PowerTech Plus*POWERTECH*™ 4.5L & 6.8L Diesel Engines Level 14 Electronic Fuel System With Denso HPCR

TECHNICAL MANUAL

POWERTECH Plus™ 4.5 L & 6.8 L Diesel Engines—Level 14 Electronic Fuel System with Denso HPCR

26JUN06 (ENGLISH)

For complete service information also see:

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

John Deere Power Systems

TP-6456 6/06

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 (CTM320) covers only Level 14 Electronic Fuel System with the Denso High Pressure Common Rail (HPCR). It is one of six volumes on 4.5 L and 6.8 L engines. The following six companion manuals cover the base engine, mechanical fuel system, and other electronic control systems. Each manual covers repair, operation, and diagnostics.

- CTM104—Base Engine
- CTM170—Level 4 Electronic Fuel System with Bosch VP44 Pump
- CTM207—Mechanical Fuel Systems
- CTM284—Level 1 Electronic Fuel System with Delphi (Lucas) DP201 Pump
- CTM331—Level 12 Electronic Fuel System with Stanadyne DE 10 Pump
- CTM320—Level 14 Electronic Fuel System with the Denso High Pressure Common Rail (HPCR)

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

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

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

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

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

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

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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Prevent Battery Explosions

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

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

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

TS204 –UN–23AUG88

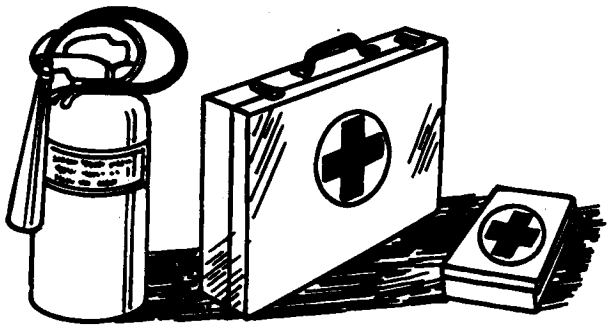
DX,SPARKS –19–03MAR93–1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 –UN–23AUG88

DX,FIRE2 –19–03MAR93–1/1

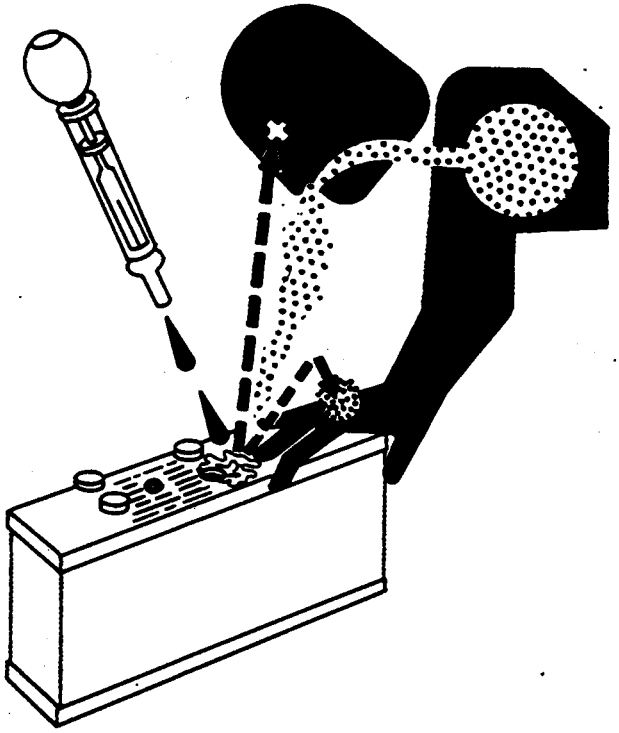
Handling Batteries Safely

TS204 –UN–23AUG88

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

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

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



TS203 –UN–23AUG88

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

Avoid the hazard by:

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

If you spill acid on yourself:

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

If acid is swallowed:

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

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

DPSG,OUO1004,2758 –19–11MAY00–1/1

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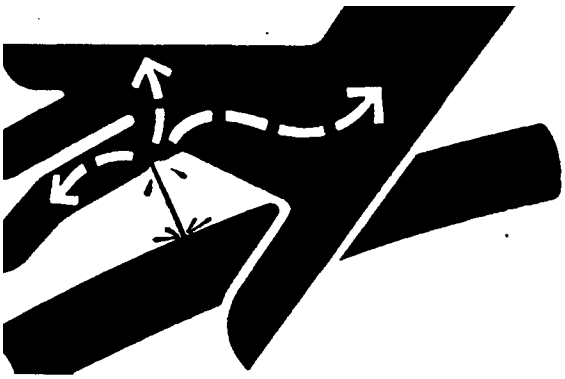
Avoid High-Pressure Fluids



X9811 –UN–23AUG88

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

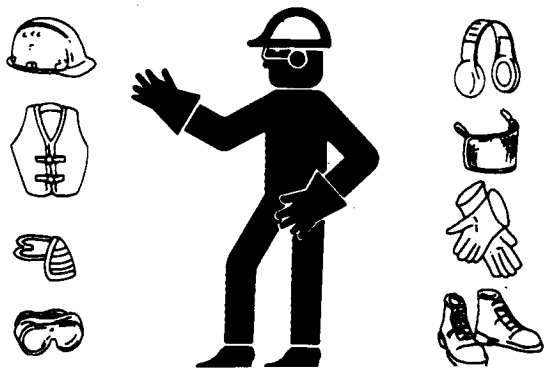
Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

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

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

DX,FLUID –19–03MAR93–1/1

Wear Protective Clothing



TS206 –UN–23AUG88

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

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

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

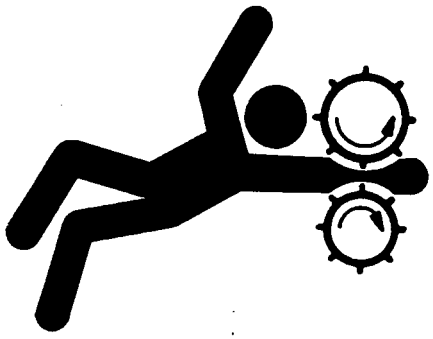
Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

DX,WEAR –19–10SEP90–1/1

Service Machines Safely

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

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



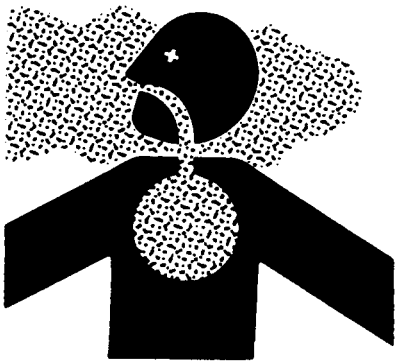
TS228 –UN–23AUG88

DX,LOOSE –19–04JUN90–1/1

Work In Ventilated Area

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

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



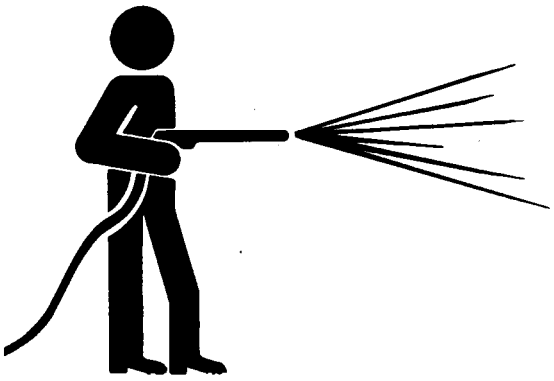
TS220 –UN–23AUG88

DX,AIR –19–17FEB99–1/1

Work in Clean Area

Before starting a job:

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



T6642EJ –UN–18OCT88

DX,CLEAN –19–04JUN90–1/1

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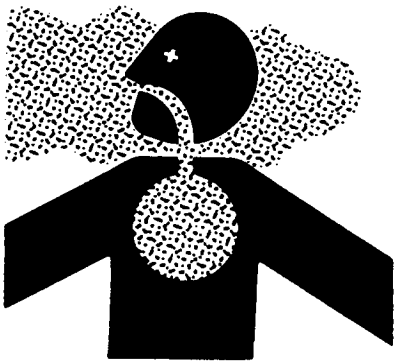
Remove Paint Before Welding or Heating



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

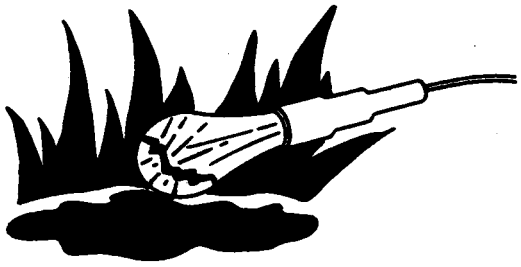
Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can accidentally burst when heat goes beyond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

TS953 –UN–15MAY90

DX,TORCH –19–10DEC04–1/1

Illuminate Work Area Safely

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



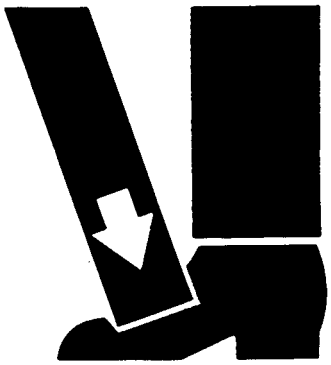
TS223 –UN–23AUG88

DX,LIGHT –19–04JUN90–1/1

Use Proper Lifting Equipment

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

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



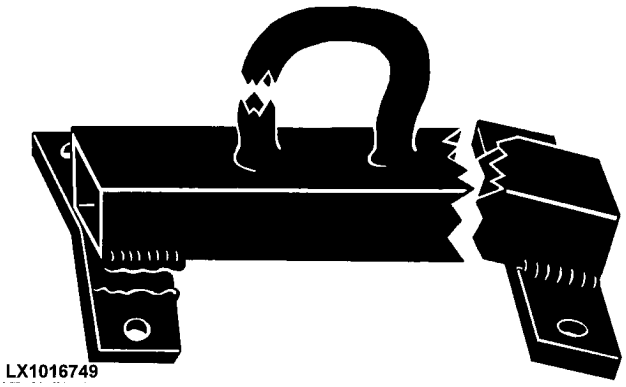
TS226 –UN–23AUG88

DX,LIFT –19–04JUN90–1/1

Construct Dealer-Made Tools Safely

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

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



LX1016749 –UN–01JUL97

Construct Dealer-Made Tools Safely

DPSG,OUO1004,899 –19–19MAY99–1/1

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Practice Safe Maintenance

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

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

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

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

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

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

TS218 –UN–23AUG88

DX,SERV –19–17FEB99–1/1

Use Proper Tools

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

Use power tools only to loosen threaded parts and fasteners.

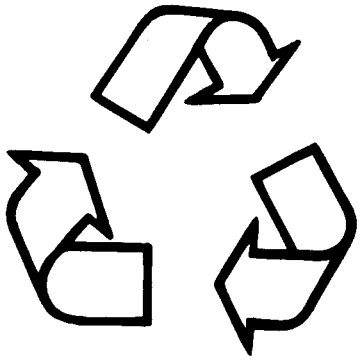
For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only service parts meeting John Deere specifications.

TS779 –UN–08NOV89

DX,REPAIR –19–17FEB99–1/1

Dispose of Waste Properly



TS1133 –UN–26NOV90

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

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

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

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

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

DX,DRAIN –19–03MAR93–1/1

Live With Safety

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

TS231 –19–07OCT88

DX,LIVE –19–25SEP92–1/1

Engine Serial Number Plate Information

A—Engine Serial Number
B—Application Data or Type

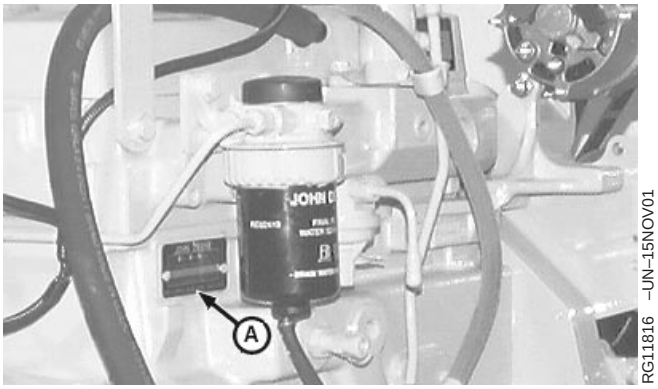
Engine Serial Number/Application Data

DB92450,000003F –19–31MAR06–1/3

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:



Serial Number Plate

A—Engine Serial Number Plate

RG6068L123456

RG	Factory producing engine
6	Number of Cylinders
068	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

DB92450,000003F –19–31MAR06–2/3

6068HF485

6	Number of Cylinders
068	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

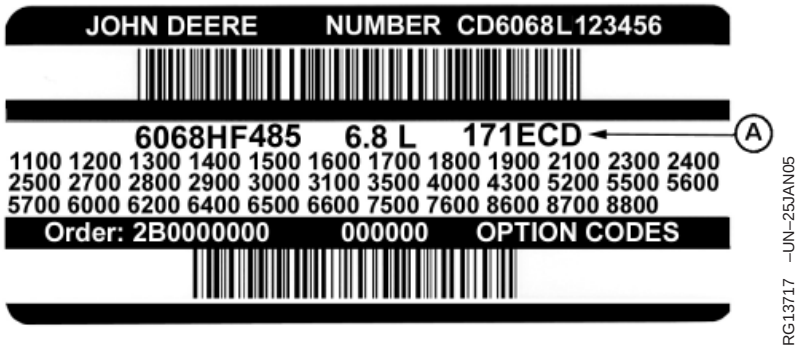
AP	Industries JohnDeere Mexico S.A. de C.V. (Saltillo/Monterrey, Mexico)
AT	Agritalia srl (Vittoria, Sicily, Italy)
BE	Bell EquipmnetCo. (Richards Bay, South Africa)
CQ	John Deere Brazil (Horizontina, Brazil)
DW	John Deere Davenport Works (Davenport, Iowa)
E	John Deere Ottumwa Works (Ottumwa, Iowa)
F	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

DB92450,000003F –19–31MAR06–3/3

OEM Engine Option Code Label



OEM Engine Option Code 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.

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

RG41183,00000ED –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.

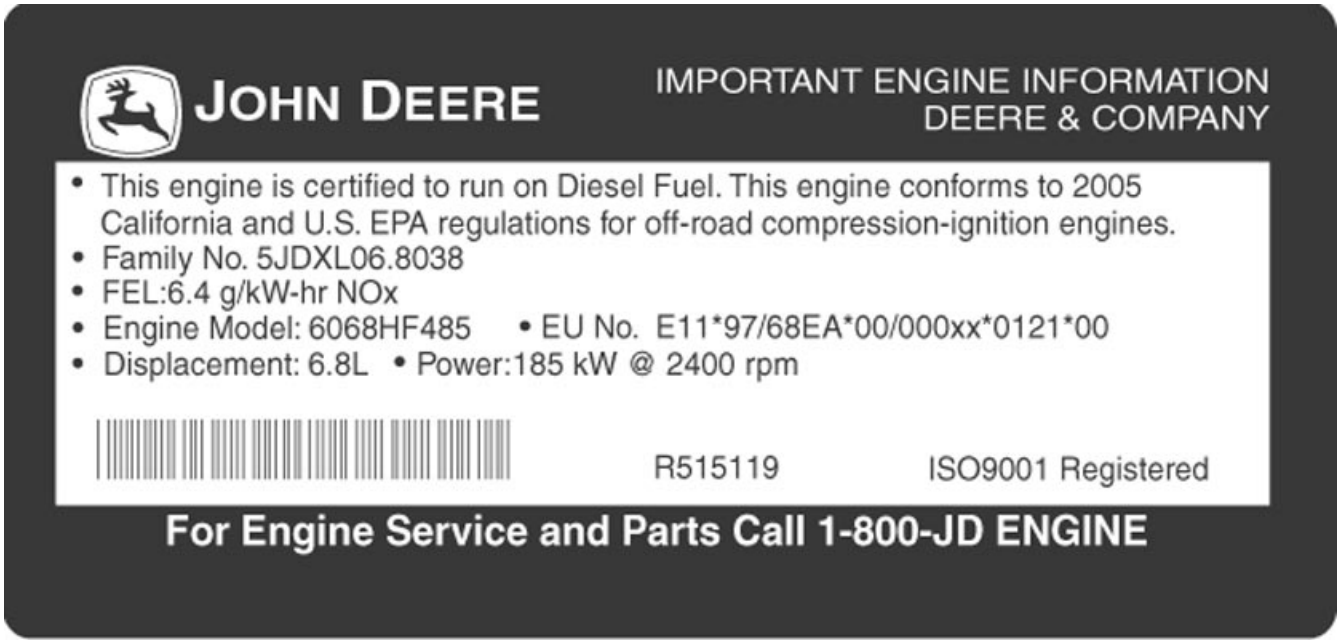
The regulations prohibit tampering with the emission-related components listed below which would render that component inoperative or to make any adjustment on the engine beyond published specifications. It is also illegal to install a part or component where the principle effect of that component is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

Emissions Control System Certification Label



6.8L 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.

DN22556,000005B –19–07APR06–1/1

Engine Application Charts

JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)
PE6068HF485
CD6068HF485

RG40854,0000009 –19–11APR03–1/1

Lubricants and Coolant

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

RG40854,000000A –19–07SEP05–1/1

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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

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

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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

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.

