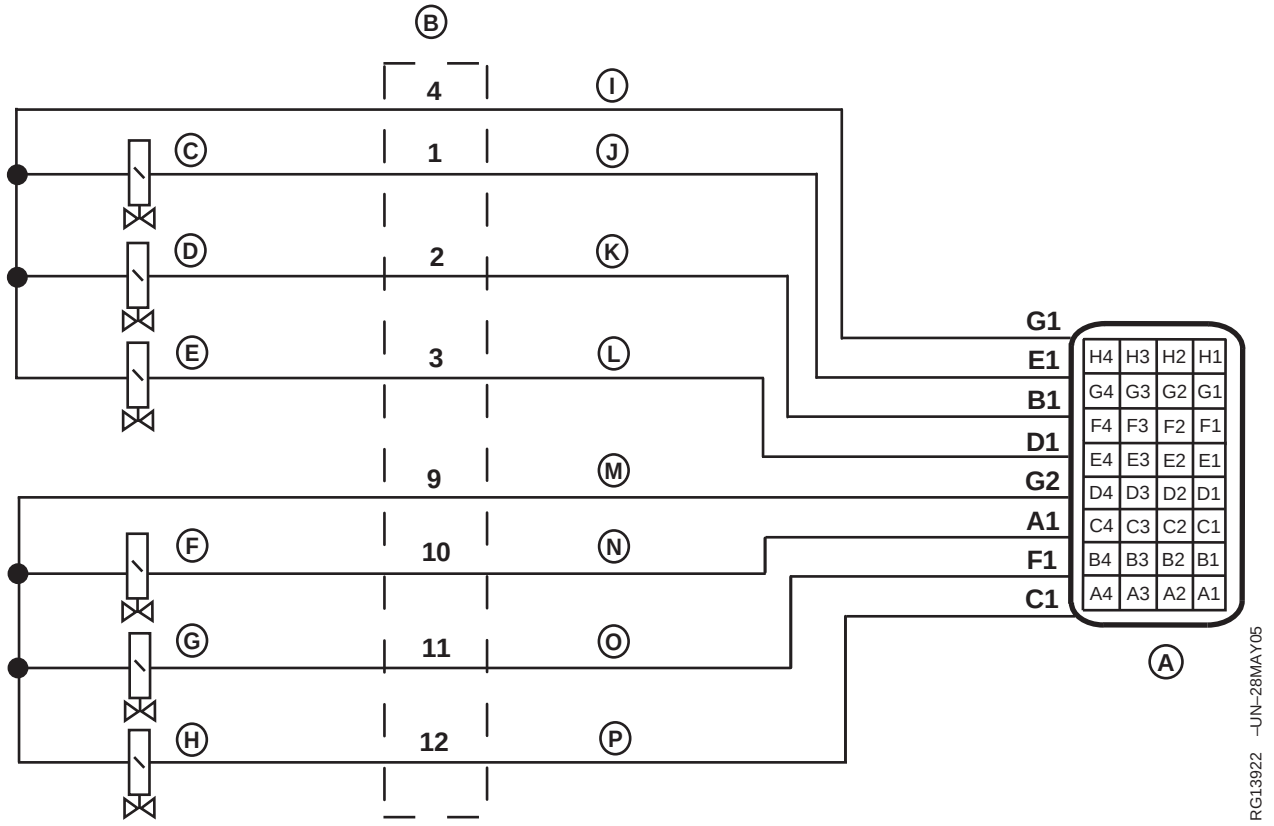
High pressure fuel is delivered to the high pressure common rail (HPCR) (A) through the high fuel pressure fuel inlet (B) from the high pressure fuel pump. The high pressure common rail delivery lines (F) transport the fuel to the electronic injectors (EIs) (G). The fuel rail pressure sensor (C) detects the fuel pressure inside the rail. The engine control unit uses this sensor to monitor the fuel pressure to determine how long to keep the high pressure fuel pump fuel control valve open.

If an abnormally high pressure is generated within the HPCR, the pressure limiter (D) opens to release the excess pressure and drain fuel back to the tank.

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

RG40854,0000153 –19–26AUG05–1/1

Electronic Injector (EI) Operation



ECU to EI Connections

A—ECU Harness Connector #J1
B—EI Interconnect Connector (Cylinder Head)
C—Cylinder #1 Injector
D—Cylinder #2 Injector
E—Cylinder #3 Injector
F—Cylinder #4 Injector
G—Cylinder #5 Injector
H—Cylinder #6 Injector
I—1-3 Cylinder 90V Supply
J—Cylinder #1 EI Control Wire
K—Cylinder #2 EI Control Wire
L—Cylinder #3 EI Control Wire
M—4-6 Cylinder 90V Supply
N—Cylinder #4 EI Control Wire
O—Cylinder #5 EI Control Wire
P—Cylinder #6 EI Control Wire

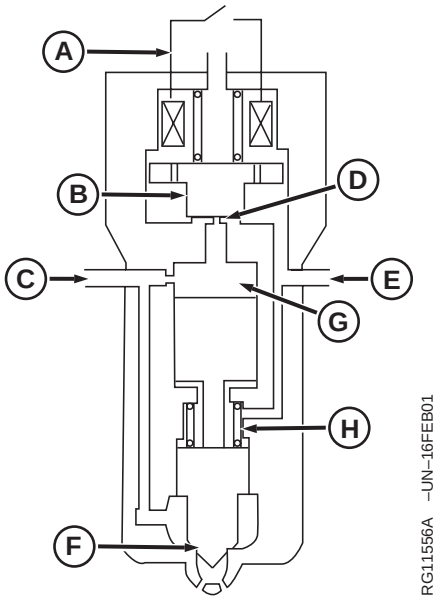
The electronic injectors (EIs) are located inside the engine's cylinder head and are electronically controlled by the ECU. The amount of fuel delivered to the cylinder is in direct proportion with the length of time current is supplied to the two-way electromagnetic valve (TWV) on each EI. The ECU sends a signal in specific sequence to each EI. This controls the volume of fuel, the timing of delivery, and the rate of delivery for each EI. Once the fuel enters the EI, the high pressure overcomes the nozzle valve allowing the fuel to spray into the respective cylinder. Excess fuel from the nozzle routes through the fuel return line and back to the fuel tank.

Continued on next page

EI - No Injection

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

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



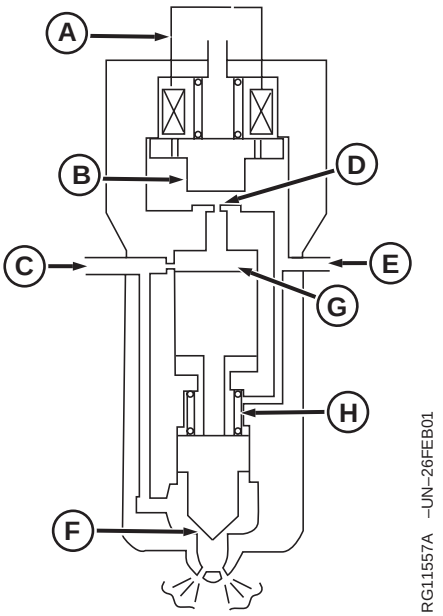
No/Ending Injection

RG40854,0000128 –19–28JAN05–2/4

EI - Begin Injection

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

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



Begin Injection

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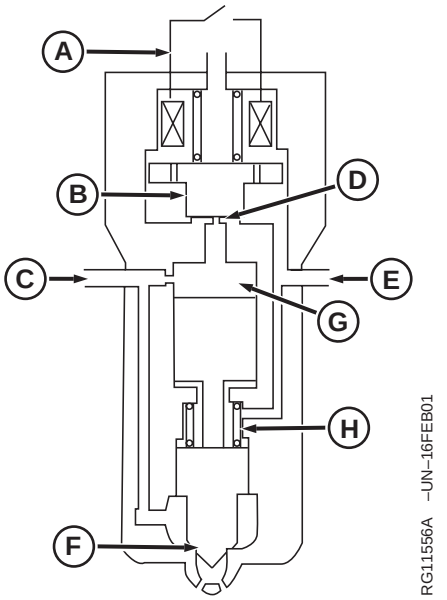
RG40854,0000128 –19–28JAN05–3/4

EI - Ending Injection

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

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



No/Ending Injection

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About This Group

In this group, the electronic air system information is described under the following headings:

- VGT-EGR System Operation
- Turbocharger
- Turbo Actuator
- EGR Cooler
- EGR Valve
- Air Intake Manifold

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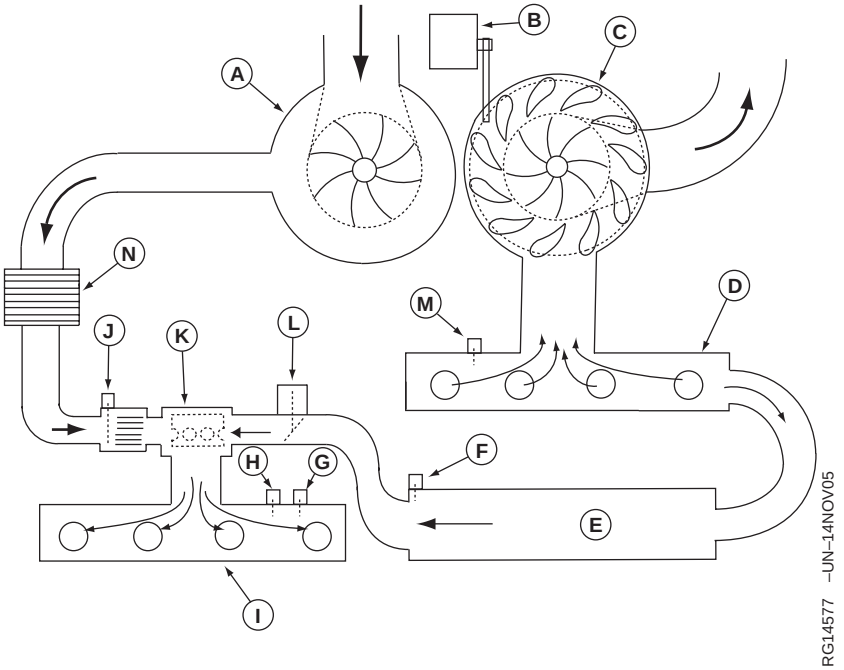
VGT-EGR System Operation



Variable Geometry Turbocharging (VGT)—Exhaust Gas Recirculation (EGR) System Diagram

A—Compressor
B—VGT Actuator
C—Turbine
D—Exhaust Manifold
E—EGR Cooler
F—EGR Exhaust Temperature Sensor
G—Manifold Pressure Sensor
H—Mixed Air Temperature Sensor
I—Intake Manifold
J—Fresh Air Temperature Sensor (on air heater)
K—EGR Charge Air Mixing Chamber
L—EGR Valve
M—Exhaust Pressure Sensor
N—Charge Air Cooler

The Variable Geometry Turbocharger (VGT) system uses moveable vanes in the exhaust turbine housing (C) to restrict the flow of exhaust gasses. This decreases gas pressure to the turbine but increases gas velocity. Increased velocity of gas hitting the blades causes the turbo to turn faster.

Also, while gas pressure is decreased to the turbine when the vanes close, pressure is increased inside the exhaust manifold (D). This pressure is also used to increase charge air pressure. When pressure rises inside the exhaust manifold due to increased load and the turbine vanes closing, the EGR (exhaust gas recirculation) valve (L) will open to allow a portion of the exhaust gas to bypass the turbocharger through the EGR cooler (E) and be routed to the intake manifold (I).

Between the EGR valve and the intake manifold is the charge air mixing chamber (K) where the cooled exhaust gasses are mixed with the cooled intake air. Under full load conditions, as much as 10-12% of the intake air is exhaust gases. The combined pressure of the exhaust gasses and the turbocharged air boosts the charge air pressure for increased power and reduced emissions.

The EGR and VGT are both performance and emission control features and provide the following benefits:

- an efficient means of reducing NOX emissions.
- enhanced engine performance by allowing more advanced dynamic timing.
- lower cylinder temperatures due to reduced oxygen in the combustion process.
- reduced soot due to lower cylinder temperatures.
- engines that meet or exceed fuel economy goals and emissions regulations.
- improved performance at high altitudes.

Continued on next page

For additional information on the VGT/EGR components, refer to the following pages.

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Turbocharger

The turbocharger, which is a turbine driven by exhaust gases, allows the engine to produce additional power using waste exhaust gas. Exhaust gases power the turbine to turn the compressor which draws in and pumps the intake air (“charge air”) to the intake manifold.

This engine employs a Variable Geometry Turbocharger (VGT), which uses moveable vanes in the exhaust turbine housing to restrict the flow of exhaust gasses. This decreases gas pressure to the turbine but increases gas velocity. Increased velocity of gas hitting the blades causes the turbo to turn faster.

While gas pressure is decreased to the turbine when the vanes close, pressure is increased inside the exhaust manifold (D). This pressure is also used to increase charge air pressure. When pressure rises inside the exhaust manifold due to increased load and the turbine vanes closing, the EGR (exhaust gas recirculation) valve will open to allow a portion of the exhaust gas to bypass the turbocharger through the EGR cooler and be routed to the intake manifold.

When air is compressed its temperature rises, so before entering the intake manifold, the charge air is routed through an air cooler to increase the air’s density, resulting in more air entering the combustion chambers. For more turbocharger information, refer to the Base Engine manual.

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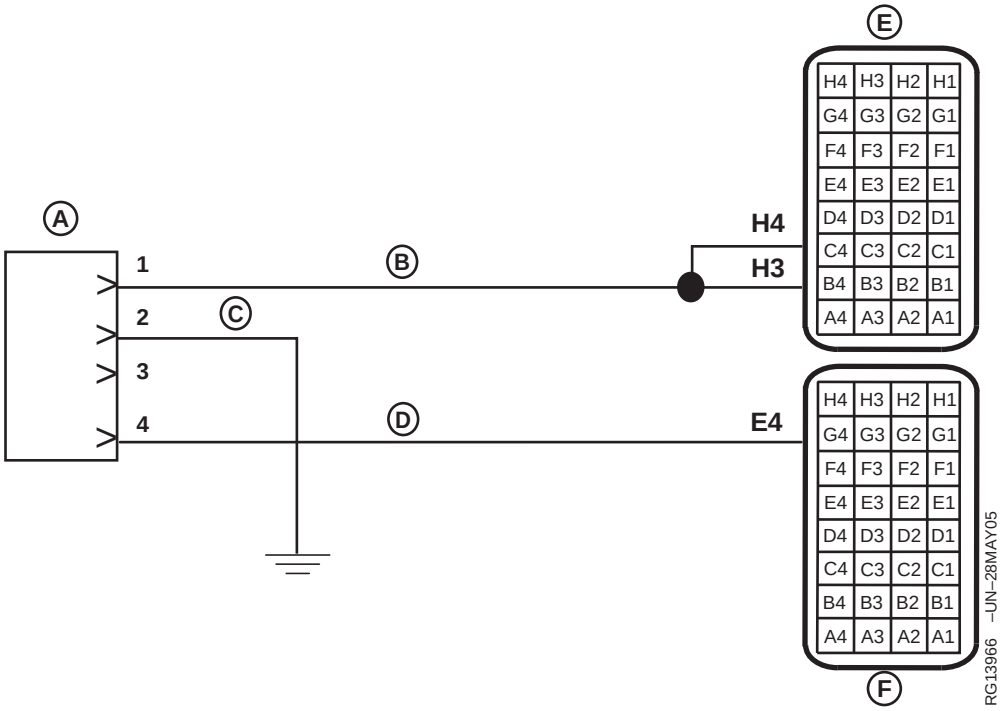
Turbo Actuator



VGT Actuator Schematic

A—Turbo Actuator
B—H-Bridge
C—Turbo Actuator Ground Circuit
D—Turbo Actuator Command Circuit
E—ECU Connector J1
F—ECU Connector J3

The Variable Geometry Turbocharger (VGT) uses an electronically controlled actuator to move the vanes in the exhaust turbine housing. The VGT vanes allow exhaust gas pressure to be increased or decreased based on engine load demand and speed. They work by restricting the flow of exhaust gasses, which decreases gas pressure to the turbine but increases gas velocity. Increased velocity of gas hitting the blades causes the turbo to turn faster.

Various sensor inputs are used by the engine control unit (ECU) to continuously calculate a desired level of boost. The ECU sends analog signals to the actuator to move the vanes and EGR (exhaust gas recirculation) valve accordingly to ensure availability of proper exhaust pressures for EGR/fresh air mixing.

The variable output capability of the VGT provides the ability to increase low speed torque, provide a quicker transient response, and increase peak torque while also improving fuel economy. As engine speed and load demands increase, the ECU signals the VGT actuator to close the vanes on the turbine. This drives exhaust gas pressures and velocities upward, which in turn increases engine boost. The increase in boost pressures also limits smoke and reduces emission particulates released to the atmosphere.

To keep the actuator's circuit board from overheating, engine coolant plumbed from the coolant pump is circulated through the actuator and returned to the thermostat housing. For more actuator information, refer to the Base Engine manual.

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EGR Cooler

Before exhaust gasses reach the EGR (exhaust gas recirculation) valve, the gasses are cooled in the exhaust gas cooler. The gasses travel through internal tubes surrounded by engine coolant. The coolant is routed from the intake manifold, through the cooler, and returned to the intake manifold. The cooler is a counter-flow design, which means that engine coolant flows in the opposite direction of the exhaust gases.

Exhaust gases enter the cooler at 450-750°C and exit at 170-250°C.

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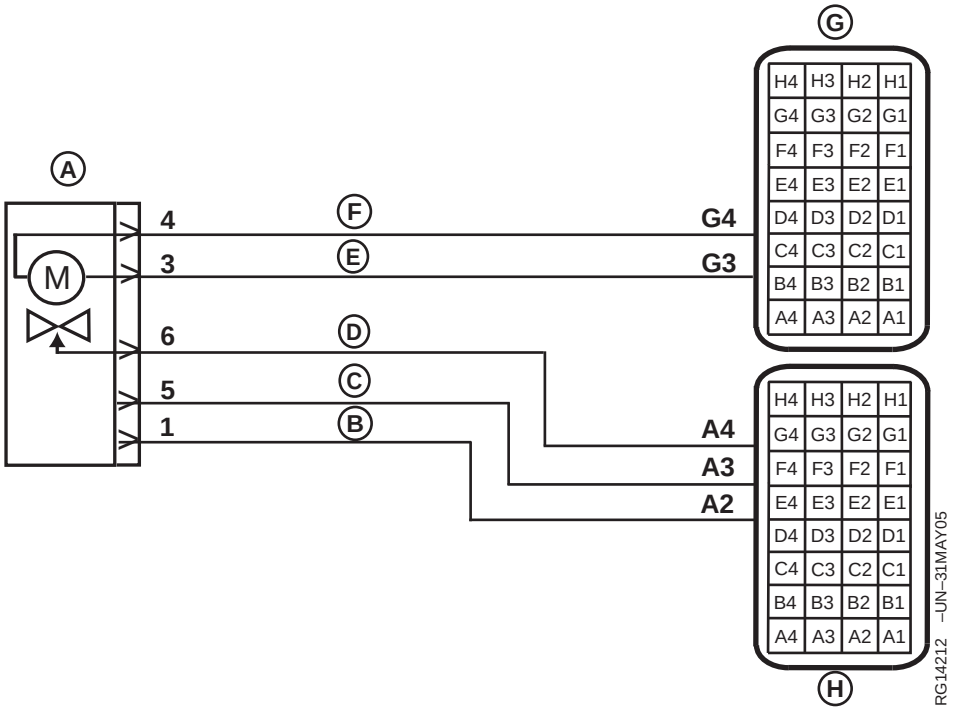
EGR Valve



EGR Valve Schematic

A—EGR Valve
B—EGR Valve Position 5V Supply
C—EGR Valve Position Ground
D—EGR Valve Position Input
E—H-Bridge +
F—H-Bridge -
G—ECU Connector #J1
H—ECU Connector #J3

The Exhaust Gas Recirculation (EGR) valve is part of the intake manifold assembly. The function of the EGR valve, controlled by the engine ECU, is to mix given volumes of exhaust gases with the intake air. The mixture of exhaust gases and intake air increases engine boost allows more air to be introduced into the combustion chamber. This in turn allows more fuel to be introduced to the combustion process, driving power levels upward. (2). Diluting the intake air with as much as 10-12% exhaust gases (full load conditions) aids in controlling NOX (nitrous oxide) emissions.

The valve becomes functional when the engine is under load and the engine coolant is at operating temperature. At startup and under light load conditions, the valve remains closed.

According to engine load and/or speed requirements and inputs from various temperature and pressure sensors, the ECU calculates the appropriate analog “command” signal for the EGR valve. Valve position will change as the ECU varies the signal to regulate the amount of EGR allowed into the air intake manifold.

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Air Intake Manifold

Both recirculated exhaust gas and fresh air enter the air intake manifold through their respective ports. Sensors on the manifold that measure fresh air (from air cooler) and mixed air temperatures are monitored by the ECU. Also, a manifold air pressure sensor sends pressure information to the ECU. The ECU can then determine if the desired mixture and amount of air is present for the current operating condition. This EGR/air mixture is drawn into the engine piston chambers to be mixed with fuel and ignited.

DB92450,000000A –19–22MAR05–1/1

About This Group

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

- Electronic Control System Terminology
- Electronic Control System Operation
- Sensor Locations
- Electronic Control System Overview
- Monitoring Engine Parameters
- Measuring Temperature
- Engine Control Unit (ECU) Temperature Sensor
- Engine Coolant Temperature (ECT) Sensor
- Exhaust Gas Recirculation (EGR) Exhaust Temperature Sensor
- Exhaust Gas Recirculation (EGR) Fresh Air Temperature Sensor
- Exhaust Gas Recirculation (EGR) Mixed Air Temperature Sensor
- Fuel Temperature Sensor
- Turbo Compressor Inlet Temperature Sensor
- Turbo Turbine Inlet Temperature
- Measuring Pressure
- Barometric Air Pressure (BAP) Sensor
- Exhaust Pressure Sensor
- Fuel Rail Pressure Sensor
- Fuel Transfer Pump Pressure Sensor
- Manifold Air Pressure Sensor
- Oil Pressure Sensor
- Measuring Throttle Position
- Analog Throttle
- Multi-state Throttle
- Dual-state Throttle
- Tri-state Throttle
- Ramp Throttle
- Measuring Speed
- Crank Position Sensor
- Turbo Speed Sensor
- Pump Position Sensor
- Pump Control Valve (PCV)
- Water in Fuel (WIF) Sensor
- Engine Coolant Level Switch
- Sensor Supply #1
- Sensor Supply #2
- Sensor Supply #3
- Sensor Supply #4
- Sensor Supply #5
- Electronic Injector (EI) Wiring Harness Connector
- Engine Control Unit (ECU)
- Controlled Area Network (CAN)
- Intake Air Heater Operation
- Cruise Control Operation
- Engine Protection
- Derate Programs
- Multiple Torque Curve Selection
- Governor Droop Mode Selection

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Electronic Control System Glossary of Terms

Actuator	A device controlled by the (ECU) to perform a certain function.
Analog	Signal which has a continuous range of possible voltages. Usually 0 to 5 volt or 0 to 12 volt signals.
Boost	Air pressure in the intake manifold.
CAN	Controller Area Network. The network on vehicles that allows communication between controllers.
DTC	Diagnostic Trouble Code. A code which is stored in the ECU's memory when the ECU detects a problem in the electronic control system.
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.
EGR	Exhaust Gas Recirculation. This is the process of returning some of the exhaust gas back into the intake manifold and mixing it with the fresh air coming in. This is done to help reduce certain types of emissions.
ECU	Engine Control Unit. The computer which controls the fuel, air, and ignition systems on the engine. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
EUI	Electronic Unit Injector. An EUI is an electronically controlled injection pump and injector combined. The ECU controls the start of injection and the amount of fuel injected by energizing and de-energizing the solenoid in the EUI valve housing. See or ELECTRONIC UNIT INJECTOR (EUI) OPERATION ON THE SINGLE RAIL FUEL SYSTEM in Group 130 for details.
FMI	Failure Mode Identifier. The second part of a two-part code that identifies control system fault codes according to the J1939 standard. The FMI identifies the type of failure that has occurred. The first half of the code is the Suspect Parameter Number (SPN).
MAP	Manifold Air Pressure. Pressure of the air in the intake manifold. see MEASURING PRESSURE later in this group.
MAT	Manifold Air Temperature (sensor). Measures the temperature of the air in the intake manifold. See MEASURING TEMPERATURE later in this Group for details.
Multi-State	A type of throttle that allows the engine to run between 1-3 set engine speeds.
PDM	Parallel Data Module. Device used as part of SERVICE ADVISOR™ that allows communication with the ECU.
Pilot Injection	During low temperature conditions the fuel is injected into the cylinder in two or more pulses. The first pulse is the smaller of the two and is called the pilot pulse. This helps ignite the main pulse and makes engine starts faster. There is a noticeable increase in diesel knock when the engine goes out of pilot mode.
PROM	Programmable, Read-Only Memory. The computer chip which contains the calibration information for the engine control system. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
PWM	Pulse Width Modulation. A digital signal (not analog) which consists of a pulse generated at a fixed frequency. When an actuator is controlled by a PWM signal, the on time of the signal is increased or decreased (modulated) to increase or decrease the output of the actuator.
RAM	Random Access Memory. The portion of computer memory within the ECU which changes as the engine is running and is stored while the engine is off. See ENGINE CONTROL UNIT (ECU) later in this Group for details.

Continued on next page

Sensor	Device used by the ECU to monitor various engine parameters.
Service Advisor	Service Advisor (SA). The tool used to read and clear DTCs, read sensor and actuator data, and perform engine tests. The SA consists of an Windows ('95, '98, '00) or NT compatible computer and 2 kits available from John Deere Distribution Service Center (DSC): JDIS121 - ECU Communication Hardware Kit and the software which is available through the John Deere Dealer Website.
SPN	Suspect Parameter Number. The first half of a two-part code that identifies control system fault codes according to the J1939 Standard. The SPN identifies the system or component that has the failure. The second half of the code is the Failure Mode Identifier (FMI).
TPS	Throttle Position Sensor. The TPS measures the position of the throttle, which is controlled by the machine operator. See MEASURING THROTTLE POSITION later in this Group for details.
WIF	Water In Fuel Sensor. The WIF detects water in fuel in the water separator bowl on the fuel filter housing.

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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 Electronic Control Unit (ECU). This energizes the ECU and allows it to "boot-up" and ready itself for engine start.

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

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

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

Engine Running Mode

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

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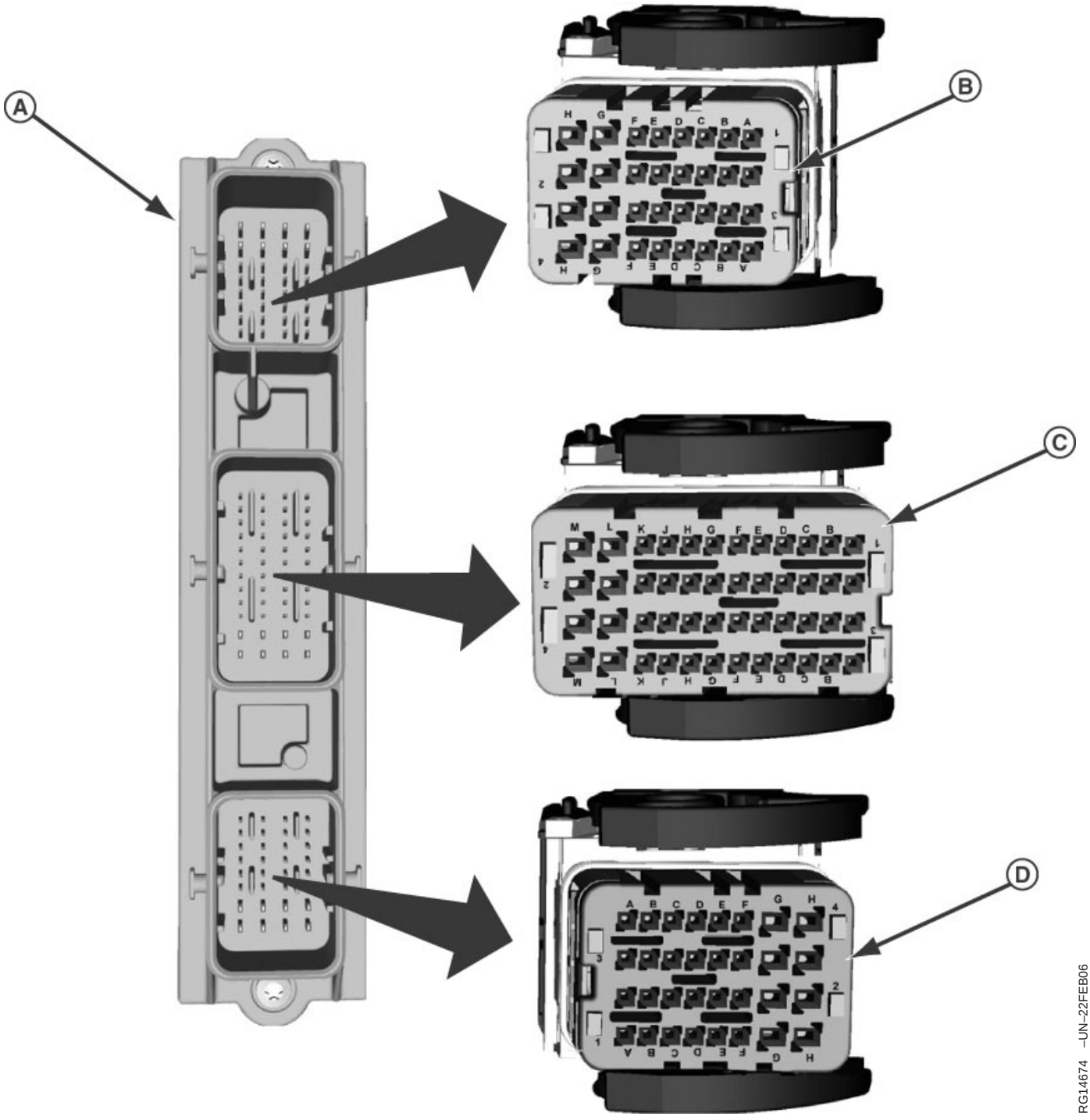
Engine Control Unit (ECU) Self-Diagnosis



Deere ECU and Harnesses Connectors

A—ECU Connector Assembly

B—Engine Harness Black Connector (turned 90° counter clockwise)

C—Control Panel Harness Red Connector (turned 90° clockwise)

D—Engine Harness Blue Connector (turned 90° counter clockwise)

Continued on next page

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

There are two types of DTCs:

- Active
- Stored

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

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

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

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

SPN/FMI CODES

SPN/FMI codes are written from the SAE J1939 standard as a two part code. The first part is called the Suspect Parameter Number (SPN). Typically, it contains between 2 and 6 digits. The SPN identifies the system or the component that has the failure; for example SPN 110 indicates a failure in the engine coolant temperature system. 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 14 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™, to display active and stored DTCs. When using SERVICE ADVISOR™ the codes will be displayed in an XXXXXX.YY format. For example, 110.03 will be displayed as 000110.03.

WARNING LAMP

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

CLEARING STORED DTCs

Stored DTCs can be cleared through SERVICE ADVISOR.™.

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SERVICE ADVISOR

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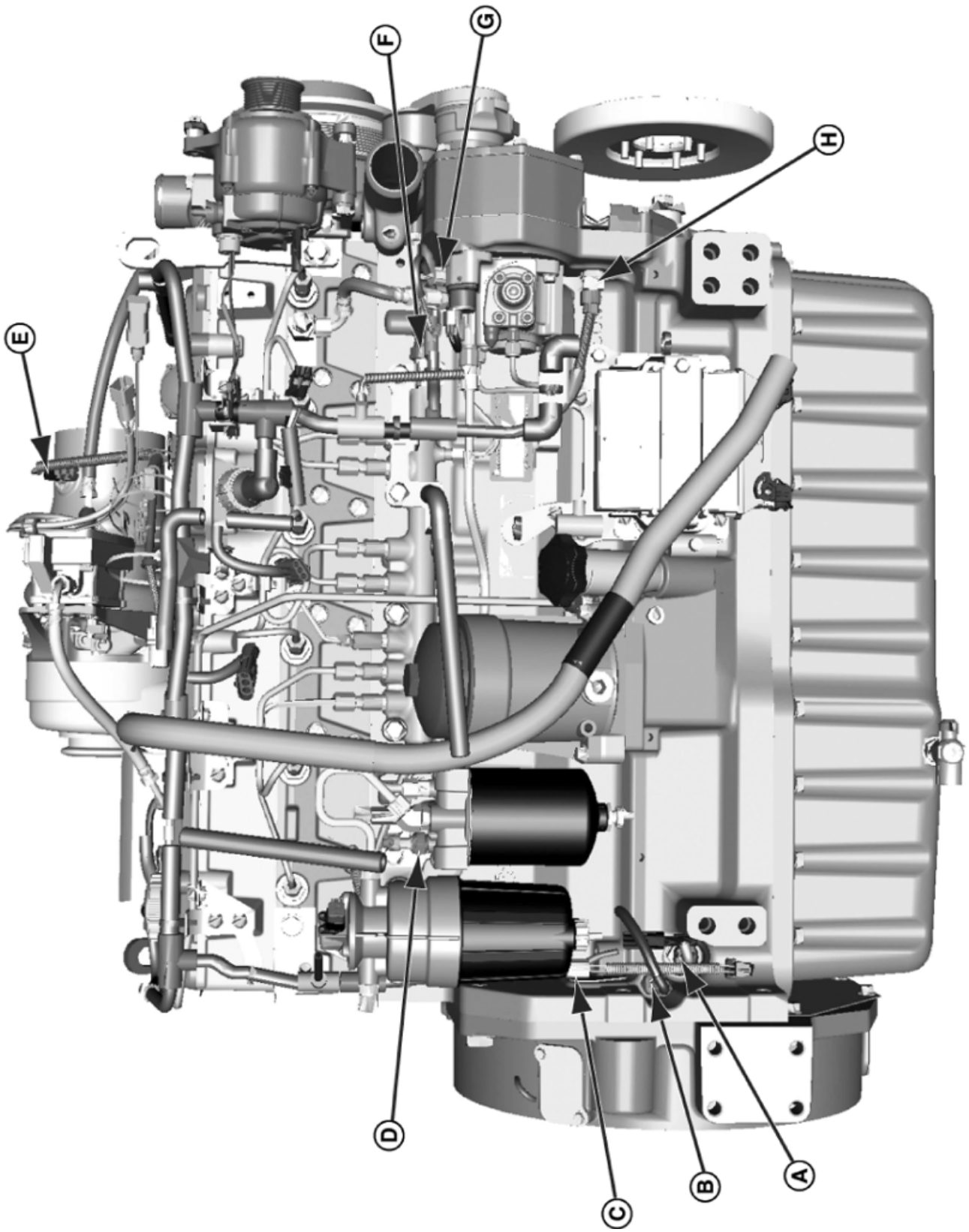
Sensor Locations



Electronic Control System Overview for a Single Rail System, Fuel Side

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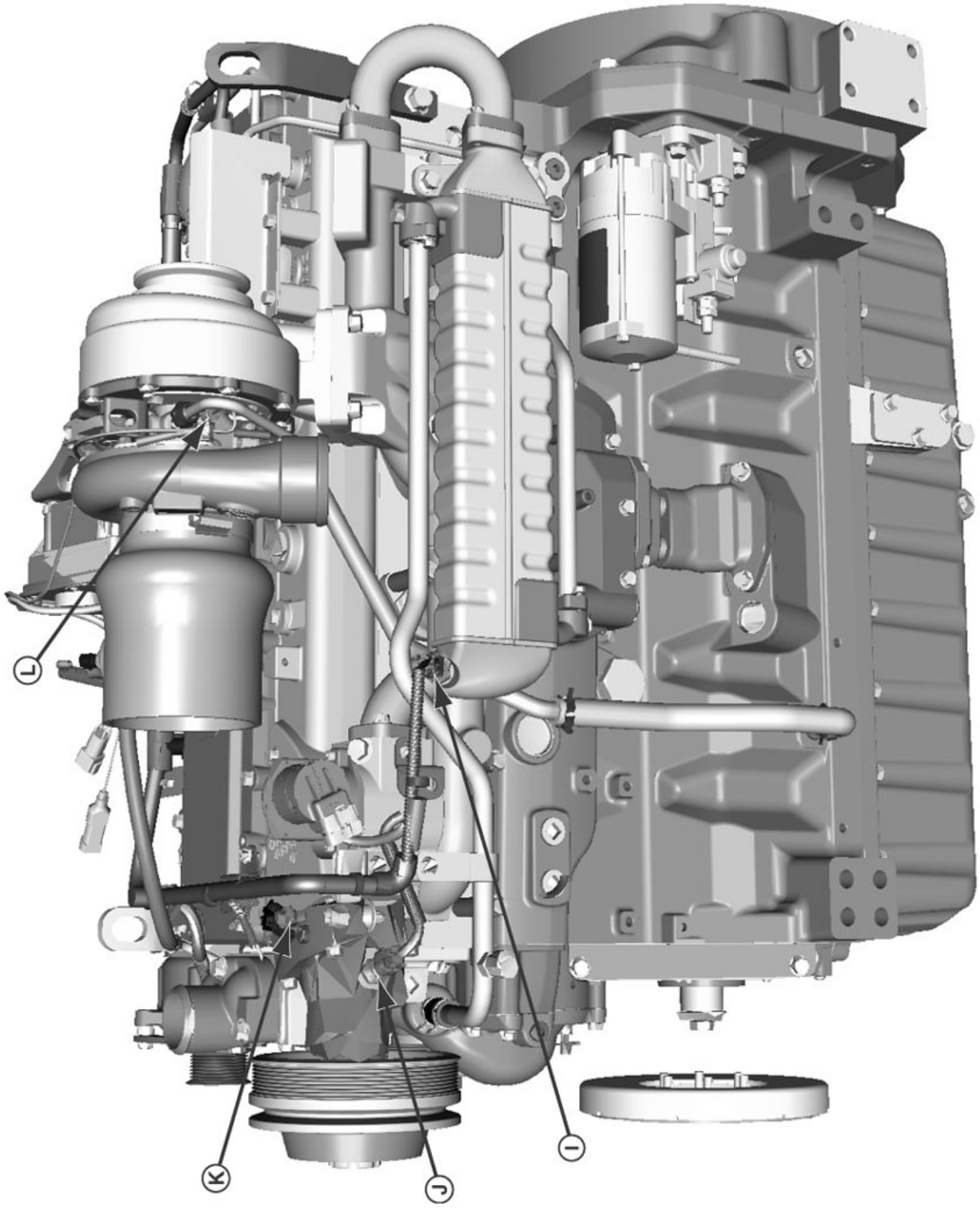

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Electronic Control System Overview for a Single Rail System, EGR Side

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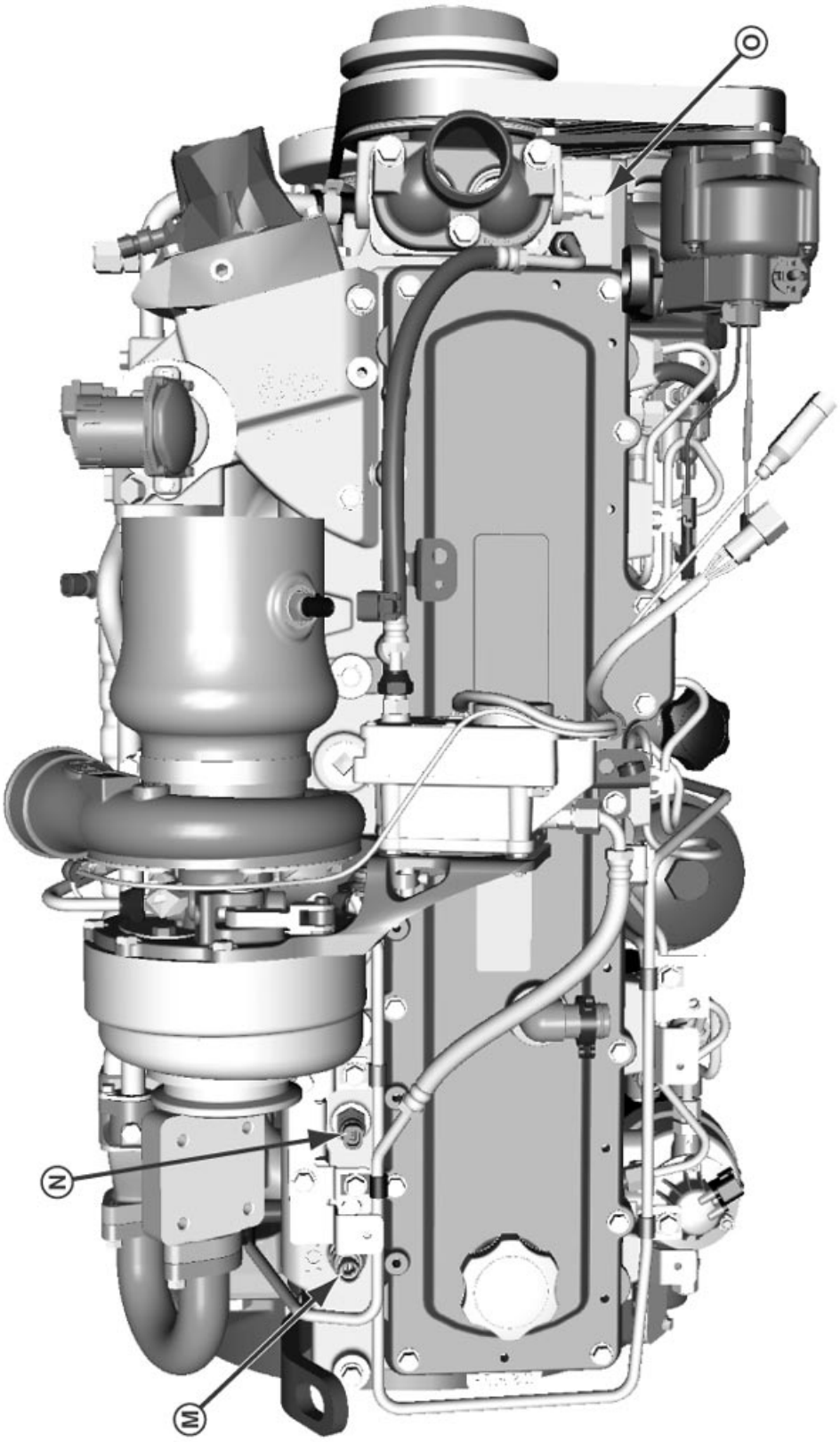

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Electronic Control System Overview for a Single Rail System, Top View

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A—Crank Position Sensor
B—Oil Pressure Sensor
C—Water in Fuel (WIF) Sensor
D—Fuel Pressure Sensor
E—Compressor Inlet Temperature Sensor
F—Fuel Rail Pressure Sensor
G—Fuel Temperature Sensor
H—Cam Position Sensor
I—Exhaust Gas Recirculation (EGR) Temperature Sensor
J—Fresh Air Inlet Temperature Sensor
K—Manifold Air Pressure (MAP) Sensor
L—Turbo Speed Sensor
M—MAP Sensor
N—Mixed air and EGR Temperature Sensor
O—Engine Coolant Temperature (ECT) Sensor

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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 and, on some applications to provide engine protection, the following engine parameters are monitored by the ECU:

- Crank Position
- Engine Control Unit (ECU) Temperature
- Engine Coolant Temperature (ECT)
- Exhaust Gas Recirculation (EGR) Exhaust Temperature
- Exhaust Gas Recirculation (EGR) Fresh Air Temperature
- Exhaust Gas Recirculation (EGR) Mixed Air Temperature
- Exhaust Gas Recirculation (EGR) Valve
- Exhaust Pressure
- Fuel Rail Pressure
- Fuel Temperature
- Fuel Transfer Pump Pressure
- Manifold Air Pressure (MAP)
- Oil Pressure
- Pump Control Valve
- Pump Position
- Throttle Position
- Turbo Compressor Inlet Temperature
- Turbo Speed
- Turbo Turbine Inlet Temperature
- Water In Fuel (WIF)

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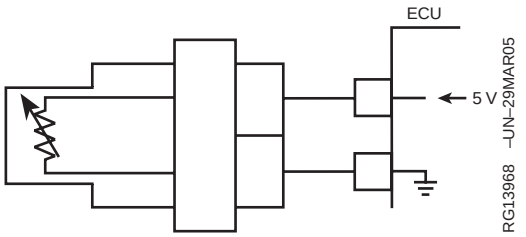
Measuring Temperature

The Engine Coolant (ECT), Oil, Fuel, Compressor Inlet, and Exhaust Gas Recirculation (EGR) Temperature Sensors are thermistors - temperature-sensitive, variable resistors. The Engine Control Unit (ECU) sends 5 volts to the sensor. Resistance of the sensor increases as the temperature to which it is exposed increases (negative temperature coefficient), in return causes a larger voltage drop across it. The ECU monitors the voltage drop across the sensor and compares the voltage drop to pre-programmed values in its memory. This is done to determine the temperature, and whether that temperature is within acceptable limits.

The ECU has the ability to derate the engine power or shut down the engine in an attempt to protect the engine and its components. If certain temperatures exceed the threshold, the ECU will enable the engine protection. For more information on engine protection and derate programs, see ENGINE PROTECTION and/or DERATE PROGRAMS both later n this Group.



Typical Temperature Sensor Schematic

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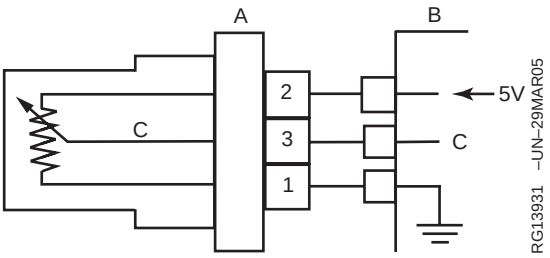
Measuring Pressure

All engine pressure sensors (A) are 3-wire variable resistors. As pressure changes, sensor resistance changes. The ECU (B) supplies the sensor with a 5-volt reference voltage and monitors the input voltage from the sensor input wire (C). As pressure increases, the wiper arm of pin 3 is moved toward pin 2. This causes an increased voltage drop across pins 1 and 3. The ECU compares the voltage drop to a pre-programmed value in the ECU's memory to determine the correct pressure.

The ECU has the ability to derate the engine power or shut down the engine in an attempt to protect the engine and its components. If certain temperatures exceed the threshold, the ECU will enable the engine protection. For more information on engine protection and derate programs, see ENGINE PROTECTION and/or DERATE PROGRAMS both later n this Group.



Typical Pressure Sensor Schematic

A—Pressure Sensor
B—ECU
C—Pressure Input

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Measuring Speed

Speed sensors operate by detecting notches or flat spots on their corresponding gear/timing wheel/shaft. When a tooth/notch/flat spot (timing device) on the gear/timing wheel/shaft is directly under the sensor, a voltage is induced. The sensors use an internal magnet to create this voltage signal from the timing device on their respective gear/timing wheel/shaft. The magnetic field is pulled towards the gear/timing wheel/shaft as the teeth pass directly under the sensor. As the root diameter (area between teeth) pass the sensor, the magnetic field moves back toward the sensor. This creates the voltage signal that the ECU monitors for timing and speed. When a notch (one or more missing teeth) passes under the sensor, the pattern of the signal changes. By monitoring these changes in the signal, the ECU calculates the speed and the cylinder number that is ready for injection. The ECU monitors both the crank position and pump position sensors to verify that they are in time with each other.

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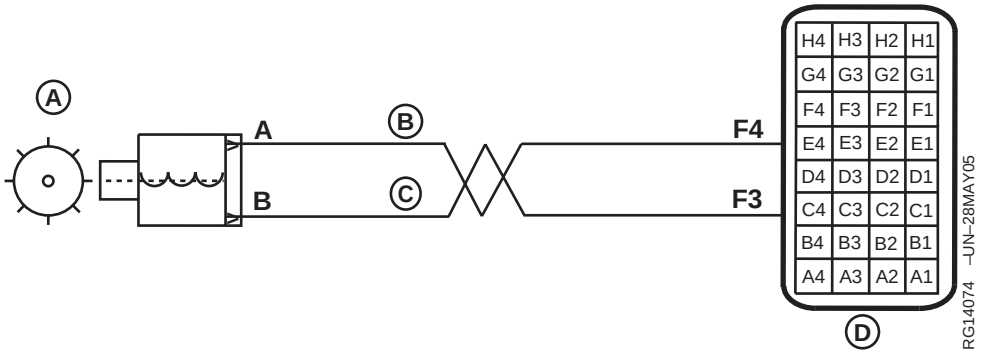
Crankshaft Position Sensor



Crankshaft Position Sensor Schematic

A—Crankshaft Position Sensor **C—Crankshaft Speed Return** **D—ECU Connector J3** **E—Crankshaft Gear**
B—Crankshaft Speed Input

The crankshaft position sensor is located on the rear of the engine under the primary filter near the oil pressure sensor. It is an inductive pickup type sensor that detects the cutouts on two adjacent teeth on the crankshaft gear.

The ECU uses the inputs of both the crankshaft position and pump position sensors to precisely control the timing and duration of fuel injection.

If there is a problem with the crankshaft position sensor, the ECU will use the pump position sensor to determine engine timing. This may require prolonged engine cranking to start the engine.

The ECU provides engine protection for crankshaft position sensor problems. For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

For more information on how speed sensors operate, see MEASURING SPEED earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

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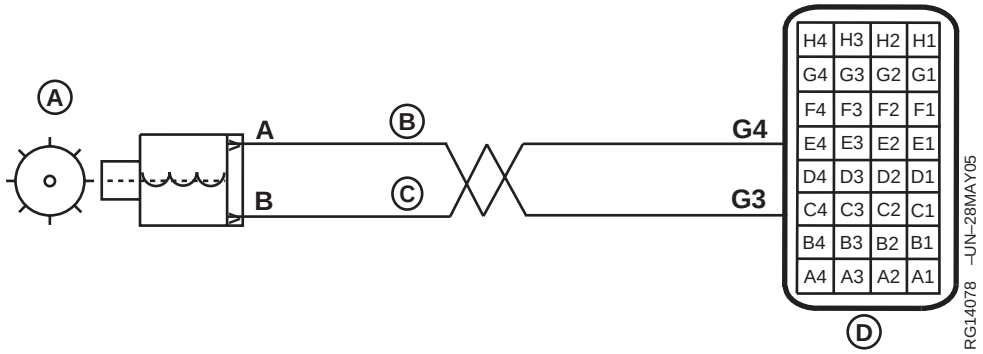
Pump Position Sensor



Pump Position Sensor Schematic

A—Pump Position Sensor **B—Pump Speed Input** **C—Pump Speed Return** **D—ECU Connector J3**

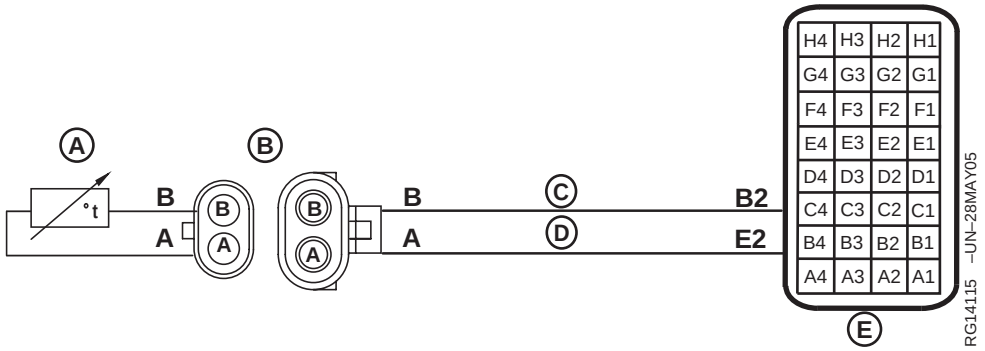
The pump position sensor is located on the side of the high pressure fuel pump. It is an inductive type pickup sensor that detects notches on the auxiliary gear of the high pressure fuel pump camshaft. The auxiliary gear is composed of 6 evenly spaced notches with one additional notch offset to tell the ECU that cylinder #1 is approaching Top-Dead-Center. If there is a problem with the pump position sensor, the ECU will use the crank position sensor to determine engine timing. This may require prolonged engine cranking to start the engine.

For more information on how speed sensors operate, see MEASURING SPEED earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,0000036 –19–12SEP05–1/1

Exhaust Gas Recirculation (EGR) Exhaust Temperature Sensor



EGR Exhaust Temperature Sensor Schematic

A—EGR Exhaust Gas Temperature Sensor
B—EGR Exhaust Gas Temperature Sensor Connector
C—EGR Exhaust Temperature Ground
D—EGR Exhaust Temperature Input
E—ECU Connector J3

The EGR exhaust temperature sensor is located on the EGR cooler. The ECU uses this sensor to measure the temperature of the exhaust exiting the EGR cooler. The ECU then compares the temperatures of the EGR exhaust, EGR fresh air, and the EGR mixed air to determine if proper cooling and mixing has occurred. If the temperature is not correct, the ECU can adjust the signal going to the VGT actuator to compensate the mixture accordingly. The ECU also uses this sensor for engine protection purposes.

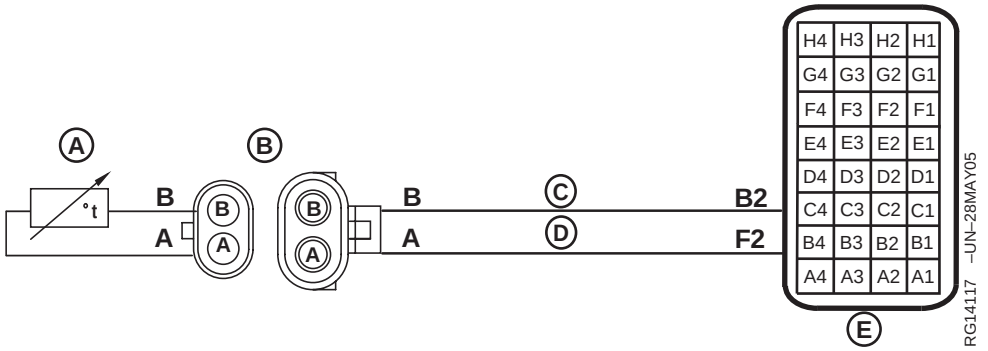
For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

For more information on how temperature sensors operate, see MEASURING TEMPERATURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,0000037 –19–12SEP05–1/1

Fresh Air Temperature Sensor



EGR Fresh Air Temperature Sensor Schematic

A—EGR Fresh Air Temperature Sensor
B—EGR Fresh Air Temperature Sensor Connector
C—EGR Fresh Air Temperature Ground
D—EGR Fresh Air Temperature Input
E—ECU Connector J3

The EGR fresh air temperature sensor is located near on near the fresh air inlet tube near the inlet to the intake manifold. The ECU uses this sensor to measure the temperature of the fresh air entering the EGR valve. The ECU then compares the temperatures of the EGR exhaust, EGR fresh air, and the EGR mixed air to determine if proper cooling and mixing has occurred. If the temperature is not correct, the ECU can adjust the signal going to the EGR valve to compensate the mixture accordingly. The ECU also uses this sensor for engine protection purposes.

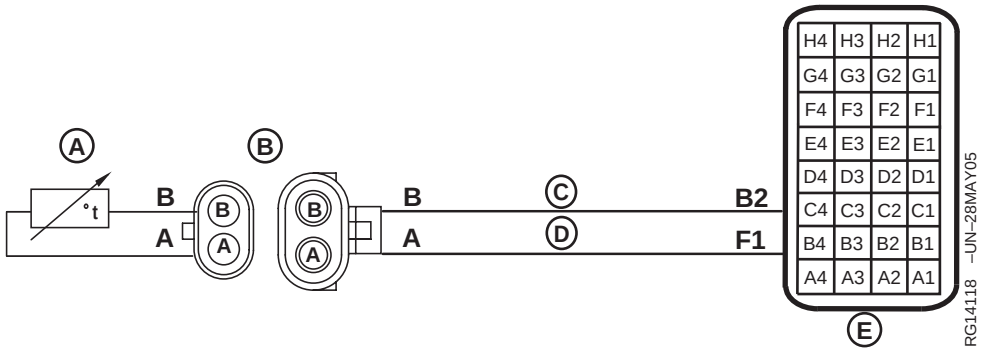
For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

For more information on how temperature sensors operate, see MEASURING TEMPERATURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,0000038 –19–12SEP05–1/1

Exhaust Gas Recirculation (EGR) Mixed Temperature Sensor



EGR Mixed Air Temperature Sensor

A—EGR Mixed Air Temperature Sensor
B—EGR Mixed Air Temperature Sensor Connector
C—EGR Mixed Air Temperature Ground
D—EGR Mixed Air Temperature Input
E—ECU Connector J3

The EGR mixed air temperature sensor is located on the air intake manifold. The ECU uses this sensor to measure the temperature of the mixed air leaving the EGR valve and entering the air intake manifold. The ECU then compares the temperatures of the EGR exhaust, EGR fresh air, and the EGR mixed air to determine if proper cooling and mixing has occurred. If the temperature is not correct, the ECU can adjust the signal going to the VGT actuator to compensate the mixture accordingly. The EGR mixed air temperature helps the ECU calculate the correct fueling for the engine. The EGR mixed air is the air that will be used in the cylinder for engine combustion. The ECU also uses this sensor for engine protection purposes.

For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

For more information on how temperature sensors operate, see MEASURING TEMPERATURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

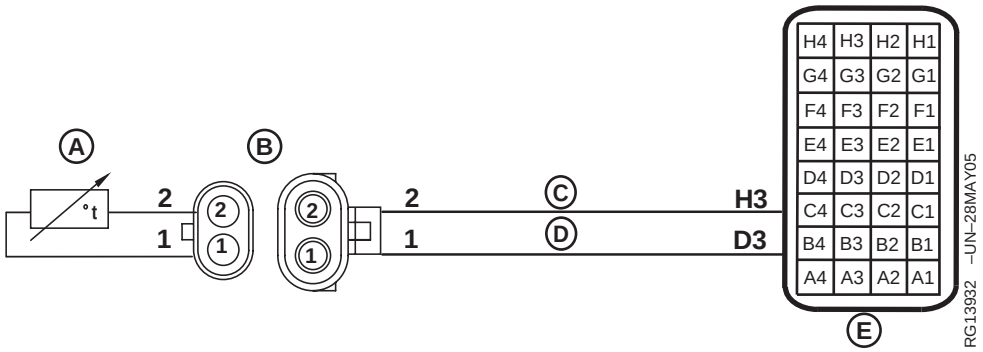
DN22556,0000039 –19–12SEP05–1/1

Engine Control Unit (ECU) Temperature Sensor

The ECU temperature sensor is located internal to the ECU. This sensor cannot be repaired or replaced without replacing the entire ECU. This sensor is used to determine the internal temperature of the ECU. If the temperature exceeds the temperature specification, the ECU will limit the speed of the engine in an attempt to protect the ECU from permanent damage.

DN22556,000003A –19–06SEP05–1/1

Engine Coolant Temperature (ECT) Sensor



Temperature Sensor Connections Schematic

A—Engine Coolant Temperature Sensor
B—Engine Coolant Temperature Sensor Connector
C—Engine Coolant Temperature Ground
D—Engine Coolant Temperature Input
E—ECU Connector J3

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

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

- Engine protection purposes. Depending on the severity of the temperature increase, ECU transmits a diagnostic code for either least, moderately, and most severe levels. For each level of severity, engine is derated commensurately. 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 startup based on the initial ECT readings.
- Idle speed determination — In order to decrease engine warm-up time, the ECU will increase idle speed after startup, if a low coolant temperature is measured.
- The ECU uses coolant temperature to control the exhaust gas recirculation (EGR) valve.

For more information on how temperature sensors operate, see MEASURING TEMPERATURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,000003B –19–12SEP05–1/1

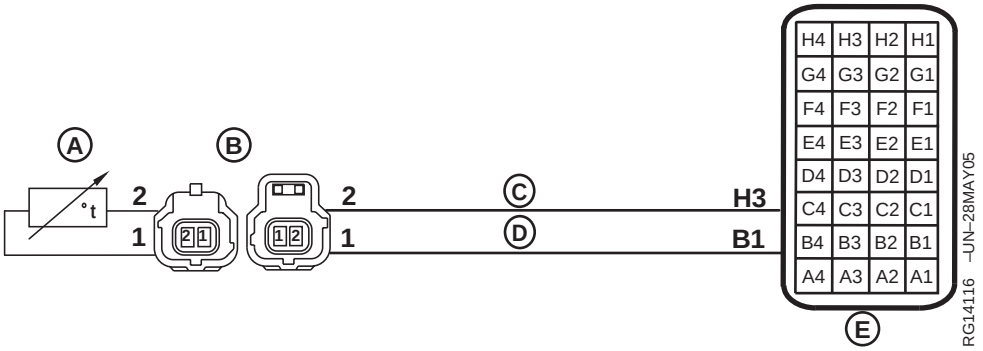
Barometric Air Pressure (BAP) Sensor

The BAP sensor is located internal to the ECU. This sensor cannot be repaired or replaced without replacing the entire ECU. This sensor is used to determine the pressure of the ambient air at the mounting location of the ECU. This helps the ECU determine the air density for calculating the correct air/fuel ratio.

For more information on how pressure sensors operate, see MEASURING PRESSURE earlier in this Group.

RG41221,00002A9 –19–15MAY05–1/1

Fuel Temperature Sensor



Fuel Temperature Sensor Schematic

A—Fuel Temperature Sensor
B—Fuel Temperature Sensor Connector
C—Fuel Temperature Ground
D—Fuel Temperature Input
E—ECU Connector J3

The fuel temperature sensor is located on the high pressure fuel pump. The ECU uses this sensor input to calculate fuel density and adjust fuel delivery accordingly. The ECU also uses the fuel temperature sensor for engine protection purposes. In addition, the glow plug operation is driven off of the fuel temperature. If the temperature of the fuel drops below specification, the air heater will turn on for a predetermine length of time. For more glow plug information, see AIR HEATER OPERATION later in this Group.

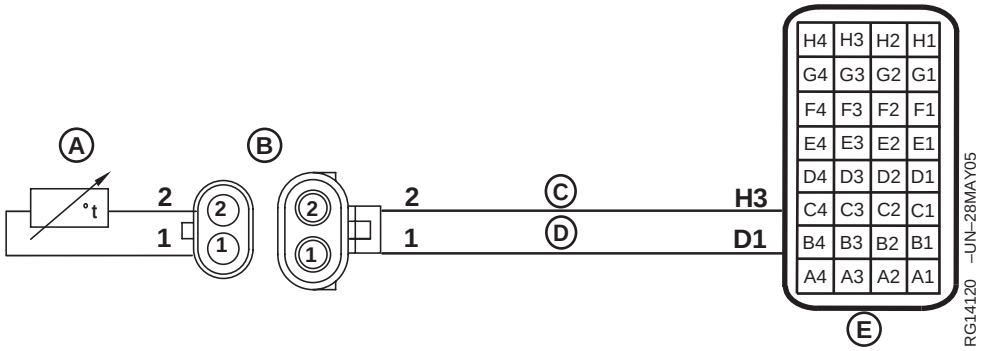
For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

For more information on how temperature sensors operate, see MEASURING TEMPERATURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,000003C –19–12SEP05–1/1

Turbo Compressor Inlet Temperature Sensor



Turbo Compressor Inlet Temperature Sensor Schematic

A—Turbo Compressor Inlet Temperature Sensor
B—Turbo Compressor Inlet Temperature Sensor Connector
C—Turbo Compressor Inlet Temperature Ground
D—Turbo Compressor Inlet Temperature Input
E—ECU Connector J3

The turbo compressor inlet temperature sensor is located on the fresh air intake of the turbo. The ECU uses this sensor to calculate the ambient air temperature rise across the air filter. The ECU also uses this sensor in addition to the EGR fresh air temperature to calculate the temperature of the turbo compressor outlet temperature. From these calculations, the ECU can determine if the air/fuel ration is correct, or if changes are required.

For more information on how temperature sensors operate, see MEASURING TEMPERATURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,000003D –19–12SEP05–1/1

Turbo Turbine Inlet Temperature

There is no turbo turbine temperature sensor. This temperature is calculated by the ECU. The ECU uses the following parameters to create the model based temperature:

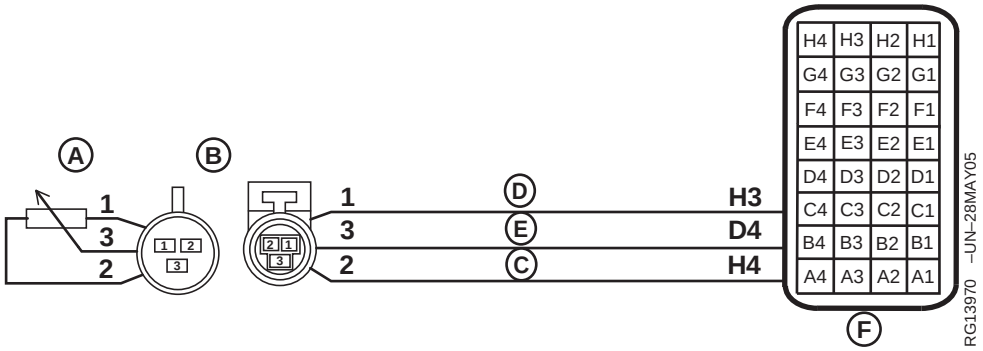
- Manifold Air Pressure
- EGR Mixed Air Temperature
- Timing base on the crank position or the pump position sensor
- Fuel Rail Pressure
- Engine Speed
- EGR Exhaust Pressure
- Fresh Air to Fuel Ratio
- A software filter to represent a time delay for component heat up rate.

The ECU also uses this temperature for engine protection purposes.

For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

DN22556,000003E –19–06SEP05–1/1

Exhaust Pressure Sensor



Exhaust Pressure Sensor Connections Schematic

A—Exhaust Pressure Sensor
B—Exhaust Pressure Sensor Connector
C—Exhaust Pressure Sensor 5V Supply
D—Exhaust Pressure Sensor Ground
E—Exhaust Pressure Sensor Input
F—ECU Connector J3

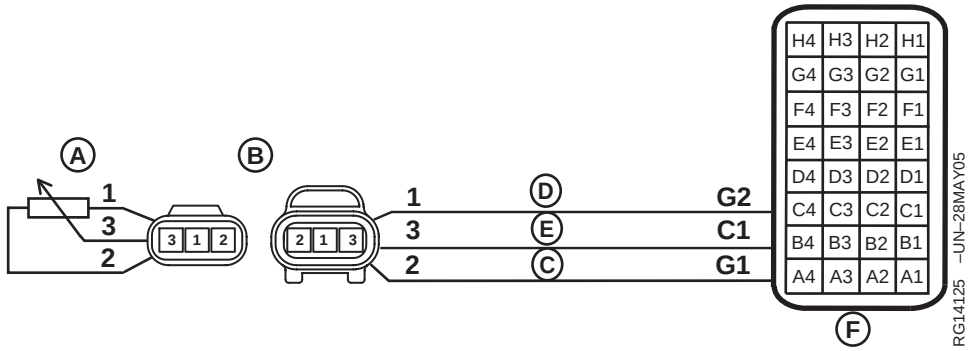
The exhaust gas pressure sensor is located on the exhaust manifold. The exhaust gas pressure sensor sends an exhaust gas pressure equivalent signal to the ECU. The ECU uses this signal to monitor and evaluate whether exhaust gas is adequate for current operating conditions. If pressure is too high or too low, the ECU will shut down the exhaust gas recirculation system, until the problem has been resolved.

For more information on how pressure sensors operate, see MEASURING PRESSURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,000003F –19–12SEP05–1/1

Fuel Rail Pressure Sensor



Fuel Rail Pressure Sensor Schematic

A—Fuel Rail Pressure Sensor
B—Fuel Rail Pressure Sensor Connector
C—Fuel Rail Pressure Sensor 5V Supply
D—Fuel Rail Pressure Sensor Ground
E—Fuel Rail Pressure Sensor Input
F—ECU Connector J3

The fuel rail pressure sensor is located on the end of the high pressure common rail (HPCR). The fuel rail pressure sensor sends a pressure equivalent signal to the ECU. The ECU monitors fuel pressure to control the amount and timing of fuel being transferred from the high pressure fuel pump to the HPCR. The ECU uses this signal input to determine if fuel rail pressure is adequate for the current operating condition. The ECU will command more or less fuel from the high pressure fuel pump by altering the signal to the pump control valve. For more information on the pump control valve, see PUMP CONTROL VALVE (PCV) later in this Group. The ECU also uses this sensor to determine if there is an electronic injector problem by measuring the drop of pressure every time the engine injects fuel to a specific cylinder. This sensor is used for engine protection.

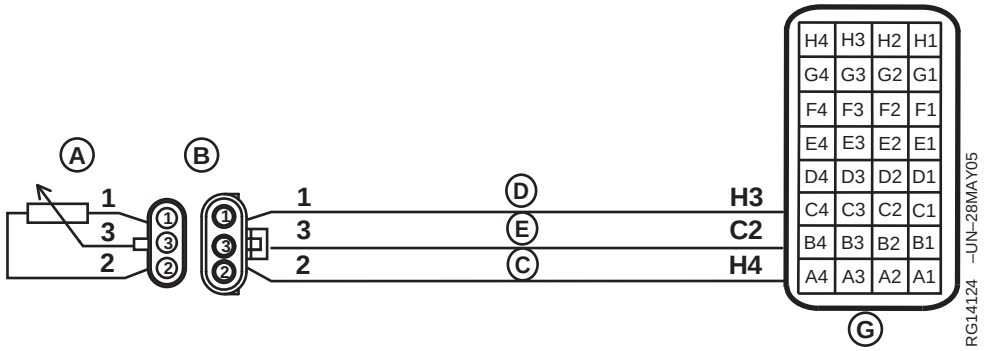
For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

For more information on how pressure sensors operate, see MEASURING PRESSURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,0000040 –19–12SEP05–1/1

Fuel Transfer Pump Pressure Sensor



A—Fuel Transfer Pump Pressure Sensor
B—Fuel Transfer Pump Pressure Sensor Connector
C—Fuel Transfer Pump Pressure Sensor 5V Supply
D—Fuel Transfer Pump Pressure Sensor Ground
E—Fuel Transfer Pump Pressure Sensor Input
F—ECU Connector J3

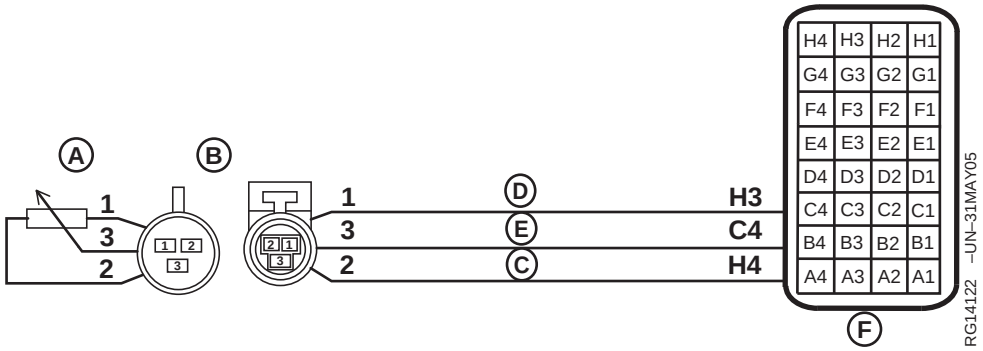
The fuel transfer pump pressure sensor is located on the primary filter header. The fuel pressure sensor sends a pressure equivalent signal to the ECU. The ECU monitors fuel pressure to determine if fuel is continuously passing through the low pressure side of the fuel system, or if there is a leak or blockage in it.

For more information on how pressure sensors operate, see MEASURING PRESSURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,0000041 –19–12SEP05–1/1

Manifold Air Pressure (MAP) Sensor



MAP Sensor Schematic

A—MAP Pressure Sensor
B—MAP Pressure Sensor Connector
C—MAP Pressure Sensor 5V Supply
D—MAP Pressure Sensor Ground
E—MAP Pressure Sensor Input
F—ECU Connector J3

The MAP sensor is located on the intake manifold. The ECU uses manifold absolute pressure to help calculate the amount of airflow into the engine. The MAP sensor also supplies the ECU with a direct measurement of turbo boost.

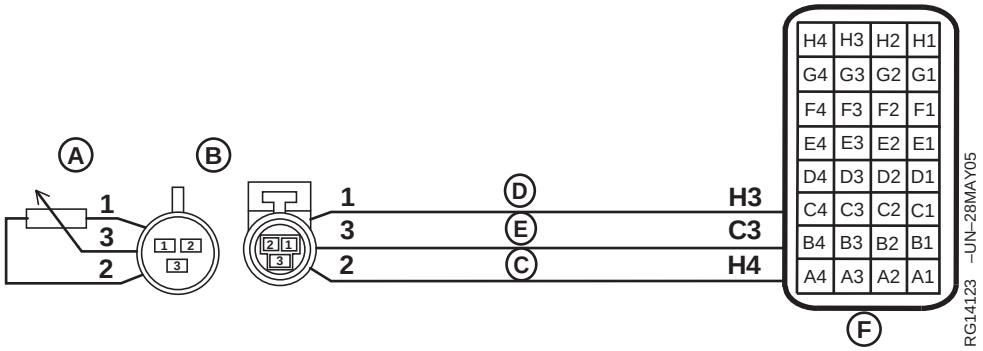
For more information on how pressure sensors operate, see MEASURING PRESSURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,0000042 –19–15NOV05–1/1

03
140
25

Oil Pressure Sensor



Oil Pressure Sensor Schematic

A—Oil Pressure Sensor
B—Oil Pressure Sensor Connector
C—Oil Pressure Sensor 5V Supply
D—Oil Pressure Sensor Ground
E—Oil Pressure Sensor Input
F—ECU Connector #J3

The oil pressure sensor is located on the engine block below the primary fuel filter. The oil pressure sensor sends an oil pressure equivalent signal to the ECU. The ECU uses this signal to determine if engine oil pressure is adequate for the current operating conditions. The ECU monitors oil pressure for engine protection purposes.

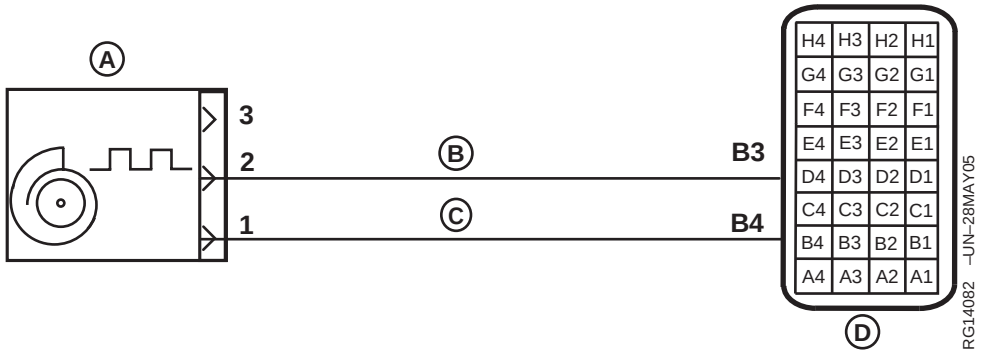
For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

For more information on how pressure sensors operate, see MEASURING PRESSURE earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,0000043 –19–12SEP05–1/1

Turbo Speed Sensor



Turbo Speed Sensor Schematic

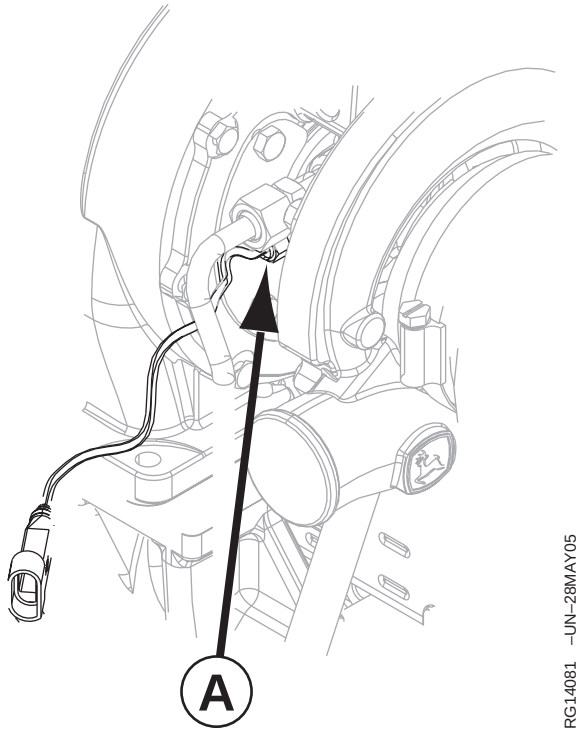
The turbo speed sensor (A) is located on the turbocharger. The turbo speed sensor uses a flat spot on the shaft to measure turbo speed. The ECU monitors turbo speed to ensure that turbo is running within acceptable range. At most severe high turbo speed levels, the ECU will use this sensor for engine protection.

For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

For more information on how speed sensors operate, see MEASURING SPEED earlier in this Group.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

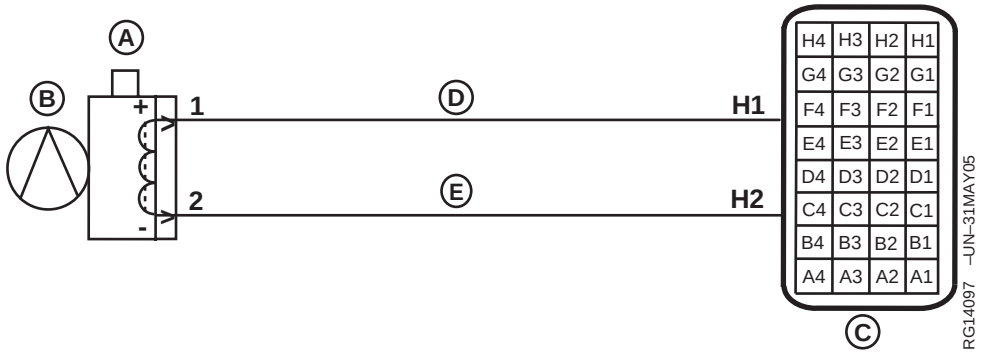
A—Turbo Speed Sensor
B—Turbo Speed Sensor Ground
C—Turbo Speed Sensor Input
D—ECU Connector #J1



Turbo Speed Sensor Location

DN22556,0000044 –19–06SEP05–1/1

Pump Control Valve (PCV)



Pump Control Valve (PCV) Schematic

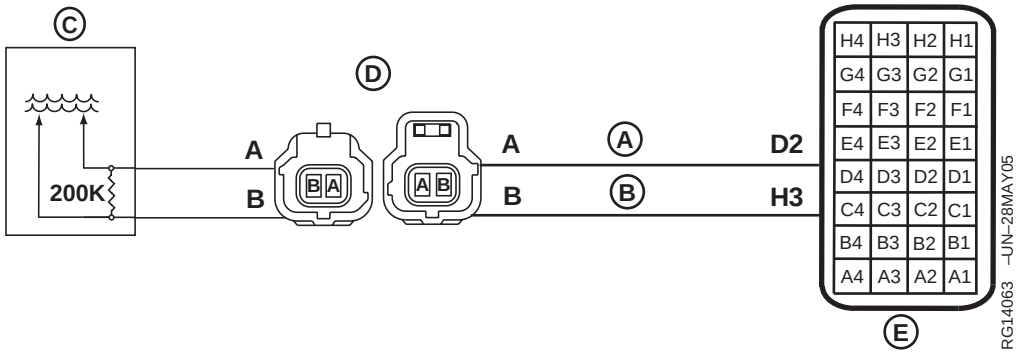
A—ECU Connector #J1 **B—Pump Solenoid Input** **C—Pump Solenoid Ground**

The Pump Control Valve is located on the high pressure fuel pump. The ECU sends an electronic signal to the PCV through the pump solenoid to regulate the delivery of fuel to the High Pressure Common Rail (HPCR). When the PCV is energized, fuel is allowed discharge from the fuel outlet on the high pressure fuel pump to the high pressure common rail (HPCR). The ECU varies the ON-time of this signal to ensure the proper amount of fuel is available.