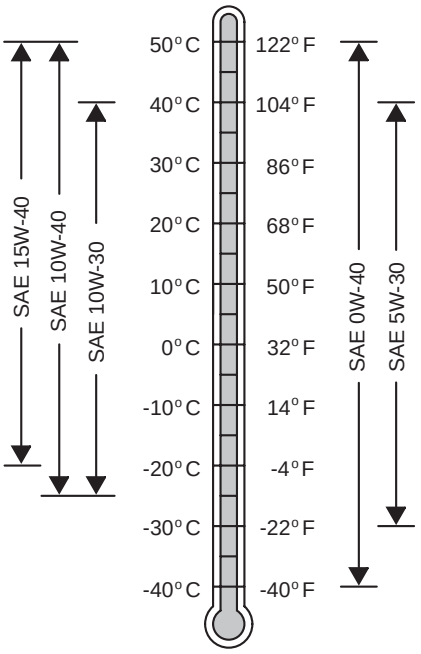
Other oils may be used if they meet one or more of the following:

- 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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DX,ENOIL11 –19–23NOV05–1/1

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.

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

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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.

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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DX,ENOIL13 –19–19DEC05–1/1

Diesel Fuel

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

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

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

Required fuel properties

In all cases, the fuel 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

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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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DX,FUEL6 –19–14NOV05–1/1

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.

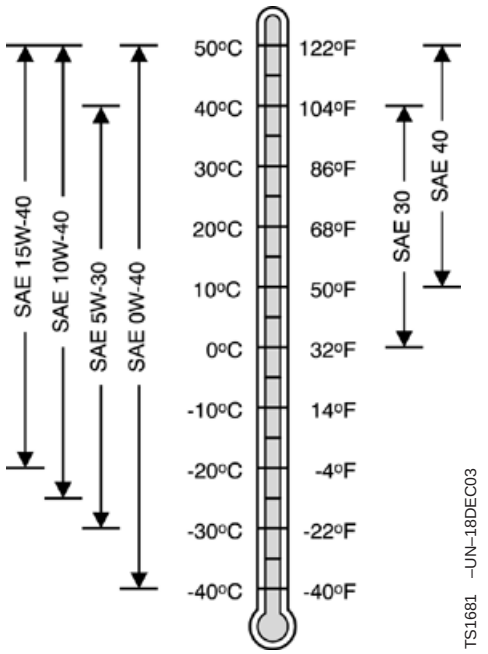
Other oils may be used if they meet one or more of the following:

- 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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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

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.

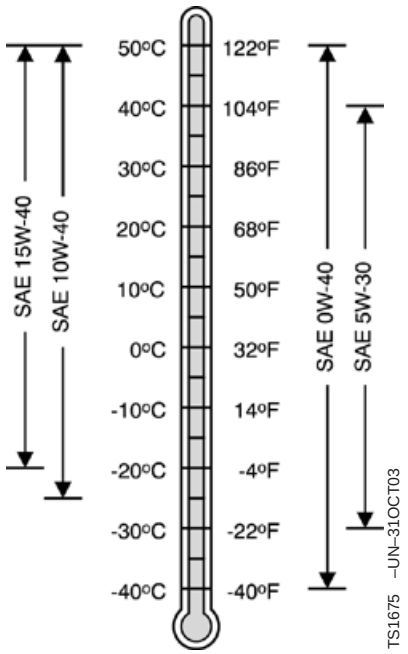
Other oils may be used if they meet one or more of the following:

- 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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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.

DX,FUEL7 –19–14NOV05–1/1

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

Continued on next page

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, as 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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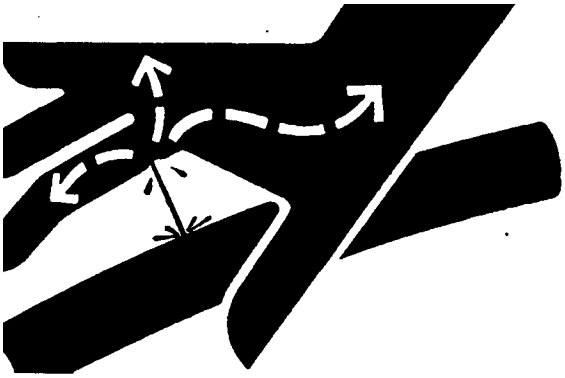
Relieve Fuel System Pressure

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 Pre-Filter/Water Bowl Base

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

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

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

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

NOTE: Mounting bracket does not need to be removed.

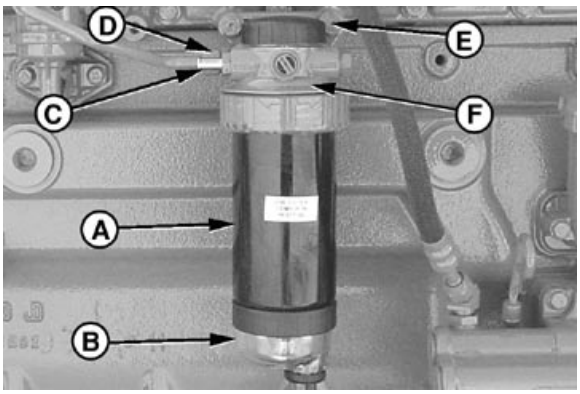
7. Replace parts as necessary.

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

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

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

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



Pre-filter (OEM engines)

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

Continued on next page

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

Specification	
Pre-filter Fuel Filter Inlet Line—Torque	9 N•m (6.6 lb-ft)
Pre-filter Outlet Line—Torque	9 N•m (6.6 lb-ft)

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

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Replace Pre-Filter Element

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

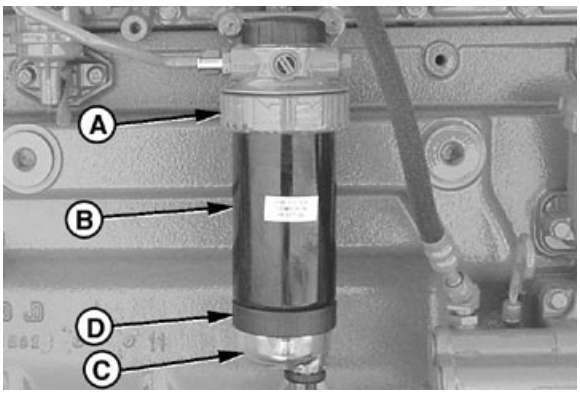
1. Thoroughly clean fuel filter/water bowl assembly and surrounding area, if not previously done.
2. Connect a fuel line to filter drain adapter and drain all fuel from filter/water bowl.

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

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

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

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



Pre-filter (OEM engines)

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

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Remove and Install Final Fuel Filter/Water Bowl Base

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

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

Final fuel filter may be equipped with a water bowl.

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

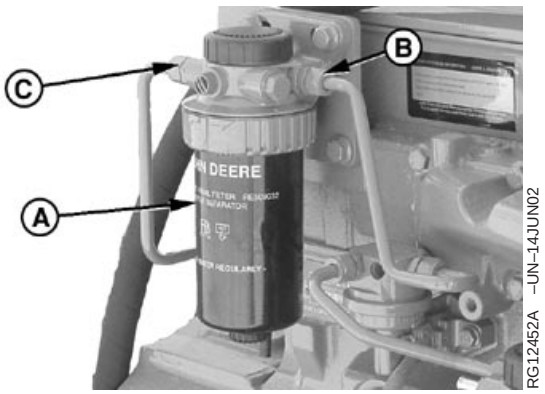
NOTE: Fuel lines may be connected to different filter inlet and outlet ports depending on engine application.

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

Specification

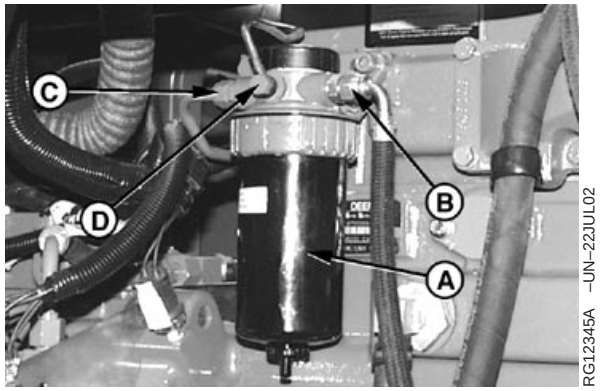
Final Fuel Filter Base-to-Bracket—Torque	50 N•m (36.9 lb-ft)
Final Fuel Filter Bracket to Cylinder Head—Torque	73 N•m (53.4 lb-ft)

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



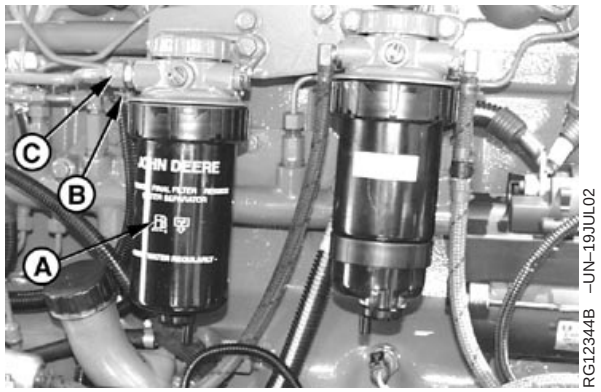
RG12452A –UN–14JUN02

Final Fuel Filter (OEM engines)



RG12345A –UN–22JUL02

Final Fuel Filter (Combine engines)



RG12344B –UN–19JUL02

Final Fuel Filter (6020 Tractor engines)

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

Continued on next page

Specification	
Final Fuel Filter Inlet Line—	
Torque	9 N•m (6.6 lb-ft)
Final Fuel Filter Outlet Line—	
Torque	9 N•m (6.6 lb-ft)

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

RG41183,00000CC –19–01APR05–2/2

Replace Final Fuel Filter Element

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

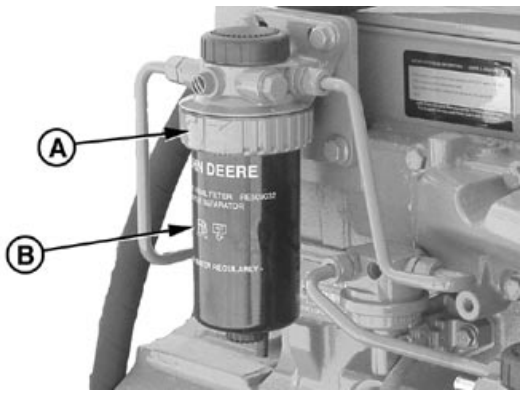
1. Thoroughly clean fuel filter/water bowl assembly and surrounding area, if not previously done.
2. Connect a fuel line to filter drain adapter and drain all fuel from filter/water bowl.

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

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

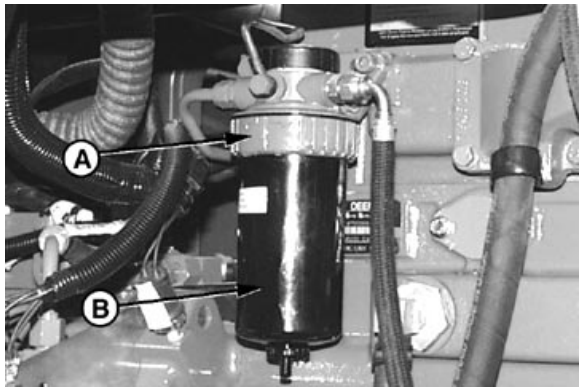
NOTE: The fuel filter must be indexed properly and the key on canister must be oriented in slot of mounting base for correct installation.

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



RG12452B –UN–14JUN02

Final Fuel Filter (OEM engines)



RG12345B –UN–22JUL02

Final Fuel Filter (Combine engines)

RG12344A –UN–19JUL02

Final Fuel Filter (6020 Tractor engines)

A—Retaining Ring
B—Final Fuel Filter Element

RG41183,00000CE –19–01APR05–1/1

Remove Fuel Transfer Pump

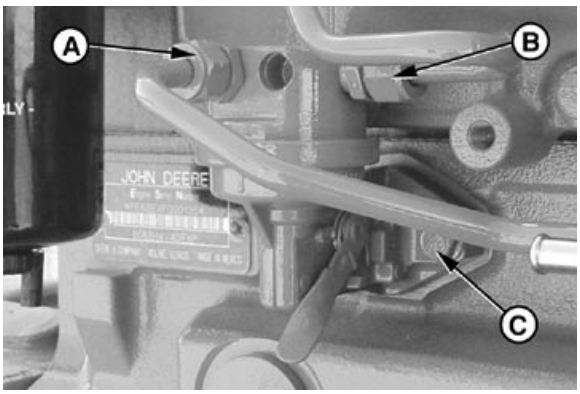
IMPORTANT: A backup wrench must always be used when disconnecting fittings or fuel lines from supply pump to avoid damage to fittings.

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

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

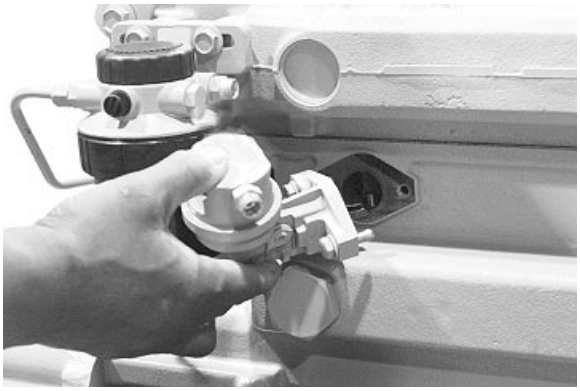
3. Cover opening on cylinder block to prevent dirt from entering the engine.
4. Inspect face of pump lever for wear. If lever face is worn flat or concave, replace pump.

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



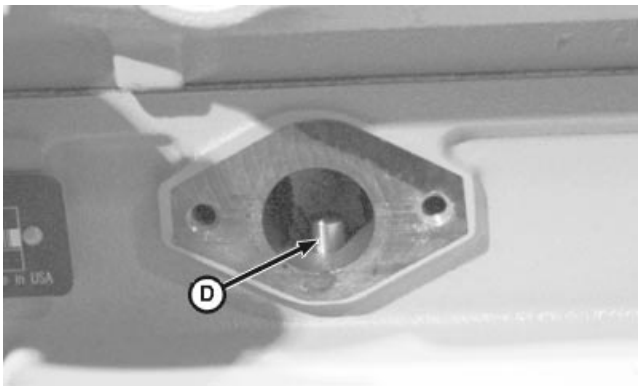
RG12453A –UN–14JUN02

Mechanical Fuel Transfer Pump Supply Lines



RG9051 –UN–16MAR98

Remove Mechanical Fuel Transfer Pump



RG12022 –UN–27NOV01

Mechanical Fuel Transfer Pump Push Rod

RG41183,00000CF –19–01APR05–1/1

Install Fuel Transfer Pump

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

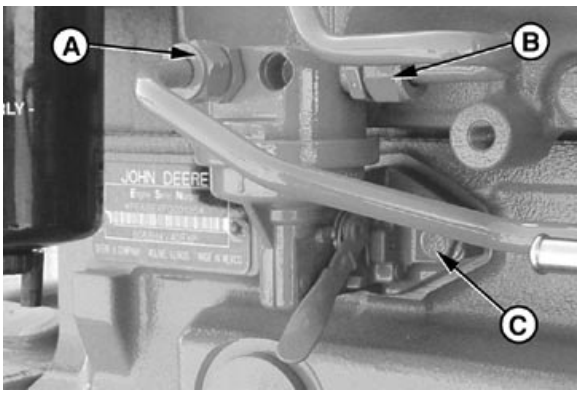
1. Install the fuel transfer pump to cylinder block with pumping lever resting on top of push rod, using a new O-ring. Tighten cap screws (C) to specifications.

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

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

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

3. Bleed the fuel system. See BLEED THE FUEL SYSTEM later in this Group.



Fuel Transfer Pump Lines

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

RG41183,00000D0 –19–01APR05–1/1

Remove and Install High Pressure Fuel Pump

Remove High Pressure Fuel Pump

02
090
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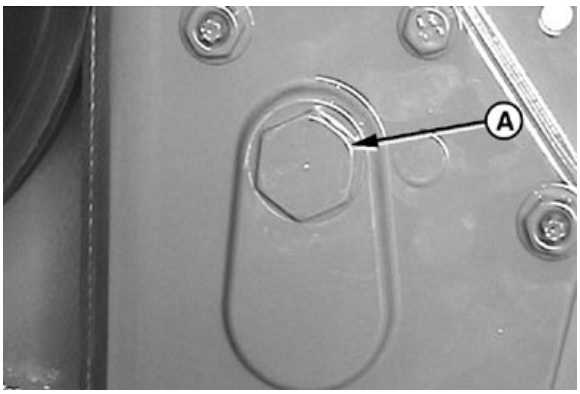
1. Rotate engine with JDG820 Flywheel Turning Tool until JDE81-4 Timing Pin engages timing hole in flywheel. Engine should be at No.1 “TDC-Compression”.
2. Verify engine is at No.1 “TDC-Compression”. Remove screw (A) for window on injection pump gear. A marked line on the gear (B) should be visible through the window.

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

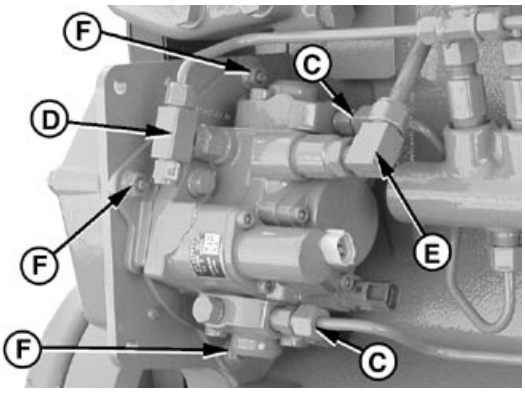
3. Remove high pressure fuel lines (C).
4. Remove fuel leak-off lines at top of tee intersection the high pressure fuel pump, regulating valve, and leak-off line meet to return to tank (D).
5. Disconnect low pressure fuel supply line from the fuel supply inlet (E) on the high pressure fuel pump.
6. Remove 3 capscrews (E) from fuel pump adapter plate
7. Carefully remove high pressure fuel pump from front cover.

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



High pressure pump window screw

High pressure pump gear timing mark



High pressure pump

Continued on next page

Install High Pressure Fuel Pump

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

Specification

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

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

Specification

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

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

Specification

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

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

Specification

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

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

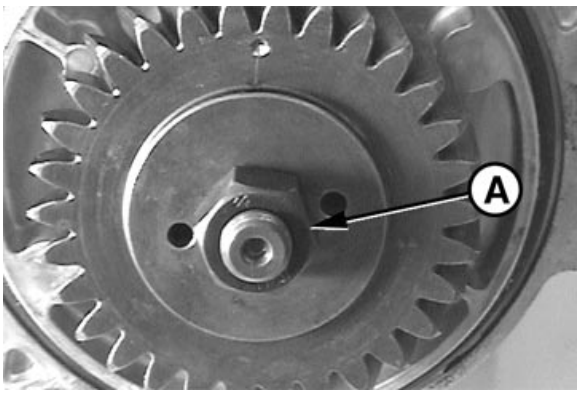
Specification

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

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

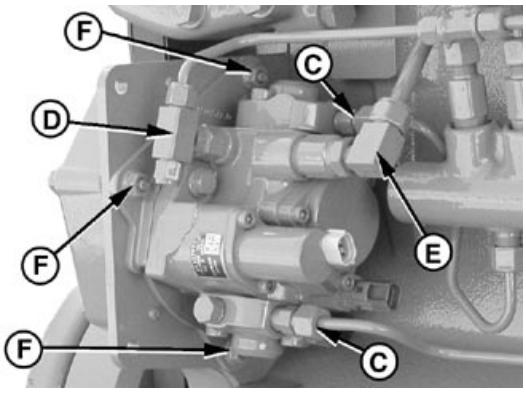
Specification

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



High Pressure Pump Gear

High pressure pump gear timing mark



High Pressure Pump

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

Continued on next page

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

RG41183,00000D1 –19–01APR05–3/3

02
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12

Remove and Install High Pressure Fuel Pump Inlet Filter

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

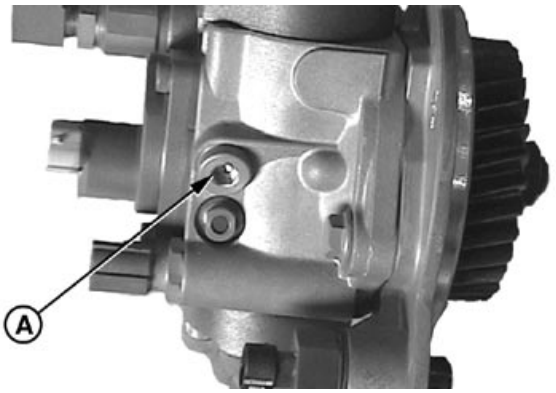
NOTE: Keep foreign material free from replacement components.

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

Specification

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

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



RG12541A –UN–19JUL02

A—High Pressure Fuel Pump Inlet Filter Plug

RG41183,00000D2 –19–01APR05–1/1

Remove and Install High Pressure Common Rail

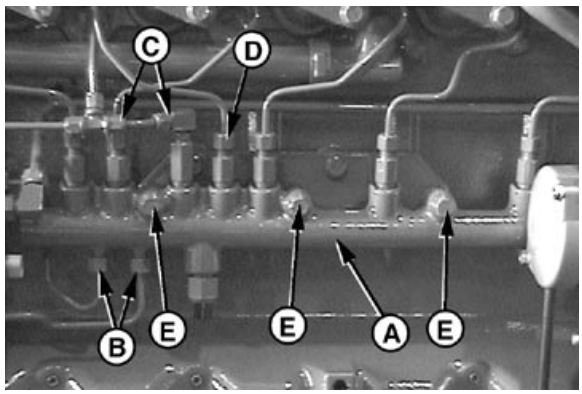
Remove High Pressure Common Rail

CAUTION: Let the engine sit for 5 minutes to allow rail pressure to lower. Be careful of hot turbocharger when disconnecting leak-off and injector delivery lines.

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

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

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



RG12459A –UN–18JUN02

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

Continued on next page

RG41183,00000D3 –19–01APR05–1/2

Install High Pressure Common Rail (HPCR)

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

Specification

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

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

Specification

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

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

Specification

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

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

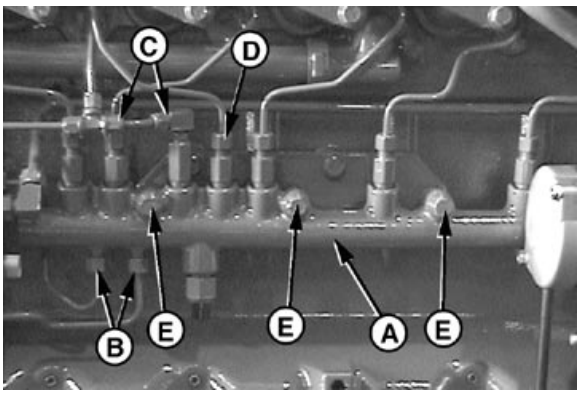
Specification

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

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

Specification

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



RG12459A –UN–18JUN02

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

RG41183,00000D3 –19–01APR05–2/2

Remove and Install Flow Dampers

Remove Flow Dampers

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

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

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

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

3. Remove clamp that secures fuel line to faulty flow damper.

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

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

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

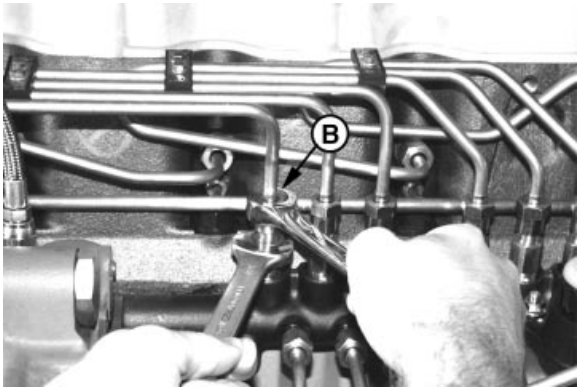
5. Loosen fuel line fitting on EI inlet connector. The line does not need to be removed.

6. Remove flow damper keeping internal components together (B).

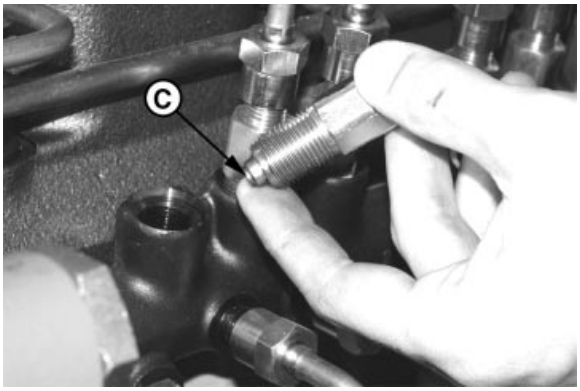
IMPORTANT: Make sure magnet is clean before using.

7. Remove orifice plate (D) from inside flow damper bore on high pressure common rail using a magnet (C).

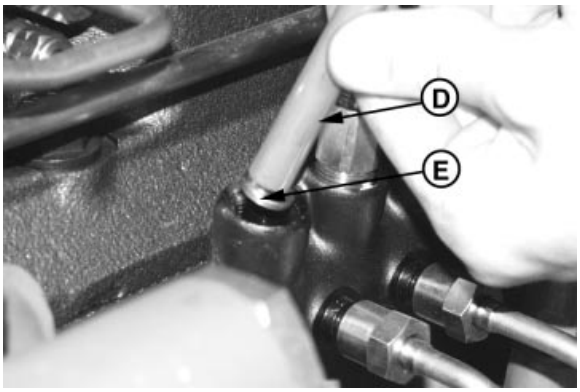
8. Replace complete flow damper as an assembly.



Fuel Fitting



Flow Damper Internal Components



Removing Orifice Plate

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

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 N•m (130 lb-ft)

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

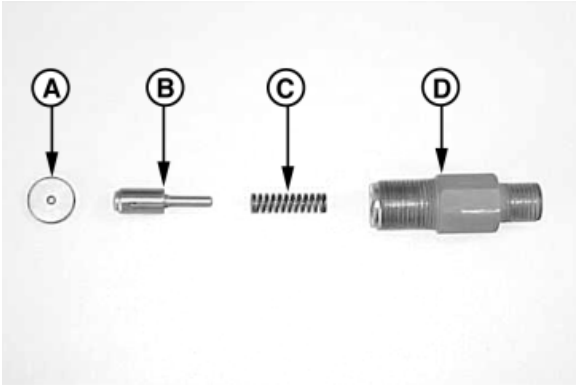
Specification

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

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

Specification

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



Flow Damper Exploded View

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

RG41183,00000D4 –19–01APR05–2/2

Remove and Install Pressure Limiter

Remove Pressure Limiter

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

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

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

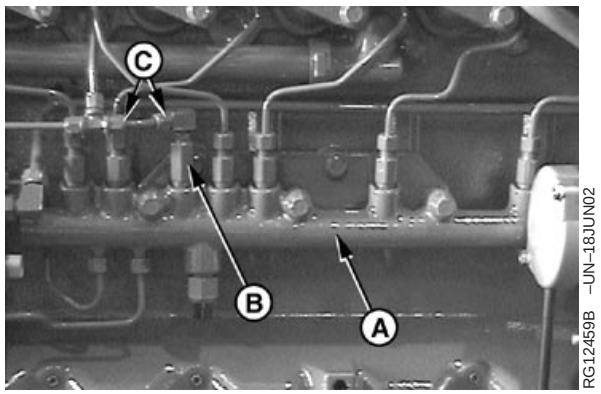
2. Thoroughly clean all fuel lines, fittings, components, and chamfered area around the pressure limiter.

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

IMPORTANT: Clean magnet prior to removing pressure limiter.

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

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



High Pressure Common Rail (HPCR)

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

Continued on next page

Install Pressure Limiter

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

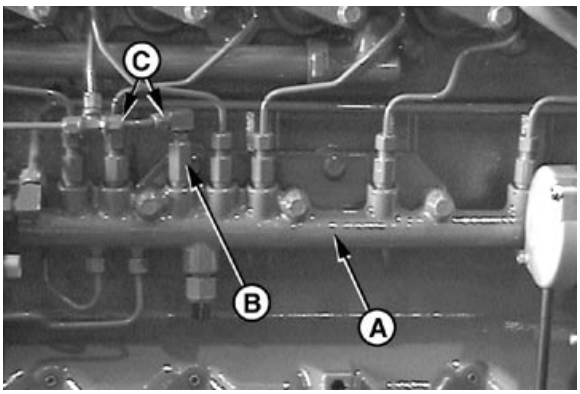
Specification

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

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

Specification

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



High Pressure Common Rail (HPCR)

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

RG41183,00000D5 –19–01APR05–2/2

Remove Electronic Injectors (EIs)

1. Remove rocker arm cover with vent tube.

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

2. Disconnect High Pressure Common Rail (HPCR) delivery line (A) of the electronic injector (D) to be removed.

3. Remove wires from EI studs (F) of EI to be removed.

4. Loosen side feed tube retaining nut (B) and EI hold down clamp cap screw.

5. Remove side feed tube (C) and electronic injector hold down clamp (E)

6. Using the injector removal tool JDG1652A (G), remove EI from the cylinder head.

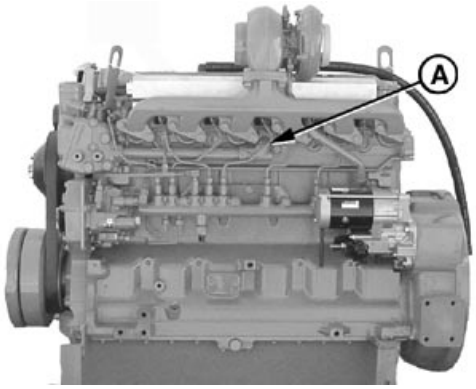
IMPORTANT: When removing the Electronic Injector (EI), do not twist the top of the EI. This will damage the EI solenoid.

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

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

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

A—HPCR Delivery Line
B—Side Feed Tube Retaining Nut
C—Side Feed Tube
D—Electronic Injector (EI)
E—EI Hold Down Clamp
F—EI Stud
G—EI Removal Tool (JDG1652A)



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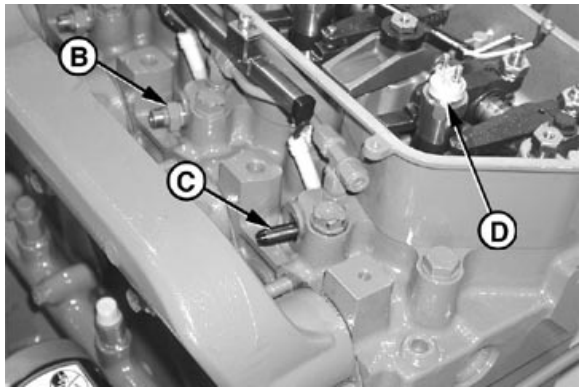
Remove Heat Shield and Rocker Arm Cover



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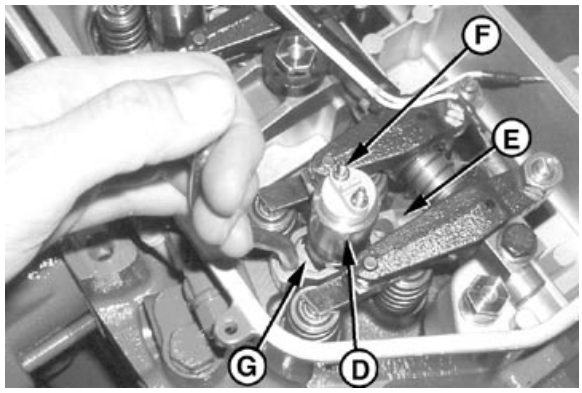
Side Feed Tube Removal



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Electronic Injector Removal

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Clean Electronic Injector (EI) Bore

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

RG40854,0000118 –19–03JUN02–1/1

Clean Electronic Injector (EI) Orifice

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

RG40854,0000117 –19–03JUN02–1/1

Clean Electronic Injector (EI) Body

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

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

RG40854,0000116 –19–03JUN02–1/1

Inspect Electronic Injector (EI) Body

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

RG40854,0000115 –19–03JUN02–1/1

Install Electronic Injectors (EIs)

IMPORTANT: If any injectors are being replaced, make sure the injector calibration paper included with the new injector is completely filled out. This information is needed for calibrating the ECU for proper fueling to keep the engine running at maximum performance and within emission compliance.

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

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

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

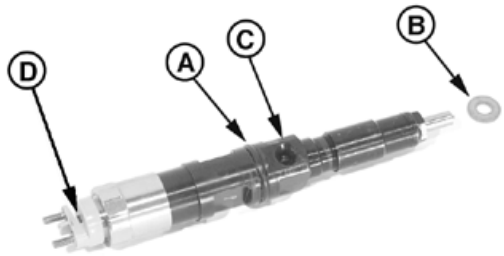
IMPORTANT: When installing the Electronic Injector (EI), do not twist the top of the EI. This will cause the EI calibration to be changed.

2. If EI is being re-installed, o-rings on the EI(s) (A) must be replaced. Lubricate o-ring with amojell (petroleum jelly) clean oil or equivalent.

3. Slide the forked legs of the EI hold down clamp (H) around the flat part of the EI. Orient the EI conical bore (C) in the side of the EI away from the clamp.

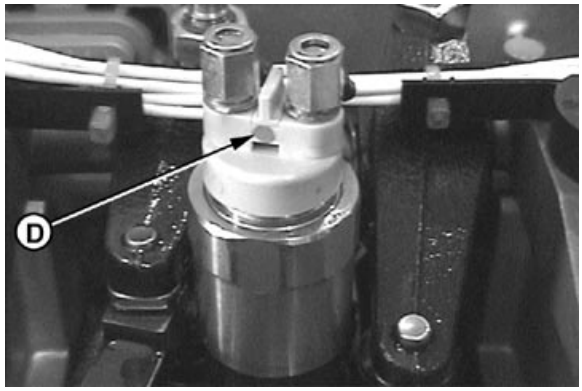
4. Carefully insert the EI and clamp assembly into the bore until it “pops” into place. The EI position mark (D) needs to face towards the side feed tube (E).