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,0000045 –19–06SEP05–1/1

Water in Fuel (WIF) Sensor



Water In Fuel Sensor Schematic

A—WIF Input
B—WIF Ground
C—WIF Sensor
D—WIF Sensor Connector
E—ECU Connector J3

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

For more information on sensor locations, see ELECTRONIC CONTROL SYSTEM OVERVIEW earlier in this Group.

DN22556,0000046 –19–12SEP05–1/1

Measuring Throttle Position

This engine has the ability to operate off several different throttle types. Depending on the application, the engine control unit (ECU) will be programmed to run off the desired throttle type(s). Check your application for its specific throttle option(s).

RG40854,00000E7 –19–31MAR05–1/1

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 pre-programmed 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.

John Deere engine provide the optionality to use two analog throttles, or an analog throttle with a multi-state throttle on the same engine. If an engine is equipped with more than one throttle, the ECU will use which ever throttle is providing the greatest input voltage.

RG41221,00002B7 –19–10APR06–1/1

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 type of switch used. There are three Switching configuration that are used to select the engine speed.

- Dual-state Throttle - See DUAL-STATE THROTTLE later in this Group.
- Tri-state Throttle - See TRI-STATE THROTTLE later in this Group.
- Ramp Throttle - See RAMP THROTTLE later in this Group.

RG41221,00002B2 –19–10APR06–1/1

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 cannot be adjusted. If speeds different from low and high idle are required, the Tri-state throttle should be used. See TRI-STATE THROTTLE later in this Group.

RG41221,00002B3 –19–10APR06–1/1

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.

RG41221,00002B4 –19–10APR06–1/1

Ramp Throttle

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

RG41221,00002B5 –19–10APR06–1/1

Measuring Speed

Speed sensors operate by detecting notches or flat spots on their corresponding gear/timing wheel/shaft. When a tooth/notch/flat spot (timing device) on the gear/timing wheel/shaft is directly under the sensor, a voltage is induced. The sensors use an internal magnet to create this voltage signal from the timing device on their respective gear/timing wheel/shaft. The magnetic field is pulled towards the gear/timing wheel/shaft as the teeth pass directly under the sensor. As the root diameter (area between teeth) pass the sensor, the magnetic field moves back toward the sensor. This creates the voltage signal that the ECU monitors for timing and speed. When a notch (one or more missing teeth) passes under the sensor, the pattern of the signal changes. By monitoring these changes in the signal, the ECU calculates the speed and the cylinder number that is ready for injection. The ECU monitors both the crank position and pump position sensors to verify that they are in time with each other.

RG40854,00000E8 –19–26AUG05–1/1

Engine Coolant Level Switch

This optional sensor provides ECU signal with a path to ground, whenever the engine coolant drops below a certain level. Loss of coolant switch is used for engine protection purposes. For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

The engine coolant level switch is a trimmable option. For more information on trimmable options, see JOHN DEERE TRIMMABLE OPTION in Section 04, Group 160 later in this manual. The user has the ability to choose a normally open or a normally closed switch. Depending on the switch configuration, diagnostics will vary.

DB92450,000000D –19–10APR06–1/1

Sensor Supply #1

John Deere engine sensors must have 5 volts and sensor return (ground) supplied to them to function properly. There are too many sensors to for just one sensor supply and return to handle. For this reason, there are several sets of sensor supply voltages and grounds.

The following sensors use Sensor Supply #1:

NOTE: Some sensors are not available or are optional for certain applications. The sensors on the following list may not all be available on this engine.

- Fuel Rail Pressure Sensor

RG41221,00002AA –19–10APR06–1/1

Sensor Supply #2

John Deere engine sensors must have 5 volts and sensor return (ground) supplied to them to function properly. There are too many sensors to for just one sensor supply and return to handle. For this reason, there are several sets of sensor supply voltages and grounds.

The following sensors use Sensor Supply #2:

NOTE: Some sensors are not available or are optional for certain applications. The sensors on the following list may not all be available on this engine.

- Engine Coolant Temperature Sensor
- Exhaust Pressure Sensor
- Fuel Temperature Sensor
- Fuel Transfer Pump Pressure Sensor
- Manifold Air Pressure Sensor
- Oil Pressure Sensor
- Oil Temperature Sensor (Customer Supplied)
- Turbo Compressor Inlet Air Temperature
- Water in Fuel Sensor

RG41221,00002AB –19–10APR06–1/1

Sensor Supply #3

John Deere engine sensors must have 5 volts and sensor return (ground) supplied to them to function properly. There are too many sensors to for just one sensor supply and return to handle. For this reason, there are several sets of sensor supply voltages and grounds.

The following sensors use Sensor Supply #3:

NOTE: Some sensors are not available or are optional for certain applications. The sensors on the following list may not all be available on this engine.

- Analog Throttle (A) Sensor

RG41221,00002AC –19–10APR06–1/1

Sensor Supply #4

John Deere engine sensors must have 5 volts and sensor return (ground) supplied to them to function properly. There are too many sensors to for just one sensor supply and return to handle. For this reason, there are several sets of sensor supply voltages and grounds.

The following sensors use Sensor Supply #4:

NOTE: Some sensors are not available or are optional for certain applications. The sensors on the following list may not all be available on this engine.

- Analog Throttle (B) Sensor
- Multi-State Throttle Switch
- Loss of Coolant Switch
- External Shutdown Switch
- External Derate Switch
- Override Shutdown Switch

RG41221,00002AD –19–10APR06–1/1

Sensor Supply #5

John Deere engine sensors must have 5 volts and sensor return (ground) supplied to them to function properly. There are too many sensors to for just one sensor supply and return to handle. For this reason, there are several sets of sensor supply voltages and grounds.

The following sensors use Sensor Supply #5:

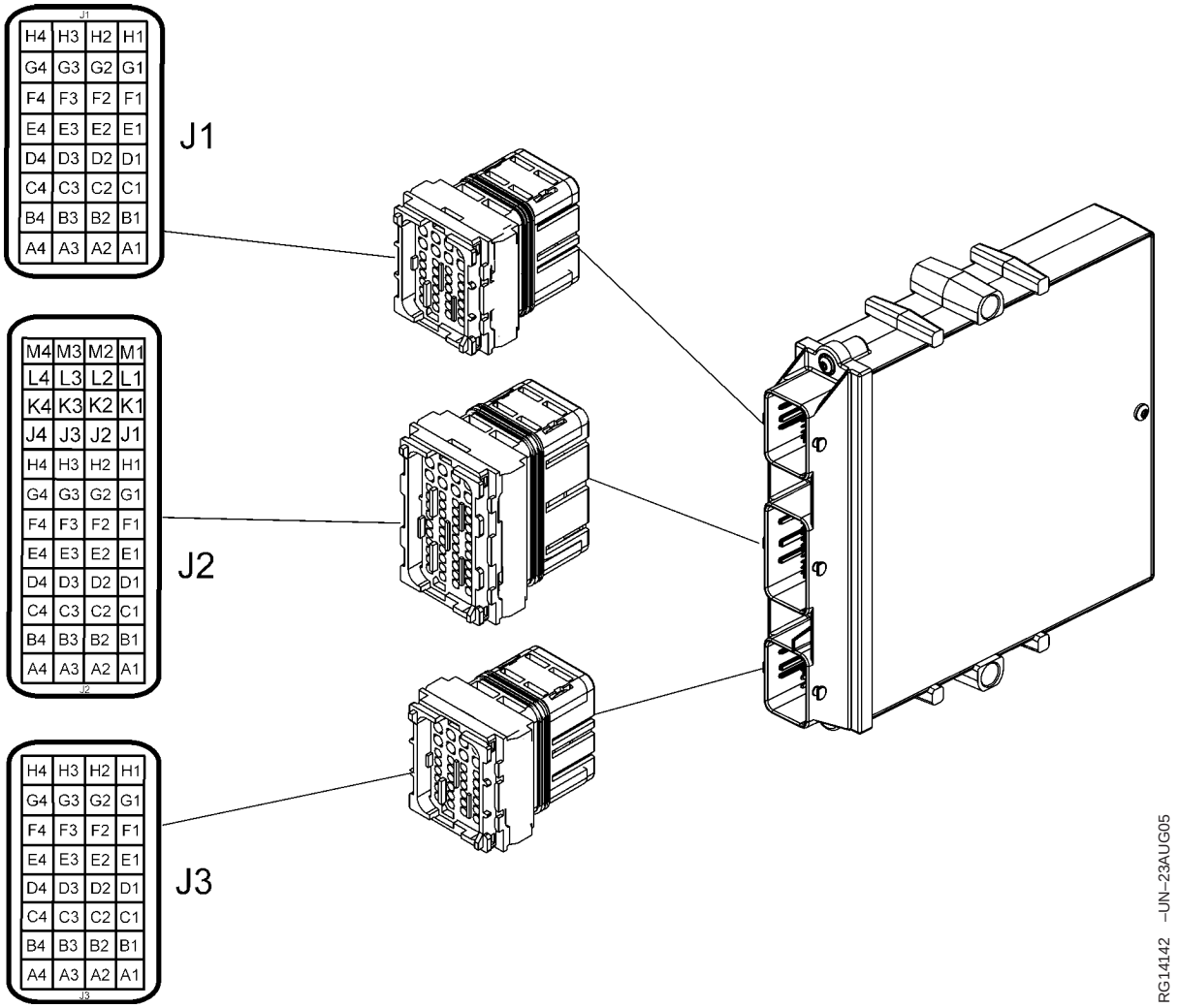
03
140
36

NOTE: Some sensors are not available or are optional for certain applications. The sensors on the following list may not all be available on this engine.

- Exhaust Gas Recirculation Valve

RG41221,00002AE –19–10APR06–1/1

Engine Control Unit (ECU)



Engine Control Unit (ECU)

J1—32 pin connector - black insert **J2—48 pin connector - red insert** **J3—32 pin connector - blue insert**

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

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

The ECU connects to the wiring harness through three connectors. Each connector is marked with terminal numbers.

Analog/Digital Converters

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

Continued on next page

Central Processing Unit (CPU)

The central processing unit performs the mathematical computations and logical functions that are necessary in controlling injection fuel quantity and injection timing. The CPU communicates its desired fuel quantity and timing to the high pressure fuel pump and EIs.

Self-Diagnosis

The ECU detects 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.

Diagnostic Trouble Codes (DTCs)

If the ECU detects a problem with the electronic control system, a Diagnostic Trouble Code (DTC) specific to the failed system will be stored in the ECU's memory.

There are two types of DTCs:

- Active
- Stored

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

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

Memory

The ECU contains 3 different types of memory:

— Random Access Memory - RAM

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

— Read Only Memory - ROM

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

— Electrical Erasable Programmable Read Only Memory - EEPROM

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

Sensor Monitoring

The ECU monitors fuel system sensors and components. The sensors, in turn, provide input voltages equivalent to real-time engine operating temperatures and pressures. The ECU compares these inputs against maximum and minimum voltage equivalents to temperature and pressure standards. If the ECU determines that a monitored temperature or pressure is over or under the required standard, it either derates or shuts off the engine, depending on the severity of the input received.

The ECU also monitors its circuits for over-voltage and under-voltage conditions, which would be most likely caused by wiring shorts, opens, or grounds. If such a condition is detected, the ECU will set a diagnostic trouble code.

For additional temperature and pressure sensor explanation, see MEASURING TEMPERATURE and MEASURING PRESSURE later in this group.

For more information on repairing the ECU, see ENGINE CONTROL UNIT (ECU) in Section 02, Group 110 earlier in this manual.

Intake Air Heater Operation

The Intake Air Heater function is not included on all engines. The intake air heater is used to increase intake manifold air temperature to improve cold starting. When the operator turns the key from “OFF” to “ON”, the ECU calculates the ECT, determines if the temperature is below the set point, turns on the “Air Heater Indicator” light on the dash, 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.

For application specific information on air heater times vs. temperatures, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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Controlled Area Network (CAN)

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

Just about any type of information can be communicated over the CAN bus, such as throttle position, application-requested derates and/or engine shutdown, diagnostic fault codes, etc. Also, any vehicle displays typically use the CAN bus.

CAN also allows diagnostic software such as SERVICE ADVISOR™ to communicate with the engine controller.

SERVICE ADVISOR is a trademark of Deere & Company

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Cruise Control Operation

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

The cruise control has the normal functions of:

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

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

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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 operators 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 operators manual to retrieve this information for a given application.
- **Engine Protection with Shutdown** — The ECU will derate the engine for given DTCs. If a DTC that requires shutdown is set, the ECU will severely derate the engine and shut the engine down in 30 seconds. If the problem is corrected within the 30 second delay period, the power will increase at a particular rate until full power is reached.

There are two levels of engine protection:

SHUTDOWN OVERRIDE

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

The engine protection shutdowns can be overridden for 30 seconds at a time. This can be used to move a vehicle to a safe location. Each time the switch is pushed, the shutdown timer is reset to 30 seconds, and the engine will run in a derated power mode.

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Derate Programs

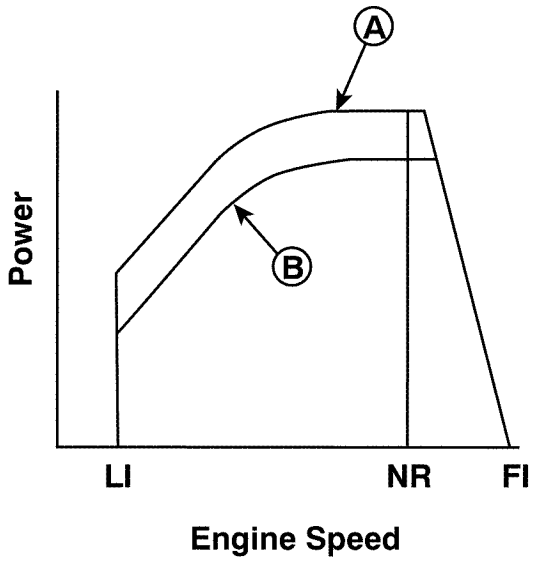
The Electronic Control Unit (ECU) will derate the amount of fuel that is delivered to the engine when sensor inputs exceed normal operating ranges. A Diagnostic Trouble Code (DTC) always accompanies a fuel derate. See APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual for derate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

RG40854,00000F1 –19–20MAY02–1/1

Multiple Torque Curve Selection

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

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



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

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Torque Curves

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Governor Droop Mode Selection

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

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

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Section 04
Diagnostics

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About This Group

This section of the manual contains necessary information for observable diagnostics and fuel-related test procedures. Use this information in conjunction with the 9.0 L Diesel Engines Base Engine manual (CTM 400). Group 150 is divided into two areas: 1) diagnosis of observed malfunctions and 2) test procedures for DTCs. The observed 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.

- E1 - Engine Cranks/Won't Start
- E2 - Engine Misfires/Runs Irregularly
- E3 - Engine Does Not Develop Full Power
- E4 - Engine Emits Excessive White Exhaust Smoke
- E5 - Engine Emits Excessive Black or Gray Exhaust Smoke
- E6 - Engine Will Not Crank
- E7 - Engine Idles Poorly
- E8 - Abnormal Engine Noise
- E9 - Analog Throttle (A) Will Not Respond
- E10 - Analog Throttle (B) Will Not Respond

- F1 - Fuel Supply System Check
- F2 - Excessive Fuel Consumption
- F3 - Fuel in Oil

- D1 - ECU Does Not Communicate with Service ADVISOR
- D2 - Diagnostic Gauge Does Not Communicate with ECU

- 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 Air in Fuel
  - Check Fuel Supply Pressure
  - Check for Restricted Fuel Leak-off Line
  - Bleed the Fuel System
  - Check High Pressure Fuel Pump Static Timing

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E1 - Engine Cranks/Won't Start

RG41221,00000F0 –19–25OCT05–1/1

E1 - Engine Cranks/Won't Start Diagnostic Procedure

NOTE: This procedure applies to engines with John Deere Engine Control Units (ECUs). This procedure should be used if engine cranking speed is OK, but engine will not start, or only starts after prolonged cranking. If engine will not crank, determine problem in the starting/charging system, see E6 — ENGINE WILL NOT CRANK later in this Group.

– – –1/1

❶ **E1 - Preliminary Check**	Before using this diagnostic chart: 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 CHECK ENGINE CRANKING SPEED in Section 04 of the 9.0L Base Engine manual (CTM 400). 3. Ensure that oil viscosity is correct. See FUELS, LUBRICANTS, AND COOLANT in Section 01, Group 02 of the 9.0L Base Engine manual (CTM 400). Was the problem found?	**YES:** Repair and retest. **NO:** GO TO ❷

– – –1/1

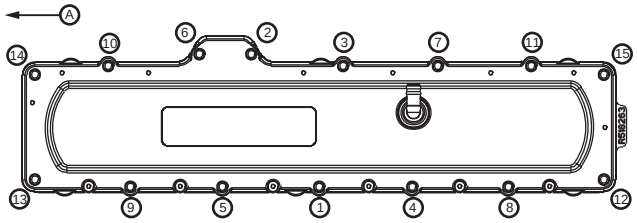
❷ **Active DTC Test**	1. Ignition ON, engine OFF *NOTE: If DTCs are cleared through Diagnostic Gauge Snapshot information for ALL DTCs will be lost.* 2. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use Diagnostic Gauge. 3. Make note of any DTCs. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Section. 4. Clear DTCs. Does diagnostic display show any active DTCs?	**YES:** Diagnose active DTCs first. If any of the DTCs have a SPN of 636 or 637, go to those first. **NO:** No active DTCs present. GO TO ❸ **NO:** Diagnostic software does NOT communicate with ECU. See D1 - ECU DOES NOT COMMUNICATE WITH SERVICE ADVISOR later in this Group.

– – –1/1

❸ **Pump Position and Crank Indicator Test**	1. Start cranking engine. 2. While cranking, use Service ADVISOR to observe pump position status, pump position sensor input noise indicator, crank position input noise indicator, and crank position status. See DATA PARAMETER DESCRIPTION in Section 04, Group 160 for an explanation of the Pump Position/Crank Position parameters. Do any of the following parameters display these values? **Pump Position Status** = Less than 15 **Pump Position Sensor Input Noise Indicator** = Above 0% **Crank Position Status** = Less than 15 **Crank Position Sensor Input Noise Indicator** = Above 0%	**YES:** Inspect vehicle for possible failures that can cause any of these conditions: Bad electrical connections, damaged sensor, damaged high pressure fuel pump camshaft or crankshaft timing ring, EMI from improperly installed radio equipment, or other electronic devices. Repair and retest. **NO:** GO TO ❹ – – –1/1

❹ **Air Heater Check**	1. Ignition ON, engine OFF. 2. Read engine coolant temperature Is engine coolant temperature above 0°C (32°F)?	**YES:** GO TO ❺ **NO:** See A1 - INTAKE AIR HEATER CHECK diagnostic procedure later in this Group. – – –1/1

❺ **Fuel Supply System Test**	Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK diagnostic procedure later in this Group. Are any fuel supply system problems present?	**YES:** Repair and retest. **NO:** GO TO ❻ – – –1/1

❻ **Injector Clamp, Harness, and Connector Test**	1. Ignition OFF 2. Remove rocker arm cover. *NOTE: Rocker arm cover gasket is reusable if no visible damages is detected. Do NOT store cover on gasket surface.* 3. Check valve rocker arm operation. Visually inspect contact surfaces of valve tips and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage. *NOTE: Verify that hold-down clamps are positioned correctly.* 4. Check that the hold down clamp cap screws on all EIs are tightened to specification. See INSTALL ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 5. Inspect EI harness and EI harness connector for damage. 6. When diagnostics are completed, reassemble the rocker arm cover and tighten rocker arm capscrews to specifications and in the proper sequence. **Specification** Rocker Arm Cover Cap Screws—Torque..... 20 Nm (15 lb-ft)  RG13907 –UN–14JAN05 *Rocker Arm Cover Tightening Sequence* Are all components in proper working order?	**YES:** GO TO ❼ **NO:** Repair faulty component and retest. – – –1/1
❼ **Pump Position Timing Check**	Verify pump position timing is correct. See CHECK HIGH PRESSURE FUEL PUMP STATIC TIMING later in this Group. **IMPORTANT: There is no timing adjustment for the fuel pump. Use this procedure to check for proper installation.** Is the pump position timing correct?	**YES:** GO TO ❽ **NO:** Repair and retest. – – –1/1

❽ EGR Valve Check	1. Ignition OFF 2. Remove the EGR valve. See REMOVE AND INSTALL EXHAUST GAS RECIRCULATION (EGR) VALVE in Section 02, Group 100 earlier in this manual. 3. Check the valve to make there are no restrictions causing the valve to stick open. Is the EGR valve free to open and close properly?	**YES:** GO TO ❾ **NO:** Replace ERG valve and retest. – – –1/1
❾ Turbo Vane Check	1. Ignition OFF 2. Remove the turbo actuator. 3. Inspect the turbo vanes to ensure that they are not stuck closed. Are turbo vanes stuck closed?	**YES:** Replace all require turbo components and retest. **NO:** GO TO ❿ – – –1/1
❿ ECU Programming Test	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT in Section 03, Group 140 earlier in this manual.* 1. Download software payload file for engine serial of engine displaying 000629.12. For instructions on downloading a payload file, see REPROGRAMMING ENGINE CONTROL UNIT (ECU) in Group 160. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Program the ECU using the payload file downloaded for this engine. 5. Ignition OFF for 2 minutes. 6. Ignition ON, engine cranking Does the engine start?	**YES:** New software repaired ECU. **NO:** Faulty ECU. – – –1/1

E2 - Engine Misfires/Runs Irregularly

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E2 - Engine Misfires/Runs Irregularly Diagnostic Procedure

Misfiring means that after starting, the engine runs with at least one cylinder functioning improperly. Vibrations, power drop and no smoke are observed. Irregular Running means that abnormal vibrations, abnormal running, and black smoke are observed during acceleration at full load conditions and between 1200 to 1500 rpm.

Before using this diagnostic procedure check for any active DTCs using the application error code display system.

– – –1/1

❶ **Possible causes**	The following items could cause or be mistaken as miss/rough running: 1. Transmission problems. 2. Engine Accessories such as A/C cycling on and off. 3. Electromagnetic interference (EMI) from improperly installed radios, etc. 4. Intake manifold air leaks. 5. Fuel system problems. (presence of air or water) 6. Engine mechanical problems. Are any major visible signs noticed?	**YES:** Repair and retest. **NO:** GO TO ❷

– – –1/1

❷ **Transmission Evaluation Test**	Park the vehicle and place the transmission in neutral with parking brake on. Does the engine still run rough/misfire?	**YES:** GO TO ❸ **NO:** Check/Repair transmission and retest.

– – –1/1

❸ **Accessories Evaluation Test**	Check accessory items like A/C compressor, engine fan etc. cycling on and off causing the appearance of rough running. Where there any problem accessories?	**YES:** Repair and retest. **NO:** GO TO ❹

– – –1/1

❹ **EMI Evaluation Test**	Turn off all EMI producing equipment, like radios, external equipment controllers, GPS etc. Does the engine still run rough/misfire?	**YES:** GO TO ❺ **NO:** Turn on each EMI producing item while monitoring engine. Repair item that causes engine problem and retest. – – –1/1
❺ **Intake Manifold Air Leak Test**	see TEST FOR AIR LEAKS in the engine base manual. Did the air system check good?	**YES:** GO TO ❻ **NO:** Repair and retest. – – –1/1
❻ **Fuel Supply System Test**	See F1 - FUEL SUPPLY SYSTEM CHECK later in this Group. Did the air system check good?	**YES:** GO TO ❼ **NO:** Repair and retest. – – –1/1
❼ **Engine No Load Performance Check**	1. Ignition ON, engine idling 2. Observe engine performance at a no load operating point. Is the engine running rough?	**YES:** GO TO ⓫ **NO:** GO TO ❽ – – –1/1
❽ **Engine Loaded Performance Check**	1. Ignition ON, engine under load conditions. 2. Observe engine performance at loaded operating point. Is the engine running rough?	**YES:** GO TO ⓾ **NO:** GO TO ❾ – – –1/1

9 Recreate Conditions	Operate engine under conditions where the miss/rough running complaint occurs. Could the problem be duplicated?	**YES:** GO TO 10 **NO:** Problem could not duplicated. Verify complaint and try to reproduce conditions of miss/rough running again. Connect Service ADVISOR and look at the stored codes to get an idea of what to look for. For instructions on connecting to Service ADVISOR, see CONNECTING TO SERVICE ADVISOR in Group 160 later in this manual. – – –1/1

10 Head Gasket Failure Check	Check for head gasket joint failures. See CHECK FOR HEAD GASKET FAILURES in Section 04 of the Base Engine manual. Are there signs of head gasket failures?	**YES:** Replace head gasket and retest. **NO:** GO TO 11 – – –1/1

11 Active DTC Test With Engine Running Rough	Read DTCs using the diagnostic gage or Service ADVISOR while engine is operating under conditions where the miss/rough running complaint occurs. For instructions on connecting to Service ADVISOR, see CONNECTING TO SERVICE ADVISOR in Group 160 later in this manual. Does the diagnostic equipment display any active DTCs?	**YES:** Take note of the operating conditions and troubleshoot any active DTC at these conditions. If any of the DTCs have an SPN of 636 or 637, diagnose those first. **NO:** GO TO 12 – – –1/1

12 Compression Test	1. Using Service ADVISOR, perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST earlier in this manual. 2. Make note of the results. Did you run the test at least three times?	**YES:** GO TO 13 **NO:** Run test until you have at least three sets of results. – – –1/1

13 Misfire Test	1. Using Service ADVISOR, perform the Misfire Test. For instructions, see ENGINE TEST INSTRUCTIONS - CYLINDER MISFIRE TEST earlier in this manual. 2. Make note of the results. Did you run the test at least three times?	**YES:** GO TO 14 **NO:** Run test until you have at least three sets of results. – – –1/1

14 Comparing Test Results	Compare the results from all three tests to see if there is any correlation. Look for cylinder(s) that have values that are more than 10% lower or higher as an average than the rest. Do at least two of the tests point to the same cylinder? The Misfire test along with the Cutout test results tend to point more toward a bad injector than a physical problem with the cylinder. The Compression test along with the Cutout test results tend to point more to a physical problem with a cylinder. Do the test results indicate any problems?	**YES:** Results indicate low compression in a cylinder. GO TO 15 **YES:** Results indicate a bad injector. GO TO 17 **NO:** GO TO 15 – – –1/1

15 Mechanical Compression Pressure Check	Determine the cause of low compression pressure on the low scoring cylinders. See TEST ENGINE COMPRESSION PRESSURE WITH MECHANICAL GAUGE in Base engine manual. Was cause of low compression found?	**YES:** Repair and retest. **NO:** GO TO 16 – – –1/1

16 Valve Clearance Test	Check valve lash. See ADJUST VALVE CLEARANCE in Section 02, Group 021 of the Base Engine manual. Valve clearance on all valves within specification?	**YES:** GO TO 17 **NO:** Adjust valve clearance. – – –1/1

17 Injector Clamp, Harness, and Connector Test	1. Ignition OFF 2. Remove rocker arm cover. *NOTE: Rocker arm cover gasket is reusable if no visible damages is detected. Do NOT store cover on gasket surface.* 3. Check valve rocker arm operation. Visually inspect contact surfaces of valve tips and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage. *NOTE: Verify that hold-down clamps are positioned correctly.* 4. Check that the hold down clamp cap screws on all EIs are tightened to specification. See INSTALL ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 5. Inspect EI harness and EI harness connector for damage. 6. When diagnostics are completed, reassemble the rocker arm cover and tighten rocker arm capscrews to specifications and in the proper sequence. See ADJUST VALVE CLEARANCE in the 9.0L Base Engine manual (CTM400). Are all components in proper working order?	**YES:** GO TO 18 **NO:** Repair faulty component and retest. – – –1/1

18 EGR Valve Check	1. Ignition OFF 2. Remove the EGR valve. See REMOVE AND INSTALL EXHAUST GAS RECIRCULATION (EGR) VALVE in Section 02, Group 100 earlier in this manual. 3. Check the valve to make there are no restrictions causing the valve to stick open. Is the EGR valve free to open and close properly?	**YES:** GO TO 19 **NO:** Replace ERG valve and retest. – – –1/1

19 Turbo Vane Check	1. Ignition OFF 2. Manually move actuator linkage its full range of travel. Does linkage move freely its full range of travel?	**YES:** Check all stored codes to see if any point to a possible problem. **NO:** Repair components that are causing the lack of linkage movement. See REMOVE AND INSTALL ACTUATOR LINKAGE Section 2, Group 100 in CTM400. Retest. – – –1/1

E3 - Engine Does Not Develop Full Power

RG41221,00000F2 –19–20OCT05–1/1

E3 - Engine Does Not Develop Full Power Diagnostic Procedure

– – –1/1

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

– – –1/1

❷ **Active DTC Test**	*NOTE: Some DTCs may cause the ECU to derate the engine, which would cause low power.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING TO SERVICE ADVISOR in Group 160 later in this manual. 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 idling 6. Read DTCs using SERVICE ADVISOR™. Does the diagnostic software display any active DTCs?	**YES:** Diagnose active DTCs first. **NO:** GO TO ❸

SERVICE ADVISOR is a trademark of Deere & Company

– – –1/1

❸ **Exhaust Emission Check**	Operate engine at full load rated speed. Does the engine emit excessive smoke?	**YES: Heavy white exhaust smoke:** See E4 - ENGINE EMITS EXCESSIVE WHITE EXHAUST SMOKE diagnostic procedure later in this Group. **YES: Heavy black or gray exhaust smoke:** See E5 - ENGINE EMITS EXCESSIVE BLACK OR GRAY EXHAUST SMOKE diagnostic procedure later in this Group. **NO:** GO TO ❹ – – –1/1

❹ **Torque Curve Selection Check**	*NOTE: This check is not required for applications that either do not select multiple torque curves or use torque curve selection over the Controller Area Network (CAN). For specific application torque curve information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual. For applications that do not require this check, GO TO* ❺ 1. Recreate the conditions of the low power complaint. 2. Read the torque curve number. 3. Compare the torque curve parameter to the appropriate torque curve chart. The ECU has the ability to operate on multiple torque curves selected by certain operating conditions. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual and refer to the corresponding torque curve for your application. Is the torque curve correct?	**YES:** GO TO ❺ **NO:** Refer to machine manual to determine components that could prevent the correct torque curve from being selected. – – –1/1

❺ **Governor Droop Selection Mode Check**	*NOTE: This check is not required for applications that either do not select different droop modes or use droop mode selection over the Controller Area Network (CAN). For specific application governor droop mode information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual. For applications that do not require this check, GO TO* ❻ 1. Operate engine and attempt to recreate the low power condition. 2. Read the desired speed governor curve and the maximum speed governor curve . 3. Compare governor selection to the appropriate governor mode chart. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual and refer to the corresponding maximum speed and desired speed governor curves for your application. Is the governor droop mode correct?	**YES:** GO TO ❻ **NO:** Refer to machine manual to determine components that could prevent the correct governor droop from being selected. OR Investigate droop mode selection problems including checking for open, short, and grounded circuits in the droop mode selection wiring. – – –1/1

❻ **Compression Test**	1. Using Service ADVISOR, perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 of this Section. 2. Make note of the results. Do all of the cylinders score within 10% of each other?	**YES:** GO TO ❼ **NO:** See E2 - ENGINE MISFIRE/RUNS IRREGULARLY diagnostic procedure earlier in this Group. – – –1/1

❼ **Misfire Test**	1. Using Service ADVISOR, perform the Misfire Test. For instructions, see ENGINE TEST INSTRUCTIONS - MISFIRE TEST in Section 04, Group 160 of this Section. 2. Make note of the results. Do all of the cylinders score within 10% of each other?	**YES:** GO TO ❽ **NO:** See E2 - ENGINE MISFIRE/RUNS IRREGULARLY diagnostic procedure earlier in this Group. – – –1/1

❽ **Throttle Test**	1. Operate engine at full load rated speed. 2. At these operating conditions, using the diagnostic software read throttle position data parameter. Is throttle position 97% or above?	**YES:** GO TO ❾ **NO:** Refer to your machine manual and perform the throttle calibration procedure; then retest. – – –1/1

❾ **Turbocharger Failure Check**	Check the following that could cause reduced boost pressure: • Restricted air cleaner • Intake air leak • Exhaust air leak • Restriction in exhaust • Faulty turbocharger. See TURBOCHARGER INSPECTION in Section 02, Group 080 in 9.0L Base Engine manual (CTM 400). Was the problem found?	**YES:** Repair problem and retest. **NO:** GO TO ❿ – – –1/1

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❿ **Fuel Supply System Test**	Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK diagnostic procedure later in this Group. Are any fuel supply system problems found?	**YES:** Repair and retest. **NO:** GO TO ⓫ – – –1/1

11 Injector Clamp, Harness, and Connector Check	1. Ignition OFF 2. Remove rocker arm cover. *NOTE: Rocker arm cover gasket is reusable if no visible damages is detected. Do NOT store cover on gasket surface.* 3. Check valve rocker arm operation. Visually inspect contact surfaces of valve tips and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage. *NOTE: Verify that hold-down clamps are positioned correctly.* 4. Check that the hold down clamp cap screws on all EIs are tightened to specification. See INSTALL ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 5. Inspect EI harness and EI harness connector for damage. 6. When diagnostics are completed, reassemble the rocker arm cover and tighten rocker arm capscrews to specifications and in the proper sequence. See ADJUST VALVE CLEARANCE in the 9.0L Base Engine manual (CTM400). Are all components in proper working conditions?	**YES:** GO TO 12 **NO:** Repair faulty component and retest. – – –1/1

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12 EGR Valve Check	1. Ignition OFF 2. Remove the EGR valve. See REMOVE AND INSTALL EXHAUST GAS RECIRCULATION (EGR) VALVE in Section 02, Group 100 earlier in this manual. 3. Check the valve to make there are no restrictions causing the valve to stick open. Is the EGR valve free to open and close properly?	**YES:** GO TO 13 **NO:** Replace EGR valve and retest. – – –1/1

13 Turbo Vane Check	1. Ignition OFF 2. Manually move actuator linkage its full range of travel. Does linkage move freely its full range of travel?	**YES:** GO TO 14 **NO:** Repair components that are causing the lack of linkage movement. See REMOVE AND INSTALL ACTUATOR LINKAGE Section 2, Group 100 in CTM400. Retest. – – –1/1

14 **Valve Clearance Check**	Check valve lash. See ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 9.0L Base Engine manual (CTM 400). Clearance on all valves within specification?	**YES:** Consult John Deere Field Support. **NO:** Adjust valve clearance and retest. – – –1/1

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 L1 - EXCESSIVE OIL CONSUMPTION in Section 04 of the Base Engine manual.

– – –1/1

❶ **E4 - Preliminary Procedure**	1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. 2. Ensure engine coolant level is not extremely low. Was the problem found?	**YES:** Repair and retest. **NO:** GO TO ❷
❷ **Head Gasket Test**	Check for failed head gasket. See CHECK FOR HEAD GASKET FAILURES in Section 04 of the Base Engine manual. Is the head gasket in good working condition?	**YES:** GO TO ❸ **NO:** See HEAD GASKET INSPECTION AND REPAIR SEQUENCE in Group 021 of the Base Engine manual.
❸ **Compression Test**	1. Connect the Service ADVISOR. For instructions on connecting to Service ADVISOR, see CONNECTING TO SERVICE ADVISOR in Group 160 later in this manual. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 of this Section. Do all cylinders score within 10% of each other?	**YES:** GO TO ❹ **NO:** See E2 - ENGINE MISFIRE/RUNS IRREGULARLY diagnostic procedure earlier in this Group.

❹ **EGR Cooler Leakage**	Check for exhaust gas leaks in the EGR cooler. See PRESSURE TEST EGR COOLER FOR AIR LEAKS in Base Engine Manual. Is the cooler leaking?	**YES:** Repair and restart engine, check for smoke. **NO:** GO TO ❺ – – –1/1
❺ **Fuel Pressure Check**	Check fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE later in this Group. Is the fuel pressure within specification?	**YES:** GO TO ❻ **NO:** See F1 - FUEL SUPPLY SYSTEM CHECK diagnostic procedure later in this Group. – – –1/1
❻ **Fuel Rail Pressure Check**	1. Ignition On, engine running at low idle. 2. Using the ECU diagnostic software, read fuel rail pressure - actual. Is the fuel rail pressure - actual 35 MPa (350 bar) (5076 psi)?	**YES:** GO TO ❼ **NO:** See F1 - FUEL SUPPLY SYSTEM CHECK diagnostic procedure later in this Group. – – –1/1
❼ **Valve Clearance Check**	Check valve lash. See ADJUST VALVE CLEARANCE in Section 02, Group 021 of the Base Engine manual.	**YES:** Ensure there are no engine mechanical problems. If no other problems are found, see E3 - ENGINE DOES NOT DEVELOP FULL POWER diagnostic procedure earlier in this Group. **NO:** Faulty high pressure fuel pump OR Faulty ECU – – –1/1

E5 - Engine Emits Excessive Black or Gray Exhaust Smoke

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

NOTE: This procedure should be used if the engine emits excessive black or gray smoke. If engine emits a less heavy, bluish exhaust smoke, see 9.0L - L1 - EXCESSIVE OIL CONSUMPTION in Section 04, 9.0L Diesel Engines Base Engine manual (CTM400).

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❶ **E5 - Preliminary Check**	1. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. 2. Ensure engine is not excessively loaded. 3. Ensure air filter is not restricted or plugged. Was the problem found?	**YES:** Repair and retest **NO:** GO TO ❷

– – –1/1

❷ **Intake and Exhaust Restriction and Air Leak Test**	Check for intake and exhaust restrictions and air leaks. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS and CHECK FOR EXHAUST AIR LEAKS in Section 04 of the 9.0L Base Engine manual (CTM 400). Intake and/or exhaust restriction found?	**YES:** Repair or replace components as necessary. **NO:** GO TO ❸

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❸ **Turbocharger Failure Test**	Check the following that could cause reduces boost pressure: • Restricted air cleaner • Intake air leak • Exhaust air leak • Restriction in exhaust • Faulty turbocharger. See TURBOCHARGER INSPECTION in Section 02, Group 080 of the 9.0L Base Engine manual (CTM 400). Was the problem found?	**YES:** Repair problem and retest. **NO:** GO TO ❹

– – –1/1

❹ **Valve Clearance Check**	Check valve lash. See ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 9.0L Base Engine manual (CTM 400). Valve clearance on all valves within specification?	**YES:** GO TO ❺ **NO:** Adjust valve clearance and retest. If dark smoke is still present, GO TO ❺ – – –1/1

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

E6 - Engine Will Not Crank

Symptom	Problem	Solution
E6 - Engine Will Not Crank	Weak battery	Replace battery.
	Corroded or loose battery connections	Clean battery terminals and connections.
	Defective main switch or start safety switch	Repair switch as required.
	Starter solenoid defective	Replace solenoid.
	Starter defective	Replace starter.
	Start circuit defective	Check wiring, fuses, and relays.
	Engine is seized	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 80 of the 9.0L Base Engine manual (CTM 400).
	Electronic control system problem or basic engine problem	See E2 - ENGINE MISFIRE/RUNS IRREGULARLY diagnostic procedure earlier in this Group.

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E8 - Abnormal Engine Noise

Symptom	Problem	Solution
Abnormal Engine Noise	Worn main or connecting rod bearings	See CRANKSHAFT , MAIN BEARINGS, AND FLYWHEEL REPAIR AND ADJUSTMENT in Section 2, Group 40 of the 9.0L Base Engine manual (CTM 400).
	Excessive crankshaft end play	Check crankshaft end play. See CHECK CRANKSHAFT END PLAY in Group 040 of the 9.0L Base Engine manual (CTM 400).
	Loose main bearing caps	Check bearing clearance; replace bearings and bearing cap screws as required. See CRANKSHAFT , MAIN BEARINGS, AND FLYWHEEL REPAIR AND ADJUSTMENT in Section 2, Group 40 of the 9.0L Base Engine manual (CTM 400).
	Worn connecting rod bushings and piston pins	CYLINDER BLOCK, LINERS, PISTONS, AND RODS REPAIR AND ADJUSTMENT in Section 2, Group 30 of the 9.0L Base Engine manual (CTM 400).
	Scored pistons	Inspect pistons. See CYLINDER BLOCK, LINERS, PISTONS, AND RODS REPAIR AND ADJUSTMENT in Section 2, Group 30 of the 9.0L Base Engine manual (CTM 400).
	Worn timing gears or excess back lash	Check timing gear back lash. See CHECK CAMSHAFT ENDPLAY AND GEAR BACKLASH in Section 2, Group 050 of the 9.0L Base Engine manual (CTM 400).
	Excessive valve clearance	Check and adjust valve clearance. See ADJUST VALVE CLEARANCE IN Section 2, Group 021 of the 9.0L Base Engine manual (CTM 400).

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Continued on next page

Symptom	Problem	Solution
	Worn camshaft	Inspect camshaft. See CAMSHAFT AND TIMING GEAR TRAIN REPAIR AND ADJUSTMENT in Section 2, Group 050 of the 9.0L Base Engine manual (CTM 400).
	Worn rocker arm shaft(s)	Inspect rocker arm shafts. See CYLINDER HEAD AND VALVES REPAIR AND ADJUSTMENT in Section 2, Group 021 of the 9.0L Base Engine manual (CTM 400).
	Insufficient engine lubrication	See L2 - ENGINE OIL PRESSURE LOW in Section 4 oof the 9.0L Base Engine manual (CTM 400).
	Turbocharger noise	See TURBOCHARGER INSPECTION in Section 2, Group 080 of the 9.0L Base Engine manual (CTM 400).

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E9 - Analog Throttle (A) Does Not Respond

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

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

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E10 - Analog Throttle (B) Does Not Respond

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

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

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F1 Fuel Supply System Check

RG41183,0000119 –19–26MAY06–1/1

F1 - Fuel Supply System Check Diagnostic Procedure

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❶ **F1 - Preliminary Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Check for ruptured fuel lines. 2. Check for restricted vent in fuel tank. 3. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. Was the problem found?	**YES:** Repair and retest **NO:** GO TO ❷
❷ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Section. 4. Refresh DTC list. Does display show any Active DTC's?	**YES:** Troubleshoot Active DTC's. **NO:** GO TO ❸
❸ **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. Was air present in the fuel?	**YES:** Repair problem then retest. **NO:** GO TO ❹

– – –1/1

❹ **Fuel Line Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Check for a partially restricted fuel flow between the following: • Fuel tank and primary filter inlet • Primary filter and secondary filter inlet • Secondary filter outlet and high pressure pump inlet Are there any fuel restrictions?	**YES:** Repair problem and retest. **NO:** GO TO ❺ – – –1/1
❺ **Fuel Pressure at Secondary (Final) Fuel Filter Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, 2. Monitor Low Pressure Fuel Pressure - Actual. Is the pressure 20 kPa ± 5 kPa (3 ± 0.75 psi)?	**YES:** GO TO ❼ **NO:** Replace both fuel filters, GO TO ❻ – – –1/1
❻ **Fuel Pressure at Secondary (Final) Fuel Filter Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, 2. Monitor Low Pressure Fuel Pressure - Actual. Is the pressure 20 kPa ± 5 kPa (3 ± 0.75 psi)?	**YES:** GO TO ❼ **NO:** Replace low pressure fuel sensor, retest. – – –1/1
❼ **High Pressure Fuel Pump Overflow Orifice Check**	1. Ignition OFF 2. Disconnect the fuel return line from the high pressure fuel pump overflow orifice. 3. Connect a clear hose to the overflow valve routing the other end into a suitable container for diesel fuel. Use line form JT03513 Kit. 4. Ignition ON, engine cranking or running. Is fuel flow present through overflow orifice?	**YES:** Pump working properly. GO TO ❽ **NO:** Replace pump and retest. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP ASSEMBLY in Section 2, Group 90 earlier in this manual. – – –1/1

8 Cranking Fuel Rail Pressure Test	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, Engine Cranking 2. Monitor Fuel Rail Pressure - Actual. Is pressure 20 MPa (200 bar) (2900 psi) or above?	**YES:** Cranking fuel pressure good, GO TO 9 **NO:** GO TO 1 – – –1/1

9 Fuel Rail Pressure Test	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, Engine Running at low idle 2. Monitor Fuel Rail Pressure - Actual. Is pressure 35 MPa (350 bar) (5076 psi) or above?	**YES:** No fuel system problem found. **NO:** GO TO 10 – – –1/1

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10 Pressure Limiter Test	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* **CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.** **If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.** 1. Before removing fuel line from pressure limiter, turn engine OFF and let sit for at least 5 minutes. This will relieve fuel pressure from the high pressure common rail. 2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure limiter. 3. Disconnect fuel return line fitting at the fuel leak-off line from the pressure limiter valve. Do NOT remove the pressure limiter valve. 4. Run a clear line from a suitable container for diesel fuel to the pressure limiter valve 5. Ignition ON, engine running. 6. Check fuel flow at pressure limiter valve. Is there anyl fuel flow present?	**YES:** Replace pressure limiter, retest **NO:** Fuel system checks good. – – –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.
	Improper type of fuel.	Use proper fuel.
	Improper valve clearance.	Adjust valves. See ADJUST VALVE CLEARANCE in the 9.0L Base Engine manual (CTM400).
	Exhaust Gas Recirculation (EGR) valve sticking or restricted	Remove and inspect EGR valve. See REMOVE AND INSTALL EGR VALVE in Section 2, Group 100 in this manual.
	Fuel injectors defective.	If testing indicates a possible faulty injector, remove and inspect injectors. See REMOVE AND INSTALL ELECTRONIC INJECTORS and CLEAN AND INSPECT ELECTRONIC INJECTOR BODY in Section 2, Group 100 of this manual.
	High pressure fuel pump timing incorrect.	Check and adjust pump timing. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING later in this Group.

Continued on next page

Symptom	Problem	Solution
	Improper turbocharger operation.	Check for trouble codes according to instructions in this manual.
	Low engine temperature.	Coolant temperature too low. Check thermostat. See INSPECT THERMOSTAT AND TEST OPENING TEMPERATURE in the 9.0L Base Engine manual (CTM400).

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F3 - Fuel in Oil

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

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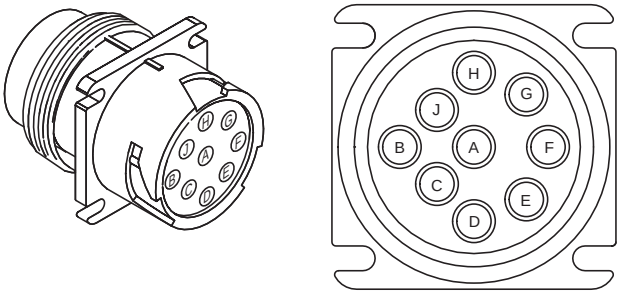
D1 - ECU Does Not Communicate with Service ADVISOR

RG41221,00000FD –19–18OCT05–1/1

D1 - ECU Does Not Communicate with Service ADVISOR Diagnostic Procedure

– – –1/1

❶ **PDM or EDL Power Light Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR. For instructions on connecting Service ADVISOR, see CONNECTING TO SERVICE ADVISOR in Group 160 later in this manual. 2. Make sure all connections between the diagnostic connector and the service tool are properly connected. Make sure that ECU connectors are properly connected. 3. Ignition ON. 4. Note power light on the Parallel Data Module (PDM) or Electronic Data Link (EDL). Does the light illuminate?	**YES:** GO TO ❷ **NO:** If using PDM, GO TO ❓ If using EDL: Faulty USB cable or connector OR Faulty connection in PC or EDL. – – –1/1

❷ **CAN Circuit Voltage Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF. 2. Disconnect the diagnostic connector from the PDM or EDL cable. 3. Using a multimeter, measure voltage between diagnostic connector terminal A and: • Terminal C (CAN high) in the diagnostic connector. • Terminal D (CAN low) in the diagnostic connector. Is the voltage 2.1-2.9V on both circuits?  RXA0067609 –UN–05JUN03 *Diagnostic Connector (J1939 Interface)* **A—Ground** **B—Battery** **C—CAN Hi** **D—CAN Lo** **E—Shield**	**YES:** GO TO ❸ **NO:** Open in CAN circuit. GO TO ❹ – – –1/1
❸ **Open CAN Circuit Test (covered by #5?)**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF. 2. Disconnect the diagnostic connector from the PDM or EDL cable. 3. Using a multimeter, measure voltage between a good chassis ground and: • Terminal C (CAN high) in the diagnostic connector. • Terminal D (CAN low) in the diagnostic connector. Is the voltage good on both circuits?	**YES:** CAN circuit from ECU to diagnostic connector OK. Faulty PDM or EDL cable or connection OR Faulty PDM or EDL OR Faulty diagnostic software/computer configuration **NO:** CAN wiring between ECU and diagnostic connector is open or shorted. GO TO ❺ NOTE: If voltages are the same, CAN Hi and CAN Low are shorted together. – – –1/1

❹ **CAN Terminator Resistance Check**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove CAN terminator from the terminator connector. 3. Using a multimeter, measure resistance between terminals A and B in the terminator. Does the resistance measure between approximately 125 ohms?	**YES:** CAN terminator resistor OK. GO TO ❻ **NO:** Faulty CAN terminator resistor. – – –1/1
❺ **Harness CAN Wiring Open Test**	1. Ignition OFF. 2. Disconnect ECU connector J2. 3. Using a multimeter, measure resistance between: • Terminal A in the CAN terminator and terminal A1 in the ECU connector J2. • Terminal B in the CAN terminator and terminal B1 in the ECU connector J2. • Terminal A in the CAN terminator and terminal C in the diagnostic connector. • Terminal B in the CAN terminator and terminal D in the diagnostic connector. • Terminal A in the diagnostic connector and a good chassis ground. Does each resistance measure 5 ohms or less?	**YES:** Engine harness CAN wiring not open. GO TO ❼ **NO:** Open in wiring that measured high resistance. Repair and retest. – – –1/1
❻ **Harness CAN Wiring Ground Test**	1. Ignition OFF. 2. ECU connector J2 still disconnected. 3. Disconnect the 21- or 23- pin control panel connector. 4. Using a multimeter, measure resistance between: • Terminal C (CAN high) and terminal A (ground) in the diagnostic connector. • Terminal D (CAN low) and terminal A (ground) in the diagnostic connector. Does the resistance measure at least 20K ohms?	**YES:** Engine harness CAN wiring OK. Problem may be intermittent. **NO:** Gounded wiring that measured low resistance. Repair and retest. – – –1/1
❼ **Ground Circuit Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Using a multimeter, check resistance between terminal A in the diagnostic connector and a good chassis ground. Is resistance 5 ohms or less?	**YES:** Ground circuit OK. GO TO ❾ **NO:** Open in ground circuit. Repair and retest. – – –1/1

❽ **Power Circuit Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition ON. 2. Disconnect the diagnostic cable from the diagnostic connector. 3. Using a multimeter, measure the voltage between the ground terminal and the power terminal (terminals A and B) in the diagnostic connector. Is the voltage approximately battery voltage?	**YES:** Faulty wiring or connection between diagnostic connector and PDM OR Faulty PDM **NO:** GO TO ❿ – – –1/1

❾ **Check Fuses**	1. Ignition OFF. 2. Check system fuses. Are any fuses blown?	**YES:** Replace fuse and retest. **NO:** GO TO ⓫ – – –1/1

❿ **ECU Power Test**	1. Ignition OFF. 2. Disconnect ECU connector J2. 3. Using a multimeter, check resistance between terminal B in the diagnostic connector and terminal B2 in connector J2. Is resistance 5K ohms or less?	**YES:** Faulty ECU. **NO:** Repair open circuit in harness. – – –1/1

D2 - Diagnostic Gauge Does Not Communicate With ECU

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D2 - Diagnostic Gauge Does Not Communicate With ECU Diagnostic Procedure

NOTE: 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*

– – –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 ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors, CAN terminator connector, the instrument panel connector, diagnostic gage connector and any connectors between them looking for dirty, damaged, or poorly positioned terminals. Was the problem found?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Ignition ON Does the diagnostic gage display an error code?	**YES:** GO TO ❸ **NO:** No power to the gage. GO TO ❸ **NO:** No error but has power. Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS in this Section 4 Group 160 of this manual.

– – –1/1

❸ **Sensor Voltage Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect any **ONE** of the following: *NOTE: When sensor is disconnected DTC will set. This DTC will clear once the sensor is reconnected.* • Fuel temperature sensor • EGR Fresh Air temperature sensor • Engine coolant temperature sensor For sensor location, see SENSOR LOCATION in Section 03, Group 140 of this manual. 3. Ignition ON 4. Using a multimeter, measure the voltage between both terminals of the selected sensor harness connector. Is the voltage 4.5 volts or above?	**YES:** GO TO ❺ **NO:** GO TO ❹ – – –1/1

❹ **Power Supply Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect ECU connector #J2. 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between a good chassis ground and terminal B2 in ECU connector #J2 on the harness end of the ECU connector. Is the voltage 10 volts or above?	**YES:** Faulty ECU power wiring OR Faulty ECU. **NO:** Faulty ECU power fuse OR Key-on signal wire shorted to ground OR Faulty ignition switch OR Faulty key-on power fuse. – – –1/1

❺ **Diagnostic Gauge Power Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition ON 2. View diagnostic gauge Does the gage have power.	**YES:** GO TO ❽ **NO:** GO TO ❻ – – –1/1

❻ **Open in Diagnostic Gauge Connector Ground Wire Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the diagnostic gauge from the diagnostic connector. 3. Using a multimeter, measure voltage between the switched voltage terminal and the ground terminal (terminals D and E) of the harness end of the diagnostic gauge connector. Is voltage substantially less than battery voltage?	**YES:** GO TO ❼ **NO:** 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 and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 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. Does the light illuminate?	**YES:** Open or short to ground in diagnostic gauge power wire. **NO:** Open in diagnostic gauge connector ground wire. – – –1/1
❽ **Open in Harness Circuit Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect ECU connector #J2 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 B1 in the ECU connector #J2. • Terminal G in the diagnostic gauge connector and terminal A1 in the ECU connector #J2. Does the resistance measure 5 ohms or less?	**YES:** GO TO ❾ **NO:** Open in harness wire(s) that measured greater than 5 ohms. OR Connector terminals in wrong position – – –1/1

❾ CAN Resistance Test	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. ECU connector #J2 and diagnostic connectors still disconnected. 3. Using a multimeter, measure resistance between terminals B and G in the harness end of the diagnostic connector. Does the resistance measure between 45 and 75 ohms?	**YES:** GO TO ❿ **NO:** Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness – – –1/1

❿ CAN High and Low Voltage Test	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Reconnect ECU connector #J2. 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 Is the voltage between 1.5 and 3.5 volts?	**YES:** Faulty ECU connection OR Faulty diagnostic gauge connection OR Faulty diagnostic software/computer configuration OR Faulty ECU **NO:** CAN wiring shorted to ground or power OR Faulty ECU – – –1/1

A1 - Intake Air Heater Check

RG41221,00002C6 –19–28SEP05–1/1

A1 - Intake Air Heater Check Diagnostic Procedure

Related Information
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 engine coolant temperature that the ECU detects at key-on.

Alarm Level:
N/A

Control Unit Response:
If coolant temperature is below the setpoint (typically 0-5°C), the ECU will turn on the intake air heater when the operator turns the ignition switch to ON. The ECU will turn the heater off during cranking, then turn it back on during run-up and for a period of time after run-up.

Additional References:
For further intake air heater information, see INTAKE AIR HEATER OPERATION in Section 03, Group 140 earlier in this manual.

For application-specific information on intake air heater times vs. temperatures, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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 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 INTAKE AIR HEATER OPERATION in Section 03, Group 140 earlier in this manual.* 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. Was the problem found?	**YES:** GO TO ❷ **NO:** 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 INTAKE AIR HEATER OPERATION in Section 03, Group 140 earlier in this manual.* 1. Key ON, engine OFF 2. Verify that the air heater indicator light is working Does the light illuminate?	**YES:** GO TO ❸ **NO:** 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 INTAKE AIR HEATER OPERATION in Section 03, Group 140 earlier in this manual.* 1. Connect the SERVICE ADVISOR™. For instructions on connecting to the SERVICE ADVISOR™, see CONNECTING TO SERVICE ADVISOR in Group 160 later in this manual. 2. Ignition ON, engine OFF 3. Start the ECU Communication Software 4. Make note of any DTCs, then clear all DTCs. 5. Key ON, engine OFF 6. Read DTCs using SERVICE ADVISOR. Does the diagnostic software display any DTCs?	**YES:** Go to appropriate diagnostic procedure **NO:** GO TO ❹

SERVICE ADVISOR is a trademark of Deere & Company

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❹ **Engine Coolant Temperature Check**	*NOTE: For wiring and theory of operation information, see INTAKE AIR HEATER OPERATION in Section 03, Group 140 earlier in this manual.* 1. Key ON, engine OFF 2. Using the diagnostic software, read engine coolant temperature. Is the engine coolant temperature -5°C (23°F) or less?	**YES:** GO TO ❺ **NO:** Air heater will not come on if temperature is above -5°C (23°F).

– – –1/1

❺ **Air Heater Check**	*NOTE: For wiring and theory of operation information, see INTAKE AIR HEATER OPERATION in Section 03, Group 140 earlier in this manual.* 1. Key OFF 2. Monitor the temperature of air heater housing 3. Key ON, engine OFF 4. Continue to monitor temperature of air heater housing Does the air heater housing temperature increase?	**YES:** No air heater related problem found **NO:** GO TO ❻ – – –1/1

❻ **Air Heater Relay Check**	*NOTE: For wiring and theory of operation information, see INTAKE AIR HEATER OPERATION in Section 03, Group 140 earlier in this manual.* 1. Key OFF 2. Listen for air heater relay to click while turning key ON (engine OFF). Does the relay click?	**YES:** Faulty power wire to relay OR Faulty wire between relay and heater OR Faulty air heater relay **NO:** Faulty air heater enable wire OR Faulty relay ground OR Faulty relay – – –1/1

04
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Check Fuel Supply Quality

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. Drain primary filter into a clean container, see operators manual.
2. Check for water or debris in the drained fuel.
3. Drain secondary filter into a clean container, see operators manual.
4. Check for water or debris in the drained fuel.
5. Key ON for 1 minute to prime fuel system.
6. Repeat steps 1-5 above.
7. If water or debris is still found replace filters as per operators manual and repeat steps 1-5. If water and or debris is still found drain and clean fuel tank as per vehicle maintenance manual, else go to step 8.
8. Run engine for 1 minute at 1500 rpm.
9. Operate under load for 1 minute, observing engine performance. If problems still occur go step 10.
10. Reduce engine speed to idle and shutdown engine.
11. Disconnect fuel line from inlet side of primary fuel filter, and fuel return line from fuel pump return, as per operator's manual.

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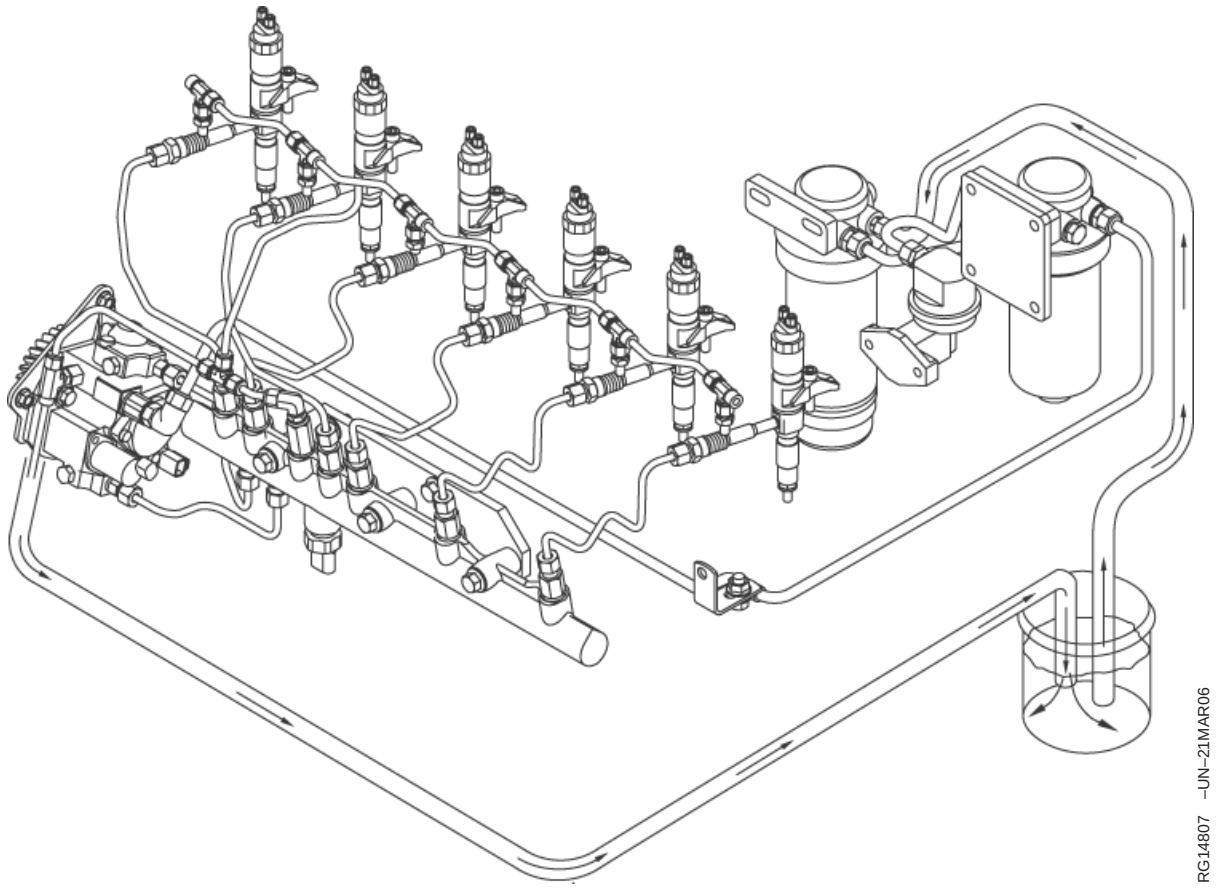

Test Quality of Fuel

12. Connect one hose to inlet port of primary fuel filter, and connect another hose to fuel pump return, as shown.
13. Submerge hose in a container of good quality, clean fuel meeting engine specifications.
14. Operate engine under load and observe performance. If performance improves, fuel is contaminated or not of the proper grade. Check fuel source.

RG41183,0000117 –19–22MAR06–2/2

Test for Air in Fuel

The fuel system will self-purge of air, but a large amount of air entering the fuel system can cause the engine to be hard to start, run rough, misfire, knock, smoke, or produce low power.

To check for air in the system, follow the procedure below.

1. Preliminary checks:
   - Check for loose fittings between fuel tank and fuel supply pump.
   - Check for loose fittings on the fuel cooler, if applicable.
   - Make sure primary filter element is on tight and gasket is intact.
   - Check for damaged fuel pick-up tube in tank.
   - Check for low fuel level in tank.
   - Check for foaming in tank. Foaming strongly suggests air leaking past injectors. If there is foaming, inspect the injector hold down clamp torque, o-rings and seals. See REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2 of this manual.
   - Air may enter system when engine is turned off: Make sure lines are properly tightened between the secondary filter and the high pressure fuel pump and between high pressure fuel pump leak-off port and cylinder head.
2. Check for air in fuel system:
   a. Disconnect the return-to-tank line from the T-connector located next to the #6 injector fuel line (on some applications the T-connector will be located between injector fuel lines #1 and #2).

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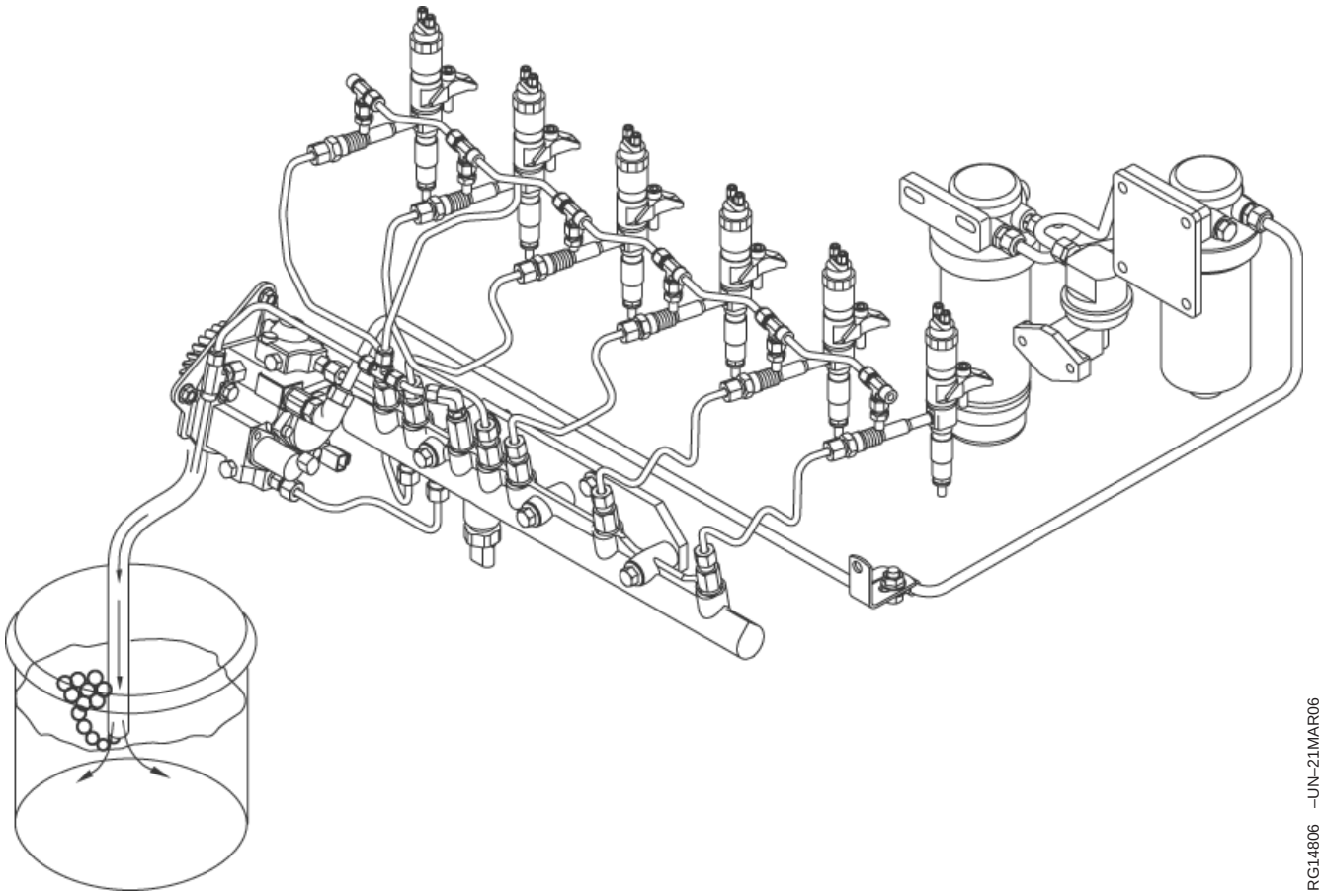

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Check For Air in Fuel System

b. Install a clear plastic hose with proper fittings between the T-connector and the return-to-tank line, OR submerge hose in a container of clean fuel, as shown.
c. Start engine. Run engine for 1 minute at 1500 rpm. Observe hose and container (if used) for bubbles. Stop engine.
d. If there are bubbles, go to the next step to determine source of the air. Reconnect fuel lines.

3. Check for air in fuel tank supply line:
   a. Disconnect the fuel tank supply line from the fuel supply pump.
   b. Install a clear plastic hose with proper fittings between the fuel tank supply line and the fuel supply pump. Tool JT03513C Fuel Supply System Test Kit is designed for this task.
   c. Operate engine and check for air bubbles in hose. If there are bubbles, check for damaged tank, damaged tank components, and for loose or damaged fuel supply lines and hoses.
   d. If no problem was found, go to the next step. Reconnect fuel lines.
4. Check for air in the high pressure pump fuel supply line:
   a. Disconnect the line between the secondary filter and the high pressure fuel pump.
   b. Install a clear plastic hose with proper fittings between the filter and the pump.
   c. Operate engine and allow hose to fill with fuel, then check for air bubbles in hose. If there are bubbles, check for damaged primary filter head or gasket, and for loose or damaged primary filter.

Continued on next page

d. If source of air was not found, a likely cause is air leaking past one or more injectors. Inspect the injector hold down clamp torque, o-rings and seals. See REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2 of this manual. Reconnect fuel lines.

NOTE: If the engine has a fuel cooler, rule out air entering from the fuel cooler before removing injectors.

RG41183,0000118 –19–22MAR06–3/3

Check Fuel Supply Pressure

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

Check for low pressure fuel system DTC's using the service tool, see CONNECTING TO SERVICE ADVISOR in Section 04 Group 160 in this manual.

If any SPN 94 codes appear troubleshoot them first.

RG41183,000011A –19–15NOV05–1/1

Check for Restricted Fuel Leak-off Line

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

1. Check all return lines and ensure there are no kinked or pinched lines.

NOTE: For more information on location of leak-off lines see maintenance manual for that application.

2. Disconnect fuel leak-off line at the engine.
3. Remove fuel tank cap.
4. Force compressed air through the fuel leak-off line while listening at the fuel tank filler neck.

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

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

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Check High Pressure Fuel Pump Static Timing

IMPORTANT: There is no timing adjustment for the fuel pump. Use this procedure to check for proper installation.

1. Remove cover from the pump gear housing. Clean off gasket material.
2. Remove plugs in engine block and install JDG820 Flywheel Turning Tool. Rotate engine flywheel in normal running direction until No. 1 piston is at "TDC" of its compression stroke.
3. Install JDE81-4 Timing Pin into hole in flywheel.
4. Check if timing marks on the pump gear and cam gear are lined up.

NOTE: If timing marks are not lined up, engine may be at No. 6 TDC-Compression. Rotate engine one full revolution in running direction until JDE81-4 Timing Pin engages in flywheel again.

5. If timing marks are not lined up when engine is at No. 1 TDC—Compression, see REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP in Section 2 Group 90.
6. If timing marks are lined up, no adjustment is necessary.
7. Install gear housing cover with new gasket.

Specification	
Pump Gear Housing Cover—Torque	31 Nm (23 lb-ft)

8. Remove JDG820 Flywheel Turning Tool and JDE81-4 Timing Pin. Install plugs back into engine block.

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Check for Fuel in Oil

IMPORTANT: Fuel in the oil system causes early failure of engine components.

Fuel in the oil will cause the engine to wear at a faster rate. The engine may run rough because of fuel loss in a cylinder.

A rise in the oil level is an indication of fuel leaking into the oil system.

Items that could cause this condition are:

- Plugged return line on the high pressure pump overflow line causing to much back pressure in the pump thus fuel being pushed out the drive shaft seal and leaking into the main gear housing.
- Bad injector seal allowing overflow fuel to run down the injector bore into the cylinder.

RG41183,000011D –19–25AUG05–1/1

About This Group

This group of the manual contains necessary information to diagnose the electronic control system, fuel system and air system. Use this information in conjunction with Base Engine Manual.

See the Base Engine Manual 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, terminals and wiring harnesses are serviceable and available.

To help diagnose electronic control system problems, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual. It contains useful information, such as system wiring schematic and ECU terminal identification.

IMPORTANT: 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/Cab connector and the ECU/Engine connector. Note that these measurements are normally made in the harness connector. Measurements made on the ECU itself will specifically call that out.

RG41221,00001DC –19–03OCT05–1/1

Electrical Concepts

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

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

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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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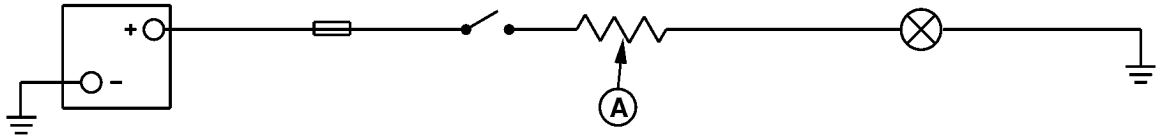
RG9891 –UN–06JAN99



High Resistance Circuit

A—Unwanted Resistance

Definition of Circuit Malfunctions

1. **High Resistance Circuit:**

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

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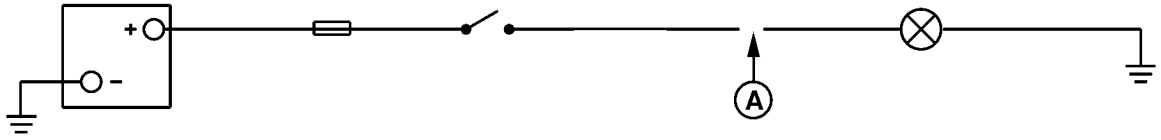

Open Circuit

A—Break or Separation in Circuit

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

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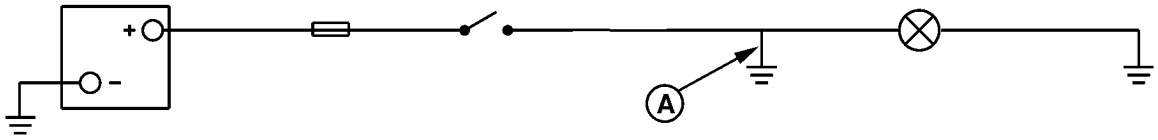

Grounded Circuit

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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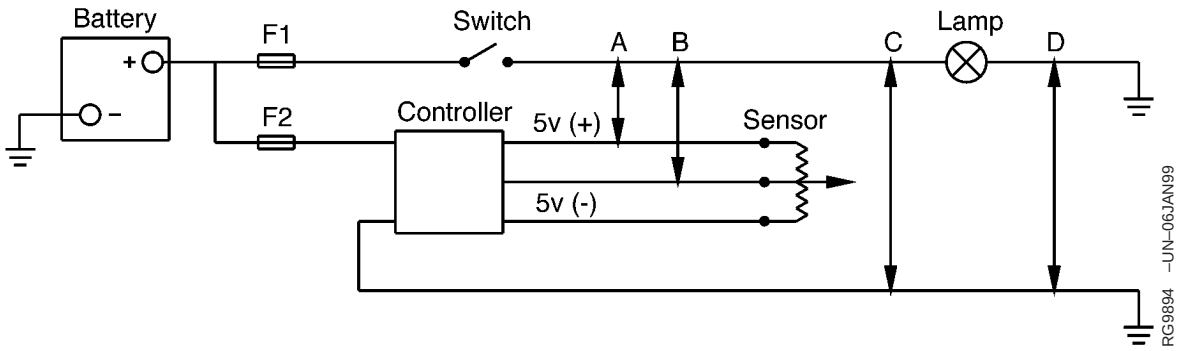

Shorted Circuit

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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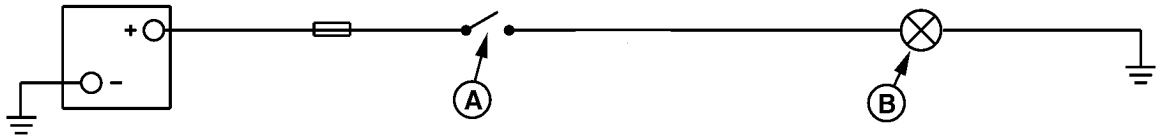

Locations of Circuit Malfunctions

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 reestablished good continuity through the connector.

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Troubleshooting Circuit Malfunctions

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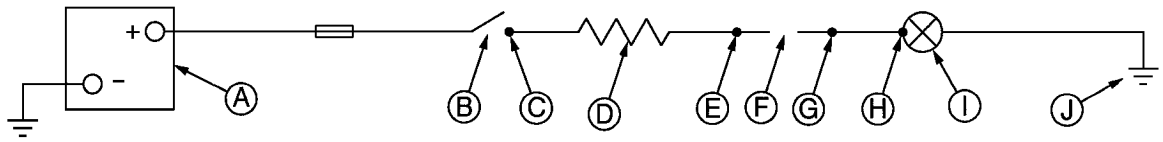

Troubleshooting Circuit Malfunctions

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 easily accessible between (C) and (H).

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

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

   b. Repair the circuit as required.

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

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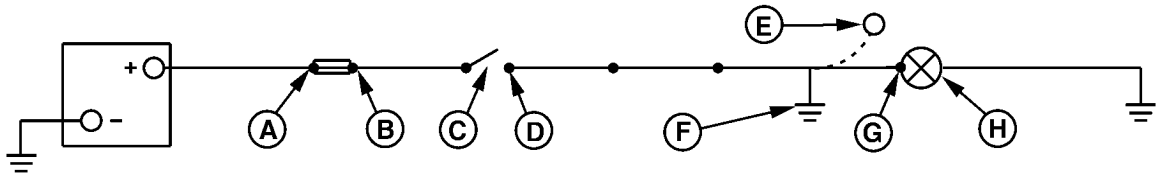

Ground Circuit

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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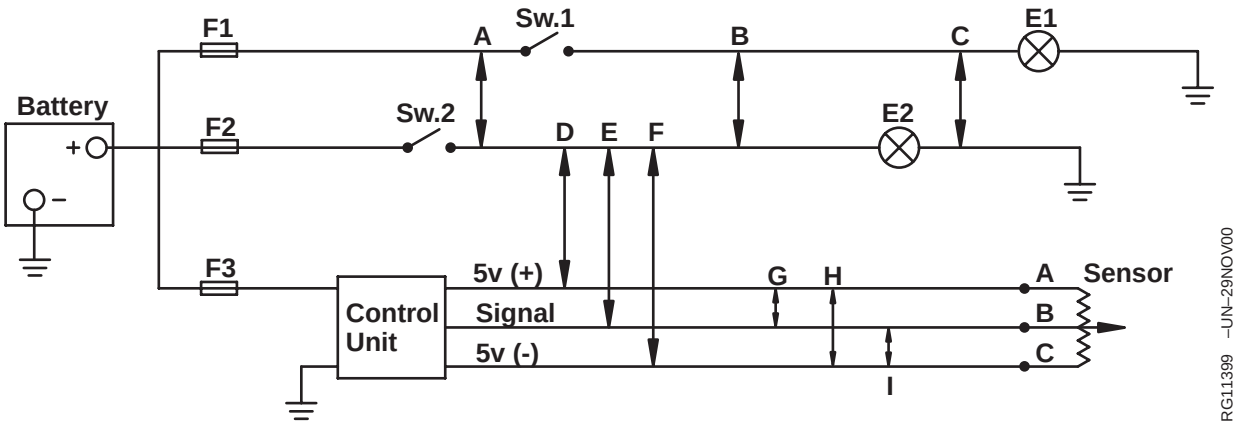

4. **Shorted Circuit:**

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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 (E2) is on all of the time.

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

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

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

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

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

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

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

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

Do the following to isolate a "Shorted Circuit:"

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

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

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

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

Continued on next page

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

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

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

f. Alternate Method to Check for Shorted Circuit.

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

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

g. Repair the “Shorted Circuit” as follows:

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

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

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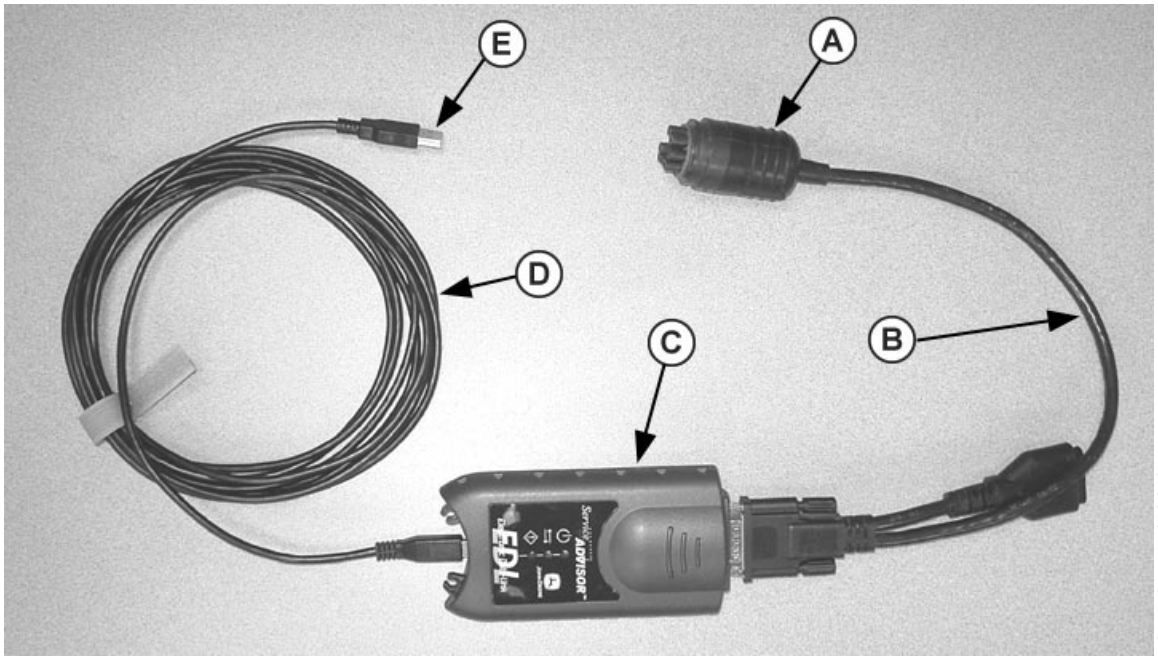
Connecting to Service ADVISOR

The current Service ADVISOR connecting hardware includes the Electronic Data Link, or EDL. The EDL supersedes the PDM.