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



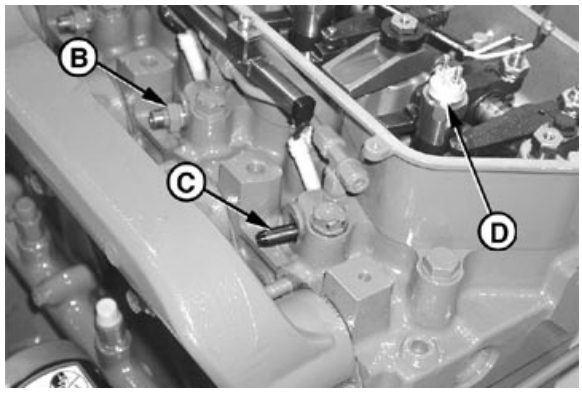
RG12470A –UN–14JUN02

Electronic Injector



RG12467A –UN–14JUN02

Injector Position Mark



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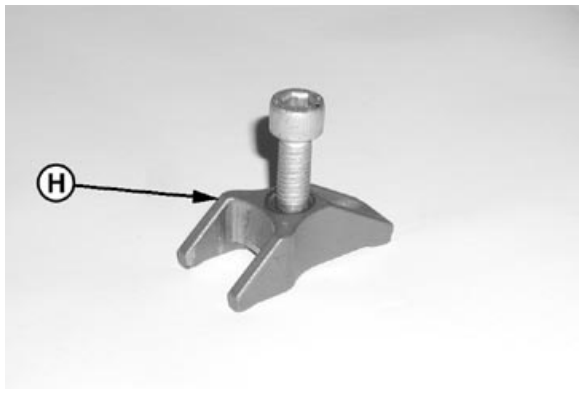
Side Feed Tube Installation



RG12466A –UN–19JUL02

Injector Hold Down Clamp and Cap Screw

Continued on next page RG40854,000011A –19–03JUN02–1/3

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

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

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

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

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

8. Tighten EI hold down clamp tight to seat.

9. Torque side feed tube retaining nut to specification.

Specification

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

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

Specification

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

11. Torque side feed tube retaining nut to specification.

Specification

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

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

Specification

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

Continued on next page

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

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

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

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

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

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

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

17. Calibrate the ECU for proper electronic injector fueling. See ELECTRONIC INJECTOR CALIBRATION in Section 04, Group 160 later in this manual.

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RG40854,000011A –19–03JUN02–3/3

Remove and Install Leak-off Lines

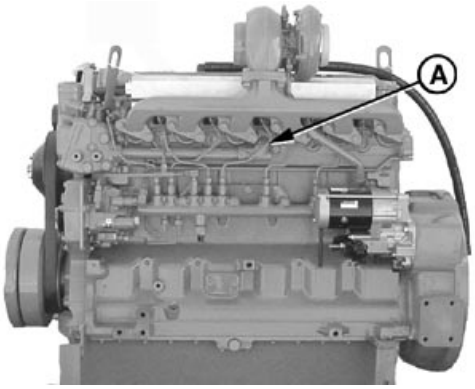
Remove Leak-off Lines

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

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

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

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



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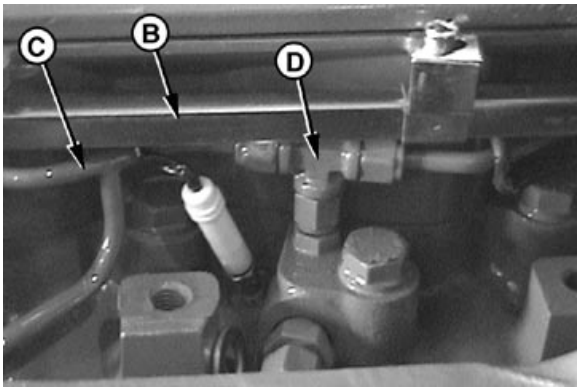
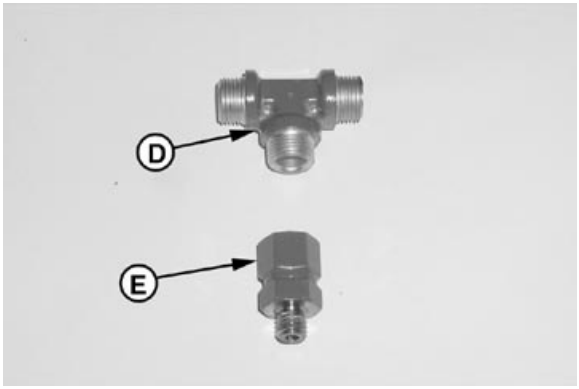
Remove Heat Shield



RG12456A –UN–14JUN02

Injector Leak-off Lines



RG12457A –UN–19JUL02

Injector T-fitting and Leak-off Fitting

Continued on next page

RG40854,000011B –19–03JUN02–1/2

Installation of Leak-off Lines

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

Specification

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

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

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

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

Specification

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

4. Install glow plug harness rail (B). Torque screws to specification.

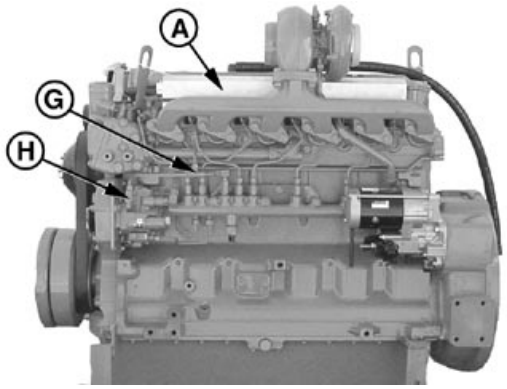
5. Connect glow plugs (C) to glow plug harness.

6. Install heat shield (A). Torque cap screws to specification.

Specification

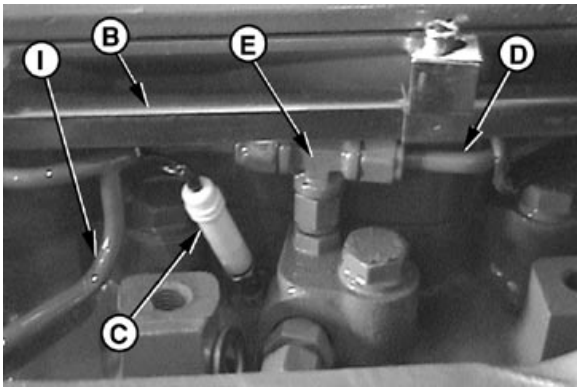
Heat Shield Cylinder Head Cap
Screws—Torque ..... 60 N•m (44 lb-ft)
Heat Shield Rocker Arm Carrier
Cap Screws—Torque ..... 10 N•m (7.4 lb-ft)

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



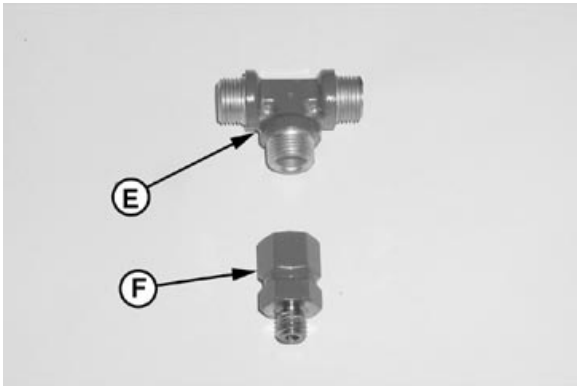
RG12471D –UN–24JUL02

Engine Side View



RG12456C –UN–25JUL02

Injector Leak-off Lines



RG12457B –UN–24JUL02

Injector T-fitting and Leak-off fitting

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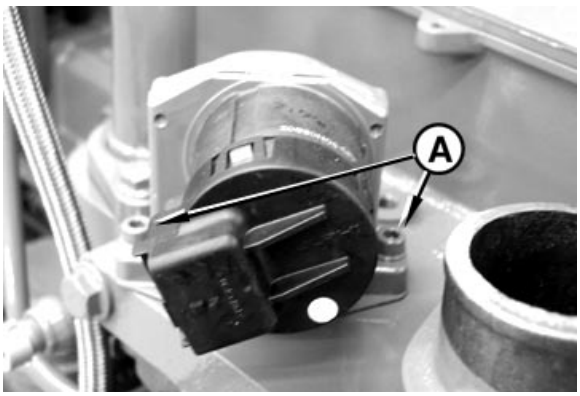
Remove and Install Exhaust Gas Recirculation (EGR) Valve

1. Disconnect wire harness connector from the exhaust gas recirculation valve.
2. Remove two, attaching screws (A), and carefully remove the EGR valve by rotating it slightly and pulling it straight out.
3. Remove gasket and clean mating surfaces. Vacuum loose debris from intake housing.
4. Inspect valve lands (C) for wear and damage. Remove carbon deposits and debris.



EGR Valve

A—Attaching Screws

RG41183,00000F5 –19–10MAY06–1/2

5. Replace EGR O-rings (B) each time valve is removed.
6. 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)

7. Tighten EGR valve to final specifications. Connect wiring harness.

Specification	
Screw—Torque	15 N•m (11 lb-ft)

IMPORTANT: Before starting engine after servicing EGR valve, the EGR valve settings must be reset by performing special test in Service ADVISOR™ . See "Exhaust Gas Recirculation Valve Reset" in Section 04, Group 160 later in this manual.

Inspect EGR Valve

B—O-Rings
C—EGR Valve Lands

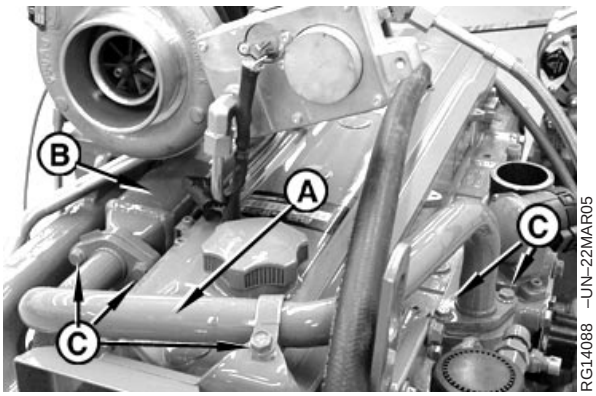
RG41183,00000F5 –19–10MAY06–2/2

Remove and Install EGR Exhaust Tube

1. Remove EGR exhaust tube and P-clamp attaching cap screws (C) and gaskets.
2. Inspect exhaust tube for damage or leaks and clean mating surfaces.
3. Install exhaust tube by placing in position. Use new gaskets and ensure all mating surfaces are flush. Hand tighten all cap screws to assure alignment. Tighten cap screws to specifications.

Specification

EGR Exhaust Tube Cap Screws—Torque	35 N•m (25 lb-ft)
Exhaust Tube P-Clamp Cap Screw—Torque	25 N•m (18 lb-ft)



RG14088 –UN–22MAR05

EGR Exhaust Tube

A—EGR Exhaust Tube
B—EGR Cooler
C—EGR Exhaust Tube Cap Screws

RG19661,0000041 –19–31MAY05–1/1

Remove and Install EGR Coolant Inlet Tube

1. Remove coolant tube-to-EGR cooler cap screw .
2. Remove P-clamps at the rear and side of the engine.
3. Loosen EGR coolant inlet tube hose clamp located at the oil cooler and remove coolant tube.
4. Inspect coolant tube and mating surfaces for defects and nicks which may cause leaks.
5. Install tube in EGR Cooler and tighten to specifications.

Specification

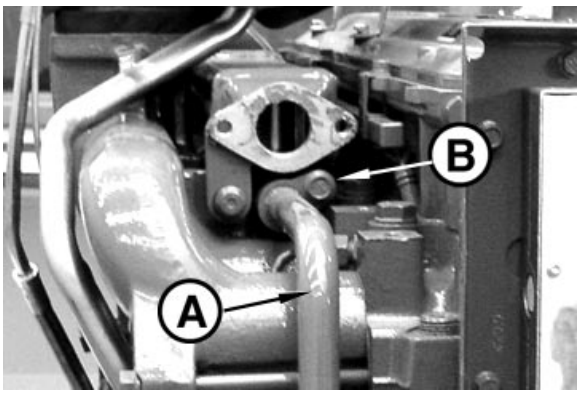
EGR Coolant Inlet Tube Cap Screw—Torque ..... 35 N•m (25 lb-ft)

6. Insert coolant tube in hose and secure hose clamp.
7. Tighten P-clamp cap screws to specifications.

Specification

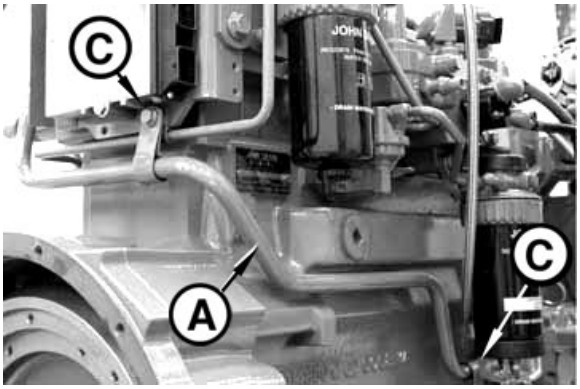
Coolant Tube P-Clamp Cap Screws—Torque ..... 25 N•m (18 lb-ft)

A—EGR Inlet Coolant Tube
B—Cap Screw
C—P-Clamps
D—Hose Clamp



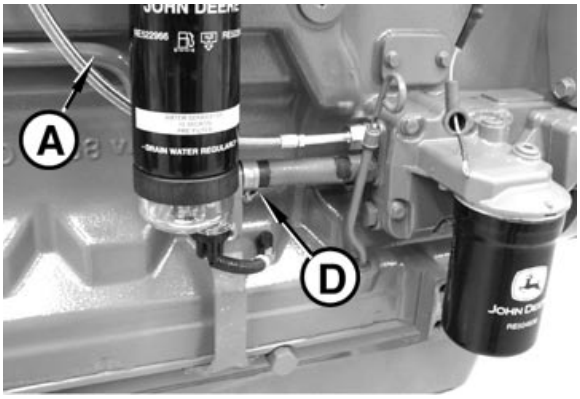
RG14087 –UN–23MAR05

Coolant Tube Cap Screw



RG14090 –UN–23MAR05

Coolant Tube Clamps



RG14098 –UN–23MAR05

Coolant Tube Hose Connection

RG19661,0000042 –19–22MAR05–1/1

Remove and Install Exhaust Gas Recirculation (EGR) Cooler

02
100
4

1.

Remove the EGR exhaust tube. See REMOVE AND INSTALL EGR EXHAUST TUBE earlier in this Group.

2. Remove the EGR coolant inlet tube. See REMOVE AND INSTALL EGR COOLANT INLET TUBE earlier in this Group.

3. Loosen EGR cooler rear support bushing cap screw (B).

4. Remove front EGR cooler cap screws (C).

5. Remove rear support bushing. Carefully remove the EGR cooler (A) and coolant outlet tube (D) as an assembly by sliding to the rear of the engine. If required, coolant outlet tube can be removed from the EGR cooler.

6. Inspect EGR cooler for damage and leaks.

7. Install coolant outlet tube to EGR cooler, if removed. Tighten cap screw to specifications.

Specification

EGR Cooler Outlet Tube Cap Screw—Torque ..... 35 N•m (25 lb-ft)

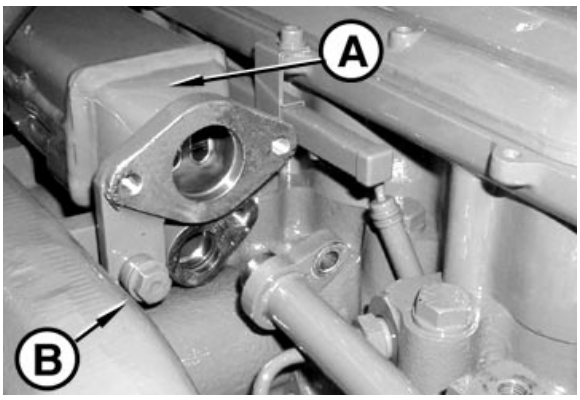
8. Install EGR cooler and outlet tube by carefully sliding the assembly forward and inserting the coolant tube into the thermostat housing (E).

9. Align the back of the EGR cooler and install the rear support bushing with cap screw and tighten to specifications.

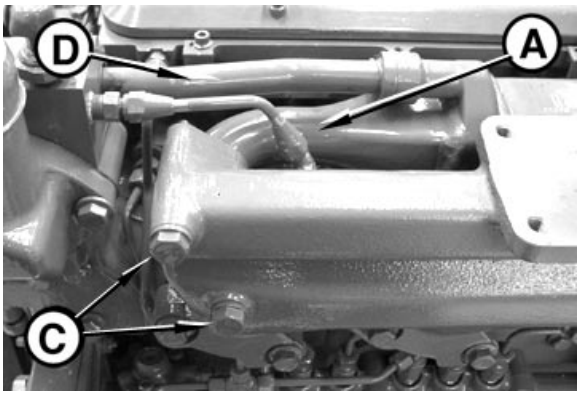
Specification

Rear Support Bushing Cap Screw—Torque ..... 35 N•m (25 lb-ft)

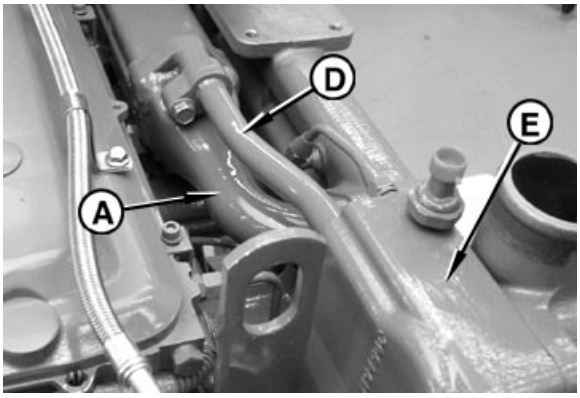
A—EGR Cooler
B—Rear Support Bushing
C—Front Cap Screws
D—EGR Coolant Outlet Tube
E—Thermostat Housing



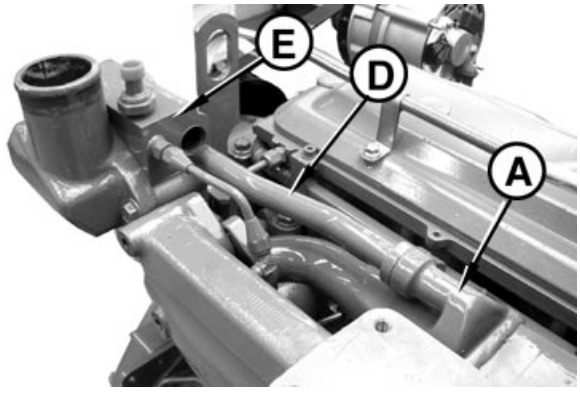
EGR Cooler Rear Support Bushing Cap Screw



EGR Cooler Front Cap Screws



EGR Coolant Outlet Tube



EGR Coolant Outlet Tube

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10. Install and tighten EGR cooler front attaching cap screws to specifications.