RG41221,00001E1 –19–02MAY06–1/5



Connecting to Service ADVISOR

A—to 9-Pin Diagnostic Connector on Engine
B—John Deere Controller Cable
C—EDL (Electronic Data Link)
D—USB Cable
E—to PC with Service ADVISOR

Connecting to Service ADVISOR Using EDL

DS10117 ECU Communication Hardware Kit is required to connect Service ADVISOR to the ECU. For obtaining the latest version of software, please refer to your John Deere Dealer web site.

The engine harness diagnostic connector is a black, circular connector with a square mounting flange and a dust cap. There are nine available pins. Depending on application, the location of the diagnostic connector may vary. On OEM, the connector is located near the ECU on the engine wiring harness.

1. Locate diagnostic connector on engine and remove dust cap.
2. Connect John Deere Controller Cable (B) to the diagnostic connector on the engine harness.
3. Connect the other end of the John Deere Controller Cable to the EDL (C).
4. Connect the USB cable (D) to the EDL.
5. Connect the other end of the USB cable to the computer that has Service ADVISOR installed.
6. Key ON, engine off or running, verify that power light on EDL is illuminated green.

Continued on next page

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7. Start the diagnostic software and select the appropriate application.
8. Connect to the application. The CAN light on the EDL should illuminate red when the connection to the ECU is made.
9. If Service ADVISOR does not connect, see D1 - ECU DOES NOT COMMUNICATE WITH SERVICE ADVISOR diagnostic procedure in Group 150 of this manual.
10. If power to the EDL is lost while cranking the engine for the Compression Test, use the Power Adapter. The Power Adapter connects between the EDL and the John Deere Controller Cable.
11. When finished, replace the dust cap on the diagnostic connector.

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Power Adapter

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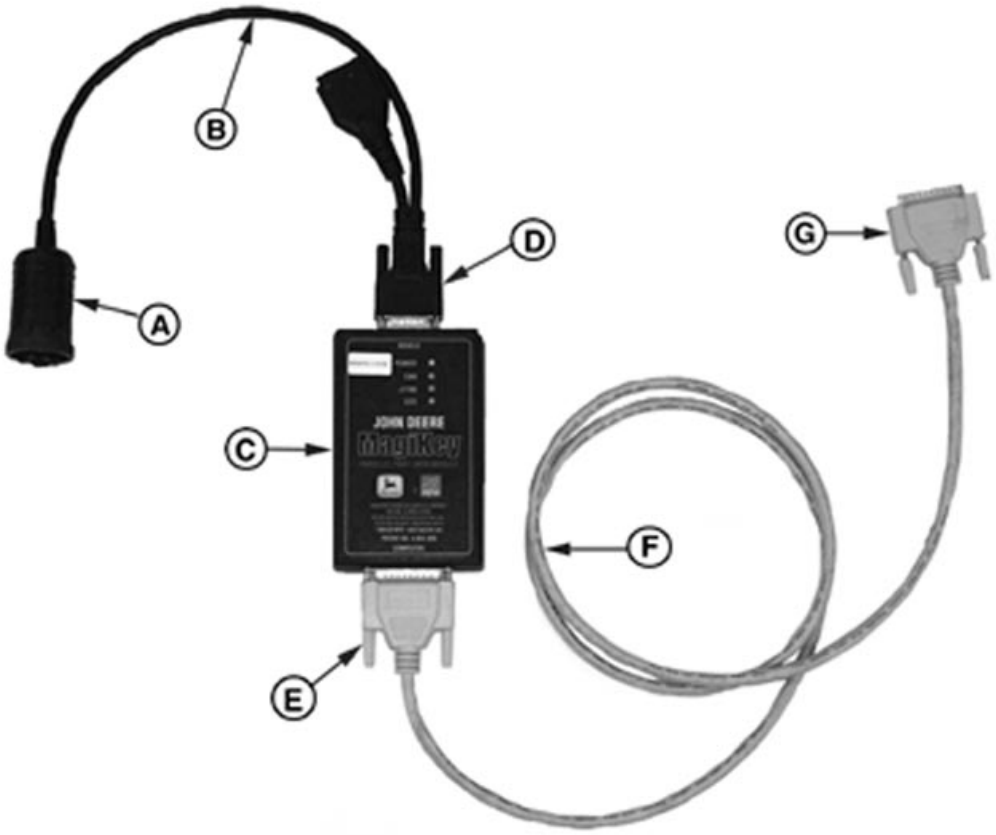

Connecting to Service ADVISOR

A—Diagnostic Connector Mate
B—John Deere Controller Cable
C—PDM (Parallel Data Module)
D—26 Pin PDM Connector
E—25 Pin PDM Connector
F—PC Cable
G—PC Connector

Connecting to Service ADVISOR Using PDM

DS10023 ECU Communication Hardware Kit or JDIS121 ECU Communication Hardware Kit is required to connect Service ADVISOR to the ECU. Please refer to your John Deere Dealer web site for obtaining the latest version of software.

The diagnostic connector is a black, circular connector with a square mounting flange and a dust cap. There are nine available pins. Depending on application, the location of the diagnostic connector may vary. On OEM, the connector is located near the ECU on the engine wiring harness.

1. Locate diagnostic connector on engine and remove dust cap.
2. Connect John Deere Controller Cable (B) to the diagnostic connector on the engine harness using the diagnostic connector mate (A).
3. Connect the other end of the John Deere Controller Cable to the PDM (C) module at the 26 pin PDM connector (D).
4. Connect the PC cable (F) to the PDM module at the 25 pin PDM connector (E).
5. Connect the other end of the PC cable to the computer that has Service ADVISOR installed.
6. Key ON, engine off or running, verify that power light on PDM is illuminated green.

Continued on next page

7. Start the diagnostic software and select the appropriate application.
8. Connect to the application. The CAN light on the PDM should illuminate red when the connection to the ECU is made.
9. If Service ADVISOR does not connect, see D1 - ECU DOES NOT COMMUNICATE WITH SERVICE ADVISOR diagnostic procedure in Group 150 of this manual.
10. If power to the PDM is lost while cranking the engine for the Compression Test, use the Power Adapter. The Power Adapter connects between the PDM and the 26 pin PDM connector.
11. When finished, replace the dust cap on the diagnostic connector.

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Power Adapter

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Viewing Active DTCs on Diagnostic Gauge

NOTE: For complete Powerview operating instructions, refer to the Operator's Manual, associated with this CTM and subject engine.

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens.

1.

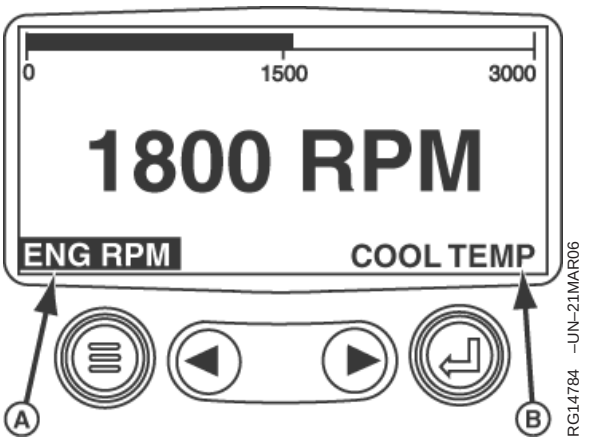

Figure 1. Normal Operation, Single-Parameter Display

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During normal operation, either the single, or four,-parameter screen is displayed. Examples are shown in figures 1 and 2.

When the ignition switch is turned on, Powerview defaults to the single-parameter display (fig. 1). To change to the four-parameter display:

a. Press the menu key (E). Main Menu (fig. 3) is displayed.

b. If "GO TO 4-UP DISPLAY" item is not highlighted, press scroll-up arrow key (F), until it is highlighted (J), as shown in figure 3.

A—Eng (Engine)RPM
B—Cool Temp (Coolant Temperature)
C—Oil Press (Pressure)
D—Bat Volt (Battery Voltage)
E—Menu (Select) Key
F—Arrow Key, Scroll Up
G—Arrow Key, Scroll Down
H—Enter Key

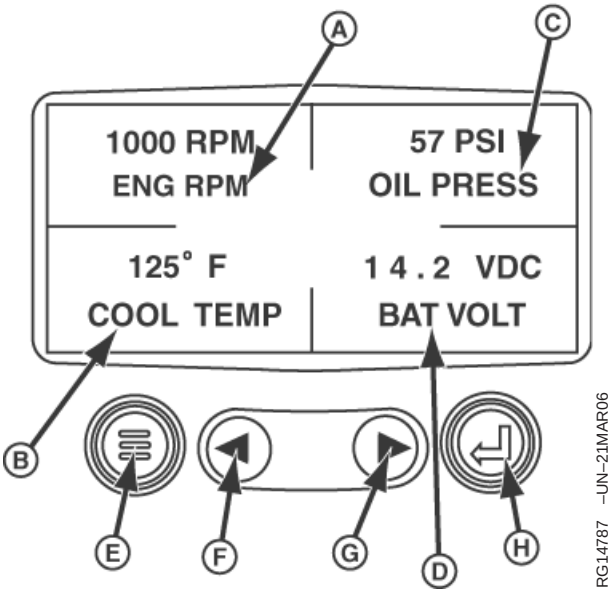

Figure 2. Normal Operation, Four-Parameter Display

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c. Once this item is highlighted, press the enter key (H). The four-parameter display (fig. 2) appears.

NOTE: whichever is selected, the one, or the four, – parameter display, Powerview always defaults to the last one selected. Also, when the one-parameter display is selected, main menu shows "GO TO 4-UP DISPLAY" item and, when the four-parameter display is selected, main menu shows "GO TO 1-UP DISPLAY" item.

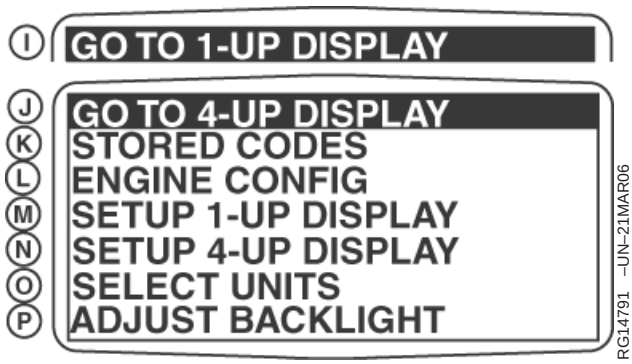

Figure 3. Main Menu, Select Go To 1 or 4-Up Display

I—Go To 1-Up Display
J—Go To 4-Up Display
K—Stored Codes
L—Engine Config (Configuration)
M—Setup 1-Up Display
N—Setup 4-Up Display
O—Select Units
P—Adjust Backlight

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2. When the diagnostic gauge receives a trouble code from an engine control unit, the single, or four, -parameter screen will be replaced with the "Warning" message. The SPN and FMI number will be displayed along with a description of the problem (C) and suggested, “Corrective Action” (D).

IMPORTANT: Ignoring active trouble codes can result in severe engine damage.

3. When the word “NEXT” (E) appears above the arrow keys (H) (I), there are more trouble codes that can be viewed by using the arrow keys. To view the next trouble code, press the right arrow key (I). To view the previous trouble code, press the left arrow key (H).

   As the trouble code being viewed is changed, the “1 of x” (fig. 4 (B)) shows the number of the trouble code being displayed, out of a total number of active trouble codes. (For example, “3 of 5” means viewing the third trouble code of a total number of five, active trouble codes.) As the arrow keys are used to display next, or previous, trouble codes, the left-hand number changes to the number of the trouble code to which the scroll was advanced or returned.

4. To acknowledge and hide the code and return to the single or four -parameter display, press the "Enter" Key (fig. 4 (J)).

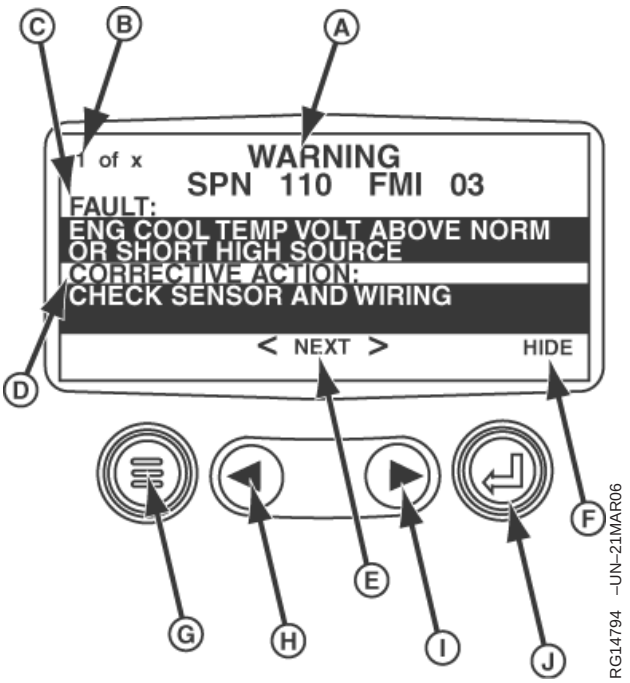

Figure 4. Active Trouble Codes Displayed

A—Warning
B—1 of x
C—Fault: (example) Eng Cool Temp Volt Above Norm or Short High Source
D—Corrective Action: (example) Check Sensor and Wiring
E—Next
F—Hide
G—Menu Key
H—Scroll Up or Back Arrow
I—Scroll Down or Forward Arrow
J—Enter Key

Continued on next page

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5. Upon returning to the one or four – parameter display screen, while a DTC is still active, one of the following icons is shown. Also, refer to figure 5.

   A—Eng (Engine) RPM
   B—Cool Temp (Coolant Temperature
   C—Oil Press (Pressure)
   D—Bat Volt (Battery Voltage)

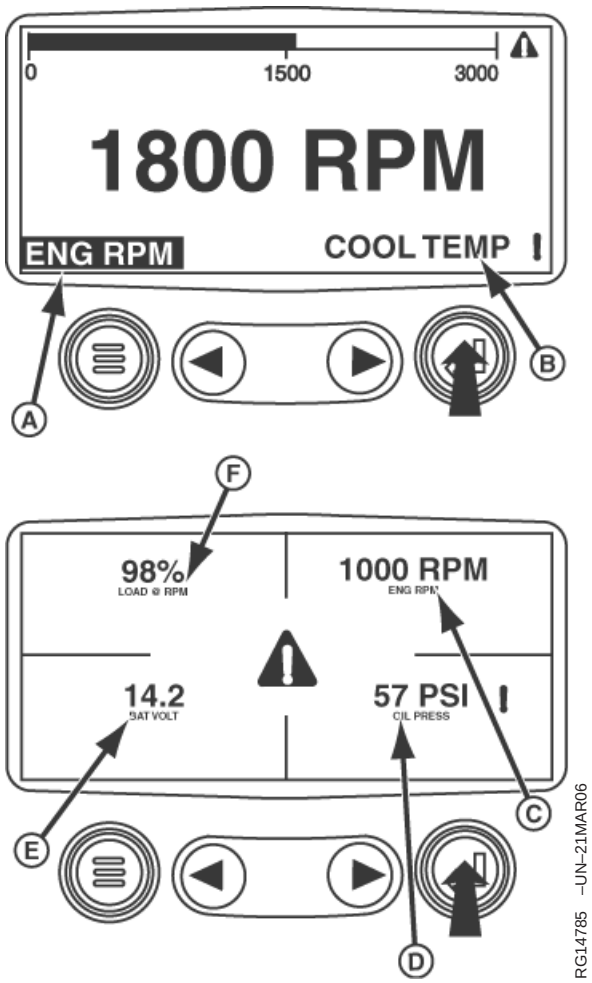

Figure 5. One and Four -Parameter Displays, With Icon Examples

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RG14795 –UN–21MAR06

Figure 6. Indicates Fault Warning

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RG14796 –UN–21MAR06

Figure 7. Indicates Engine Derate or Shutdown Condition Fault

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RG14793 –UN–21MAR06

Figure 8. Indicates Auxiliary Gauge Fault

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Viewing Stored DTCs on Diagnostic Gauge

NOTE: For complete Powerview operating instructions, refer to the Operator's Manual, associated with this CTM and subject engine.

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens.

1. Turn the ignition switch on. Powerview defaults to the single-parameter display. For examples of single and four -parameter displays, see figure 1.

2. Press menu key (E). Main menu is displayed, with 'GO TO 4-UP DISPLAY" highlighted. (This can also be accomplished from the four-parameter display, except "GO TO 1-UP DISPLAY" is highlighted.)

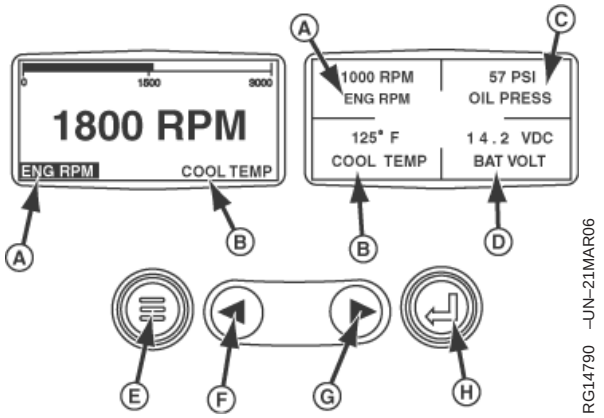

Figure 1. Normal Operation, Single and Four -Parameter Displays

A—Eng (Engine) RPM
B—Cool Temp (Coolant Temp)
C—Oil Press (Pressure)
D—Bat Volt (Battery Voltage)
E—Menu (Select Key)
F—Arrow Scroll (Back or Up) Key
G—Arrow Scroll (Forward or Down) Key
H—Enter Key

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3. Once the "Stored Codes" menu item has been highlighted press the "Enter" key (fig. 1 (H)) to view the stored codes.

4. Press Enter key. "Requesting Fault Codes" screen is momentarily displayed.

   a. a. If there are no stored fault codes, "No Stored Fault Codes" screen is momentarily displayed. Powerview then returns to main menu display, with "Stored Codes" item still highlighted.

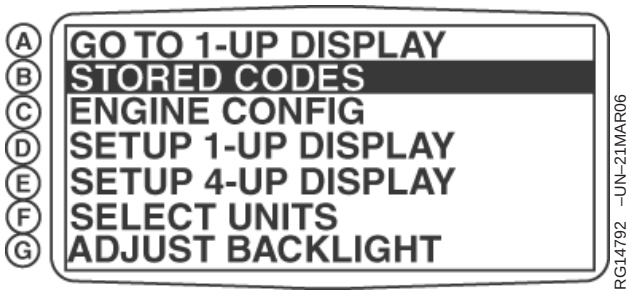

Figure 2. Main Menu, "Stored Codes" Item Highlighted

A—Go to 1-Up Display
B—Stored Codes
C—Engine Config (Configuration)
D—Setup 1-Up Display
E—Setup 4-Up Display
F—Select Units
G—Adjust Backlight

Continued on next page

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b. b. If there are stored fault codes, fault code screen is displayed. For an example, refer to figure 3.

5. When the word “NEXT” (E) appears above the arrow keys (H) and (I), there are more, stored trouble codes that can be viewed by using the arrow keys. To view the next trouble code, press the right arrow key (I). To view the previous trouble code, press the left arrow key (H). As the trouble code being viewed is changed, the “1 of x” (B) shows the number of the trouble code being displayed, out of a total number of active trouble codes. (For example, “3 of 5” means viewing the third trouble code of a total number of five, active trouble codes.) As the arrow keys are used to display next, or previous, trouble codes, the left-hand number changes to the number of the trouble code to which the scroll was advanced or returned.

6. Press the menu key (G) to return to the main menu.

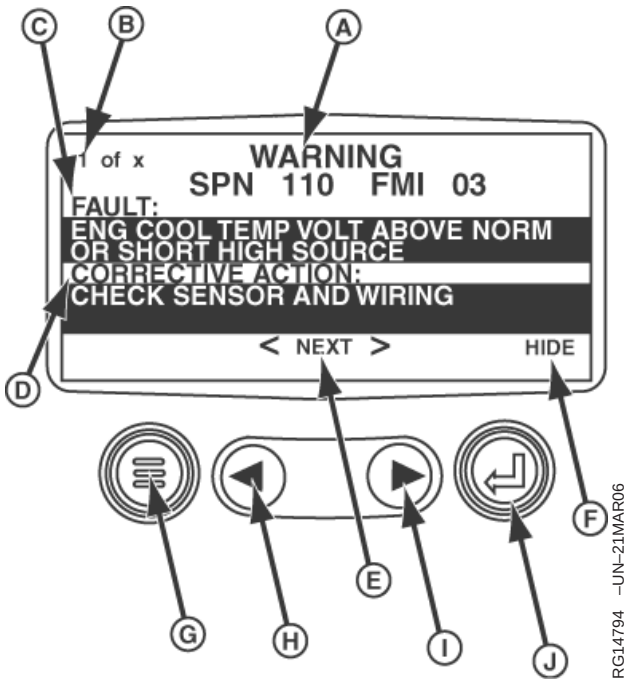

Figure 3. Fault Code Display Screen

A—Warning
B—1 of x
C—Fault: (example) Eng Cool Temp Volt Above Norm or Short High Source
D—Corrective Action: (example) Check Sensor and Wiring
E—Next
F—Hide
G—Menu (Select) Button
H—Arrow Scroll (Backward)
I—Arrow Scroll (Forward)

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Clearing Stored DTCs on Diagnostic Gauge

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens.

1. Turn power to diagnostic gauge off.

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2. Turn power on to diagnostic gauge. As soon as screen backlight comes on, simultaneously press and hold menu (C) and enter (F) keys. A menu appears (See figure 1.) on the screen with the following options: “Clear Fault Codes” (A); and, “Restore All Defaults” (B), with “Clear Fault Codes” item highlighted.

NOTE: Because there is only a split-second moment when this step can successfully be performed, it might have to be done more than once, before success is achieved.

3. With “Clear Fault Codes”: item highlighted, press enter (F) key.

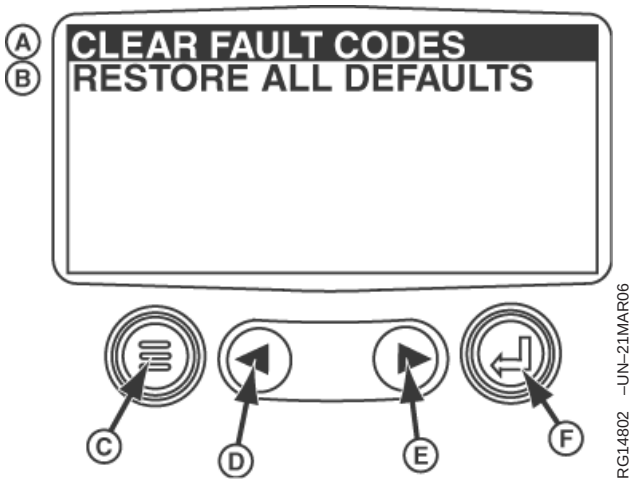

Figure 1. Clear Faults Restore Defaults

A—Clear Fault Codes
B—Restore All Defaults
C—Menu (Select) Key
D—Scroll Up Arrow Key
E—Scroll Down Arrow Key
F—Enter Key

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4. Screen displays that stored fault codes have been cleared. (See figure 2.)

5. Prior to restarting the engine, or other such operation, turn power to the diagnostic gauge off, then turn it back on again.

Figure 2. Cleared All Fault Codes Screen

A—Cleared All Fault Codes

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Data Parameter Description

Following is a list of the data parameters that can be read on Service ADVISOR. JDIS121 - ECU Communication Hardware Kit available from John Deere. Included in the list below is a brief description of each parameter, the range of possible readings, and each parameter's unit of measurement.

Continued on next page

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Parameter	Units	Description
Air Heater Status	N/A[a]	Determines if the air heater is ON or OFF.
Air Heater Time Remaining	N/A[a]	The amount time the air heater will be turned ON.
Air Heater Wait Lamp	N/A[a]	Determines if he air heater wait lamp should be turned ON or OFF.
Analog Throttle (A) Input Voltage	volts	Voltage from analog throttle (A) position sensor (potentiometer).
Analog Throttle (B) Input Voltage	volts	Voltage from analog throttle (B) position sensor (potentiometer).
Analog Throttle (C) Input Voltage	volts	Voltage from analog throttle (A) position sensor (potentiometer).
Barometric Air Pressure	kPa (psi)	Barometric Air Pressure (BAP) value. The BAP is the pressure of the outside air. This varies determined on the location of this application.
Battery Voltage	volts	Switched battery voltage may vary depending on application.
Crank Position Improper Pattern Indicator	%	A "0" reading means that there is NO improper pattern. Between 0—100, the crank pattern becomes progressively more improper. When 100 is reached, a trouble code is thrown.
Crank Position Input Noise Indicator	%	A "0" reading means that there is NO noise. Between 0—100, crank noise becomes progressively worse. When 100 is reached, a trouble code is thrown.
Crank Position Sensor Speed	rpm	The speed of the crank timing wheel.
Crank Position Status	N/A[a]	When status is 15, the ECU is receiving ALL of the signal. When the status is below 15, it means that the ECU is not receiving all of the signal.
Cruise Accelerate	N/A[a]	The cruise accelerate function has been activated. This should increase the speed at which cruise is set.
Cruise Brake Switch	N/A[a]	The cruise brake function has been activated. This will cancel the cruise when the brake is applied until operator resumes operation.
Cruise Clutch Switch	N/A[a]	The cruise clutch function has been activated. This will cancel the cruise when the clutch is applied until operator resumes operation.
Cruise Coast Switch	N/A[a]	The cruise coast function has been activated. This should decrease the speed at which cruise is set.
Cruise Resume Switch	N/A[a]	The cruise resume function has been activated. This will reset the cruise to the speed at which cruise was at prior to using the brake or clutch.
Cruise Set Switch	N/A[a]	The cruise set function has been activated. This should lock the current engine speed in when switch is activated.
Desired Speed Governor Curve	N/A[a]	The mode selected is dependent on the application. See APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.
ECU Boot Block Part Number	N/A[a]	Part number for the Engine Control Unit (ECU) boot block.
ECU Configuration File Part Number	N/A[a]	Part number for the configuration file in the ECU.
ECU EOL Data Part Number	N/A[a]	Part number for the data programmed into the ECU at the end of the assembly line. EOL = End of Line
ECU Part Number	N/A[a]	Part number for the Engine Control Unit (ECU) hardware.
ECU Serial Number	N/A[a]	Serial number for the Engine Control Unit (ECU).
ECU Software Assembly Part Number	N/A[a]	Part number for the Engine Control Unit (ECU) software assembly.
ECU Software Part Number	N/A[a]	Part number for the Engine Control Unit (ECU) operating software.
ECU Temperature	°C (°F)	The internal temperature of the ECU.

[a]N/A = Not Applicable

Continued on next page

Parameter	Units	Description
Engine Coolant Temperature	°C (°F)	Engine Coolant Temperature value. *NOTE: If there is an active fault for the ECT circuit, the ECT value displayed will be the "limp-home" value.*
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[a]	The model number for the engine.
Engine Oil Pressure	kPa (psi)	Engine Oil Pressure value
Engine Oil Pressure Input Voltage	volts	Engine Oil Pressure Sensor input voltage to the ECU.
Engine Oil Temperature	°C (°F)	Engine Oil Temperature value.
Engine Serial Number	N/A[a]	Serial number for the engine.
Engine Speed	rpm	The speed that the crank sensor detects the crank timing wheel to be moving at.
Exhaust Gas Recirculation Exhaust Temperature	°C (°F)	Exhaust Gas Recirculation Exhaust Temperature value.
Exhaust Gas Recirculation Exhaust Temperature Input Voltage	volts	The exhaust gas recirculation exhaust temperature sensor input voltage to the ECU.
Exhaust Gas Recirculation Fresh Air Temperature	°C (°F)	Exhaust Gas Recirculation Fresh Air Temperature value.
Exhaust Gas Recirculation Fresh Air Temperature Input Voltage	volts	The exhaust gas recirculation fresh air temperature sensor input voltage to the ECU.
Exhaust Gas Recirculation Mixed Air Temperature	°C (°F)	Exhaust Gas Recirculation Mixed Air Temperature value.
Exhaust Gas Recirculation Mixed Air Temperature Input Voltage	volts	The exhaust gas recirculation mixed air temperature sensor input voltage to the ECU.
Exhaust Gas Recirculation Valve Position - Actual	%	The actual measured position of the exhaust gas recirculation valve.
Exhaust Gas Recirculation Valve Position - Desired	%	The ECU desired or requested position of the exhaust gas recirculation valve.
Exhaust Gas Recirculation Valve Position Input Voltage	volts	The exhaust gas recirculation valve position sensor input voltage to the ECU.
Exhaust Pressure	kPa (psi)	Exhaust Pressure value.
Exhaust Pressure Input Voltage	volts	The exhaust pressure sensor input voltage to the ECU.
Fan Speed - Actual	rpm	The actual measured speed of the fan.
Fan Speed - Desired	rpm	The ECU desired or requested speed of the fan.
Fan State	N/A[a]	What is controlling the fan?
Fuel Mode	N/A[a]	This code explains the operation mode of the engine.
Fuel Rail Pressure - Actual	MPa (psi)	The actual measured fuel rail pressure displayed in absolute pressure.
[a]N/A = Not Applicable		

Continued on next page

Parameter	Units	Description
Fuel Rail Pressure - Desired	MPa (psi)	The ECU desired or request fuel rail pressure displayed in absolute pressure.
Fuel Rail Pressure Sensor Supply Voltage	volts	Voltage that the ECU supplies the Fuel Rail Pressure Sensor.
Fuel System Part Number	N/A[a]	The part number for the fuel system used on the engine.
Fuel System Serial Number	N/A[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 value displayed will be the "limp-home" value.*
Fuel Temperature Input Voltage	volts	Fuel Temperature Sensor input voltage to the ECU.
Fuel Transfer Pump Pressure - Actual	kPa (psi)	The actual measured fuel transfer pump pressure displayed in absolute pressure.
Fuel Transfer Pump Pressure - Desired	kPa (psi)	The ECU desired or request fuel transfer pump pressure displayed in absolute pressure.
Fuel Transfer Pump Pressure Input Voltage	volts	Fuel Transfer Pump Pressure sensor input voltage to the ECU.
Fuel Usage Rate	L/hr (gal/hr)	Total amount of fuel the ECU has commanded the EIs to deliver during the total hours shown by the Engine Hour Meter parameter.
Glow Plug Status	On/Off	The glow plugs have power to run for a specified amount of time dependent on fuel temperature. For more information, see GLOW PLUG OPERATION in Section 03, Group 140 of this manual.
Glow Plug Time Remaining	sec	The glow plugs have power to run for a specified amount of time dependent on fuel temperature. For more information, see GLOW PLUG OPERATION in Section 03, Group 140 of this manual.
Inject Start Time	microsec	If value of zero appears, one or more of the injectors are not firing.
Inject Pulse Time	count	The time the ECU is pulsing the injector in counts.
Manifold Absolute Pressure	kPa (psi)	Manifold Air Pressure value (boost pressure). *NOTE: If there is an active fault for the MAP circuit, the MAP value displayed will be the “limp-home” value.*
Manifold Absolute Pressure Input Voltage	volts	The Manifold Absolute Pressure 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.
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 Vehicle Option Part Number.
Performance Option Part Number	N/A[a]	These are the engine performance specific options relate to power and torque.
Pilot Injection	N/A[a]	On some applications, a pilot injection feature aids engine starting. On applications with the pilot injection feature, this parameter displays ON when pilot injection is on; OFF when pilot injection is off. On applications that don’t have pilot injection, this parameter will read N/A.
Pump Position Sensor Improper Pattern Indicator	%	A "0" reading means that there is NO improper pattern. Between 0—100, the pump position pattern becomes progressively more improper. When 100 is reached, a trouble code is thrown.
[a]N/A = Not Applicable		

Continued on next page

Parameter	Units	Description
Pump Position Sensor Input Noise Indicator	%	A "0" reading means that there is NO noise. Between 0—100, pump position noise becomes progressively worse. When 100 is reached, a trouble code is thrown.
Pump Position Sensor Speed	rpm	The speed of the pump position timing wheel.
Pump Position Sensor Status	N/A[a]	When status is 15, the ECU is receiving ALL of the signal. When the status is below 15, it means that the ECU is not receiving all of the signal.
Sensor Supply 1 Voltage	volts	Voltage that the ECU supplies sensors.
Sensor Supply 2 Voltage	volts	Voltage that the ECU supplies sensors.
Sensor Supply 3 Voltage	volts	Voltage that the ECU supplies sensors.
Sensor Supply 3 Voltage	volts	Voltage that the ECU supplies sensors.
Sensor Supply 3 Voltage	volts	Voltage that the ECU supplies sensors.
Start of Injection Position	degree	Position when ECU sends signal to injector to fire.
Throttle Position	%	Percent of the throttle being used.
Throttle Type	N/A[a]	Level 14 Electronic Fuel Systems operate with several different types of throttles. Throttle Type displays the type being used on this application.
Torque Curve Number	N/A[a]	On some applications, the ECU limits the max fuel on multiple torque curves. This displays the torque curve the ECU is currently using to limit maximum fuel. For definition of the possible torque curves, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.
Total Fuel Consumption	L gal	The total amount of fuel the engine has consumed.
Transfer Pump Control Status	On/Off	The transfer pump is given its voltage from the ECU. The pump primes for 40 seconds at key ON. During operation, the status is always on.
Transfer Pump Current	%	Percent of current supplied to transfer pump to produced the correct pressure.
Transfer Pump Duty Cycle	sec	The transfer pump is given its voltage from the ECU. The pump primes for 40 seconds at key ON. During operation, the status is always on.
Transfer Pump Power Status	N/A[a]	Power ON or OFF to the transfer pump.
Transfer Pump Priming Time	seconds	Amount of time remaining to prime the fuel system.
Turbo Actuator Position - Actual	%	The actual measured turbo actuator position displayed.
Turbo Actuator Position - Desired	%	The ECU desired or requested turbo actuator position.
Turbo Actuator Position Input Voltage	volts	Turbo Actuator input voltage to the ECU.
Turbo Compressor Inlet Air Temperature	°C (°F)	Turbo Compressor Inlet Air Temperature value.
Turbo Compressor Inlet Air Temperature Input Voltage	volts	Turbo Compressor Inlet Air Temperature sensor input voltage to the ECU.
Turbo Speed	rpm	The speed at which the turbo blades are spinning.
Vehicle Driveshaft Speed	rpm	The speed of the vehicle driveshaft.
Vehicle Option Part Number	N/A[a]	These are the vehicle specific options for the engine like fuel derates, shutdowns, sensor thresholds, etc.
Vehicle Serial Number	N/A[a]	The serial number of the vehicle that this engine is located in.
[a]N/A = Not Applicable		

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Parameter	Units	Description
Vehicle Speed - Calculated	km/h (mi/hr)	Vehicle speed calculated by ECU from wheel speed PWM signal.
Vehicle Speed - CAN	km/h (mi/hr)	Vehicle speed ECU detects over CAN.

RG41221,00001E6 –19–10MAY06–6/6

Snapshot Information

NOTE: To view Snapshot information Service ADVISOR is required.

Snapshot information is categorized in two types, Snapshot Capture, and Snapshot Recording. Snapshot information is generated when an engine DTC is set.

- **Snapshot Capture** - Is a snapshot of specific parameters at the exact instant in time that the DTC was set. All engine DTCs will have a Snapshot Capture associated with it. This information will also contain the engine hours for the first and latest occurrence of the DTC
- **Snapshot Recording** - Is a short recording of specific parameters when certain DTCs are set. The recording will include parameter readings for a short period before and after the DTC was set. These are normally two to five seconds long, depending on the DTC that was set. Only specific DTCs will have a Snapshot Recordings associated with it when the DTC is set. If the DTC Count is greater than one then the snapshot recording could contain playbacks the first and latest occurrences and can be played back by selecting the occurrence to be viewed.

IMPORTANT: It is important to save all Snapshot information before clearing DTCs. Once codes have been cleared then the Snapshot information is also cleared. For help in troubleshooting engine DTCs it is recommended not to clear codes until problem has been resolved.

Viewing a Snapshot Capture

1. With a live connection already established with Service ADVISOR, click on the icon to get codes.

2. The window will display all active and stored codes. In this window there is a column for Snapshot Capture. If there is a “Yes” in the Snapshot Capture column then there is Snapshot Capture data available for that DTC.

Continued on next page

3. Click once on the DTC to highlight that row and then click on the “Snapshot Capture” button below to view the information. At the same time the information is being displayed in the Service ADVISOR window it is downloading this information for viewing off-line.

Viewing a Snapshot Recordings

1. With a live connection already established with Service ADVISOR, click on the icon to get codes.

2. The window will display all active and stored codes. In this window there is a column for Snapshot Recordings. If there is a “Yes” in the Snapshot Recording column then there is Snapshot Recording available for that DTC.

3. Click once on the DTC to highlight that row and then click on the “Snapshot Recording” button below to view the information. At the same time the information is being displayed in the Service ADVISOR window it is downloading this information for viewing off-line.

4. Click on the play button to start the playback of the recording. Refer to the online help in Service ADVISOR for more information about playing a recording and other options available.

Importing a Snapshot Recording for playback when off-line can be found in “C: Program Files Service ADVISOR xvds TierIII recs”.

DN22556,0000054 –19–27JAN06–2/2

Terminal Test

The purpose of this test is to check for several conditions, at the connector, that could be the cause of error codes being generated.

When performing a terminal test do the following.

- **Visual inspection for:**

Corrosion in the pins of the connector.
Water in the connector.
Dirt in the connector.
Foreign material in the connector.
Terminal mating surface wear.

NOTE: If the surface of a terminal gets worn corrosion will build up causing problems. Replace all worn terminals.

- **Wiring problems**

Pinched or melted wiring.
Loose or broken wires at the back of the connector.

NOTE: This can be done by lightly pulling on each wire to see if it pulls out of the connector. If the terminal comes out on the wire it is an indication the locking mechanism is broken and the connector needs replacing. If the wire comes out with out the terminal, extract the old terminal and replace it. Always use the proper terminal and tools to avoid problems in the future. The terminal must be replaced with one on the same plating to avoid dissimilar metal corrosion.

- **Contact pressure**

There is a slight amount of pressure applied by the female terminal on the male terminal to keep a good connection during times of vibration.
Connector Adapter Tool Kit, JT07328, will be required for this.
Select the terminal adapter that matches the connector you are testing.
Insert the male terminal all the way into the female terminal without twisting or bending.

Continued on next page

Slowly pull the male terminal out of the female noting that there is some pressure. If no pressure is felt or the male terminal is sloppy in the female terminal, replace the terminal.

NOTE: Be sure to select the proper male terminal or the test is invalid.

DN22556,0000056 –19–27JAN06–2/2

Engine Test Instructions—Cylinder Misfire Test

For instructions on connecting to Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group.

The Cylinder Misfire Test is used to compare the performance of each cylinder relative to each of the other cylinders. The test will help identify problems such as an engine misfire or irregularly running engine. During the test, the Engine Control Unit (ECU) will disable a cylinder, then accelerate the engine with a fixed amount of fuel and measure the time taken to accelerate the engine from one speed to the next with that cylinder disabled. The ECU will then repeat the procedure for the remaining cylinders.

The Cylinder Misfire Test cannot determine if an engine is delivering low power. The test results are only a guide to help determine if there is a problem in a cylinder. The results alone should not be used as a conclusive reason for replacing parts. Other information such as the results of a Compression Test, Cylinder Cutout Test, and other engine diagnostic procedures should be used along with this test information to accurately determine the source of an engine problem.

Before executing the Cylinder Misfire Test

- Warm engine to normal operating temperature.
- Repair the cause of any Diagnostic Trouble Codes (DTCs) if possible.

NOTE: The ECU will not allow the test to run if there is an active engine timing error code (any 637 code), an active engine position error code (any 636 code), coolant temperature is below 40° C (104° F) or above 110° C (230° F). If the engine goes into an overspeed condition while running test, the test will stop.

- Remove any load to the engine that may change during the test. For example, turn the air conditioner off.

Performing the Cylinder Misfire Test

1. Engine idling.
2. Select Cylinder Misfire Test in Service ADVISOR.
3. Follow instruction given by the diagnostic software. The software will instruct users that the throttle lever be moved from low idle position to wide open throttle position, then back to low idle position 6 times.

The diagnostic software will inform the test operator if the test was not successfully completed. If the test was successfully completed, the results will be displayed on the screen.

Results shown will represent each cylinders' performance as a percentage in relation to the average of all cylinders. If any cylinder is above or below the average by more than 10%, it indicates the cylinder is contributing either too much (above average) or not enough (below average) the average engine performance.

NOTE: Run this test at least 3 times to ensure repeatable, accurate results.

The Compression Test and Cylinder Cutout Test should also be performed to help determine that there is a problem in a specific cylinder.

RG41183,00000FE –19–20FEB06–1/1

Engine Test Instructions—Compression Test

For instructions on connecting to Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group.

The Compression Test is used to compare the compression of each cylinder to the average compression of all cylinders. The test will help determine if a cylinder has low compression compared to all other cylinders. During the test, the Engine Control Unit (ECU) will disable the engine from starting, then measure the time it takes the piston of each cylinder to accelerate through and past TDC. A piston that accelerated faster than the rest would indicate that cylinder has lower compression than the other cylinders.

The Compression Test cannot determine the true compression pressure of any cylinder, it can only compare each cylinder to the average. The test results are only a guide to help determine if a cylinder has low average compression. The results alone should not be used as a conclusive reason for performing any major engine work. Other information such as the results of the Cylinder Misfire Test, Cylinder Cutout Test, and other engine diagnostic procedures should be used to accurately determine the source of an engine problem.

Before executing the Compression Test

- Warm engine to normal operating temperature.
- Repair the cause of any Diagnostic Trouble Codes (DTCs) if possible.

NOTE: The ECU will not allow the test to run if there is an active engine timing error code (any 637 code), the engine cranking speed is below 100 rpm, coolant temperature is below -30° C (-22° F) or above 200° C (392° F).

- Ensure that the battery and starter are in good working condition

Performing the Compression Test

1. Engine OFF.

2. Select Compression Test in the Service ADVISOR.

3. Follow instruction given by the diagnostic software. The software will instruct that the engine be cranked for up to 15 seconds. Typically, it should take less than 5 seconds. Service ADVISOR. should be observed carefully for instructions during the test.

   Error messages and test results will be displayed on the Service ADVISOR screen.

   Results shown will represent each cylinders' compression as a percentage in relation to the average of all cylinders. Any cylinder reading that is more than 10% below the rest indicates the cylinder's compression is possibly low.

NOTE: Run this test at least 3 times to ensure repeatable, accurate results.

Further engine diagnostics should be performed to determine the cause of low compression.

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Engine Test Instructions— Cylinder Cutout Test

For instructions on connecting to Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group.

The Cylinder Cutout Test is used to aid in identifying a cylinder that is having a problem or to help in diagnosing mechanical or intermittent problems. During the test, the Engine Control Unit (ECU) will disable the cylinder that the technician selects. The test can be performed while operating the vehicle under the conditions that the problem occurs.

The Cylinder Cutout Test can not determine if an engine is developing low power. The test is only a guide to help determine if there is a problem in a cylinder. The results alone should not be used as a conclusive reason for replacing parts. Other information such as the results of a Compression Test, Cylinder Misfire Test and other engine diagnostic procedures should be used along with this test information to accurately determine the source of the engine problem.

Before executing the Cylinder Cutout Test

- Warm engine to normal operating temperature.
- Repair the cause of any Diagnostic Trouble Codes (DTCs) if possible.

NOTE: The ECU will not allow the test to run if there is an active engine timing error code (any 637 code), an active engine position error code (any 636 code), coolant temperature is below 40° C (104° F) or above 110° C (230° F). If the engine goes into an overspeed condition while running test, the test will stop.

- Ensure that the battery and starter are in good working condition

Performing the Cylinder Cutout Test

1. Engine idling or under the conditions that the problem occurred.
2. Select Cylinder Cutout Test in Service ADVISOR.
3. Follow instructions given by Service ADVISOR.
4. Observe engine operation and the parameters displayed on the Service ADVISOR screen. These parameters include: engine load at current speed, engine speed, and manifold air temperature.
5. Use this data and observations to help in the diagnosis of the problem.

NOTE: Run this test at least 3 times to ensure repeatable, accurate results.

Analysis

A contribution below 70% means that the cylinder is probably not working at all. If a switched-off cylinder does not make any difference to the engine sound, this cylinder is probably not working at all.

A contribution between 70%-90% means that the cylinder does not give its full potential. If the sound slightly changes when the cylinder is cutout the cylinder is working but not to the full potential. To confirm this diagnostic, perform a Cylinder Misfire Test and Compression Test to help confirm the cylinder has a problem.

If the sound is better with a cylinder cutoff, this cylinder is probably firing at the wrong time. This may be due to a damaged injector or a bad electrical connection between ECU and injector. If the results of the Cylinder Cutout Test and Cylinder Misfire Test lead to the same cylinder and the Compression Test checks good for that cylinder then the injector wiring or injector is probably bad. First check the electrical connections, looking for shorts to the chassis especially, then if no problems are found, replace faulty injector.

Exhaust Gas Recirculation Valve Reset

For instructions on connecting to Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group.

The Exhaust Gas Recirculation Valve Reset procedure resets all stored valve positions data. For more information see EGR Valve in Section 3 Group 135.

NOTE: This procedure is only ran if you replace the EGR valve with a new valve.

NOTE: Replacing a valve to test for a bad valve (part swapping) is not recommended. It will cause several error codes to be generated because the stored values the ECU is using to compare to will be out of tolerance of the new valve.

1. Ignition ON, engine OFF.
2. Select Exhaust Gas Recirculation Valve Recalibration in Service ADVISOR.
3. Follow the instructions on the screens.
4. When successful, click “OK”.
5. Turn ignition OFF for thirty seconds.
6. Ignition ON, engine OFF for thirty seconds. The EGR valve performs a learn process for minimum and maximum travel.
7. Start and run engine to normal operating temperature to ensure engine is operating correctly.

RG41183,00000F2 –19–02MAY06–1/1

Turbocharger Learn Value Reset

For instructions on connecting to Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group.

The Turbo Learn Value Reset Test procedure resets all stored valve positions data. For more information see Turbo Actuator in Section 3 Group 135.

1. Ignition ON, engine OFF.
2. Select Turbo Learn Value Reset Test in Service ADVISOR.
3. Follow the instructions on the screens.
4. When successful, click “OK”.

NOTE: Some VGT Actuators will start the learn process immediately, be sure the process has not started before going to the next step. If the processes started immediately go to the last step to proceed.

5. Turn ignition OFF for thirty seconds.
6. Ignition ON, engine OFF for thirty seconds. The VGT performs a learn process for minimum and maximum travel.
7. Start and run engine to normal operating temperature to ensure engine is operating correctly.

RG41183,00000F6 –19–18JAN06–1/1

Harness Diagnostic Mode Test

NOTE: Before running this test ensure you have saved all Snapshot Captures and Recordings. For more information see SNAPSHOT INFORMATION earlier in this group.

Purpose:
This procedure is designed to test the engine wiring harness and associated components for numerous types of errors. Including opens, shorts actuator communication and cycling.

Test Conditions:
This test can only be run when the engine is not running. Cylinder fueling is disabled for all cylinders when the test is initiated. If the ECU senses an engine start request the Harness Diagnostic Mode Test will be aborted and the engine will start. Test Operation: The ECU continuously monitors all the sensors for normal operation while power is applied to the ECU. During the Harness Diagnostic Mode Test the ECU will set up and trigger some special tests also. These are tests that the ECU can not perform while the engine is running. When the test starts all codes and related Snapshot information is erased from the ECU memory. The test starts and check are made of various components. You may hear the EGR valve and turbo Actuator cycle. The actuators will do a learn cycle. The ECU compares these new learned values with the original values that were created when the part was new. If the ECU determines the values are good it will store them as the last good values but not change the original values. The ECU gathers test information as it runs the various tests. If it finds any problems during the test it will store the code and display it at the end of the test.

Test Procedures:

1. Select Harness Diagnostic Mode Test in Service ADVISOR. A screen appears with a list of all the ECU codes (active and stored).

2. Press “Next” to start the test, “Cancel” to exit the test or “Print” to print a list of the codes. After pressing “Next” follow the directions on the screen.

3. At the end of the test another list of codes will be presented. Compare this list with the initial list to see if there are any additional codes.

4. Go to those DTC(s) and troubleshoot them to fix the problem(s).

NOTE: If a stored code does not show back up after the test it may be a bad or intermittent connection. You may want to run the test again and manipulate the wiring harness to see if the code reappears. If it does check the harness and connector for problems.

DN22556,000005C –19–25APR06–1/1

Reprogramming Engine Control Unit (ECU)

The ECU may be reprogrammed using Service Advisor. See E-LEARNING under the Service ADVISOR help section. Also, refer to the training material provided with your Service Advisor training course. All authorized Service Advisor users have received this training. On-line training is available at John Deere University, which is an internet-based distance-learning application.

RG41221,00001EA –19–02MAY06–1/1

John Deere Trimmable Options

Trimmable options are features that can be turned ON or Off during an ECU programming cycle. These features will customize an engine for each individual customer. Not all engines have the trim feature.

To update trimmable features, download the software payload file and start the programming sequence through the service tool. The trim page automatically appears if the payload has trim incorporated.

For more information help select the correct option, use the help documentation available in each section of the trim page.

RG41221,00001EB –19–21MAR06–1/1

Downloading Payload File For Service ADVISOR

NOTE: An Internet connection will be needed.

See E-LEARNING under the Service ADVISOR help section. Also, refer to the training material provided with your Service Advisor training course. All authorized Service Advisor users have received this training. On-line training is available at John Deere University, which is an internet-based distance-learning application.

RG41221,00001EE –19–02MAY06–1/1

Downloading Electronic Injector Calibration Files

NOTE: This procedure requires an internet connection.

Electronic injectors in this engine have specific settings for optimum performance. To maintain this performance when any of the electronic injectors are replaced or swapped the ECU will need to be reprogrammed with the correct setting for each cylinder. This is done by using the Injector Calibration Tool in Service ADVISOR.

Connect to the John Deere Custom Performance web site. If you have questions about how to use the site check their HELP section.

RG41183,00000FB –19–21MAR06–1/1

Electronic Injector Calibration

A connection with must be made with Service ADVISOR. Select Injector Calibration.

The screen will show a table of the existing injector information that is stored in the ECU.

Options to perform:

- Swap Injectors
- Change Injectors
- View Calibration History

Swapping Injectors:

Swapping injectors is used for testing suspected injector problems only. This is used for moving injectors from one cylinder to another to see if the symptom moves cylinders with the injector. Information in the ECU is specific for each injector and the cylinder that it is installed in. When injectors are moved to different cylinders then the ECU needs to be updated with this information also. Since the information for the existing injectors is already in the ECU and just needs to be moved to a different cylinder number there are pull down menus that allow the injector information to be transferred from one cylinder to the other. Service ADVISOR will display the original injector information and the new injector information and ask for confirmation before actually moving the injector information.

Changing Injectors

Continued on next page

If an injector is being replaced then the information for that injector must be loaded into the ECU. This is done by selecting the Change Injector button in Service ADVISOR. The screen will display a table showing the existing information that is stored in the ECU and will have pull down menus available in the serial number field if there are injector calibration files available on the computer. For down loading injector calibration files see Downloading Electronic Injector Calibration Files earlier in this group. If the injector calibration file is available, then selecting the file that corresponds with the injector installed in the cylinder will automatically populate all information fields for that cylinder. If the calibration file is not available then the information for each field can be entered manually. Once all the injector information has been updated then by clicking the Next button and verify that the data entered is correct and then click on the Submit button.

View Calibration History

Anytime an injector calibration is performed with Service ADVISOR a history is kept for reviewing any injector changes in the past. This information is only kept on the computer that performed the injector calibration procedure so if multiple computers are used not all information will be in one history report.

RG41183,00000FD –19–31MAR06–2/2

Diagnostic Trouble Codes (DTCs)

SPN/FMI CODES

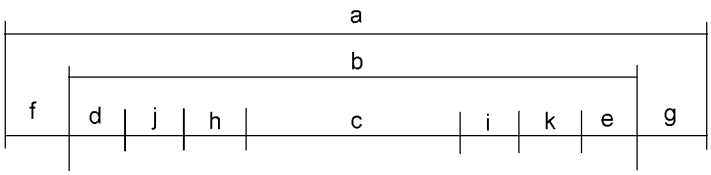
SPN/FMI codes are written from the SAE J1939 standard as a two-part code. The first part is called the Suspect Parameter Number (SPN). Typically, it contains between 2 and 4 digits. The SPN identifies the system or the component that has the failure; for example SPN 110 indicates a failure in the engine coolant temperature circuit. The second part of the code is called the Failure Mode Identifier (FMI) code. The FMI contains 2 digits and identifies the type of failure that has occurred. For example, FMI 03 indicates value Out of Range High (OORH). In order to determine the exact failure, both the SPN and FMI are required. Combining SPN 110 with FMI 03 yields “engine coolant temperature input voltage out of range high.”

On this applications the ECU transmits SPN/FMI codes over the Controller Area Network (CAN). This allows for service tools such as Service ADVISOR to display active and stored DTCs. When using Service ADVISOR, the codes will be displayed in a 000000.00 format. For example, code 110.03 will be displayed as 000110.03. For an explanation of FMI codes, see FAILURE MODE INDICATOR DESIGNATIONS later in this Group.

RG41221,00001F0 –19–11NOV05–1/1

Failure Mode Indicator Designations

RG14537 –UN–31OCT05



Relationship of FMI Designations and Range of Sensor Input

Region a: Total signal input range possible that can be seen by an electronic module.

Region b: Total signal range physically possible as defined by an application.

Region c: Range defined as normal for a given real world measurement.

Region d: Range defined as Extremely below normal, of what is considered normal for the given real world measurement. Associated with FMI 01.

Region e: Range defined as Extremely above normal, of what is considered normal for the given real world measurement. Associated with FMI 00.

Region f: Range which is low outside the range of what is considered physically possible for a given system. Associated with FMI 04 (Out Of Range Low, OORL).

Region g: Range which is high outside the range of what is considered physically possible for a given system. Associated with FMI 03 (Out Of Range High, OORH), 05, 06.

Region h: Range defined as Slightly below normal, of what is considered normal for a given real-world measurement. Associated with FMI 17.

Region i: Range defined as Slightly above normal, of what is considered normal for a given real-world measurement. Associated with FMI 15.

Region j: Range defined as Moderately below normal, of what is considered normal for a given real-world measurement. Associated with FMI 18.

Region k: Range defined as Moderately above normal, of what is considered normal for a given real-world measurement. Associated with FMI 16.

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FMI	Description
00	**Data Valid but Above Normal Operational Range—Extreme Level.**The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined extreme level limits for that particular measure of the real world condition. Broadcast of data values is continued as normal.
01	**Data Valid but Below Normal Operational Range—Extreme Level** The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined extreme level limits for that particular measure of the real world condition. Broadcast of data values is continued as normal.
02	**Data Erratic, Intermittent or Incorrect**Measurements that change at a rate that is not considered possible in the real world condition and caused by improper operation of the measuring device or its connection to the module. Broadcast of data value is substituted with the "error indicator" value. Incorrect data includes any data not received and any data that is exclusive of the situations covered by FMIs 3, 4, 5 and 6 below. Data may also be considered incorrect if it is inconsistent with other information collected or known about the system.
03	**Value Out of Range High (OORH)** A voltage signal, data or otherwise, is above the predefined limits that bound the range. Broadcast of data value is substituted with the "error indicator" value. Any signal external to an electronic control module whose voltage remains at a high level when the ECM commands it to low. Broadcast of data value is substituted with the "error indicator" value.
04	**Value Out of Range Low (OORL)** A voltage signal, data or otherwise, is below the predefined limits that bound the range. Broadcast of data value is substituted with the "error indicator" value. Any signal external to an electronic control module whose voltage remains at a low level when the ECM commands it to high. Broadcast of data value is substituted with the "error indicator" value.
05	**Current Below Normal** A current signal, data or otherwise, is below the predefined limits that bound the range. Broadcast of data value is substituted with the "error indicator" value. Any signal external to an electronic control module whose current remains off when the ECM commands it on. Broadcast of data value is substituted with the "error indicator" value.
06	**Current Above Normal** A current signal, data or otherwise, is above the predefined limits that bound the range. Broadcast of data value is substituted with the "error indicator" value. Any signal external to an electronic control module whose current remains on when the ECM commands it off. Broadcast of data value is substituted with the "error indicator" value.
07	**Mechanical System not Responding or Out of Adjustment** Any fault that is detected as the result of an improper mechanical adjustment or an improper response or action of a mechanical system that, with a reasonable confidence level, is not caused by an electronic or electrical system failure. This type of fault may or may not be directly associated with the value of general broadcast information.
08	**Abnormal Frequency or Pulse Width or Period**To be considered in cases of FMI 4 and 5. Any frequency or PWM signal that is outside the predefined limits which bound the signal range for frequency or duty cycle (outside region b of the signal range). Also if the signal is an ECM output, any signal whose frequency or duty cycle is not consistent with the signal which is emitted. Broadcast of data value is substituted with the "error indicator" value.
09	**Abnormal Update Rate**Any failure that is detected when receipt of data via the data link or as input from a smart actuator or smart sensor is not at the update rate expected or required by the ECM (outside region c of the signal range). Also any error that causes the ECM not to send information at the rate required by the system. This type of fault may or may not be directly associated with the value of general broadcast information.
10	**Abnormal Rate of Change**Any data, exclusive of the abnormalities covered by FMI 2, that is considered valid but whose data is changing at a rate that is outside the predefined limits that bound the rate of change for a properly functioning system (outside region c of the signal range). Broadcast of data values is continued as normal.
11	**Root Cause Not Known**It has been detected that a failure has occurred in a particular subsystem but the exact nature of the fault is not known. Broadcast of data value is substituted with the "error indicator" value.
12	**Bad Intelligent Device or Component**Inconsistency of data indicates that a device with some internal intelligence, such as a controller, module, smart sensor or smart actuator, is not properly functioning. This data may be internal to a module or external from a data link message or from various system responses. Broadcast of data value is substituted with the "error indicator" value. This error is to include all internal controller trouble codes that cannot be caused by connections or systems external to the controller.

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Continued on next page

13	**Out of Calibration**A failure that can be identified to be the result of not being properly calibrated. This may be the case for a subsystem which can identify that the calibration attempting to be used by the controller is out of date. Or it may be the case that the mechanical subsystem is determined to be out of calibration. This failure mode does not relate to a signal range.
14	**Special Instructions**SPNs 611 through 615 are defined as "System Diagnostic Codes" and are used to identify failures that cannot be tied to a specific field-replaceable component. Specific subsystem fault isolation is the goal of any diagnostic system, but for various reasons this cannot always be accomplished. These SPNs allow the manufacturer some flexibility to communicate non-"specific component" diagnostic information. Because SPN 611-615 use the standard SPN/FMI format, it allows the use of standard diagnostic tools, electronic dashboards, satellite systems and other advanced devices that scan Parameter Groups containing the SPN/FMI formats. Because manufacturer-defined codes are not desirable in terms of standardization, the use of these codes should only occur when diagnostic information cannot be communicated as a specific component and failure mode. This failure mode does not relate to the signal range, and may or may not be directly associated with the value of general broadcast information.
15	**Data Valid but Above Normal Operating Range—Slight Level**The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined slight level limits for that particular message of the real world condition. Broadcast of data values is continued as normal.
16	**Data Valid but Above Normal Operating Range—-Moderate Level**The signal communicating information is within a defined acceptable and valid range, but the real world condition is above what would be considered normal as determined by the predefined moderate level limits for that particular message of the real world condition. Broadcast of data values is continued as normal.
17	**Data Valid but Below Normal Operating Range—Slight Level**The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined slight level limits for that particular message of the real world condition. Broadcast of data values is continued as normal.
18	**Data Valid but Below Normal Operating Range—Moderate Level**The signal communicating information is within a defined acceptable and valid range, but the real world condition is below what would be considered normal as determined by the predefined moderate level limits for that particular message of the real world condition. Broadcast of data values is continued as normal.
19	**Received Network Data In Error**Any failure that is detected when the data received via the network is found substituted with the "error indicator" value (i.e. FE (16), see J1939/71). This type of failure is associated with received network data. The component used to measure the real world signal is wired directly to the module sourcing the data to the network and not to the module receiving the data via the network. This type of fault may or may not be directly associated with the value of general broadcast information.
20-30	**Reserved for SAE Assignment**
31	**Not Available or Condition Exists**Used to indicate that the FMI is not available or that the condition that is identified by the SPN exists. When no applicable FMI exists for the reported SPN, FMI 31 can be used. Also in cases when the reported SPN name has the failure information in it, FMI 31 can be used to indicated that the condition reported by the SPN exists. This type of fault may or may not be directly associated with the value of general broadcast information.

WL30140,0000041 –19–12MAY06–3/3

Intermittent Fault Diagnostics

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

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

Suggestions for diagnosing intermittent faults:

- If diagnostic chart indicates that the problem is intermittent, try to reproduce the operating conditions that were present when the DTC set. Service ADVISOR can be used to help locate intermittent problems, as it includes a function called Recording. The Recording function permits the recording of data parameter values during a diagnostic session. If a DTC sets during a certain diagnostic session, the parameters can be played back and observed to see what each parameter’s value was when the DTC occurred.
- If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching Service ADVISOR to see if the fault resets.
- To check the connection between the harness and a sensor or the harness and the ECU, use JT07328 Connector Adapter Test Kit. Insert the male end of the appropriate test adapter into the female end of the ECU or sensor connector terminal. There should be moderate resistance when the test adapter is inserted into the terminal. If the connection is loose, replace the female terminal.

Possible Causes of Intermittent Faults:

- Faulty connection between sensor or actuator and harness.
- Faulty contact between terminals in connector.
- Faulty terminal/wire connection.
- Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc. can cause faulty signals to be sent to the ECU.

RG41221,00001F3 –19–19SEP05–1/1

T1 — Multi-state Throttle Input High

The multi-state throttle input voltage exceeds the high voltage specification.

RG41221,00001F4 –19–19SEP05–1/1

T1 — Multi-state Throttle Input High Diagnostic Procedure

Related Information:
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.

Alarm Level:
Warning

Control Unit Response:
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 the other throttle.

If the multi-state throttle is the only throttle, or all other throttles are faulted, the ECU will use a default “limp-home” throttle value of low idle engine speed.

Additional References:
For further multi-state throttle information, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the multi-state throttle connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the multi-state throttle through all positions. 7. Read DTCs. Does 000091.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect multi-state throttle switch at two wire connector behind the instrument panel. 3. Install a jumper wire between both terminals of the switch connector on the instrument panel harness. 4. Ignition ON, engine OFF 5. Read DTCs. Does 000091.03 reoccur?	**YES:** GO TO ❹ **NO:** Faulty multi-state throttle switch connector. OR Faulty multi-state throttle switch. – – –1/1
❹ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the jumper wire. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between multi-state input terminal (terminal A) and a good chassis ground. Is the voltage above 4.0 volts?	**YES:** GO TO ❺ **NO:** GO TO ❻ – – –1/1

❺ **Throttle Position Ground Circuit Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Multi-state throttle connector still disconnected. 3. Disconnect ECU connector J2. 4. Using a multimeter, measure resistance between terminal A in the multi-state throttle connector and terminal G3 in ECU connector J2 on the engine harness. Is the resistance 5 ohms or less?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Open in multi-state throttle ground circuit. – – –1/1

❻ **Throttle Position Input Circuit Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Multi-state throttle connector and ECU connector J2 still disconnected. 3. Using a multimeter, measure resistance between terminal B in the multi-state throttle connector and terminal B4 in ECU connector J2 on the engine harness. Is the resistance 5 ohms or less?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Open in multi-state throttle input circuit. – – –1/1

T2 — Multi-state Throttle Input Low

The multi-state throttle input voltage drops below the low voltage specification.

RG41221,00001F5 –19–19SEP05–1/1

T2 — Multi-state Throttle Input Low Diagnostic Procedure

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Related Information:
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.

Alarm Level:
Warning

Control Unit Response:
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 the other throttle.

If the multi-state throttle is the only throttle, or all other throttles are faulted, the ECU will use a default “limp-home” throttle value of low idle engine speed.

Additional References:
For further multi-state throttle information, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the multi-state throttle connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the multi-state throttle through all positions. 7. Read DTCs. Does 000091.04 reoccur?	**YES:** GO TO ❸ **NO:** 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 MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect multi-state throttle switch at two wire connector behind the instrument panel. 3. Make note of any DTCs, then clear all DTCs. 4. Ignition ON, engine OFF 5. Read DTCs. Does 000091.04 reoccur?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **Throttle Position Ground Circuit Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Multi-state throttle connector still disconnected. 3. Disconnect ECU connector J2. 4. Using a multimeter, measure resistance between terminal A in the multi-state throttle connector and terminal G3 in ECU connector J2 on the engine harness. Is the resistance 5 ohms or less?	**YES:** Open in the multi-state throttle ground circuit. **NO:** Faulty multi-state throttle switch connector. OR Faulty multi-state throttle switch.

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❺ **Throttle Position Input Circuit Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Multi-state throttle connector and ECU connector J2 still disconnected. 3. Using a multimeter, measure resistance between terminal B in the multi-state throttle connector and terminal B4 in ECU connector J2 on the engine harness. Is the resistance 5 ohms or less?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Short to ground in multi-state input circuit. OR Open in multi-state input circuit. – – –1/1

T3 — Analog Throttle (A) Input High

The analog throttle (A) input voltage exceeds the high voltage specification.

RG41221,00001F6 –19–19SEP05–1/1

T3 — Analog Throttle (A) Input High Diagnostic Procedure

Related Information:
The analog throttle (A) input voltage exceeds the maximum threshold. The voltage is higher than what is physically possible for the throttle lever to achieve.

Alarm Level:
Warning

Control Unit Response:
If more than one throttle is available, the ECU will ignore the input from the analog throttle (A) and will use the input values from the other throttle.

If the analog throttle (A) is the only throttle, or all other throttles are faulted, the ECU will use a default “limp-home” throttle value of low idle engine speed.

Additional References:
For further analog throttle information, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the analog throttle (A) connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (A) through full travel. 7. Read DTCs. Does the analog throttle (A) high voltage DTC reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Throttle Idle Position Voltage Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Analog Throttle (A) in the idle position. 3. Using the ECU diagnostic software, read analog throttle (A) input voltage. Is the voltage 4.5 volts or above?	**YES:** GO TO ❺ **NO:** GO TO ❹ – – –1/1

❹ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine ON or OFF 2. Slowly operate analog throttle (A) through full travel. 3. Using the ECU diagnostic software, read analog throttle (A) input voltage. Does the voltage go above 4.5 volts anytime through the travel?	**YES:** GO TO ❻ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❺ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect analog throttle (A) sensor connector behind the instrument panel. 3. Ignition ON, engine OFF 4. Using the ECU diagnostic software, read analog throttle (A) input voltage. Is the voltage 0.5 volts or less?	**YES:** GO TO ❻ **NO:** Short to voltage in analog throttle (A) input circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

❻ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Analog throttle (A) connector disconnected. 3. Using a test light connected to battery voltage (+), probe the ground terminal (terminal A) in the analog throttle (A) sensor connector on the instrument panel harness. Does the light illuminate?	**YES:** Faulty analog throttle (A) sensor connector. OR Faulty analog throttle (A) sensor. **NO:** Open in analog throttle (A) ground circuit. OR Faulty ECU connection OR Faulty ECU – – –1/1

T4 — Analog Throttle (A) Input Low

The analog throttle (A) input voltage drops below the low voltage specification.

RG41221,00001F7 –19–19SEP05–1/1

T4 — Analog Throttle (A) Input Low Diagnostic Procedure

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Related Information:
The analog throttle (A) input voltage drops below the minimum threshold. The voltage is lower than what is physically possible for the throttle lever to achieve.

Alarm Level:
Warning

Control Unit Response:
If more than one throttle is available, the ECU will ignore the input from the analog throttle (A) and will use the input values from the other throttle.

If the analog throttle (A) is the only throttle, or all other throttles are faulted, the ECU will use a default “limp-home” throttle value of low idle engine speed.

Additional References:
For further analog throttle information, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the analog throttle (A) connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (A) through full travel. 7. Read DTCs. Does the analog throttle (A) low voltage DTC reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Throttle Idle Position Voltage Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Analog Throttle (A) in the idle position. 3. Using the ECU diagnostic software, read analog throttle (A) input voltage. Is the voltage 0.5 volts or less?	**YES:** GO TO ❺ **NO:** GO TO ❹ – – –1/1

❹ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine ON or OFF 2. Slowly operate analog throttle (A) through full travel. 3. Using the ECU diagnostic software, read analog throttle (A) input voltage. Does the voltage go below 0.5 volts anytime through the travel?	**YES:** GO TO ❺ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❺ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect analog throttle (A) sensor connector behind the instrument panel. 3. Install a jumper wire between the 5V supply terminal and the input terminal (terminals B and C) in the analog throttle (A) sensor connector on the instrument panel harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read analog throttle (A) input voltage. Is the voltage 4.5 volts or less?	**YES:** GO TO ❻ **NO:** Faulty analog throttle (A) sensor connector OR Faulty analog throttle (A) sensor – – –1/1

❻ **Throttle Position 5V Supply Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove jumper wire. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between the analog throttle (A) ground terminal and the 5V supply terminal (terminals A and C) in the analog throttle (A) connector on the instrument panel harness. Is the voltage 4.0 volts or above?	**YES:** GO TO ❼ **NO:** GO TO ❽ – – –1/1

❼ **Throttle Position Input Wire Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Analog throttle (A) sensor connector still disconnected. 3. Disconnect ECU connector J2. 4. Using a multimeter, measure resistance between terminal B in the analog throttle (A) sensor connector and terminal A4 in ECU connector J2 on the engine harness. Is the resistance 5 ohms or below?	**YES:** Open in analog throttle (A) input circuit. OR Short to ground in analog throttle (A) input circuit **NO:** Faulty ECU connection OR Faulty ECU – – –1/1

❽ **Throttle Position 5V Supply Wire Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Analog throttle (A) sensor connector and ECU connector J2 still disconnected. 3. Using a multimeter, measure resistance between terminal C in the analog throttle (A) sensor connector and terminal A3 in ECU connector J2 on the engine harness. Is the resistance 5 ohms or below?	**YES:** Open in analog throttle (A) 5V supply circuit. OR Short to ground in analog throttle (A) 5V supply circuit. **NO:** Faulty ECU connection OR Faulty ECU – – –1/1

T5 — Analog Throttle (B) Input High

The analog throttle (B) input voltage exceeds the high voltage specification.

RG41221,00001F8 –19–19SEP05–1/1

T5 — Analog Throttle (B) Input High Diagnostic Procedure

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Related Information:
The analog throttle (B) input voltage exceeds the maximum threshold. The voltage is higher than what is physically possible for the throttle lever to achieve.

Alarm Level:
Warning

Control Unit Response:
If more than one throttle is available, the ECU will ignore the input from the analog throttle (B) and will use the input values from the other throttle.

If the analog throttle (B) is the only throttle, or all other throttles are faulted, the ECU will use a default “limp-home” throttle value of low idle engine speed.

Additional References:
For further analog throttle information, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the analog throttle (B) connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (B) through full travel. 7. Read DTCs. Does the analog throttle (B) high voltage DTC reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Throttle Idle Position Voltage Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Analog Throttle (B) in the idle position. 3. Using the ECU diagnostic software, read analog throttle (B) input voltage. Is the voltage 4.5 volts or above?	**YES:** GO TO ❺ **NO:** GO TO ❹ – – –1/1

❹ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine ON or OFF 2. Slowly operate analog throttle (B) through full travel. 3. Using the ECU diagnostic software, read analog throttle (B) input voltage. Does the voltage go above 4.5 volts anytime through the travel?	**YES:** GO TO ❻ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❺ **Throttle Position Input Shorted Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect analog throttle (B) sensor connector behind the instrument panel. 3. Ignition ON, engine OFF 4. Using the ECU diagnostic software, read analog throttle (B) input voltage. Is the voltage 0.5 volts or less?	**YES:** GO TO ❻ **NO:** Short to voltage in analog throttle (B) input circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

❻ **Throttle Position Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Analog throttle (B) connector disconnected. 3. Using a test light connected to battery voltage (+), probe the ground terminal (terminal A) in the analog throttle (B) sensor connector on the instrument panel harness. Does the light illuminate?	**YES:** Faulty analog throttle (B) sensor connector. OR Faulty analog throttle (B) sensor. **NO:** Open in analog throttle (B) ground circuit. OR Faulty ECU connection OR Faulty ECU – – –1/1

T6 — Analog Throttle (B) Input Low

The analog throttle (B) input voltage drops below the low voltage specification.

RG41221,00001F9 –19–19SEP05–1/1

T6 — Analog Throttle (B) Input Low Diagnostic Procedure

Related Information:
The analog throttle (B) input voltage drops below the minimum threshold. The voltage is lower than what is physically possible for the throttle lever to achieve.

Alarm Level:
Warning

Control Unit Response:
If more than one throttle is available, the ECU will ignore the input from the analog throttle (B) and will use the input values from the other throttle.

If the analog throttle (B) is the only throttle, or all other throttles are faulted, the ECU will use a default “limp-home” throttle value of low idle engine speed.

Additional References:
For further analog throttle information, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the analog throttle (B) connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (B) through full travel. 7. Read DTCs. Does the analog throttle (B) low voltage DTC reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Throttle Idle Position Voltage Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Analog Throttle (B) in the idle position. 3. Using the ECU diagnostic software, read analog throttle (B) input voltage. Is the voltage 0.5 volts or less?	**YES:** GO TO ❺ **NO:** GO TO ❹ – – –1/1
❹ **Throttle Travel Voltage Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine ON or OFF 2. Slowly operate analog throttle (B) through full travel. 3. Using the ECU diagnostic software, read analog throttle (B) input voltage. Does the voltage go below 0.5 volts anytime through the travel?	**YES:** GO TO ❺ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❺ **Throttle Position Wiring Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect analog throttle (B) sensor connector behind the instrument panel. 3. Install a jumper wire between the 5V supply terminal and the input terminal (terminals A and C) in the analog throttle (B) sensor connector on the instrument panel harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read analog throttle (B) input voltage. Is the voltage 4.5 volts or less?	**YES:** GO TO ❻ **NO:** Faulty analog throttle (B) sensor connector OR Faulty analog throttle (B) sensor – – –1/1

❻ **Throttle Position 5V Supply Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove jumper wire. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between the analog throttle (B) ground terminal and the 5V supply terminal (terminals A and C) in the analog throttle (B) connector on the instrument panel harness. Is the voltage 4.0 volts or above?	**YES:** GO TO ❼ **NO:** GO TO ❽ – – –1/1

❼ **Throttle Position Input Wire Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Analog throttle (B) sensor connector still disconnected. 3. Disconnect ECU connector J2. 4. Using a multimeter, measure resistance between terminal B in the analog throttle (B) sensor connector and terminal F3 in ECU connector J2 on the engine harness. Is the resistance 5 ohms or below?	**YES:** Open in analog throttle (B) input circuit. OR Short to ground in analog throttle (B) input circuit **NO:** Faulty ECU connection OR Faulty ECU – – –1/1

❽ **Throttle Position 5V Supply Wire Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Analog throttle (B) sensor connector and ECU connector J2 still disconnected. 3. Using a multimeter, measure resistance between terminal C in the analog throttle (B) sensor connector and terminal G2 in ECU connector J2 on the engine harness. Is the resistance 5 ohms or below?	**YES:** Open in analog throttle (B) 5V supply circuit. OR Short to ground in analog throttle (B) 5V supply circuit. **NO:** Faulty ECU connection OR Faulty ECU – – –1/1

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

Throttle voltage is above or below the specification.

RG41221,00001FA –19–19SEP05–1/1

T22 — Analog Throttle (A) Input Voltage Out of Range Diagnostic Procedure

Related Information:
The analog throttle (A) input voltage exceeds the maximum or drops below the minimum threshold. The voltage is higher or lower than what is physically possible for the throttle lever to achieve.

Alarm Level:
Warning

Control Unit Response:
If more than one throttle is available, the ECU will ignore the input from the analog throttle (A) and will use the input values from the other throttle.

If the analog throttle (A) is the only throttle, or all other throttles are faulted, the ECU will use a default “limp-home” throttle value of low idle engine speed.

Additional References:
For further analog throttle information, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the analog throttle (A) connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (A) through full travel. 7. Read DTCs. Does the analog throttle (A) voltage out of range DTC reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Multiple Throttle Check**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Is this engine equipped with more than one throttle?	**YES:** GO TO ❹ **NO:** GO TO ❹ – – –1/1

❹ **Throttle Reset Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* *NOTE: The ECU will default to use the functioning throttle on engines that are equipped with more than one throttle.* 1. Ignition ON, engine OFF 2. Return the analog throttle (A) to the 0% throttle position. 3. Ignition OFF for 15 seconds. 4. Ignition ON, engine running. 5. Move the analog throttle (A) through full travel. Does the engine speed increase above low idle?	**YES:** Analog Throttle (A) is properly functioning. **NO:** GO TO ❺ – – –1/1

❺ **DTC Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Make note of any DTCs, then clear all DTCs. 3. Ignition ON, engine running 4. Move the analog throttle (A) through full travel. 5. Read DTCs. Do additional DTCs set related to analog throttle (A)?	**YES:** Diagnose this code first. **NO:** Faulty ECU – – –1/1

T23 — Multi-State Voltage Out of Range

Throttle voltage is above or below the specification.

RG41221,00001FB –19–19SEP05–1/1

T23 — Multi-State Voltage Out of Range Diagnostic Procedure

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Related Information:
The multi-state throttle input voltage exceeds the maximum or drops below the minimum threshold. The voltage is higher or lower than what is physically possible for the throttle lever to achieve.

Alarm Level:
Warning

Control Unit Response:
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 the other throttle.

If the multi-state throttle is the only throttle, or all other throttles are faulted, the ECU will use a default “limp-home” throttle value of low idle engine speed.

Additional References:
For further multi-state throttle information, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the multi-state throttle connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the multi-state throttle through full travel. 7. Read DTCs. Does the multi-state throttle voltage out of range DTC reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Multiple Throttle Check**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* Is this engine equipped with more than one throttle?	**YES:** GO TO ❹ **NO:** GO TO ❹ – – –1/1

❹ **Throttle Reset Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* *NOTE: The ECU will default to use the functioning throttle on engine that are equipped with more than one throttle.* 1. Ignition ON, engine OFF 2. Return the multi-state throttle to the low idle (0%) throttle position. 3. Ignition OFF for 15 seconds. 4. Ignition ON, engine running. 5. Move the multi-state throttle through all positions. Does the engine speed increase above low idle?	**YES:** Multi-state throttle is properly functioning. **NO:** GO TO ❺ – – –1/1

❺ **DTC Test**	*NOTE: For wiring and theory of operation, see MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Make note of any DTCs, then clear all DTCs. 3. Ignition ON, engine running 4. Move the multi-state throttle through full travel. 5. Read DTCs. Do additional DTCs set related to multi-state throttle?	**YES:** Diagnose this code first. **NO:** Faulty ECU – – –1/1

T24 — Analog Throttle (B) Input Voltage Out of Range

Throttle voltage is above or below the specification.

RG41221,00001FC –19–19SEP05–1/1

T24 — Analog Throttle (B) Input Voltage Out of Range Diagnostic Procedure

Related Information:
The analog throttle (B) input voltage exceeds the maximum or drops below the minimum threshold. The voltage is higher or lower than what is physically possible for the throttle lever to achieve.

Alarm Level:
Warning

Control Unit Response:
If more than one throttle is available, the ECU will ignore the input from the analog throttle (B) and will use the input values from the other throttle.

If the analog throttle (B) is the only throttle, or all other throttles are faulted, the ECU will use a default “limp-home” throttle value of low idle engine speed.

Additional References:
For further analog throttle information, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the analog throttle (B) connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (B) through full travel. 7. Read DTCs. Does the analog throttle (B) voltage out of range DTC reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Multiple Throttle Check**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Is this engine equipped with more than one throttle?	**YES:** GO TO ❹ **NO:** GO TO ❹ – – –1/1

❹ **Throttle Reset Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* *NOTE: The ECU will default to use the functioning throttle on engines that are equipped with more than one throttle.* 1. Ignition ON, engine OFF 2. Return the analog throttle (B) to the 0% throttle position. 3. Ignition OFF for 15 seconds. 4. Ignition ON, engine running. 5. Move the analog throttle (B) through full travel. Does the engine speed increase above low idle?	**YES:** Analog Throttle (B) is properly functioning. **NO:** GO TO ❺ – – –1/1

❺ **DTC Test**	*NOTE: For wiring and theory of operation, see ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Make note of any DTCs, then clear all DTCs. 3. Ignition ON, engine running 4. Move the analog throttle (B) through full travel. 5. Read DTCs. Do additional DTCs set related to analog throttle (B)?	**YES:** Diagnose this code first. **NO:** Faulty ECU – – –1/1

000028.03 — Throttle Voltage High

Throttle voltage is above the high voltage specification.

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

Application	Diagnostic Procedure
OEM	See T5 — ANALOG THROTTLE (B) INPUT HIGH diagnostic procedure earlier in this Group.

RG41221,00001FD –19–19SEP05–1/1

000028.04 — Throttle Voltage Low

Throttle voltage is below the low voltage specification.

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

Application	Diagnostic Procedure
OEM	See T6 — ANALOG THROTTLE (B) INPUT LOW diagnostic procedure earlier in this Group.

RG41221,00001FE –19–19SEP05–1/1

000028.14 — Throttle Voltage Out of Range

Throttle voltage is above or below the specification.

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

Application	Diagnostic Procedure
OEM	See T24 — ANALOG THROTTLE (B) INPUT VOLTAGE OUT OF RANGE diagnostic procedure earlier in this Group.

RG41221,00001FF –19–19SEP05–1/1

000029.03 — Throttle Voltage High

Throttle voltage is above the high voltage specification.

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

Application	Diagnostic Procedure
OEM	See T3 — ANALOG THROTTLE (A) INPUT HIGH diagnostic procedure earlier in this Group.

RG41221,0000200 –19–19SEP05–1/1

000029.04 — Throttle Voltage Low

Throttle voltage is below the low voltage specification.

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

Application	Diagnostic Procedure
OEM	See T4 — ANALOG THROTTLE (A) INPUT LOW diagnostic procedure earlier in this Group.

RG41221,0000201 –19–19SEP05–1/1

000029.14 — Throttle Voltage Out of Range

Throttle voltage is above or below the specification.

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

Application	Diagnostic Procedure
OEM	See T22 — ANALOG THROTTLE (A) INPUT VOLTAGE OUT OF RANGE diagnostic procedure earlier in this Group.

RG41221,0000202 –19–19SEP05–1/1

000091.03 — Throttle Voltage High

Throttle voltage is above the high voltage specification.

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

Application	Diagnostic Procedure
OEM	See T1 — MULTI-STATE THROTTLE INPUT HIGH diagnostic procedure earlier in this Group.

RG41221,0000203 –19–19SEP05–1/1

000091.04 — Throttle Voltage Low

Throttle voltage is below the low voltage specification.

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

Application	Diagnostic Procedure
OEM	See T2 — MULTI-STATE THROTTLE INPUT LOW diagnostic procedure earlier in this Group.

RG41221,0000204 –19–19SEP05–1/1

000091.09 — Throttle Invalid

ECU received invalid or missing throttle information.

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

Application	Diagnostic Procedure
Combine	T7 - CAN Throttle Invalid
Loader	T7 - CAN Throttle Invalid

RG41221,00000E9 –19–22JAN03–1/1

000091.14 — Throttle Voltage Out of Range

Throttle voltage is above or below the specification.

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

Application	Diagnostic Procedure
OEM	See T23 — MULTI-STATE THROTTLE VOLTAGE OUT OF RANGE diagnostic procedure earlier in this Group.

RG41221,0000205 –19–19SEP05–1/1

000094.03 — Fuel Transfer Pump Pressure Input Voltage High

The fuel transfer pump pressure input voltage exceeds the sensor's high voltage specification. This can be caused by an open ground circuit or the input or supply circuit shorted to a voltage source.

RG41221,0000206 –19–19SEP05–1/1

000094.03 — Fuel Transfer Pump Pressure Input Voltage High Diagnostic Procedure

Related Information
The fuel transfer pump pressure input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a pressure that is higher than what is physically possible for the fuel transfer pump.

For OEM applications, the high fuel transfer pump pressure input voltage specification is 4.9 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default fuel transfer pump pressure of 101 kPa (1.0 bar) (14.6 psi).

Additional References:
For further fuel transfer pump pressure sensor information, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

NOTE: If a Sensor Supply Voltage High DTC occurs, troubleshoot that fault first.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* Without disconnecting, visually inspect the ECU connectors and the fuel transfer pump pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs. Does 000094.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Ground Circuit Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition OFF. 2. Disconnect pressure sensor connector. 3. Using a multimeter, check resistance between terminal A in the sensor connector and a good chassis ground. Is resistance near 0 ohms?	**YES:** Ground circuit OK. GO TO ❹ **NO:** Open in ground circuit. Repair and retest. – – –1/1

❹ **Input Circuit Short to Power Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition ON. 2. Using a multimeter, check voltage between terminal C in the sensor connector and a good chassis ground. Is voltage more than 4.9 volts?	**YES:** Short to power source in input circuit. GO TO ❺ **NO:** Input circuit OK. Check supply circuit. GO TO ❻. – – –1/1

❺ **Input Wiring Short to Power Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition OFF, sensor still disconnected. 2. Disconnect J3 from the ECU. 3. Using a multimeter, measure resistance between terminal C2 in ECU connector and all other terminals in the ECU connectors. Are all resistance checks more than 2000 ohms?	**YES:** Input wiring OK. Check ECU. GO TO ❽ **NO:** Input wiring shorted to circuit measuring low resistance. Repair and retest. – – –1/1
❻ **Supply Circuit Short to Power Source Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition ON. 2. Using a multimeter, check voltage between terminal B in the sensor connector and a good chassis ground. Is voltage between 4.5 and 5.5?	**YES:** Supply circuit OK. **Replace sensor** and retest. **NO:** Supply circuit shorted to higher power source. GO TO ❼. – – –1/1
❼ **Supply Wiring Short to Power Source Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect the connectors from the ECU. 3. Using a multimeter, measure resistance between terminal H4 in the ECU connector and all other terminals in the ECU connectors. Does resistance measure 2000 ohms or more?	**YES:** Supply wiring OK. Check ECU. GO TO ❽ **NO:** Supply wiring shorted to circuit measuring low resistance. Repair and retest. – – –1/1
❽ **ECU Test**	1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, check that resistances between the following ECU pins fall within the range of values shown. • J3-H3 and J3-H4: 50K-90K ohms • J3-H3 and J3-C2: 130K-200K ohms Are all measured resistance values within range?	**YES:** ECU OK. Reinstall ECU and retest. **NO:** Replace ECU and retest. – – –1/1

000094.04 — Fuel Transfer Pump Pressure Input Voltage Low

The fuel transfer pump pressure input voltage drops below the sensor's low voltage specification. This can be caused by a grounded input, open input, grounded supply, or open supply circuit.

RG41221,0000207 –19–19SEP05–1/1

000094.04 — Fuel Transfer Pump Pressure Input Voltage Low Diagnostic Procedure

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Related Information
The fuel transfer pump pressure input voltage drops below the sensor's low voltage specification. The voltage corresponds to a pressure that is lower than what is physically possible for the fuel transfer pump.

For OEM applications, the low fuel transfer pump pressure input voltage specification is 0.1 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default fuel transfer pump pressure of 101 kPa (1.01 bar) (14.6 psi).

Additional References:
For further fuel transfer pump pressure sensor information, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* Without disconnecting, visually inspect the ECU connectors and the fuel transfer pump pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000094.04 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Sensor Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition OFF. 2. Disconnect oil pressure sensor connector. 3. In the connector, install a jumper wire between the supply and input terminals (terminals B and C). 4. Ignition ON, engine OFF. 5. Read DTCs. Does 000100.03 (input voltage high) occur?	**YES:** Input and supply circuits OK. Replace sensor and retest. **NO:** Sensor OK. Faulty input or supply circuit. GO TO ❹

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❹ **Supply Circuit Test I**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition OFF. 2. Remove jumper wire. 3. Ignition ON. 4. Using a multimeter, measure voltage between terminal B in the sensor connector and a good chassis ground. Is voltage 4.5-5.5?	**YES:** Supply circuit OK. Check input circuit. GO TO ❼ **NO:** Open or short to ground in oil pressure sensor 5V supply circuit. GO TO ❺.

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❺ **Supply Circuit Test II**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition OFF, sensor still disconnected. 2. Disconnect J3 from the ECU. 3. Using a multimeter, measure resistance between terminal B in the sensor connector and a good chassis ground. Does resistance measure 20K ohms or more?	**YES:** Supply circuit not grounded. Check for open circuit. GO TO ❻ **NO:** Low resistance to ground in supply circuit. Repair and retest. – – –1/1
❻ **Supply Wiring Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition OFF. 2. Disconnect J1 and J2 from the ECU. 3. Using a multimeter, measure resistance between terminal H4 in the ECU connector and all other terminals in the ECU connectors. Are all resistance measurements 2000 ohms or more?	**YES:** Supply circuit not open. Check ECU. GO TO ❾ **NO:** Low resistance between supply circuit and the circuit that measured low. Repair and retest. – – –1/1
❼ **Input Circuit Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition OFF. 2. Using a multimeter, measure resistance between terminal C in the sensor connector and a good chassis ground. Does resistance measure 2000 ohms or more?	**YES:** Input circuit not grounded. Check for open circuit. GO TO ❽ **NO:** Low resistance to ground in input circuit. Repair and retest. – – –1/1
❽ **Input Wiring Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition OFF. 2. Disconnect J1, J2, and J3 from the ECU. 3. Using a multimeter, measure resistance between terminal C2 in the ECU connector and all other terminals in the ECU connectors. Are all resistance measurements 2000K or more?	**YES:** Input circuit not open. Check ECU. GO TO ❾ **NO:** Low resistance between input circuit and the circuit that measured low. Repair and retest. – – –1/1

❾ **ECU Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, check that resistances between the following ECU pins fall within the range of values shown. • J3-H3 and J3-H4: 50K-90K ohms • J3-H3 and J3-C2: 130K-200K ohms Are all measured resistance values within ranges shown?	**YES:** ECU OK. Reinstall ECU and retest. **NO:** Replace ECU and retest. – – –1/1

000094.17 — Fuel Transfer Pump Pressure Low Least Severe

The ECU senses a fuel transfer pump pressure below specification.

RG41221,00002BB –19–05DEC05–1/1

000094.17 — Fuel Transfer Pump Pressure Low Least Severe Procedure

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Related Information

For OEM applications, the low fuel transfer pump pressure specification is -5 kPa (0.05 bar) (-0.5 psi).

Alarm Level:
Warning

Control Unit Response:

If this code sets the ECU increases the PWM signal sent to the transfer pump motor until it reaches 100%. It stays at 100% until the problem is fixed.

Additional References:
For further fuel transfer pump pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.

For further fuel transfer pump information, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	*NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 1. Ignition ON, Engine OFF. 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group 3. Write down all DTCs and their occurrence count. If any DTCs have Snapshot Capture of Snapshot Recording information save the information. For instructions on saving and using Snapshot Information, see SNAPSHOT INSTRUCTIONS earlier in this group. 4. Refresh DTC list. Did error code reappear as active?	**YES:** GO TO ❷ **NO:** GO TO ⓭ – – –1/1

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❷ **Primary and Secondary Filter Check**	*NOTE: For theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Replace the primary and secondary filter elements. 3. Ignition ON, engine OFF 4. Refresh DTCs. Does 000094.17 reoccur?	**YES:** GO TO ❸ **NO:** Filters were restricted. Problem is fixed. – – –1/1

❸ **Fuel Level Check**	*NOTE: For theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Check the fuel level in the tank. Is the fuel level extremely low?	**YES:** Add fuel and retest. **NO:** GO TO ❹ – – –1/1

❹ Fuel Tank Check	*NOTE: For theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Inspect the fuel tank for proper venting. Is the fuel tank vented properly?	**YES:** GO TO ❺ **NO:** Repair problem and retest. – – –1/1
❺ Fuel Line Check	*NOTE: For theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Inspect all fuel lines between the tank and the primary filter inlet for damage or restrictions. Are the fuel lines free of damage and restrictions?	**YES:** GO TO ❻ **NO:** Clean, repair, or replace bad fuel line and retest. – – –1/1
❻ Low Pressure Fuel Pressure Sensor Test	*NOTE: For theory of operation, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Ignition ON, Engine OFF. 3. Using Service ADVISOR monitor Fuel Transfer Pump Pressure - Actual, Manifold Absolute Pressure, Engine Oil Pressure. Are all readings within 35KPa (5psi) of each other?	**YES:** GO TO ❼ **NO:** Replace fuel pressure sensor if it is out of range with the others, retest. – – –1/1
❼ Test for Air in Fuel	*NOTE: For theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* see TEST FOR AIR IN FUEL in Section 04, Group 150 earlier in this manual. Is there air in the fuel?	**YES:** Repair problem, retest. **NO:** GO TO ❽ – – –1/1
❽ Test Fuel Quality	*NOTE: For theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* see TEST FOR FUEL QUALITY in Section 04, Group 150 earlier in this manual. Is there a fuel quality problem?	**YES:** Repair problem, retest. **NO:** GO TO ❾ – – –1/1

❾ **Check Snapshot Information**	1. Open all saved Snapshot information for this error code and other related error codes as noted above, see SNAPSHOT INSTRUCTIONS earlier in this Section. 2. Review information. Can you determine the fault or operating conditions causing a fault by looking at the stored information?	**YES:** Repair problem you have identified. Retest. **YES:** Determined operating conditions that produced the fault. GO TO ❻ – – –1/1

000097.03 — Water-in-Fuel Signal Voltage High

The Water-in-Fuel signal (input) voltage exceeds the sensor's high voltage specification.

RG41221,0000208 –19–19SEP05–1/1

000097.03 — Water-in-Fuel Signal Voltage High Diagnostic Procedure

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Related Information:
The water-in-fuel sensor signal (input) voltage exceeds the maximum threshold. The voltage is higher than what is physically possible for the water-in-fuel sensor to achieve.

Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open input or open ground circuit. Less probable is a short from the 5V input wire to a higher voltage source.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU's water-in-fuel engine protection feature will be disabled.

References:
For further water-in-fuel information, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the WIF sensor connector looking for contamination, damage, or poor positioning. Check wiring for damage. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF. 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs. Does 000097.03 reoccur?	**YES:** GO TO ❸ **NO:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❸. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Sensor Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the WIF sensor. 3. Using a multimeter, check resistance between the sensor terminals. Is resistance less than 250K ohms?	**YES:** Sensor OK. GO TO ❹ **NO:** Replace sensor and retest. – – –1/1

❹ **Input Circuit Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Sensor still disconnected. 2. Ignition ON, engine OFF. 3. Using a multimeter, check voltage between the input terminal (A) of the sensor connector and a good chassis ground. Does the voltage measure 4.5V - 5.5V?	**YES:** Input circuit OK. GO TO ❼ **NO:** (Voltage below 4.5V) Open or high resistance in input circuit. GO TO ❻ **NO:** (Voltage above 5.5V) Input circuit shorted to a power source. GO TO ❺ – – –1/1

❺ **Input Wiring Shorted to a Voltage Source Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON 2. Sensor still disconnected. 3. Disconnect J3 at the ECU. Inspect connector and ECU pins. 4. Using a multimeter, check for any voltage in the input circuit in the harness (between D2 and sensor connector terminal A). Do you measure any voltage?	**YES:** Input wiring shorted to voltage source. Repair and retest. **NO:** Remove and test ECU. GO TO ❽ – – –1/1

❻ **Input Circuit Wiring Open Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect J3 at the ECU. Inspect connector and ECU pins. 4. Using a multimeter, check continuity of the input circuit in the harness (between D2 and sensor connector terminal A). Does resistance measure 2 ohms or less?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❽ **NO:** Open or high resistance in the input wiring. Repair and retest. – – –1/1

❼ **Ground Circuit Wiring Open Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect J3 at the ECU. Inspect connector and ECU pins. 4. Using a multimeter, check continuity of the ground circuit in the harness (between H3 and sensor connector terminal B). Does resistance measure 2 ohms or less?	**YES:** Ground wiring OK. Remove and test ECU. GO TO ❽ **NO:** Open or high resistance in ground wiring. Repair and retest. – – –1/1

❽ **ECU Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the J3-D2 and J3-H3 pin in the ECU. Does resistance measure between 9K and 14K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

000097.04 — Water-in-Fuel Signal Voltage Low

The Water-in-Fuel signal (input) voltage drops below the sensor's low voltage specification.

RG41221,0000209 –19–19SEP05–1/1

000097.04 — Water-in-Fuel Signal Voltage Low Diagnostic Procedure

Related Information:
The water-in-fuel sensor signal (input) voltage drops below the minimum threshold. The voltage is lower than what is physically possible for the water-in-fuel sensor to achieve.

Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault is low resistance to ground (grounded input circuit).

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU's water-in-fuel engine protection feature will be disabled.

Additional References:
For further water-in-fuel information, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the WIF sensor connector looking for contamination, damage, or poor positioning. Check wiring for damage. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Does 000097.04 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Shorted Sensor Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the WIF sensor. 3. Using a multimeter, check resistance between the sensor terminals. Is resistance more than 200K ohms?	**YES:** Sensor not shorted. GO TO ❹ **NO:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

❹ **Grounded Sensor Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor disconnected. 3. Using a multimeter, check resistance between each sensor terminal and a good chassis ground. Is resistance less than 200K ohms?	**YES:** Low resistance to ground. Replace sensor and retest. **NO:** Sensor not grounded. Check wiring. GO TO ❺ – – –1/1

❺ **Input Circuit Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Using a multimeter, check resistance between the sensor connector input terminal (A) and a good chassis ground. Is resistance less than 5K ohms?	**YES:** Low resistance to ground in input circuit. GO TO ❻ **NO:** Input wiring OK. Remove and test ECU. – – –1/1

❻ **Input Circuit Wiring Ground Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect J3 at the ECU. Inspect connector and ECU pins. 4. Using a multimeter, check resistance between the input terminal (A) in the sensor harness connector and a good chassis ground. Is resistance less than 1M ohms?	**YES:** Low resistance to ground in input wiring. Repair and retest. **NO:** Input wiring OK. Remove and test ECU. GO TO ❻ – – –1/1

❼ **ECU Test**	*NOTE: For wiring and theory of operation, see WATER-IN-FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between pins J3-D2 and J3-H3 in the ECU. Is resistance 9K to 14K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

000097.16 — Water in Fuel Detected

The Water in Fuel sensor signals the ECU that an excessive amount of water is in the sediment bowl of the primary fuel filter.

RG41221,000020A –19–19SEP05–1/1

000097.16 — Water in Fuel Detected Diagnostic Procedure

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Related Information:
The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system on the principle that water is a better conductor of electricity than is fuel. When water is present in the fuel filter sediment bowl, resistance to ground in the WIF circuit is decreased, resulting in a voltage drop in the input (supply) circuit.

Alarm Level:
STOP

Control Unit Response:

NOTE: Using the ECU's trimmable features, the customer has the option to choose an engine shutdown option. If the shutdown feature was not selected, a standard derate will be activated. The time that the shutdown condition needs to be active before the engine shutdown occurs is adjustable through trim options. Available choices are 30 seconds and immediate.

The ECU will derate 20% per minute until the engine is running at 50% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

On OEM application engines with the shutdown feature programmed in the ECU, the ECU will shut down the engine in either 0 or 30 seconds after the code sets.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further water-in-fuel information, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Water in Fuel Checks**	*NOTE: For wiring and theory of operation, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* Check the following items that can cause water in fuel: • Poor fuel quality or water in fuel storage tank. • Loose fuel tank cap. • Missing or damaged fuel tank cap seal. • Excessive condensation build up in fuel tank. • Loose or damaged fuel filter or sediment bowl. • Moisture build-up over time. Was cause of the DTC determined?	**YES:** Repair problem, drain sediment bowl, and retest. **NO:** Check for wiring or sensor problem. GO TO ❷ – – –1/1
❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the WIF sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1
❸ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF. 3. Make note of any DTCs, then clear all DTCs. 4. Ignition OFF. Wait 30 seconds. 5. Ignition ON, engine OFF. 6. Read DTCs. Does 000097.16 reoccur?	**YES:** GO TO ❹ **NO:** Manipulate the harness wiring while monitoring the error codes. If code returns, note where in the harness that the error occured. GO TO ❹. If code does not return and no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❹ **WIF Sensor Check**	*NOTE: For wiring and theory of operation, see WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the WIF sensor. 3. Using a multimeter, measure resistance between both terminals in the WIF sensor. Is the resistance significantly less than 200K ohms?	**YES:** Faulty WIF sensor. Replace and retest. **NO:** Inconclusive results. If 00097.16 returns and there is no water in the sediment bowl, verify that WIF input circuit is not grounded. See procedures for 000097.04. – – –1/1

000100.01 — Engine Oil Pressure Extremely Low

The ECU senses an extremely low oil pressure.

RG41221,000020B –19–19SEP05–1/1

000100.01 — Engine Oil Pressure Extremely Low Diagnostic Procedure

Related Information:
The ECU senses an oil pressure below the 2nd threshold. Oil pressure below the first threshold would have already set code 100.18.

Alarm Level:
STOP

Control Unit Response:

NOTE: Using the ECU's trimmable features, the customer has the option to choose an engine shutdown option. If the shutdown feature was not selected, a standard derate will be activated. The time that the shutdown condition needs to be active before the engine shutdown occurs is adjustable through trim options. Available choices are 30 seconds and immediate.

The ECU will derate 20% per minute until the engine is running at 40% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

The ECU will shut down the engine in either 0 or 30 seconds after the code sets on OEM application engines with the shutdown feature programmed in the ECU.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further oil pressure sensor information, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Preliminary Checks**	1. Check crankcase oil level. 2. Check oil viscosity and quality. 3. Check for plugged oil filter. Was the problem found?	**YES:** Repair and retest. **NO:** GO TO ❷ – – –1/1

❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Visually inspect the oil pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1

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❸ **Sensor Ground Circuit Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the oil pressure sensor connector. 3. Using a multimeter, measure resistance between the sensor ground terminal (A or 1) in the oil pressure sensor connector and a good chassis ground. Does resistance measure 5 ohms or more?	**YES:** Ground circuit open (high resistance to ground will cause a bogus high pressure reading). Repair and retest. **NO:** GO TO ❹ – – –1/1

❹ **Oil Pressure Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Under the conditions where DTC 000100.01 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in Section 04 of the 9.0L Diesel Engines Base Engine manual (CTM 400). Is engine oil pressure below specification?	**YES:** See L2 - ENGINE OIL PRESSURE LOW diagnostic procedure in Section 04 of the 9.0L Diesel Engines Base Engine Manual (CTM 400). **NO:** Faulty oil pressure sensor. Replace and retest. – – –1/1

000100.03 — Engine Oil Pressure Input Voltage High

Input voltage in the sensor circuit rises to a level that is outside its normal operating range. This can be caused by an open ground circuit or the input or supply circuit shorted to a voltage source.

RG41221,000020C –19–19SEP05–1/1

000100.03 — Engine Oil Pressure Input Voltage High Diagnostic Procedure

Related Information:
The oil pressure input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a pressure that is higher than what is physically possible for oil pressure.

For OEM applications, the high oil pressure input voltage specification is 4.95 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default oil pressure of 500 kPa (72.5 psi) (5.00 bar).

ECU's low oil pressure engine protection feature disabled.

Additional References:
For further oil pressure sensor information, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

NOTE: If a Sensor Supply Voltage High DTC occurs, troubleshoot that fault first.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF. 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running. 6. Read DTCs. Did 000100.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Ground Circuit Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect pressure sensor connector. 3. Using a multimeter, check resistance between terminal A in the sensor connector and a good chassis ground. Is resistance near 0 ohms?	**YES:** Ground circuit OK. GO TO ❹ **NO:** Open in ground circuit. Repair and retest. – – –1/1

❹ **Input Circuit Short to Power Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON. 2. Using a multimeter, check voltage between terminal C in the sensor connector and a good chassis ground. Is voltage more than 4.9 volts?	**YES:** Short to power source in input circuit. GO TO ❺ **NO:** Input circuit OK. Check supply circuit. GO TO ❻. – – –1/1
❺ **Input Wiring Shorted to Power Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect J3 from the ECU. 3. Using a multimeter, measure resistance between terminal C3 in ECU connector and all other terminals in the ECU connectors. Are all resistance checks more than 2000 ohms?	**YES:** Input wiring OK. Check ECU. GO TO ❽ **NO:** Input wiring shorted to circuit measuring low resistance. Repair and retest. – – –1/1
❻ **Supply Circuit Shorted to Power Source Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON. 2. Using a multimeter, check voltage between terminal B in the sensor connector and a good chassis ground. Is voltage between 4.5 and 5.5?	**YES:** Supply circuit OK. **Replace sensor** and retest. **NO:** Supply circuit shorted to higher power source. GO TO ❼. – – –1/1
❼ **Supply Wiring Shorted to Power Source Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect the connectors from the ECU. 3. Using a multimeter, measure resistance between terminal H4 in the ECU connector and all other terminals in the ECU connectors. Does resistance measure 2000 ohms or more?	**YES:** Supply wiring OK. Check ECU. GO TO ❽ **NO:** Supply wiring shorted to circuit measuring low resistance. Repair and retest. – – –1/1

❽ **ECU Test**	1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, check that resistances between the following ECU pins fall within the range of values shown. • J3-H3 and J3-H4: 50K-90K ohms • J3-H3 and J3-C3: 130K-200K ohms Are all measured resistance values within range?	**YES:** ECU OK. Reinstall ECU and retest. **NO:** Replace ECU and retest. – – –1/1

000100.04 — Engine Oil Pressure Input Voltage Low

Input voltage in the sensor circuit drops to a level that is outside its normal operating range. This can be caused by a grounded input, open input, grounded supply, or open supply circuit.

RG41221,000020D –19–19SEP05–1/1

000100.04 — Engine Oil Pressure Input Voltage Low Diagnostic Procedure

Related Information:
The oil pressure input voltage drops below the sensor's low voltage specification. The voltage corresponds to a pressure that is lower than what is physically possible for oil pressure.

For OEM applications, the low engine oil pressure input voltage specification is 0.125 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default oil pressure of 500 kPa (72.5 psi) (5.00 bar).

ECU's low oil pressure engine protection feature disabled.

Additional References:
For further oil pressure sensor information, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

NOTE: If a Sensor Supply Voltage Low DTC occurs, troubleshoot that fault first.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the oil pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000100.04 reoccur?	**YES:** GO TO ❸ **NO:** 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 Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect oil pressure sensor connector. 3. In the connector, install a jumper wire between the supply and input terminals (terminals B and C). 4. Ignition ON, engine OFF. 5. Read DTCs. Does 000100.03 (input voltage high) occur?	**YES:** Input and supply circuits OK. Replace sensor and retest. **NO:** Sensor OK. Faulty input or supply circuit. GO TO ❹ – – –1/1

❹ **Supply Circuit Test I**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove jumper wire. 3. Ignition ON. 4. Using a multimeter, measure voltage between terminal B in the sensor connector and a good chassis ground. Is voltage 4.5-5.5?	**YES:** Supply circuit OK. Check input circuit. GO TO ❼ **NO:** Open or short to ground in oil pressure sensor 5V supply circuit. GO TO ❺. – – –1/1
❺ **Supply Circuit Test II**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect J3 from the ECU. 3. Using a multimeter, measure resistance between terminal B in the sensor connector and a good chassis ground. Does resistance measure 20K ohms or more?	**YES:** Supply circuit not grounded. Check for open circuit. GO TO ❻ **NO:** Low resistance to ground in supply circuit. Repair and retest. – – –1/1
❻ **Supply Wiring Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect J1 and J2 from the ECU. 3. Using a multimeter, measure resistance between terminal H4 in the ECU connector and all other terminals in the ECU connectors. Are all resistance measurements 2000 ohms or more?	**YES:** Supply circuit not open. Check ECU. GO TO ❾ **NO:** Low resistance between supply circuit and the circuit that measured low. Repair and retest. – – –1/1
❼ **Input Circuit Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Using a multimeter, measure resistance between terminal C in the sensor connector and a good chassis ground. Does resistance measure 2000 ohms or more?	**YES:** Input circuit not grounded. Check for open circuit. GO TO ❽ **NO:** Low resistance to ground in input circuit. Repair and retest. – – –1/1

❽ **Input Wiring Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect J1, J2, and J3 from the ECU. 3. Using a multimeter, measure resistance between terminal C3 in the ECU connector and all other terminals in the ECU connectors. Are all resistance measurements 2000K or more?	**YES:** Input circuit not open. Check ECU. GO TO ❾ **NO:** Low resistance between input circuit and the circuit that measured low. Repair and retest. – – –1/1

❾ **ECU Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, check that resistances between the following ECU pins fall within the range of values shown. • J3-H3 and J3-H4: 50K-90K ohms • J3-H3 and J3-C3: 130K-200K ohms Are all measured resistance values within ranges shown?	**YES:** ECU OK. Reinstall ECU and retest. **NO:** Replace ECU and retest. – – –1/1

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000100.18 — Engine Oil Pressure Moderately Low

The ECU senses an oil pressure below the warning value set point in the ECU.

RG41221,000020E –19–27MAR06–1/1

000100.18 - Engine Oil Pressure Moderately Low Diagnostic Procedure

Related Information:
The ECU senses an oil pressure below the first threshold.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate 5% per minute until the engine is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further oil pressure sensor information, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Preliminary Checks**	1. Check crankcase oil level. 2. Check oil viscosity and quality. 3. Check for plugged oil filter. Was the problem found?	**YES:** Repair and retest. **NO:** GO TO ❷

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❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Visually inspect the oil pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1

❸ **Sensor Ground Circuit Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the oil pressure sensor connector. 3. Using a multimeter, measure resistance between the sensor ground terminal (A or 1) in the oil pressure sensor connector and a good chassis ground. Does resistance measure 5 ohms or more?	**YES:** Ground circuit open (high resistance to ground will cause a bogus high pressure reading). Repair and retest. **NO:** GO TO ❹ – – –1/1

❹ **Oil Pressure Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Under the conditions where DTC 000100.18 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in Section 04 of the 9.0L Diesel Engines Base Engine manual (CTM 400). Is engine oil pressure below specification?	**YES:** See L2 - ENGINE OIL PRESSURE LOW diagnostic procedure in Section 04 of the 9.0L Diesel Engines Base Engine manual (CTM 400). **NO:** Faulty oil pressure sensor. Replace and retest. – – –1/1

000100.31 — Engine Oil Pressure Invalid

The ECU receives a higher-than-expected sensor input voltage when engine speed is zero.

RG41221,000020F –19–19SEP05–1/1

000100.31 — Engine Oil Pressure Invalid Diagnostic Procedure

NOTE: If DTC 000100.31 is accompanied with DTC 000100.03 or 000100.04, follow that diagnostic procedure first.

Related Information:
The ECU detects oil pressure when the engine speed is zero.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU's low oil pressure engine protection feature disabled.

Additional References:
For further oil pressure sensor information, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the oil pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000100.31 reoccur?	**YES:** Likely cause of this fault is bad sensor, wiring, or connectors. Troubleshoot and repair according to procedures for 000100.03 Engine Oil Pressure Input Voltage High. **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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000102.02 — Manifold Air Pressure Invalid

The ECU receives an invalid pressure from the manifold air pressure sensor.

RG41221,0000210 –19–19SEP05–1/1

000102.02 — Manifold Air Pressure Invalid Diagnostic Procedure

Related Information:
The manifold air pressure sensor is invalid compared to the Barometric Air Pressure sensor and Exhaust Pressure sensor.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will use a default manifold air pressure model to run the engine.

Additional References:
For further manifold air pressure sensor information, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the manifold air pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Make note of any DTCs, then clear all DTCs. 4. Ignition ON, engine running 5. Read DTCs. Did 000102.02 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **MAP Sensor Ground Circuit Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the manifold air pressure sensor connector. 3. Using a multimeter, measure resistance between terminal 1 (A) in the MAP sensor connector and a good chassis ground. Is resistance 5 ohms or less?	**YES:** Ground circuit OK. GO TO ❹ **NO:** Open sensor ground wire. Repair and retest. – – –1/1

❹ **MAP Sensor 5V Supply Wire Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect ECU connector J3. 3. Using a multimeter, measure resistance between terminal 2 in the manifold air pressure sensor connector and terminal H4 in the ECU connector J3. Is resistance 5 ohms or less?	**YES:** Supply wiring OK. GO TO ❺ **NO:** Open in supply wiring. – – –1/1

❺ **MAP Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Using a multimeter, measure resistance between terminal 3 in the sensor connector and terminal C4 in the ECU connector J3. Is resistance 5 ohms or less?	**YES:** Input wiring OK. Faulty manifold air pressure sensor. **NO:** Open in sensor input wire. – – –1/1

000102.03 — Manifold Air Pressure Input Voltage High

Input voltage in the sensor circuit rises to a level that is outside its normal operating range. This can be caused by an open ground circuit or the input or supply circuit shorted to a voltage source.

RG41221,0000211 –19–19SEP05–1/1

000102.03 — Manifold Air Pressure Input Voltage High Diagnostic Procedure

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NOTE: If a Sensor Supply Voltage High DTC occurs, troubleshoot that fault first.

Related Information:
The Manifold Absolute Pressure (MAP) sensor is a pressure transducer located in the intake manifold. The ECU uses the MAP sensor to measure air pressure in the intake manifold. The MAP signal varies as intake manifold pressure varies. High pressures result in higher voltages, lower pressures result in lower voltages.

For OEM applications, the high manifold air pressure input voltage specification is 4.9 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will use a default manifold air pressure model to run the engine.

Additional References:
For further manifold air pressure sensor information, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the manifold air pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs. Did 000102.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Ground Circuit Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect sensor connector. 3. Using a multimeter, check resistance between terminal A in the sensor connector and a good chassis ground. Is resistance near 0 ohms?	**YES:** Ground circuit OK. GO TO ❹ **NO:** Open in ground circuit. Repair and retest. – – –1/1

❹ **Input Circuit Short to Power Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON. 2. Using a multimeter, check voltage between terminal C in the sensor connector and a good chassis ground. Is voltage more than 4.9 volts?	**YES:** Short to power source in input circuit. GO TO ❺ **NO:** Input circuit OK. Check supply circuit. GO TO ❻. – – –1/1

❺ Input Wiring Short to Power Test	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect J3 from the ECU. 3. Using a multimeter, measure resistance between terminal C4 in ECU connector and all other terminals in the ECU connectors. Are all resistance checks more than 2000 ohms?	**YES:** Input wiring OK. Check ECU. GO TO ❽ **NO:** Input wiring shorted to circuit measuring low resistance. Repair and retest. – – –1/1

❻ Supply Circuit Short to Power Source Test	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON. 2. Using a multimeter, check voltage between terminal B in the sensor connector and a good chassis ground. Is voltage between 4.5 and 5.5?	**YES:** Supply circuit OK. **Replace sensor** and retest. **NO:** Supply circuit shorted to higher power source. GO TO ❼. – – –1/1

❼ Supply Wiring Short to Power Source Test	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect the connectors from the ECU. 3. Using a multimeter, measure resistance between terminal H4 in the ECU connector and all other terminals in the ECU connectors. Does resistance measure 2000 ohms or more?	**YES:** Supply wiring OK. Check ECU. GO TO ❽ **NO:** Supply wiring shorted to circuit measuring low resistance. Repair and retest. – – –1/1

❽ ECU Test	1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, check that resistances between the following ECU pins fall within the range of values shown. • J3-H3 and J3-H4: 50K-90K ohms • J3-H3 and J3-C4: 130K-200K ohms Are all measured resistance values within range?	**YES:** ECU OK. Reinstall ECU and retest. **NO:** Replace ECU and retest. – – –1/1

000102.04 — Manifold Air Pressure Input Voltage Low

Input voltage in the sensor circuit drops to a level that is outside its normal operating range. This can be caused by a grounded input, open input, grounded supply, or open supply circuit.

RG41221,0000212 –19–19SEP05–1/1

000102.04 — Manifold Air Pressure Input Voltage Low Diagnostic Procedure

Related Information:
The manifold air pressure input voltage drops below the sensor's low voltage specification. The voltage corresponds to a pressure that is lower than what is physically possible for manifold air pressure.

For OEM applications, the high manifold air pressure input voltage specification is 0.1 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will use a default manifold air pressure model to run the engine.

Additional References:
For further manifold air pressure sensor information, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

NOTE: If a Sensor Supply Voltage Low DTC occurs, troubleshoot that fault first.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the manifold air pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000102.04 reoccur?	**YES:** GO TO ❸ **NO:** 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 Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect pressure sensor connector. 3. In the connector, install a jumper wire between the supply and input terminals (terminals B and C). 4. Ignition ON, engine OFF. 5. Read DTCs. Does 000100.03 (input voltage high) occur?	**YES:** Input and supply circuits OK. Replace sensor and retest. **NO:** Sensor OK. Faulty input or supply circuit. GO TO ❹ – – –1/1

❹ **Supply Circuit Test I**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove jumper wire. 3. Ignition ON. 4. Using a multimeter, measure voltage between terminal B in the sensor connector and a good chassis ground. Is voltage 4.5-5.5?	**YES:** Supply circuit OK. Check input circuit. GO TO ❼ **NO:** Open or short to ground in oil pressure sensor 5V supply circuit. GO TO ❺. – – –1/1

❺ **Supply Circuit Test II**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF, sensor still disconnected. 2. Disconnect J3 from the ECU. 3. Using a multimeter, measure resistance between terminal B in the sensor connector and a good chassis ground. Does resistance measure 20K ohms or more?	**YES:** Supply circuit not grounded. Check for open circuit. GO TO ❻ **NO:** Low resistance to ground in supply circuit. Repair and retest. – – –1/1
❻ **Supply Wiring Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect J1 and J2 from the ECU. 3. Using a multimeter, measure resistance between terminal H4 in the ECU connector and all other terminals in the ECU connectors. Are all resistance measurements 2000 ohms or more?	**YES:** Supply circuit not open. Check ECU. GO TO ❾ **NO:** Low resistance between supply circuit and the circuit that measured low. Repair and retest. – – –1/1
❼ **Input Circuit Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Using a multimeter, measure resistance between terminal C in the sensor connector and a good chassis ground. Does resistance measure 2000 ohms or more?	**YES:** Input circuit not grounded. Check for open circuit. GO TO ❽ **NO:** Low resistance to ground in input circuit. Repair and retest. – – –1/1
❽ **Input Wiring Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect J1, J2, and J3 from the ECU. 3. Using a multimeter, measure resistance between terminal C4 in the ECU connector and all other terminals in the ECU connectors. Are all resistance measurements 2000K or more?	**YES:** Input circuit not open. Check ECU. GO TO ❾ **NO:** Low resistance between input circuit and the circuit that measured low. Repair and retest. – – –1/1

❾ **ECU Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove ECU. 3. Using a multimeter, check that resistances between the following ECU pins fall within the range of values shown. • J3-H3 and J3-H4: 50K-90K ohms • J3-H3 and J3-C4: 130K-200K ohms Are all measured resistance values within ranges shown?	**YES:** ECU OK. Reinstall ECU and retest. **NO:** Replace ECU and retest. – – –1/1

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000103.00 — Turbo Overspeed Most Severe

The ECU detects a turbo speed above the specification.

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000103.00 — Turbo Overspeed Most Severe Diagnostic Procedure

NOTE: DTC 000103.00 may be accompanied with DTC 000103.05 or 000103.06 during the Harness Diagnostic Mode Test, follow 000103.05 or 000103.06 diagnostic procedure first.

Related Information:
The ECU detects a turbo speed that exceeds the capability of the turbo. This can happen at high altitude in addition to high load and high temperature conditions. Erratic actuator operation can also result in a turbo overspeed.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate engine speed 20% per minute until the engine is can operate at 50% of full speed. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further turbo speed sensor information, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the turbo speed sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load. 6. Read DTCs. Did 000103.00 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Turbo Linkage Test**	*NOTE: For wiring and theory of operation, see TURBO ACTUATOR in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF 2. Push the turbo linkage to the fully open position. 3. Release to allow linkage to return to fully closed position. Does the linkage move freely?	**YES:** GO TO ❹ **NO:** Adjust linkage and retest. See REMOVE AND INSTALL ACTUATOR LINKAGE Section 2, Group 100 in CTM400. – – –1/1

❹ **Turbo Speed Sensor Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the turbo speed sensor. See REMOVE AND INSTALL TURBO SPEED SENSOR in Section 02, Group 110 earlier in this manual. 3. Inspect the tip of the sensor for damage and debris. Is the sensor free from debris and damage?	**YES:** GO TO ❺ **NO:** GO TO ❼ – – –1/1
❺ **Turbo Speed Sensor Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor still removed from the turbo. 3. Hold the sensor's magnetic tip against a small flat blade screw driver. Does the screw driver stick to the sensor?	**YES:** GO TO ❻ **NO:** Faulty turbo speed sensor. Replace and retest. – – –1/1
❻ **Turbo Speed Sensor Continuity Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor still removed from the turbo. 3. Using a multimeter, measure resistance between both terminals in the turbo speed sensor. Is the resistance between 635 and 1065 ohms?	**YES:** GO TO ❼ **NO:** Faulty turbo speed sensor. Replace and retest. – – –1/1
❼ **Turbo Blade Damage Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Remove the compressor air inlet tube and check for damage to the blades. Is there damage to blades?	**YES:** Replace turbo and retest. **NO:** GO TO ❽ – – –1/1

❽ **Excessive Compressor Shaft End Play Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Apply side load to the compressor shaft and check for excessive end play. Does the compressor wheel come in contact with housing or does the housing show signs of prior contact?	**YES:** Replace turbo and retest. **NO:** Faulty ECU. – – –1/1

000103.02 — Turbo Speed Mismatch

Actual turbo speed does not match the ECU's software model for turbo speed under current operating conditions.

RG41221,0000214 –19–19SEP05–1/1

000103.02 — Turbo Speed Mismatch Diagnostic Procedure

NOTE: If DTC 000103.02 is accompanied with DTC 000103.05 or 000103.06, follow that diagnostic procedure first.

Related Information:
Turbo speed does not match the ECU's software model for turbo speed under current operating conditions.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further turbo speed sensor information, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the turbo speed sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load. 6. Read DTCs. Did 000103.02 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Turbo Speed Sensor Ground Wire Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the turbo speed sensor and ECU connector J1. 3. Using a multimeter, measure resistance between terminal 2 in the turbo speed sensor and terminal B3 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open or short in the turbo speed ground wire. Repair and retest. – – –1/1

❹ **Turbo Speed Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor and ECU connector J1 still disconnected. 3. Using a multimeter, measure resistance between terminal 1 in the turbo speed sensor and terminal B4 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open or short in the turbo speed input wire. Repair and retest. – – –1/1

❺ **Turbo Speed Sensor Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the turbo speed sensor. See REMOVE AND INSTALL TURBO SPEED SENSOR in Section 02, Group 110 earlier in this manual. 3. Inspect the tip of the sensor for damage and debris. Is the sensor free from debris and damage?	**YES:** GO TO ❻ **NO:** GO TO ❽ – – –1/1
❻ **Turbo Speed Sensor Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor still removed from the turbo. 3. Hold the sensor's magnetic tip against the engine block. Does the sensor stick to the engine block?	**YES:** GO TO ❼ **NO:** Faulty turbo speed sensor. Replace and retest. – – –1/1
❼ **Turbo Speed Sensor Continuity Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor still removed from the turbo. 3. Using a multimeter, measure resistance between both terminals in the turbo speed sensor. Is the resistance between 800 and 900 ohms?	**YES:** GO TO ❽ **NO:** Faulty turbo speed sensor. Replace and retest. – – –1/1
❽ **Turbo Blade Damage Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Remove the compressor air inlet tube and check for damage to the blades. Is there damage to blades?	**YES:** Replace turbo and retest. **NO:** GO TO ❾ – – –1/1

❾ **Excessive Compressor Shaft End Play Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Apply side load to the compressor shaft and check for excessive end play. Does the compressor wheel come in contact with housing or does the housing show signs of prior contact?	**YES:** Replace turbo and retest. **NO:** Faulty ECU. – – –1/1

000103.05 — Turbo Speed Sensor Current Low

The ECU detects low current on the turbo speed sensor wiring.

RG41221,0000215 –19–25APR06–1/1

000103.05 — Turbo Speed Sensor Current Low Diagnostic Procedure

NOTE: If other turbo related DTCs accompany 000103.05, diagnose 000103.05 first.

Related Information:
The ECU detects low current on the turbo speed sensor wiring through the Harness Diagnostic Mode Test on the ECU diagnostic software.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further turbo speed information, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the turbo speed sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Turbo Speed Sensor Ground Wire Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the turbo speed sensor and ECU connector J1. 3. Using a multimeter, measure resistance between terminal 2 in the turbo speed sensor and terminal B3 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❸ **NO:** Open in the turbo speed ground wire. Repair and retest. – – –1/1

❸ **Turbo Speed Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor and ECU connector J1 still disconnected. 3. Using a multimeter, measure resistance between terminal 1 in the turbo speed sensor and terminal B4 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in the turbo speed input wire. Repair and retest. – – –1/1

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❹ **Turbo Speed Sensor Continuity Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor connector still disconnected. 3. Using a multimeter, measure resistance between both terminals in the turbo speed sensor. Is the resistance between 800 and 900 ohms?	**YES:** Faulty ECU **NO:** Faulty turbo speed sensor. Replace and retest. – – –1/1

000103.06 — Turbo Speed Sensor Current High

The ECU detects high current on the turbo speed sensor wiring.

RG41221,0000216 –19–25APR06–1/1

000103.06 — Turbo Speed Sensor Current High Diagnostic Procedure

NOTE: If other turbo related DTCs accompany 000103.06, diagnose 000103.06 first.

Related Information:
The ECU detects high current on the turbo speed sensor wiring through the Harness Diagnostic Mode Test on the ECU diagnostic software.

Alarm Level:
Warning

Control Unit Response:
If this codes, the ECU will control the engine to run under normal operation.

Additional References:
For further turbo speed sensor information, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the turbo speed sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Turbo Speed Sensor Ground Wire Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal B3 in ECU connector J1 and all terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❸ **NO:** Short in turbo speed sensor ground circuit to wire(s) that measured less than 2000 ohms. – – –1/1

❸ **Turbo Speed Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal B4 in ECU connector J1 and all terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in turbo speed sensor input circuit to wire(s) that measured less than 2000 ohms. – – –1/1

❹ **Turbo Speed Sensor Continuity Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect Turbo speed sensor connector. 3. Using a multimeter, measure resistance between both terminals in the turbo speed sensor. Is the resistance between 800 and 900 ohms?	**YES:** Faulty ECU **NO:** Faulty turbo speed sensor. Replace and retest. – – –1/1

000103.08 — Turbo Speed Invalid

The ECU detects a turbo speed that is not possible under the current operating conditions.

RG41221,0000217 –19–19SEP05–1/1

000103.08 — Turbo Speed Invalid Diagnostic Procedure

NOTE: If DTC 000103.08 is accompanied with DTC 000103.05 or 000103.06, follow that diagnostic procedure first.

Related Information:
The ECU detects a turbo speed that is in range, but invalid under the current operating conditions.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further turbo speed sensor information, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the turbo speed sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load. 6. Read DTCs. Did 000103.08 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Turbo Speed Sensor Ground Wire Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the turbo speed sensor and all three ECU connectors. 3. Using a multimeter, measure resistance between terminal 2 in the turbo speed sensor and all terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in turbo speed sensor ground circuit to wire(s) that measured less than 2000 ohms. – – –1/1

❹ **Turbo Speed Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor and all three ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal 1 in the turbo speed sensor and all terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❺ **NO:** Short in turbo speed sensor input circuit to wire(s) that measured less than 2000 ohms. – – –1/1

❺ **Turbo Speed Sensor Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the turbo speed sensor. See REMOVE AND INSTALL TURBO SPEED SENSOR in Section 02, Group 110 earlier in this manual. 3. Inspect the tip of the sensor for damage and debris. Is the sensor free from debris and damage?	**YES:** GO TO ❻ **NO:** GO TO ❽ – – –1/1
❻ **Turbo Speed Sensor Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor still removed from the turbo. 3. Hold the sensor's magnetic tip against the engine block. Does the sensor stick to the engine block?	**YES:** GO TO ❼ **NO:** Faulty turbo speed sensor. Replace and retest. – – –1/1
❼ **Turbo Speed Sensor Continuity Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor still removed from the turbo. 3. Using a multimeter, measure resistance between both terminals in the turbo speed sensor. Is the resistance between 800 and 900 ohms?	**YES:** GO TO ❽ **NO:** Faulty turbo speed sensor. Replace and retest. – – –1/1
❽ **Turbo Blade Damage Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Remove the compressor air inlet tube and check for damage to the blades. Is there damage to blades?	**YES:** Replace turbo and retest. **NO:** GO TO ❾ – – –1/1

⑨ **Excessive Compressor Shaft End Play Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Apply side load to the compressor shaft and check for excessive end play. Does the compressor wheel come in contact with housing or does the housing show signs of prior contact?	**YES:** Replace turbo and retest. **NO:** Faulty ECU. – – –1/1

000103.31 — Turbo Speed Missing

The ECU does not detect a signal coming from the turbo speed sensor.

RG41221,0000218 –19–11APR06–1/1

000103.31 — Turbo Speed Missing Diagnostic Procedure

NOTE: If DTC 000103.31 is accompanied with DTC 000103.05 or 000103.06, follow that diagnostic procedure first.

Related Information:
The ECU does not detect a signal coming from the turbo speed sensor.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further turbo speed sensor information, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the turbo speed sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load. 6. Read DTCs. Did 000103.31 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Turbo Speed Sensor Ground Wire Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the turbo speed sensor and ECU connector J1 connectors. 3. Using a multimeter, measure resistance between terminal 2 in the turbo speed sensor and terminal B3 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open or short in the turbo speed ground wire. Repair and retest. – – –1/1

❹ **Turbo Speed Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo speed sensor and ECU connector J1 still disconnected. 3. Using a multimeter, measure resistance between terminal 1 in the turbo speed sensor and terminal B4 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open or short in the turbo speed input wire. Repair and retest. – – –1/1

❺ **Turbo Speed Sensor Continuity Test**	*NOTE: For wiring and theory of operation, see TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the turbo speed sensor. See REMOVE AND INSTALL TURBOCHARGER SPEED SENSOR in Section 02, Group 110 earlier in this manual. 3. Using a multimeter, measure resistance between both terminals in the turbo speed sensor. Is the resistance between 800 and 900 ohms?	**YES:** Faulty ECU **NO:** Faulty turbo speed sensor. Replace and retest. – – –1/1

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000105.00 — Exhaust Gas Recirculation (EGR) Mixed Air Temperature Extremely High

The ECU senses an exhaust gas recirculation mixed air temperature above specification.

RG41221,0000219 –19–03APR05–1/1

000105.00 — Exhaust Gas Recirculation (EGR) Mixed Air Temperature Extremely High Diagnostic Procedure

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Related Information:
The ECU senses an EGR mixed air temperature of 123° C (253° F) on OEM engines.

Alarm Level:
STOP

Control Unit Response:
The ECU will derate 20% per minute until the engine is running at 40% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR mixed air temperature sensor information, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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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 EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR mixed air temperature sensor connector looking for dirty, damaged, or poorly positioned terminals. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **EGR Mixed Air Temperature Sensor and Circuit Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Check the following items that can cause high EGR mixed air temperature: • 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 EGR mixed air temperature determined?	**YES:** Repair problem and retest. **NO:** GO TO ❸ – – –1/1
❸ **EGR Mixed Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR mixed air temperature sensor connector and ECU connector #J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR mixed air temperature sensor connector and terminal F1 in ECU connector #J3 on the engine harness. • Terminal B in the EGR mixed air temperature sensor connector and terminal B2 in ECU connector #J3 on the engine harness. All measurements 5 ohms or less?	**YES:** Faulty EGR mixed air temperature sensor. **NO:** GO TO ❹ – – –1/1
❹ **EGR Mixed Air Temperature Sensor Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 3 (terminal B2 or F1 in ECU connector #3) and all other terminals in all three ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measures less than 2000 ohms. **NO:** Open in wire that was more than 5 ohms in step 3 – – –1/1

000105.03 — Exhaust Gas Recirculation (EGR) Mixed Air Temperature Input Voltage High

The exhaust gas recirculation mixed air temperature input voltage exceeds the sensor's high voltage specification.

RG41221,000021A –19–03APR05–1/1

000105.03 — Exhaust Gas Recirculation (EGR) Mixed Air Temperature Input Voltage High Diagnostic Procedure

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Related Information:
The EGR mixed air temperature input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a temperature that is lower than what is physically possible for EGR mixed air temperature.

For OEM applications, the high exhaust gas recirculation gas mixed air temperature input voltage specification is 4.95 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default EGR mixed air temperature of 60° C (140° F)

ECU's high EGR mixed air temperature engine protection feature disabled.

Additional References:
For further EGR mixed air temperature sensor information, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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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 EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR mixed air temperature sensor connector looking for dirty, damaged, or poorly positioned terminals. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine OFF 6. Read DTCs using DST or SERVICE ADVISOR™. Did 000105.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **EGR Fresh Air Temperature Sensor and Connector Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect EGR mixed air temperature sensor connector 3. Install a jumper wire between both terminals in the EGR gas mixed air temperature sensor connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read exhaust gas recirculation mixed air temperature input voltage Is the voltage above 0.15 volts?	**YES:** GO TO ❹ **NO:** Faulty EGR mixed air temperature sensor connector OR Faulty EGR mixed air temperature sensor – – –1/1

❹ **EGR Fresh Air Temperature Sensor Open Ground Circuit Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove jumper wire between both terminals. 3. Install a jumper wire between the EGR mixed air temperature input terminal (terminal A) of the sensor connector on the engine harness and a good chassis ground. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic connector, read exhaust gas recirculation mixed air temperature input voltage Is the voltage 0.15 volts or below?	**YES:** Open in EGR mixed air temperature sensor ground circuit OR Faulty ECU connection OR Faulty ECU **NO:** Open in EGR mixed air temperature sensor input circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

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000105.04 — Exhaust Gas Recirculation (EGR) Mixed Air Temperature Input Voltage Low

The exhaust gas recirculation mixed air temperature input voltage drops below the sensor's low voltage specification.

RG41221,000021B –19–03APR05–1/1

000105.04 — Exhaust Gas Recirculation (EGR) Mixed Air Temperature Input Voltage Low Diagnostic Procedure

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Related Information:
The EGR mixed air temperature input voltage drops below the sensor's low voltage specification. The voltage corresponds to a temperature that is higher than what is physically possible for EGR mixed air temperature.

For OEM applications, the low EGR mixed air temperature input voltage specification is 0.15 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default EGR mixed air temperature of 60° C (140° F)

ECU's high EGR mixed air temperature engine protection feature disabled.

Additional References:
For further EGR mixed air temperature sensor information, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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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 EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR mixed air temperature sensor connector looking for dirty, damaged, or poorly positioned terminals. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine OFF 6. Read DTCs using DST or SERVICE ADVISOR™. Did 000105.04 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **EGR Fresh Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR mixed air temperature sensor connector. 3. Ignition ON, engine OFF 4. Using the ECU diagnostic software, read exhaust gas recirculation mixed air temperature input voltage. Is the voltage below 4.95 volts?	**YES:** Short to ground in EGR mixed air temperature sensor input circuit. OR Faulty ECU connector OR Faulty ECU **NO:** Faulty EGR mixed air temperature sensor connector. OR Faulty EGR mixed air temperature sensor.

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000105.15 — Exhaust Gas Recirculation (EGR) Mixed Air Temperature High Least Severe

The ECU senses a exhaust gas recirculation mixed air temperature above specification.

RG41221,000021C –19–03APR05–1/1

000105.15 — Exhaust Gas Recirculation (EGR) Mixed Air Temperature High Least Severe Diagnostic Procedure

Related Information:
The ECU senses an EGR mixed air temperature of 120° C (248° F) on OEM engines.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further EGR mixed air temperature sensor information, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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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 EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR mixed air temperature sensor connector looking for dirty, damaged, or poorly positioned terminals. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **EGR Mixed Air Temperature Sensor and Circuit Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Check the following items that can cause high EGR mixed air temperature: • 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 exhaust EGR mixed air temperature determined?	**YES:** Repair problem and retest. **NO:** GO TO ❸ – – –1/1

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❸ **EGR Mixed Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR mixed air temperature sensor connector and ECU connector #J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR mixed air temperature sensor connector and terminal F1 in ECU connector #J3 on the engine harness. • Terminal B in the EGR mixed air temperature sensor connector and terminal B2 in ECU connector #J3 on the engine harness. All measurements 5 ohms or less?	**YES:** Faulty EGR mixed air temperature sensor. **NO:** GO TO ❹ – – –1/1

❹ **EGR Mixed Air Temperature Sensor Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 3 (terminal B2 or F1 in ECU connector #3) and all other terminals in all three ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measures less than 2000 ohms. **NO:** Open in wire that was more than 5 ohms in step 3 – – –1/1

000105.16 — Exhaust Gas Recirculation (EGR) Mixed Air Temperature Moderately High

The ECU senses a exhaust gas recirculation mixed air temperature above specification.

RG41221,000021D –19–03APR05–1/1

000105.16 — Exhaust Gas Recirculation (EGR) Mixed Air Temperature Moderately High Diagnostic Procedure

Related Information:
The ECU senses an EGR mixed air temperature of 121° C (250° F) on OEM engines.

Alarm Level:
STOP

Control Unit Response:
The ECU will derate 5% per minute until the engine is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR mixed air temperature sensor information, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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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 EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR mixed air temperature sensor connector looking for dirty, damaged, or poorly positioned terminals. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **EGR Mixed Air Temperature Sensor and Circuit Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Check the following items that can cause EGR mixed air temperature: • 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 EGR mixed air temperature determined?	**YES:** Repair problem and retest. **NO:** GO TO ❸ – – –1/1

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❸ **EGR Mixed Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR mixed air temperature sensor connector and ECU connector #J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR mixed air temperature sensor connector and terminal F1 in ECU connector #J3 on the engine harness. • Terminal B in the EGR mixed air temperature sensor connector and terminal B2 in ECU connector #J3 on the engine harness. All measurements 5 ohms or less?	**YES:** Faulty EGR mixed air temperature sensor. **NO:** GO TO ❹ – – –1/1

❹ **EGR Mixed Air Temperature Sensor Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 3 (terminal B2 or F1 in ECU connector #3) and all other terminals in all three ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measures less than 2000 ohms. **NO:** Open in wire that was more than 5 ohms in step 3 – – –1/1

000107.00 — Air Filter Restriction High

This code will set if the air pressure switch changes state due to excessively low air pressure (high vacuum).

WL30140,0000028 –19–12MAY06–1/1

000107.00 — Air Filter Restriction High Diagnostic Procedure

Related Information:
The air pressure switch is located on the clean side of the air filter. Depending on application, the switch and ECU will be set up for either normally closed or normally open

Alarm Level:
Warning

Control Unit Response:
Refer to Derate Specifications for the application.

Engine performance will degrade according to the degree of restriction.

Additional References:

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❶ **Check Air Filter and Ducting**	Check air filter and all air intake ducting for restrictions. Was air filter dirty or were any restrictions found?	**YES:** Repair and retest. **NO:** GO TO ❷

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❷ **Check for Intake Restrictions**	Inspect air intake system on suction side of turbo for any source of blockage. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS in Section 4 of 9.0L Diesel Engines Base Engine Manual (CTM 400). Were any restrictions found?	**YES:** Repair and retest. **NO:** GO TO ❸

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❸ **Switch Wiring Test**	1. Disconnect the air filter pressure switch. 2. Disconnect the harness from the ECU. 3. Check the switch circuit for opens, grounds, and poor connections. Were any wiring problems found?	**YES:** Repair and retest. **NO:** Switch may be out of calibration. Replace switch and retest. – – –1/1

000108.02 — Barometric Air Pressure Invalid

The ECU receives an invalid pressure from the barometric air pressure sensor.

RG41221,000021E –19–03MAR06–1/1

000108.02 — Barometric Air Pressure Invalid Diagnostic Procedure

Related Information:
The barometric air pressure sensor is an internal ECU sensor.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default barometric air pressure to run the engine.

Additional References:
For further barometric air pressure sensor information, see BAROMETRIC AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000108.02 error code active?	**YES:** GO TO ❷ **NO:** Abnormal condition set code. Return to service and monitor further.

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Replace ECU. **NO:** If no other active or stored codes exists, clear codes. Return to service and monitor further. – – –1/1

000110.00 — Engine Coolant Temperature Extremely High

The ECU senses a coolant temperature above the 3rd threshold specification.

RG41221,0000220 –19–03MAR06–1/1

000110.00 — Engine Coolant Temperature Extremely High Diagnostic Procedure

Related Information:
The ECU senses an engine coolant temperature of 113° C (235° F) on OEM engines.

Alarm Level:
STOP

Control Unit Response:

NOTE: Using the ECU's trimmable features, the customer has the option to choose an engine shutdown option. If the shutdown feature was not selected, a standard derate will be activated. The time that the shutdown condition needs to be active before the engine shutdown occurs is adjustable through trim options. Available choices are 30 seconds and immediate.

The ECU will derate 20% per minute until the engine is running at 40% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

The ECU will shut down the engine in either 0 or 30 seconds after the code sets on OEM application engines with the shutdown feature programmed in the ECU.

On non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further engine coolant temperature sensor information, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Troubleshooting:

GO TO 000110.15 Engine Coolant Temperature Least Severe diagnostic procedure. The procedure for troubleshooting code 110.00 is the same as the other two "engine coolant temperature high" procedures (110.15 and 110.16).

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000110.00 error code active?	**YES:** Further troubleshooting procedures are being developed. **NO:** GO TO ❷ – – –1/1

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** Further troubleshooting procedures are being developed. – – –1/1

000110.03 — Engine Coolant Temperature Input Voltage High

The engine coolant temperature input voltage exceeds the sensor's high voltage specification. Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open circuit. Less probable is a short from the 5V input wire to a power source.

RG41221,0000221 –19–26SEP05–1/1

000110.03 — Engine Coolant Temperature Input Voltage High Diagnostic Procedure

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Related Information:
The engine coolant temperature input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a temperature that is lower than what is physically possible for engine coolant temperature.

For OEM applications, the high engine coolant temperature input voltage specification is 4.95 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default engine coolant temperature of 90° C (194° F)

When in start mode, the ECU will default the engine coolant temperature to -30° C (-22° F).

ECU's high engine coolant temperature engine protection feature disabled.

Additional References:
For further engine coolant temperature sensor information, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the engine coolant temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000110.03 reoccur?	**YES:** GO TO ❸ **NO:** 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 Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor terminals. Is resistance less than 100K ohms?	**YES:** Sensor not open. GO TO ❹ **NO:** Excessively high resistance in the sensor. Replace and retest. – – –1/1

❹ **Input Circuit Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON. 2. Temperature sensor still disconnected. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground. Is voltage above 4.5-5.5V?	**YES:** Input OK. Check ground circuit. GO TO ❼ **NO:** If voltage is greater than 5.5V, sensor 5V input wire shorted to a higher voltage source. GO TO ❺ **NO:** If voltage is less than 4.5V, open or high resistance in input wiring. GO TO ❻ – – –1/1
❺ **Harness Shorted to Higher Voltage Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect 30-pin connectors from ECU. 3. Ignition ON. 4. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground Is voltage zero?	**YES:** Harness wiring OK. Remove and test ECU. GO TO❾ **NO:** Voltage is above 5.5V: harness or connected wiring shorted to a higher voltage source. Repair and retest. – – –1/1
❻ **Harness Input Wiring Open Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Sensor still disconnected. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's input wiring in the harness. Is resistance near zero ohms?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❾ **NO:** Open or high resistance in input wiring. Repair and retest. – – –1/1
❼ **Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Use a multimeter and JT07328 Connector Adapter Test Kit to check resistance from the return terminal in the sensor connector to a good chassis ground. Is resistance near zero ohms?	**YES:** Ground circuit OK. Reconnect and retest. **NO:** Voltage is significantly above zero ohms: Open or high resistance in ground circuit. GO TO ❽ – – –1/1

8 Harness Ground Wiring Test	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's ground wiring in the harness. Is resistance near zero ohms?	**YES:** Wiring OK. Remove and test ECU. GO TO 10 **NO:** Resistance is significantly above zero ohms: Open or high resistance in ground wiring. Repair and retest. – – –1/1

9 ECU Input Circuit Test	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input and ground pins the ECU. Is resistance 1.5K to 3.5K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

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10 ECU Ground Circuit Test	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter and JT07328 Connector Adapter Test Kit, measure resistance between the sensor circuit's ground pin and pin J2-L2 or J2-L3 in the ECU. Is resistance near zero ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Resistance is 2 ohms or more: Faulty ECU. Replace and retest. – – –1/1

000110.04 — Engine Coolant Temperature Input Voltage Low

The engine coolant temperature input voltage drops below the sensor's low voltage specification. Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault on this circuit is low resistance to ground (grounded circuit).

RG41221,0000222 –19–26SEP05–1/1

000110.04 — Engine Coolant Temperature Input Voltage Low Diagnostic Procedure

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Related Information:
The engine coolant temperature input voltage drops below the sensor's low voltage specification. The voltage corresponds to a temperature that is higher than what is physically possible for engine coolant temperature.

For OEM applications, the high engine coolant temperature input voltage specification is 0.15 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default engine coolant temperature of 90° C (194° F).

When in start mode, the ECU will default the engine coolant temperature to -30° C (-22° F).

ECU's high engine coolant temperature engine protection feature disabled.

Additional References:
For further engine coolant temperature sensor information, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the engine coolant temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000110.04 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Sensor Shorted Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor pins. Is resistance more than 100 ohms?	**YES:** Sensor not shorted. GO TO ❹ **NO:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

❹ **Sensor Grounded Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between each sensor pin and a good chassis ground. Is resistance 1M ohms or more?	**YES:** Sensor OK. Check wiring. GO TO ❺ **NO:** Low resistance to ground. Replace sensor and retest. – – –1/1
❺ **Grounded Input Circuit Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground. Is resistance 1000 ohms or more?	**YES:** Input circuit OK. Reconnect and retest. **NO:** GO TO ❻ – – –1/1
❻ **Harness Input Wiring Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector (J3) from the ECU. Inspect connector and ECU pins. 3. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground. Is resistance 1M ohms or more?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❼ **NO:** Input wire shorted to ground. Repair and retest. – – –1/1
❼ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input (J3-D3) and ground pin (J3-H3) in the ECU. Is resistance 1.5K to 3.5K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

000110.15 — Engine Coolant Temperature High Least Severe

The ECU senses a engine coolant temperature above the first threshold specification.

RG41221,0000223 –19–05MAY06–1/1

000110.15 — Engine Coolant Temperature High Least Severe Diagnostic Procedure

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Related Information:
The ECU senses a engine coolant temperature of 110° C (230° F) on OEM engines.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine normally.

Additional References:
For further engine coolant temperature sensor information, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

If it is obvious that the coolant is overheating, see C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04 of the 9.0L Diesel Engines Base Engine manual (CTM 400).

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the engine coolant temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Engine Coolant Temperature Sensor and Circuit Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Under the conditions where DTC 000110.15 occurs, using a temperature gauge, verify that engine coolant temperature is above extremely high specification. *NOTE: On OEM applications, the most severe ECT specification is 107°C (224°F). For ECT specification on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.* Is the engine coolant temperature above the high limit specification?	**YES:** Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL in Section 04 of the 9.0L Diesel Engines Base Engine manual (CTM 400). **NO:** GO TO ❸ – – –1/1

❸ **Engine Coolant Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the engine coolant temperature sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between the following: • Terminal 1 in the engine coolant temperature sensor connector and terminal D3 in ECU connector J3 on the engine harness. • Terminal 2 in the engine coolant temperature sensor connector and terminal H3 in ECU connector J3 on the engine harness. All measurements 5 ohms or less?	**YES:** Faulty engine coolant temperature sensor. **NO:** GO TO ❹ – – –1/1

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❹ **Engine Coolant Air Temperature Sensor Wiring Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 3 (terminal D3 or H3 in ECU connector 3) and all other terminals in all three ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measures less than 2000 ohms. **NO:** Open in wire that was more than 5 ohms in step 3 – – –1/1

000110.16 — Engine Coolant Temperature Moderately High

The ECU senses a engine coolant temperature above the 2nd threshold specification.

RG41221,0000224 –19–03MAR06–1/1

000110.16 — Engine Coolant Temperature Moderately High Diagnostic Procedure

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Related Information:
The ECU senses a engine coolant temperature of 111° C (232° F) on OEM engines.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate 5% per minute until the engine is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further engine coolant temperature sensor information, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Troubleshooting:

GO TO 000110.15 Engine Coolant Temperature Least Severe diagnostic procedure. The procedure for troubleshooting code 110.16 is the same as the other two “engine coolant temperature high” procedures (110.00 and 110.15).

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000110.16 error code active?	**YES:** Further troubleshooting procedures are being developed. **NO:** GO TO ❷ – – –1/1

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** Further troubleshooting procedures are being developed. – – –1/1

000110.17 — Engine Coolant Temperature Low Least Severe

The ECU senses a engine coolant temperature is not rising to normal operating temperatures.

RG41221,00002C7 –19–19SEP05–1/1

000110.15 — Engine Coolant Temperature Low Least Severe Diagnostic Procedure

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Related Information:
The ECU senses a engine coolant temperature has not increased when the engine should be running at normal operating conditions.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further engine coolant temperature sensor information, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the engine coolant temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Thermostat Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Test the thermostat for proper function. See INSPECT THERMOSTAT AND TEST OPENING TEMPERATURE in Section 04, Group 150 in CTM86. Is the thermostat functioning properly?	**YES:** GO TO ❸ **NO:** Replace the thermostat. – – –1/1

❸ **Engine Coolant Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the engine coolant temperature sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between the following: • Terminal 1 in the engine coolant temperature sensor connector and terminal D3 in ECU connector J3 on the engine harness. • Terminal 2 in the engine coolant temperature sensor connector and terminal H3 in ECU connector J3 on the engine harness. All measurements 5 ohms or less?	**YES:** Faulty engine coolant temperature sensor. OR Faulty ECU **NO:** GO TO ❹ – – –1/1

❹ **Engine Coolant Air Temperature Sensor Wiring Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 3 (terminal D3 or H3 in ECU connector 3) and all other terminals in all three ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measures less than 2000 ohms. **NO:** Open in wire that was more than 5 ohms in step 3 – – –1/1

000111.01 — Engine Coolant Level Low

The ECU detects a low engine coolant level.

RG41221,0000225 –19–19SEP05–1/1

000111.01 — Engine Coolant Level Low Diagnostic Procedure

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NOTE: OEM engines are programmed using trimmable features. The customer had the option to install a "Normally Open" or a "Normally Closed" engine coolant level switch. The ECU's software must correlate the type of switch being used to properly protect the engine. For more information on trimmable features, see JOHN DEERE TRIMMABLE OPTIONS earlier in this Group.

Related Information:
The loss of coolant switch is not submerged into coolant causing the ECU to sense continuity to ground on the loss of coolant temperature input circuit.

The engine coolant level switch is a trimmable option. Depending on the engine, if this option is selected, the engine can support both normally open and normally closed switches. This is defined during ECU programming.

Alarm Level:
STOP

Control Unit Response:
The ECU will derate 50% per minute until the engine is running at 50% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further engine coolant temperature switch information, see ENGINE COOLANT LEVEL SWITCH in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Coolant Level Check**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT LEVEL SWITCH in Section 03, Group 140 earlier in this manual.* **CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.** • Check the coolant level. Is the coolant level at proper level?	**YES:** GO TO ❷ **NO:** Determine cause of low coolant level, repair problem, refill coolant, and retest. – – –1/1

❷ **Trim Option Check**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT LEVEL SWITCH in Section 03, Group 140 earlier in this manual.* The engine coolant level switch is a trimmable option. Depending on the engine, if this option is selected, the engine can support both normally open and normally closed switches. This is defined during ECU programming. Does this engine have a coolant level switch installed?	**YES:** GO TO ❸ **NO:** Check ECU program. Make sure that the option for Engine Coolant Level Switch is NOT selected from the trim page. If it is, deselect the option. – – –1/1

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❸ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ENGINE COOLANT LEVEL SWITCH in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the engine coolant level switch connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❹ – – –1/1

❹ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT LEVEL SWITCH in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000111.01 reoccur?	**YES:** GO TO ❺ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❺ **Loss of Coolant Temperature Switch Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT LEVEL SWITCH in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect loss of coolant switch connector. 3. Ignition ON, engine OFF 4. Using the ECU diagnostic software, read DTCs. Did 000111.01 reoccur?	**YES:** Short to ground in loss of coolant temperature switch input circuit. **NO:** GO TO ❻ – – –1/1
❻ **Loss of Coolant Temperature Switch (Normally Closed) Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT LEVEL SWITCH in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Loss of coolant switch still disconnected. 3. Install a jumper wire between terminal A in the loss of coolant switch connector on the engine harness and a good chassis ground. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read DTCs. Did 000111.01 reoccur?	**YES:** Faulty coolant level switch (normally closed) **NO:** GO TO ❼ – – –1/1

❼ **Loss of Coolant Temperature Switch (Normally Open) Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT LEVEL SWITCH in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Loss of coolant switch still disconnected. 3. Disconnect ECU connector J2. 4. Using a multimeter, measure resistance between terminal A in the coolant level switch connector and terminal G4 in the ECU connector 2 on the engine harness. Is the resistance 5 ohms or less?	**YES:** Faulty coolant level switch (normally open) **NO:** Open in loss of coolant temperature switch input circuit. OR Faulty ECU – – –1/1

000157.03 — Fuel Rail Pressure Input Voltage High

The rail pressure input voltage exceeds the sensor's high voltage specification.

RG41221,0000226 –19–19SEP05–1/1

000157.03 — Fuel Rail Pressure Input Voltage High Diagnostic Procedure

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Related Information:
The fuel rail pressure input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a pressure that is higher than what is physically possible for fuel rail pressure.

For OEM applications, the high fuel rail pressure input voltage specification is 4.99 volts.

Alarm Level:
STOP

Control Unit Response:
The ECU will derate 50% per minute until the engine is running at 50% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

The ECU will command the high pressure fuel pump to a default pressure of 200 MPa (2000 bar) (29,000 psi).

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further fuel rail pressure sensor information, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the fuel rail pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000157.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Fuel Rail Pressure Ground Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect fuel rail pressure sensor connector. 3. Ignition ON, engine OFF 4. Probe the fuel rail pressure sensor connector ground terminal (terminal 1) on the engine harness with a test light connected to battery voltage. Does the light illuminate?	**YES:** GO TO ❹ **NO:** Open in fuel rail pressure sensor ground circuit. OR Faulty ECU connection OR Faulty ECU – – –1/1

❹ **Fuel Rail Pressure 5V Supply Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Fuel rail pressure sensor connector still disconnected. 3. Disconnect ECU connector J3. 4. Using a multimeter, measure resistance between terminal 3 in the fuel rail pressure sensor connector and terminal C1 in the ECU connector J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Short in fuel rail pressure sensor input circuit to 5V supply. – – –1/1

❺ **Fuel Rail Pressure Input Circuit Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Fuel rail pressure sensor connector and ECU connector J3 still disconnected. 3. Using a multimeter, measure resistance between terminal 2 in the fuel rail pressure sensor connector and terminal G1 in the ECU connector J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** Faulty fuel rail pressure sensor. **NO:** Open in fuel rail pressure sensor 5V supply circuit. OR Faulty ECU connection OR Faulty ECU – – –1/1

000157.04 — Fuel Rail Pressure Input Voltage Low

The rail pressure input voltage drops below the sensor's low voltage specification.

RG41221,0000227 –19–19SEP05–1/1

000157.04 — Fuel Rail Pressure Input Voltage Low Diagnostic Procedure

Related Information:
The fuel rail pressure input voltage drops below the sensor's low voltage specification. The voltage corresponds to a pressure that is lower than what is physically possible for fuel rail pressure.

For OEM applications, the low fuel rail pressure input voltage specification is 0.1 volts.

Alarm Level:
STOP

Control Unit Response:
The ECU will derate 50% per minute until the engine is running at 50% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

The ECU will command the high pressure fuel pump to a default pressure of 200 MPa (2000 bar) (29,000 psi)

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further fuel rail pressure sensor information, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the fuel rail pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000157.04 reoccur?	**YES:** GO TO ❸ **NO:** 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 Rail Pressure Signal Shorted Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the fuel rail pressure sensor connector. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between terminal 2 in the fuel rail pressure sensor connector on the engine harness and a good chassis ground. Is the voltage 4.9 volts or above?	**YES:** GO TO ❹ **NO:** Open in fuel rail pressure sensor 5V supply circuit. OR Short to ground in fuel rail pressure sensor 5V supply circuit. OR Faulty ECU connector OR Faulty ECU – – –1/1

❹ **Fuel Rail Pressure Input Circuit Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Fuel rail pressure sensor connector still disconnected. 3. Using a multimeter, measure resistance between terminals 1 and 3 in the fuel rail pressure sensor connector on the engine harness. Is the resistance 5 ohms or less?	**YES:** Short to ground in fuel rail pressure input wire. Faulty ECU connector OR Faulty ECU **NO:** Faulty fuel rail pressure sensor connector. OR Faulty fuel rail pressure sensor. – – –1/1

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000157.10 — Fuel Rail Pressure Loss Detected

The ECU detects a sudden decrease in fuel pressure while the engine is not injecting or pumping.

RG41221,0000228 –19–19SEP05–1/1

000157.10 — Fuel Rail Pressure Loss Detected Diagnostic Procedure

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Related Information:
The ECU detects a sudden decrease in fuel rail pressure while engine is not injecting or pumping fuel. This usually occurs when the engine is shifted from high idle to low idle.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine may not start due to lack of fuel pressure.

The engine may start and run normal when no load is applied to engine.

Additional References:
For further fuel rail pressure sensor information, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the fuel rail pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Run engine at high idle under load. Quickly remove load and move the throttle position to low idle. 7. Repeat step 6 several times. 8. Read DTCs. Did 000157.10 reoccur?	**YES:** GO TO ❸ **NO:** Try to recreate problem. If problem cannot be recreated, 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 Lines/Fittings Leakage Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine running 2. Inspect all fuel lines and fittings for leakage. Is there any fuel leakage present?	**YES:** Tighten loose fitting to proper specification or replace faulty fuel line and retest. **NO:** GO TO ❹ – – –1/1

❹ **Pressure Limiter Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* **CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.** **If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.** **CAUTION: Fuel in the high pressure common rail is under extremely high pressure. Do NOT start this procedure until the engine has been turned OFF for at least 5 minutes.** 1. Ignition OFF 2. Let engine sit 5 minutes with cranking or running to relieve fuel pressure. 3. Disconnect fuel line from pressure limiter valve on high pressure common rail. 4. Ignition ON, engine running 5. Observe the pressure limiter valve for fuel leakage. Is fuel present at the pressure limiter valve?	**YES:** Faulty fuel pressure limiter valve. Replace pressure limiter valve. See REMOVE AND INSTALL PRESSURE LIMITER in Group 090 earlier in this manual. **NO:** GO TO ❺ – – –1/1
❺ **Faulty Electronic Injector Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect leak-off line at each electronic injector. 3. Ignition ON, engine running 4. Using the ECU diagnostic software, perform the Cylinder Cutout Test. For instructions, see ENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST in Section 04, Group 160 of this manual. Do all cylinders show a slight misfire?	**YES:** Faulty ECU **NO:** Faulty electronic injector(s) on cylinder(s) that do NOT show misfire. – – –1/1

000157.17 — Fuel Rail Pressure Not Developed

The ECU does not detect 10 MPa (100 bar) (1450 psi) of fuel rail pressure after cranking the engine for approximately 3 seconds.