Specification	
EGR Cooler Cap Screws—Torque	35 N•m (25 lb-ft)

RG19661,000003F –19–21MAR05–2/2

Remove and Install Exhaust Gas Recirculation (EGR) Tubing

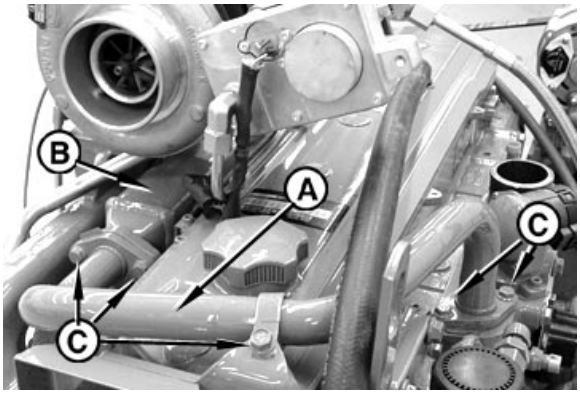
Remove and Install EGR Exhaust Tube

1. Remove EGR exhaust tube and P-clamp attaching cap screws (C) and gaskets.

2. Install exhaust tube by placing in position. Use new gaskets and ensure all mating surfaces are flush. Hand-tighten all cap screws to assure alignment. Tighten cap screws to specifications.

Specification	
EGR Exhaust Tube Cap Screw—Torque	35 N•m (25 lb-ft)

Specification	
Exhaust Tube P-Clamp Cap Screw—Torque	25 N•m (18 lb-ft)



RG14088 –UN–22MAR05

EGR Exhaust Tube

A—EGR Exhaust Tube
B—EGR Cooler
C—EGR Exhaust Tube Cap Screws

Remove and Install EGR Coolant Inlet Tube

Continued on next page

DB92450,000001B –19–31MAR05–1/2

1. Remove coolant tube-to-EGR cooler cap screw (B).
2. Remover P-clamps (C) at the rear and side of the engine.
3. Loosen EGR coolant inlet tube (A) hose clamp located at the oil cooler and remove coolant tube.
4. Install tube in EGR Cooler and tighten to specifications.

Specification

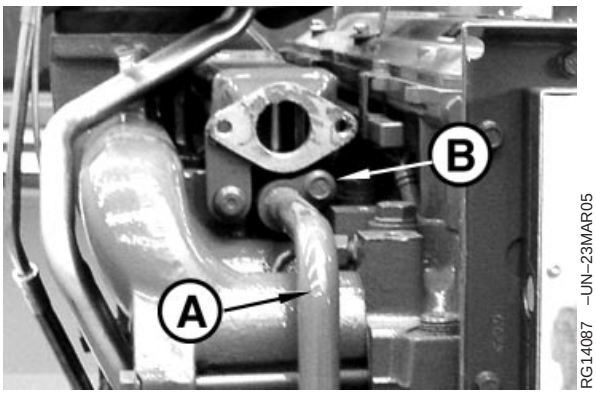
EGR Coolant Inlet Tube Cap Screw—Torque ..... 35 N•m (25 lb-ft)

5. Insert coolant tube in hose and secure hose clamp (D).
6. Tighten P-clamp cap screws to specifications.

Specification

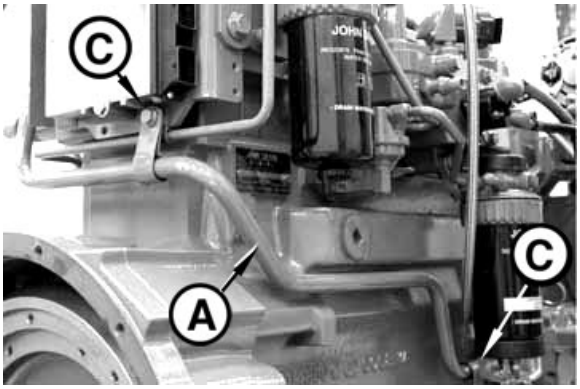
EGR Cooler Outlet Tube Cap Screw—Torque ..... 25 N•m (18 lb-ft)

A—EGR Inlet Coolant Tube
B—Cap Screw
C—P-Clamps
D—Hose Clamp



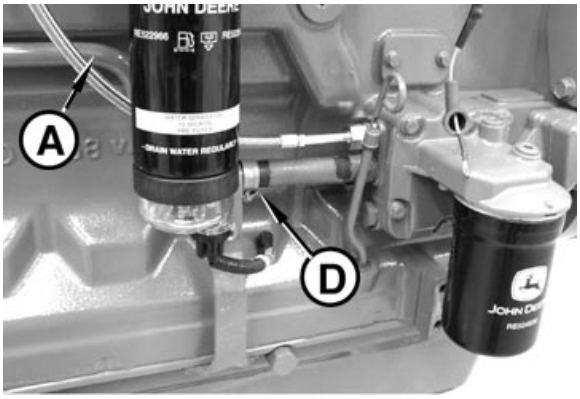
RG14087 –UN–23MAR05

Coolant Tube Cap Screw



RG14090 –UN–23MAR05

Coolant Tube Clamps



RG14098 –UN–23MAR05

Coolant Tube Hose Connection

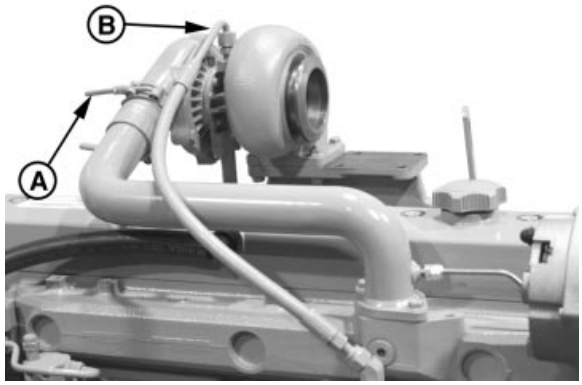
DB92450,000001B –19–31MAR05–2/2

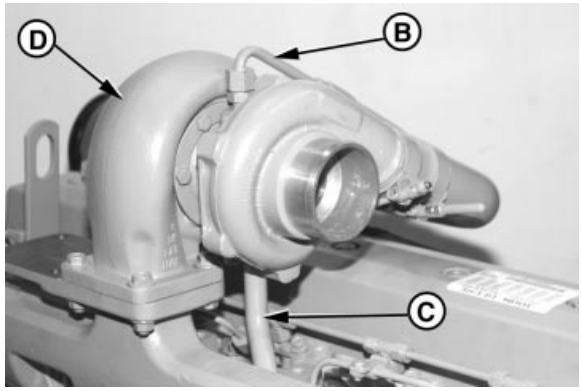
Remove Turbocharger

CAUTION: After operating engine, allow exhaust system to cool before removing turbocharger.

IMPORTANT: When cleaning turbocharger, do not spray directly into compressor cover or turbine housing. If turbocharger inspection is required, do not clean exterior prior to removal. Doing so may wash away evidence of a potential failure mode. (See TURBOCHARGER INSPECTION later in this group.)

1. Thoroughly clean exterior of turbocharger and surrounding area to prevent entry of dirt into the air intake system during removal.
2. Remove air intake hose and exhaust elbow (shown removed). Loosen hose clamp (A).
3. Disconnect oil inlet line (B) and oil return pipe (C) from turbocharger (D).

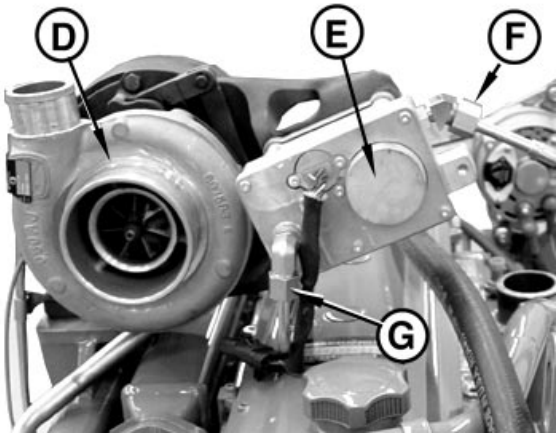




Oil Inlet Line and Oil Return Pipe

RG41183,00000F3 –19–29MAY05–1/2

4. Disconnect turbocharger actuator (E) coolant inlet (F) and outlet (G) lines.
5. Remove exhaust gas recirculation cooler. See REMOVE AND INSTALL EXHAUST GAS RECIRCULATION COOLER later in this group.
6. Remove mounting cap screws and nuts, and lift turbocharger (D) from exhaust manifold. Remove stainless steel gasket.
7. Place turbocharger on a clean, flat surface. Cap or plug all air intake and exhaust openings.



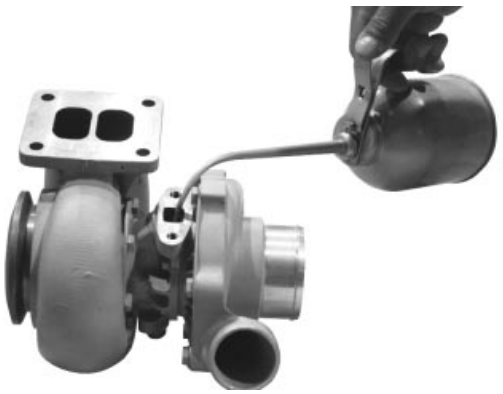
Actuator Coolant Lines and Turbocharger

RG41183,00000F3 –19–29MAY05–2/2

Install Turbocharger

IMPORTANT: If turbocharger failed because of foreign material entering the air intake system, be sure to examine the system and clean as required to prevent a repeat failure.

If not done previously, prime (prelube) the turbocharger rotating assembly prior to mounting turbocharger on engine. Prelube center housing with clean engine oil through the oil drain hole. Turn rotating assembly by hand to lubricate bearings.



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Prelube Turbocharger

1. Clean turbocharger-to-exhaust manifold mounting surfaces of any debris or old gasket material.

IMPORTANT: Turbochargers can be either single or dual entry. Make sure the appropriate single or dual gasket is used when installing turbocharger.

NOTE: Some turbochargers are installed with a liquid gasket in production. Replace with a new stainless steel gasket when servicing.

2. Position turbocharger and new stainless steel gasket onto exhaust manifold. Tighten stud nuts to specifications.

Specification	
Turbocharger-to-Exhaust Manifold Nuts—Torque	70 N•m (52 lb-ft)

Continued on next page

RG41183,00000F4 –19–10MAY06–1/5

NOTE: Turbochargers for service are designed for a specific application. In case where engine connections are not in line with turbocharger connections, follow the procedure described in step 3. Otherwise go directly to step 4.

3. Procedure to re-orient turbocharger housings:

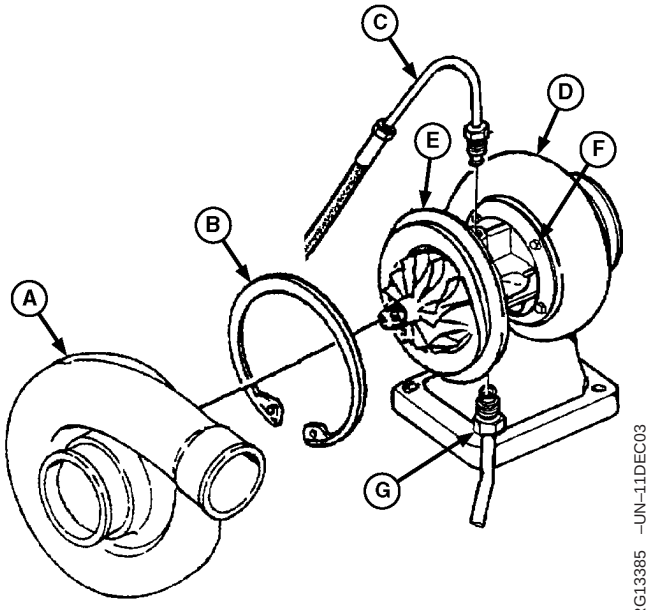
   a. Loosen cap screws (F) of turbine housing (D).

   b. Rotate center housing (E) until oil inlet is in line with oil supply tube (C) and oil outlet is in line with oil return pipe (G).

   c. Tighten turbine housing cap screws (F) to specification.

Specification

Center Housing-to-Turbine Housing Cap Screw—Torque..... 20 N•m (177 lb-in.)



RG13385 –UN–11DEC03

Turbocharger

A—Compressor Cover
B—Snap Ring
C—Oil Inlet Line
D—Turbine Housing
E—Center Housing
F—Cap Screw
G—Oil Return Pipe

   d. Compress snap ring (B) securing compressor cover (A), then rotate until in line with air inlet pipe. Release snap ring.

   e. If not done previously, prime (prelube) the turbocharger.

Continued on next page

RG41183,00000F4 –19–10MAY06–2/5

4. Install oil return pipe (C) to turbocharger. Tighten oil return pipe cap screws to specifications.

Specification

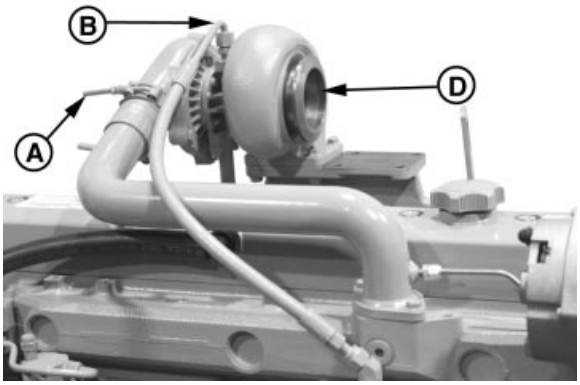
Turbocharger Oil Return Pipe Cap Screws—Torque ..... 24 N•m (212 lb-in.)

5. Connect turbocharger oil inlet line (B) and tighten to specifications.

Specification

Turbocharger Oil Inlet Line (At Turbocharger)—Torque ..... 24 N•m (212 lb-in.)
Turbocharger Oil Inlet Line (At Oil Filter Header)—Torque..... 24 N•m (212 lb-in.)

A—Hose Clamp
B—Oil Inlet Line
C—Oil Return Pipe
D—Turbocharger
E—Actuator
F—Actuator Coolant Inlet
G—Actuator Coolant Outlet

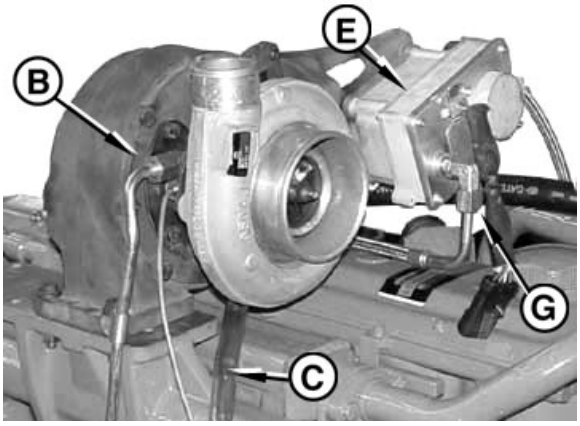


RG7618B –UN–06NOV97

Install Turbocharger

RG7619B –UN–06NOV97

Connect Turbocharger Lines



RG14104 –UN–24MAR05

Install VG Turbocharger

Continued on next page

RG41183,00000F4 –19–10MAY06–3/5

6. Connect turbocharger actuator inlet (F) and outlet (G) coolant line fittings. Connect wiring sensor leads to wire harness.

7. Connect air inlet hose-to-turbocharger compressor housing. Tighten hose clamp (A) on air inlet line to specifications.

Specification	
Turbocharger Air Inlet Hose Clamp—Torque	6 N•m (4.5 lb-ft) (53 lb-in.)

IMPORTANT: Since the greatest suction force occurs between air cleaner and turbocharger, ensure that hose connections are tight to prevent entry of dirt into system.