RG41221,0000229 –19–19SEP05–1/1

000157.17 — Fuel Rail Pressure Not Developed Diagnostic Procedure

NOTE: If DTC 000157.17 is accompanied with DTC 001347.03 or 001347.05, follow one of these diagnostic procedures first.

Related Information:
The ECU does not detect 10 MPa (100 bar) (1450 psi) of fuel rail pressure after cranking the engine for approximately 3 seconds.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will not start.

Additional References:
For further fuel rail pressure sensor information, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Preliminary Check**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Has the fuel system been recently opened prior to this code setting?	**YES:** Bleed the fuel system. See BLEED THE FUEL SYSTEM in Section 04, Group 150 earlier in this manual. **NO:** GO TO ❷

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❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the fuel rail pressure sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1

❸ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking for at least 10 seconds. 6. Read DTCs. Did 000157.17 reoccur?	**YES:** GO TO ❹ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❹ **Fuel Lines/Fittings Leaking Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine cranking. 2. Inspect all fuel lines and fittings for leakage. Is fuel leakage present?	**YES:** Tighten loose fitting to proper specification and retest. **NO:** GO TO ❺ – – –1/1

❺ **Secondary (Final) Fuel Filter Pressure Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine cranking 2. Using the diagnostic software, read fuel transfer pump pressure - actual. Is the fuel pressure 30 kPa (0.3 bar) (4.4 psi) or above?	**YES:** GO TO ❾ **NO:** GO TO ❻ – – –1/1

❻ **Faulty Secondary (Final) Fuel Filter Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Replace the secondary fuel filter element. See REMOVE AND INSTALL SECONDARY FUEL FILTER in Section 02, Group 090 earlier in this manual. Does the engine start?	**YES:** Retest to verify problem has been repaired. **NO:** GO TO ❼ – – –1/1

❼ **Faulty Primary Filter Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Replace the primary filter element. See REMOVE AND INSTALL PRIMARY FUEL FILTER in Section 02, Group 090 earlier in this manual. 3. Ignition ON, engine cranking Does the engine start?	**YES:** Primary filter element was faulty. Problem fixed. **NO:** GO TO ❽ – – –1/1

❽ **Restricted Fuel Line Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* **CAUTION: Fuel lines may be under high pressure. Use extreme caution while opening fuel lines. Let the engine sit for several minutes after cranking or running prior to opening fuel lines.** **CAUTION: Escaping fluid under pressure can penetrate skin causing serious injury. Avoid the hazard be relieving pressure before disconnecting hydraulic or other high pressure lines. Tighten all connections before applying pressure. Search for leaks with a piece or cardboard. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately. Any fluids injected into the skin must be surgically removed within 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, USA.** 1. Ignition OFF for 5 minutes. 2. Disconnect the fuel lines between the fuel tank and the high pressure fuel pump. 3. Check fuel lines for restrictions. Are any fuel line(s) restricted?	**YES:** Clean or replace fuel line and retest. **NO:** Faulty fuel transfer pump. Replace and retest. – – –1/1

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❾ **Pressure Limiter Valve Test**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* **CAUTION: Fuel lines may be under high pressure. Use extreme caution while opening fuel lines. Let the engine sit for several minutes after cranking or running prior to opening fuel lines.** **CAUTION: Escaping fluid under pressure can penetrate skin causing serious injury. Avoid the hazard be relieving pressure before disconnecting hydraulic or other high pressure lines. Tighten all connections before applying pressure. Search for leaks with a piece or cardboard. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately. Any fluids injected into the skin must be surgically removed within 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, USA.** 1. Before removing pressure limiter, turn engine off and let sit for 5 minutes. This will relieve fuel pressure from the High Pressure Common Rail. 2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure limiter. 3. Disconnect the fuel leak-off line fitting at the pressure limiter valve. Do NOT remove the pressure limiter valve. 4. Run a clear line from the pressure limiter to a container that is suitable for diesel fuel. 5. Ignition ON, engine cranking. Is more than a minimal fuel flow present?	**YES:** Faulty pressure limiter valve. Replace pressure limiter and retest. See REMOVE AND INSTALL PRESSURE LIMITER in Section 02, Group 090 earlier in this manual. **NO:** Faulty high pressure fuel pump. Replace and retest. – – –1/1

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000158.17 — ECU Power Down Error

The ECU is unable to complete proper power down procedures after detecting a key off condition.

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000158.17 — ECU Power Down Error Diagnostic Procedure

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Related Information:
The ECU is unable to complete proper power down procedures after detecting a key off condition. The ECU detects voltage on the switched voltage input wire to the ECU when it expects to see 0 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the vehicle battery may be drained because ECU will not power down.

Additional References:
For further ECU information, see ENGINE CONTROL UNIT in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the battery connections looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000158.17 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Wiring and Ignition Switch Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect ECU connector J2. Inspect ECU pins and connector terminals. 3. Using a multimeter, measure voltage between terminal J2-B2 and a good chassis ground. 4. While observing multimeter still connected to terminal J2-B2, turn the ignition key through all of its positions EXCEPT “On.” Also observe multimeter while manipulating wiring at ignition switch. Is any measurement 3 volts or more?	**YES:** ECU power supply wire from ignition shorted to battery voltage OR Faulty ignition switch. **NO:** Faulty ECU – – –1/1

000174.00 — Fuel Temperature Extremely High

The ECU senses a fuel temperature above specification.

RG41221,000022B –19–19SEP05–1/1

000174.00 — Fuel Temperature Extremely High Diagnostic Procedure

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Related Information:
The ECU senses a fuel temperature of 100° C (212° F) on OEM engines.

Alarm Level:
STOP

Control Unit Response:

NOTE: OEM engines are programmed using trimmable features. The customer had the option to choose an engine shutdown feature. If this feature was programmed into the ECU , the ECU will shut the engine down if this code sets. If the shutdown feature was not selected, a standard derate will be activated.

The ECU will derate 5% per minute until the engine is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

The ECU will shutdown the engine 30 seconds after the code sets on OEM application engines with the shutdown feature programmed in the ECU.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further fuel temperature sensor information, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Preliminary Check**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Before using this diagnostic procedure: 1. Ensure that fuel level in tank is not extremely low. 2. If engine is equipped with fuel cooler, make sure air side of cooler is clean. Cause of extremely high fuel temperature found?	**YES:** Repair and retest. **NO:** GO TO ❷ – – –1/1
❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the fuel temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1
❸ **Fuel Supply Pressure Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Determine the fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE in Section 04, Group 150 earlier in this manual. Is the fuel pressure below specification?	**YES:** GO TO ❹ **NO:** Determine cause of low supply pressure. See F1 - FUEL SUPPLY SYSTEM CHECK diagnostic procedure in Section 04, Group 150 earlier in this manual. – – –1/1
❹ **Restricted Fuel Leak-off Line Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Check for restricted fuel leak-off line. See CHECK FOR RESTRICTED FUEL LEAK-OFF LINE in Section 04, Group 150 earlier in this manual. Is fuel restriction found?	**YES:** Determine cause of restriction, repair, and retest. **NO:** GO TO ❺ – – –1/1

❺ Overflow Valve Test	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the fuel line from the high pressure fuel pump overflow valve. 3. Connect one end of a clear line to the high pressure fuel pump overflow valve and direct the other end to a suitable container for diesel fuel. 4. Ignition ON, engine running Is fuel flow present from the overflow valve?	**YES:** GO TO ❻ **NO:** Faulty high pressure fuel pump overflow valve. – – –1/1

❻ Fuel Cooler Check	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the fuel cooler. 3. Inspect the fuel cooler for damage or restrictions. Is the fuel cooler free of damage or restrictions?	**YES:** Faulty high pressure fuel pump. Replace and retest. **NO:** Faulty fuel cooler. Replace and retest. – – –1/1

000174.03 — Fuel Temperature Input Voltage High

The fuel temperature input voltage exceeds the sensor's high voltage specification. Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open circuit. Less probable is a short from the 5V input wire to a power source.

RG41221,000022C –19–26SEP05–1/1

000174.03 — Fuel Temperature Input Voltage High Diagnostic Procedure

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Related Information:
The fuel temperature input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a temperature that is lower than what is physically possible for fuel temperature.

For OEM applications, the high fuel temperature input voltage specification is 4.9 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default fuel temperature of 40° C (104° F).

The ECU's high fuel temperature engine protection feature disabled.

Additional References:
For further fuel temperature sensor information, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the fuel temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000174.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Sensor Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor terminals. Is resistance less than 100K ohms?	**YES:** Sensor not open. GO TO ❹ **NO:** Excessively high resistance in the sensor. Replace and retest. – – –1/1

❹ **Input Circuit Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON. 2. Temperature sensor still disconnected. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground. Is voltage above 4.5-5.5V?	**YES:** Input OK. Check ground circuit. GO TO ❼ **NO:** If voltage is greater than 5.5V, sensor 5V input wire shorted to a higher voltage source. GO TO ❺ **NO:** If voltage is less than 4.5V, open or high resistance in input wiring. GO TO ❻ – – –1/1

❺ **Harness Shorted to Higher Voltage Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect 30-pin connectors from ECU. 3. Ignition ON. 4. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground Is voltage zero?	**YES:** Harness wiring OK. Remove and test ECU. GO TO❾ **NO:** Voltage is above 5.5V: harness or connected wiring shorted to a higher voltage source. Repair and retest. – – –1/1
❻ **Harness Input Wiring Open Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Sensor still disconnected. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's input wiring in the harness. Is resistance near zero ohms?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❾ **NO:** Open or high resistance in input wiring. Repair and retest. – – –1/1
❼ **Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Use a multimeter and JT07328 Connector Adapter Test Kit to check resistance from the return terminal in the sensor connector to a good chassis ground. Is resistance near zero ohms?	**YES:** Ground circuit OK. Reconnect and retest. **NO:** Voltage is significantly above zero ohms: Open or high resistance in ground circuit. GO TO ❽ – – –1/1
❽ **Harness Ground Wiring Test**	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's ground wiring in the harness. Is resistance near zero ohms?	**YES:** Wiring OK. Remove and test ECU. GO TO ❿ **NO:** Resistance is significantly above zero ohms: Open or high resistance in ground wiring. Repair and retest. – – –1/1

9 ECU Input Circuit Test	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input and ground pins the ECU. Is resistance is 1.5K to 3.5K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

10 ECU Ground Circuit Test	*NOTE: For wiring and theory of operation, see ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter and JT07328 Connector Adapter Test Kit, measure resistance between the sensor circuit's ground pin and pin J2-L2 or J2-L3 in the ECU. Is resistance near zero ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Resistance is 2 ohms or more: Faulty ECU. Replace and retest. – – –1/1

000174.04 — Fuel Temperature Input Voltage Low

The fuel temperature input voltage drops below the sensor's low voltage specification. Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault on this circuit is low resistance to ground (grounded circuit).

RG41221,000022D –19–26SEP05–1/1

000174.04 — Fuel Temperature Input Voltage Low Diagnostic Procedure

Related Information:
The fuel temperature input voltage drops below the sensor's low voltage specification. The voltage corresponds to a temperature that is higher than what is physically possible for fuel temperature.

For OEM applications, the low fuel temperature input voltage specification is 0.1 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default fuel temperature of 40° C (104° F).

The ECU's high fuel temperature engine protection feature disabled.

Additional References:
For further fuel temperature sensor information, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the fuel temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group). 3. Start the ECU diagnostic software. 4. Make note of any DTCs. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Section. 5. Clear DTCs. 6. Ignition ON, engine OFF. 7. Read DTCs. Did 000174.04 reoccur?	**YES:** GO TO ❸ **NO:** 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 Shorted Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor pins. Is resistance more than 100 ohms?	**YES:** Sensor not shorted. GO TO ❹ **NO:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

❹ **Sensor Grounded Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between each sensor pin and a good chassis ground. Is resistance 1M ohms or more?	**YES:** Sensor OK. Check wiring. GO TO ❺ **NO:** Low resistance to ground. Replace sensor and retest. – – –1/1

❺ **Grounded Input Circuit Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground. Is resistance 1000 ohms or more?	**YES:** Input circuit OK. Reconnect and retest. **NO:** GO TO ❻ – – –1/1

❻ **Harness Input Wiring Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector (J3) from the ECU. Inspect connector and ECU pins. 3. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground. Is resistance 1M ohms or more?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❼ **NO:** Input wire shorted to ground. Repair and retest. – – –1/1

❼ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input J3-B1) and ground pin (J3-H3) in the ECU. Is resistance 1.5K to 3.5K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

000174.16 — Fuel Temperature Moderately High

The ECU senses a fuel temperature above specification.

RG41221,000022E –19–19SEP05–1/1

000174.16 — Fuel Temperature Moderately High Diagnostic Procedure

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Related Information:
The ECU senses a fuel temperature of 95° C (203° F) on OEM engines.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further fuel temperature sensor information, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Preliminary Check**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Before using this diagnostic procedure: 1. Ensure that fuel level in tank is not extremely low. 2. If engine is equipped with fuel cooler, make sure cooler is clean. Cause of moderately high fuel temperature found?	**YES:** Repair and retest. **NO:** GO TO ❷

– – –1/1

❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the fuel temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1
❸ **Fuel Supply Pressure Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Determine the fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE in Section 04, Group 150 earlier in this manual. Is the fuel pressure below specification?	**YES:** GO TO ❹ **NO:** Determine cause of low supply pressure. See F1 - FUEL SUPPLY SYSTEM CHECK diagnostic procedure in Section 04, Group 150 earlier in this manual. – – –1/1
❹ **Restricted Fuel Leak-off Line Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Check for restricted fuel leak-off line. See CHECK FOR RESTRICTED FUEL LEAK-OFF LINE in Section 04, Group 150 earlier in this manual. Is fuel restriction found?	**YES:** Determine cause of restriction, repair, and retest. **NO:** GO TO ❺ – – –1/1
❺ **Overflow Valve Test**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the fuel line from the high pressure fuel pump overflow valve. 3. Connect one end of a clear line to the high pressure fuel pump overflow valve and direct the other end to a suitable container for diesel fuel. 4. Ignition ON, engine running Is fuel flow present from the overflow valve?	**YES:** GO TO ❻ **NO:** Faulty high pressure fuel pump overflow valve. – – –1/1

❻ **Fuel Cooler Check**	*NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the fuel cooler. 3. Inspect the fuel side of the fuel cooler for damage or restrictions. Is the fuel cooler free of damage or restrictions?	**YES:** Faulty high pressure fuel pump. Replace and retest. **NO:** Faulty fuel cooler. Replace and retest. – – –1/1

000189.00 — Engine Speed Derate

The ECU detects a condition that requires an engine speed derate.

RG41221,000022F –19–19SEP05–1/1

000189.00 — Engine Speed Derate

Related Information:
The engine speed derate diagnostic trouble code is information to the operator that the ECU has detected a condition such as high ECU temperature and is derating the engine by limiting the maximum amount of engine speed available to the engine. This code will only set as a result of another DTC setting.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will limit the amount of engine speed in an attempt to protect the engine.

Additional References:
For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Intermittent Fault Test**	1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Do any of the following DTCs set? • If DTC 001136.00 is active, see the following procedure later in this Group: – DTC 001136.00 ECU TEMPERATURE EXTREMELY HIGH diagnostic procedure	**YES:** Diagnose the DTC that set in addition to 000189.00. Once this problem is cleared, 000189.00 will also clear. **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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000190.00 — Engine Overspeed Extreme

The ECU detects that engine speed exceeds the maximum rpm.

RG41221,0000230 –19–03APR05–1/1

000190.00 — Engine Overspeed Extreme Diagnostic Procedure

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Related Information:
The ECU detects that engine speed exceeds the maximum rpm.

Alarm Level:
STOP

Control Unit Response:

If this code sets, the ECU stops fuel flow to the High Pressure Common Rail (HPCR) through the control of the Pump Control Valve (PCV) solenoid.

Additional References:
For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Applications Check**	For the engine to exceed the maximum allowed engine speed at this level, the application must be mechanically pushing the engine. Check the application for anything that could be pushing the engine to an overspeed condition. Problem found to be application related?	**YES:** Repair application problem and retest. **NO:** Faulty ECU – – –1/1

000190.16 — Engine Overspeed Moderate

The ECU detects that engine speed exceeds the maximum rpm.

RG41221,0000231 –19–03APR05–1/1

000190.16 — Engine Overspeed Moderate Diagnostic Procedure

Related Information:
The ECU detects that engine speed exceeds the maximum rpm.

Alarm Level:
STOP

Control Unit Response:

If this code sets, the ECU stops fuel flow to the High Pressure Common Rail (HPCR) through the control of the Pump Control Valve (PCV) solenoid.

Additional References: For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Applications Check**	For the engine to exceed the maximum allowed engine speed at this level, the application must be mechanically pushing the engine. Check the application for anything that could be pushing the engine to an overspeed condition. Problem found to be application related?	**YES:** Repair application problem and retest. **NO:** Faulty ECU

– – –1/1

000237.02 — VIN Security Data Conflict

The ECU detects a VIN on the CCU, ECU, or ICU that does not match the VIN of the other two controllers, or the ECU is unable to communicate with the CCU or ICU.

DB92450,000006E –19–07APR06–1/1

000237.02 — VIN Security Data Conflict

Related Information:
The VIN includes information pertaining to the vehicle model number, the vehicle serial number, and the option code that is available for each specific vehicle. There are several checks set up in the ECU to verify that all of the correct electronic controllers are being used.

After power on, the ECU will wait 50 seconds and then request the VIN. If no responses are received, the ECU will try 2 more times in 50-second increments. After a valid response, the ECU will wait 1 hour before requesting the VIN again.

CAN bus communication problems can cause this code.

If a controller was just re-programmed there may be a problem with the released software.

Alarm Level:
Warning

Control Unit Response:
ECU will derate the engine to 90% of full power.

DTC 000237.02 will NOT reset with a key cycle.

DTC 001569.31 will set.

Additional References:
For further VIN code information, refer to the Technical Manual for the equipment on which the code set.

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000237.02 error code active?	**YES:** GO TO ❸ **NO:** GO TO ❷

– – –1/1

❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see your application manual.

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❸ **VIN Information Check**	1. Ignition ON, Engine OFF. 2. From Service ADVISOR read the Vehicle Identification Number on the CCU, ECU, and ICU. Do the numbers all agree?	**YES:** Probable CAN communication problem. Further troubleshooting procedures are being developed. **NO:** For further troubleshooting procedures see your application manual.

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000237.13 — VIN Option Code Invalid

The ECU detects an option code on the ECU that does not match the option code of the other controllers.

DB92450,000006F –19–07APR06–1/1

000237.13 — VIN Option Code Invalid

Related Information:
The VIN includes information pertaining to the vehicle model number, the vehicle serial number, and the option code that is available for each specific vehicle. There are several checks set up in the ECU to verify that all of the correct electronic controllers are being used.

After power on, the ECU will wait 50 seconds and then request the VIN. If no responses are received, the ECU will try 2 more times in 50-second increments. After a valid response, the ECU will wait 1 hour before requesting the VIN.

CAN bus communication problems can cause this code.

Alarm Level:
Warning

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Control Unit Response:
ECU will derate the engine to low idle.

DTC 000189.00 will also set.

Additional References:
For further VIN code information, refer to the Test Manual for the equipment on which the code set.

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000237.13 error code active?	**YES:** GO TO ❸ **NO:** GO TO ❷

– – –1/1

❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see your application manual. – – –1/1

❸ **VIN Information Check**	1. Ignition ON, Engine OFF. 2. From Service ADVISOR read the Vehicle Identification Number on the CCU, ECU, and ICU. Do the numbers all agree?	**YES:** Probable CAN communication problem. Further troubleshooting procedures are being developed. **NO:** For further troubleshooting procedures see your application manual. – – –1/1

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000237.31 — Vehicle Model Number Invalid

The ECU detects a vehicle model number on the CCU, ECU, or ICU that does not match the vehicle model number of the other two controllers.

DB92450,0000070 –19–07APR06–1/1

000237.31 — Vehicle Model Number Invalid

Related Information:
The VIN includes information pertaining to the vehicle model number, the vehicle serial number, and the option code that is available for each specific vehicle. There are several checks set up in the ECU to verify that all of the correct electronic controllers are being used.

After power on, the ECU will wait 50 seconds and then request the VIN. If no responses are received, the ECU will try 2 more times in 50-second increments. After a valid response, the ECU will wait 1 hour before requesting the VIN.

CAN bus communication problems can cause this code.

Alarm Level:
Warning

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Control Unit Response:
ECU will derate the engine to low idle.

DTC 000189.00 will also set.

Additional References:
For further VIN code information, refer to the Test Manual for the equipment on which the code set.

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000237.31 error code active?	**YES:** GO TO ❸ **NO:** GO TO ❷

– – –1/1

❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see your application manual. – – –1/1

❸ **VIN Information Check**	1. Ignition ON, Engine OFF. 2. From Service ADVISOR read the Vehicle Identification Number on the CCU, ECU, and ICU. Do the numbers all agree?	**YES:** Probable CAN communication problem. Further troubleshooting procedures are being developed. **NO:** For further troubleshooting procedures see your application manual. – – –1/1

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000412.00 — Exhaust Gas Recirculation (EGR) Exhaust Temperature Extremely High

The ECU senses an exhaust gas recirculation exhaust temperature above specification.

RG41221,0000232 –19–28SEP05–1/1

000412.00 — Exhaust Gas Recirculation (EGR) Exhaust Temperature Extremely High Diagnostic Procedure

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,220

Related Information
The ECU senses an EGR exhaust temperature above 290° C (554° F) on OEM engines.

Alarm Level:
STOP

Control Unit Response:
The ECU will derate the engine immediately until engine is running at 90% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR exhaust temperature information, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 200 later in this manual.

IMPORTANT: If any turbocharger or EGR valve codes have also been set, diagnose those codes first.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* Without disconnecting, visually inspect the ECU connectors and the EGR exhaust temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load. 6. Read DTCs. Did 000412.00 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Exhaust Gas Recirculation Exhaust Temperature Sensor Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Ignition OFF. 2. Remove EGR exhaust temperature sensor. 3. Wiring harness connector is still connected to the EGR exhaust temperature sensor. 4. Ignition ON, engine OFF. 5. Using a heat gun, apply heat to the tip of the sensor. 6. Using the diagnostic software, read exhaust gas recirculation exhaust temperature. Does the temperature increase when heat is applied to the sensor?	**YES:** GO TO ❹ **NO:** Replace EGR exhaust temperature sensor. – – –1/1

❹ **Engine Coolant Level Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* **CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.** • Check the coolant level. Is the coolant level at proper level?	**YES:** GO TO ❺ **NO:** Determine cause of low coolant level, repair problem, refill coolant, and retest. – – –1/1

❺ **Engine Coolant Thermostat Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Ignition OFF. 2. Remove thermostats and test for proper operation. See REMOVE AND TEST THERMOSTATS in Section 02, Group 070 of CTM400. Are the thermostats functioning properly?	**YES:** GO TO ❻ **NO:** Replace thermostat. See REMOVE AND TEST THERMOSTATS in Section 02, Group 070 of CTM400. – – –1/1

❻ **Exhaust Gas Recirculation Cooler Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Ignition OFF. 2. Remove exhaust gas recirculation cooler. See REMOVE AND INSTALL EXHAUST GAS RECIRCULATION COOLANT MANIFOLD in Section 02, Group 80 in CTM400. 3. Inspect the EGR cooler for debris and carbon build up in the exhaust gas passage causing blockage or loss of heat transfer. 4. Inspect coolant passage for proper coolant flow through EGR cooler. Is the exhaust gas or coolant passages blocked or restricted?	**YES:** Replace EGR cooler. See REMOVE AND INSTALL EXHAUST GAS RECIRCULATION COOLANT MANIFOLD in Section 02, Group 80 in CTM400. **NO:** GO TO ❼ – – –1/1

❼ **EGR Exhaust Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Ignition OFF 2. Disconnect the EGR exhaust temperature sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR exhaust temperature sensor connector and terminal E2 in ECU connector J3 on the engine harness. • Terminal B in the EGR exhaust temperature sensor connector and terminal B2 in ECU connector J3 on the engine harness. All measurements 5 ohms or less?	**YES:** Faulty EGR exhaust temperature sensor. **NO:** GO TO ❹ – – –1/1

❽ **EGR Exhaust Temperature Sensor Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 7 (terminal B2 or E2 in ECU connector J3) and all other terminals in all three ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measures less than 2000 ohms. **NO:** Open in wire that was more than 5 ohms in step 7. – – –1/1

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000412.03 — Exhaust Gas Recirculation (EGR) Exhaust Temperature Input Voltage High

The exhaust gas recirculation exhaust temperature input voltage exceeds the sensor's high voltage specification. Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open circuit. Less probable is a short from the 5V input wire to a power source.

RG41221,0000233 –19–26SEP05–1/1

000412.03 — Exhaust Gas Recirculation (EGR) Exhaust Temperature Input Voltage High Diagnostic Procedure

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Related Information:
The EGR exhaust temperature input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a temperature that is lower than what is physically possible for EGR temperature.

For OEM applications, the high EGR exhaust temperature input voltage specification is 4.95 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will use the EGR pressure to control engine.

The ECU's high EGR exhaust temperature engine protection feature disabled.

Additional References:
For further EGR exhaust temperature sensor information, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the EGR exhaust temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000412.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor terminals. Is resistance less than 100K ohms?	**YES:** Sensor not open. GO TO ❹ **NO:** Excessively high resistance in the sensor. Replace and retest. – – –1/1

❹ **Input Circuit Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON. 2. Temperature sensor still disconnected. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground. Is voltage above 4.5-5.5V?	**YES:** Input OK. Check ground circuit. GO TO ❼ **NO:** If voltage is greater than 5.5V, sensor 5V input wire shorted to a higher voltage source. GO TO ❺ **NO:** If voltage is less than 4.5V, open or high resistance in input wiring. GO TO ❻ – – –1/1

❺ **Harness Shorted to Higher Voltage Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect 30-pin connectors from ECU. 3. Ignition ON. 4. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground Is voltage zero?	**YES:** Harness wiring OK. Remove and test ECU. GO TO❾ **NO:** Voltage is above 5.5V: harness or connected wiring shorted to a higher voltage source. Repair and retest. – – –1/1
❻ **Harness Input Wiring Open Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Sensor still disconnected. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's input wiring in the harness. Is resistance near zero ohms?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❾ **NO:** Open or high resistance in input wiring. Repair and retest. – – –1/1
❼ **Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Use a multimeter and JT07328 Connector Adapter Test Kit to check resistance from the return terminal in the sensor connector to a good chassis ground. Is resistance near zero ohms?	**YES:** Ground circuit OK. Reconnect and retest. **NO:** Voltage is significantly above zero ohms: Open or high resistance in ground circuit. GO TO ❽ – – –1/1
❽ **Harness Ground Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's ground wiring in the harness. Is resistance near zero ohms?	**YES:** Wiring OK. Remove and test ECU. GO TO ❿ **NO:** Resistance is significantly above zero ohms: Open or high resistance in ground wiring. Repair and retest. – – –1/1

9 ECU Input Circuit Test	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input (J3-E2) and ground pin (J3-B2) the ECU. Is resistance 1.5K to 3.5K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

10 ECU Ground Circuit Test	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter and JT07328 Connector Adapter Test Kit, measure resistance between the sensor circuit's ground pin (J3-B2) and pin J2-L2 or J2-L3 in the ECU. Is resistance near zero ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Resistance is 2 ohms or more: Faulty ECU. Replace and retest. – – –1/1

000412.04 — Exhaust Gas Recirculation (EGR) Exhaust Temperature Input Voltage Low

The exhaust gas recirculation exhaust temperature input voltage drops below the sensor's low voltage specification. Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault on this circuit is low resistance to ground (grounded circuit).

RG41221,0000234 –19–26SEP05–1/1

000412.04 — Exhaust Gas Recirculation (EGR) Exhaust Temperature Input Voltage Low Diagnostic Procedure

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Related Information:
The EGR exhaust temperature input voltage drop below the sensor's low voltage specification. The voltage corresponds to a temperature that is higher than what is physically possible for EGR exhaust temperature.

For OEM applications, the low EGR exhaust temperature input voltage specification is 0.15 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will use the exhaust gas recirculation pressure to control engine.

ECU's high EGR exhaust temperature engine protection feature disabled.

Additional References:
For further EGR exhaust temperature sensor information, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the EGR exhaust temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000412.04 reoccur?	**YES:** GO TO ❸ **NO:** 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 Shorted Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor pins. Is resistance more than 100 ohms?	**YES:** Sensor not shorted. GO TO ❹ **NO:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

❹ **Sensor Grounded Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between each sensor pin and a good chassis ground. Is resistance 1M ohms or more?	**YES:** Sensor OK. Check wiring. GO TO ❺ **NO:** Low resistance to ground. Replace sensor and retest. – – –1/1

❺ **Grounded Input Circuit Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground. Is resistance 1000 ohms or more?	**YES:** Input circuit OK. Reconnect and retest. **NO:** GO TO ❻ – – –1/1

❻ **Harness Input Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector (J3) from the ECU. Inspect connector and ECU pins. 3. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground. Is resistance 1M ohms or more?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❼ **NO:** Input wire shorted to ground. Repair and retest. – – –1/1

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❼ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input (J3-E2) and ground pin (J3-B2) in the ECU. Is resistance 1.5K to 3.5K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

000412.16 — Exhaust Gas Recirculation (EGR) Exhaust Temperature Moderately High

The ECU senses an exhaust gas recirculation exhaust temperature above specification.

RG41221,000029B –19–27MAR06–1/1

000412.16 - Exhaust Gas Recirculation (EGR) Exhaust Temperature Moderately High Diagnostic Procedure

Related Information
The ECU senses an EGR exhaust temperature above 280° C (536° F) on OEM engines.

When DTC is Displayed:
When ever the ignition is on and the error is active.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engine immediately until engine is running at 95% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR exhaust temperature information, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 200 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* Without disconnecting, visually inspect the ECU connectors and the EGR exhaust temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load. 6. Read DTCs. Did 000412.00 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Exhaust Gas Recirculation Exhaust Temperature Sensor Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Ignition OFF. 2. Remove EGR exhaust temperature sensor. 3. Wiring harness connector is still connected to the EGR exhaust temperature sensor. 4. Ignition ON, engine OFF. 5. Using a heat gun, apply heat to the tip of the sensor. 6. Using the diagnostic software, read exhaust gas recirculation exhaust temperature. Does the temperature increase when heat is applied to the sensor?	**YES:** GO TO ❹ **NO:** Replace EGR exhaust temperature sensor. – – –1/1

❹ **Engine Coolant Level Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* **CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.** • Check the coolant level. Is the coolant level at proper level?	**YES:** GO TO ❺ **NO:** Determine cause of low coolant level, repair problem, refill coolant, and retest. – – –1/1
❺ **Engine Coolant Thermostat Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Ignition OFF. 2. Remove thermostats and test for proper operation. See REMOVE AND TEST THERMOSTATS in Section 02, Group 070 of CTM400. Are the thermostats functioning properly?	**YES:** GO TO ❻ **NO:** Replace thermostat. See REMOVE AND TEST THERMOSTATS in Section 02, Group 070 of CTM400. – – –1/1
❻ **Exhaust Gas Recirculation Cooler Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Ignition OFF. 2. Remove exhaust gas recirculation cooler. See REMOVE AND INSTALL EXHAUST GAS RECIRCULATION COOLANT MANIFOLD in Section 02, Group 80 of CTM 400. 3. Inspect the EGR cooler for debris and carbon build up in the exhaust gas passage causing blockage or loss of heat transfer. 4. Inspect coolant passage for proper coolant flow through EGR cooler. Is the exhaust gas or coolant passages blocked or restricted?	**YES:** Replace EGR cooler. See REMOVE AND INSTALL EXHAUST GAS RECIRCULATION COOLANT MANIFOLD in Section 02, Group 80 IN CTM 400. **NO:** GO TO ❼ – – –1/1

❼ **EGR Exhaust Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Ignition OFF 2. Disconnect the EGR exhaust temperature sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR exhaust temperature sensor connector and terminal E2 in ECU connector J3 on the engine harness. • Terminal B in the EGR exhaust temperature sensor connector and terminal B2 in ECU connector J3 on the engine harness. All measurements 5 ohms or less?	**YES:** Faulty EGR exhaust temperature sensor. **NO:** GO TO ❹ – – –1/1

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❽ **EGR Exhaust Temperature Sensor Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR supporting information.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 7 (terminal B2 or E2 in ECU connector J3) and all other terminals in all three ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measures less than 2000 ohms. **NO:** Open in wire that was more than 5 ohms in step 7. – – –1/1

000611.03 — Electronic Injector Wiring Shorted To Power Source

The ECU detects that injector wiring is shorted to a power source.

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000611.03 — Electronic Injector Wiring Shorted To Power Source Diagnostic Procedure

IMPORTANT: Other DTCs may set with 000611.03. Follow this procedure first and make repairs as directed.

Related Information:
The ECU detects that injector wiring is shorted to a power source.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the ECU will try to operate the engine under normal operating conditions.

The engine will experience cylinder misfire and/or black/gray smoke may be observed.

Depending on the cause of the DTC, the engine may not start.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the electronic injector interconnect connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000611.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Engine Operation Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running 2. Run engine at high idle. 3. Observe engine performance for exhaust smoke. Does engine have excessive white or gray exhaust smoke?	**YES:** GO TO ❺ **NO:** GO TO ❹ – – –1/1

❹ **Engine Misfire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running 2. Run engine at high idle. Does the engine misfire?	**YES:** GO TO ❺ **NO:** GO TO ❻ – – –1/1

❺ **Engine Speed Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running 2. Run engine at high idle. Does engine speed go above 900 rpm?	**YES:** GO TO ❻ **NO:** GO TO ❼ – – –1/1

❻ **Short in 90V Circuit Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors and the electronic injector connector at the rear of the cylinder head. 3. Using a multimeter, measure resistance between: • The electronic injector 90V terminal G1 in the harness end of the ECU connector J1 and all other terminals in all three ECU connectors. • The electronic injector 90V terminal G2 in the harness end of the ECU connector J1 and all other terminals in all three ECU connectors. All measurements greater than 2000 ohms?	**YES:** Faulty ECU connections. OR Faulty ECU **NO:** Short in 90V circuit that measured less than 2000 ohms. – – –1/1

❼ **Short in Electronic Injector Control Circuit Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Using the ECU diagnostic software, perform the Cylinder Cutout Test. For instructions on how to run this test, see ENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST earlier in this Group. *NOTE: After performing the Cylinder Cutout Test, you should be able to identify one or more cylinders that did not affect the way the engine ran. This will be the cylinder(s) referred to in the following test.* 2. Ignition OFF 3. Disconnect all three ECU connectors and the electronic injector connector at the rear of the cylinder head. 4. Using a multimeter, measure resistance between the control terminal of the electronic injector(s) identified in the Cylinder Cutout Test at the ECU connector and all other terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** Faulty ECU connections. OR Faulty ECU **NO:** Short in electronic injector control circuit that measured less than 2000 ohms. – – –1/1

000611.04 — Electronic Injector Wiring Shorted To Ground

The ECU detects that injector wiring is shorted to ground.

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000611.04 — Electronic Injector Wiring Shorted To Ground Diagnostic Procedure

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IMPORTANT: Other DTCs may set with 000611.04. Follow this procedure first and make repairs as directed.

Related Information:
The ECU detects that injector wiring is shorted to a ground.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the ECU will try to operate the engine under normal operating conditions.

The engine will experience cylinder misfire and/or black/gray smoke may be observed.

Depending on the cause of the DTC, the engine may not start.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the electronic injector interconnect connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000611.04 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Engine Starting Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Crank engine and try to start. Does the engine start?	**YES:** GO TO ❹ **NO:** GO TO ❺ – – –1/1

❹ **Engine Operation Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running at high idle. 2. Observe engine performance. Does engine run rough omitting excessive black smoke?	**YES:** GO TO ❻ **NO:** GO TO ❺ – – –1/1

❺ **Short in Electronic Injector Wiring Harness Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors and the electronic injector connector at the rear of the cylinder head. 3. Using a multimeter, measure resistance between: • Terminal G1 in the harness end of the ECU connector J1 and all other terminals in all three ECU connectors. • Terminal G2 in the harness end of the ECU connector J1 and all other terminals in all three ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO ❼ **NO:** Short in electronic injector 90V circuit that measured less than 2000 ohms. – – –1/1

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❻ **Short in Electronic Injector Wiring Harness Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Using the ECU diagnostic software, perform the Cylinder Cutout Test. For instructions on how to run this test, see ENGINE TEST INSTRUCTIONS - CYLINDER CUTOUT TEST earlier in this Group. *NOTE: After performing the Cylinder Cutout Test, you should be able to identify one or more cylinders that did not affect the way the engine ran. This will be the cylinder(s) referred to in the following test.* 2. Ignition OFF 3. Disconnect all three ECU connectors and the electronic injector connector at the rear of the cylinder head. 4. Using a multimeter, measure resistance between the control terminal of the electronic injector identified in the Cylinder Cutout Test at the ECU connector and all other terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❼ **NO:** Short in electronic injector control wire from step 5 to wire that measured less than 2000 ohms. – – –1/1

❼ **ECU and Electronic Injector Wiring Connection Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Electronic injector wiring harness connector at the side of the cylinder head disconnected. 3. Using a multimeter, measure resistance between: • Terminal 4 in the cylinder head side of the electronic injector wiring harness and a good chassis ground. • Terminal 9 in the cylinder head side of the electronic injector wiring harness and a good chassis ground. All measurements greater than 2000 ohms?	**YES:** Faulty electronic injector wiring connection OR Faulty ECU connection OR Faulty ECU **NO:** GO TO ❽

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❽ **Electronic Injector Wiring Harness Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove the rocker arm cover. 3. Disconnect all electrical connections from all electronic injectors. 4. Using a multimeter, measure resistance between: • One terminal on top of the electronic injector and the body of the injector. • The other terminal on top of the electronic injector and the body of the injector. • Perform the above resistance check on all of the injectors. All measurements greater than 2000 ohms?	**YES:** Faulty electronic injector wiring harness inside the cylinder head. **NO:** Faulty electronic injector that measured less than 2000 ohms.

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000627.01 — Electronic Injector Supply Voltage Problem

The ECU detects a supply voltage problem that prevents Electronic Injector functionality.

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000627.01 — Electronic Injector Supply Voltage Problem Diagnostic Procedure

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Related Information:
The ECU detects a voltage supply problem which prevents the electronic injectors from working.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will try to operate the engine under normal operating conditions.

Engine may not start.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For further electronic injector information, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual or ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual or ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running 6. Read DTCs. Did 000627.01 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **ECU Power Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual or ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect ECU connector J2. 3. Using a multimeter, measure voltage between a good chassis ground and: • Terminal L1 in ECU connector J2 in the engine harness • Terminal L4 in ECU connector J2 in the engine harness • Terminal M1 in ECU connector J2 in the engine harness • Terminal M4 in ECU connector J2 in the engine harness Do all terminals measure battery voltage?	**YES:** GO TO ❻ **NO:** GO TO ❹

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❹ **Battery Voltage Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual or ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* Using a multimeter, measure battery voltage across both battery terminals. Measures at or near battery voltage?	**YES:** Faulty ECU power supply fuse. OR Faulty ECU connection. OR Open or short in ECU power circuit. **NO:** Faulty battery or charging system.

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❺ **Battery Supply Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual or ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. ECU connector J2 still disconnected. 3. Using a multimeter, measure resistance between the positive battery wire and the following: • Terminal L1 in ECU connector J2 in the engine harness • Terminal L4 in ECU connector J2 in the engine harness • Terminal M1 in ECU connector J2 in the engine harness • Terminal M4 in ECU connector J2 in the engine harness All measurements 5 ohms or less?	**YES:** Faulty ECU **NO:** Open or short in ECU power circuit. OR Faulty ECU power supply fuse. – – –1/1

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❻ **90 Volt Supply Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual or ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. ECU connector J2 still disconnected. 3. Disconnect the electronic injector (EI) wiring harness connector located on the cylinder head. 4. Using a multimeter, measure resistance between the following: 9 • Terminal 4 in the electronic injector (EI) wiring harness connector and terminal G1 in ECU connector J2. • Terminal 9 in the electronic injector (EI) wiring harness connector and terminal G2 in ECU connector J2. All measurements 5 ohms or less?	**YES:** GO TO ❼ **NO:** Open or short in 90V supply wire that measures greater than 5 ohms. – – –1/1

❼ **90 Volt Supply Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual or ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Electronic injector (EI) wiring harness connector still disconnected. 3. Remove the rocker arm cover. 4. Using a multimeter, measure resistance between the following: • Terminal 4 in the electronic injector (EI) wiring harness connector on the cylinder head and the 90V terminal on injectors 1, 2, and 3. • Terminal 9 in the electronic injector (EI) wiring harness connector on the cylinder head and the 90V terminal on injectors 4, 5, and 6. All measurements 5 ohms or less?	**YES:** Faulty ECU connection. OR Faulty ECU **NO:** Faulty injector wiring harness internal to the cylinder head. Replace injector wiring harness and retest. – – –1/1

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000627.16 — ECU Power Supply Voltage Higher Than Expected

The ECU detects a voltage above specification on one or more of the ECU voltage wires anytime the engine is cranking or running.

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000627.16 — ECU Power Supply Voltage Higher Than Expected

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Related Information:
Battery voltage powers the ECU and is measured so that the ECU can compensate for variations in battery voltage as it controls the output device drivers.

The ECU detects a voltage greater than 36 volts for 1 second on one or more of the ECU voltage wires anytime the engine is cranking or running.

Alarm Level:
Warning

Control Unit Response:
Engine may not start.

Additional References:
For further information, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine running at 1500 rpm 3. Start the ECU diagnostic software 4. Using the ECU diagnostic software, read battery voltage. Does the battery voltage measure above 36 volts?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Battery Voltage Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine running at 1500 rpm 2. Using a multimeter, measure voltage across the positive and negative battery terminals. Does the battery voltage measure above 36 volts?	**YES:** Faulty charging system. See STARTING AND CHARGING SYSTEM DIAGNOSTICS in Section 110 earlier in this manual. **NO:** Faulty ECU – – –1/1

000627.18 — ECU Power Supply Voltage Lower Than Expected

The ECU detects a voltage below specification on one of the ECU voltage wires anytime when engine speed is above 1200 rpm.

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000627.18 ECU Power Supply Voltage Lower Than Expected Diagnostic Procedure

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Related Information:
Battery voltage powers the ECU and is measured so that the ECU can compensate for variations in battery voltage as it controls the output device drivers.

The ECU detects a voltage less than 6 volts for 1 second on one of the ECU voltage wires anytime when engine speed is greater than 1200 rpm.

Alarm Level:
Warning

Control Unit Response:
The ECU will try to operate the engine under normal operating conditions.

The engine may not start due to low battery voltage.

Additional References:
For further information, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine running at low idle 3. Start the ECU diagnostic software 4. Using the ECU diagnostic software, read battery voltage. Does the battery voltage measure below 6.0 volts?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Battery Voltage Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine running at low idle 2. Using a multimeter, measure voltage across the positive and negative battery terminals. Does the battery voltage measure below 6.0 volts?	**YES:** Faulty charging system. See OEM STARTING AND CHARGING SYSTEMS REPAIR AND ADJUSTMENT in Section 2, Group 100 in CTM400. **NO:** GO TO ❹ – – –1/1
❹ **ECU Power Circuit Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect ECU connector J2 on the engine harness. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between terminal a good chassis ground and the following: • Terminal L1 in ECU connector J2 on the engine harness • Terminal L4 in ECU connector J2 on the engine harness • Terminal M1 in ECU connector J2 on the engine harness • Terminal M4 in ECU connector J2 on the engine harness • Terminal B2 in ECU connector J2 on the engine harness Does the battery voltage measure below 6.0 volts?	**YES:** GO TO ❺ **NO:** Open or short to ground in the ECU power supply wire(s) that measured below 6.0 volts. – – –1/1

❺ **ECU Ground Circuit Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. ECU connector J2 still disconnected. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between battery voltage and the following terminals: • Terminal L2 in ECU connector J2 on the engine harness • Terminal L3 in ECU connector J2 on the engine harness • Terminal M2 in ECU connector J2 on the engine harness Does the voltage measure above 6.0 volts?	**YES:** Faulty ECU **NO:** Open in ground circuit that showed low voltage – – –1/1

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000629.13 — ECU Error

The ECU detects an internal problem.

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000629.13 — ECU Error Diagnostic Procedure

Related Information:
The ECU detects an internal problem. The most probable cause of this fault is an error during reprogramming or an incorrectly programmed ECU. Other possible causes include faulty ECU harness wiring/connections or a faulty ECU.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the engine will not start or run.

Additional References:
For further engine control unit information, see ENGINE CONTROL UNIT in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **When Did Code Appear?**	Did code appear during programming?	**YES:** GO TO ❷ **NO:** GO TO ❸

– – –1/1

❷ **Reprogramming the ECU Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT in Section 03, Group 140 earlier in this manual.* 1. Download again the correct payload file for the serial number of the engine, then reprogram the ECU. 2. Ignition OFF for 2 minutes. 3. Ignition ON, engine OFF. 4. Read DTCs. Did 000628.12 reoccur?	**YES:** Check connections between the PC and the ECU, then attempt the programming procedure again. If unsuccessful, repeat connection check and attempt the reprogramming procedure at least two more times. If code returns each time, replace ECU, reprogram, and retest. **NO:** Programming successful. Run engine to verify engine functions properly. – – –1/1

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❸ **Unswitched Power Test**	1. Ignition OFF. 2. Remove ECU connector J2. 3. Check for battery voltage between the unswitched power terminals in J2 and a good chassis ground. For terminal numbers, see ECU TERMINAL IDENTIFICATION in Section 6, Group 210 of this manual. Is battery voltage present at each unswitched power terminal?	**YES:** GO TO ❹ **NO:** On the circuit(s) having low or no voltage, check between J2 and battery for opens. Note that the problem may be of an intermittent nature. Repair and retest. – – –1/1

❹ **Ground Wiring Test**	1. Ignition OFF. 2. ECU connector J2 still removed. 3. Check resistance between the ground terminals in J2 and a good chassis ground. For terminal numbers, see ECU TERMINAL IDENTIFICATION in Section 6, Group 210 of this manual. Is resistance at each ground terminal near zero ohms?	**YES:** Wiring OK. Replace ECU. **NO:** On the circuit(s) that measure high resistance to ground, check wiring between J2 and battery for opens. Note that the problem may be of an intermittent nature. Repair and retest. – – –1/1

000636.02 — Pump Position Sensor Input Noise

The ECU detects excessive noise (extra pulses) on the pump position sensor input.

RG41221,000023E –19–19SEP05–1/1

000636.02 — Pump Position Sensor Input Noise Diagnostic Procedure

Related Information:
The ECU detects excessive noise (extra pulses) on the pump position sensor input.

Alarm Level:
Warning

Control Unit Response:
If this code sets, prolonged cranking time may be required to start the engine.

The ECU will only use the crank position sensor input to determine piston position.

If a crank position sensor diagnostic trouble code accompanies 000636.02, the engine will die and will not restart until at least one of the two codes is repaired.

Additional References:
For further pump position sensor information, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the pump position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running 6. Read DTCs. Did 000636.02 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Noise Detection Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. 000636.02 is most likely caused by radiated or conducted electrical “noise” from some part of the machine. This problem may be caused by loose electrical ground or power connection anywhere on the machine. Things to check: • All harness connections. • Alternator connections. • Chassis ground and battery ground connections. • Corrosion, dirt, or paint can cause intermittent and “noisy” connections. • Check the wiring for intermittent open and short circuits; particularly the pump position sensor wiring. 2. Other possible causes of 000636.02: • Electromagnetic interference (EMI) from an incorrectly installed 2-way radio. • Interference from some radar source. • Possible burrs on the pump position timing wheel notches, should be clean, square edges. Was the problem found?	**YES:** Repair and retest. **NO:** Replace pump position sensor and retest. – – –1/1

000636.05 — Pump Position Sensor Current Low

The ECU detects low current on the pump position sensor wiring.

RG41221,000023F –19–25APR06–1/1

000636.05 — Pump Position Sensor Current Low Diagnostic Procedure

NOTE: If other pump position sensor related DTCs accompany 000636.05, diagnose 000636.05 first.

Related Information:
The ECU detects low current on the pump position sensor wiring through the Harness Diagnostic Mode Test on the ECU diagnostic software.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further pump position sensor information, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the pump position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Pump Position Sensor Ground Wire Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Disconnect the pump position sensor and ECU connector J3. 3. Using a multimeter, measure resistance between terminal B in the pump position sensor and terminal G3 in ECU connector J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❸ **NO:** Open in the pump position ground wire. Repair and retest. – – –1/1

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❸ **Pump Position Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Pump position sensor and ECU connector J3 still disconnected. 3. Using a multimeter, measure resistance between terminal 1 in the pump position sensor and terminal G4 in ECU connector J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in the pump position input wire. Repair and retest. – – –1/1

❹ **Pump Position Sensor Continuity Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Pump position sensor connector still disconnected. 3. Using a multimeter, measure resistance between both terminals in the pump position sensor. Is the resistance between 2500 and 3500 ohms?	**YES:** Faulty ECU **NO:** Faulty pump position sensor. Replace and retest. – – –1/1

000636.06 — Pump Position Sensor Current High

The ECU detects high current on the pump position sensor wiring.

RG41221,0000240 –19–25APR06–1/1

000636.06 — Pump Position Sensor Current High Diagnostic Procedure

NOTE: If other pump position sensor related DTCs accompany 000636.06, diagnose 000636.06 first.

Related Information:
The ECU detects high current on the pump position sensor wiring through the Harness Diagnostic Mode Test on the ECU diagnostic software.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further pump position sensor information, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the pump position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Pump Position Sensor Ground Wire Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal G3 in ECU connector J3 and all terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❸ **NO:** Short in pump position sensor ground circuit to wire(s) that measured less than 2000 ohms. – – –1/1

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❸ **Pump Position Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Pump position sensor and all three ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal G4 in ECU connector J3 and all terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in pump position sensor input circuit to wire(s) that measured less than 2000 ohms. – – –1/1

❹ **Pump Position Sensor Continuity Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Pump position sensor connector still disconnected. 3. Using a multimeter, measure resistance between both terminals in the pump position sensor. Is the resistance between 2500 and 3500 ohms?	**YES:** Faulty ECU **NO:** Faulty pump position sensor. Replace and retest. – – –1/1

000636.08 — Pump Position Sensor Input Missing

The ECU does not detect the pump position sensor input.

RG41221,0000241 –19–19SEP05–1/1

000636.08 — Pump Position Sensor Input Missing Diagnostic Procedure

Related Information:
The ECU does not detect the pump position sensor input.

Alarm Level:
Warning

Control Unit Response:
If this code sets, prolonged cranking time may be required to start the engine.

The ECU will only use the crank position sensor input to determine piston position.

If a crank position sensor diagnostic trouble code accompanies 000636.08, the engine will die and will not restart until at least one of the two codes is repaired.

Additional References:
For further pump position sensor information, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the pump position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running 6. Read DTCs. Did 000636.08 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Pump Position Sensor Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Disconnect pump position sensor connector. 3. Using a multimeter, measure resistance between both terminals of the pump position sensor connector on the engine harness. Does the resistance measure between 2500 and 3500 ohms?	**YES:** GO TO ❹ **NO:** Faulty pump position sensor. – – –1/1
❹ **Open in Pump Position Input and Return Circuit Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Disconnect pump position sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between: • Terminal A in the pump position sensor connector and terminal G4 in the ECU connector J3 on the engine harness. • Terminal B in the pump position sensor connector and terminal G3 in the ECU connector J3 on the engine harness. Do both measure 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in circuit that measured above 5 ohms OR Terminals A and B in the pump position sensor harness connector inverted. OR Terminals G3 and G4 in the ECU connector J3 inverted. – – –1/1

❺ **Pump Position Sensor Input Wiring Harness Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Pump Position sensor connector still disconnected. 3. Disconnect all 3 ECU connectors. 4. Using a multimeter, measure resistance between terminal G4 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all 3 ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO ❻ **NO:** Short in pump position sensor input circuit to wire that measured less than 2000 ohms. – – –1/1

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❻ **Pump Position Sensor Return Wiring Harness**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Pump Position sensor connector and ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal G3 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all 3 ECU connectors. All measurements greater than 2000 ohms?	**YES:** Faulty pump position sensor connector. OR Faulty pump position sensor. OR Faulty ECU connector OR Faulty ECU **NO:** Short in pump position sensor return circuit to wire that measured less than 2000 ohms. – – –1/1

000636.10 — Pump Position Sensor Input Pattern Error

The ECU detects an improper pattern on the pump position sensor input.

RG41221,0000242 –19–19SEP05–1/1

000636.10 — Pump Position Sensor Input Pattern Error Diagnostic Procedure

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Related Information:
The ECU detects an improper pattern on the pump position sensor input.

Alarm Level:
Warning

Control Unit Response:
If this code sets, prolonged cranking time may be required to start the engine.

The moment that 000636.10 sets, the engine may hesitate or die, but will restart.

The ECU will only use the crank position sensor input to determine piston position.

If a crank position sensor diagnostic trouble code accompanies 000636.10, the engine will die and will not restart until at least one of the two codes is repaired.

Additional References:
For further pump position sensor information, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the pump position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running 6. Read DTCs. Did 000636.10 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Pump Position Sensor Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Disconnect pump position sensor connector. 3. Using a multimeter, measure resistance between both terminals of the pump position sensor connector on the engine harness. Does the resistance measure between 2500 and 3500 ohms?	**YES:** GO TO ❹ **NO:** Faulty pump position sensor. – – –1/1

❹ **Open in Pump Position Input and Return Circuit Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Disconnect pump position sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between: • Terminal A in the pump position sensor connector and terminal G4 in the ECU connector J3 on the engine harness. • Terminal B in the pump position sensor connector and terminal G3 in the ECU connector J3 on the engine harness. Do both measure 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in circuit that measured above 5 ohms OR Terminals A and B in the pump position sensor harness connector inverted. OR Terminals G3 and G4 in the ECU connector J3 inverted. – – –1/1

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❺ **Pump Position Sensor Input Wiring Harness Test**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Pump Position sensor connector still disconnected. 3. Disconnect all 3 ECU connectors. 4. Using a multimeter, measure resistance between terminal G4 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all 3 ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO ❻ **NO:** Short in pump position sensor input circuit to wire that measured less than 2000 ohms. – – –1/1

❻ **Pump Position Sensor Return Wiring Harness**	*NOTE: For wiring and theory of operation, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Pump Position sensor connector and ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal G3 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all 3 ECU connectors. All measurements greater than 2000 ohms?	**YES:** Faulty pump position sensor connector. OR Faulty pump position sensor. OR Faulty ECU connector OR Faulty ECU **NO:** Short in pump position sensor return circuit to wire that measured less than 2000 ohms. – – –1/1

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000637.02 — Crank Position Input Noise

The ECU detects excessive noise (extra pulses) on the crank position sensor input.

RG41221,0000243 –19–19SEP05–1/1

000637.02 — Crank Position Input Noise Diagnostic Procedure

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Related Information:
The ECU detects excessive noise (extra pulses) on the crank position sensor input.

Alarm Level:
Warning

Control Unit Response:
If this code sets, prolonged cranking time may be required to start the engine.

The ECU will only use the pump position sensor input to determine piston position.

If a pump position sensor diagnostic trouble code accompanies 000637.02, the engine will die and will not restart until at least one of the two codes is repaired.

The ECU will derate 50% per minute until the engine is running at 50% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further crank position sensor information, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the crank position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running 6. Read DTCs. Did 000637.02 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Noise Detection Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 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 connection anywhere on the machine. Things to check: • All harness connections. • Alternator connections. • Chassis ground and battery ground connections. • Corrosion, dirt, or paint can cause intermittent and “noisy” connections. • Check the wiring for intermittent open and short circuits; particularly the pump position sensor wiring. 2. Other possible causes of 000637.02: • Electromagnetic interference (EMI) from an incorrectly installed 2-way radio. • Interference from some radar source. • Possible burrs on the pump position timing wheel notches, should be clean, square edges. Was the problem found?	**YES:** Repair and retest. **NO:** Replace crank position sensor and retest. – – –1/1

000637.05 — Crank Position Sensor Current Low

The ECU detects low current on the crank position sensor wiring.

RG41221,0000244 –19–25APR06–1/1

000637.05 — Crank Position Sensor Current Low Diagnostic Procedure

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NOTE: If other crank position sensor related DTCs accompany 000637.05, diagnose 000637.05 first.

Related Information:
The ECU detects low current on the crank position sensor wiring through the Harness Diagnostic Mode Test on the ECU diagnostic software.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further crank position sensor information, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the crank position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Crank Position Sensor Ground Wire Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Disconnect the crank position sensor and ECU connector J3. 3. Using a multimeter, measure resistance between terminal B in the crank position sensor and terminal F3 in ECU connector J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❸ **NO:** Open in the crank position ground wire. Repair and retest. – – –1/1

❸ **Crank Position Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Crank position sensor and ECU connector J3 still disconnected. 3. Using a multimeter, measure resistance between terminal A in the crank position sensor and terminal F4 in ECU connector J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in the crank position input wire. Repair and retest. – – –1/1

❹ **Crank Position Sensor Continuity Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Crank position sensor connector still disconnected. 3. Using a multimeter, measure resistance between both terminals in the crank position sensor. Is the resistance between 2500 and 3500 ohms?	**YES:** Faulty ECU **NO:** Faulty crank position sensor. Replace and retest. – – –1/1

000637.06 — Crank Position Sensor Current High

The ECU detects high current on the crank position sensor wiring.

RG41221,0000245 –19–25APR06–1/1

000637.06 — Crank Position Sensor Current High Diagnostic Procedure

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NOTE: If other crank position sensor related DTCs accompany 000637.06, diagnose 000637.06 first.

Related Information:
The ECU detects high current on the crank position sensor wiring through the Harness Diagnostic Mode Test on the ECU diagnostic software.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further crank position sensor information, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the crank position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Crank Position Sensor Ground Wire Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Disconnect the crank position sensor and all three ECU connectors. 3. Using a multimeter, measure resistance between terminal F3 in ECU connector J3 and all terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❸ **NO:** Short in crank position sensor ground circuit to wire(s) that measured less than 2000 ohms. – – –1/1

❸ **Crank Position Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Crank position sensor and all three ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal F4 in ECU connector J3 and all terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in crank position sensor input circuit to wire(s) that measured less than 2000 ohms. – – –1/1

❹ **Crank Position Sensor Continuity Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Crank position sensor connector still disconnected. 3. Using a multimeter, measure resistance between both terminals in the crank position sensor. Is the resistance between 2500 and 3500 ohms?	**YES:** Faulty ECU **NO:** Faulty crank position sensor. Replace and retest. – – –1/1

000637.07 — Crank Position/Pump Position Timing Moderately Out of Sync

The ECU detects that the pump position and crank position inputs are not in sync with each other.

RG41221,0000246 –19–05OCT05–1/1

000637.07 — Crank Position/Pump Position Timing Moderately Out of Sync Diagnostic Procedure

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Related Information:
The ECU detects that the pump position and crank position inputs are not in sync with each other.

Alarm Level:
Warning

Control Unit Response:
Depending on the cause of 000637.07, the engine may die and then it may or may not restart.

If the engine continues to run, it will develop low power.

Additional References:
For further crank position sensor information, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For further pump position sensor information, see PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors, crank position sensor connector, and the pump position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running or cranking. 6. Read DTCs. Did 000637.07 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Pump Position Timing Check**	Verify pump position timing is correct. See CHECK HIGH PRESSURE FUEL PUMP STATIC TIMING in Section 04, Group 150 earlier in this manual. **IMPORTANT: There is no timing adjustment for the fuel pump. Use the Static Timing procedure to check for proper installation.** Is the timing correct?	**YES:** GO TO ❹ **NO:** Repair and retest. – – –1/1
❹ **Crank Timing Wheel and Sensor Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Remove the crank position sensor. See REMOVE AND INSTALL CRANK POSITION SENSOR in Section 02, Group 110 earlier in this manual. 3. Inspect the crank timing wheel for broken teeth, nicks, burrs, or other damage. 4. Inspect the crank position sensor for cracks, debris, or other damage. Is the timing wheel and sensor free from damage?	**YES:** GO TO ❺ **NO:** Determine the cause of damage. Replace faulty component and retest. – – –1/1

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❺ **Crank Position Sensor Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Crank position sensor connector still disconnected. 3. Using a multimeter, measure resistance between both terminals in the crank position sensor. Is the resistance between 2500 and 3500 ohms?	**YES:** GO TO ❻ **NO:** Faulty crank position sensor. – – –1/1

❻ **Pump Position Sensor Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the pump position sensor connector. 3. Using a multimeter, measure resistance between both terminals in the pump position sensor. Does the resistance measure between 2500 and 3500 ohms?	**YES:** GO TO ❼ **NO:** Faulty pump position sensor. – – –1/1

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❼ **Open in Crank Position Sensor Input and Return Wire Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the crank position sensor and ECU connector J3. 3. Using a multimeter, measure resistance between: • Terminal A in the crank position sensor connector AND terminal F4 in ECU connector J3 on the engine harness. • Terminal B in the crank position sensor connector AND terminal F3 in ECU connector J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❽ **NO:** Open in crank position sensor wire that measure over 5 ohms. OR Terminal A and B in the crank position sensor harness connector possibly inverted. OR Terminals F3 and F4 in the ECU connector J3 inverted. – – –1/1

8 Crank Position Sensor Input Wiring Harness Test	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Crank position sensor connector still disconnected. 3. Disconnect all three ECU connectors. 4. Using a multimeter, measure resistance between terminal F4 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all three ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO 9 **NO:** Short in crank position sensor input circuit to wire(s) that measured less than 2000 ohms. – – –1/1

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9 Crank Position Sensor Ground Wiring Harness Test	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Crank position sensor connector and all three ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal F3 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all three ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO 10 **NO:** Short in crank position sensor ground circuit to wire(s) that measured less than 2000 ohms. – – –1/1

10 Open in Pump Position Sensor Input and Return Wire Test	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the pump position sensor and ECU connector J3. 3. Using a multimeter, measure resistance between: • Terminal A in the pump position sensor connector AND terminal G4 in ECU connector J3 on the engine harness. • Terminal B in the pump position sensor connector AND terminal G3 in ECU connector J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO 11 **NO:** Open in pump position sensor wire that measure over 5 ohms. OR Terminal A and B in the pump position sensor harness connector inverted. OR Terminals G3 and G4 in the ECU connector J3 inverted. – – –1/1

11 Pump Position Sensor Input Wiring Harness Test	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Pump position sensor connector still disconnected. 3. Disconnect all three ECU connectors. 4. Using a multimeter, measure resistance between terminal G4 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all three ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO 12 **NO:** Short in pump position sensor input circuit to wire(s) that measured less than 2000 ohms. – – –1/1

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12 Pump Position Sensor Ground Wiring Harness Test	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF. 2. Pump position sensor connector and all three ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal G3 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all three ECU connectors. All measurements greater than 2000 ohms?	**YES:** Faulty ECU connector. OR Faulty ECU **NO:** Short in pump position sensor ground circuit to wire(s) that measured less than 2000 ohms. – – –1/1

000637.08 — Crank Position Input Missing

The ECU does not detect the crank position sensor input.

RG41221,0000247 –19–19SEP05–1/1

000637.08 — Crank Position Input Missing Diagnostic Procedure

Related Information:
The ECU does not detect the crank position sensor input.

Alarm Level:
Warning

Control Unit Response:
If this code sets, prolonged cranking time may be required to start the engine.

The ECU will only use the pump position sensor input to determine piston position.

If a pump position sensor diagnostic trouble code accompanies 000637.08, the engine will die and will not restart until at least one of the two codes is repaired.

The ECU will derate 50% per minute until the engine is running at 50% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further crank position sensor information, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the crank position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running 6. Read DTCs. Did 000637.08 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Crank Sensor Observable Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the crank position sensor. See REMOVE AND INSTALL CRANK POSITION SENSOR in Section 02, Group 110 of this manual. 3. Inspect the sensor tip for damage, such as cracks or debris. Is sensor free from damage?	**YES:** GO TO ❹ **NO:** Determine and repair the cause of damage to sensor. Replace sensor and retest. – – –1/1

❹ **Crank Sensor Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Crank position sensor still removed from the engine. 3. Using a multimeter, measure resistance between both terminals of the crank position sensor connector on the engine harness. Does the resistance measure between 2500 and 3500 ohms?	**YES:** GO TO ❺ **NO:** Faulty crank position sensor. – – –1/1
❺ **Open in Crank Sensor Input and Return Circuit Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect crank position sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between: • Terminal A in the pump position sensor connector and terminal F4 in the ECU connector J3 on the engine harness. • Terminal B in the pump position sensor connector and terminal F3 in the ECU connector J3 on the engine harness. Do both measure 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in circuit that measured above 5 ohms OR Terminals A and B in the crank position sensor harness connector inverted. OR Terminals F3 and F4 in the ECU connector J3 inverted. – – –1/1
❻ **Crank Position Sensor Input Wiring Harness Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Crank position sensor connector still disconnected. 3. Disconnect all 3 ECU connectors. 4. Using a multimeter, measure resistance between terminal F4 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all 3 ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO ❻ **NO:** Short in crank position sensor input circuit to wire that measured less than 2000 ohms. – – –1/1

❼ **Crank Position Sensor Return Wiring Harness**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Crank Position sensor connector and ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal F3 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all 3 ECU connectors. All measurements greater than 2000 ohms?	**YES:** Faulty crank position sensor connector. OR Faulty crank position sensor. OR Faulty ECU connector OR Faulty ECU **NO:** Short in crank position sensor return circuit to wire that measured less than 2000 ohms. – – –1/1

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000637.10 — Crank Position Input Pattern Error

The ECU detects an improper pattern on the crank position sensor input.

RG41221,0000248 –19–21OCT05–1/1

000637.10 — Crank Position Input Pattern Error Diagnostic Procedure

Related Information:
The ECU detects an improper pattern on the crank position sensor input.

Alarm Level:
Warning

Control Unit Response:
Prolonged cranking time may be required to start the engine.

The ECU will only use the pump position sensor input to determine piston position.

If a pump position sensor diagnostic trouble code accompanies 000637.10, the engine will die and will not restart until at least one of the two codes is repaired.

The ECU will derate 50% per minute until the engine is running at 50% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further crank position sensor information, see CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the crank position sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000637.10 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

❸ **Crank Sensor Observable Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove the crank position sensor. See REMOVE AND INSTALL CRANK POSITION SENSOR in Section 02, Group 110 of this manual. 3. Inspect the sensor tip for damage, such as cracks or debris. Is sensor free from damage?	**YES:** GO TO ❹ **NO:** Determine and repair the cause of damage to sensor. Replace sensor and retest. – – –1/1

❹ **Crank Sensor Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect crank position sensor connector. 3. Using a multimeter, measure resistance between both terminals of the crank position sensor connector on the engine harness. Does the resistance measure between 2500 and 3500 ohms?	**YES:** GO TO ❺ **NO:** Faulty crank position sensor. – – –1/1
❺ **Open in Crank Sensor Input and Return Circuit Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect crank position sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between: • Terminal A in the sensor connector and terminal F4 in the ECU connector J3 on the engine harness. • Terminal B in the sensor connector and terminal F3 in the ECU connector J3 on the engine harness. Do both measure 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in circuit that measured above 5 ohms OR Terminals A and B in the crank position sensor harness connector inverted. OR Terminals F3 and F4 in the ECU connector J3 inverted. – – –1/1
❻ **Crank Position Sensor Input Wiring Harness Test**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Crank position sensor connector still disconnected. 3. Disconnect all 3 ECU connectors. 4. Using a multimeter, measure resistance between terminal F4 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all 3 ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO ❻ **NO:** Short in crank position sensor input circuit to wire that measured less than 2000 ohms. – – –1/1

❼ **Crank Position Sensor Return Wiring Harness**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Crank Position sensor connector and ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal F3 in the ECU connector J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all 3 ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO ❽ **NO:** Short in crank position sensor return circuit to wire that measured less than 2000 ohms. – – –1/1

❽ **Pump Position Timing Check**	Verify pump position timing is correct. See CHECK HIGH PRESSURE FUEL PUMP STATIC TIMING in Section 04, Group 150 earlier in this manual. **IMPORTANT: There is no timing adjustment for the fuel pump. Use the Static Timing procedure to check for proper installation.** Is pump position timing correct?	**YES:** Faulty crank position sensor connector. OR Faulty crank position sensor. OR Faulty ECU connector OR Faulty ECU **NO:** Repair and recheck. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP in Section 2, Group 090 in this manual. – – –1/1

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000640.11 — Engine Shutdown—Vehicle Request Invalid

ECU received an invalid request to shut down the engine..

Alarm Level:
STOP

Control Unit Response:
The engine will not shut down.

Additional References:
Refer to the equipment's diagnostic test manual.

WL30140,000002D –19–12APR06–1/1

000640.11 — Engine Shutdown—Vehicle Request Invalid

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000640.11 error code active?	**YES:** GO TO ❸ **NO:** GO TO ❷

– – –1/1

❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see the application manual.

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000640.31 — Engine Shutdown—Vehicle Request

The ECU receives a valid engine shutdown signal.

WL30140,000002E –19–12APR06–1/1

000640.31 — Engine Shutdown - Vehicle Request Diagnostic Procedure

Alarm Level:
STOP

Control Unit Response:
The engine will shut down. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
Refer to the equipment's diagnostic test manual.

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000640.11 error code active?	**YES:** GO TO ❸ **NO:** GO TO ❷

– – –1/1

❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see the application manual.

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000641.04 — Turbo Actuator Error

The turbo actuator has been disabled after numerous attempts to power the controller.

RG41221,0000249 –19–24MAY06–1/1

000641.04 — Turbo Actuator Error Diagnostic Procedure

Related Information:
The ECU receives a message stating the actuator could not reach it expected end points during the Turbo Learn portion of the Harness Diagnostic Mode Test.

When DTC is Displayed:
When ever the ignition is on and the error is active.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine may experience low power due to turbo actuator not moving.

Additional References:
For further turbo actuator information, see TURBO ACTUATOR in Section 03, Group 135 earlier in this manual.

For further turbocharger information, see AIR INTAKE AND EXHAUST SYSTEM REPAIR AND ADJUSTMENT in the base engine manual.

NOTE: When directed to run the HARNESS DIAGNOSTIC MODE TEST or TURBO LEARN VALVE RESET TEST the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000641.04 active?	**YES:** GO TO ❷ **NO:** GO TO ❽ – – –1/1

❷ **Actuator Supply Voltage Check**	1. Ignition OFF, Engine OFF. 2. Disconnect actuator connector from engine harness connector. 3. Ignition ON, Engine OFF. 4. Measure the voltage between the power (terminal 1) and ground (terminal 2 in the engine harness connector. Is the voltage approximately battery voltage?	**YES:** GO TO ❽ **NO:** GO TO ❸ – – –1/1
❸ **VGT Actuator Connector Terminal Test**	1. Disconnect VGT actuator connectors. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ⓫. – – –1/1
❹ **Ground Connection Check**	Measure resistance between VGT actuator ground (terminal 2) in engine harness and application single point ground. Is resistance less than 1 ohm?	**YES:** GO TO ❺. **NO:** Repair connection. Reconnect all connectors and retest. – – –1/1
❺ **Power Connection Check One**	Measure resistance between VGT actuator power (terminal 1) and the ECU VGT power (J1 terminal H3) in the engine harness. Is resistance less than 1 ohm?	**YES:** GO TO ❻. **NO:** Repair connection. Reconnect all connectors and retest. – – –1/1

❻ **Power Connection Check Two**	Measure resistance between VGT actuator power (terminal 1) and the ECU VGT power (J1 terminal H4) in the engine harness. Is resistance less than 1 ohm?	**YES:** GO TO ❼. **NO:** Repair connection. Reconnect all connectors and retest. – – –1/1
❼ **ECU Internal Resistance Check**	Measure resistance between the ECU VGT power (J1 terminal H4) and ECU ground (J2 terminal M2) on the ECU. Is resistance between 4.5k and 5.5k ohms?	**YES:** Everything checks good. Reconnect all connectors and retest. **NO:** Wiring checks good. Replace ECU and retest. – – –1/1
❽ **Occurrence Count Check**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review occurrence counts in the snapshot capture information for this code. Is count greater than five?	**YES:** GO TO ❾. **NO:** GO TO ❿. – – –1/1
❾ **VGT Actuator and ECU Connector Terminal Test**	1. Disconnect VGT actuator connector and all ECU connectors. 2. Perform TERMINAL TEST on all connectors. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ❿. – – –1/1
❿ **Further Review of Snapshot Information**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO ⓫. **NO:** GO TO ⓭. – – –1/1
⓫ **Engine Error Operating Point Test**	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Is 000641.04 active?	**YES:** GO TO ⓬. **NO:** GO TO ⓱. – – –1/1

⓬ **Actuator Cooling System Check**	1. Ignition OFF, Engine OFF. 2. Bleed air from the actuator cooling system, see BLEEDING ACTUATOR COOLING SYSTEM in base engine manual. 3. Ignition ON, Engine ON. 4. Set engine to operating point that caused error. Is 000641.04 active?	**YES:** Remove and Replace VGT actuator. Recalibrate, see TURBO LEARN VALVE RESET TEST. **NO:** Problem fixes. Actuator cooling system had air in it. – – –1/1

⓭ **VGT Connector Terminal Test**	1. Ignition OFF, Engine OFF. 2. Disconnect VGT actuator connector. 3. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ⓮. – – –1/1

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⓮ **ECU Connector Terminal Test**	1. Disconnect ECU connectors J1 (black face) and J2 (red face). 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ⓯. – – –1/1

⓯ **Actuator Removal and Install**	1. Reconnect ECU connector. 2. Remove and Install turbo actuator, see REMOVE AND INSTALL TURBOCHARGER ACTUATOR in base engine manual. 3. Recalibrate, see TURBO LEARN VALVE RESET TEST. 4. Refresh codes. Is 000641.04 active?	**YES:** GO TO ⓰. **NO:** Problem fixed. Bad actuator. – – –1/1

16 Reprogram ECU	1. Ignition ON, Engine OFF. 2. Reprogram ECU, see REPROGRAMMING ENGINE CONTROL UNIT (ECU). 3. Run Harness Diagnostic Mode Test. 4. Refresh codes. Is 000641.04 active?	**YES:** Remove and Replace ECU. Retest. **NO:** Problem fixed. Bad ECU program. – – –1/1

17 VGT Actuator Connector Terminal Test	1. Ignition OFF, Engine OF. 2. Disconnect VGT actuator connectors. 3. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Remove and Replace VGT actuator. Recalibrate, see TURBO LEARN VALVE RESET TEST. – – –1/1

000641.12 — ECU/Turbo Actuator Communication Error

The ECU and turbo actuator controller have lost communication.

RG41221,000024B –19–24MAY06–1/1

000641.12 - ECU/Turbo Actuator Communication Error Diagnostic Procedure

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Related Information:
The ECU determines it has lost communications withe the actuator.

When DTC is Displayed:
When ever the ignition is on and the error is active.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the Actuator will go to the 20% closed position and stay there.

Additional References:
For further turbo actuator information, see TURBO ACTUATOR in Section 03, Group 135 earlier in this manual.

For further turbocharger information, see AIR INTAKE AND EXHAUST SYSTEM REPAIR AND ADJUSTMENT in the base engine manual.

NOTE: When directed to run the HARNESS DIAGNOSTIC MODE TEST or TURBO LEARN VALVE RESET TEST the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000641.12 active?	**YES:** GO TO ❷ **NO:** GO TO ㉕
❷ **Actuator Supply Voltage Check**	1. Ignition OFF, Engine OFF. 2. Disconnect actuator connector from engine harness connector. 3. Ignition ON, Engine OFF. 4. Measure the voltage between the power (terminal 1) and ground (terminal 2 in the engine harness connector. Is the voltage approximately battery voltage?	**YES:** GO TO ❸ **NO:** GO TO ❹
❸ **VGT Actuator Connector Terminal Test**	1. Disconnect VGT actuator connectors. 2. Check connector, see TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ❹.
❹ **Ground Connection Check**	Measure resistance between VGT actuator ground (terminal 2) in engine harness and application single point ground. Is resistance less than 1 ohm?	**YES:** GO TO ❺. **NO:** Repair connection. Reconnect all connectors and retest.
❺ **Actuator Communications Circuit Resistance Check**	Measure resistance between VGT actuator ground (terminal 2) and VGT (UART) communications (terminal 4) in the actuator harness. Is resistance between 45k and 55k ohms?	**YES:** GO TO ❻. **NO:** Repair connection. Reconnect all connectors and retest.