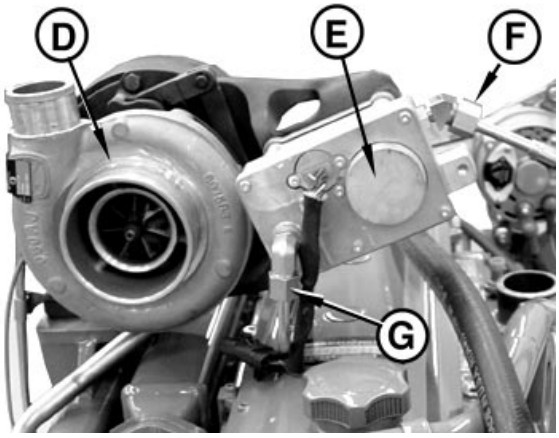
8. Install exhaust adapter and exhaust elbow. Tighten cap screws and clamp to specifications.

Specification	
Exhaust Adapter-to-Turbocharger Clamp—Torque	7.5 N•m (5.5 lb-ft) (66 lb-in.)
Turbocharger Exhaust Elbow—Torque	47 N•m (35 lb-ft)

IMPORTANT: Before starting engine after servicing turbocharger, the turbocharger setting must be reset by performing special test in Service ADVISOR™ . See "Turbocharger Learn Value Reset" in Section 04, Group 160 later in this manual.

IMPORTANT: Failure to thoroughly clean all oil from the air-to-air aftercooler and lines will result in an engine over speed situation upon start-up, resulting in engine damage.

9. On engines equipped with an air-to-air aftercooler: after a turbocharger failure, it is absolutely necessary to clean air-to-air aftercooler and lines of all contamination, especially oil. Follow this procedure to clean air-to-air aftercooler and lines:



Connect VG Turbocharger Actuator Coolant Line

A—Hose Clamp
B—Oil Inlet Line
C—Oil Return Pipe
D—Turbocharger
E—Actuator
F—Actuator Coolant Inlet
G—Actuator Coolant Outlet

Continued on next page

- Remove air-to-air aftercooler from machine. See Remove and Install Air-to-Air Aftercooler in this group.
- Clean all oil residue from air-to-air aftercooler and lines using PMCC2638 John Deere Cooling System Cleaner or equivalent.
- Dry the inside of air-to-air aftercooler and lines using compressed air.

RG41183,00000F4 –19–10MAY06–5/5

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.

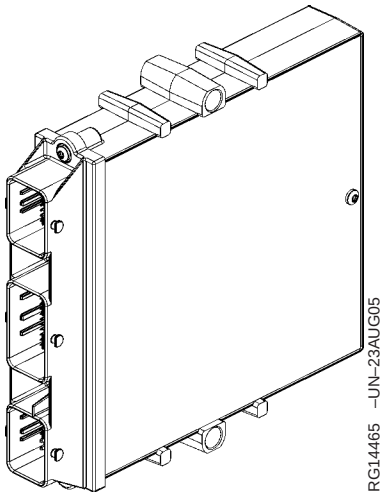
The ECU is not repairable. If it is found to be defective, replace it as a unit.

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 Engine Coolant Temperature (ECT) Sensor

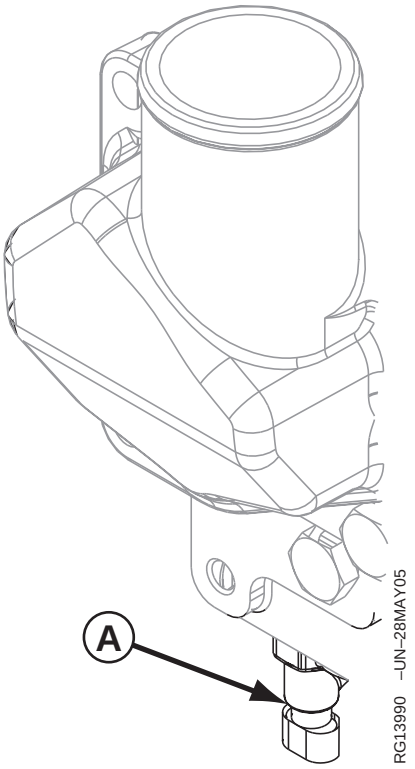
NOTE: For an expanded component location drawing, see ELECTRONIC CONTROL SYSTEM OVERVIEW in Section 03, Group 140 of this manual.

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

Specification	
Coolant Temperature Sensor (In Thermostat Cover)—Torque	25 N•m (7 lb-ft)

3. Install sensor wiring connector.

A—Engine Coolant Temperature Sensor



Engine Coolant Temperature Sensor

RG41183,00000D8 –19–02APR05–1/1

Remove and Install Fuel Temperature Sensor

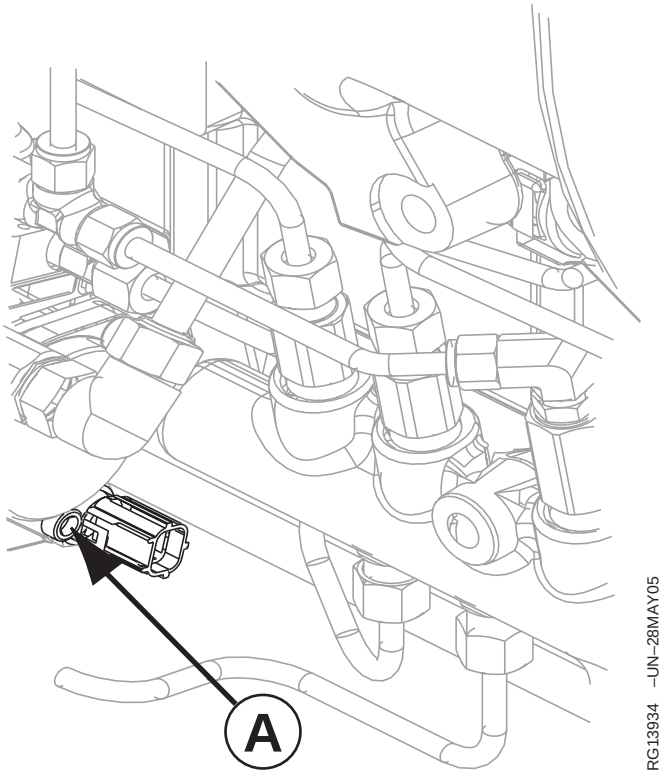
NOTE: For an expanded component location drawing, see ELECTRONIC CONTROL SYSTEM OVERVIEW in Section 03, Group 140 of this manual.

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

Specification

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

A—Fuel Temperature Sensor



Fuel Temperature Sensor

RG41183,00000D9 –19–02APR05–1/1

Remove and Install Exhaust Gas Recirculation (EGR) Exhaust Temperature Sensor

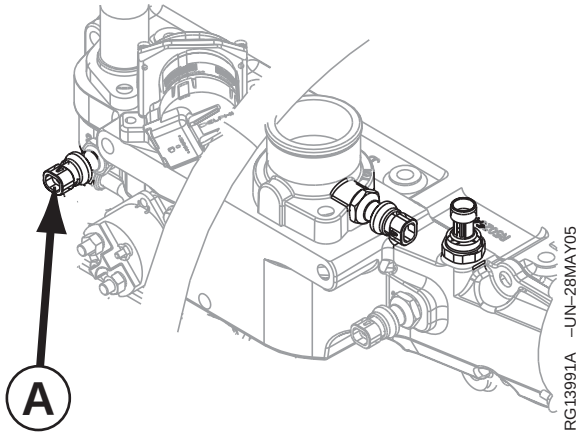
NOTE: For an expanded component location drawing, see ELECTRONIC CONTROL SYSTEM OVERVIEW in Section 03, Group 140 of this manual.

1. Disconnect EGR exhaust temperature sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT 405 High Temperature Grease and install sensor. Tighten to specifications.

Specification

EGR Exhaust Sensor—Torque ..... 60 N•m (44 lb-ft)

3. Install sensor wiring connector.



Exhaust Temperature Sensor

A—Exhaust Temperature Sensor

RG41183,00000DA –19–27JUN06–1/1

Remove and Install Exhaust Gas Recirculation (EGR) Fresh Air Temperature Sensor

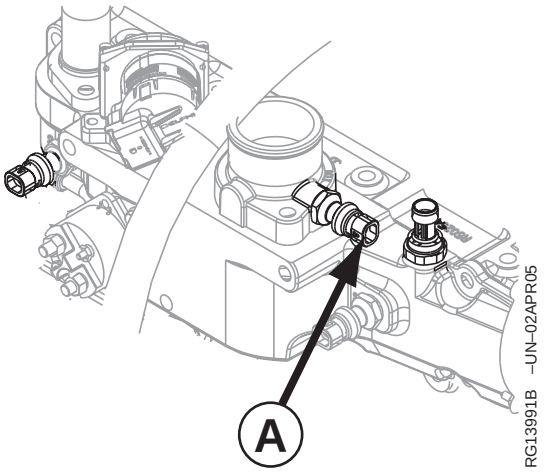
NOTE: For an expanded component location drawing, see ELECTRONIC CONTROL SYSTEM OVERVIEW in Section 03, Group 140 of this manual.

1. Disconnect EGR fresh air temperature sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT 405 High Temperature Grease and install sensor. Tighten to specifications.

Specification

EGR Fresh Air Sensor—Torque ..... 17 N•m (13 lb-ft)

3. Install sensor wiring connector.



EGR Fresh Air Temperature Sensor

A—EGR Fresh Air Temperature Sensor

RG41183,00000DB –19–02APR05–1/1

Remove and Install Manifold Air Temperature Sensor

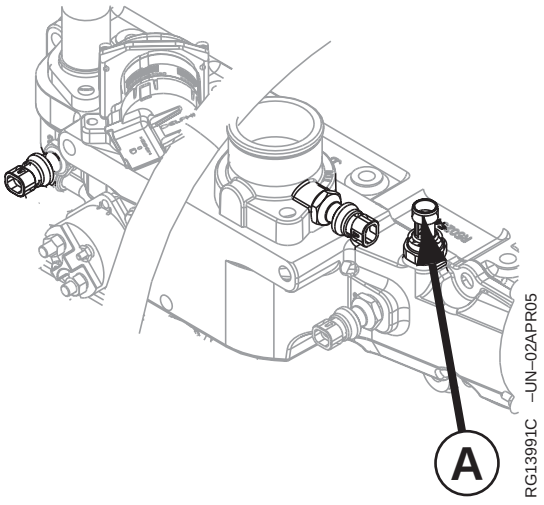
NOTE: For an expanded component location drawing, see ELECTRONIC CONTROL SYSTEM OVERVIEW in Section 03, Group 140 of this manual.

1. Disconnect Manifold air temperature sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT 405 High Temperature Grease and install sensor. Tighten to specifications.

Specification

Manifold Air Sensor—Torque ..... 17 N•m (13 lb-ft)

3. Install sensor wiring connector.



Manifold Air Temperature Sensor

A—Manifold Air Temperature Sensor

RG41183,00000DC –19–27JUN06–1/1

Remove and Install Oil Pressure Sensor

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

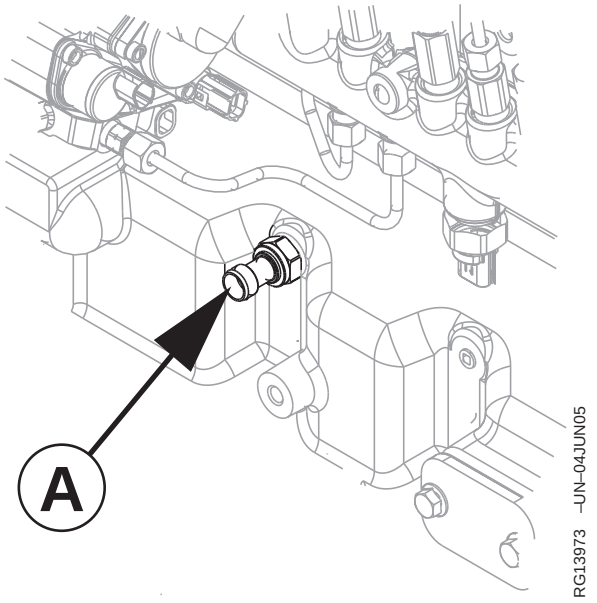
1. Disconnect oil pressure sensor (A) wiring connection and remove sensor.
2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specification.

Specification

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

3. Reconnect oil pressure sensor wiring connection.

A—Oil Pressure Sensor



Oil Pressure Sensor

RG41183,00000DD –19–02APR05–1/1

Remove and Install Fuel Rail Pressure Sensor

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

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

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

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

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

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

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

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

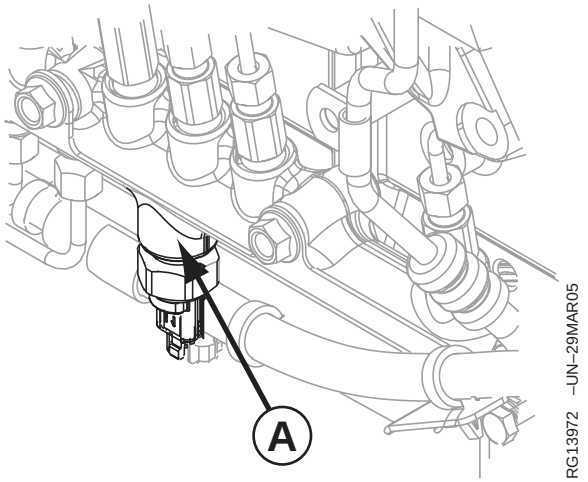
4. Coat new sensor threads with JDT405 High Temperature Grease.

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

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

6. Reconnect sensor wiring connection.

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



Fuel Rail Pressure Sensor

A—Fuel Rail Pressure Sensor

RG41183,00000DE –19–02APR05–1/1

Remove and Install Fuel Transfer Pump Pressure Sensor

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

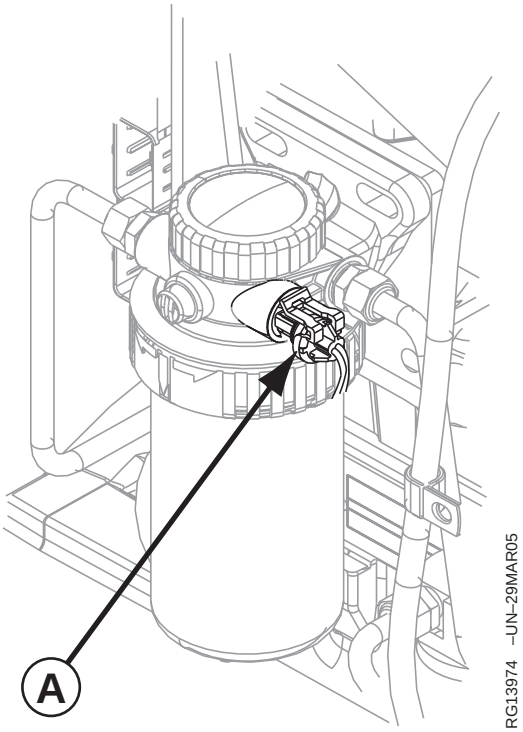
IMPORTANT: If any dirt, paint chips, or debris enters the fuel system, injector failure will occur!

1. Disconnect fuel pressure sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT 405 High Temperature Grease and install sensor. Tighten to specifications.

Specification

Fuel Pressure Sensor—Torque..... 25 N•m (18 lb-ft)

3. Install sensor wiring connector.

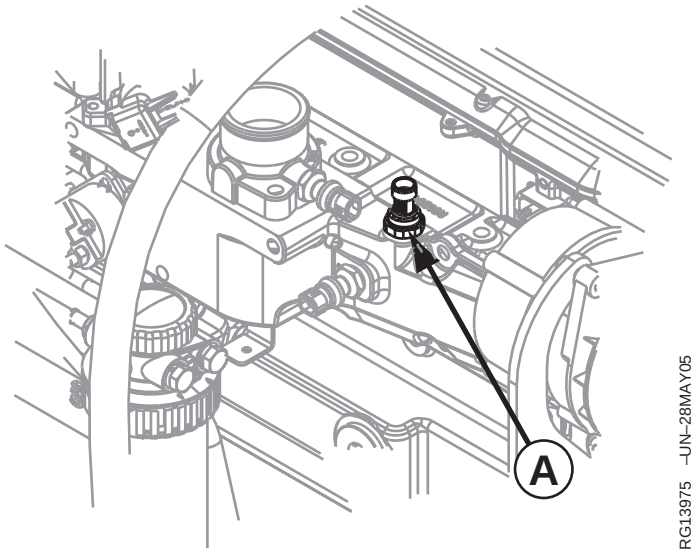


Fuel Transfer Pump Pressure Sensor

A—Fuel Transfer Pump Pressure Sensor

RG41183,00000DF –19–02APR05–1/1

Remove and Install Manifold Air Pressure (MAP) Sensor



Manifold Air (MAP) Sensor

A—Manifold Air (MAP) Sensor

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

1. Disconnect MAP sensor (A) wiring connector and remove sensor.

2. Coat new sensor O-ring with JDT 405 High Temperature Grease and install sensor. Tighten to specifications.

Specification	
Manifold Absolute (MAP) Sensor—Torque	18 N•m (13 lb-ft)

3. Install sensor wiring connector.

RG41183,00000E0 –19–02APR05–1/1

Remove and Install Crank Position Sensor

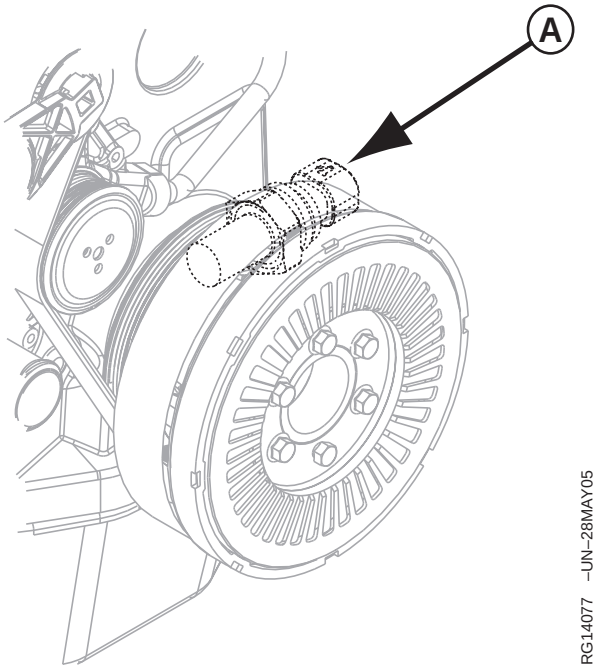
NOTE: For an expanded component location drawing, see ELECTRONIC CONTROL SYSTEM OVERVIEW in Section 03, Group 140 of this manual.