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❻ **Actuator Power Circuit Resistance Check**	Measure resistance between VGT actuator power (terminal 1) and ground (terminal 2) in the actuator harness. *NOTE: Be sure to put the red lead on terminal 1 and the black lead on terminal 2 because of the capacitor action in the supply.* Is resistance greater than 20M ohms in 20 seconds?	**YES:** GO TO ❼. **NO:** Repair connection. Reconnect all connectors and retest. – – –1/1

❼ **ECU Communications Circuit Resistance Check**	Measure resistance between ECU communications ground (terminal 2) and VGT (UART) communications (terminal 4) in the engine harness. Is resistance between 1k and 2k ohms?	**YES:** GO TO ❽. **NO:** GO TO ⓮. – – –1/1

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❽ **ECU Power Circuit Resistance Check**	Measure resistance between VGT actuator power (terminal 1) and ground (terminal 2) in the actuator harness. Is resistance between 4.5k and 5.5k ohms?	**YES:** GO TO ❾. **NO:** GO TO ⓴. – – –1/1

❾ **Communications Short to High Voltage Check**	1. Ignition ON, Engine OFF. 2. Measure the voltage between the (UART) communications (terminal 4) and ground (terminal 2) in the engine harness? Is voltage above 5.5 volts?	**YES:** GO TO ❿. **NO:** GO TO ⓫. – – –1/1

❿ **Communications Short Restistance Check**	1. Ignition OFF, Engine OFF. 2. Remove all ECU connectors. 3. Measure resistance between the ECU (UART) communications (J3 terminal E3) wire and all other terminals in all connectors Are any terminals shorted to J3 terminal E3?	**YES:** Repair wiring and retest. **NO:** Check for pinched or melted wiring. Reconnect all connectors and retest. – – –1/1

⓫ **Actuator Retest**	1. Ignition OFF, Engine OFF. 2. Reconnect VGT actuator connector. 3. Ignition ON, Engine OFF. 4. Retest, see Harness Diagnostic Mode Test. Is 000641.12 active?	**YES:** GO TO ⓬. **NO:** Problem fixed. Bad connection. – – –1/1
⓬ **Actuator Removal and Install**	1. Reconnect ECU connector. 2. Remove and Install turbo actuator, see REMOVE AND INSTALL TURBOCHARGER ACTUATOR in base engine manual. 3. Recalibrate, see TURBO LEARN VALVE RESET TEST. 4. Refresh codes. Is 000641.12 active?	**YES:** GO TO ⓭. **NO:** Problem fixed. Bad actuator. – – –1/1
⓭ **Reprogram ECU**	1. Ignition ON, Engine OFF. 2. Reprogram ECU, see REPROGRAMMING ENGINE CONTROL UNIT (ECU). 3. Run Harness Diagnostic Mode Test. 4. Refresh codes. Is 000641.12 active?	**YES:** Remove and Replace ECU. Retest. **NO:** Problem fixed. Bad ECU program. – – –1/1
⓮ **ECU Communications Circuit Resistance Check**	Measure resistance between ECU communications ground (terminal 2) and VGT (UART) communications (terminal 4) in the engine harness. Is resistance less than 10 ohms?	**YES:** UART wire shorted to ground. Repair and retest. **NO:** GO TO ⓯. – – –1/1
⓯ **ECU Connectors Terminal Test**	1. Disconnect all ECU connectors. 2. Check all connectors, see TERMINAL TEST earlier in this section. Were any problems found?	**YES:** Repair problems and retest. **NO:** GO TO ⓰. – – –1/1

16 UART Wire Resistance Check	Measure resistance between the UART communications (terminal 4) in the actuator engine harness connector and the ECU UART communications (J3 terminal E3). Is resistance less than 1 ohm?	**YES:** GO TO 17. **NO:** UART wire open. Repair and retest. – – –1/1
17 Ground Wire Resistance Check	Measure resistance between the ground (terminal 2) in the actuator engine harness connector and the ECU ground (J2 terminal M2). Is resistance less than 1 ohm?	**YES:** GO TO 18. **NO:** Ground wire open. Repair and retest. – – –1/1
18 ECU Internal Resistance Check	Measure resistance between the ECU VGT power (J1 terminal H4) and ECU ground (J2 terminal M2) on the ECU. Is resistance between 4.5k and 5.5k ohms?	**YES:** Everything checks good. Reconnect all connectors and retest. **NO:** Wiring checks good. Replace ECU and retest. – – –1/1
19 VGT Actuator Connector Terminal Test	1. Disconnect VGT actuator connectors. 2. Check connector, see TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 21. – – –1/1
20 ECU J1 Connector Terminal Test	1. Disconnect VGT actuator connectors. 2. Check connector, see TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 22. – – –1/1
21 Ground Connection Check	Measure resistance between VGT actuator ground (terminal 2) in engine harness and application single point ground. Is resistance less than 1 ohm?	**YES:** GO TO 22. **NO:** Repair connection. Reconnect all connectors and retest. – – –1/1
22 Power Connection Check One	Measure resistance between VGT actuator power (terminal 1) and the ECU VGT power (J1 terminal H3) in the engine harness. Is resistance less than 1 ohm?	**YES:** GO TO 23. **NO:** Repair connection. Reconnect all connectors and retest. – – –1/1
23 Power Connection Check Two	Measure resistance between VGT actuator power (terminal 1) and the ECU VGT power (J1 terminal H4) in the engine harness. Is resistance less than 1 ohm?	**YES:** GO TO 24. **NO:** Repair connection. Reconnect all connectors and retest. – – –1/1

24 ECU Internal Resistance Check	1. Disconnect ECU connector J2 (red face). 2. Measure resistance between the ECU VGT power (J1 terminal H4) and ECU ground (J2 terminal M2) on the ECU. Is resistance between 4.5k and 5.5k ohms?	**YES:** Everything checks good. Reconnect all connectors and retest. **NO:** Wiring checks good. Replace ECU and retest. – – –1/1
25 Occurrence Count Check	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review occurrence counts in the snapshot capture information for this code. Is count greater than five?	**YES:** GO TO 26. **NO:** GO TO 27. – – –1/1
26 VGT Actuator and ECU Connector Terminal Test	1. Disconnect VGT actuator connector and all ECU connectors. 2. Check all connectors, see TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 27. – – –1/1
27 Further Review of Snapshot Information	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO 28. **NO:** GO TO 30. – – –1/1
28 Engine Error Operating Point Test	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Is 000641.12 active?	**YES:** GO TO 29. **NO:** GO TO 34. – – –1/1
29 Actuator Cooling System Check	1. Ignition OFF, Engine OFF. 2. Bleed air from the actuator cooling system, see BLEEDING ACTUATOR COOLING SYSTEM in base engine manual. 3. Ignition ON, Engine ON. 4. Set engine to operating point that caused error. Is 000641.12 active?	**YES:** Remove and Replace VGT actuator. Recalibrate, see TURBO LEARN VALVE RESET TEST. **NO:** Problem fixes. Actuator cooling system had air in it. – – –1/1

30 VGT Connector Terminal Test	1. Ignition OFF, Engine OFF. 2. Disconnect VGT actuator connector. 3. PCheck connector, see TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 31. – – –1/1

31 ECU Connector Terminal Test	1. Disconnect ECU connectors J1 (black face) and J2 (red face). 2. Check connector, see TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 32. – – –1/1

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32 Actuator Removal and Install	1. Reconnect ECU connector. 2. Remove and Install turbo actuator, see REMOVE AND INSTALL TURBOCHARGER ACTUATOR in base engine manual. 3. Recalibrate, see TURBO LEARN VALVE RESET TEST. 4. Refresh codes. Is 000641.12 active?	**YES:** GO TO 33. **NO:** Problem fixed. Bad actuator. – – –1/1

33 Reprogram ECU	1. Ignition ON, Engine OFF. 2. Reprogram ECU, see REPROGRAMMING ENGINE CONTROL UNIT (ECU). 3. Run Harness Diagnostic Mode Test. 4. Refresh codes. Is 000641.12 active?	**YES:** Remove and Replace ECU. Retest. **NO:** Problem fixed. Bad ECU program. – – –1/1

000641.13 — Turbo Actuator Learned Value Error

The turbo actuator determines that the learned value is incorrect.

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000641.13 - Turbo Actuator Learned Value Error Diagnostic Procedure

Related Information:
The ECU receives a message stating the actuator could not reach it expected end points during the Turbo Learn portion of the Harness Diagnostic Mode Test.

When DTC is Displayed:
After running the Harness Diagnostic Mode Test.

Alarm Level:
Warning

Control Unit Response:
The error code will be displayed at the end of the test.

Additional References:
For further turbo actuator information, see TURBO ACTUATOR in Section 03, Group 135 earlier in this manual.

For further turbocharger information, see AIR INTAKE AND EXHAUST SYSTEM REPAIR AND ADJUSTMENT in the base engine manual.

NOTE: When directed to run the HARNESS DIAGNOSTIC MODE TEST or TURBO LEARN VALVE RESET TEST the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Run Harness Diagnostic Mode Test. 5. Refresh DTC list. Is 000641.13 active?	**YES:** GO TO ❷ **NO:** GO TO ❾ – – –1/1

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❷ **Actuator Linkage Test**	1. Ignition OFF, Engine OFF. **CAUTION: Turbo and linkage may be very hot.** 2. Check turbo to actuator linkage for free movement through it's complete travel, see REMOVE AND INSTALL ACTUATOR LINKAGE in base engine manual. Is linkage movement free?	**YES:** GO TO ❸ **NO:** GO TO ❺ – – –1/1

❸ **Actuator Linkage Hold Position Check**	1. Not the position of the actuator linkage. It should change in the next step. 2. Ignition ON, Engine ON. 3. Linkage should have moved slightly and is being held in that position. Did linkage move and is it being held in position?	**YES:** GO TO ❹ **NO:** Remove and replace Actuator. Recalibarate actuator using Service ADVISOR, TURBO LEARN VALVE RESET TEST. – – –1/1

❹ **Other Codes Check**	1. Ignition ON, Engine OFF. 2. Refresh DTC list. Are there any 000641 error codes active?	**YES:** Troubleshoot those active codes. **NO:** Replace Actuator. Recalibrate using Service ADVISOR, TURBO LEARN VALVE RESET TEST. – – –1/1
❺ **Turbo Vane and Linkage Check**	1. Ignition OFF, Engine OFF. 2. Disconnect actuator linkage form actuator. 3. Move linkage through full range moving turbo vanes. Is movement free?	**YES:** GO TO ❻ **NO:** GO TO ❼ – – –1/1
❻ **Actuator Travel Check**	1. Disconnect linkage form actuator. 2. Using an appropriate wrench on actuator shaft, move through full range checking for sticking and spring return. Is movement free and is there spring tension?	**YES:** Repair binding linkage. Run Harness Diagnostic Mode Test in Service ADVISOR. **NO:** Replace Actuator. Recalibrate using Service ADVISOR, TURBO LEARN VALVE RESET TEST. – – –1/1
❼ **Actuator to Turbo Linkage Check**	1. Disconnect linkage form turbo. 2. Inspect linkage for evidence of binding problems or possible binding problems. Is linkage free from problems?	**YES:** Is movement free **NO:** GO TO ❽. – – –1/1

❽ **Turbo Vane Travel Check**	Using an appropriate wrench on turbo vane shaft, move through full range checking for sticking. Is movement free?	**YES:** Repair binding linkage. Run Harness Diagnostic Mode Test in Service ADVISOR. **NO:** Replace Turbo. Recalibrate using Service ADVISOR, TURBO LEARN VALVE RESET TEST. – – –1/1

❾ **Occurrence Count Check**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review occurrence counts in the snapshot capture information for this code. Is count greater than five?	**YES:** GO TO ❿. **NO:** GO TO ⓫. – – –1/1

❿ **VGT Actuator Connector Terminal Test**	1. Disconnect VGT actuator connectors. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ⓫. – – –1/1

⓫ **Further Review of Snapshot Information**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO ⓬. **NO:** GO TO ⓭. – – –1/1

⓬ **Engine Error Operating Point Test**	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Did 000641.13 appear active when engine got hot?	**YES:** GO TO ❷. **NO:** GO TO ⓰. – – –1/1

⓭ **VGT Actuator Connector Terminal Test**	1. Disconnect VGT actuator connectors. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ⓮. – – –1/1

14 ECU Connector Terminal Test	1. Disconnect ECU connector J3 (blue face). 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 15. – – –1/1

15 Actuator Removal and Install	1. Reconnect ECU connector. 2. Remove and Install turbo actuator, see REMOVE AND INSTALL TURBOCHARGER ACTUATOR in base engine manual. 3. Recalibrate, see TURBO LEARN VALVE RESET TEST. 4. Refresh codes. Is 000641.13 active?	**YES:** GO TO 16. **NO:** Problem fixed. Bad actuator. – – –1/1

16 VGT Actuator Connector Terminal Test	1. Disconnect VGT actuator connectors. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 11. – – –1/1

000641.16 — Turbo Actuator Temperature Moderately High

The ECU receives a turbo actuator temperature above specification message from the actuator.

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000641.16 — Turbo Actuator Temperature Moderately High Diagnostic Procedure

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Related Information:
The turbo actuator notifies the ECU that the turbo actuator temperature is above specification [115°C (239°F)].

When DTC is Displayed:
After running the Harness Diagnostic Mode Test.

Alarm Level:
Warning

Control Unit Response:
Normal operation.

Additional References:
For further turbo actuator information, see TURBO ACTUATOR in Section 03, Group 135 earlier in this manual.

For further turbocharger information, see AIR INTAKE AND EXHAUST SYSTEM REPAIR AND ADJUSTMENT in the base engine manual.

NOTE: When directed to run the HARNESS DIAGNOSTIC MODE TEST or TURBO LEARN VALVE RESET TEST the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Run Harness Diagnostic Mode Test. 5. Refresh DTC list. Is 000641.16 active?	**YES:** GO TO ❷ **NO:** GO TO ❻ – – –1/1

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❷ **Coolant Temperature Codes Check**	1. Ignition ON, Engine ON. 2. Run engine to hottest operating temperature. 3. Refresh codes. 4. Check list for high coolant temperature codes 000110.00, 000110.15 or 000110.16. Are any of these codes active?	**YES:** Troubleshoot those codes first. **NO:** GO TO ❸ – – –1/1

❸ **Air Flow Check**	1. Ignition OFF, Engine OFF. **CAUTION: Turbo and actuator may be very hot.** 2. Check for blocked air flow around the actuator. Is area open and free of obstructions?	**YES:** GO TO ❹ **NO:** Clear area and retest. – – –1/1

❹ **Actuator Cooling System Check**	1. Ignition OFF, Engine OFF. 2. Bleed air from the actuator cooling system, see BLEEDING ACTUATOR COOLING SYSTEM in base engine manual. 3. Ignition ON, Engine ON. 4. Set engine to operating point that caused error. Is 000641.16 active?	**YES:** Remove and Replace VGT actuator. Recalibrate, see TURBO LEARN VALVE RESET TEST. **NO:** Problem fixes. Actuator cooling system had air in it. – – –1/1
❺ **Turbo Vane and Linkage Check**	1. Ignition ON, Engine ON. 2. Run engine to hottest operating temperature. 3. Refresh codes. Is 000641.16 active?	**YES:** Remove and Replace actuator. Recalibrate, see TURBO LEARN VALVE RESET TEST. **NO:** Problem fixed. Actuator cooling system had air in it. – – –1/1
❻ **Occurrence Count Check**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review occurrence counts in the snapshot capture information for this code. Is count greater than five?	**YES:** GO TO ❼. **NO:** GO TO ❽. – – –1/1
❼ **VGT Actuator Connector Terminal Test**	1. Disconnect VGT actuator connectors. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ❽. – – –1/1
❽ **Further Review of Snapshot Information**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO ❾. **NO:** GO TO ⓫. – – –1/1

9 Engine Error Operating Point Test	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Did 000641.16 appear active when engine got hot?	**YES:** GO TO 10. **NO:** GO TO 8. – – –1/1
10 Actuator Cooling System Check	1. Ignition OFF, Engine OFF. 2. Bleed air from the actuator cooling system, see BLEEDING ACTUATOR COOLING SYSTEM in base engine manual. 3. Ignition ON, Engine ON. 4. Set engine to operating point that caused error. Is 000641.16 active?	**YES:** Remove and Replace VGT actuator. Recalibrate, see TURBO LEARN VALVE RESET TEST. **NO:** Problem fixes. Actuator cooling system had air in it. – – –1/1
11 VGT Actuator Connector Terminal Test	1. Disconnect VGT actuator connectors. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 12. – – –1/1
12 ECU Connector Terminal Test	1. Disconnect ECU connectors J1 (black face) and J3 (blue face). 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 13. – – –1/1
13 Actuator Removal and Install	1. Reconnect ECU connector. 2. Remove and Install turbo actuator, see REMOVE AND INSTALL TURBOCHARGER ACTUATOR in base engine manual. 3. Recalibrate, see TURBO LEARN VALVE RESET TEST. 4. Refresh codes. Is 000641.16 active?	**YES:** GO TO 14. **NO:** Problem fixed. Bad actuator. – – –1/1

⓮ **Reprogram ECU**	1. Ignition ON, Engine OFF. 2. Reprogram ECU, see REPROGRAMMING ENGINE CONTROL UNIT (ECU). 3. Run Harness Diagnostic Mode Test. 4. Refresh codes. Is 000641.16 active?	**YES:** Remove and Replace ECU. Retest. **NO:** Problem fixed. Bad ECU program.

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000647.05 — Fan Drive Output 1 Shorted or Open

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This procedure is being developed and will be available as soon as possible.

Alarm Level:
STOP

Control Unit Response:
The engine will not shut down.

Additional References:
Refer to the equipment's diagnostic test manual.

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000647.05 — Engine Shutdown—Vehicle Request Invalid

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000647.05 error code active?	**YES:** GO TO ❷ **NO:** GO TO ❷

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see the application manual.

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000647.07 — Fan Drive Output 2 Shorted or Open

ECU has detected fan drive output 2 shorted or open.

Alarm Level:
STOP

Control Unit Response:
The engine will not shut down.

Additional References:
Refer to the equipment's diagnostic test manual.

WL30140,0000030 –19–12APR06–1/1

000647.07 — Engine Shutdown—Vehicle Request Invalid

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000647.07 error code active?	**YES:** GO TO ❷ **NO:** GO TO ❷

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see the application manual.

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000651.02 — Cylinder 1 Electronic Injector Part Number Invalid

The ECU detects an incorrect injector part number was installed or calibrated into cylinder 1.

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000651.02 — Cylinder 1 Electronic Injector Part Number Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect part number for the injector in cylinder 1. If the incorrect injector part number has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 1 is electrically injector 0.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 1.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed in cylinder 1?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector Part Number Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the part number for the injector in cylinder 1. 3. Compare the part number (provided with the new injector) of the newly installed injector to the part number found in the diagnostic software. 4. If the part number of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual. 7. Compare the part number located on the top tab of the injector to that of the diagnostic software. Do the injector part numbers match? Install the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual.	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector with the correct part number and recalibrate ECU. – – –1/1

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000651.05 — Cylinder 1 Electronic Injector Circuit Open

The ECU detects an open in the cylinder 1 electronic injector circuit.

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000651.05 — Cylinder 1 Electronic Injector Circuit Open Diagnostic Procedure

Related Information:
The ECU detects an open in the cylinder 1 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 1 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000651.05 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Open in Electronic Injector Control Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 1 in the harness end of the injector wiring harness connector and terminal E1 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in electronic injector 1 control wire. – – –1/1

❹ **Open in 90V Supply Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Electronic injector wiring harness connector and ECU connector J1 still disconnected. 3. Using a multimeter, measure resistance between terminal 4 in the harness end of the injector wiring harness connector and terminal G1 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in electronic injector 1 90V supply wire. – – –1/1

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❺ **Cylinder 1 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 1 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❻ **NO:** Faulty cylinder 1 electronic injector solenoid. Replace injector and retest. See REMOVE AND INSTALL ELECTRONIC INJECTORS (EIs). – – –1/1

❻ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Cylinder 1 injector wires still disconnected from injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 1 electronic injector harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head (either terminal 1 or 4, the injectors are not polarity sensitive). • The other cylinder 1 electronic injector harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head Both measurements 2.0 ohms or less?	**YES:** Faulty ECU connection. OR Faulty electronic injector wiring harness connection. OR Faulty ECU **NO:** Open in wire(s) that measured above 2.0 ohms. Repair and retest. – – –1/1

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000651.06 — Cylinder 1 Electronic Injector Circuit Shorted

The ECU detects a short in the cylinder 1 electronic injector circuit.

RG41221,0000250 –19–19SEP05–1/1

000651.06 — Cylinder 1 Electronic Injector Circuit Shorted Diagnostic Procedure

Related Information:
The ECU detects a short in the cylinder 1 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 1 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000651.06 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Short In Electronic Injector Wiring Harness Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 1 in the harness end of electronic injector wiring connector and the following: • Terminal 4 in the harness end of the electronic injector wiring harness connector. • Terminal 9 in the harness end of the electronic injector wiring harness connector. Is the resistance greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in wires that measured less than 2000 ohms. Repair and retest. – – –1/1

❹ **Cylinder 1 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 1 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❺ **NO:** Faulty cylinder 1 electronic injector solenoid. Replace injector and retest. See REMOVE AND INSTALL ELECTRONIC INJECTORS (EIs). – – –1/1

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❺ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Keep cylinder 1 wiring harness disconnected from electronic injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Cylinder 1 injector wires still disconnected from injector. 5. Using a multimeter, measure resistance between the following: • One of the eyelets for injector 1 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. • The other eyelet for injector 1 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. Is resistance 5 ohms or less?	**YES:** Faulty ECU connection. OR Faulty ECU **NO:** Short in wire that measured more than 5 ohms. Repair and retest. – – –1/1

000651.07 — Cylinder 1 Electronic Injector Mechanical Failure

The fuel rail pressure does not drop at the injection of fuel to cylinder 1.

RG41221,0000251 –19–17OCT05–1/1

000651.07 — Cylinder 1 Electronic Injector Mechanical Failure Diagnostic Procedure

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Related Information:
The ECU does not detect a drop in fuel rail pressure when cylinder 1 injects fuel.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 1 may not be injecting fuel.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Initial Inspection**	1. Check for fuel leaks on the high-pressure side of the fuel delivery system. 2. Check the oil dipstick for fuel in the oil pan. 3. Check for severely bent or pinched fuel lines. Were any problems found?	**YES:** Repair and retest. If there is fuel in the oil pan, remove the rocker cover and inspect injectors as described in step 6. GO TO ❻ **NO:** GO TO ❷

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❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1
❸ **Flow Damper Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running under condition that set 000651.07. 2. Using the ECU diagnostic software, watch for 000651.07 to set (refresh the active code list until 000651.07 sets). 3. While turning ignition OFF, listen for the ball to seat in flow damper that corresponds to cylinder 1. *NOTE: It is difficult to distinguish between cylinder 1 flow damper click and the other flow damper clicks. Make sure the click is made by the flow damper for cylinder 1. It takes 5-10 seconds for the ball to reseat.* Does cylinder 1 flow damper click?	**YES:** GO TO ❹ **NO:** Faulty flow damper. Replace flow damper and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1
❹ **Injector Wiring Harness Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2.Remove rocker arm cover with vent tube. (to reinstall, see REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 02, Group 090 of this manual) 3. Verify all injector terminal nuts are tightened to specification. **Specification** Injector Terminal Nut—Torque..... 2.25 ± 0.5 Nm (27 ± 6 lb-in) All connections tightened per specification?	**YES:** GO TO ❺ **NO:** Tighten retaining nut(s) to specification and retest. – – –1/1

❺ Injector Fuel Line Restriction Test	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* **CAUTION: Fuel lines may be under high pressure. Use extreme caution while opening fuel lines. Let the engine sit for several minutes after cranking or running prior to opening fuel lines.** **CAUTION: Escaping fluid under pressure can penetrate skin causing serious injury. Avoid the hazard be relieving pressure before disconnecting hydraulic or other high pressure lines. Tighten all connections before applying pressure. Search for leaks with a piece or cardboard. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately. Any fluids injected into the skin must be surgically removed within 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, USA.** 1. Ignition OFF for 5 minutes. 2. Disconnect the fuel line between high pressure common rail and the fuel inlet connector for injector at cylinder 1 according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: While removing the fuel line nut, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.** 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line according to INSTALL INJECTORS in Section 2 Group 090 of this manual and retest. **NO:** GO TO ❻ – – –1/1
❻ Fuel Inlet Connector (Side Feed Tube) Check	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove the fuel inlet connector (“side feed tube”) according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: Inlet connector and o-ring must be replaced whenever the inlet connector nut is loosened. The tip of the connector is comparatively soft and form-fits into the injector. Once deformed, the connector will not re-seal properly.** 3. Inspect the fuel inlet connector at cylinder 1 for galling, nicks, burrs, or other damage. *NOTE: Anything more than a hairline on the inlet connector where it contacts the injector indicates there may be a faulty seal at the injector.* Does the inlet connector appear damaged?	**YES:** Remove and inspect injector at cylinder 1 according to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2 Group 090 of this manual. **NO:** Replace the fuel inlet connector according to INSTALL INJECTORS in Section 2 Group 090 of this manual. – – –1/1

000651.13 — Cylinder 1 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,0000252 –19–17OCT05–1/1

000651.13 — Cylinder 1 Electronic Injector QR Code Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect QR Code was calibrated into the ECU. If the incorrect injector QR code has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 1 is electrically injector 0.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 1.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed into cylinder 1?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector QR Code Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the QR Code of the injector in cylinder 1. 3. Compare the QR code (provided with the new injector) of the newly installed injector to the QR Code found in the diagnostic software. 4. If the QR code of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the rocker cover. 7. Compare the QR code located on the tag on the top of the injector to that of the diagnostic software. Do the QR codes match? If removed, install the rocker cover. Tighten the rocker cover cap screws to specification and in the proper sequence. Refer to ADJUST VALVE CLEARANCE in Section 2, Group 21 of the 9.0L Base Engine manual (CTM400).	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate the injector with the correct QR code. – – –1/1

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000652.02 — Cylinder 2 Electronic Injector Part Number Invalid

The ECU detects an incorrect injector part number was installed or calibrated into cylinder 2.

RG41221,0000253 –19–17OCT05–1/1

000652.02 — Cylinder 2 Electronic Injector Part Number Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect part number for the injector in cylinder 2. If the incorrect injector part number has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 2 is electrically injector 4.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 2.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed in cylinder 2?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector Part Number Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the part number for the injector in cylinder 2. 3. Compare the part number (provided with the new injector) of the newly installed injector to the part number found in the diagnostic software. 4. If the part number of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual. 7. Compare the part number located on the top tab of the injector to that of the diagnostic software. Do the injector part numbers match? Install the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual.	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector with the correct part number and recalibrate ECU. – – –1/1

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000652.05 — Cylinder 2 Electronic Injector Circuit Open

The ECU detects an open in the cylinder 2 electronic injector circuit.

RG41221,0000254 –19–19SEP05–1/1

000652.05 — Cylinder 2 Electronic Injector Circuit Open Diagnostic Procedure

Related Information:
The ECU detects an open in the cylinder 2 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 2 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000652.05 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Open in Electronic Injector Control Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 2 in the harness end of the injector wiring harness connector and terminal B1 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in electronic injector 2 control wire. – – –1/1

❹ **Open in 90V Supply Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Electronic injector wiring harness connector and ECU connector J1 still disconnected. 3. Using a multimeter, measure resistance between terminal 4 in the harness end of the injector wiring harness connector and terminal G1 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in electronic injector 2 90V supply wire. – – –1/1

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❺ **Cylinder 2 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 2 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❻ **NO:** Faulty cylinder 2 electronic injector solenoid. Replace injector and retest. See REMOVE AND INSTALL ELECTRONIC INJECTORS (EIs). – – –1/1

❻ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Cylinder 2 injector wires still disconnected from injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 2 electronic injector harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head (either terminal 2 or 4, the injectors are not polarity sensitive). • The other cylinder 2 electronic injector harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head Both measurements 2.0 ohms or less?	**YES:** Faulty ECU connection. OR Faulty electronic injector wiring harness connection. OR Faulty ECU **NO:** Open in wire(s) that measured above 2.0 ohms. Repair and retest. – – –1/1

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000652.06 — Cylinder 2 Electronic Injector Circuit Shorted

The ECU detects a short in the cylinder 2 electronic injector circuit.

RG41221,0000255 –19–19SEP05–1/1

000652.06 - Cylinder 2 Electronic Injector Circuit Shorted Diagnostic Procedure

Related Information:
The ECU detects a short in the cylinder 2 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 2 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000652.06 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Short In Electronic Injector Wiring Harness Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 2 in the harness end of electronic injector wiring connector and the following: • Terminal 4 in the harness end of the electronic injector wiring harness connector. • Terminal 9 in the harness end of the electronic injector wiring harness connector. Is the resistance greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in wires that measured less than 2000 ohms. Repair and retest. – – –1/1

❹ **Cylinder 2 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 2 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❺ **NO:** Faulty cylinder 2 electronic injector solenoid. Replace injector and retest. See REMOVE AND INSTALL ELECTRONIC INJECTORS (EIS). – – –1/1

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❺ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Keep cylinder 2 wiring harness disconnected from electronic injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Cylinder 2 injector wires still disconnected from injector. 5. Using a multimeter, measure resistance between the following: • One of the eyelets for injector 2 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. • The other eyelet for injector 2 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. Is resistance 5 ohms or less?	**YES:** Faulty ECU connection. OR Faulty ECU **NO:** Short in wire that measured more than 5 ohms. Repair and retest. – – –1/1

000652.07 — Cylinder 2 Electronic Injector Mechanical Failure

The fuel rail pressure does not drop at the injection of fuel to cylinder 2.

RG41221,0000256 –19–17OCT05–1/1

000652.07 — Cylinder 2 Electronic Injector Mechanical Failure Diagnostic Procedure

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Related Information:
The ECU does not detect a drop in fuel rail pressure when cylinder 2 injects fuel.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 2 may not be injecting fuel.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Initial Inspection**	1. Check for fuel leaks on the high-pressure side of the fuel delivery system. 2. Check the oil dipstick for fuel in the oil pan. 3. Check for severely bent or pinched fuel lines. Were any problems found?	**YES:** Repair and retest. If there is fuel in the oil pan, remove the rocker cover and inspect injector as described in step 6. GO TO ❻ **NO:** GO TO ❷

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❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1
❸ **Flow Damper Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running under condition that set 000652.07. 2. Using the ECU diagnostic software, watch for 000652.07 to set (refresh the active code list until 000652.07 sets). 3. While turning ignition OFF, listen for the ball to seat in flow damper that corresponds to cylinder 2. *NOTE: It is difficult to distinguish between cylinder 2 flow damper click and the other flow damper clicks. Make sure the click is made by the flow damper for cylinder 2. It takes 5-10 seconds for the ball to reseat.* Does cylinder 2 flow damper click?	**YES:** GO TO ❹ **NO:** Faulty flow damper. Replace flow damper and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1
❹ **Injector Wiring Harness Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2.Remove rocker arm cover with vent tube. (to reinstall, see REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 02, Group 090 of this manual) 3. Verify all injector terminal nuts are tightened to specification. **Specification** Injector Terminal Nut—Torque..... 2.25 ± 0.5 Nm (27 ± 6 lb-in) All connections tightened per specification?	**YES:** GO TO ❺ **NO:** Tighten retaining nut(s) to specification and retest. – – –1/1

❺ Injector Fuel Line Restriction Test	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* **CAUTION: Fuel lines may be under high pressure. Use extreme caution while opening fuel lines. Let the engine sit for several minutes after cranking or running prior to opening fuel lines.** **CAUTION: Escaping fluid under pressure can penetrate skin causing serious injury. Avoid the hazard be relieving pressure before disconnecting hydraulic or other high pressure lines. Tighten all connections before applying pressure. Search for leaks with a piece or cardboard. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately. Any fluids injected into the skin must be surgically removed within 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, USA.** 1. Ignition OFF for 5 minutes. 2. Disconnect the fuel line between high pressure common rail and the fuel inlet connector for injector at cylinder 2 according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: While removing the fuel line nut, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.** 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line according to INSTALL INJECTORS in Section 2 Group 090 of this manual and retest. **NO:** GO TO ❻ – – –1/1

❻ Fuel Inlet Connector (Side Feed Tube) Check	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove the fuel inlet connector (“side feed tube”) according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: Inlet connector and o-ring must be replaced whenever the inlet connector nut is loosened. The tip of the connector is comparatively soft and form-fits into the injector. Once deformed, the connector will not re-seal properly.** 3. Inspect the fuel inlet connector at cylinder 2 for galling, nicks, burrs, or other damage. *NOTE: Anything more than a hairline on the inlet connector where it contacts the injector indicates there may be a faulty seal at the injector.* Does the inlet connector appear damaged?	**YES:** Remove and inspect injector at cylinder 2 according to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2 Group 090 of this manual. **NO:** Replace the fuel inlet connector according to INSTALL INJECTORS in Section 2 Group 090 of this manual. – – –1/1

000652.13 — Cylinder 2 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,0000257 –19–17OCT05–1/1

000652.13 - Cylinder 2 Electronic Injector QR Code Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect QR Code was calibrated into the ECU. If the incorrect injector QR code has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 2 is electrically injector 4.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 2.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed into cylinder 2?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector QR Code Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the QR Code of the injector in cylinder 2. 3. Compare the QR code (provided with the new injector) of the newly installed injector to the QR Code found in the diagnostic software. 4. If the QR code of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the rocker cover. 7. Compare the QR code located on the tag on the top of the injector to that of the diagnostic software. Do the QR codes match? If removed, install the rocker cover. Tighten the rocker cover cap screws to specification and in the proper sequence. Refer to ADJUST VALVE CLEARANCE in Section 2, Group 21 of the 9.0L Base Engine manual (CTM400).	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate the injector with the correct QR code. – – –1/1

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000653.02 — Cylinder 3 Electronic Injector Part Number Invalid

The ECU detects an incorrect injector part number was installed or calibrated into cylinder 3.

RG41221,0000258 –19–27MAR06–1/1

000653.02 — Cylinder 3 Electronic Injector Part Number Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect part number for the injector in cylinder 3. If the incorrect injector part number has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 3 is electrically injector 2.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 3.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed in cylinder 3?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector Part Number Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the part number for the injector in cylinder 3. 3. Compare the part number (provided with the new injector) of the newly installed injector to the part number found in the diagnostic software. 4. If the part number of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual. 7. Compare the part number located on the top tab of the injector to that of the diagnostic software. Do the injector part numbers match? Install the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual.	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector with the correct part number and recalibrate ECU. – – –1/1

000653.05 — Cylinder 3 Electronic Injector Circuit Open

The ECU detects an open in the cylinder 3 electronic injector circuit.

RG41221,0000259 –19–19SEP05–1/1

000653.05 — Cylinder 3 Electronic Injector Circuit Open Diagnostic Procedure

Related Information:
The ECU detects an open in the cylinder 3 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 3 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000653.05 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Open in Electronic Injector Control Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 3 in the harness end of the injector wiring harness connector and terminal D1 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in electronic injector 3 control wire. – – –1/1

❹ **Open in 90V Supply Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Electronic injector wiring harness connector and ECU connector J1 still disconnected. 3. Using a multimeter, measure resistance between terminal 4 in the harness end of the injector wiring harness connector and terminal G1 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in electronic injector 3 90V supply wire. – – –1/1

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❺ **Cylinder 3 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 3 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❻ **NO:** Faulty cylinder 3 electronic injector solenoid. Replace injector and retest. See REMOVE ELECTRONIC INJECTORS (EIs) and INSTALL ELECTRONIC INJECTORS (EIs) – – –1/1

❻ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Cylinder 3 injector wires still disconnected from injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 3 electronic injector harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head (either terminal 3 or 4, the injectors are not polarity sensitive). • The other cylinder 3 electronic injector harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head Both measurements 2.0 ohms or less?	**YES:** Faulty ECU connection. OR Faulty electronic injector wiring harness connection. OR Faulty ECU **NO:** Open in wire(s) that measured above 2.0 ohms. Repair and retest. – – –1/1

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000653.06 — Cylinder 3 Electronic Injector Circuit Shorted

The ECU detects a short in the cylinder 3 electronic injector circuit.

RG41221,000025A –19–19SEP05–1/1

000653.06 - Cylinder 3 Electronic Injector Circuit Shorted Diagnostic Procedure

Related Information:
The ECU detects a short in the cylinder 3 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 3 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000653.06 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Short In Electronic Injector Wiring Harness Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 3 in the harness end of electronic injector wiring connector and the following: • Terminal 4 in the harness end of the electronic injector wiring harness connector. • Terminal 9 in the harness end of the electronic injector wiring harness connector. Is the resistance greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in wires that measured less than 2000 ohms. Repair and retest. – – –1/1

❹ **Cylinder 3 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 3 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❺ **NO:** Faulty cylinder 3 electronic injector solenoid. Replace injector and retest. See REMOVE ELECTRONIC INJECTORS (EIS) AND INSTALL ELECTRONIC INJECTORS (EIs) – – –1/1

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❺ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Keep cylinder 3 wiring harness disconnected from electronic injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Cylinder 3 injector wires still disconnected from injector. 5. Using a multimeter, measure resistance between the following: • One of the eyelets for injector 3 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. • The other eyelet for injector 3 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. Is resistance 5 ohms or less?	**YES:** Faulty ECU connection. OR Faulty ECU **NO:** Short in wire that measured more than 5 ohms. Repair and retest. – – –1/1

000653.07 — Cylinder 3 Electronic Injector Mechanical Failure

The fuel rail pressure does not drop at the injection of fuel to cylinder 3.

RG41221,000025B –19–17OCT05–1/1

000653.07 — Cylinder 3 Electronic Injector Mechanical Failure Diagnostic Procedure

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Related Information:
The ECU does not detect a drop in fuel rail pressure when cylinder 3 injects fuel.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 3 may not be injecting fuel.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Initial Inspection**	1. Check for fuel leaks on the high-pressure side of the fuel delivery system. 2. Check the oil dipstick for fuel in the oil pan. 3. Check for severely bent or pinched fuel lines. Were any problems found?	**YES:** Repair and retest. If there is fuel in the oil pan, remove the rocker cover and inspect injector as described in step 6. GO TO ❻ **NO:** GO TO ❷

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❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1
❸ **Flow Damper Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running under condition that set 000653.07. 2. Using the ECU diagnostic software, watch for 000653.07 to set (refresh the active code list until 000653.07 sets). 3. While turning ignition OFF, listen for the ball to seat in flow damper that corresponds to cylinder 3. *NOTE: It is difficult to distinguish between cylinder 3 flow damper click and the other flow damper clicks. Make sure the click is made by the flow damper for cylinder 3. It takes 5-10 seconds for the ball to reseat.* Does cylinder 3 flow damper click?	**YES:** GO TO ❹ **NO:** Faulty flow damper. Replace flow damper and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1
❹ **Injector Wiring Harness Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2.Remove rocker arm cover with vent tube. (to reinstall, see REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 02, Group 090 of this manual) 3. Verify all injector terminal nuts are tightened to specification. **Specification** Injector Terminal Nut—Torque..... 2.25 ± 0.5 Nm (27 ± 6 lb-in) All connections tightened per specification?	**YES:** GO TO ❺ **NO:** Tighten retaining nut(s) to specification and retest. – – –1/1

❺ **Injector Fuel Line Restriction Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* **CAUTION: Fuel lines may be under high pressure. Use extreme caution while opening fuel lines. Let the engine sit for several minutes after cranking or running prior to opening fuel lines.** **CAUTION: Escaping fluid under pressure can penetrate skin causing serious injury. Avoid the hazard be relieving pressure before disconnecting hydraulic or other high pressure lines. Tighten all connections before applying pressure. Search for leaks with a piece or cardboard. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately. Any fluids injected into the skin must be surgically removed within 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, USA.** 1. Ignition OFF for 5 minutes. 2. Disconnect the fuel line between high pressure common rail and the fuel inlet connector for injector at cylinder 3 according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: While removing the fuel line nut, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.** 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line according to INSTALL INJECTORS in Section 2 Group 090 of this manual and retest. **NO:** GO TO ❻ – – –1/1
❻ **Fuel Inlet Connector (Side Feed Tube) Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove the fuel inlet connector (“side feed tube”) according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: Inlet connector and o-ring must be replaced whenever the inlet connector nut is loosened. The tip of the connector is comparatively soft and form-fits into the injector. Once deformed, the connector will not re-seal properly.** 3. Inspect the fuel inlet connector at cylinder 3 for galling, nicks, burrs, or other damage. *NOTE: Anything more than a hairline on the inlet connector where it contacts the injector indicates there may be a faulty seal at the injector.* Does the inlet connector appear damaged?	**YES:** Remove and inspect injector at cylinder 3 according to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2 Group 090 of this manual. **NO:** Replace the fuel inlet connector according to INSTALL INJECTORS in Section 2 Group 090 of this manual. – – –1/1

000653.13 — Cylinder 3 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,000025C –19–17OCT05–1/1

000653.13 - Cylinder 3 Electronic Injector QR Code Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect QR Code was calibrated into the ECU. If the incorrect injector QR code has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 3 is electrically injector 2.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 3.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector 3 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed into cylinder 3?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector QR Code Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the QR Code for the injector in cylinder 3. 3. Compare the QR code (provided with the new injector) of the newly installed injector to the QR Code found in the diagnostic software. 4. If the QR code of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the rocker cover. 7. Compare the QR code located on the tag on the top of the injector to that of the diagnostic software. Do the QR codes match? If removed, install the rocker cover. Tighten the rocker cover cap screws to specification and in the proper sequence. Refer to ADJUST VALVE CLEARANCE in Section 2, Group 21 of the 9.0L Base Engine manual (CTM400).	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate injector with the correct QR code. – – –1/1

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000654.02 — Cylinder 4 Electronic Injector Part Number Invalid

The ECU detects an incorrect injector part number was installed or calibrated into cylinder 4.

RG41221,000025D –19–27MAR06–1/1

000654.02 — Cylinder 4 Electronic Injector Part Number Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect part number for the injector in cylinder 4. If the incorrect injector part number has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 4 is electrically injector 5.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 4.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed in cylinder 4?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector Part Number Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the part number for the injector in cylinder 4. 3. Compare the part number (provided with the new injector) of the newly installed injector to the part number found in the diagnostic software. 4. If the part number of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual. 7. Compare the part number located on the top tab of the injector to that of the diagnostic software. Do the injector part numbers match? Install the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual.	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector with the correct part number and recalibrate ECU. – – –1/1

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000654.05 — Cylinder 4 Electronic Injector Circuit Open

The ECU detects an open in the cylinder 4 electronic injector circuit.

RG41221,000025E –19–19SEP05–1/1

000654.05 - Cylinder 4 Electronic Injector Circuit Open Diagnostic Procedure

Related Information:
The ECU detects an open in the cylinder 4 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 4 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000654.05 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Open in Electronic Injector Control Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 10 in the harness end of the injector wiring harness connector and terminal A1 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in electronic injector 4 control wire. – – –1/1

❹ **Open in 90V Supply Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Electronic injector wiring harness connector and ECU connector J1 still disconnected. 3. Using a multimeter, measure resistance between terminal 9 in the harness end of the injector wiring harness connector and terminal G2 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in electronic injector 4 90V supply wire. – – –1/1

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❺ **Cylinder 4 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 4 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❻ **NO:** Faulty cylinder 4 electronic injector solenoid. Replace injector and retest. See REMOVE ELECTRONIC INJECTORS (EIs) and INSTALL ELECTRONIC INJECTORS (EIs) – – –1/1

❻ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Cylinder 4 injector wires still disconnected from injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 4 electronic injector harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head (either terminal 9 or 10, the injectors are not polarity sensitive). • The other cylinder 4 electronic injector harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head Both measurements 2.0 ohms or less?	**YES:** Faulty ECU connection. OR Faulty electronic injector wiring harness connection. OR Faulty ECU **NO:** Open in wire(s) that measured above 2.0 ohms. Repair and retest. – – –1/1

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000654.06 — Cylinder 4 Electronic Injector Circuit Shorted

The ECU detects a short in the cylinder 4 electronic injector circuit.

RG41221,000025F –19–19SEP05–1/1

000654.06 - Cylinder 4 Electronic Injector Circuit Shorted Diagnostic Procedure

Related Information:
The ECU detects a short in the cylinder 4 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 4 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000654.06 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Short In Electronic Injector Wiring Harness Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 10 in the harness end of electronic injector wiring connector and the following: • Terminal 4 in the harness end of the electronic injector wiring harness connector. • Terminal 9 in the harness end of the electronic injector wiring harness connector. Is the resistance greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in wires that measured less than 2000 ohms. Repair and retest. – – –1/1

❹ **Cylinder 4 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 4 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❺ **NO:** Faulty cylinder 4 electronic injector solenoid. Replace injector and retest. See REMOVE ELECTRONIC INJECTORS (EIS) AND INSTALL ELECTRONIC INJECTORS (EIs) – – –1/1

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❺ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Keep cylinder 4 wiring harness disconnected from electronic injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Cylinder 4 injector wires still disconnected from injector. 5. Using a multimeter, measure resistance between the following: • One of the eyelets for injector 4 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. • The other eyelet for injector 4 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. Is resistance 5 ohms or less?	**YES:** Faulty ECU connection. OR Faulty ECU **NO:** Short in wire that measured more than 5 ohms. Repair and retest. – – –1/1

000654.07 — Cylinder 4 Electronic Injector Mechanical Failure

The fuel rail pressure does not drop at the injection of fuel to cylinder 4.

RG41221,0000260 –19–17OCT05–1/1

000654.07 — Cylinder 4 Electronic Injector Mechanical Failure Diagnostic Procedure

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Related Information:
The ECU does not detect a drop in fuel rail pressure when cylinder 4 injects fuel.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 4 may not be injecting fuel.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Initial Inspection**	1. Check for fuel leaks on the high-pressure side of the fuel delivery system. 2. Check the oil dipstick for fuel in the oil pan. 3. Check for severely bent or pinched fuel lines. Were any problems found?	**YES:** Repair and retest. If there is fuel in the oil pan, remove the rocker cover and inspect injector as described in step 6. GO TO ❻ **NO:** GO TO ❷

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❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1
❸ **Flow Damper Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running under condition that set 000654.07. 2. Using the ECU diagnostic software, watch for 000654.07 to set (refresh the active code list until 000654.07 sets). 3. While turning ignition OFF, listen for the ball to seat in flow damper that corresponds to cylinder 4. *NOTE: It is difficult to distinguish between cylinder 4 flow damper click and the other flow damper clicks. Make sure the click is made by the flow damper for cylinder 4. It takes 5-10 seconds for the ball to reseat.* Does cylinder 4 flow damper click?	**YES:** GO TO ❹ **NO:** Faulty flow damper. Replace flow damper and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1
❹ **Injector Wiring Harness Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2.Remove rocker arm cover with vent tube. (to reinstall, see REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 02, Group 090 of this manual) 3. Verify all injector terminal nuts are tightened to specification. **Specification** Injector Terminal Nut—Torque..... 2.25 ± 0.5 Nm (27 ± 6 lb-in) All connections tightened per specification?	**YES:** GO TO ❺ **NO:** Tighten retaining nut(s) to specification and retest. – – –1/1

❺ **Injector Fuel Line Restriction Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* **CAUTION: Fuel lines may be under high pressure. Use extreme caution while opening fuel lines. Let the engine sit for several minutes after cranking or running prior to opening fuel lines.** **CAUTION: Escaping fluid under pressure can penetrate skin causing serious injury. Avoid the hazard be relieving pressure before disconnecting hydraulic or other high pressure lines. Tighten all connections before applying pressure. Search for leaks with a piece or cardboard. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately. Any fluids injected into the skin must be surgically removed within 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, USA.** 1. Ignition OFF for 5 minutes. 2. Disconnect the fuel line between high pressure common rail and the fuel inlet connector for injector at cylinder 4 according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: While removing the fuel line nut, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.** 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line according to INSTALL INJECTORS in Section 2 Group 090 of this manual and retest. **NO:** GO TO ❻ – – –1/1

❻ **Fuel Inlet Connector (Side Feed Tube) Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove the fuel inlet connector (“side feed tube”) according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: Inlet connector and o-ring must be replaced whenever the inlet connector nut is loosened. The tip of the connector is comparatively soft and form-fits into the injector. Once deformed, the connector will not re-seal properly.** 3. Inspect the fuel inlet connector at cylinder 4 for galling, nicks, burrs, or other damage. *NOTE: Anything more than a hairline on the inlet connector where it contacts the injector indicates there may be a faulty seal at the injector.* Does the inlet connector appear damaged?	**YES:** Remove and inspect injector at cylinder 4 according to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2 Group 090 of this manual. **NO:** Replace the fuel inlet connector according to INSTALL INJECTORS in Section 2 Group 090 of this manual. – – –1/1

000654.13 — Cylinder 4 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,0000261 –19–17OCT05–1/1

000654.13 - Cylinder 4 Electronic Injector QR Code Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect QR Code was calibrated into the ECU. If the incorrect injector QR code has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 4 is electrically injector 5.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 4.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed into cylinder 4?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector QR Code Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the QR Code for the injector in cylinder 4. 3. Compare the QR code (provided with the new injector) of the newly installed injector to the QR Code found in the diagnostic software. 4. If the QR code of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the rocker cover. 7. Compare the QR code located on the tag on the top of the injector to that of the diagnostic software. Do the QR codes match? If removed, install the rocker cover. Tighten the rocker cover cap screws to specification and in the proper sequence. Refer to ADJUST VALVE CLEARANCE in Section 2, Group 21 of the 9.0L Base Engine manual (CTM400).	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate the injector with the correct QR code. – – –1/1

000655.02 — Cylinder 5 Electronic Injector Part Number Invalid

The ECU detects an incorrect injector part number was installed or calibrated into cylinder 5.

RG41221,0000262 –19–17OCT05–1/1

000655.02 - Cylinder 5 Electronic Injector Part Number Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect part number for the injector in cylinder 5. If the incorrect injector part number has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 5 is electrically injector 1.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 5.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed in cylinder 5?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector Part Number Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the part number for the injector in cylinder 5. 3. Compare the part number (provided with the new injector) of the newly installed injector to the part number found in the diagnostic software. 4. If the part number of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual. 7. Compare the part number located on the top tab of the injector to that of the diagnostic software. Do the injector part numbers match? Install the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual.	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector with the correct part number and recalibrate ECU. – – –1/1

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000655.05 — Cylinder 5 Electronic Injector Circuit Open

The ECU detects an open in the cylinder 5 electronic injector circuit.

RG41221,0000263 –19–19SEP05–1/1

000655.05 — Cylinder 5 Electronic Injector Circuit Open Diagnostic Procedure

Related Information:
The ECU detects an open in the cylinder 5 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 5 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000655.05 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Open in Electronic Injector Control Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 11 in the harness end of the injector wiring harness connector and terminal F1 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in electronic injector 5 control wire. – – –1/1

❹ **Open in 90V Supply Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Electronic injector wiring harness connector and ECU connector J1 still disconnected. 3. Using a multimeter, measure resistance between terminal 9 in the harness end of the injector wiring harness connector and terminal G2 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in electronic injector 5 90V supply wire. – – –1/1

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❺ **Cylinder 5 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 5 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❻ **NO:** Faulty cylinder 5 electronic injector solenoid. Replace injector and retest. See REMOVE ELECTRONIC INJECTORS (EIs) and INSTALL ELECTRONIC INJECTORS (EIs) – – –1/1

❻ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Cylinder 5 injector wires still disconnected from injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 5 electronic injector harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head (either terminal 9 or 11 the injectors are not polarity sensitive). • The other cylinder 5 electronic injector harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head Both measurements 2.0 ohms or less?	**YES:** Faulty ECU connection. OR Faulty electronic injector wiring harness connection. OR Faulty ECU **NO:** Open in wire(s) that measured above 2.0 ohms. Repair and retest. – – –1/1

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000655.06 — Cylinder 5 Electronic Injector Circuit Shorted

The ECU detects a short in the cylinder 5 electronic injector circuit.

RG41221,0000264 –19–19SEP05–1/1

000655.06 — Cylinder 5 Electronic Injector Circuit Shorted Diagnostic Procedure

Related Information:
The ECU detects a short in the cylinder 5 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 5 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000655.06 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Short In Electronic Injector Wiring Harness Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 11 in the harness end of electronic injector wiring connector and the following: • Terminal 4 in the harness end of the electronic injector wiring harness connector. • Terminal 9 in the harness end of the electronic injector wiring harness connector. Is the resistance greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in wires that measured less than 2000 ohms. Repair and retest. – – –1/1

❹ **Cylinder 5 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 5 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❺ **NO:** Faulty cylinder 5 electronic injector solenoid. Replace injector and retest. See REMOVE ELECTRONIC INJECTORS (EIS) AND INSTALL ELECTRONIC INJECTORS (EIs) – – –1/1

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❺ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Keep cylinder 5 wiring harness disconnected from electronic injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Cylinder 5 injector wires still disconnected from injector. 5. Using a multimeter, measure resistance between the following: • One of the eyelets for injector 5 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. • The other eyelet for injector 5 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. Is resistance 5 ohms or less?	**YES:** Faulty ECU connection. OR Faulty ECU **NO:** Short in wire that measured more than 5 ohms. Repair and retest. – – –1/1

000655.07 — Cylinder 5 Electronic Injector Mechanical Failure

The fuel rail pressure does not drop at the injection of fuel to cylinder 5.

RG41221,0000265 –19–17OCT05–1/1

000655.07 — Cylinder 5 Electronic Injector Mechanical Failure Diagnostic Procedure

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Related Information:
The ECU does not detect a drop in fuel rail pressure when injector in cylinder 5 injects fuel.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 5 may not be injecting fuel.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Initial Inspection**	1. Check for fuel leaks on the high-pressure side of the fuel delivery system. 2. Check the oil dipstick for fuel in the oil pan. 3. Check for severely bent or pinched fuel lines. Were any problems found?	**YES:** Repair and retest. If there is fuel in the oil pan, remove the rocker cover and inspect injector as described in step 6. GO TO ❻ **NO:** GO TO ❷

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❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1
❸ **Flow Damper Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running under condition that set 000655.07. 2. Using the ECU diagnostic software, watch for 000655.07 to set (refresh the active code list until 000655.07 sets). 3. While turning ignition OFF, listen for the ball to seat in flow damper that corresponds to cylinder 5. *NOTE: It is difficult to distinguish between cylinder 5 flow damper click and the other flow damper clicks. Make sure the click is made by the flow damper for cylinder 5. It takes 5-10 seconds for the ball to reseat.* Does cylinder 5 flow damper click?	**YES:** GO TO ❹ **NO:** Faulty flow damper. Replace flow damper and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1
❹ **Injector Wiring Harness Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2.Remove rocker arm cover with vent tube. (to reinstall, see REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 02, Group 090 of this manual) 3. Verify all injector terminal nuts are tightened to specification. **Specification** Injector Terminal Nut—Torque..... 2.25 ± 0.5 Nm (27 ± 6 lb-in) All connections tightened per specification?	**YES:** GO TO ❺ **NO:** Tighten retaining nut(s) to specification and retest. – – –1/1

❺ **Injector Fuel Line Restriction Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* **CAUTION: Fuel lines may be under high pressure. Use extreme caution while opening fuel lines. Let the engine sit for several minutes after cranking or running prior to opening fuel lines.** **CAUTION: Escaping fluid under pressure can penetrate skin causing serious injury. Avoid the hazard be relieving pressure before disconnecting hydraulic or other high pressure lines. Tighten all connections before applying pressure. Search for leaks with a piece or cardboard. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately. Any fluids injected into the skin must be surgically removed within 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, USA.** 1. Ignition OFF for 5 minutes. 2. Disconnect the fuel line between high pressure common rail and the fuel inlet connector for injector at cylinder 5 according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: While removing the fuel line nut, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.** 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line according to INSTALL INJECTORS in Section 2 Group 090 of this manual and retest. **NO:** GO TO ❻ – – –1/1
❻ **Fuel Inlet Connector (Side Feed Tube) Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove the fuel inlet connector (“side feed tube”) according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: Inlet connector and o-ring must be replaced whenever the inlet connector nut is loosened. The tip of the connector is comparatively soft and form-fits into the injector. Once deformed, the connector will not re-seal properly.** 3. Inspect the fuel inlet connector at cylinder 5 for galling, nicks, burrs, or other damage. *NOTE: Anything more than a hairline on the inlet connector where it contacts the injector indicates there may be a faulty seal at the injector.* Does the inlet connector appear damaged?	**YES:** Remove and inspect injector at cylinder 5 according to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2 Group 090 of this manual. **NO:** Replace the fuel inlet connector according to INSTALL INJECTORS in Section 2 Group 090 of this manual. – – –1/1

000655.13 — Cylinder 5 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,0000266 –19–17OCT05–1/1

000655.13 - Cylinder 5 Electronic Injector QR Code Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect QR Code was calibrated into the ECU. If the incorrect injector QR code has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 5 is electrically injector 1.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 5.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed into cylinder 5?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector QR Code Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the QR Code for the injector in cylinder 5. 3. Compare the QR code (provided with the new injector) of the newly installed injector to the QR Code found in the diagnostic software. 4. If the QR code of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the rocker cover. 7. Compare the QR code located on the tag on the top of the injector to that of the diagnostic software. Do the QR codes match? If removed, install the rocker cover. Tighten the rocker cover cap screws to specification and in the proper sequence. Refer to ADJUST VALVE CLEARANCE in Section 2, Group 21 of the 9.0L Base Engine manual (CTM400).	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate the injector with the correct QR code. – – –1/1

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000656.02 — Cylinder 6 Electronic Injector Part Number Invalid

The ECU detects an incorrect injector part number was installed or calibrated into cylinder 6.

RG41221,0000267 –19–17OCT05–1/1

000656.02 - Cylinder 6 Electronic Injector Part Number Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect part number for the injector in cylinder 6. If the incorrect injector part number has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 6 is electrically injector 3.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 6.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed in cylinder 6?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector Part Number Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the part number for the injector in cylinder 6. 3. Compare the part number (provided with the new injector) of the newly installed injector to the part number found in the diagnostic software. 4. If the part number of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual. 7. Compare the part number located on the top tab of the injector to that of the diagnostic software. Do the injector part numbers match? Install the injector. Refer to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2, Group 90 of this manual.	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector with the correct part number and recalibrate ECU. – – –1/1

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000656.05 — Cylinder 6 Electronic Injector Circuit Open

The ECU detects an open in the cylinder 6 electronic injector circuit.

RG41221,0000268 –19–19SEP05–1/1

000656.05 - Cylinder 6 Electronic Injector Circuit Open Diagnostic Procedure

Related Information:
The ECU detects an open in the cylinder 6 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 6 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000656.05 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Open in Electronic Injector Control Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 12 in the harness end of the injector wiring harness connector and terminal C1 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in electronic injector 6 control wire. – – –1/1

❹ **Open in 90V Supply Wire Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Electronic injector wiring harness connector and ECU connector J1 still disconnected. 3. Using a multimeter, measure resistance between terminal 9 in the harness end of the injector wiring harness connector and terminal G2 in the harness end of ECU connector J1. Is the resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in electronic injector 6 90V supply wire. – – –1/1

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❺ **Cylinder 6 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 6 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❻ **NO:** Faulty cylinder 6 electronic injector solenoid. Replace injector and retest. See REMOVE ELECTRONIC INJECTORS (EIs) and INSTALL ELECTRONIC INJECTORS (EIs) – – –1/1

❻ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Cylinder 6 injector wires still disconnected from injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Using a multimeter, measure resistance between: • One of the cylinder 6 electronic injector harness eyelets and the corresponding terminal at the connector on the rear of the cylinder head (either terminal 9 or 12, the injectors are not polarity sensitive). • The other cylinder 6 electronic injector harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head Both measurements 2.0 ohms or less?	**YES:** Faulty ECU connection. OR Faulty electronic injector wiring harness connection. OR Faulty ECU **NO:** Open in wire(s) that measured above 2.0 ohms. Repair and retest. – – –1/1

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000656.06 — Cylinder 6 Electronic Injector Circuit Shorted

The ECU detects a short in the cylinder 6 electronic injector circuit.

RG41221,0000269 –19–19SEP05–1/1

000656.06 - Cylinder 6 Electronic Injector Circuit Shorted Diagnostic Procedure

Related Information:
The ECU detects a short in the cylinder 6 electronic injector circuit.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 6 will not fire.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 000656.06 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Short In Electronic Injector Wiring Harness Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2. Disconnect electronic injector wiring harness connector at side of cylinder head. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure resistance between terminal 12 in the harness end of electronic injector wiring connector and the following: • Terminal 4 in the harness end of the electronic injector wiring harness connector. • Terminal 9 in the harness end of the electronic injector wiring harness connector. Is the resistance greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in wires that measured less than 2000 ohms. Repair and retest. – – –1/1

❹ **Cylinder 6 Electronic Injector Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove rocker arm cover. 3. Using a multimeter, measure resistance between: • Both terminals on cylinder 6 electronic injector. • Both terminals on a known good electronic injector. Is the difference between the two electronic injector 0.1 ohms or less? *NOTE: Because electronic injector resistance varies with temperature, a comparison is used to compensate for the effects of temperature. Typical injector resistance should be 0.35—0.55 ohms.*	**YES:** GO TO ❺ **NO:** Faulty cylinder 6 electronic injector solenoid. Replace injector and retest. See REMOVE ELECTRONIC INJECTORS (EIS) AND INSTALL ELECTRONIC INJECTORS (EIs) – – –1/1

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❺ **Electronic Injector Harness in Cylinder Head Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Keep cylinder 6 wiring harness disconnected from electronic injector. 3. Disconnect electronic injector wiring harness from side of cylinder head. 4. Cylinder 6 injector wires still disconnected from injector. 5. Using a multimeter, measure resistance between the following: • One of the eyelets for injector 6 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. • The other eyelet for injector 6 and the corresponding terminal in the electronic injector wiring harness connector on the side of cylinder head. Is resistance 5 ohms or less?	**YES:** Faulty ECU connection. OR Faulty ECU **NO:** Short in wire that measured more than 5 ohms. Repair and retest. – – –1/1

000656.07 — Cylinder 6 Electronic Injector Mechanical Failure

The fuel rail pressure does not drop at the injection of fuel to cylinder 6.

RG41221,000026A –19–17OCT05–1/1

000656.07 — Cylinder 6 Electronic Injector Mechanical Failure Diagnostic Procedure

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Related Information:
The ECU does not detect a drop in fuel rail pressure when injector in cylinder 6 injects fuel.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the engine will run rough and misfire since the injector in cylinder 6 may not be injecting fuel.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Initial Inspection**	1. Check for fuel leaks on the high-pressure side of the fuel delivery system. 2. Check the oil dipstick for fuel in the oil pan. 3. Check for severely bent or pinched fuel lines. Were any problems found?	**YES:** Repair and retest. If there is fuel in the oil pan, remove the rocker cover and inspect injector as described in step 6. GO TO ❻ **NO:** GO TO ❷

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❷ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❸ – – –1/1
❸ **Flow Damper Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine running under condition that set 000656.07. 2. Using the ECU diagnostic software, watch for 000656.07 to set (refresh the active code list until 000656.07 sets). 3. While turning ignition OFF, listen for the ball to seat in flow damper that corresponds to cylinder 6. *NOTE: It is difficult to distinguish between cylinder 6 flow damper click and the other flow damper clicks. Make sure the click is made by the flow damper for cylinder 6. It takes 5-10 seconds for the ball to reseat.* Does cylinder 6 flow damper click?	**YES:** GO TO ❹ **NO:** Faulty flow damper. Replace flow damper and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1
❹ **Injector Wiring Harness Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF **CAUTION: Possible strong electronic shock hazard if engine is cranking or running!** 2.Remove rocker arm cover with vent tube. (to reinstall, see REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 02, Group 090 of this manual) 3. Verify all injector terminal nuts are tightened to specification. **Specification** Injector Terminal Nut—Torque..... 2.25 ± 0.5 Nm (27 ± 6 lb-in) All connections tightened per specification?	**YES:** GO TO ❺ **NO:** Tighten retaining nut(s) to specification and retest. – – –1/1

❺ **Injector Fuel Line Restriction Test**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* **CAUTION: Fuel lines may be under high pressure. Use extreme caution while opening fuel lines. Let the engine sit for several minutes after cranking or running prior to opening fuel lines.** **CAUTION: Escaping fluid under pressure can penetrate skin causing serious injury. Avoid the hazard be relieving pressure before disconnecting hydraulic or other high pressure lines. Tighten all connections before applying pressure. Search for leaks with a piece or cardboard. Protect hands and body from high pressure fluids. If an accident occurs, see a doctor immediately. Any fluids injected into the skin must be surgically removed within 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, USA.** 1. Ignition OFF for 5 minutes. 2. Disconnect the fuel line between high pressure common rail and the fuel inlet connector for injector at cylinder 6 according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: While removing the fuel line nut, do not allow the inlet connector to turn. If the inlet connector is allowed to turn, galling might occur on the injector sealing surface. This could cause fuel leaks.** 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line according to INSTALL INJECTORS in Section 2 Group 090 of this manual and retest. **NO:** GO TO ❻ – – –1/1
❻ **Fuel Inlet Connector (Side Feed Tube) Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove the fuel inlet connector (“side feed tube”) according to REMOVE INJECTORS in Section 2 Group 090 of this manual. **IMPORTANT: Inlet connector and o-ring must be replaced whenever the inlet connector nut is loosened. The tip of the connector is comparatively soft and form-fits into the injector. Once deformed, the connector will not re-seal properly.** 3. Inspect the fuel inlet connector at cylinder 6 for galling, nicks, burrs, or other damage. *NOTE: Anything more than a hairline on the inlet connector where it contacts the injector indicates there may be a faulty seal at the injector.* Does the inlet connector appear damaged?	**YES:** Remove and inspect injector at cylinder 6 according to REMOVE AND INSTALL ELECTRONIC INJECTORS in Section 2 Group 090 of this manual. **NO:** Replace the fuel inlet connector according to INSTALL INJECTORS in Section 2 Group 090 of this manual. – – –1/1

000656.13 — Cylinder 6 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,000026B –19–17OCT05–1/1

000656.13 - Cylinder 6 Electronic Injector QR Code Invalid Diagnostic Procedure

Related Information:
The ECU detects an incorrect QR Code was calibrated into the ECU. If the incorrect injector QR code has been installed, this engine's performance may be drastically effected. This engine will also be out of compliance with Tier 3 emission requirements resulting in large fines.

NOTE: The injector in cylinder 6 is electrically injector 3.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will attempt to run the engine under normal operating conditions.

The engine may run rough due to an incorrectly calibrated injector in cylinder 6.

Additional References:
For further electronic injector information, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was the ECU recently replaced or reprogrammed with new software?	**YES:** Verify that the correct engine serial number payload was programmed into the ECU. Compare the Engine Serial number on the side of the engine to the engine serial number inside the ECU using the engine diagnostic software. **NO:** GO TO ❷

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❷ **Installation of New Injector Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was a new injector recently installed into cylinder 6?	**YES:** GO TO ❸ **NO:** Faulty ECU. – – –1/1

❸ **Injector QR Code Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read the QR Code for the injector in cylinder 6. 3. Compare the QR code (provided with the new injector) of the newly installed injector to the QR Code found in the diagnostic software. 4. If the QR code of the newly installed injector is NOT AVAILABLE, perform steps 5-7. Otherwise, skip steps 5-7. 5. Ignition OFF. 6. Remove the rocker cover. 7. Compare the QR code located on the tag on the top of the injector to that of the diagnostic software. Do the QR codes match? If removed, install the rocker cover. Tighten the rocker cover cap screws to specification and in the proper sequence. Refer to ADJUST VALVE CLEARANCE in Section 2, Group 21 of the 9.0L Base Engine manual (CTM400).	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate the injector with the correct QR code. – – –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 the message is not valid.

RG41221,000026C –19–19SEP05–1/1

000898.09 - Vehicle Speed or Torque Message Invalid Diagnostic Procedure

Related Information:
The ECU does not receive the engine speed or torque message over CAN, or the message is not valid.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the engine will run at low idle only.

Additional References:
For further engine control unit information, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.

Refer to your vehicle or application manual for more information on wiring and controllers.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs. Did 000898.09 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **CAN Resistance Check**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the diagnostic connector. 3. Using a multimeter, measure resistance between terminal C and D in the harness end of the diagnostic connector. Does the resistance measure between 45 and 75 ohms?	**YES:** GO TO ❹ **NO:** Faulty or missing CAN terminator. OR Open or short in CAN wire(s). – – –1/1

❹ **Application Check**	*NOTE: For wiring and theory of operation, see ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* Check the following on the application wiring and controller side: • Verify that all ground connections are being properly made. • Verify that battery voltage is being supplied to the application controller (not the engine ECU). • Verify all CAN wiring and terminators are functioning properly. • Verify the application controller is functioning properly. Are all application wiring and controllers functioning properly?	**YES:** Faulty ECU **NO:** Application problem. Repair and retest. – – –1/1

000970.02 — Auxiliary Engine Shutdown Switch Signal Invalid

The ECU reads an input voltage from the application's controller that is out of specification.

Alarm Level:
STOP

Control Unit Response:
The engine will not shut down.

Additional References:
Refer to the equipment's diagnostic test manual.

OUO1004,0000CC0 –19–12APR06–1/1

000970.02 — Engine Shutdown—Vehicle Request Invalid

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 000970.02 error code active?	**YES:** GO TO ❷ **NO:** GO TO ❷

– – –1/1

❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see the application manual.

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000970.31 — Engine Shutdown - Auxiliary Request

The ECU does not detect voltage on the engine shutdown input.

RG41221,000026D –19–19SEP05–1/1

000970.31 — Engine Shutdown - Auxiliary Request Diagnostic Procedure

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Related Information:
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.

Alarm Level:
STOP

Control Unit Response:
If this code sets, the ECU will shut the engine down.

Additional References:
For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for injector wiring information.

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❶ **Intermittent Fault Test**	1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running 6. Read DTCs. Did 000970.31 reoccur?	**YES:** Check application controller to determine why request was made to ECU to shut down engine. **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

000971.31 — Engine Derate - Auxiliary Request

The ECU does not detect voltage on the engine shutdown input.

RG41221,000026E –19–19SEP05–1/1

000971.31 — Engine Derate - Auxiliary Request Diagnostic Procedure

Related Information:
On OEM applications, the external derate switch is a normally open switch. When the property being measured exceeds a certain value, the switch will close. When the switch is closed, the voltage is grounded, which will cause the ECU to derate the engine.

Alarm Level:
STOP

Control Unit Response:

NOTE: OEM engines are programmed using trimmable features. The customer had the option to choose the amount of engine derate to associate with this 000971.31. The amount of derate will vary between all engines.

The ECU will derate 50% per minute until the engine is running at 50% of full power.
OR
The ECU will derate 20% per minute until the engine is running at 80% of full power.
OR
The ECU will derate 2% per minute until the engine is running at 80% of full power.

Additional References:
For other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual for injector wiring information.

For more information on engine protection, see ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.

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❶ **Intermittent Fault Test**	1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running 6. Read DTCs. Did 000971.31 reoccur?	**YES:** Check application controller to determine why request was made to ECU to derate engine. **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

001075.05 — Fuel Transfer Pump Current Low

The ECU detects low current on the fuel transfer pump wiring.

RG41221,00002BE –19–19SEP05–1/1

001075.05 — Fuel Transfer Pump Current Low

Related Information
The ECU detects low current on the fuel transfer pump wiring through the ECU diagnostic test on the ECU diagnostic software.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further fuel transfer pump information, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* Without disconnecting, visually inspect the ECU connectors and the fuel transfer pump connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Fuel Transfer Pump Ground Wire Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Disconnect the fuel transfer pump connector. 3. Using a multimeter, measure the resistance between terminal 6 and a good chassis ground. Is the resistance 5 ohms or less?	**YES:** GO TO ❸ **NO:** Open in fuel transfer pump ground wire. – – –1/1

❸ **Fuel Transfer Pump Power Wire Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Fuel transfer pump connector still disconnected. 3. Disconnect ECU connector J1. 4. Using a multimeter, measure the resistance between terminal 5 in the fuel transfer pump connector and one of the following terminals; L1, L4, M1 or M4 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in fuel transfer pump power wire. – – –1/1

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❹ **Fuel Transfer Pump Power On Signal Wire Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Fuel transfer pump connector and ECU connector J1 still disconnected. 3. Using a multimeter, measure the resistance between terminal 4 in the fuel transfer pump connector and terminal D4 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in fuel transfer pump power on signal wire. – – –1/1

❺ **Fuel Transfer Pump Status Out Wire Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Fuel transfer pump connector and ECU connector J1 still disconnected. 3. Using a multimeter, measure the resistance between terminal 3 in the fuel transfer pump connector and terminal E2 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❻ **NO:** Open in fuel transfer pump status out wire. – – –1/1

❻ **Fuel Transfer Pump Current Out Wire Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Fuel transfer pump connector and ECU connector J1 still disconnected. 3. Using a multimeter, measure the resistance between terminal 2 in the fuel transfer pump connector and terminal C3 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** GO TO ❼ **NO:** Open in fuel transfer pump current out wire. – – –1/1

❼ **Fuel Transfer Pump Speed Command Wire Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Fuel transfer pump connector and ECU connector J1 still disconnected. 3. Using a multimeter, measure the resistance between terminal 1 in the fuel transfer pump connector and terminal D2 in ECU connector J1 on the engine harness. Is the resistance 5 ohms or less?	**YES:** Faulty ECU **NO:** Open in fuel transfer pump speed command wire. – – –1/1

001075.06 — Fuel Transfer Pump Current High

The ECU detects high current on the fuel transfer pump wiring.

RG41221,00002C0 –19–25APR06–1/1

001075.06 — Fuel Transfer Pump Current High

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Related Information
The ECU detects high current on the fuel transfer pump wiring through the ECU diagnostic test on the ECU diagnostic software.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further fuel transfer pump information, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* Without disconnecting, visually inspect the ECU connectors and the fuel transfer pump connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Fuel Transfer Pump Speed Command Wire Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure the resistance between terminal D2 in the ECU connector J1 and all other terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❸ **NO:** Open in fuel transfer pump ground wire. – – –1/1
❸ **Fuel Transfer Pump Current Out Wire Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. All three ECU connectors still disconnected. 3. Using a multimeter, measure the resistance between terminal C3 in the ECU connector J1 and all other terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in fuel transfer pump current out circuit to wire(s) that measured less than 2000 ohms. – – –1/1
❹ **Fuel Transfer Pump Status Out Wire Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. All three ECU connectors still disconnected. 3. Using a multimeter, measure the resistance between terminal E2 in the ECU connector J1 and all other terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** GO TO ❺ **NO:** Short in fuel transfer pump status out circuit to wire(s) that measured less than 2000 ohms. – – –1/1
❺ **Fuel Transfer Pump Power On Signal Wire Test**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Ignition OFF 2. All three ECU connectors still disconnected. 3. Using a multimeter, measure the resistance between terminal D4 in the ECU connector J1 and all other terminals in all three ECU connectors on the engine harness. All measurements greater than 2000 ohms?	**YES:** Faulty ECU **NO:** Short in fuel transfer pump power on signal circuit to wire(s) that measured less than 2000 ohms. – – –1/1

001075.12 — Fuel Transfer Pump Error

The ECU detects an error the fuel transfer pump.

RG41221,00002C1 –19–25APR06–1/1

001075.12 — Fuel Transfer Pump Error

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NOTE: If DTC 001075.12 is accompanied with DTC 000094.17 follow that diagnostic procedure first.

Related Information
The ECU detects an error internal to the fuel transfer pump.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Engine power may be reduced due to lack of fuel pressure.

Additional References:
For further fuel transfer pump information, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual.

For information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* Without disconnecting, visually inspect the ECU connectors and the fuel transfer pump connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Fuel Transfer Pump Check**	*NOTE: For wiring and theory of operation, see FUEL TRANSFER PUMP OPERATION in Section 03, Group 130 earlier in this manual* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs. Did 001075.12 reoccur?	**YES:** Replace the fuel transfer pump. **NO:** Faulty ECU 04 160 ,407 – – –1/1

001109.31 — Engine Protection Shutdown Warning

Engine Protection Shutdown Warning

Engine Shutdown Warning

This code informs the operator that the ECU will shut the engine down because it has detected a condition such as water in fuel, low oil pressure, high engine coolant temperature, or high fuel temperature. 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.

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DTC 001109.31 will set if:

- The ECU detects water in fuel.
- The ECU detects low oil pressure.
- The ECU detects a high engine coolant temperature.
- The ECU detects a high fuel temperature.

If DTC 001109.31 sets, the following will occur:

- If the ECU has engine protection with shutdown, it will derate the engine for 30 seconds and will shut the engine down.

If DTC 001109.31 sets:

Troubleshoot the diagnostic trouble code(s) that have set in association with the shutdown warning.

RG41221,0000273 –19–08SEP05–1/1

001110.31 — Engine Protection Shutdown

Engine Protection Shutdown

Engine Protection Shutdown:

This code informs the operator that the ECU shut the engine down because it has detected a condition such as water in fuel, low oil pressure, high engine coolant temperature, or high fuel temperature. 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 water in fuel.
- The ECU detects low oil pressure.
- The ECU detects a high engine 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:

Troubleshoot the diagnostic trouble codes that have set in association with the engine shutdown.

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RG41221,0000274 –19–08SEP05–1/1

001136.00 — ECU Temperature Extremely High

The ECU detects an internal temperature above specification.

RG41221,0000275 –19–28OCT05–1/1

001136.00 — ECU Temperature Extremely High Diagnostic Procedure

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Related Information:
The ECU senses an internal ECU temperature of 135° C (275° F) on OEM engines.

Alarm Level:
STOP

Control Unit Response:
The ECU will derate engine speed 10 rpm per second until the engine is running at 1200 rpm. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual. Key Off will reset the derate.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further ECU temperature sensor information, see ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **ECU Mounting Check**	*NOTE: For wiring and theory of operation, see ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Verify that all ECU mounting cap screws are torqued to specification. **Specification** ECU Mounting Cap Screws - Non Isolated ECU—Torque ..... 25 N•m (18.5 lb-ft) **Specification** ECU Mounting Cap Screws - Isolated ECU—Torque ..... 20 N•m (14.7 lb-ft) Is the ECU mounted correctly?	**YES:** GO TO ❷ **NO:** Tighten cap screws to specification and retest.

– – –1/1

❷ **ECU Cleanliness Check**	*NOTE: For wiring and theory of operation, see ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Verify that ECU is free from excess dirt and debris. Excess dirt and debris will act as insulation causing the ECU to overheat. Is the ECU clean?	**YES:** GO TO ❸ **NO:** Clean ECU and retest. Make checking the ECU periodically for dirt and debris a regular preventive maintenance item. If problem persists, take measures to prevent dirt and debris accumulation. – – –1/1

❸ **ECU Mounting Location Check**	*NOTE: For wiring and theory of operation, see ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Verify that the ECU mounting location does not have restricted air flow. Air flow is required for proper cooling. Is the mounting location restricting airflow?	**YES:** Modify or move the mounting location to allow proper airflow. **NO:** If no reason for the overheating code can be found, clear the code and continue to operate the equipment normally. If multiple system failures begin to occur that seem to be the result of a faulty ECU, replace the ECU. – – –1/1

001136.16 — ECU Temperature Moderately High

The ECU detects an internal temperature above specification.

RG41221,0000276 –19–02NOV05–1/1

001136.16 — ECU Temperature Moderately High Diagnostic Procedure

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Related Information:
The ECU senses an internal ECU temperature of 125° C (257° F) on OEM engines.

Alarm Level:
Warning

Control Unit Response:
None.

Additional References:
For further ECU temperature sensor information, see ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

IMPORTANT: Although engine systems will continue to operate normally with this code, further overheating of the ECU may result in engine derates and multiple system failures.

– – –1/1

❶ **ECU Mounting Check**	*NOTE: For wiring and theory of operation, see ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Verify that all ECU mounting cap screws are torqued to specification. **Specification** ECU Mounting Cap Screws - Non Isolated ECU—Torque ..... 25 N•m (18.5 lb-ft) **Specification** ECU Mounting Cap Screws - Isolated ECU—Torque ..... 20 N•m (14.7 lb-ft) Is the ECU mounted correctly?	**YES:** GO TO ❷ **NO:** Tighten cap screws to specification and retest.

– – –1/1

❷ **ECU Cleanliness Check**	*NOTE: For wiring and theory of operation, see ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Verify that ECU is free from excess dirt and debris. Excess dirt and debris will act as insulation causing the ECU to overheat. Is the ECU clean?	**YES:** GO TO ❸ **NO:** Clean ECU and retest. Make checking the ECU periodically for dirt and debris a regular preventive maintenance item. If problem persists, take measures to prevent dirt and debris accumulation. – – –1/1

❸ **ECU Mounting Location Check**	*NOTE: For wiring and theory of operation, see ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Verify that the ECU mounting location does not have restricted air flow. Air flow is required for proper cooling. Is the mounting location restricting airflow?	**YES:** Modify or move the mounting location to allow proper airflow. **NO:** If no reason for the overheating code can be found, clear the code and continue to operate the equipment normally. If multiple system failures begin to occur that seem to be the result of a faulty ECU, replace the ECU. – – –1/1

001172.03 — Turbo Compressor Inlet Temperature Input Voltage High

The turbo compressor inlet temperature input voltage exceeds the sensor's high voltage specification. Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open circuit. Less probable is a short from the 5V input wire to a power source.

RG41221,0000277 –19–26SEP05–1/1

001172.03 — Turbo Compressor Inlet Temperature Input Voltage High Diagnostic Procedure

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,414

Related Information:
The turbo compressor inlet temperature input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a temperature that is lower than what is physically possible for turbo compressor inlet temperature.

For OEM applications, the high turbo compressor inlet temperature input voltage specification is 4.95 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default turbo compressor inlet temperature of 30° C (86° F).

Additional References:
For further turbo compressor inlet temperature sensor information, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the turbo compressor inlet temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

– – –1/1

❷ Intermittent Fault Test	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 001172.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

04
160
,415

❸ Sensor Test	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor terminals. Is resistance less than 100K ohms?	**YES:** Sensor not open. GO TO ❹ **NO:** Excessively high resistance in the sensor. Replace and retest. – – –1/1

❹ Input Circuit Test	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON. 2. Temperature sensor still disconnected. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground. Is voltage 4.5-5.5V?	**YES:** Input OK. Check ground circuit. GO TO ❼ **NO:** If voltage is greater than 5.5V, sensor 5V input wire shorted to a higher voltage source. GO TO ❺ **NO:** If voltage is less than 4.5V, open or high resistance in input wiring. GO TO ❻ – – –1/1

❺ **Harness Shorted to Higher Voltage Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect 30-pin connectors from ECU. 3. Ignition ON. 4. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground Is voltage zero?	**YES:** Harness wiring OK. Remove and test ECU. GO TO❾ **NO:** Voltage is above 5.5V: harness or connected wiring shorted to a higher voltage source. Repair and retest. – – –1/1
❻ **Harness Input Wiring Open Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 3. Sensor still disconnected. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's input wiring in the harness. Is resistance near zero ohms?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❾ **NO:** Open or high resistance in input wiring. Repair and retest. – – –1/1
❼ **Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Use a multimeter and JT07328 Connector Adapter Test Kit to check resistance from the return terminal in the sensor connector to a good chassis ground. Is resistance near zero ohms?	**YES:** Ground circuit OK. Reconnect and retest. **NO:** Voltage is significantly above zero ohms: Open or high resistance in ground circuit. GO TO ❽ – – –1/1
❽ **Harness Ground Wiring Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the circuit's 30-pin connector from the ECU. Inspect connector and ECU pins. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's ground wiring in the harness. Is resistance near zero ohms?	**YES:** Wiring OK. Remove and test ECU. GO TO ❿ **NO:** Resistance is significantly above zero ohms: Open or high resistance in ground wiring. Repair and retest. – – –1/1

9 ECU Input Circuit Test	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input (J3-D1) and ground pin (J3-H3) the ECU. Is resistance 1.5K to 3.5K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

10 ECU Ground Circuit Test	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter and JT07328 Connector Adapter Test Kit, measure resistance between the sensor circuit's ground pin (J3-H3) and pin J2-L2 or J2-L3 in the ECU. Is resistance near zero ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Resistance is 2 ohms or more: Faulty ECU. Replace and retest. – – –1/1

001172.04 — Turbo Compressor Inlet Temperature Input Voltage Low

The turbo compressor inlet temperature input voltage drops below the sensor's low voltage specification. Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault on this circuit is low resistance to ground (grounded circuit).

RG41221,0000278 –19–26SEP05–1/1

001172.04 — Turbo Compressor Inlet Temperature Input Voltage Low Diagnostic Procedure

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160
,418

Related Information:
The turbo compressor inlet temperature input voltage drops below the sensor's low voltage specification. The voltage corresponds to a temperature that is higher than what is physically possible for turbo compressor inlet temperature.

For OEM applications, the high turbo compressor inlet temperature input voltage specification is 0.25 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default turbo compressor inlet temperature of 30° C (86° F).

Additional References:
For further turbo compressor inlet temperature sensor information, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the turbo compressor inlet temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 001172.04 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

04
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,419

❸ **Sensor Shorted Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor pins. Is resistance more than 100 ohms?	**YES:** Sensor not shorted. GO TO ❹ **NO:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

❹ **Sensor Grounded Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between each sensor pin and a good chassis ground. Is resistance 1M ohms or more?	**YES:** Sensor OK. Check wiring. GO TO ❺ **NO:** Low resistance to ground. Replace sensor and retest. – – –1/1

❺ **Grounded Input Circuit Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground. Is resistance 1000 ohms or more?	**YES:** Input circuit OK. Reconnect and retest. **NO:** GO TO ❻ – – –1/1

❻ **Harness Input Wiring Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector (J3) from the ECU. Inspect connector and ECU pins. 3. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground. Is resistance 1M ohms or more?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❼ **NO:** Input wire shorted to ground. Repair and retest. – – –1/1

❼ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input (J3-D1) and ground pin (J3-H3) in the ECU. Is resistance 1.5K to 3.5K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

001172.16 — Turbo Compressor Inlet Temperature Moderately High

The ECU senses a turbo compressor inlet temperature above specification.

RG41221,0000279 –19–19SEP05–1/1

001172.16 — Turbo Compressor Inlet Temperature Moderately High Diagnostic Procedure

04
160
,421

Related Information:
The ECU detects a turbo compressor inlet temperature above specification.

Alarm Level:
Warning

Control Unit Response:

Additional References:
For further turbo compressor inlet temperature sensor information, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the turbo compressor inlet temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under condition that set 001172.16 to set. 6. Read DTCs. Did 001172.16 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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,422

❸ **Restricted Air Filter Check**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Check the intake air filter for excessive dirt and debris restricting air flow. Is the filter restricted?	**YES:** Replace intake air filter and retest. **NO:** GO TO ❹ – – –1/1

❹ **Air Filter Mounting Location Check**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Make sure that the intake air filter is mounted in a location to draw fresh air. Drawing air directly from the engine is too hot causing the compressor inlet temperature to exceed specification. Is the intake air filter drawing fresh air?	**YES:** GO TO ❺ **NO:** Modify the mounting location of the air filter and retest. – – –1/1

❺ **Turbo Compressor Inlet Temperature Input Wire Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the turbo compressor inlet temperature sensor. 3. Ignition ON engine OFF 4. Using the diagnostic software, read turbo compressor inlet temperature input voltage. Is the voltage greater than 4.9 volts?	**YES:** GO TO ❻ **NO:** Short to ground in turbo compressor inlet temperature sensor input circuit. OR Faulty ECU connection OR Faulty ECU – – –1/1

❻ **Turbo Compressor Inlet Temperature Ground Wire Test**	*NOTE: For wiring and theory of operation, see TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Turbo compressor inlet temperature sensor still disconnected. 3. Ignition ON engine OFF 4. Probe the turbo compressor inlet temperature sensor connector ground terminal (terminal 2) on the engine harness with a test light connected to battery voltage. Does the light illuminate?	**YES:** Faulty turbo compressor inlet temperature sensor. **NO:** Open in turbo compressor inlet temperature sensor ground circuit. – – –1/1

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160
,423

001180.00 — Turbo Turbine Inlet Temperature Extremely High

The ECU calculates a turbo turbine inlet temperature above specification.

RG41221,000027A –19–05OCT05–1/1

001180.00 — Turbo Turbine Inlet Temperature Extremely High Diagnostic Procedure

04
160
,424

Related Information:
The ECU calculates a turbo turbine inlet temperature above specification.

There is no turbo turbine temperature sensor. This temperature is calculated by the ECU which uses numerous parameters to create the model-based temperature.

For OEM applications, the high turbo turbine inlet temperature threshold is 750° C (1382° F).

Alarm Level:
Warning

Control Unit Response:
The ECU will derate 5% per minute until the engine is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further turbo turbine inlet temperature information, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1
❷ **Air Filter Check**	*NOTE: For wiring and theory of operation, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Check the air filter and inlet tubing for restrictions or damage. Was damage or restrictions found?	**YES:** Clean or replace component that is damaged or restricted and retest. **NO:** GO TO ❸ – – –1/1
❸ **Engine Ventilation Check**	*NOTE: For wiring and theory of operation, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* Check the engine compartment for adequate fresh air supply to the engine. If the engine compartment is dirty, fresh air restrictions can cause high turbo turbine inlet temperatures. Is the engine compartment receiving adequate fresh air?	**YES:** GO TO ❹ **NO:** Clean restriction and redesign engine compartment to allow adequate air flow. – – –1/1

❹ **Turbo Compressor Inlet Temperature Calculation Check**	*NOTE: For wiring and theory of operation, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* *NOTE: The ECU uses exhaust gas recirculation mixed air temperature, manifold air pressure, fuel rail pressure, and engine speed to calculate turbo turbine inlet temperature. If one or more of these values are incorrect, an invalid turbo turbine inlet temperature will be used.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF. 3. Start the ECU diagnostic software. 4. Read DTCs. Are there any DTCs related to exhaust gas recirculation mixed air temperature, manifold air pressure, fuel rail pressure, or engine speed?	**YES:** Diagnose that DTC first. **NO:** GO TO ❺ – – –1/1

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,426

❺ **Charge Air System Check**	Check the entire charge air system for leaks and restrictions. Were leak(s) or restriction(s) found?	**YES:** Repair leak(s) or restriction(s) and retest. **NO:** Inconclusive results. – – –1/1

001180.16 — Turbo Turbine Inlet Temperature Moderately High

The ECU calculates a turbo turbine inlet temperature above specification.

RG41221,000027B –19–05OCT05–1/1

001180.16 - Turbo Turbine Inlet Temperature Moderately High Diagnostic Procedure

04
160
,427

Related Information:
The ECU calculates a turbo turbine inlet temperature above specification.

There is no turbo turbine temperature sensor. Turbine inlet temperature is calculated by the ECU which uses numerous parameters to create the model based temperature.

For OEM applications, the high turbo turbine inlet temperature threshold is 730° C (1346° F).

Alarm Level:
Warning

Control Unit Response:
The ECU will derate to 95% of full power immediately. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further turbo turbine inlet temperature information, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Air Filter Check**	*NOTE: For wiring and theory of operation, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Check the air filter and inlet tubing for restrictions or damage. Was damage or restrictions found?	**YES:** Clean or replace component that is damaged or restricted and retest. **NO:** GO TO ❸ – – –1/1

04
160
,428

❸ **Engine Ventilation Check**	*NOTE: For wiring and theory of operation, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* Check the engine compartment for adequate fresh air supply to the engine. If the engine compartment is dirty, fresh air restrictions can cause high turbo turbine inlet temperatures. Is the engine compartment receiving adequate fresh air?	**YES:** GO TO ❹ **NO:** Clean restriction and redesign engine compartment to allow adequate air flow. – – –1/1

❹ **Turbo Compressor Inlet Temperature Calculation Check**	*NOTE: For wiring and theory of operation, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* *NOTE: The ECU uses exhaust gas recirculation mixed air temperature, manifold air pressure, fuel rail pressure, and engine speed to calculate turbo turbine inlet temperature. If one or more of these values are incorrect, an invalid turbo turbine inlet temperature will be used.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF. 3. Start the ECU diagnostic software. 4. Read DTCs. Are there any DTCs related to exhaust gas recirculation mixed air temperature, manifold air pressure, fuel rail pressure, or engine speed?	**YES:** Diagnose that DTC first. **NO:** GO TO ❺ – – –1/1

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160
,429

❺ **Charge Air System Check**	Check the entire charge air system for leaks and restrictions. Were leak(s) or restriction(s) found?	**YES:** Repair leak(s) or restriction(s) and retest. **NO:** Inconclusive results. – – –1/1

001347.03 — Pump Control Valve Current High

ECU detects high current in the pump control return wire.

RG41221,000027F –19–19SEP05–1/1

001347.03 — Pump Control Valve Current High Diagnostic Procedure

04
160
,430

Related Information:
The ECU detects high current in the pump control valve (PCV) return wire. Typically this means that there is a short to power in the PCV circuit.

Alarm Level:
STOP

Control Unit Response:
Depending on the severity of this problem, engine operation will be affected. If the PCV current is high enough, the pump will not supply the high pressure common rail enough fuel to run the engine under normal operating conditions.

Additional References:
For further pump control valve information, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the pump control valve connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 001347.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

04
160
,431

❸ **Short in PCV Supply Wire Check**	*NOTE: For wiring and theory of operation, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect PCV connector and all three ECU connectors. 3. Using a multimeter, measure resistance between terminal H1 on the ECU connector J1 and all other terminals in the three ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO ❹ **NO:** Short in PCV supply wire with circuit that measured less than 2000 ohms. – – –1/1

❹ **Short in PCV Return Wire Check**	*NOTE: For wiring and theory of operation, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. PCV and all ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal H2 on the ECU connector J1 and all other terminals in the three ECU connectors. All measurements greater than 2000 ohms?	**YES:** Faulty PCV. **NO:** Short in PCV return wire with circuit that measured less than 2000 ohms. – – –1/1

001347.05 — Pump Control Valve Current Mismatch

The ECU is unable to match the measured pump current with the commanded pump current.

DN22556,000004C –19–23NOV05–1/1

001347.05 — Pump Control Valve Current Mismatch Diagnostic Procedure

04
160
,432

Related Information:
The ECU is unable to match the measured pump current with the commanded pump current.

Alarm Level:
STOP

Control Unit Response:
The engine will increase power for a short period of time until the high pressure common rail pressure exceeds the pressure relief valve high pressure specification.

Additional References:
For further pump control valve information, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the pump control valve sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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 cranking or running. 6. Read DTCs. Did 001347.05 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Open in PCV Supply Wire Check**	*NOTE: For wiring and theory of operation, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect PCV connector and ECU connector J1. 3. Using a multimeter, measure resistance of the PCV supply wire between terminal 1 of the PCV connector and H1 of the ECU connector J1 on the engine harness. Does the resistance measure 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open in PCV supply wire. – – –1/1

❹ **Open in PCV Return Wire Check**	*NOTE: For wiring and theory of operation, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. PCV and all ECU connector J1 still disconnected. 3. Using a multimeter, measure resistance of the PCV return wire between terminal 2 of the PCV connector and H2 of the ECU connector J1 on the engine harness. Does the resistance measure 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open in PCV return wire. – – –1/1

❺ Short in PCV Supply Wire Check	*NOTE: For wiring and theory of operation, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect PCV connector and all three ECU connectors. 3. Using a multimeter, measure resistance between terminal H1 on the ECU connector J1 and all other terminals in the three ECU connectors. All measurements greater than 2000 ohms?	**YES:** GO TO ❻ **NO:** Short in PCV supply wire with circuit that measured less than 2000 ohms. – – –1/1

❻ Short in PCV Return Wire Check	*NOTE: For wiring and theory of operation, see PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. PCV and all ECU connectors still disconnected. 3. Using a multimeter, measure resistance between terminal H2 on the ECU connector J1 and all other terminals in the three ECU connectors. All measurements greater than 2000 ohms?	**YES:** Faulty PCV. **NO:** Short in PCV return wire with circuit that measured less than 2000 ohms. – – –1/1

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001347.07 — Fuel Rail Pressure Control Error

The ECU detects fuel rail pressure 5 MPa (50 Bar) (725 psi) above or below the expected pressure.

RG41221,0000281 –19–05DEC05–1/1

001347.07 — Fuel Rail Pressure Control Error Diagnostic Procedure

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NOTE: If DTC 0001347.07 is accompanied with DTC 000094.17, 000157.03, 000157.04, or 000157.10, follow that diagnostic procedure first.

Related Information:
The ECU detects fuel rail pressure 5 MPa (725 psi) above or below the expected pressure.

Alarm Level:
Warning

Control Unit Response: If this code sets, the ECU will command the high pressure fuel pump to increase or decrease the amount of fuel supplied to the HPCR depending on the Actual and Desired values.

The engine could miss or run rough.

Engine may have low power.

Additional References:
For further fuel rail pressure sensor information, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	*NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 1. Ignition ON, Engine OFF. 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group 3. Write down all DTCs and their occurrence count. If any DTCs have Snapshot Capture of Snapshot Recording information save the information. For instructions on saving and using Snapshot Information, see SNAPSHOT INSTRUCTIONS earlier in this group. 4. Refresh DTC list. Did error code reappear as active?	**YES:** GO TO ❷ **NO:** GO TO ❷ – – –1/1

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❷ **Check Snapshot Information**	1. Open all saved Snapshot information for this error code and other related error codes as noted above, see SNAPSHOT INSTRUCTIONS earlier in this Section. 2. Review information. Can you determine the fault or operating conditions causing a fault by looking at the stored information?	**YES:** Repair problem you have identified. Retest. **YES:** Determined operating conditions that produced the fault. GO TO ❸ **NO:** GO TO ❸ – – –1/1

❸ **Rail Pressure Check**	*NOTE: For theory of operation, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, Engine at operating point where error occurs. 2. Using Service ADVISOR monitor Fuel rail Pressure - Actual and Fuel Rail Pressure - Desired. Are Actual and Desired fuel rail pressure within 5 MPa (725 psi) of each other?	**YES:** Pressures are within limits. Try another Speed/Load point. **NO:** If Actual is below Desired. GO TO ❹ **NO:** If Actual is above Desired. GO TO ❺ – – –1/1

❹ **Low Pressure Fuel System Check**	*NOTE: For theory of operation, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.* 1. Using Service ADVISOR monitor Fuel transfer Pump Pressure - Actual and Fuel transfer Pump Pressure - Desired. 2. Record fuel transfer pump pressure. Is Actual Pressure at least 15KPa (2psi)?	**YES:** GO TO ❺ **NO:** Change filter and retest. **NO:** Filters changed and still see low pressure GO TO ❺. – – –1/1

❺ **Rail Pressure Sensor Test**	*NOTE: For theory of operation, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. *NOTE: Fuel is at high Pressure, wait 5 minutes to allow rail pressure to reduce before opening any fuel lines.* 2. Remove rail pressure sensor, see REMOVE AND INSTALL FUEL RAIL PRESSURE SENSOR in Section 02 Group 110. 3. Reconnect rail pressure sensor connector and set sensor in an open place. 4. Ignition ON, Engine OFF. 5. Using Service ADVISOR monitor Fuel rail Pressure - Actual, Manifold Absolute Pressure, Engine Oil Pressure and Fuel Transfer Pump Pressure - Actual. Are all readings within 35KPa (5psi) of each other?	**YES:** Reinstall fuel rail pressure sensor, see REMOVE AND INSTALL FUEL RAIL PRESSURE SENSOR in Section 02 Group 110. GO TO ❻ **YES:** If Actual rail pressure was higher than Desired in Step 3 ❽. **NO:** Replace fuel rail pressure sensor if it is out of range with the others, retest. – – –1/1

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❻ **Rail Pressure Limiter Check**	*NOTE: For theory of operation, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. *NOTE: Fuel is at high Pressure, wait 5 minutes to allow rail pressure to reduce before opening any fuel lines.* 2. Remove rail pressure limiter fuel leak off line, see REMOVE AND INSTALL PRESSURE LIMITER in Section 02 Group 90. 3. Connect one end of a temporary fuel line to the pressure limiter and place the other end into a suitable fuel container. A suitable line can be found in kit JT03513. 4. Ignition ON, Engine at operating point where error occurred. Is fuel flowing freely into container from the fuel limiter?	**YES:** Replace fuel limiter, see REMOVE AND INSTALL HIGH PRESSURE LIMITER in Section 02 Group 70. Retest. **NO:** Reinstall fuel limiter leak off line, see REMOVE AND INSTALL HIGH PRESSURE LIMITER in Section 02 Group 90. GO TO ❼ – – –1/1

❼ **High Pressure Fuel Pump Timing Check**	*NOTE: For theory of operation, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove high pressure pump gear housing cover, set engine timing and check pump gear alignment, see REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP ASSEMBLY in Section 02 Group 90. Are pump timing marks aligned?	**YES:** GO TO ❽ **NO:** Re-time pump, see REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP ASSEMBLY in Section 02 Group 90. – – –1/1

❽ **High Pressure Fuel Pump Control valve Connector Check**	*NOTE: For theory of operation, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove high pressure fuel pump control valve connector. 3. Check for loose, corroded terminals or wiring. 4. Replace connector and tie back in place (if applicable). 5. Ignition ON, Engine at operating point where error occurred. Did 001347.07 reappear as active?	**YES:** GO TO ❾ **NO:** Pump control valve connection fixed problem. – – –1/1

❾ **High Pressure Fuel pump**	*NOTE: For theory of operation, see MEASURING PRESSURE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove and replace high pressure fuel pump, see REMOVE AND INSTALL HIGH PRESSURE PUMP ASSEMBLY in Section 02 Group 90. 3. Ignition ON, Engine at operating point where error occurred. Did 001347.07 reappear as active?	**YES:** GO TO ❿ **NO:** Pump fixed problem. – – –1/1

❿ **ECU**	1. Ignition OFF. 2. Remove and replace ECU, see REMOVE AND INSTALL ECU in Section 02 Group 110. 3. Ignition ON, Engine at operating point where error occurred. Did 001347.07 reappear as active?	**YES:** Reassemble all parts, reconnect all connectore, visually inspect all wiring. Retest **NO:** ECU fixed problem. – – –1/1

001568.02 — Torque Curve Selection Invalid

The ECU receives torque curve selection information over CAN, but the information received is not valid.

Related Information:
The ECU has the ability operate the engine on different torque curves. Individual curves can be selected based on information sent to the ECU over CAN (Controller Area Network) by another controller.

Alarm Level:
Warning

Control Unit Response:
The ECU will select a default torque curve to continue running.

Depending on application, the selected default torque curve may be a lower power curve.

WL30140,0000033 –19–12APR06–1/1

001568.02—Torque Curve Selection Invalid Diagnostic Procedure

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 001568.02 error code active?	**YES:** GO TO ❷ **NO:** GO TO ❷

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see the application manual.

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001569.31 — Fuel Derate

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Fuel Derate

Fuel Derate

The fuel derate trouble code is information to the operator that the ECU has detected a condition such as low fuel pressure, high fuel pressure, water in fuel, low oil pressure, high exhaust gas recirculation gas mixed air temperature, high air filter restriction, high engine coolant temperature, or low coolant level, and is derating the engine by limiting the maximum amount of fuel available to the engine.

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:

Troubleshoot the diagnostic trouble code(s) associated with the fuel derate.

RG41221,0000282 –19–08SEP05–1/1

001639.01 — Fan Speed Signal Missing

The ECU detects that fan speed input is missing.

WL30140,0000035 –19–12APR06–1/1

001639.01 — Fan Speed Signal Missing Diagnostic Procedure

Related Information:
The ECU monitors various parameters such as engine coolant temperature, oil temperature, air temperature, and other components on the engine. When these become excessive, the ECU commands the fan drive to run at a higher speed. The ECU sends a PWM signal through the fan drive solenoid control wire to energize the fan drive solenoid. This controls the fan speed. The ECU monitors fan speed through a hall effect sensor in the fan drive. This allows the ECU to determine if there is any significant difference between desired and actual fan speed.

Alarm Level:
Warning

Control Unit Response:
The ECU commands the fan to run at the highest possible speed. Code will set in 13 seconds, time to clear is 3 seconds.

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 001639.01 error code active?	**YES:** GO TO ❷ **NO:** Abnormal condition set code. Return to service and monitor further.

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see the application manual.

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001639.16 — Fan Speed Higher Than Expected

The ECU detects fan speed higher than expected.

WL30140,0000036 –19–12APR06–1/1

001639.16 — Fan Speed Higher Than Expected Diagnostic Procedure

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Related Information:
The ECU monitors various parameters such as engine coolant temperature, oil temperature, air temperature, and other components on the engine. When these become excessive, the ECU commands the fan drive to run at a higher speed. The ECU sends a PWM signal through the fan drive solenoid control wire to energize the fan drive solenoid. This controls the fan speed. The ECU monitors fan speed through a hall effect sensor in the fan drive. This allows the ECU to determine if there is any significant difference between desired and actual fan speed.

Alarm Level:
Warning

Control Unit Response:
The ECU detects fan speed 300 rpm higher than Desired Fan Speed. Time to set is 180 seconds, time to clear is 10 seconds. The code is inhibited during warm-up.

There is no change in engine performance

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 001639.16 error code active?	**YES:** GO TO ❷ **NO:** Abnormal condition set code. Return to service and monitor further. – – –1/1

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Check all fan connectors, see TERMINAL TEST. **NO:** See application manual for further troubleshooting procedures. – – –1/1

001639.18 — Fan Speed Lower Than Expected

The ECU detects fan speed lower than expected.

WL30140,0000037 –19–12APR06–1/1

001639.18 — Fan Speed Lower Than Expected Diagnostic Procedure

Related Information:
The ECU monitors various parameters such as engine coolant temperature, oil temperature, air temperature, and other components on the engine. When these become excessive, the ECU commands the fan drive to run at a higher speed. The ECU sends a PWM signal through the fan drive solenoid control wire to energize the fan drive solenoid. This controls the fan speed. The ECU monitors fan speed through a hall effect sensor in the fan drive. This allows the ECU to determine if there is any significant difference between desired and actual fan speed.

Alarm Level:
Warning

Control Unit Response:
The ECU detects fan speed 300 rpm lower than Desired Fan Speed. Code will set in 180 seconds. Time to clear is 10 seconds.

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There is no change in engine performance

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 001639.18 error code active?	**YES:** GO TO ❷ **NO:** Abnormal condition set code. Return to service and monitor further.

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Check all fan connectors, see TERMINAL TEST. **NO:** See application manual for further troubleshooting procedures. – – –1/1

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002000.13 — Security Violation

The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

Security Violation

- When the ignition is first turned on, all of the controllers on the machine communicate with each other to make sure that all controllers are correct for the particular machine.

DTC 002000.13 will set if:

- The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

If DTC 002000.13 sets, the following will occur:

- The ECU will allow the engine to start, but will only allow low idle engine speed.

If DTC 002000.13 sets:

- If one of the controllers on the machine has just been replaced, make sure the correct controller was installed.
- If all controllers on the machine are the correct part numbers, check to see if any of the controllers have active or stored CAN related DTCs. If they do, go to the appropriate diagnostic procedure.

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RG40854,000000B –19–12MAY06–1/1

002005.09 — ACU Message Missing

The ECU does not receive the torque speed select message from ACU (Armrest Control Unit, source address 5) over CAN or the message is not valid.

WL30140,0000038 –19–12APR06–1/1

002005.09 — ACU Message Missing Diagnostic Procedure

Related Information:
The CAN transmits the vehicle's desired torque speed control to the ECU from the ACU.

CAN bus communication problems can cause this code.

Alarm Level:
Warning

Control Unit Response:
Other ECU codes will be set due to loss of throttle information. ECU will respond to these codes according to its programming, such as setting engine speed to low idle.

Additional References:
For further ACU code information, refer to the Test Manual for the equipment on which the code set.

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 002005.09 error code active?	**YES:** GO TO ❸ **NO:** GO TO ❷

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see application manual.

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❸ **ACU Information Check**	1. Ignition ON, Engine OFF. 2. From Service ADVISOR read the Armrest Controller Number. Do the numbers agree?	**YES:** Probable CAN communication problem. Further troubleshooting procedures are being developed. **NO:** For further troubleshooting procedures see application manual.

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002030.09 — CAB Message Missing

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The ECU does not receive the a/c clutch status message from cab controller (source address 30) over CAN, or the message is not valid.

WL30140,0000039 –19–12APR06–1/1

002030.09 — CAB Message Missing Diagnostic Procedure

Related Information:
The CAN transmits the vehicle's desired a/c (air conditioner) clutch status to the ECU from the cab controller.

CAN bus communication problems can cause this code.

Alarm Level:
Warning

Control Unit Response:
The ECU will default the fan speed to 1200 rpm.

Additional References:
For further CAB code information, refer to the Test Manual for the equipment on which the code set.

Additional References:
For further ACU code information, refer to the Test Manual for the equipment on which the code set.

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 002030.09 error code active?	**YES:** GO TO ❸ **NO:** GO TO ❷ – – –1/1

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see the application manual. – – –1/1

❸ **ACU Information Check**	1. Ignition ON, Engine OFF. 2. From Service ADVISOR read the Cab Controller Number. Do the numbers agree?	**YES:** Probable CAN communication problem. Further troubleshooting procedures are being developed. **NO:** For further troubleshooting procedures see the application manual. – – –1/1

002071.09 — CCU Message Missing

The ECU does not receive the CCU (Chassis Control Unit, source address 71) messages over CAN or the messages are not valid.

WL30140,000003A –19–12APR06–1/1

002071.09 — CCU Message Missing Diagnostic Procedure

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Related Information:
The CCU (or CCD on some equipment) transmits vehicle information such as transmission oil temperature, tire size, and vehicle speed to the ECU over CAN.

CAN bus communication problems can cause this code.

Alarm Level:
Warning

Control Unit Response:
The ECU will default to the highest fan speed to compensate for transmission oil temperature.

The ECU will use a default tire size.

The ECU will not allow transport boost.

Additional References:
For further CCU code information, refer to the Test Manual for the equipment on which the code set.

Additional References:
For further ACU code information, refer to the Test Manual for the equipment on which the code set.

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Refresh DTC list. Is 002071.09 error code active?	**YES:** GO TO ❸ **NO:** GO TO ❷ – – –1/1

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❷ **Occurrence Count Check**	1. Ignition ON, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** Perform Terminal Test, repair any problems. **NO:** For further troubleshooting procedures see the application manual. – – –1/1

❸ **ACU Information Check**	1. Ignition ON, Engine OFF. 2. From Service ADVISOR read the CCU Controller Number. Do the numbers agree?	**YES:** Probable CAN communication problem. Further troubleshooting procedures are being developed. **NO:** For further troubleshooting procedures see the application manual. – – –1/1

002630.00 — Exhaust Gas Recirculation (EGR) Fresh Air Temperature Extremely High

The ECU senses an exhaust gas recirculation fresh air temperature above specification.

RG41221,0000283 –19–28SEP05–1/1

002630.00 - Exhaust Gas Recirculation (EGR) Fresh Air Temperature Extremely High Diagnostic Procedure

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Related Information
The ECU senses an EGR fresh air temperature of 91° C (195° F) on OEM applications.

Alarm Level:
STOP

Control Unit Response:
The ECU will derate 20% per minute until engine is running at 40% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.

On non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR fresh air temperature sensor information, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

IMPORTANT: If any turbocharger or EGR valve codes have also been set, diagnose those codes first.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the EGR fresh air temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs. Did 002630.00 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **Restricted or Dirty Charge Air Cooler and or Radiator**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Make sure that the charge air cooler and radiator is clean and free from excess debris. The charge air cooler and radiator need to be cleaned periodically. Are the charge air cooler and radiator exteriors clean?	**YES:** GO TO ❹ **NO:** Clean the exterior of the charge air cooler and/or radiator then retest

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❹ **Check EGR Fresh Air Temperature Sensor**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the EGR fresh air temperature sensor from the inlet to the intake manifold. 3. Ignition ON, engine OFF 4. Give sensor time to adjust to ambient temperature. 5. Using the ECU diagnostic software, read exhaust gas recirculation fresh air temperature. Is the sensor reading and the ambient temperature relatively close?	**YES:** GO TO ❺ **NO:** GO TO ❻

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❺ **Charge Air Cooler Internal Performance**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Measure pressure drop across the charge air cooler. Is the pressure drop between 8 and 16 KPa?	**YES:** Check for obstruction in the charge air cleaner. **NO:** GO TO ❻ – – –1/1

❻ **EGR Fresh Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR fresh air temperature sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR fresh air temperature sensor connector and terminal F2 in ECU connector J3 on the engine harness. • Terminal B in the EGR fresh air temperature sensor connector and terminal B2 in ECU connector J3 on the engine harness. All measurements 5 ohms or less?	**YES:** Faulty EGR fresh air temperature sensor. **NO:** GO TO ❼ – – –1/1

❼ **EGR Fresh Air Temperature Sensor Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 6 (terminal B2 or F2 in ECU connector J3) and all other terminals in all three ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measures less than 2000 ohms. **NO:** Open in wire that was more than 5 ohms in step 6 – – –1/1

002630.03 — Exhaust Gas Recirculation (EGR) Fresh Air Temperature Input Voltage High

The exhaust gas recirculation fresh air temperature input voltage exceeds the sensor's high voltage specification. Because this circuit is designed to see a voltage increase as resistance to ground increases, the probable cause of this fault is an open circuit. Less probable is a short from the 5V input wire to a power source.

RG41221,0000284 –19–26SEP05–1/1

002630.03 — Exhaust Gas Recirculation (EGR) Fresh Air Temperature Input Voltage High Diagnostic Procedure

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Related Information:
The EGR fresh air temperature input voltage exceeds the sensor's high voltage specification. The voltage corresponds to a temperature that is lower than what is physically possible for EGR fresh air temperature.

For OEM applications, the high EGR fresh air temperature input voltage specification is 4.95 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default EGR fresh air temperature of 50° C (122° F).

The ECU's high EGR fresh air temperature engine protection feature disabled.

Additional References:
For further EGR fresh air temperature sensor information, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the EGR fresh air temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 002630.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor terminals. Is resistance less than 100K ohms?	**YES:** Sensor not open. GO TO ❹ **NO:** Excessively high resistance in the sensor. Replace and retest. – – –1/1
❹ **Input Circuit Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON. 2. Temperature sensor still disconnected. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground. Is voltage above 4.5-5.5V?	**YES:** Input OK. Check ground circuit. GO TO ❼ **NO:** If voltage is greater than 5.5V, sensor 5V input wire shorted to a higher voltage source. GO TO ❺ **NO:** If voltage is less than 4.5V, open or high resistance in input wiring. GO TO ❻ – – –1/1

❺ **Harness Shorted to Higher Voltage Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect 30-pin connectors from ECU. 3. Ignition ON. 4. Using a multimeter and JT07328 Connector Adapter Test Kit, read voltage between the sensor connector input terminal and a good chassis ground Is voltage zero?	**YES:** Harness wiring OK. Remove and test ECU. GO TO❾ **NO:** Voltage is above 5.5V: harness or connected wiring shorted to a higher voltage source. Repair and retest. – – –1/1
❻ **Harness Input Wiring Open Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector (J3) from the ECU. Inspect connector and ECU pins. 3. Sensor still disconnected. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's input wiring in the harness. Is resistance near zero ohms?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❾ **NO:** Open or high resistance in input wiring. Repair and retest. – – –1/1
❼ **Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Use a multimeter and JT07328 Connector Adapter Test Kit to check resistance from the return terminal in the sensor connector to a good chassis ground. Is resistance near zero ohms?	**YES:** Ground circuit OK. Reconnect and retest. **NO:** Voltage is significantly above zero ohms: Open or high resistance in ground circuit. GO TO ❽ – – –1/1

❽ **Harness Ground Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Sensor still disconnected. 3. Disconnect the circuit's 30-pin connector (J3) from the ECU. Inspect connector and ECU pins. 4. Use a multimeter and JT07328 Connector Adapter Test Kit to check continuity of the sensor's ground wiring in the harness. Is resistance near zero ohms?	**YES:** Wiring OK. Remove and test ECU. GO TO ❿ **NO:** Resistance is significantly above zero ohms: Open or high resistance in ground wiring. Repair and retest. – – –1/1

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❾ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input (J3-F2) and ground pin (J3-B2) the ECU. Is resistance 1.5K to 3.5K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

❿ **ECU Ground Circuit Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter and JT07328 Connector Adapter Test Kit, measure resistance between the sensor circuit's ground pin (J3-B2) and pin J2-L2 or J2-L3 in the ECU. Is resistance near zero ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Resistance is 2 ohms or more: Faulty ECU. Replace and retest. – – –1/1

002630.04 — Exhaust Gas Recirculation (EGR) Fresh Air Temperature Input Voltage Low

The exhaust gas recirculation fresh air temperature input voltage drops below the sensor's low voltage specification. Because this circuit is designed to see a voltage drop as resistance to ground decreases, the probable cause of this fault on this circuit is low resistance to ground (grounded circuit).

RG41221,0000285 –19–26SEP05–1/1

002630.04 — Exhaust Gas Recirculation (EGR) Fresh Air Temperature Input Voltage Low Diagnostic Procedure

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Related Information:
The EGR fresh air temperature input voltage drops below the sensor's low voltage specification. The voltage corresponds to a temperature that is higher than what is physically possible for EGR fresh air temperature.

For OEM applications, the low EGR fresh air temperature input voltage specification is 0.15 volts.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default exhaust gas recirculation fresh air temperature of 50° C (122° F)

The ECU's high exhaust gas recirculation fresh air temperature engine protection feature disabled.

Additional References:
For further exhaust gas recirculation fresh air temperature sensor information, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the EGR fresh air temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 002630.04 reoccur?	**YES:** GO TO ❸ **NO:** 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 Shorted Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the sensor. 3. Using a multimeter and JT07328 Connector Adapter Test Kit, check resistance between the sensor pins. Is resistance more than 100 ohms?	**YES:** Sensor not shorted. GO TO ❹ **NO:** Excessively low resistance in the sensor. Replace and retest. – – –1/1

❹ **Sensor Grounded Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between each sensor pin and a good chassis ground. Is resistance 1M ohms or more?	**YES:** Sensor OK. Check wiring. GO TO ❺ **NO:** Low resistance to ground. Replace sensor and retest. – – –1/1

❺ **Grounded Input Circuit Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground. Is resistance 1000 ohms or more?	**YES:** Input circuit OK. Reconnect and retest. **NO:** GO TO ❻ – – –1/1

❻ **Harness Input Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Disconnect the circuit's 30-pin connector (J3) from the ECU. Inspect connector and ECU pins. 3. With the sensor still disconnected, use a multimeter and JT07328 Connector Adapter Test Kit to check resistance between the sensor connector input terminal and a good chassis ground. Is resistance 1M ohms or more?	**YES:** Input wiring OK. Remove and test ECU. GO TO ❼ **NO:** Input wire shorted to ground. Repair and retest. – – –1/1

❼ **ECU Input Circuit Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. ECU removed. 2. Using a multimeter, measure resistance between the sensor circuit's input (J3-F2) and ground pin (J3-B2) in the ECU. Is resistance 1.5K to 3.5K ohms?	**YES:** ECU OK. Reinstall and retest. **NO:** Faulty ECU. Replace and retest. – – –1/1

002630.15 — Exhaust Gas Recirculation (EGR) Fresh Air Temperature High Least Severe

The ECU senses an exhaust gas recirculation fresh air temperature above specification.

RG41221,0000286 –19–19SEP05–1/1

002630.15 - Exhaust Gas Recirculation (EGR) Fresh Air Temperature High Least Severe Diagnostic Procedure

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Related Information
The ECU senses an EGR fresh air temperature of 88° C (190° F) on OEM applications.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will control the engine to run under normal operation.

Additional References:
For further EGR fresh air temperature sensor information, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the EGR fresh air temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs. Did 002630.00 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Restricted or Dirty Charge Air Cooler and or Radiator**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Make sure that the charge air cooler and radiator is clean and free from excess debris. The charge air cooler and radiator need to be cleaned periodically. Are the charge air cooler and radiator exteriors clean?	**YES:** GO TO ❹ **NO:** Clean the exterior of the charge air cooler and/or radiator then retest – – –1/1

❹ **Check EGR Fresh Air Temperature Sensor**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the EGR fresh air temperature sensor from the inlet to the intake manifold. 3. Ignition ON, engine OFF 4. Give sensor time to adjust to ambient temperature. 5. Using the ECU diagnostic software, read exhaust gas recirculation fresh air temperature. Is the sensor reading and the ambient temperature relatively close?	**YES:** GO TO ❺ **NO:** GO TO ❻ – – –1/1

❺ **Charge Air Cooler Internal Performance**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Measure pressure drop across the charge air cooler. Is the pressure drop between 8 and 16 KPa?	**YES:** Check for obstruction in the charge air cleaner. **NO:** GO TO ❻ – – –1/1

❻ **EGR Fresh Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR fresh air temperature sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR fresh air temperature sensor connector and terminal F2 in ECU connector J3 on the engine harness. • Terminal B in the EGR fresh air temperature sensor connector and terminal B2 in ECU connector J3 on the engine harness. All measurements 5 ohms or less?	**YES:** Faulty EGR fresh air temperature sensor. **NO:** GO TO ❼ – – –1/1

❼ **EGR Fresh Air Temperature Sensor Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 6 (terminal B2 or F2 in ECU connector J3) and all other terminals in all three ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measures less than 2000 ohms. **NO:** Open in wire that was more than 5 ohms in step 6 – – –1/1

002630.16 — Exhaust Gas Recirculation (EGR) Fresh Air Temperature Moderately High

The ECU senses an exhaust gas recirculation fresh air temperature above specification.

RG41221,0000287 –19–19SEP05–1/1

002630.16 - Exhaust Gas Recirculation (EGR) Fresh Air Temperature Moderately High Diagnostic Procedure

Related Information
The ECU senses an EGR fresh air temperature of 91° C (195° F) on OEM applications.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate 5% per minute until engine is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR fresh air temperature sensor information, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and the EGR fresh air temperature sensor connector looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

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❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs. Did 002630.00 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Restricted or Dirty Charge Air Cooler and or Radiator**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Make sure that the charge air cooler and radiator is clean and free from excess debris. The charge air cooler and radiator need to be cleaned periodically. Are the charge air cooler and radiator exteriors clean?	**YES:** GO TO ❹ **NO:** Clean the exterior of the charge air cooler and/or radiator then retest – – –1/1
❹ **Check EGR Fresh Air Temperature Sensor**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove the EGR fresh air temperature sensor from the inlet to the intake manifold. 3. Ignition ON, engine OFF 4. Give sensor time to adjust to ambient temperature. 5. Using the ECU diagnostic software, read exhaust gas recirculation fresh air temperature. Is the sensor reading and the ambient temperature relatively close?	**YES:** GO TO ❺ **NO:** GO TO ❻ – – –1/1

❺ **Charge Air Cooler Internal Performance**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Measure pressure drop across the charge air cooler. Is the pressure drop between 8 and 16 KPa?	**YES:** Check for obstruction in the charge air cleaner. **NO:** GO TO ❻ – – –1/1

❻ **EGR Fresh Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR fresh air temperature sensor connector and ECU connector J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR fresh air temperature sensor connector and terminal F2 in ECU connector J3 on the engine harness. • Terminal B in the EGR fresh air temperature sensor connector and terminal B2 in ECU connector J3 on the engine harness. All measurements 5 ohms or less?	**YES:** Faulty EGR fresh air temperature sensor. **NO:** GO TO ❼ – – –1/1

❼ **EGR Fresh Air Temperature Sensor Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 6 (terminal B2 or F2 in ECU connector J3) and all other terminals in all three ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measures less than 2000 ohms. **NO:** Open in wire that was more than 5 ohms in step 6 – – –1/1

002659.02 — Exhaust Gas Recirculation (EGR) Flow/Temperature Mismatch

The ECU senses a mismatch between the exhaust gas recirculation flow and temperature.

RG41221,0000288 –19–27MAR06–1/1

002659.02 - Exhaust Gas Recirculation (EGR) Flow/Temperature Mismatch Diagnostic Procedure

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Related Information
The amount of EGR flow change in temperature or pressure does not match with the ECU.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will run command the engine to run in open loop control.

Additional References:
For further EGR valve information, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 200 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* Without disconnecting, visually inspect the EGR valve connector and wiring looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s) and retest. **NO:** GO TO ❷

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❷ **Read/Store DTCs and information**	1. Ignition ON, engine OFF *NOTE: If DTCs are cleared through Diagnostic Gauge Snapshot information for ALL DTCs will be lost.* 2. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group). 3. If using Diagnostic Gauge read and record all stored and active codes then GO TO 4. Make note of all DTCs. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Section. 5. Refresh DTC list. Does diagnostic display show 002971.02 Active?	**YES:** GO TO ❹ **NO:** Problem is intermittent. GO TO ❸ ❹.

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❸ **ECU Stored Information Check**	1. Ignition OFF. 2. Review downloaded Snapshot Information to see if the cause of the error can be determined. Were you able to determine the cause of the DTC?	**YES:** GO TO the component that is believed to be causing the failure and trouble shoot it. **NO:** GO TO ❹

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❹ **Exhaust Gas Recirculation Exhaust Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove EGR exhaust temperature sensor. 3. Ignition ON, engine OFF. 4. Using a heat gun, apply heat to sensor. 5. Using the diagnostic software, read exhaust gas recirculation exhaust temperature. Did the temperature reading change accordingly when applying heat?	**YES:** GO TO ❻ **NO:** GO TO ❺

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❺ **Exhaust Gas Recirculation Exhaust Temperature Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR exhaust temperature sensor and ECU connector J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR exhaust temperature sensor and terminal E2 in ECU connector J3 on the engine harness. • Terminal B in the EGR exhaust temperature sensor and terminal B2 in ECU connector J3 on the engine harness. Are all measurements 5 ohms or less?	**YES:** Faulty EGR exhaust temperature sensor. **NO:** Open or short in wire that measured more than 5 ohms. – – –1/1

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❻ **Exhaust Gas Recirculation Mixed Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove EGR mixed air temperature sensor 3. Ignition ON, engine OFF. 4. Using a heat gun, apply heat to sensor. 5. Using the diagnostic software, read exhaust gas recirculation mixed air temperature. Did the temperature reading change accordingly when applying heat?	**YES:** GO TO ❽ **NO:** GO TO ❼ – – –1/1

❼ **Exhaust Gas Recirculation Mixed Air Temperature Wiring Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR mixed air temperature sensor and ECU connector J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR mixed air temperature sensor and terminal F1 in ECU connector J3 on the engine harness. • Terminal B in the EGR mixed air temperature sensor and terminal B2 in ECU connector J3 on the engine harness. Are all measurements 5 ohms or less?	**YES:** Faulty EGR mixed air temperature sensor. **NO:** Open or short in wire that measured more than 5 ohms. – – –1/1

❽ **Exhaust Gas Recirculation Fresh Air Temperature Sensor Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF. 2. Remove EGR fresh air temperature sensor 3. Ignition ON, engine OFF. 4. Using a heat gun, apply heat to sensor. 5. Using the diagnostic software, read exhaust gas recirculation fresh air temperature. Did the temperature reading change accordingly when applying heat?	**YES:** GO TO ❿ **NO:** GO TO ❾ – – –1/1

9 Exhaust Gas Recirculation Fresh Air Temperature Wiring Test	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR fresh air temperature sensor and ECU connector J3. 3. Using a multimeter, measure resistance between the following: • Terminal A in the EGR fresh air temperature sensor and terminal F2 in ECU connector J3 on the engine harness. • Terminal B in the EGR fresh air temperature sensor and terminal B2 in ECU connector J3 on the engine harness. Are all measurements 5 ohms or less?	**YES:** Faulty EGR fresh air temperature sensor. **NO:** Open or short in wire that measured more than 5 ohms. – – –1/1

10 Manifold Air Pressure Sensor Check	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine running at full load rate speed. 2. Using the ECU diagnostic software, read manifold air pressure. *NOTE: Make sure to record this value for later use.* 3. Ignition OFF 4. Remove the manifold air pressure sensor. 5. Install a mechanical gage in the sensor port. 6. Ignition ON, engine running at full load rate speed. 7. Read the manifold air pressure on the gage. Are both values with 10% of each other?	**YES:** GO TO 1 **NO:** Faulty manifold air pressure sensor. – – –1/1

⓫ **Exhaust Pressure Sensor Check**	*NOTE: For wiring and theory of operation, see EXHAUST PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine running at full load rate speed. 2. Using the ECU diagnostic software, read exhaust pressure. *NOTE: Make sure to record this value for later use.* 3. Ignition OFF 4. Remove the exhaust pressure sensor. 5. Install a mechanical gage in the sensor port. 6. Ignition ON, engine running at full load rate speed. 7. Read the exhaust pressure on the gage. Are both values with 10% of each other?	**YES:** GO TO ❷ **NO:** Faulty exhaust pressure sensor. – – –1/1

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⓬ **EGR Cooler Check**	1. Ignition OFF 2. Remove the EGR cooler. 3. Check for restrictions and damage to the cooler. Is the EGR cooler functioning properly?	**YES:** Faulty ECU **NO:** Faulty EGR cooler. – – –1/1

002659.15 — Exhaust Gas Recirculation (EGR) Flow Rate High Least Severe

The ECU detects exhaust gas recirculation flow when the exhaust gas recirculation valve is closed.

RG41221,0000289 –19–27MAR06–1/1

002659.15 - Exhaust Gas Recirculation (EGR) Flow Rate High Least Severe Diagnostic Procedure

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Related Information
The ECU detects exhaust gas recirculation flow when the EGR valve is closed.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU will run command the engine to run in open loop control.

Additional References:
For further EGR valve information, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 200 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* Without disconnecting, visually inspect the EGR valve connector and wiring looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). Re-calibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. **NO:** GO TO ❷

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❷ **Read/Store DTCs and information**	1. Ignition ON, engine OFF *NOTE: If DTCs are cleared through Diagnostic Gauge Snapshot information for ALL DTCs will be lost.* 2. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group). 3. If using Diagnostic Gauge read and record all stored and active codes then GO TO 4. Make note of all DTCs. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Section. 5. Refresh DTC list. Does diagnostic display show 002971.02 Active?	**YES:** GO TO ❹ **NO:** Problem is intermittent. GO TO ❸ ❹.

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❸ **ECU Stored Information Check**	1. Ignition OFF. 2. Review downloaded Snapshot Information to see if the cause of the error can be determined. Were you able to determine the cause of the DTC?	**YES:** GO TO the component that is believed to be causing the failure and trouble shoot it. **NO:** GO TO ❹

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❹ **EGR Valve Position Sensor 5V Supply Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR valve connector. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between terminal 1 in the EGR valve connector on the engine harness and a good chassis ground. Is the voltage 4.9 volts or above?	**YES:** GO TO ❺ **NO:** Open in EGR valve 5V supply circuit. OR Short to ground in EGR valve 5V supply circuit. OR Faulty ECU connection OR Faulty ECU Repair fault then recalibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest.

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❺ **EGR Valve Position Sensor Ground Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF 2. EGR valve connector still disconnected. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between terminal 1 and terminal 5 in the EGR valve connector on the engine harness. Is the voltage 4.9 volts or above?	**YES:** GO TO ❻ **NO:** Open in EGR valve ground circuit. OR Faulty ECU connection OR Faulty ECU Repair fault then recalibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. – – –1/1

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❻ **EGR Valve Position Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF 2. EGR valve connector still disconnected. 3. Install a jumper wire between terminal 1 and terminal 6 in the EGR valve connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read exhaust gas recirculation valve position input voltage. Is the voltage 4.5 volts or greater?	**YES:** GO TO ❼ **NO:** Open in EGR valve input circuit. OR Faulty ECU connection OR Faulty ECU Repair fault then recalibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. – – –1/1

❼ **EGR Valve Position Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF 2. All connection reestablished. 3. Ignition ON, engine running at low idle 4. Using the ECU diagnostic software, read exhaust gas recirculation valve position - actual. Is the valve position 0%?	**YES:** GO TO ❽ **NO:** GO TO ❾ – – –1/1

❽ **EGR Valve Leak Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition ON, engine running 2. Check the EGR valve for exhaust leaks. Are any leaks present?	**YES:** Repair leaks and retest. **NO:** Replace the EGR valve. Re-calibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. – – –1/1

❾ **EGR Valve Learn Value Reset Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the ECU diagnostic software, run the exhaust gas recirculation valve learn value reset test. For instructions, see EXHAUST GAS RECIRCULATION VALVE LEARN VALUE RESET TEST earlier in the Group. 3. Ignition OFF for 5 minutes. 4. Ignition ON, engine running fully loaded. 5. Using the ECU diagnostic software, read DTCs. Did 002659.15 reoccur?	**YES:** Replace the EGR valve and retest. Recalibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. **NO:** EGR valve learned value needed reset. EGR is functioning correctly. – – –1/1

002659.17 — Exhaust Gas Recirculation (EGR) Flow Rate Low Least Severe

The ECU does not detect exhaust gas recirculation flow when the valve is open.

RG41221,000028A –19–27MAR06–1/1

002659.17 - Exhaust Gas Recirculation (EGR) Flow Rate Low Least Severe Diagnostic Procedure

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Related Information
The ECU does not detect EGR flow when the valve is open.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate 5% per minute until engine is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

If this code sets, the ECU will run command the engine to run in open loop control.

Additional References:
For further EGR valve information, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 200 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* Without disconnecting, visually inspect the EGR valve connector and wiring looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s) and retest. **NO:** GO TO ❷

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❷ **Read/Store DTCs and information**	1. Ignition ON, engine OFF *NOTE: If DTCs are cleared through Diagnostic Gauge Snapshot information for ALL DTCs will be lost.* 2. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group). 3. If using Diagnostic Gauge read and record all stored and active codes then GO TO 4. Make note of all DTCs. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Section. 5. Refresh DTC list. Does diagnostic display show 002971.02 Active?	**YES:** GO TO ❹ **NO:** Problem is intermittent. GO TO ❸ ❹.

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❸ **ECU Stored Information Check**	1. Ignition OFF. 2. Review downloaded Snapshot Information to see if the cause of the error can be determined. Were you able to determine the cause of the DTC?	**YES:** GO TO the component that is believed to be causing the failure and trouble shoot it. **NO:** GO TO ❹

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❹ **EGR Valve Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF. 2. Remove EGR valve and inspect for damaged or broken parts. See REMOVE AND INSTALL EXHAUST GAS RECIRCULATION (EGR) VALVE in Section 02, Group 100 earlier in this manual. 3. Ensure wire harness connection is made to the EGR valve. 4. Ignition ON, engine OFF. 5. Using Service ADVISOR, run the Harness Diagnostic Mode Test, see HARNESS DIAGNOSTIC MODE TEST. Did exhaust gas recirculation valve position - actual change as the valve moved?	**YES:** GO TO ❺ **NO:** GO TO ❻

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❺ **EGR Cooler Check**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF. 2. Remove the EGR cooler. See REMOVE AND INSTALL EXHAUST GAS RECIRCULATION (EGR) COOLER in Section 02, Group 100 earlier in this manual. 3. Inspect the EGR cooler for debris and carbon build up causing blockage. 4. Apply low pressure air on the input side of the EGR cooler. Is the low pressure air passing through the EGR cooler?	**YES:** GO TO ❻ **NO:** Replace EGR cooler. – – –1/1

❻ **EGR Valve Position Sensor 5V Supply Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF 2. Disconnect the EGR valve connector. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between terminal 1 in the EGR valve connector on the engine harness and a good chassis ground. Is the voltage 4.9 volts or above?	**YES:** GO TO ❼ **NO:** Open in EGR valve 5V supply circuit. OR Short to ground in EGR valve 5V supply circuit. OR Faulty ECU connection OR Faulty ECU Repair fault then recalibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. – – –1/1

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❼ **EGR Valve Position Sensor Ground Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF 2. EGR valve connector still disconnected. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between terminal 1 and terminal 5 in the EGR valve connector on the engine harness. Is the voltage 4.9 volts or above?	**YES:** GO TO ❽ **NO:** Open in EGR valve ground circuit. OR Faulty ECU connection OR Faulty ECU Repair fault then recalibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. – – –1/1

❽ **EGR Valve Position Sensor Input Wire Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF 2. EGR valve connector still disconnected. 3. Install a jumper wire between terminal 1 and terminal 6 in the EGR valve connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read exhaust gas recirculation valve position input voltage. Is the voltage 4.5 volts or greater?	**YES:** GO TO ❾ **NO:** Open in EGR valve input circuit. OR Faulty ECU connection OR Faulty ECU Repair fault then recalibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. – – –1/1

❾ **EGR Valve Position Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition OFF 2. All connection reestablished. 3. Ignition ON, engine running fully loaded for ten minutes. 4. Using the ECU diagnostic software, read exhaust gas recirculation valve position - actual. Is the valve position above 0%?	**YES:** Replace the EGR valve. Recalibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. **NO:** GO TO ❿ – – –1/1

❿ **EGR Valve Learn Value Reset Test**	*NOTE: For wiring and theory of operation, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the ECU diagnostic software, run the exhaust gas recirculation valve learn value reset test. For instructions, see Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. 3. Ignition OFF for 5 minutes. 4. Ignition ON, engine running fully loaded for ten minutes. 5. Using the ECU diagnostic software, read DTCs. Did 002659.15 reoccur?	**YES:** Replace the EGR valve. Recalibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. **NO:** EGR valve learned value needed reset. EGR is functioning correctly. Reecalibrate using Service ADVISOR, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. – – –1/1

002790.16 — Turbo Compressor Outlet Temperature Moderately High

The ECU senses a turbo compressor outlet temperature above specification.

RG41221,000028B –19–19SEP05–1/1

002790.16 — Turbo Compressor Outlet Temperature Moderately High Diagnostic Procedure

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NOTE: If DTC 002790.16 is accompanied with any of the following DTCs, follow those diagnostic procedures first:

- *001172.03*
- *001172.04*
- *001172.16*
- *002630.00*
- *002630.03*
- *002630.04*
- *002630.15*
- *002630.16*

Related Information:
The ECU senses a turbo compressor outlet temperature of 260° C (500° F) on OEM engines.

The ECU uses the turbo compressor inlet temperature sensor and the exhaust gas recirculation fresh air temperature sensor to calculate the turbo compressor outlet temperature.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate 5% per minute until the engine is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information on non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further turbo compressor outlet temperature information, see TURBO COMPRESSOR OUTLET TEMPERATURE in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For theory of operation, see TURBO COMPRESSOR OUTLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1
❷ **DTC Check**	*NOTE: For theory of operation, see TURBO COMPRESSOR OUTLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Read DTCs. Do any of the following DTCs set? • 001172.03 • 001172.04 • 001172.16 • 002630.00 • 002630.03 • 002630.04 • 002630.15 • 002630.16	**YES:** Following the diagnostic procedure for that DTC. **NO:** GO TO ❸ – – –1/1
❸ **Air Filter Check**	*NOTE: For theory of operation, see TURBO COMPRESSOR OUTLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Check the air filter and tubing for restrictions or damage. Was damage or restrictions found?	**YES:** Clean or replace component that is damaged or restricted and retest. **NO:** GO TO ❹ – – –1/1

❹ **Engine Ventilation Check**	*NOTE: For theory of operation, see TURBO COMPRESSOR OUTLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* Check the engine compartment for adequate fresh air supply to the engine. If the engine compartment is dirty, fresh air restrictions can cause high turbo compressor inlet temperatures. Is the engine compartment receiving adequate fresh air?	**YES:** Faulty turbo actuator. Replace turbo actuator and retest. **NO:** Clean restriction and redesign engine compartment to allow adequate air flow. – – –1/1

002791.02 — Exhaust Gas Recirculation (EGR) Valve Position Invalid

For the valve closest to the front of the engine (where the fan is), the ECU detects the exhaust gas recirculation valve is not able to achieve desired position. Most probable cause is a stuck open or closed valve.

RG41221,000028C –19–03MAR06–1/1

002791.02 - Exhaust Gas Recirculation (EGR) Valve Position Invalid Diagnostic Procedure

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Related Information
The ECU detects the EGR valve is not able to achieve desired position.

If 002791.03, 002791.04, 003513.03 or 003513.04 is active troubleshoot these codes first.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engine until it is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.

For derate and shutdown values see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR valve information, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.

When directed to run the HARNESS DIAGNOSTIC MODE TEST or EXHAUST GAS RECIRCULATION VALVE RECALIBRATION the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Run Harness Diagnostic Mode Test. 5. Refresh DTC list. Does diagnostic display show any 002791 error code active besides 002971.02?	**YES:** Troubleshoot those active codes first. **NO:** GO TO ❷ – – –1/1

❷ **Warm Engine EGR Valve Cycle Test**	1. Ignition ON, Engine ON. 2. Warm engine to normal operating temperature. 3. Read coolant temperature and ensure it is at least 80° C (175° f) and continue running the engine for 15 more minutes. *NOTE: It takes a minimum of 10 minutes in this condition for the EGR valve to go through one cycle.* 4. Refresh codes. Did code reappear active?	**YES:** GO TO ❸ **NO:** GO TO ⓬ – – –1/1

❸ **EGR Physical Condition Check**	1. Ignition OFF, Engine OFF. 2. Remove EGR valve form engine. 3. Inspect the valve for damaged or broken mechanical parts. Were any problems found?	**YES:** Remove and replace EGR valve. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. **NO:** GO TO ❹ – – –1/1

❹ **EGR Valve Movement Test**	1. Reconnect EGR valve connector. 2. Ignition ON, Engine OFF. 3. Run Harness Diagnostic Mode Test. 4. Monitor valve for full closure and smooth movement. Did the valve move smoothly and close completely?	**YES:** GO TO ❺. **NO:** Sticking valve. Replace EGR valve. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1
❺ **Occurrence Count Check**	1. Ignition OFF, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** GO TO ❻. **NO:** GO TO ❼. – – –1/1
❻ **EGR Valve Connector Terminal Test**	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ❼. – – –1/1
❼ **Further Review of Snapshot Information**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO ❽. **NO:** GO TO ❿. – – –1/1
❽ **Engine Error Operating Point Test**	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Did Code reappear active?	**YES:** GO TO ❾. **NO:** GO TO ❼ and review the data again. – – –1/1

❾ **EGR Valve Connector Terminal Test**	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace EGR valve. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1

❿ **EGR Valve Connector Terminal Test**	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ⓫. – – –1/1

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⓫ **EGR Valve Replacement/Recalibration Check**	1. Replace EGR valve. 2. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. 3. Refresh codes. Did code reappear active?	**YES:** GO TO ⓬. **NO:** Problem fixed. Bad EGR valve. – – –1/1

⓬ **ECU Connector Terminal Test**	1. Disconnect ECU connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace ECU. Retest. – – –1/1

002791.03 — Exhaust Gas Recirculation (EGR) Valve Signal Out Of Range High (OORH)

For the valve closest to the front of the engine (where the fan is), the exhaust gas recirculation valve position signal exceeds the highest specification.

RG41221,000028D –19–09MAR06–1/1

002791.03 — Exhaust Gas Recirculation (EGR) Valve Signal Out Of Range High (OORH)

Related Information:
The EGR valve position signal indicates a value that is out of the range of the expected highest value.

Alarm Level:
Warning

Control Unit Response:

When 002791.03 sets, 002791.13 will also set causing a fuel derate, also 002791.07 will set.

For derate and shutdown values see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR valve information, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.

When directed to run the HARNESS DIAGNOSTIC MODE TEST or EXHAUST GAS RECIRCULATION VALVE RECALIBRATION the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. Did 002971.03 reappear active?	**YES:** GO TO ❷ **NO:** GO TO ⑯ – – –1/1

❷ **Valve Position Check**	Using Service ADVISOR read EGR valve position input voltage. Is voltage above 5.5 volts?	**YES:** GO TO ❸ **NO:** GO TO ❺ – – –1/1

❸ **ECU Connector Check**	1. Ignition OFF, Engine OFF. 2. Disconnect the ECU connector that has the EGR valve signal input wire connected to it. 3. Perform a terminal test, see TERMINAL TEST earlier in this Group. Were any problems found?	**YES:** Repair problem and retest **NO:** GO TO ❹ – – –1/1

❹ **Short To High Voltage Test**	Measure resistance between the EGR valve signal input wire to all other wires in the ECU connector. Was a short found?	**YES:** Repair, reconnect and retest. **NO:** Look at the harness and see if you can find any pinched, frayed or melted wiring. Reconnect and retest. – – –1/1

❺ **EGR Valve Connector Check**	1. Ignition OFF, Engine OFF. 2. Disconnect the EGR valve connector. 3. Perform a terminal test, see TERMINAL TEST earlier in this Group. Were any problems found?	**YES:** Repair problem and retest **NO:** GO TO ❻ – – –1/1
❻ **EGR Valve Reconnection Test**	1. Reconnect the EGR valve connector. 2. Ignition ON, Engine OFF. 3. Refresh codes. Did 002791.03 reappear active?	**YES:** GO TO ❼ **NO:** Problem fixed. Bad EGR valve connection. – – –1/1
❼ **EGR Valve Position Circuit Resistance Test**	1. Ignition OFF, Engine OFF. 2. Disconnect EGR valve connector. 3. Measure the resistance of the EGR valve position circuit power, ground and position input to one another on the valve. Are all values between 20k and 95k ohms?	**YES:** GO TO ❽. **NO:** Bad position circuit in EGR valve. Replace valve. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1
❽ **EGR Valve Position Input Circuit Harness Resistance Test**	Measure the resistance between the position input terminal and the position ground terminal in the EGR valve harness connector. Is the measurement between 9K and 11K ohms?	**YES:** GO TO ❾. **NO:** GO TO ⓭. – – –1/1
❾ **EGR Valve Position Supply Circuit Harness Resistance Test**	Measure the resistance between the position input supply terminal and the position ground terminal in the EGR valve harness connector. Is the measurement between 109K and 111K ohms?	**YES:** GO TO ⓫. **NO:** GO TO ⓾. – – –1/1

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⑩ **ECU Connector Check**	1. Disconnect appropriate ECU connector. 2. Perform a terminal test, see TERMINAL TEST earlier in this Group. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. Retest **NO:** Reconnect all connectors and retest. – – –1/1
⑪ **ECU Connector Check**	1. Disconnect appropriate ECU connector. 2. Perform a terminal test, see TERMINAL TEST earlier in this Group. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. Retest **NO:** GO TO ⑫. – – –1/1
⑫ **EGR Valve Position Supply Circuit Harness Resistance Test Two**	Measure the resistance between the position input supply terminal in the EGR valve harness connector and the position input supply terminal in the ECU harness connector. Is the measurement less than 2 ohms?	**YES:** Replace ECU. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. **NO:** Repair problem. Run Harness Diagnostic Mode Test. Retest – – –1/1
⑬ **ECU Connector Check**	1. Disconnect appropriate ECU connector. 2. Perform a terminal test, see TERMINAL TEST earlier in this Group. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. Retest **NO:** GO TO ⑭. – – –1/1
⑭ **EGR Valve Position Supply Ground Circuit Harness Resistance Test**	Measure the resistance between the position input supply ground terminal in the EGR valve harness connector and a good chassis ground. Is the measurement less than 2 ohms?	**YES:** GO TO ⑮. **NO:** GO TO ⑯. – – –1/1
⑮ **EGR Valve Position Supply Ground Circuit Harness Resistance Test Two**	Measure the resistance between the position input ground terminal in the EGR valve harness connector and the position input ground terminal in the ECU harness connector. Is the measurement less than 2 ohms?	**YES:** Replace ECU. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. **NO:** Repair problem. Run Harness Diagnostic Mode Test. Retest – – –1/1

16 EGR Valve Position Input Circuit Harness Resistance Test	Measure the resistance between the position input terminal in the EGR valve harness connector and the position input terminal in the ECU harness connector. Is the measurement less than 2 ohms?	**YES:** Replace ECU. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. **NO:** Repair problem. Run Harness Diagnostic Mode Test. Retest – – –1/1
17 Occurrence Count Check	1. Ignition OFF, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** GO TO 18. **NO:** GO TO 19. – – –1/1
18 EGR Valve Connector Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 19. – – –1/1
19 Further Review of Snapshot Information	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO 20. **NO:** GO TO 22. – – –1/1
20 Engine Error Operating Point Test	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Did Code reappear active?	**YES:** GO TO 21. **NO:** GO TO 19 and review the data again. – – –1/1

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21 EGR Valve Connector Terminal Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace EGR valve. Recalibrate, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1

22 EGR Valve Connector Terminal Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 23. – – –1/1

23 EGR Valve Replacement/Recalibration Check	1. Replace EGR valve. 2. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. 3. Refresh codes. Did code reappear active?	**YES:** GO TO 24. **NO:** Problem fixed. Bad EGR valve. – – –1/1

24 ECU Connector Terminal Test	1. Disconnect ECU connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace ECU. Retest. – – –1/1

002791.04 — Exhaust Gas Recirculation (EGR) Valve Position Signal Out Of Range Low (OORL)

For the valve closest to the front of the engine (where the fan is), the exhaust gas recirculation valve position signal exceeds the lowest specification.

RG41221,000028E –19–09MAR06–1/1

002791.04 — Exhaust Gas Recirculation (EGR) Valve Position Signal Out Of Range Low Diagnostic Procedure

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Related Information:
The EGR valve position signal indicates a value that is out of the range of the expected lowest value.

Alarm Level:
Warning

Control Unit Response:
When 002791.04 sets, 002791.13 will also set causing a fuel derate, also 002791.07 will set.

For derate and shutdown values see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR valve information, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.

When directed to run the HARNESS DIAGNOSTIC MODE TEST or EXHAUST GAS RECIRCULATION VALVE RECALIBRATION the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. Did 002971.04 reappear active?	**YES:** GO TO ❷ **NO:** GO TO ⑯ – – –1/1

❷ **EGR Valve Connector Check**	1. Ignition OFF, Engine OFF. 2. Disconnect the EGR valve connector. 3. Perform a terminal test, see TERMINAL TEST earlier in this Group. Were any problems found?	**YES:** Repair problem and retest **NO:** GO TO ❸ – – –1/1
❸ **EGR Valve Reconnection Test**	1. Reconnect the EGR valve connector. 2. Ignition ON, Engine OFF. 3. Refresh codes. Did 002791.04 reappear active?	**YES:** GO TO ❹ **NO:** Problem fixed. Bad EGR valve connection. – – –1/1
❹ **EGR Valve Position Circuit Resistance Test**	1. Ignition OFF, Engine OFF. 2. Disconnect EGR valve connector. 3. Measure the resistance of the EGR valve position circuit power, ground and position input to one another on the valve. Are all values between 20k and 95k ohms?	**YES:** GO TO ❺. **NO:** Bad position circuit in EGR valve. Replace valve. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1

❺ **EGR Valve Position Input Circuit Harness Resistance Test**	Measure the resistance between the position input terminal and the position ground terminal in the EGR valve harness connector. Is the measurement less than 2 ohms?	**YES:** GO TO ❻. **NO:** Repair problem. Run Harness Diagnostic Mode Test. Retest – – –1/1
❻ **EGR Valve Connector Check**	1. Ignition OFF, Engine OFF. 2. Disconnect the ECU connector that has the EGR valve signal input wire connected to it. 3. Perform a terminal test, see TERMINAL TEST earlier in this Group. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. Retest **NO:** GO TO ❼ – – –1/1
❼ **Short To Ground Test**	Measure resistance between the EGR valve signal input wire to all other wires in the ECU connector. Was a short found?	**YES:** Repair, reconnect and retest. **NO:** Replace ECU and retest – – –1/1
❽ **Occurrence Count Check**	1. Ignition OFF, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** GO TO ❾. **NO:** GO TO ❿. – – –1/1
❾ **EGR Valve Connector Test**	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ❿. – – –1/1

10 Further Review of Snapshot Information	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO 11. **NO:** GO TO 13. – – –1/1
11 Engine Error Operating Point Test	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Did Code reappear active?	**YES:** GO TO 12. **NO:** GO TO 10 and review the data again. – – –1/1
12 EGR Valve Connector Terminal Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace EGR valve. Recalibrate, see EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1
13 EGR Valve Connector Terminal Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 14. – – –1/1
14 EGR Valve Replacement/Recalibration Check	1. Replace EGR valve. 2. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. 3. Refresh codes. Did code reappear active?	**YES:** GO TO 15. **NO:** Problem fixed. Bad EGR valve. – – –1/1

15 ECU Connector Terminal Test	1. Disconnect ECU connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace ECU. Retest. – – –1/1

002791.07 — Exhaust Gas Recirculation (EGR) Valve Control Error

For the valve closest to the front of the engine (where the fan is), the ECU detects that the exhaust gas recirculation valve is not responding or is out or adjustment.

RG41221,0000291 –19–09MAR06–1/1

002791.07 - Exhaust Gas Recirculation (EGR) Valve Control Error Diagnostic Procedure

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Related Information
The ECU detects that the exhaust gas recirculation valve is not responding or is out or adjustment.

If 002791.03, 002791.04, 003513.03 or 003513.04 is active troubleshoot that codes first.

Alarm Level:
Warning

Control Unit Response:
When 002791.04 sets, 002791.13 will also set causing a fuel derate, also 002791.07 will set.

For derate and shutdown values see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR valve information, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.

When directed to run the HARNESS DIAGNOSTIC MODE TEST or EXHAUST GAS RECIRCULATION VALVE RECALIBRATION the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. Did 002971.07 reappear active?	**YES:** GO TO ❷ **NO:** GO TO ⓰ – – –1/1
❷ **EGR Valve Connector Check**	1. Ignition OFF, Engine OFF. 2. Disconnect the EGR valve connector. 3. Perform a terminal test, see TERMINAL TEST earlier in this Group. Were any problems found?	**YES:** Repair problem and retest **NO:** GO TO ❸ – – –1/1
❸ **EGR Valve Reconnection Test**	1. Reconnect the EGR valve connector. 2. Ignition ON, Engine OFF. 3. Refresh codes. Did 002791.07 reappear active?	**YES:** GO TO ❼ **NO:** Problem fixed. Bad EGR valve connection. – – –1/1
❹ **EGR Valve Stored Positions Values Check**	1. Ignition ON, Engine OFF. 2. Read EGR Valve Learned Fully Open Position and EGR Valve Learned Fully Closed Position values. Are the values the same?	**YES:** GO TO ❺. **NO:** GO TO ⓾. – – –1/1

❺ **EGR Valve Drive Motor Resistance Test**	1. Ignition OFF, Engine OFF. 2. Measure the resistance between the EGR valve Drive terminals on the EGR valve. Is resistance between 2.5 and 4.5 ohms?	**YES:** GO TO ❻. **NO:** Bad drive motor in EGR valve. Replace valve. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1
❻ **EGR Valve Drive Motor Harness Resistance Test**	Measure the resistance between the EGR valve Drive terminals in the EGR valve harness connector. Is resistance between 9.5k and 11.5k ohms?	**YES:** GO TO ❿. **NO:** Bad drive motor in EGR valve. Replace valve. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest – – –1/1
❼ **ECU Connector Check**	1. Disconnect the EGR valve connector. 2. Disconnect the ECU connector that has the EGR valve signal input wire connected to it. 3. Perform a terminal test, see TERMINAL TEST earlier in this Group. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. Retest **NO:** GO TO ❽ – – –1/1
❽ **EGR Valve Drive Motor Plus (+) Harness Resistance Test**	Measure the resistance between the EGR valve motor drive plus (+) terminals in the EGR valve harness connector and ECU harness connector. Is resistance less than 5 ohms?	**YES:** GO TO ❾. **NO:** Repair problem. Run Harness Diagnostic Mode Test. Retest – – –1/1
❾ **EGR Valve Drive Motor Plus (-) Harness Resistance Test**	Measure the resistance between the EGR valve motor drive plus (-) terminals in the EGR valve harness connector and ECU harness connector. Is resistance less than 5 ohms?	**YES:** Replace ECU. Retest. **NO:** Repair problem. Run Harness Diagnostic Mode Test. Retest – – –1/1

10 Visual Inspection of EGR Valve	1. Ignition OFF, Engine OFF. 2. Remove EGR valve. 3. Perform a visual inspection of the valve looking for damaged or broken parts. Where any problems found?	**YES:** Replace valve. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest **NO:** 11 – – –1/1
11 Visual Inspection of EGR Valve Movement	1. Reconnect EGR valve connector and leave valve out so you can watch it move. **IMPORTANT: Pinch hazard, keep hands away from valve while it cycles.** 2. Ignition ON, Engine OFF. 3. Monitor EGR valve for full closure and smooth movement. 4. Run Harness Diagnostic Mode Test. Did valve move smoothly and close fully?	**YES:** 12 **NO:** Replace valve. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. Retest. – – –1/1
12 EGR Valve Position Circuit Resistance Test	1. Ignition OFF, Engine OFF. 2. Disconnect EGR valve connector. 3. Measure the resistance of the EGR valve position circuit power, ground and position input to one another on the valve. Are all values between 20k and 95k ohms?	**YES:** GO TO 13. **NO:** Bad position circuit in EGR valve. Replace valve. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1
13 ECU Connector Check	1. Disconnect the ECU connector that has the EGR valve signal input wire connected to it. 2. Perform a terminal test, see TERMINAL TEST earlier in this Group. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. Retest **NO:** GO TO 14 – – –1/1
14 EGR Valve to ECU Harness Resistance Test	Measure the resistance between the EGR valve position circuit power, ground and input whires in the harness connector to the appropriate terminal in the ECU harness connector. Are all resistance values less than 5 ohms?	**YES:** Replace ECU. Retest. **NO:** Repair problem. Run Harness Diagnostic Mode Test. Retest – – –1/1

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15 Occurrence Count Check	1. Ignition OFF, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** GO TO 16. **NO:** GO TO 17. – – –1/1

16 EGR Valve Connector Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 17. – – –1/1

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17 Further Review of Snapshot Information	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO 18. **NO:** GO TO 20. – – –1/1

18 Engine Error Operating Point Test	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Did Code reappear active?	**YES:** GO TO 19. **NO:** GO TO 17 and review the data again. – – –1/1

19 EGR Valve Connector Terminal Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace EGR valve. Recalibrate, using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1

20 EGR Valve Connector Terminal Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 21. – – –1/1
21 EGR Valve Replacement/Recalibration Check	1. Replace EGR valve. 2. Recalibrate, using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. 3. Refresh codes. Did code reappear active?	**YES:** GO TO 22. **NO:** Problem fixed. Bad EGR valve. – – –1/1
22 ECU Connector Terminal Test	1. Disconnect ECU connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace ECU. Retest. – – –1/1

002791.13 — Exhaust Gas Recirculation (EGR) Valve Out of Calibration

For the valve closest to the front of the engine (where the fan is), the ECU detects the exhaust gas recirculation valve is not able to achieve desired position.

RG41221,0000292 –19–11MAY06–1/1

002791.13 - Exhaust Gas Recirculation (EGR) Valve Out of Calibration Diagnostic Procedure

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Related Information
The ECU detects the EGR valve is not able to achieve desired position.

This code indicates the EGR valve Fully Open and Fully Closed stored values have moved out side of programmed tolerance in a short period of time or the valve was replaced and not recalibrated..

If 002791.03, 002791.04, 003513.03 or 003513.04 is active troubleshoot that codes first.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engne until it is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.

For derate and shutdown information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR valve information, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.

When directed to run the HARNESS DIAGNOSTIC MODE TEST or EXHAUST GAS RECIRCULATION VALVE RECALIBRATION the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Run Harness Diagnostic Mode Test. 5. Refresh DTC list. Does diagnostic display show any 002791 error code active besides 002971.13?	**YES:** Troubleshoot those active codes first. **NO:** GO TO ❷
❷ **Warm Engine EGR Valve Cycle Test**	1. Ignition ON, Engine ON. 2. Warm engine to normal operating temperature. 3. Read coolant temperature and ensure it is at least 80° C (175° f) and continue running the engine for 15 more minutes. *NOTE: It takes a minimum of 10 minutes in this condition for the EGR valve to go through one cycle.* 4. Refresh codes. Did code reappear active?	**YES:** GO TO ❸ **NO:** GO TO ⓬
❸ **EGR Physical Condition Check**	1. Ignition OFF, Engine OFF. 2. Remove EGR valve form engine. 3. Inspect the valve for damaged or broken mechanical parts. Were any problems found?	**YES:** Remove and replace EGR valve. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. **NO:** GO TO ❹

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❹ **EGR Valve Movement Test**	1. Reconnect EGR valve connector. 2. Ignition ON, Engine OFF. 3. Run Harness Diagnostic Mode Test. 4. Monitor valve for full closure and smooth movement. Did the valve move smoothly and close completely?	**YES:** GO TO ❺. **NO:** Sticking valve. Replace EGR valve. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1
❺ **Occurrence Count Check**	1. Ignition OFF, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** GO TO ❻. **NO:** GO TO ❼. – – –1/1
❻ **EGR Valve Connector Terminal Test**	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ❼. – – –1/1
❼ **Further Review of Snapshot Information**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO ❽. **NO:** GO TO ❿. – – –1/1
❽ **Engine Error Operating Point Test**	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Did Code reappear active?	**YES:** GO TO ❾. **NO:** GO TO ❼ and review the data again. – – –1/1

9 EGR Valve Connector Terminal Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace EGR valve. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1
10 EGR Valve Connector Terminal Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 11. – – –1/1
11 EGR Valve Replacement/Recalibration Check	1. Replace EGR valve. 2. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. 3. Refresh codes. Did code reappear active?	**YES:** GO TO 12. **NO:** Problem fixed. Bad EGR valve. – – –1/1
12 ECU Connector Terminal Test	1. Disconnect ECU connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace ECU. Retest. – – –1/1

002791.31 — Exhaust Gas Recirculation (EGR) Calibration Error

For the valve closest to the front of the engine (where the fan is), the ECU detects the exhaust gas recirculation valve is not able to achieve desired position.

RG41221,0000294 –19–11MAY06–1/1

002791.31 - Exhaust Gas Recirculation (EGR) Calibration Error Diagnostic Procedure

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Related Information
The ECU detects the EGR valve is not able to achieve desired position.

This code indicates the EGR valve Fully Open and Fully Closed stored values have moved out side of programmed tolerance over a long period of time or the valve was replaced and not recalibrated..

If 002791.03, 002791.04, 003513.03 or 003513.04 is active troubleshoot that codes first.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engne until it is running at 80% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.

For derate and shutdown information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further EGR valve information, see EXHAUST GAS RECIRCULATION VALVE in Section 03, Group 135 earlier in this manual.

When directed to run the HARNESS DIAGNOSTIC MODE TEST or EXHAUST GAS RECIRCULATION VALVE RECALIBRATION the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Run Harness Diagnostic Mode Test. 5. Refresh DTC list. Does diagnostic display show any 002791 error code active besides 002791.31?	**YES:** Troubleshoot those active codes first. **NO:** GO TO ❷ – – –1/1

❷ **Warm Engine EGR Valve Cycle Test**	1. Ignition ON, Engine ON. 2. Warm engine to normal operating temperature. 3. Read coolant temperature and ensure it is at least 80° C (175° f) and continue running the engine for 15 more minutes. *NOTE: It takes a minimum of 10 minutes in this condition for the EGR valve to go through one cycle.* 4. Refresh codes. Did code reappear active?	**YES:** GO TO ❸ **NO:** GO TO ⓬ – – –1/1

❸ **EGR Physical Condition Check**	1. Ignition OFF, Engine OFF. 2. Remove EGR valve form engine. 3. Inspect the valve for damaged or broken mechanical parts. Were any problems found?	**YES:** Remove and replace EGR valve. Recalibrate using EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. **NO:** GO TO ❹ – – –1/1

❹ **EGR Valve Movement Test**	1. Reconnect EGR valve connector. 2. Ignition ON, Engine OFF. 3. Run Harness Diagnostic Mode Test. 4. Monitor valve for full closure and smooth movement. Did the valve move smoothly and close completely?	**YES:** GO TO ❺. **NO:** Sticking valve. Replace EGR valve. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1
❺ **Occurrence Count Check**	1. Ignition OFF, Engine OFF. 2. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 3. Review occurrence counts in the snapshot capture information for this code. Is count greater that five?	**YES:** GO TO ❻. **NO:** GO TO ❼. – – –1/1
❻ **EGR Valve Connector Terminal Test**	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ❼. – – –1/1
❼ **Further Review of Snapshot Information**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO ❽. **NO:** GO TO ❿. – – –1/1
❽ **Engine Error Operating Point Test**	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Did Code reappear active?	**YES:** GO TO ❾. **NO:** GO TO ❼ and review the data again. – – –1/1

9 EGR Valve Connector Terminal Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace EGR valve. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. – – –1/1
10 EGR Valve Connector Terminal Test	1. Disconnect EGR valve connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 11. – – –1/1
11 EGR Valve Replacement/Recalibration Check	1. Replace EGR valve. 2. Recalibrate, use EXHAUST GAS RECIRCULATION VALVE RECALIBRATION. 3. Refresh codes. Did code reappear active?	**YES:** GO TO 12. **NO:** Problem fixed. Bad EGR valve. – – –1/1
12 ECU Connector Terminal Test	1. Disconnect ECU connector. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace ECU. Retest. – – –1/1

002795.07 — Turbo Actuator Position Mismatch

The ECU senses a mismatch between the actual and desired turbo actuator position.