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

Specification

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

A—Crankshaft Position Sensor



RG14077 –UN–28MAY05

Crankshaft Position Sensor

RG41183,00000E4 –19–02APR05–1/1

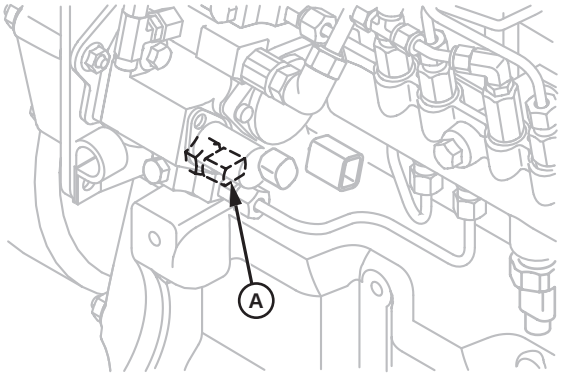
Remove and Install Pump Position Sensor

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

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

Specification

Pump Position Sensor—Torque..... 15 N•m (11 lb-ft)



RG12305 –UN–26JUN02

Pump Position Sensor

RG41183,00000E6 –19–02APR05–1/1

Remove and Install Turbo Speed Sensor

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

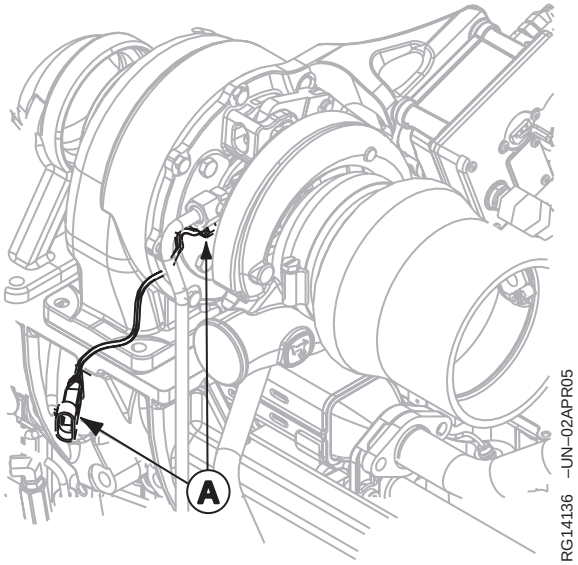
1. Disconnect turbo speed pressure sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT 405 High Temperature Grease and install sensor. Tighten to specifications.

Specification

Turbo Speed Sensor—Torque ..... 12 N•m (9 lb-ft)

3. Install sensor wiring connector.

A—Turbo Speed Sensor



Turbo Speed Sensor

RG41183,00000E7 –19–02APR05–1/1

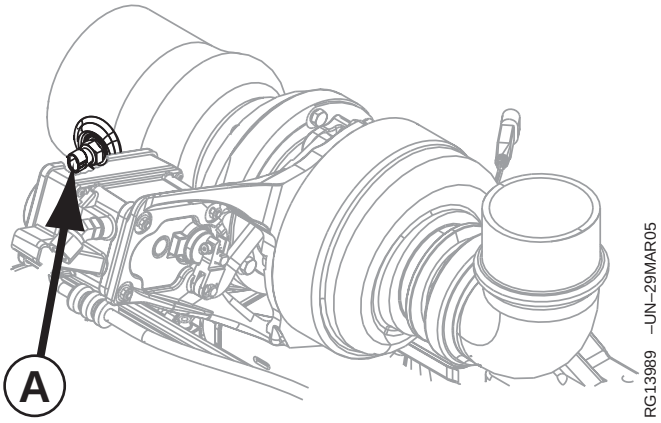
Remove and Install Turbo Compressor Inlet Temperature Sensor

1. Disconnect turbo compressor inlet temperature sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT405 High Temperature Grease and install sensor. Tighten to specifications.

Specification

Turbo Compressor Inlet Sensor—
Torque ..... 25 N•m (18 lb-ft)

3. Install sensor wiring connector.



Compressor Inlet Temperature Sensor Location

RG41183,00000C8 –19–01APR05–1/1

Remove and Install Water in Fuel (WIF) Sensor

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

1. Disconnect WIF sensor (A) wiring connector and remove sensor.
2. Coat new sensor O-ring with JDT 405 High Temperature Grease and install sensor. Tighten to specifications.

Specification

Water in Fuel Sensor—Torque ..... 14 N•m (10 lb-ft)

3. Install sensor wiring connector.

RG41183,00000D7 –19–02APR05–1/1

Remove and Install Glow Plugs

Removal of Glow Plugs

1. Disconnect glow plug (B) from glow plug harness rail (B).
2. Remove glow plug(s)

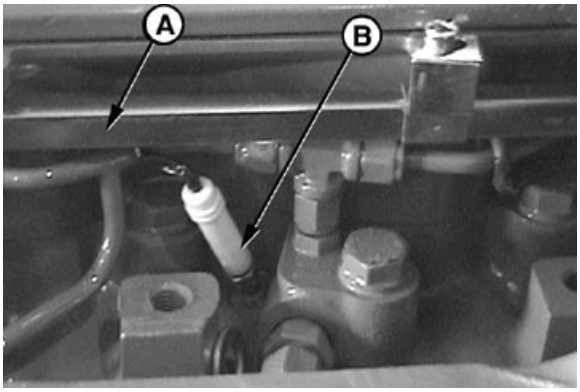
Installation of Glow Plugs

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

Specification

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

2. Connect glow plug harness connector to glow plug.



Glow Plug Location

A—Glow Plug Harness Rail
B—Glow Plug

RG41183,00000E8 –19–02APR05–1/1

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.

DB92450,0000048 –19–20FEB06–1/1

Connector Repair

DB92450,0000049 –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.

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[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*

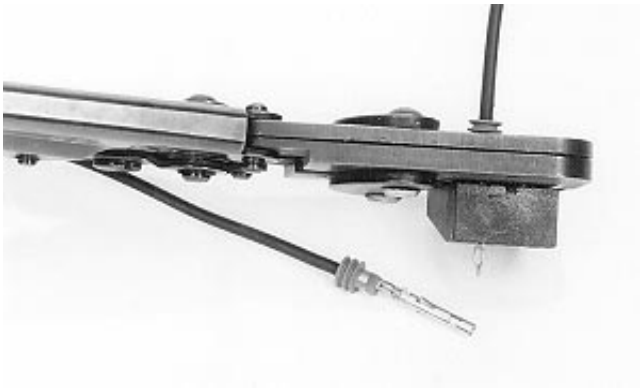
TS0136 –UN–23AUG88

DB92450,000004A –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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DB92450,000004A –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.

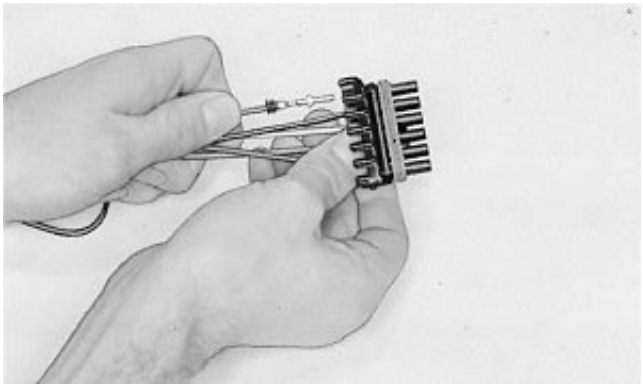
Correct terminal installation for sleeve (A) and pin (B) is illustrated.

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

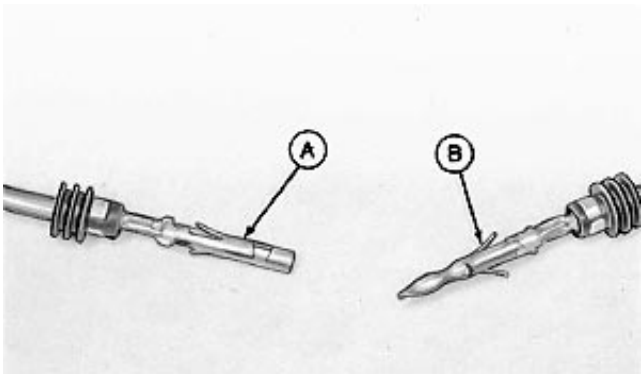
11. Repair or transfer remaining wires.

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

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



TS0130 –UN–23AUG88



TS0139 –UN–02DEC88

A—Sleeve
B—Pin

DB92450,000004A –19–20FEB06–4/4

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 (shown below).

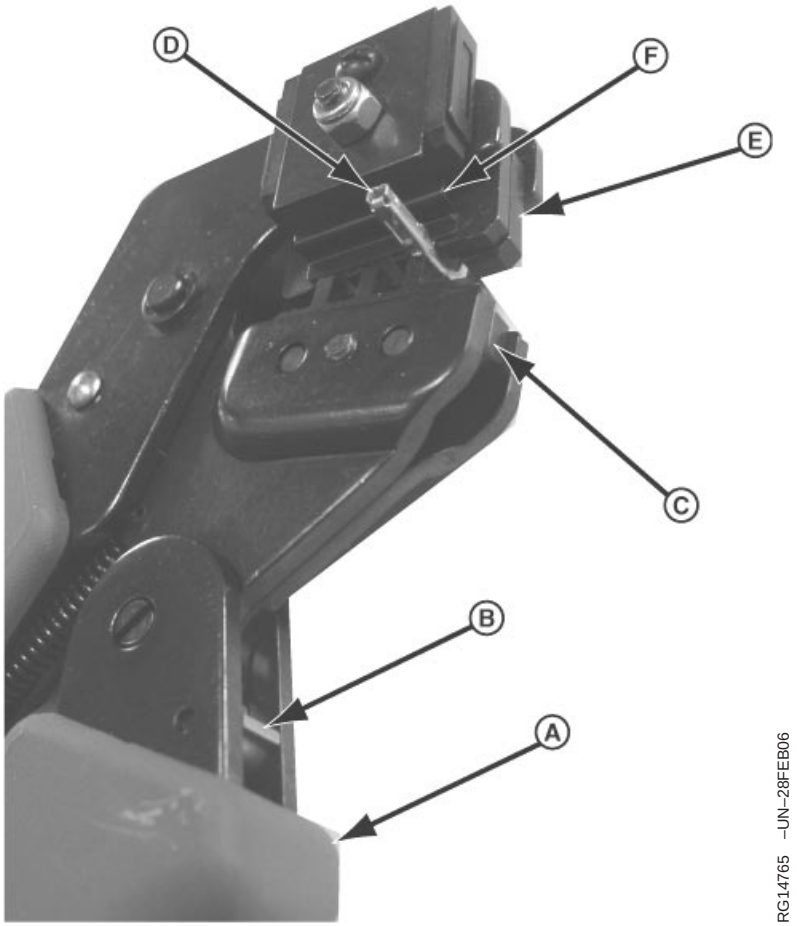
Continued on next page

DB92450,0000051 –19–23FEB06–1/14

RG14764 –UN–22FEB06

Terminal Removal Tool, Deere Part No. JDG10203

DB92450,0000051 –19–23FEB06–2/14



RG14765 –UN–28FEB06

Terminal Crimp Tool, Deere Part No. JDG102020 (shown below)

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

- Terminal crimp Tool, Deere Part No. JDG10202 (shown below).

Continued on next page

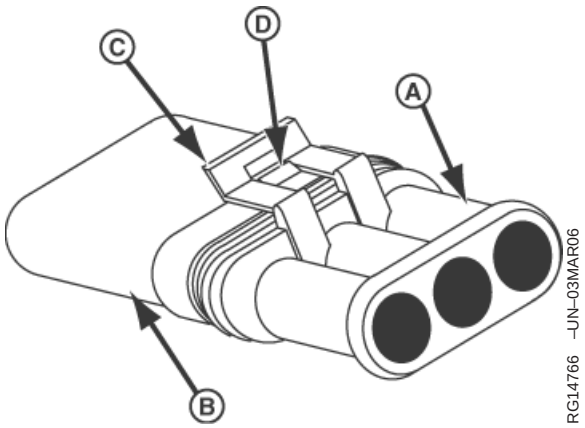
DB92450,0000051 –19–23FEB06–3/14

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)

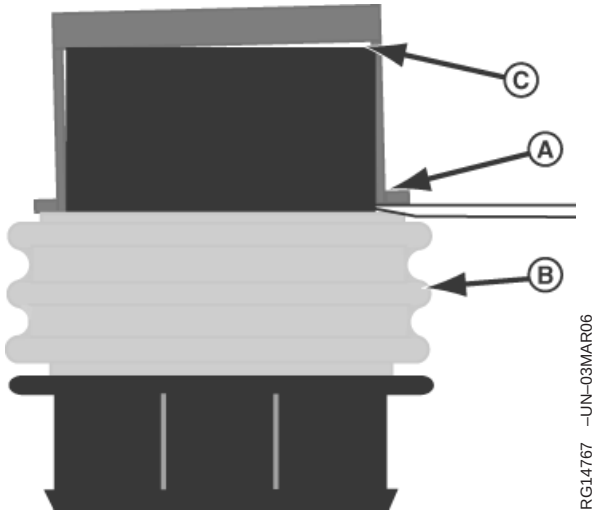
A—Female Connector
B—Male Connector
C—Locking Bar
D—Locking Tab



Separate Connectors

DB92450,0000051 –19–23FEB06–4/14

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

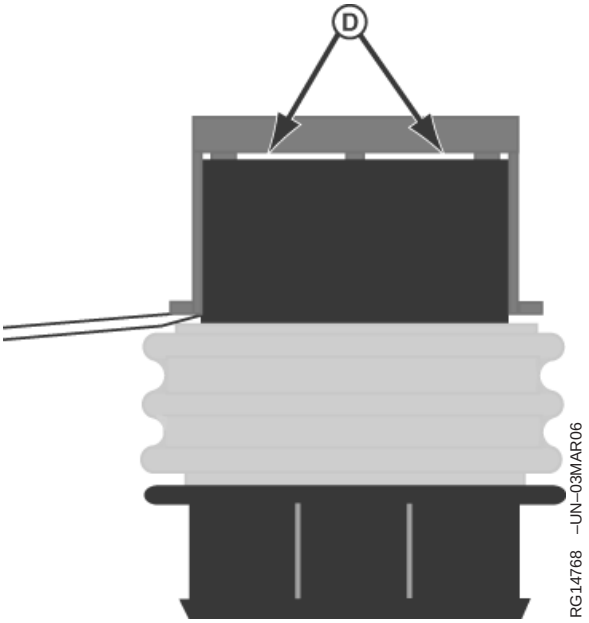


Remove Secondary Lock, Step 1.

Continued on next page

DB92450,0000051 –19–23FEB06–5/14

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, as shown.

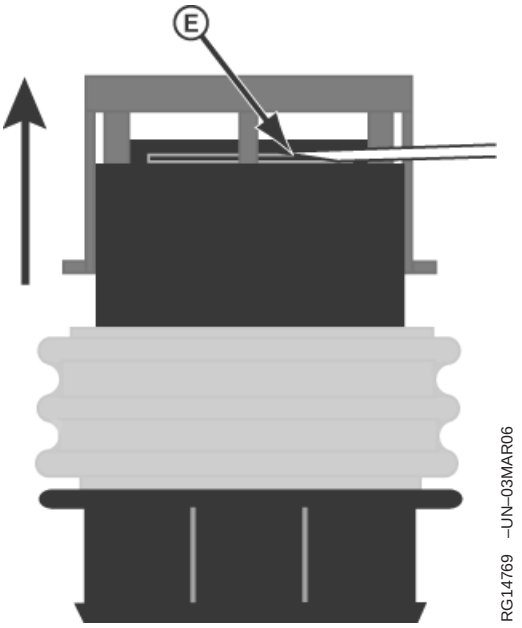


Remove Secondary Lock, Step 2.