RG41221,0000295 –19–23MAR06–1/1

002795.07 — Turbo Actuator Position Mismatch Diagnostic Procedure

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Related Information:
The ECU receives a turbo actuator position that is different from the desired turbo actuator position.

When DTC is Displayed:
Engine must be running (any speed).

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engine until it is running at 20% of full power. For more information on engine protection, see ENGINE PROTECTION in Section 04, Group 140 earlier in this manual.

For derate and shutdown information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

Additional References:
For further turbo actuator information, see TURBO ACTUATOR in Section 03, Group 135 earlier in this manual.

NOTE: When directed to run the HARNESS DIAGNOSTIC MODE TEST or TURBO LEARN VALVE RESET TEST the engine temperature should be above freezing. It is recommended that the engine temperature be at least room temperature 20° C (68° F). These tests are located in Service ADVISOR.

For wiring information see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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

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❶ **Read DTCs and Store Snapshot Information**	1. Ignition ON, engine OFF *NOTE: When DTCs are cleared Snapshot information for ALL DTCs will also be cleared.* 2. Connect Service ADVISOR, see CONNECTING TO SERVICE ADVISOR earlier in this Group. 3. Write down all DTCs and their occurrence count. If any DTCs have snapshot capture or snapshot recording information, save the information. For instructions on saving and using snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 4. Run Harness Diagnostic Mode Test. 5. Refresh DTC list. Is 000641.13 active?	**YES:** GO TO ❷ **NO:** GO TO ❾ – – –1/1

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❷ **Actuator Linkage Test**	1. Ignition OFF, Engine OFF. **CAUTION: Turbo and linkage may be very hot.** 2. Check turbo to actuator linkage for free movement through it's complete travel, see REMOVE AND INSTALL ACTUATOR LINKAGE in base engine manual. Is linkage movement free?	**YES:** GO TO ❸ **NO:** GO TO ❺ – – –1/1

❸ **Actuator Linkage Hold Position Check**	1. Not the position of the actuator linkage. It should change in the next step. 2. Ignition ON, Engine ON. 3. Linkage should have moved slightly and is being held in that position. Did linkage move and is it being held in position?	**YES:** GO TO ❹ **NO:** Remove and replace Actuator. Recalibarate actuator using Service ADVISOR, TURBO LEARN VALVE RESET TEST. – – –1/1

❹ **Other Codes Check**	1. Ignition ON, Engine OFF. 2. Refresh DTC list. Are there any 000641 error codes active?	**YES:** Troubleshoot those active codes. **NO:** Replace Actuator. Recalibrate using Service ADVISOR, TURBO LEARN VALVE RESET TEST. – – –1/1

❺ **Turbo Vane and Linkage Check**	1. Ignition OFF, Engine OFF. 2. Disconnect actuator linkage form actuator. 3. Move linkage through full range moving turbo vanes. Is movement free?	**YES:** GO TO ❻ **NO:** GO TO ❼ – – –1/1

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❻ **Actuator Travel Check**	1. Disconnect linkage form actuator. 2. Using an appropriate wrench on actuator shaft, move through full range checking for sticking and spring return. Is movement free and is there spring tension?	**YES:** Repair binding linkage. Run Harness Diagnostic Mode Test in Service ADVISOR. **NO:** Replace Actuator. Recalibrate using Service ADVISOR, TURBO LEARN VALVE RESET TEST. – – –1/1

❼ **Actuator to Turbo Linkage Check**	1. Disconnect linkage form turbo. 2. Inspect linkage for evidence of binding problems or possible binding problems. Is linkage free from problems?	**YES:** Is movement free **NO:** GO TO ❽. – – –1/1

❽ **Turbo Vane Travel Check**	Using an appropriate wrench on turbo vane shaft, move through full range checking for sticking. Is movement free?	**YES:** Repair binding linkage. Run Harness Diagnostic Mode Test in Service ADVISOR. **NO:** Replace Turbo. Recalibrate using Service ADVISOR, TURBO LEARN VALVE RESET TEST. – – –1/1
❾ **Occurrence Count Check**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review occurrence counts in the snapshot capture information for this code. Is count greater than five?	**YES:** GO TO ❿. **NO:** GO TO ⓫. – – –1/1
❿ **VGT Actuator Connector Terminal Test**	1. Disconnect VGT actuator connectors. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ⓫. – – –1/1
⓫ **Further Review of Snapshot Information**	1. Retrieve snapshot information, see SNAPSHOT INSTRUCTIONS earlier in this Group. 2. Review information to see if you can determine a possible problem or the operating point that causes the code to become active. Did you find a possible problem or the operating point at which the code becomes active?	**YES:** Found a possible problem. Repair possible problem. Run Harness Diagnostic Mode Test. **YES:** Found operating point at which the code becomes active. GO TO ⓬. **NO:** GO TO ⓭. – – –1/1
⓬ **Engine Error Operating Point Test**	1. Ignition ON, Engine ON. 2. Set engine to operating point that caused error. Did 002795.07 appear active when engine got hot?	**YES:** GO TO ❷. **NO:** GO TO ⓰. – – –1/1
⓭ **VGT Actuator Connector Terminal Test**	1. Disconnect VGT actuator connectors. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO ⓮. – – –1/1

14 ECU Connector Terminal Test	1. Disconnect ECU connector J3 (blue face). 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 15. – – –1/1

15 Actuator Removal and Install	1. Reconnect ECU connector. 2. Remove and Install turbo actuator, see REMOVE AND INSTALL TURBOCHARGER ACTUATOR in base engine manual. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** Replace ECU. Retest. – – –1/1

16 VGT Actuator Connector Terminal Test	1. Disconnect VGT actuator connectors. 2. Perform TERMINAL TEST. Were any problems found?	**YES:** Repair problem. Run Harness Diagnostic Mode Test. **NO:** GO TO 11. – – –1/1

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003509.03 — Sensor Supply 1 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG41183,000011F –19–19SEP05–1/1

003509.03 — Sensor Supply 1 Voltage High Diagnostic Procedure

Related Information:
The ECU detects a supply voltage greater than 5.26 volts on the ECU 5 volt supply circuit.

Alarm Level:
STOP

Sensors Using Sensor Supply 1 Voltage:
The following sensors use sensor supply 1 to supply voltage and ground for proper functionality: *Fuel Rail Pressure Sensor*.

NOTE: Some sensors are optional based on the application requirements of this engine. Not all of the sensors listed above will be present on all applications.

Control Unit Response:
The ECU will try to operate the engine under normal operating conditions. Depending on the cause of the DTC, the engine performance may be significantly affected.

Additional References:
For further sensor supply 1 information, see SENSOR SUPPLY 1 in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see SENSOR SUPPLY 1 in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 1 in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 001080.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Short in 5V Supply Circuit Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 1 in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal G1 in ECU connector J3 and all other terminals in all ECU connectors. Is any measurement above 2000 ohms?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Sensor 5V supply circuit shorted to wire that measured above 2000 ohms. – – –1/1

003509.04 — Sensor Supply 1 Voltage Low

The ECU detects a supply voltage below specification on the ECU 5 volt supply circuit.

RG41183,0000120 –19–19SEP05–1/1

003509.04 — Sensor Supply 1 Voltage Low Diagnostic Procedure

Related Information:
The ECU detects a supply voltage lower than 4.59 volts on the ECU 5 volt supply circuit.

Alarm Level:
STOP

Sensors Using Sensor Supply 1 Voltage:
The following sensors use sensor supply 1 to supply voltage and ground for proper functionality: *Fuel Rail Pressure Sensor*.

NOTE: Some sensors are optional based on the application requirements of this engine. Not all of the sensors listed above will be present on all applications.

Control Unit Response:
The ECU will try to operate the engine under normal operating conditions. Depending on the cause of the DTC, the engine performance may be significantly affected.

Additional References:
For further sensor supply 1 information, see SENSOR SUPPLY 1 in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see SENSOR SUPPLY 1 in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 3 in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition OFF 6. Disconnect all components supplied voltage by ECU terminal G1 in ECU connector J3. 7. Ignition ON, engine OFF 8. Read DTCs. Did 001080.04 reoccur?	**YES:** GO TO ❸ **NO:** GO TO ❹ – – –1/1

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❸ **5V Supply Circuit Shorted to Ground Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 1 in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal G1 in ECU connector J3 and: • Good chassis ground. • Terminal B2 in ECU connector J1 • Terminal L2 in ECU connector J2 • Terminal L3 in ECU connector J2 • Terminal M2 in ECU connector J2 • Terminal C3 in ECU connector J2 • Terminal G3 in ECU connector J2 • Terminal H3 in ECU connector J2 • Terminal A3 in ECU connector J3 • Terminal G2 in ECU connector J3 All measurements greater than 2000 ohms?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Sensor 5V supply circuit shorted to wire that measured above 2000 ohms. – – –1/1

❹ **Faulty Sensor Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 1 in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. While reconnecting each component connector one at a time, monitor DTCs using the ECU diagnostic software. *NOTE: Make sure you refresh the DTC screen after each connection. Software may not automatically refresh.* Does 001080.04 set after making a component connection?	**YES:** Sensor that caused 001080.04 to reoccur when connected is faulty. Replace sensor and retest. **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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003510.03 — Sensor Supply 2 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG41183,0000121 –19–12APR06–1/1

003510.03 — Sensor Supply 2 Voltage High Diagnostic Procedure

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Related Information:
The ECU detects a supply voltage greater than 5.26 volts on the ECU 5 volt supply circuit.

Alarm Level:
Warning

Sensors Using Sensor Supply 2 Voltage:
The following sensors use sensor supply 2 to supply voltage and ground for proper functionality: *Turbo Compressor Inlet Temperature Sensor, Engine Coolant Temperature Sensor, Exhaust Pressure Sensor, Fuel Temperature Sensor, Fuel Transfer Pump Pressure Sensor, Manifold Air Pressure Sensor, Oil Pressure Sensor, Oil Temperature Sensor, Water in Fuel Sensor*.

NOTE: Some sensors are optional based on the application requirements of this engine. Not all of the sensors listed above will be present on all applications.

Control Unit Response:
If this code sets, the ECU will try to operate the engine under normal operating conditions. Depending on the cause of the DTC, the engine performance may be significantly affected.

Additional References:
For further sensor supply 2 information, see SENSOR SUPPLY 2 in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see SENSOR SUPPLY 2 in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 2 in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 000620.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Short in 5V Supply Circuit Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 2 in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between the following: • Terminal A3 in ECU connector J1 and all other terminals in all three ECU connectors. • Terminal H4 in ECU connector J3 and all other terminals in all three ECU connectors. Is any measurement below 2000 ohms?	**YES:** Sensor 5V supply circuit shorted to wire that measured less than 2000 ohms. **NO:** Faulty ECU connection OR Faulty ECU – – –1/1

003510.04 — Sensor Supply 2 Voltage Low

The ECU detects a supply voltage below specification on the ECU 5 volt supply circuit.

RG41183,0000122 –19–12APR06–1/1

003510.04 — Sensor Supply 2 Voltage Low Diagnostic Procedure

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Related Information:
The ECU detects a supply voltage lower than 4.59 volts on the ECU 5 volt supply circuit.

Alarm Level:
Warning

Sensors Using Sensor Supply 2 Voltage:
The following sensors use sensor supply 2 to supply voltage and ground for proper functionality: *Turbo Compressor Inlet Temperature Sensor, Engine Coolant Temperature Sensor, Exhaust Pressure Sensor, Fuel Temperature Sensor, Fuel Transfer Pump Pressure Sensor, Manifold Air Pressure Sensor, Oil Pressure Sensor, Oil Temperature Sensor, Water in Fuel Sensor*.

NOTE: Some sensors are optional based on the application requirements of this engine. Not all of the sensors listed above will be present on all applications.

Control Unit Response:
If this code sets, the ECU will try to operate the engine under normal operating conditions. Depending on the cause of the DTC, the engine performance may be significantly affected.

Additional References:
For further sensor supply 2 information, see SENSOR SUPPLY 2 in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see SENSOR SUPPLY 2 in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 2 in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition OFF 6. Disconnect all components supplied voltage by ECU terminal H4 in ECU connector J3 and/or terminal A3 in ECU connector J1. 7. Ignition ON, engine OFF 8. Read DTCs. Did 000620.04 reoccur?	**YES:** GO TO ❸ **NO:** GO TO ❹ – – –1/1

❸ **5V Supply Circuit Shorted to Ground Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 2 in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal H4 in ECU connector J3 and: • Good chassis ground. • Terminal B2 in ECU connector J1 • Terminal L2 in ECU connector J2 • Terminal L3 in ECU connector J2 • Terminal M2 in ECU connector J2 • Terminal C3 in ECU connector J2 • Terminal G3 in ECU connector J2 • Terminal H3 in ECU connector J2 • Terminal A3 in ECU connector J3 • Terminal G2 in ECU connector J3 4. Using a multimeter, measure resistance between terminal A3 in ECU connector J1 and: • Good chassis ground. • Terminal B2 in ECU connector J1 • Terminal L2 in ECU connector J2 • Terminal L3 in ECU connector J2 • Terminal M2 in ECU connector J2 • Terminal C3 in ECU connector J2 • Terminal G3 in ECU connector J2 • Terminal H3 in ECU connector J2 • Terminal A3 in ECU connector J3 • Terminal G2 in ECU connector J3 All measurements greater than 2000 ohms?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Sensor 5V supply circuit shorted to wire that measures less than 2000 ohms. – – –1/1

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❹ **Faulty Sensor Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 2 in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. While reconnecting each component connector one at a time, monitor DTCs using the ECU diagnostic software. *NOTE: Make sure you refresh the DTC screen after each connection. Software may not automatically refresh.* Does 000620.04 set after making a component connection?	**YES:** Sensor that caused 000620.04 to reoccur when connected is faulty. Replace sensor and retest. **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

003511.03 — Sensor Supply 3 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG41183,0000123 –19–12APR06–1/1

003511.03 — Sensor Supply 3 Voltage High Diagnostic Procedure

Related Information:
The ECU detects a supply voltage greater than 5.26 volts on the ECU 5 volt supply circuit.

Alarm Level:
Warning

Sensors Using Sensor Supply 3 Voltage:
The following sensors use sensor supply 3 to supply voltage and ground for proper functionality: *Analog Throttle (A) Sensor*.

NOTE: Some sensors are optional based on the application requirements of this engine. Not all of the sensors listed above will be present on all applications.

Control Unit Response:
The ECU will try to operate the engine under normal operating conditions. Depending on the cause of the DTC, the engine performance may be significantly affected.

Additional References:
For further sensor supply 3 information, see SENSOR SUPPLY 3 in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see SENSOR SUPPLY 3 in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 3 in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 001079.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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❸ **Short in 5V Supply Circuit Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 3 in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal A3 in ECU connector J2 and all other terminals in all ECU connectors. Is any measurement above 2000 ohms?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Sensor 5V supply circuit shorted to wire that measured above 2000 ohms. – – –1/1

003511.04 — Sensor Supply 3 Voltage Low

The ECU detects a supply voltage below specification on the ECU 5 volt supply circuit.

RG41183,0000124 –19–12APR06–1/1

003511.04 — Sensor Supply 3 Voltage Low Diagnostic Procedure

Related Information:
The ECU detects a supply voltage lower than 4.59 volts on the ECU 5 volt supply circuit.

Alarm Level:
Warning

Sensors Using Sensor Supply 3 Voltage:
The following sensors use sensor supply 3 to supply voltage and ground for proper functionality: *Analog Throttle (A) Sensor*.

NOTE: Some sensors are optional based on the application requirements of this engine. Not all of the sensors listed above will be present on all applications.

Control Unit Response:
The ECU will try to operate the engine under normal operating conditions. Depending on the cause of the DTC, the engine performance may be significantly affected.

Additional References:
For further sensor supply 3 information, see SENSOR SUPPLY 3 in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see SENSOR SUPPLY 3 in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 3 in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition OFF 6. Disconnect all components supplied voltage by ECU terminal A3 in ECU connector J2. 7. Ignition ON, engine OFF 8. Read DTCs. Did 001079.04 reoccur?	**YES:** GO TO ❸ **NO:** GO TO ❹ – – –1/1

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❸ **5V Supply Circuit Shorted to Ground Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 3 in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal A3 in ECU connector J2 and: • Good chassis ground. • Terminal B2 in ECU connector J1 • Terminal L2 in ECU connector J2 • Terminal L3 in ECU connector J2 • Terminal M2 in ECU connector J2 • Terminal C3 in ECU connector J2 • Terminal G3 in ECU connector J2 • Terminal H3 in ECU connector J2 • Terminal A3 in ECU connector J3 • Terminal G2 in ECU connector J3 All measurements greater than 2000 ohms?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Sensor 5V supply circuit shorted to ground circuit. – – –1/1

❹ **Faulty Sensor Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 3 in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. While reconnecting each component connector one at a time, monitor DTCs using the ECU diagnostic software. *NOTE: Make sure you refresh the DTC screen after each connection. Software may not automatically refresh.* Does 001079.04 set after making a component connection?	**YES:** Sensor that caused 001079.04 to reoccur when connected is faulty. Replace sensor and retest. **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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003512.03 — Sensor Supply 4 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG41183,0000125 –19–12APR06–1/1

003512.03 — Sensor Supply 4 Voltage High Diagnostic Procedure

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Related Information:
The ECU detects a supply voltage greater than 5.26 volts on the ECU 5 volt supply circuit.

Alarm Level:
Warning

Sensors Using Sensor Supply 4 Voltage:
The following sensors use sensor supply 4 to supply voltage and ground for proper functionality: *Analog Throttle (B) Sensor, Multi-state Throttle Switch, all Cruise Control Switch features, External Shutdown Switch, External Derate Switch, and Override Shutdown Switch*

NOTE: Some sensors are optional based on the wants and needs of the application using this engine. Not all of the sensors listed above will be present on all applications.

Control Unit Response:
The ECU will try to operate the engine under normal operating conditions. Depending on the cause of the DTC, the engine performance may be significantly affected.

Additional References:
For further sensor supply 4 information, see SENSOR SUPPLY 4 in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

– – –1/1

❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see SENSOR SUPPLY 4 in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 4 in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 523229.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1
❸ **Short in 5V Supply Circuit Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 4 in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal G2 in ECU connector J2 and all other terminals in all ECU connectors. Is any measurement above 2000 ohms?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Sensor 5V supply circuit shorted to wire that measured above 2000 ohms. – – –1/1

003512.04 — Sensor Supply 4 Voltage Low

The ECU detects a supply voltage below specification on the ECU 5 volt supply circuit.

RG41183,0000126 –19–12APR06–1/1

003512.04 — Sensor Supply 4 Voltage Low Diagnostic Procedure

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Related Information:
The ECU detects a supply voltage lower than 4.59 volts on the ECU 5 volt supply circuit.

Alarm Level:
Warning

Sensors Using Sensor Supply 4 Voltage:
The following sensors use sensor supply 4 to supply voltage and ground for proper functionality: *Analog Throttle (B) Sensor, Multi-state Throttle Switch, all Cruise Control Switch features, External Shutdown Switch, External Derate Switch, and Override Shutdown Switch*

NOTE: Some sensors are optional based on the wants and needs of the application using this engine. Not all of the sensors listed above will be present on all applications.

Control Unit Response:
The ECU will try to operate the engine under normal operating conditions. Depending on the cause of the DTC, the engine performance may be significantly affected.

Additional References:
For further sensor supply 4 information, see SENSOR SUPPLY 4 in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see SENSOR SUPPLY 4 in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1
❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 4 in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition OFF 6. Disconnect all components supplied voltage by ECU terminal G2 in ECU connector J2. 7. Ignition ON, engine OFF 8. Read DTCs. Did 523229.04 reoccur?	**YES:** GO TO ❸ **NO:** GO TO ❹ – – –1/1
❸ **5V Supply Circuit Shorted to Ground Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 4 in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal G2 in ECU connector J2 and: • Good chassis ground. • Terminal B2 in ECU connector J1 • Terminal L2 in ECU connector J2 • Terminal L3 in ECU connector J2 • Terminal M2 in ECU connector J2 • Terminal C3 in ECU connector J2 • Terminal G3 in ECU connector J2 • Terminal H3 in ECU connector J2 • Terminal A3 in ECU connector J3 • Terminal G2 in ECU connector J3 All measurements greater than 2000 ohms?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Sensor 5V supply circuit shorted to ground circuit. – – –1/1

❹ **Faulty Sensor Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 4 in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. While reconnecting each component connector one at a time, monitor DTCs using the ECU diagnostic software. *NOTE: Make sure you refresh the DTC screen after each connection. Software may not automatically refresh.* Does 523229.04 set after making a component connection?	**YES:** Sensor that caused 523229.04 to reoccur when connected is faulty. Replace sensor and retest. **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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003513.03 — Sensor Supply 5 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG41183,0000127 –19–12APR06–1/1

003513.03 — Sensor Supply 5 Voltage High Diagnostic Procedure

Related Information:
The ECU detects a supply voltage greater than 5.26 volts on the ECU 5 volt supply circuit.

Alarm Level:
Warning

Sensors Using Sensor Supply 5 Voltage:
The following sensors use sensor supply 5 to supply voltage and ground for proper functionality: *Exhaust Gas Recirculation Valve*.

NOTE: Some sensors are optional based on the wants and needs of the application using this engine. Not all of the sensors listed above will be present on all applications.

Control Unit Response:
The ECU will try to operate the engine under normal operating conditions. Depending on the cause of the DTC, the engine performance may be significantly affected.

Additional References:
For further sensor supply 5 information, see SENSOR SUPPLY 5 in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see SENSOR SUPPLY 5 in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 5 in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 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. Did 523222.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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,540

❸ **Short in 5V Supply Circuit Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 5 in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal A2 in ECU connector J3 and all other terminals in all ECU connectors. Is any measurement above 2000 ohms?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Sensor 5V supply circuit shorted to wire that measured above 2000 ohms. – – –1/1

003513.04 — Sensor Supply 5 Voltage Low

The ECU detects a supply voltage below specification on the ECU 5 volt supply circuit.

RG41183,0000128 –19–12APR06–1/1

003513.04 — Sensor Supply 5 Voltage Low Diagnostic Procedure

Related Information:
The ECU detects a supply voltage lower than 4.59 volts on the ECU 5 volt supply circuit.

Alarm Level:
Warning

Sensors Using Sensor Supply 5 Voltage:
The following sensors use sensor supply 5 to supply voltage and ground for proper functionality: *Exhaust Gas Recirculation Valve*.

NOTE: Some sensors are optional based on the wants and needs of the application using this engine. Not all of the sensors listed above will be present on all applications.

Control Unit Response:
The ECU will try to operate the engine under normal operating conditions. Depending on the cause of the DTC, the engine performance may be significantly affected.

Additional References:
For further sensor supply 5 information, see SENSOR SUPPLY 5 in Section 03, Group 140 earlier in this manual.

For wiring information related to other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

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❶ **Visual Inspection of Connectors and Wiring**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see SENSOR SUPPLY 5 in Section 03, Group 140 earlier in this manual.* Without disconnecting, visually inspect the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for contamination, damage, or poor positioning. Are there any problems with the wiring or connectors?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷ – – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 5 in Section 03, Group 140 earlier in this manual.* 1. Connect Service ADVISOR (see CONNECTING TO SERVICE ADVISOR earlier in this Group) or use the diagnostic gage. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition OFF 6. Disconnect all components supplied voltage by ECU terminal A2 in ECU connector J3. 7. Ignition ON, engine OFF 8. Read DTCs. Did 523222.04 reoccur?	**YES:** GO TO ❸ **NO:** GO TO ❹ – – –1/1

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,542

❸ **5V Supply Circuit Shorted to Ground Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 5 in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all three ECU connectors. 3. Using a multimeter, measure resistance between terminal A2 in ECU connector J3 and: • Good chassis ground. • Terminal B2 in ECU connector J1 • Terminal L2 in ECU connector J2 • Terminal L3 in ECU connector J2 • Terminal M2 in ECU connector J2 • Terminal C3 in ECU connector J2 • Terminal G3 in ECU connector J2 • Terminal H3 in ECU connector J2 • Terminal A3 in ECU connector J3 • Terminal G2 in ECU connector J3 All measurements greater than 2000 ohms?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Sensor 5V supply circuit shorted to ground circuit. – – –1/1

❹ **Faulty Sensor Test**	*NOTE: For wiring and theory of operation, see SENSOR SUPPLY 5 in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. While reconnecting each component connector one at a time, monitor DTCs using the ECU diagnostic software. *NOTE: Make sure you refresh the DTC screen after each connection. Software may not automatically refresh.* Does 523222.04 set after making a component connection?	**YES:** Sensor that caused 523222.04 to reoccur when connected is faulty. Replace sensor and retest. **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. – – –1/1

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Section 05
Tools

Contents

Electronic Fuel System Repair and Adjustment Essential Tools

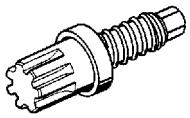
NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

SERVICEGARD is a trademark of Deere & Company

RG41221,00001C7 –19–07APR06–1/7

RG7056 –UN–17JUN05

Flywheel Turning Tool JDG820



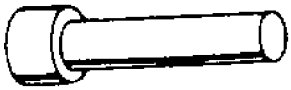
Used to rotate engine flywheel to lock engine at “TDC” to check high pressure fuel pump timing. Use with JDE81-4 Timing Pin.

RG41221,00001C7 –19–07APR06–2/7

RG5068 –UN–05DEC97

Timing Pin JDE81-4

Used to lock engine at “TDC”. Use with JDG820 Flywheel Turning Tool.



RG5068

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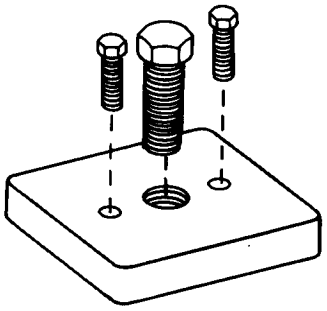
RG41221,00001C7 –19–07APR06–3/7

Injection Pump Drive Gear Puller JDG10015

Remove drive gear from tapered shaft on Denso HP4 high pressure fuel pump.



RG6032 –UN–13JAN92

JDG10015

RG41221,00001C7 –19–07APR06–4/7

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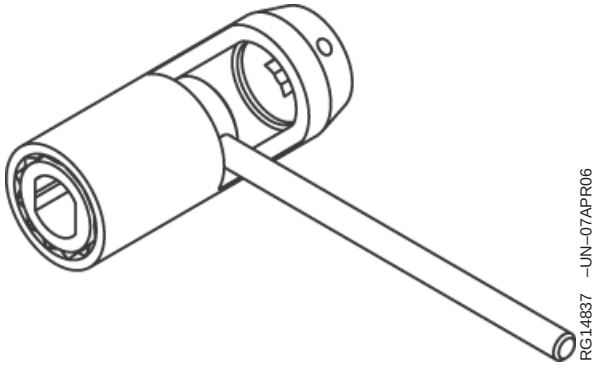
170
2

Feed Tube Torque Tool JDG10263

Used to hold injector fuel feed tube in place while tightening holding nut, in order to prevent galling of the end of the tube, and to reduce leaks.



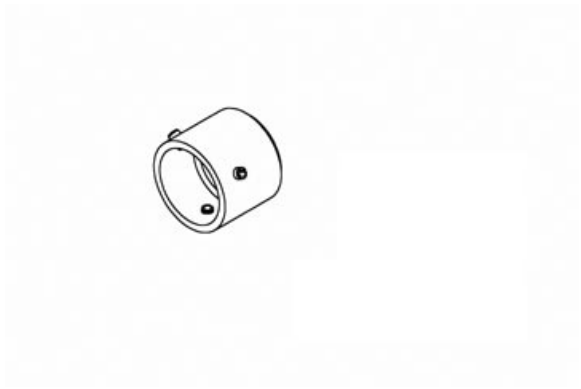
RG14837 –UN–07APR06

Feed Tube Torque Tool

RG41221,00001C7 –19–07APR06–5/7

Wiring Harness Nut Socket JDG1949

Used to remove and connect the injector harness coupling.



RG14219 –UN–26OCT05

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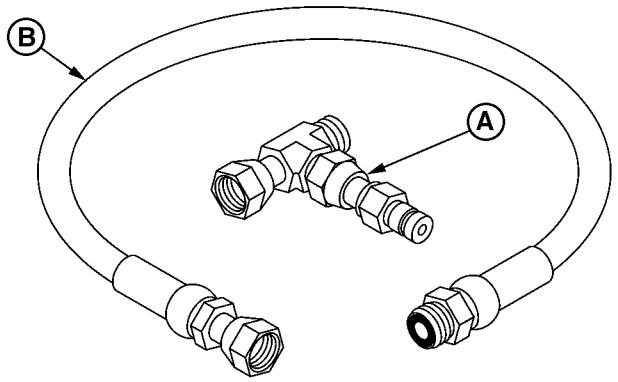
RG41221,00001C7 –19–07APR06–6/7

Fuel Supply System Test Kit JT03513C

JT03509 Fuel Pressure Test Fitting is used with JT05472 Universal Pressure Test Kit to measure fuel transfer pump pressure. JT03513-1 Fuel Air Detection Line is used to determine if air is present in fuel system. Kit includes a male o-ring-face-seal plug.



RG41221,00001C7 –19–07APR06–7/7

Electronic Engine Control Repair Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC).

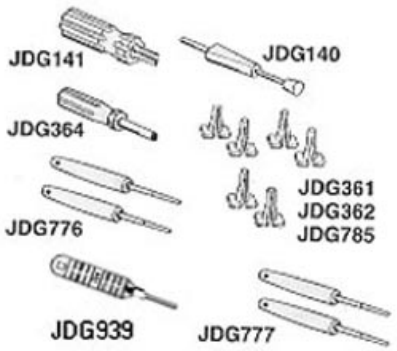
Essential Repair Tools

SERVICEGARD is a trademark of Deere & Company

RG41221,00001C9 –19–11MAY06–1/10

Technician's Electrical Repair Kit JT07195B

This kit is assembled with the most commonly used tools used to repair wiring harnesses. This kit includes the following: **JDG140** - CPC and Metrimate terminal extraction tool, **JDG141** - CPC Blade Type terminal extraction tool, **JDG361** - Deutsch 12-14 gauge terminal extraction/insertion tool, **JDG362** - Deutsch 16-18 gauge terminal extraction/insertion tool, **JDG364** - WEATHERPACK terminal extraction tool, **JDG776** - Metripack terminal extraction tool - Wide, **JDG777** - METRI-PACK terminal extraction tool - Narrow, **JDG785** - Deutsch 6-8 gauge terminal extraction/insertion tool, and **JDG939** Metri-Pack Extraction Tool.

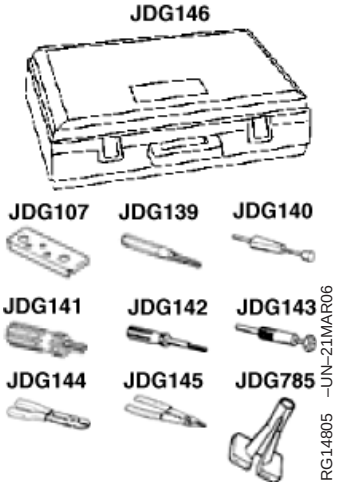


RG14535 –UN–17OCT05

RG41221,00001C9 –19–11MAY06–2/10

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.



RG14805 –UN–21MAR06

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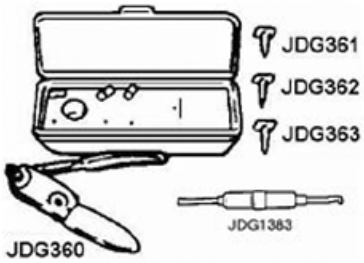
RG41221,00001C9 –19–11MAY06–3/10

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), **JDG363** - Deutsch 20-24 gauge terminal extraction/insertion tool (set of 2), and **JDG1382** - Deutsch Terminal Tool



RG14534 –UN–16OCT05

DEUTSCH is a trademark of Deutsch Co.

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RG41221,00001C9 –19–11MAY06–4/10

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TYCO-AMP™ Pro-Crimper III JDG10202

Used to crimp TYCO-AMP™ male terminals on 0.5-1.5 mm wires. This tool crimps both the wire and the seal retainer at the same time.

JDG10202

RG14809 –UN–11MAY06

Tyco and AMP are trademarks of Tyco Electronics Corporation

RG41221,00001C9 –19–11MAY06–5/10

RG14764 –UN–22FEB06

TYCO-AMP™ Terminal Extraction Tool JDG10203

Used to extract terminals from TYCO-AMP™ electrical connectors.

JDG10203

Tyco and AMP are trademarks of Tyco Electronics Corporation

Continued on next page

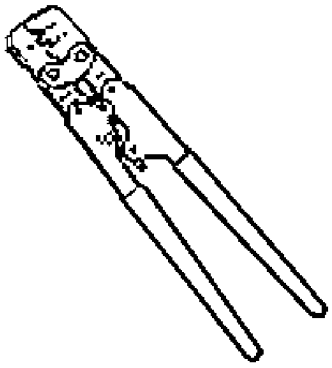
RG41221,00001C9 –19–11MAY06–6/10

Recommended Repair Tools

RG41221,00001C9 –19–11MAY06–7/10

WEATHER PACK™ Crimping Tool JDG783

Used to crimp WEATHER PACK™ male and female terminals on 14-20 gauge wires. This tool crimps both the wire and the seal retainer at the same time.



RW25542A –UN–07MAR02

WEATHER PACK is a trademark of Packard Electric

RG41221,00001C9 –19–11MAY06–8/10

METRI-PACK™ Crimping Tool JDG865

Used to crimp push-type METRI-PACK™ male and female terminals on 14-20 gauge wires.

RG14531 –UN–14OCT05

METRI-PACK is a trademark of Packard Electric Inc.

RG41221,00001C9 –19–11MAY06–9/10

Packard Crimper JDG707

Used to crimp WEATHER PACK, METRIPACK, SUMITOMO, and YAZAKI male and female terminals on 12-20 gauge wires. This tool crimps the wire and the seal retainer separately.

RG11679 –UN–05FEB01

RG41221,00001C9 –19–11MAY06–10/10

Other Materials (Consumables)

Number	Name	Use
JDT405 (U.S.)	High Temperature (Moly EP #2) Grease	Sensor O-rings.
PM37418 (U.S.) PM38621 (Canadian) 242 (LOCTITE®)	Thread Lock and Sealer, medium strength (6 ml)	Applied to screw threads
AT66865 (U.S.)	Lubricant	Insulate electrical connectors.

LOCTITE is a registered trademark of Loctite Corp.

RG41221,00001CA –19–14OCT05–1/1

Electronic and Fuel Control System Diagnostic Tools

NOTE: Order tools (non-ECU communication parts and kits) according to information given in the U.S. SERVICEGARD™ Catalog or in the European Microfiche Tool Catalog (MTC) unless otherwise noted.

NOTE: ECU communication parts and kits are available from John Deere Distribution Service Center (DSC). **United States and Canadian Agricultural dealers DO NOT ORDER without first contacting your Branch or TAM.**

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RG41221,00001CB –19–23FEB06–1/9

Universal Pressure Test Kit JT05412

Used for testing engine oil pressure, intake manifold pressure (turbo boost), and fuel transfer pump pressure.

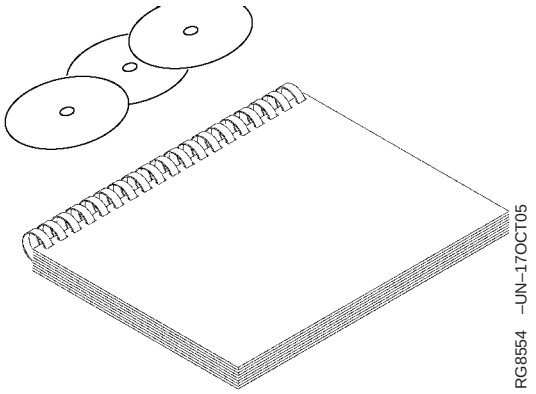
RG5162 –UN–14OCT05

JT05412

RG41221,00001CB –19–23FEB06–2/9

ECU Communication Software . . . . . .

Please refer to your John Deere Dealer website for information on obtaining the latest version of software.



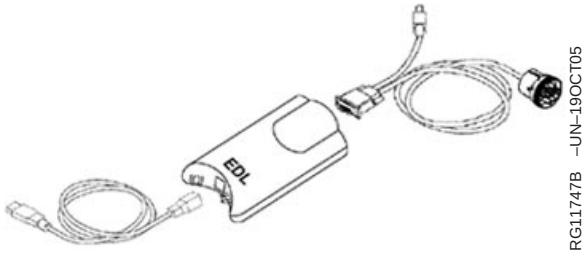
RG8554 –UN–17OCT05

Continued on next page

RG41221,00001CB –19–23FEB06–3/9

ECU Communication Hardware Full Kit DS10118

Used with ECU Communication Software Kit, this kit enables a Windows-compatible computer to read information from the Engine Control Unit (ECU). The computer must be at least a Pentium 1 with 512 MB of RAM and a USB port. In addition to the USB cable, Electronic Data Link (EDL), and cable to connect to the 9-pin diagnostic connector on the engine harness, this kit allows communication with applications that use the black 9-pin Deutsch diagnostic connector, gray 9-pin Deutsch diagnostic connector (early 8000 series tractors), and the flat 6-pin Weatherpack diagnostic connector (Lucas controllers). Kit parts may be purchased separately.



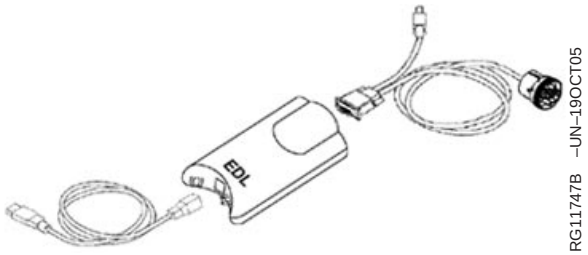
Not all kit components shown

RG41221,00001CB –19–23FEB06–4/9

05
180
2

ECU Communication Hardware Mini Kit. DS10117

Used with ECU Communication Software Kit, this kit enables a Windows-compatible computer to read information from the Engine Control Unit (ECU). The computer must be at least a Pentium 1 with 512 of RAM and a USB port. This kit allows communication with applications that use the black 9-pin Deutsch diagnostic connector. Kit includes USB cable, Electronic Data Link (EDL), and cable to connect to the 9-pin diagnostic connector on the engine harness. Kit parts may be purchased separately.



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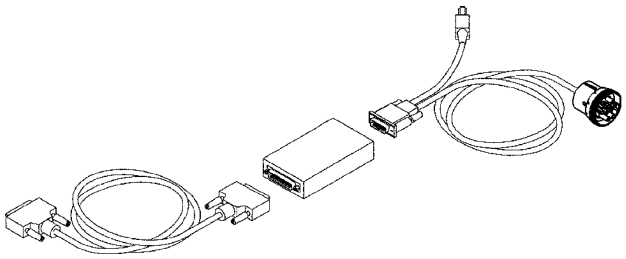
RG41221,00001CB –19–23FEB06–5/9

ECU Communication Hardware Kit
(Discontinued) JDIS121

Used with ECU Communication Software Kit, this kit enables a Windows-compatible computer to read information from the Engine Control Unit (ECU). The computer must be at least a Pentium 1 with 512 of RAM and an IEEE 1284 compliant parallel port. This kit allows communication with applications that use one of the following diagnostic connectors: black 9-pin Deutsch diagnostic connector, gray 9-pin Deutsch diagnostic connector (early 8000 series tractors), or the flat 6-pin Weatherpack diagnostic connector (Lucas controllers).

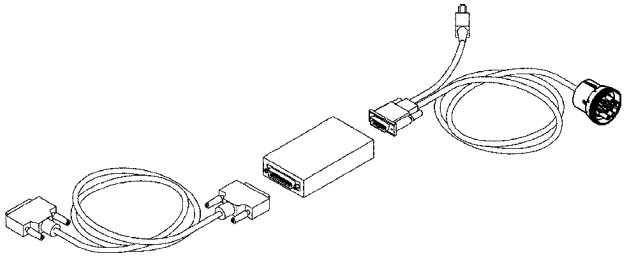


RG11747 –UN–19OCT05

RG41221,00001CB –19–23FEB06–6/9

ECU Communication Hardware Kit
(Discontinued) DS10023

Used with ECU Communication Software Kit, this kit enables a Windows-compatible computer to read information from the Engine Control Unit (ECU). The computer must be at least a Pentium 1 with 512 of RAM and an IEEE 1284 compliant parallel port. This kit allows communication with applications that use the black 9-pin Deutsch diagnostic connector.



RG11747 –UN–19OCT05

RG41221,00001CB –19–23FEB06–7/9

Digital Multimeter JT07306

Test electrical components for voltage, resistance, current flow, or temperature. It is especially good for measuring low voltage or high resistance circuits.

RG11126 –UN–19JUN00

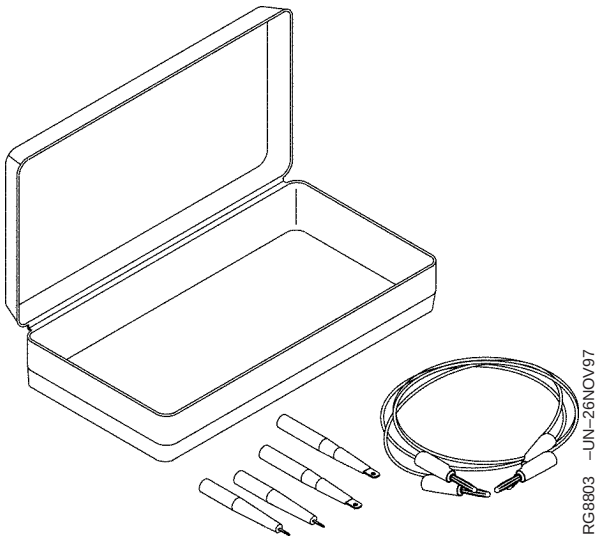
JT07306 - Digital Multimeter

Continued on next page

RG41221,00001CB –19–23FEB06–8/9

Connector Adapter Test Kit JT07328

Used with JT05791 Digital Multimeter to make voltage and resistance measurements in control system wiring harness connectors. Can also be used to test terminals for proper fit.



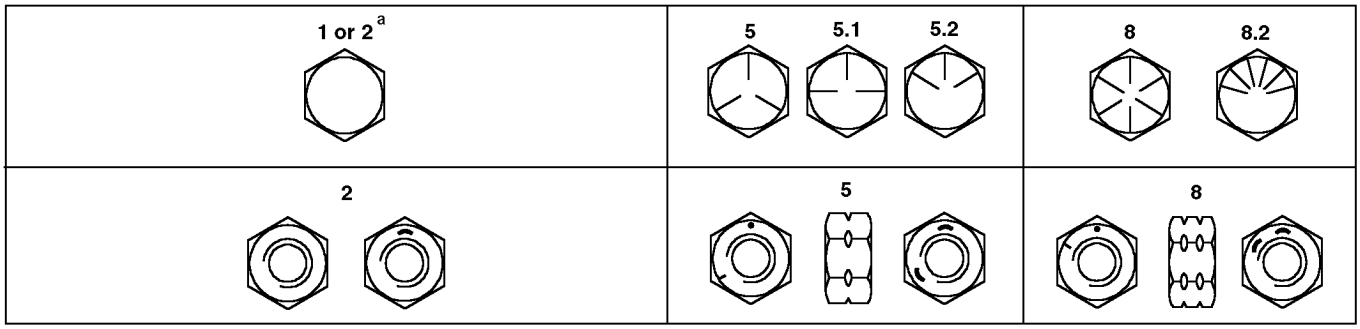
JT07328

RG41221,00001CB –19–23FEB06–9/9

Section 06
Specifications

Contents

Unified Inch Bolt and Cap Screw Torque Values



TORQ1A –UN–27SEP99

Top, SAE Grade and Head Markings; Bottom, SAE Grade and Nut Markings

	Grade 1 (No Mark)		Grade 2[a] (No Mark)		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
Size	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**
1/4	3.8 (2.8)	4.7 (3.5)	6 (4.4)	7.5 (5.5)	9.5 (7)	12 (9)	13.5 (10)	17 (12.5)
5/16	7.7 (5.7)	9.8 (7.2)	12 (9)	15.5 (11.5)	19.5 (14.5)	25 (18.5)	28 (20.5)	35 (26)
3/8	13.5 (10)	17.5 (13)	22 (16)	27.5 (20)	35 (26)	44 (32.5)	49 (36)	63 (46)
7/16	22 (16)	28 (20.5)	35 (26)	44 (32.5)	56 (41)	70 (52)	80 (59)	100 (74)
1/2	34 (25)	42 (31)	53 (39)	67 (49)	85 (63)	110 (80)	120 (88)	155 (115)
9/16	48 (35.5)	60 (45)	76 (56)	95 (70)	125 (92)	155 (115)	175 (130)	220 (165)
5/8	67 (49)	85 (63)	105 (77)	135 (100)	170 (125)	215 (160)	240 (175)	305 (225)
3/4	120 (88)	150 (110)	190 (140)	240 (175)	300 (220)	380 (280)	425 (315)	540 (400)
7/8	190 (140)	240 (175)	190 (140)	240 (175)	490 (360)	615 (455)	690 (510)	870 (640)
1	285 (210)	360 (265)	285 (210)	360 (265)	730 (540)	920 (680)	1030 (760)	1300 (960)
1-1/8	400 (300)	510 (375)	400 (300)	510 (375)	910 (670)	1150 (850)	1450 (1075)	1850 (1350)
1-1/4	570 (420)	725 (535)	570 (420)	725 (535)	1280 (945)	1630 (1200)	2050 (1500)	2600 (1920)
1-3/8	750 (550)	950 (700)	750 (550)	950 (700)	1700 (1250)	2140 (1580)	2700 (2000)	3400 (2500)
1-1/2	990 (730)	1250 (930)	990 (730)	1250 (930)	2250 (1650)	2850 (2100)	3600 (2650)	4550 (3350)

[a] Grade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

[b] "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

[c] "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

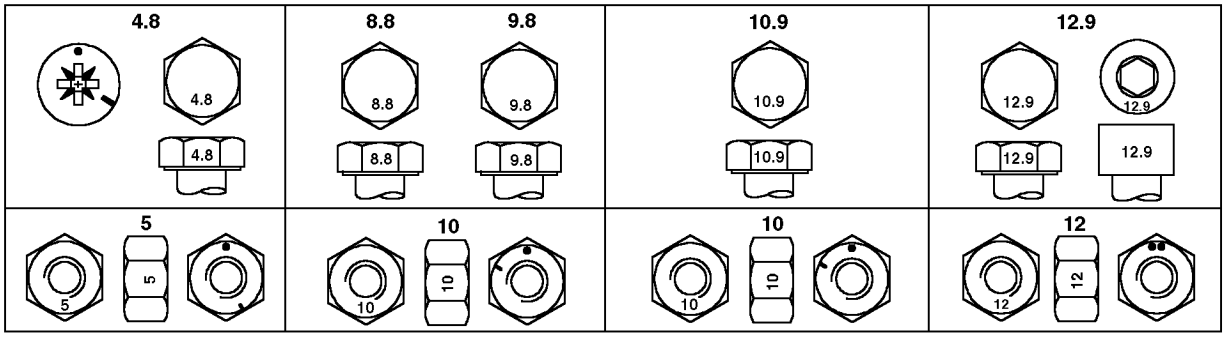
Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

RG41221,00001CC –19–23FEB06–1/1

Metric Bolt and Cap Screw Torque Values



TORQ2 –UN–07SEP99

Top, Property Class and Head Markings; Bottom, Property Class and Nut Markings

	Class 4.8		Class 8.8 or 9.8		Class 10.9		Class 12.9	
Size	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**	**Lubricated[a] N•m(lb-ft)**	**Dry[b] N•m(lb-ft)**
M6	4.7 (3.5)	6 (4.4)	9 (6.6)	11.5 (8.5)	13 (9.5)	16.5 (12.2)	15.5 (11.5)	19.5 (14.5)
M8	11.5 (8.5)	14.5 (10.7)	22 (16)	28 (20.5)	32 (23.5)	40 (29.5)	37 (27.5)	47 (35)
M10	23 (17)	29 (21)	43 (32)	55 (40)	63 (46)	80 (59)	75 (55)	95 (70)
M12	40 (29.5)	50 (37)	75 (55)	95 (70)	110 (80)	140 (105)	130 (95)	165 (120)
M14	63 (46)	80 (59)	120 (88)	150 (110)	175 (130)	220 (165)	205 (150)	260 (190)
M16	100 (74)	125 (92)	190 (140)	240 (175)	275 (200)	350 (255)	320 (235)	400 (300)
M18	135 (100)	170 (125)	265 (195)	330 (245)	375 (275)	475 (350)	440 (325)	560 (410)
M20	190 (140)	245 (180)	375 (275)	475 (350)	530 (390)	675 (500)	625 (460)	790 (580)
M22	265 (195)	330 (245)	510 (375)	650 (480)	725 (535)	920 (680)	850 (625)	1080 (800)
M24	330 (245)	425 (315)	650 (480)	820 (600)	920 (680)	1150 (850)	1080 (800)	1350 (1000)
M27	490 (360)	625 (460)	950 (700)	1200 (885)	1350 (1000)	1700 (1250)	1580 (1160)	2000 (1475)
M30	660 (490)	850 (625)	1290 (950)	1630 (1200)	1850 (1350)	2300 (1700)	2140 (1580)	2700 (2000)
M33	900 (665)	1150 (850)	1750 (1300)	2200 (1625)	2500 (1850)	3150 (2325)	2900 (2150)	3700 (2730)
M36	1150 (850)	1450 (1075)	2250 (1650)	2850 (2100)	3200 (2350)	4050 (3000)	3750 (2770)	4750 (3500)

[a] *"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.*

[b] *"Dry" means plain or zinc plated without any lubrication.*

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

RG41221,00001CD –19–23FEB06–1/1

Specifications

- **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.
  - Intake Air Heater Specifications - See OEM ENGINES - INTAKE AIR HEATER SPECIFICATIONS later in this Group.
  - ECU Terminal Identification - See OEM ENGINES - ECU TERMINAL IDENTIFICATION later in this Group.
  - Electronic Control System Schematic - See OEM ENGINES - ELECTRONIC CONTROL SYSTEM SCHEMATIC later in this Group.

RG41221,00001D1 –19–16SEP05–1/1

OEM Engines - Derate Specifications

Shown below are parameters and values that the Engine Control Unit (ECU) uses to determine if an engine must be derated.

Continued on next page

RG41221,00001D2 –19–17NOV05–1/4

Sensor or Fault Name	SPN-FMI	Parameter	Value that Triggers Fault	Derate
Analog Throttle (B)	000028.03	Input Voltage	Above 4.5 Volts	If no other throttle is available, engine will run at idle speed.
	000028.04	Input Voltage	Below 0.5 Volts	If no other throttle is available, engine will run at idle speed.
Analog Throttle (A)	000029.03	Input Voltage	Above 4.5 Volts	If no other throttle is available, engine will run at idle speed.
	000029.04	Input Voltage	Below 0.5 Volts	If no other throttle is available, engine will run at idle speed.
Fuel Transfer Pump Pressure	000094.03	Input Voltage	Above 4.9 Volts	ECU uses default pressure of 101 kPa (1.1 bar) (14.6 psi)
	000094.04	Input Voltage	Below 0.1 Volts	ECU uses default pressure of 101 kPa (1.1 bar) (14.6 psi)
Water-in-Fuel	000097.16		Water Detected	50% of full power
Oil Pressure	000100.01	Oil Pressure	1kPa at <700 rpm146 kPa at >700 rpm284 kPa at > 2000 rpm	40% of full power
	000100.03	Input Voltage	Above 4.95 Volts	ECU uses default pressure of 500 kPa (5.0 bar) (72.5 psi). Low oil pressure engine protection disabled.
	000100.04	Input Voltage	Below 0.125 Volts	ECU uses default pressure of 500 kPa (5.0 bar) (72.5 psi). Low oil pressure engine protection disabled.
	000100.18	Moderately Low Pressure	1kPa at <700 rpm202 kPa at >700 rpm311 kPa at > 2000 rpm	80% of full power
Manifold Air Pressure	000102.03	Input Voltage	Above 4.9 Volts	ECU uses a default pressure model to calculate MAP.
	000102.04	Input Voltage	Below 0.1 Volts	ECU uses a default pressure model to calculate MAP.
Turbo Speed	000103.00	Turbo Overspeed	Extremely High	80% of full power
	000103.02	ECU/Turbo Speed Mismatch		ECU uses model based on MAP and exhaust pressure.
EGR Mixed Air Temperature	000105.00	Temperature	Above 123°C (253°F)	40% of full power.

Continued on next page

	000105.03	Input Voltage	Above 4.95 Volts	ECU uses default temperature of 60°C (140°F). High EGR Fresh Air temperature protection disabled.
	000105.04	Input Voltage	Below 0.15 Volts	ECU uses default temperature of 60°C (140°F). High EGR Fresh Air temperature protection disabled.
	000105.15	Temperature	Above 120°C (248°F)	No derate.
	000105.16	Temperature	Above 121°C (250°F)	80% of full power
Engine Coolant Temperature (ECT)	000110.00	Temperature	Above 111°C (232°F)	40% of full power
	000110.03	Input Voltage	Above 4.95 Volts	ECU uses default temperature of 90°C (194°F). High ECT engine protection disabled.
	000110.04	Input Voltage	Below 0.15 Volts	ECU uses default temperature of 90°C (194°F). High ECT engine protection disabled.
	000110.15	Temperature	Above 110°C (230°F)	No derate.
	000110.16	Temperature	Above 111°C (232°F)	80% of full power
Coolant Level	000111.01	Coolant Level in Overflow Container	Switch On	50% of full power
Fuel Rail Pressure	000157.03	Input Voltage	Above 4.99 Volts	50% of full power
	000157.04	Input Voltage	Below 0.1 Volts	50% of full power
Fuel Temperature	000174.00	Temperature	Above 100°C (220°F)	80% of full power
	000174.03	Input Voltage	Above 4.9 Volts	ECU uses default temperature of 40°C (104°F). High fuel temperature engine protection disabled.
	000174.04	Input Voltage	Below 0.1 Volts	ECU uses default temperature of 40°C (104°F). High fuel temperature engine protection disabled.
	000174.16	Temperature	Above 95°C (203°F)	No derate.
EGR Exhaust Temperature	000412.00	Temperature	Above 290°C (554°F)	50% of full power
	000412.03	High Input Voltage	Above 4.95 Volts	High EGR Exhaust Temperature engine protection is disabled.
	000412.04	Input Voltage	Below 0.15 Volts	High EGR Exhaust temperature engine protection disabled.
	000412.16	Temperature	Above 280°C (536°F)	95% of full power

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Crankshaft Sensor Faults	000637.02000637.08000637.10	Signal Quality (noise, pattern, or missing)		50% of full power
Injector Part Number Invalid	00065x.02	Part number		
External Engine Shutdown Request	000971.31	Activated Request		20% or 50%
ECU Temperature	001136.00	Temperature	Above 135°C (275°F)	1200 rpm
	001136.16	Temperature	Above 125°C (257°F)	No derate.
Turbo Compressor Temperature	001172.03	Input Voltage	Above 4.95 Volts	ECU uses default temperature of 30°C (86°F).
		Input Voltage	Below 0.25 Volts	ECU uses default temperature of 30°C (86°F).
Turbo Turbine Inlet Temperature	001180.00	Temperature	Above 750°C (1382°F)	50% of full power
	001180.16	Temperature	Above 730°C (1346°F)	95% of full power
Exhaust Pressure	001209.03	Input Voltage	Above 4.9 Volts	ECU uses a default exhaust pressure model.
	001209.04	Input Voltage	Below 0.1 Volts	ECU uses a default exhaust pressure model.
EGR Fresh Air Temperature	002630.00	Temperature	Above 91°C (195°F)	40% of full power
	002630.03	Input Voltage	Above 4.95 Volts	ECU uses default temperature of 50°C (122°F). High EGR Fresh Air Temperature engine protection disabled.
	002630.04	Input Voltage	Below 0.15 Volts	ECU uses default temperature of 50°C (122°F). High EGR Fresh Air Temperature engine protection disabled.
	002630.15	Temperature	Above 91°C (195°F)	No derate.
	002630.16	Temperature	Above 89.5°C (193°F)	80% of full power
Turbo Compressor Outlet Temperature	002790.16	Temperature	Above 260°C (500°F)	50% of full power
EGR Valve Position	002791.02	Valve Position		80% of full power
	002791.03	Input Voltage	Above 4.87 Volts	EGR Valve position engine protection is disabled.
	002791.04	Input Voltage	Below 0.12 Volts	EGR Valve position engine protection is disabled.
	002791.13	Learned Value	Learned Value Error	80% of full power

OEM Engines - Torque Curve Selection

Torque Curve Selection for OEM Engines	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal Curve

SERVICE ADVISOR is a trademark of Deere & Company

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OEM Engines - Governor Mode Selection

Desired Speed Governor Selection for OEM Engines	
Mode Selected on SERVICE ADVISOR™	Conditions
0	Normal Droop (Default Gainset)
1	Isochronous Droop (Default Gainset)
2	Normal Droop (Selectable Gainset)
3	Isochronous Droop (Selectable Gainset)
6	Engine Cruise

Max. Speed Governor Selection for OEM Engines	
Mode Selected on SERVICE ADVISOR™	Conditions:
9	Normal droop with default gainset
10	Isochronous droop with default gainset
11	Normal droop with selectable gainset
12	Isochronous droop with selectable gainset
15	Absolute Maxspeed (used for speed derates)

SERVICE ADVISOR is a trademark of Deere & Company

RG41221,00001D4 –19–15NOV05–1/1

OEM Engines - Intake Air Heater Specifications

NOTE: Preheat time has an additional 5 seconds after the light turns off.

Air Heater Operating Conditions - OEM Air Heater Operation - OEM		
Engine Coolant Temperature	**Preheat Time**	**Reheat Time**
-30°C (-22°F)	15 seconds	45 seconds
-25°C (-13°F)	15 seconds	40 seconds
-20°C (-4°F)	27.5 seconds	35 seconds
-15°C (5°F)	25 seconds	27.5 seconds
-10°C (14°F)	15 seconds	20 seconds
-5°C (23°F)	15 seconds	0 seconds
0°C (32°F)	0 seconds	0 seconds

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OEM Engines - ECU Terminal Identification

ECU Terminal Function	ECU Connector	ECU Terminal (ECU Circuit, PU=pull up, PD= pull down)	Component Terminal or Engine Harness Connector Terminal
AC Clutch Relay Signal	J2	M3 (Source Driver 3)	A
AC Pressure Switch	J2	F4 (Analog 21, PD)	A
Air Filter Restriction Pressure Switch	J2	J1 (Switch In 3, PU)	J (Auxiliary Connector)
Air Heater Diagnostic	J1	A4 (Switch In 12, PD)	B
Air Heater Relay Coil Supply	J1	F4 (Source Driver 10)	+
Alternator	None	Key Switch Acc Position	J (Panel Connector)
Ambient Air Temperature	J2	G4 (Analog 23, PU)	M (Auxiliary Connector)
Battery, Switched	J2	B2	B, G (Panel Connector) B, G, H (Auxiliary Connector) A (Auxiliary Power Connector)
Battery, Unswitched, Fused	J2	L1, L4, M1, M4	B (Panel Connector via Remote On/Off Plug) E (9-Pin CAN Diagnostic Connector) Battery +
CAN 1 High	J2	A1	A (3-Pin CAN Terminator) C (9-Pin CAN Diagnostic Connector) V (Panel Connector)
CAN 1 Low	J2	B1	B (3-Pin CAN Terminator) D (9-Pin CAN Diagnostic Connector) U (Panel Connector)
CAN Shield	J2	K2	C (3-Pin CAN Terminator) E (9-Pin CAN Diagnostic Connector) F (Panel Connector)
Crank Position (Speed) Input	J3	F4	A
Crank Position (Speed) Return	J3	F3	B
Cruise Brake	J2	E1 (Switch In 2, PD)	O (Auxiliary Connector)
Cruise Cancel/Resume	J2	J2 (Switch In 6, PD)	D (Auxiliary Connector)
Cruise Remote	J2	B3 (Switch In 9, PD)	L (Auxiliary Connector)
Cruise On	J2	F2 (Switch In 1, PD)	E (Auxiliary Connector)
Cylinder 1/2/3 (Inj. 0/4/2) 90V Supply	J1	G1	4
Cylinder 4/5/6 (Inj. 5/1/3) 90V Supply	J1	G2	9
Cylinder 1 (Inj. 0) Control	J1	E1	1
Cylinder 2 (Inj. 4) Control	J1	B1	2
Cylinder 3 (Inj. 2) Control	J1	D1	3
Cylinder 4 (Inj. 5) Control	J1	A1	10
Cylinder 5 (Inj. 1) Control	J1	F1	11
Cylinder 6 (Inj. 3) Control	J1	C1	12

Continued on next page

Droop/Isochronous Input	J2	H4 (Analog 19, PD)	P (Auxiliary Connector)
EGR Pressure Input	J3	D4 (Analog 7, PD)	C
EGR Exhaust Temperature Input	J3	E2 Analog 13, PU)	A
EGR Fresh Air Temperature Input	J3	F2 (Analog 14, PU)	A
EGR Mixed Air Temperature Input	J3	F1 (Analog 15, PU)	A
EGR Valve Power	J1	G3 (H-Bridge 1+)	3
EGR Valve Ground	J1	G4 (H-Bridge 1-)	4
EGR Valve Input	J3	A4 (Analog 11, PU)	6
Engine Oil Pressure Input	J3	C3 (Analog 4, PD)	3
Engine Coolant Temperature Input	J3	D3 (Analog 8, PU)	1
Fuel Rail Pressure Input	J3	C1 (Analog 6, PU)	3
Fuel Pressure (Low-Pressure) Input	J3	C2 (Analog 5, PD)	3
Fuel Temperature Input	J3	B1 (Analog 2, PU)	1
Fuel Transfer Pump Speed Command	J1	D2 (Sink Driver 6)	1
Fuel Transfer Pump Current Out	J1	C3 (Frequency In 4)	2
Fuel Transfer Pump Status Out	J1	E2 (Switch In 11, PU)	3
Fuel Transfer Pump Power ON Signal	J1	D4 (Source Driver 6)	4
Fuel Transfer Pump (Unswitched Fused) Power	J1	Battery (+) via Auxiliary Power Connector	5
Fuel Transfer Pump Ground	J1	Chassis (-) via Auxiliary Power Connector	6
Ground, System	J2	L2, L3, M2	A (9-Pin CAN Diagnostic Connector) E (Panel Connector) X (Auxiliary Connector) B (Auxiliary Power Connector)
Ignition	Key Switch	Ignition or ACC Position	B, G, H (Auxiliary Connector) G (Panel Connector) C (Auxiliary Power Connector)
Lamp, Warning, Ground (Input)	J2	C1 (Sink Driver 3)	H (Panel Connector)
Lamp, Wait-to-Start, Ground (Input)	J2	C2 (Sink Driver 1)	A (Panel Connector)
Lamp, STOP Engine, Power	N/A	Ignition	G (Auxiliary Connector)
Lamp, STOP Engine, Ground (Input)	J2	D2 (Sink Driver 2)	W (Auxiliary Connector)
Loss of Coolant Switch Input	J2	K1 (Switch In 8, PU)	M (Auxiliary Connector)
Manifold Air Pressure Input	J3	C4 (Analog 3, PD)	3
Oil Temperature Input	J3	E3 (Analog 12, PU)	1
Pump Position (Cam Speed) Input	J3	G4	A
Pump Position (Cam Speed) Return	J3	G3	B
Pump Solenoid Return	J1	H2	2
Pump Solenoid Supply	J1	H1	1
Sensor Supply (Excitation) # 1	J3	G1	See equipment schematic
Sensor Supply Ground #1	J3	G2	See equipment schematic
Sensor Supply (Excitation) #2	J3	H4	See equipment schematic

Continued on next page

Sensor Supply Ground #2	J3	H3	See equipment schematic
Sensor Supply (Excitation) #3	J2	A3	M (Panel Connector) Primary Analog Throttle
Sensor Supply Ground #3	J2	C3	C (Panel Connector) Primary Analog Throttle
Sensor Supply (Excitation) #4	J2	G2	A (Auxiliary Connector) Secondary Analog Throttle
Sensor Supply Ground #4	J2	G3	C, Q (Auxiliary Connector) P, S (Panel Connector) Secondary Analog Throttle, Multi-State Throttle, External Shutdown Switch, External Derate Switch, Shutdown Override Switch, Loss of Coolant Switch
Sensor Supply (Excitation) #5	J3	A2	Varies—see equipment schematic
Sensor Supply Ground #5	J3	A3	Varies—see equipment schematic
Shutdown, External, Input	J2	K1 (Switch In 8, PU)	K (Auxiliary Connector)
Shutdown Override Input	J2	E3 (Switch In 7, PU)	N (Panel Connector)
Starter Relay Coil Power	Key Switch	Start Position	D (Panel Connector)
Starter Relay Switch Power	Battery	(+)	Starter
Tachometer	J2	D1 (Sink Driver 4)	K (Panel Connector)
Throttle, Primary Analog, Input	J2	A4 (Analog 20, PD)	L (Panel Connector)
Throttle, Primary Analog, Ground	J2	C3	C (Panel Connector)
Throttle, Primary Analog, Power	J2	A3	M (Panel Connector)
Throttle, Secondary Analog, Input	J2	F3 (Analog 22, PD)	F (Auxiliary Connector)
Throttle, Secondary Analog, Power	J2	G2	A (Auxiliary Connector)
Throttle, Secondary Analog, Ground	J2	C3	C (Auxiliary Connector)
Throttle, Multi-state, Ground	J2	G3	S (Panel Connector)
Throttle, Multi-state, Input	J2	B4 (Analog 25, PU)	R (Panel Connector)
Throttle, Bump Up Input Cruise—Set Accel	J2	D4 (Switch In 5, PD)	W (Panel Connector)
Throttle, Bump Down Input Cruise—Resume Coast	J2	F1 (Switch In 4, PD)	T (Panel Connector)
Throttle, Bump Enable	J2	E4 (Switch In 10, PD)	X (Panel Connector)
Turbo (VGT) Actuator Communication Input	J3	E4	4
Turbo (VGT) Actuator Ground	J3	A3	2
Turbo (VGT) Actuator Power	J1	H3, H4	1
Turbo Compressor Inlet Temperature Input	J3	D1 (Analog 10, PU)	1
Turbo (VGT) Speed Input	J1	B4	2

Continued on next page

Turbo (VGT) Speed Ground	J1	B3	1
Water-in-Fuel Input	J3	D2 (Analog 9, PU)	A

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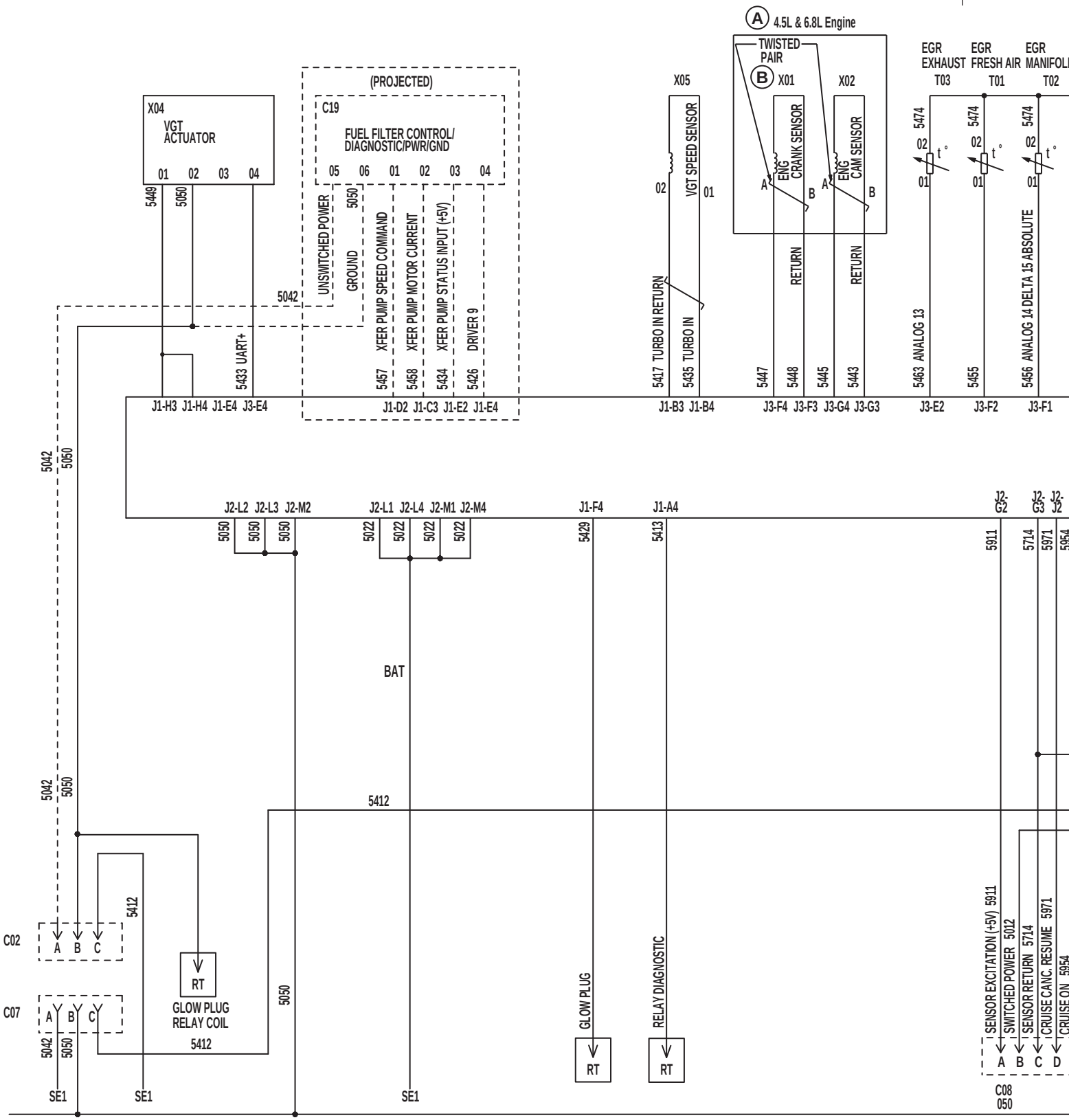
ECU/Engine Wiring Schematic



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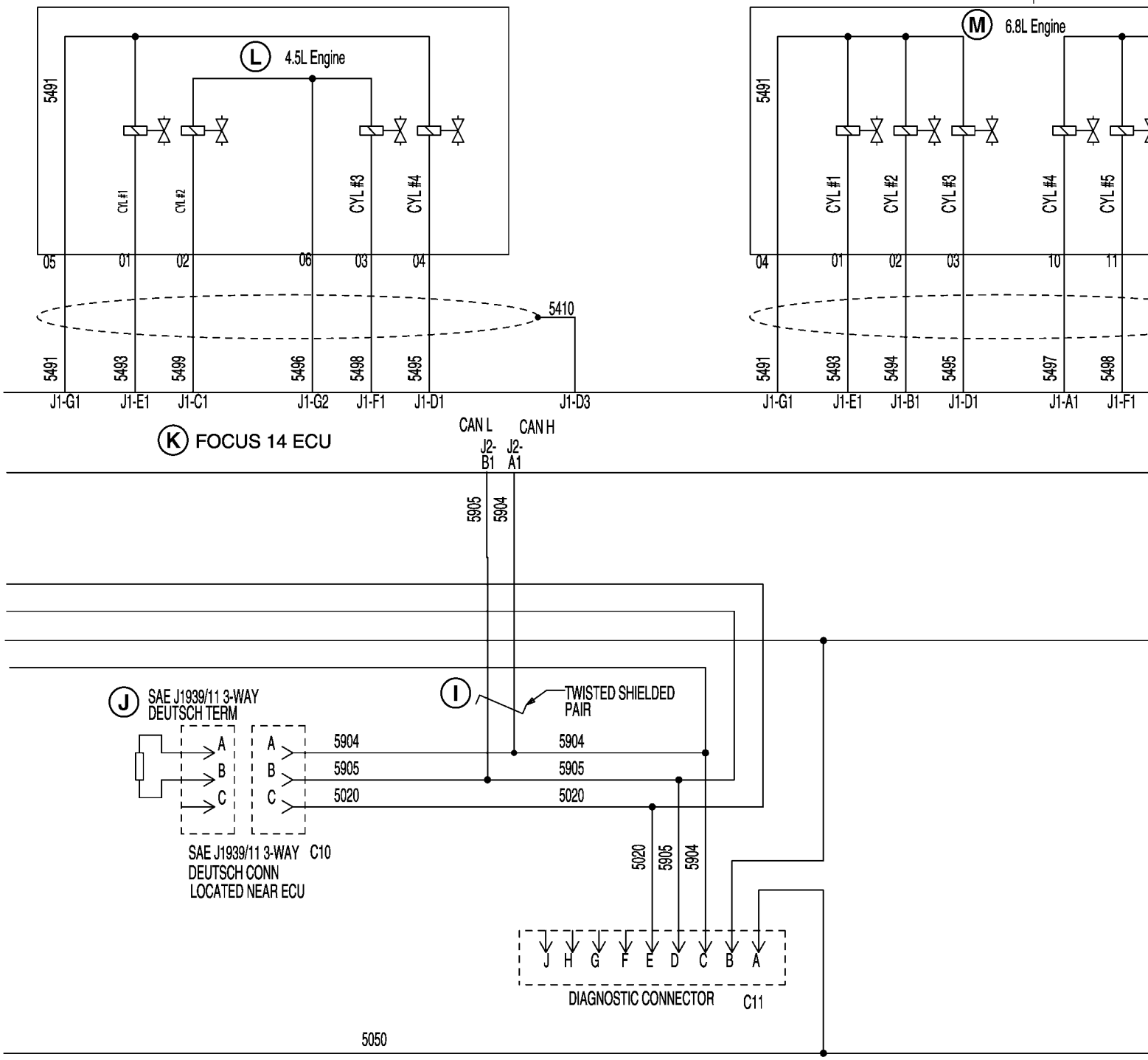
ECU/Engine Wiring Schematic, Part 1 of 2 RG41221,00001D7 –19–26MAY06–1/3



ECU/Engine Wiring Schematic, Part 2 of 2

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5002—Auxiliary Battery
5012—Switched Power, Ignition, Cruise Common, Stop Lamp Power
.5020—CAN Shield
5022—Battery
5032—Fused Unswitched Power
5042—Unswitched Power
5050—Single-Point Ground
5410—Cylinder input signal wires shield
5412—Accelerator
5413—Relay Diagnostic
5415—Excitation Return No. 2, Analog 6
5417—Turbo In Return
5419—Driver Low
5421—EGR Control No. 1+ (12V or 24V)
5422—Start
5423—EGR Control No. 1 - (12V or 24V)
5424—Driver High
5425—EGR Position No. 1 + (12V or 24V)
5426—Analog 2
5429—Glow Plug
5430—EGR Control No. 1 Wires Shielding
5433—UART+
5434—Transfer Pump Status Input (+5V)
5435—Turbo In
5436—Air Filter Restriction Switch
5439—Tachometer
5443—Engine Cam Sensor Return
5444—Excitation Return No. 5
5445—Engine Cam Sensor Power
5447—Engine Crank Sensor Power
5448—Engine Crank Sensor Return
5449—Variable Geometry Turbo (VGT) Actuator Input Signal
5453—Water-In-Fuel (WIF) Sensor Power Input
5455—EGR Fresh Air Temperature Sensor Excitation
5456—Analog 14 Delta 15 Absolute
5457—Transfer Pump Speed command
5458—Transfer Pump Motor Current
5461—Analog 8
5463—Analog 13
5467—Analog 4
5468—Analog 3
5469—Analog 5
5473—Stop Lamp
5474—Excitation Return Delta Temperature, Wait To Start
5486—EGR Control No. 2- (24V or 24V)
5491—Cylinders 1 and 2, or 1-3 Return
5493—Cylinder No. 1
5494—Cylinder No. 2
5495—Cylinder No. 3
5496—Cylinders 3 and 4, or 4-6 Return
5497—Cylinder No. 4
5498—Cylinder No. 5
5499—Cylinder No. 6
5503—EGR Control No. 2+ (12V or 24V)
5511—Excitation Voltage No. 5
5515—EGR Position No. 2 (24V or 24V)
5616—Analog 10, Excitation Voltage (+5V)
5714—Sensor Return, Override Shutdown Return, External Derate/Shut down Common
5814—Sensor Return
5904—CAN High
5905—CAN Low
5911—Sensor Excitation (+5V)
5913—Secondary Analog Throttle
5915—Analog Throttle
5916—Warning Lamp
5917—Remote Cruise
5918—Override Shutdown
5923—Bump Enable
5936—Resume Coast/Bump Down
5937—Isochronous Governor
5939—External Derate
5941—External Shutdown
5943—Cruise Brake
5947—Throttle Switch
5948—Customer Loss Of Coolant
5954—Cruise On
5955—Set Accelerate/Bump Up
5971—Cruise Cancel Resume
5981—Pulse Width Modulator Throttle
C01—13.5L Engine Fuel Injection
C11—Diagnostic Connector
C12—Transient Voltage Protector (TVP)
C13-C14—
C15—
C16—
C17—
C19—
D01—Water In Fuel (WIF)
G1—Alternator (12V)
J1—32-Position, Blue, Left- or Right-Hand, Cam, CINCH
J2—48-Position, Brown, Left- or Right-Hand, Cam, CINCH
J3—32-Position, Black, Left- or Right-Hand, Cam, CINCH
M1—Starter Motor
P03—Fuel Pressure Sensor (High)
P04—Oil Pressure Sensor (Clean Side)
P07—Fuel Pressure Sensor (Low)
SE-1—Engine Start Components
SE-2—FOCUS 14 (ECU)
T01—EGR Fresh Air Temperature Sensor
T02—EGR Manifold Temperature Sensor
T03—EGR Exhaust Temperature Sensor
T04—Coolant Temperature
T05—Fuel Temperature
T06—Compressor Inlet Temperature
X01—Engine Crank Sensor
X02—Engine Cam Sensor
X03—Delphi Torque Motor (EGR) (12V or 24V)
X04—VGT Actuator
X05—VGT Speed Sensor
X06—Delphi Torque Motor (EGR) (12V or 24V)
A—13.5L Engine
B—Twisted Pair (5 places)
C—-Auxiliary Battery Terminal
D—FOCUS 14 4.5L and 6.8L 4-Valve Engine Control Unit (ECU)
E—Increase Pressure (4 places
F—4.5L and 6.8L Engine Fuel Injection
G—+Auxiliary Battery Terminal
H—
I—Single-Point Ground
J—SAE Deutsch 3-Way Terminal/Connector, Located Near ECU
K—FOCUS 14 ECU
L—Alternator
M—Wiring Supplied With John Deere Alternator
N—Ignition
O—Coil
Q—Glow Plug Relay Coil
T—Shielded, Twisted Pair
U—Fuel Heater
Y—Fuel Pump Supply Relay

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