DB92450,0000051 –19–23FEB06–6/14

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

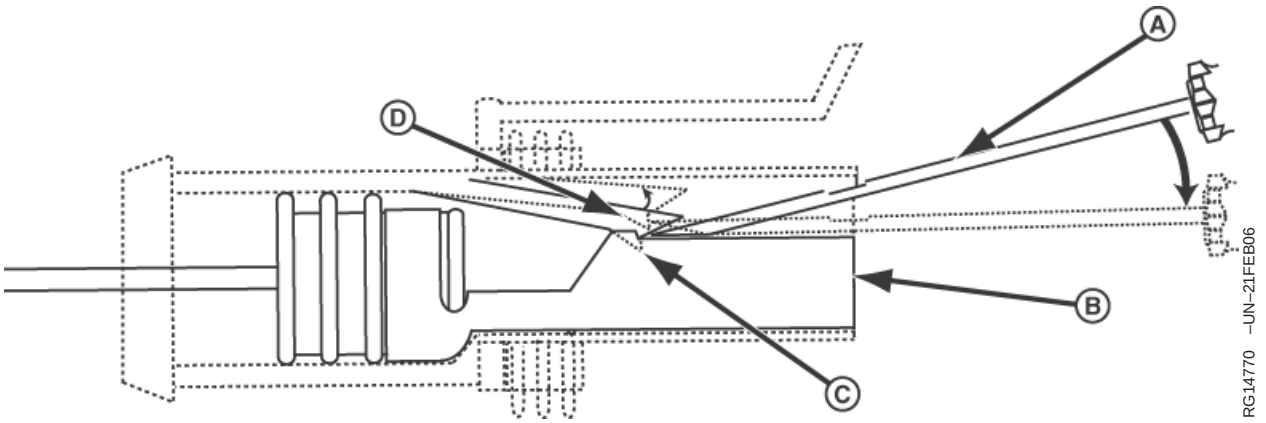
3. 3. Remove damaged wire and or terminal from connector.



Remove Secondary Lock, Step 3.

Continued on next page

DB92450,0000051 –19–23FEB06–7/14



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.

a. Insert tool (A) into terminal end of connector, as shown.

b. 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.

c. Holding tool in place and applying tension on the wire of the terminal to be replaced, pry lock tab up, until it is freed from terminal slot (D), and terminal begins to move away from terminal edge of connector.

d. 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.

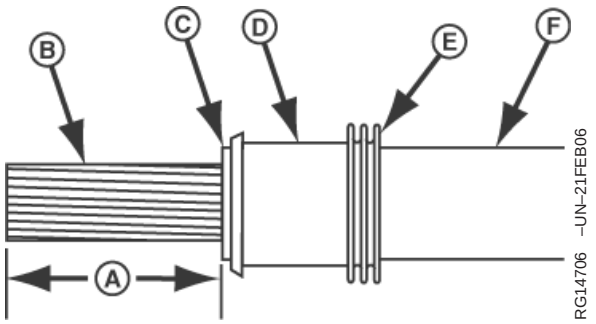
b. Insert wire into ribbed end of seal (E), and pull seal (D) down insulation (F), until non-ribbed end is well past point where insulation is to be stripped from wire.

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

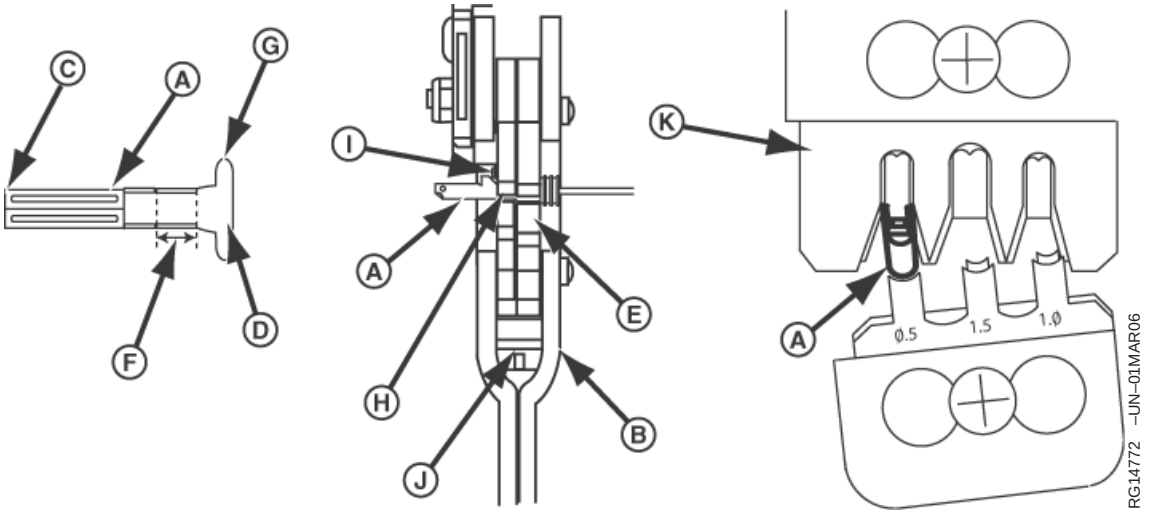
d. Pull seal toward bare wire, until only a small amount of insulation (C) appears beyond non-ribbed end of seal, as shown.

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



Stripped Wire and Seal

DB92450,0000051 –19–23FEB06–9/14



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

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

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 t ool 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.

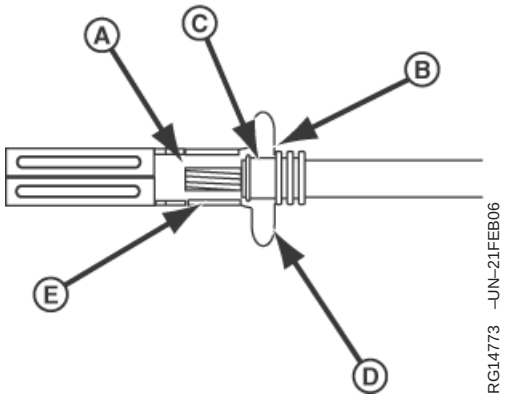
NOTE: To release the crimper pliers after any clicks have been heard, slightly squeeze tool handles until ratchet release can be pushed downward. Spring load on tool handles returns pliers to full-open position and releases terminal.

Continued on next page

DB92450,0000051 –19–23FEB06–10/14

j. 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.

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

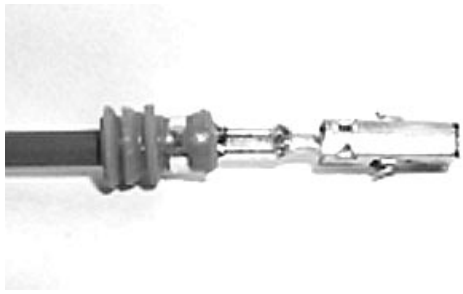


RG14773 –UN–21FEB06

Terminal, Seal, and Wire, Top and Front Views

DB92450,0000051 –19–23FEB06–11/14

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

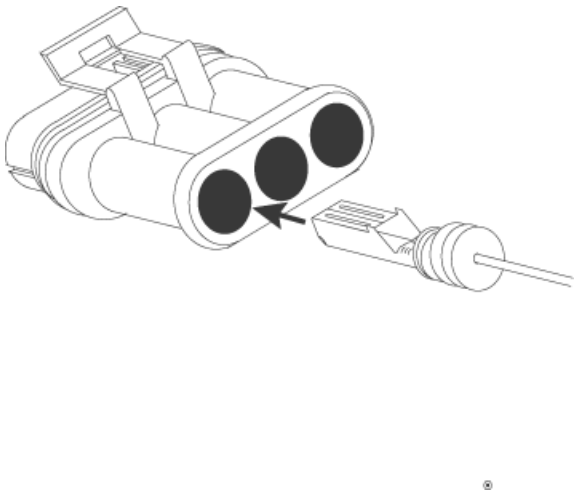


RG14709 –UN–23JAN06

Example of Successful Crimp

DB92450,0000051 –19–23FEB06–12/14

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.

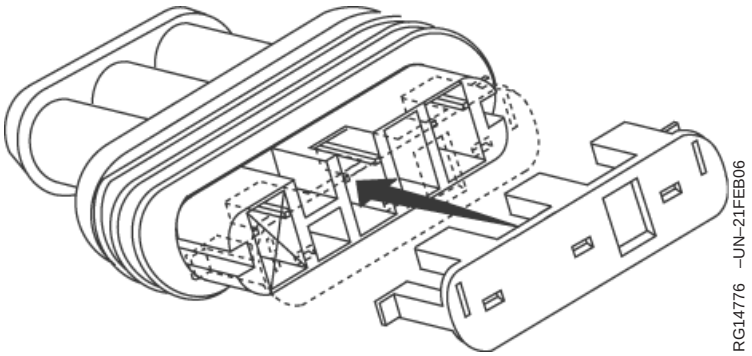


RG14775 –UN–21FEB06

Insert New Terminal and Wire

Continued on next page

DB92450,0000051 –19–23FEB06–13/14



Reattach secondary Lock

6. Reattach the secondary lock, removed in step 2, as shown.
7. Reconnect the repaired, female connector to the male connector.

DB92450,0000051 –19–23FEB06–14/14

Repair Cinch Flex Box Connector

Tools Required For Repair

- CINCH Crimper Tool JDG1727

CINCH Crimper Tool

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

Continued on next page

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

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.

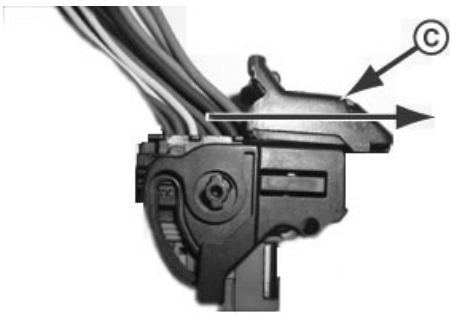
RG14592 –UN–01DEC05

Rotate lock 90 Degrees

Continued on next page

RG41183,00000E9 –19–23FEB06–4/15

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

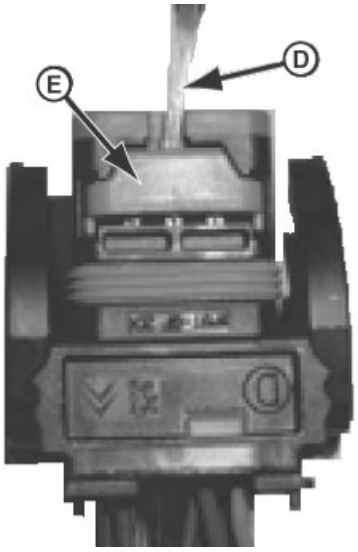


RG14581 –UN–21NOV05

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.

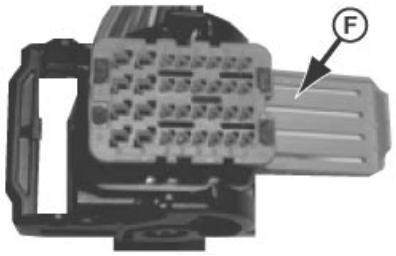


RG14582 –UN–21NOV05

Insert Thin-Bladed Tool Under Tab

RG41183,00000E9 –19–23FEB06–6/15

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



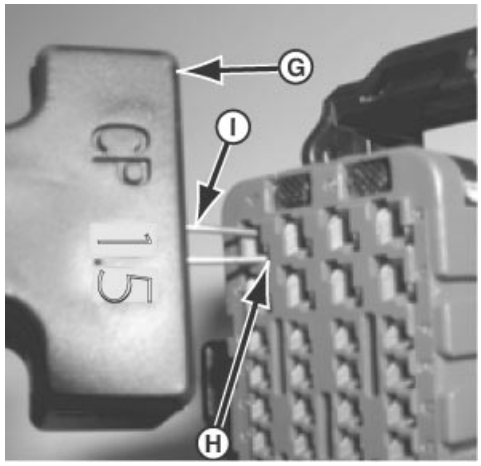
RG14583 –UN–01DEC05

Slide Terminal Retainer Out

Continued on next page

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

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.

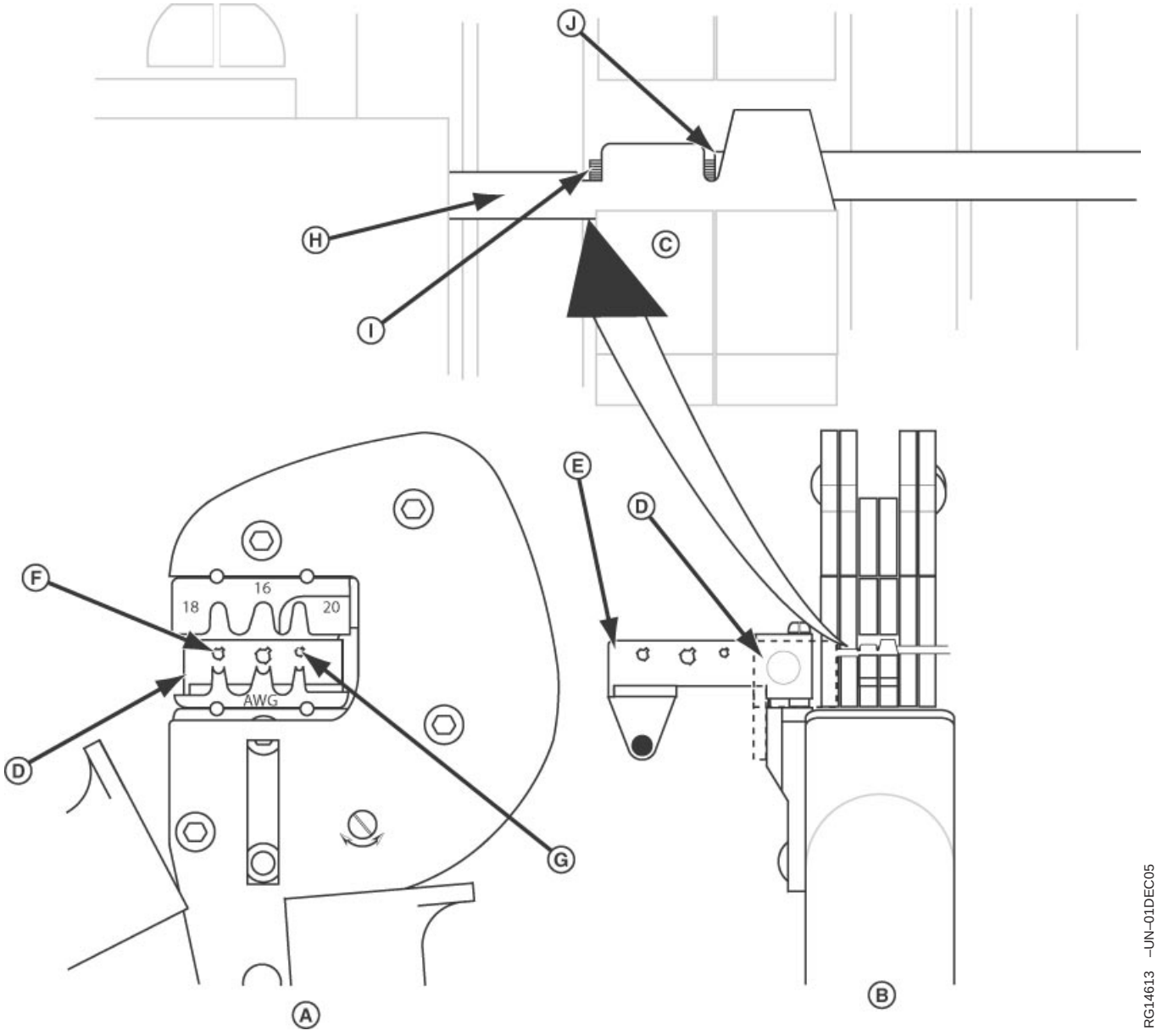
   c. If terminal is only exposed, use long-nose pliers to pull it from the connector.

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

Continued on next page

RG41183,00000E9 –19–23FEB06–9/15



CINCH Crimper Elements

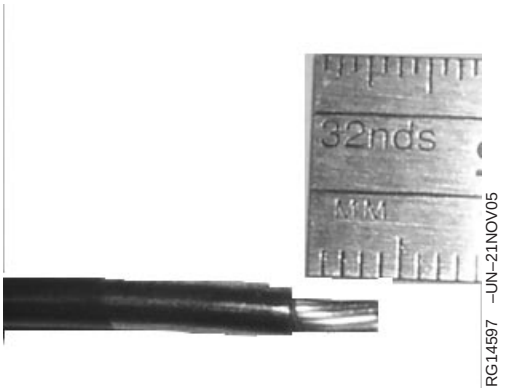
A—Crimper Side View
B—Crimper Front View
C—Wire-in-Terminal Blowup
D—Terminal Block (Closed)
E—Terminal Block (Open)
F—1.5 mm Terminal Recess
G—0.6 mm Terminal Recess
H—Terminal Seated in Block Recess
I—Wire in Terminal (4.0 mm Insulation Stripped)
J—Wire in Terminal (insulation end)

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.

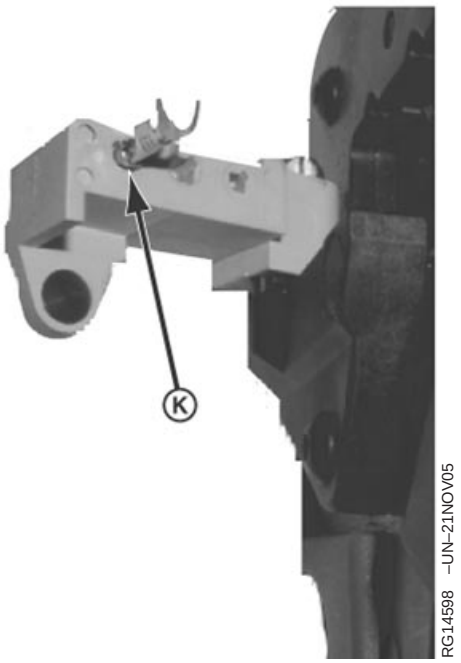


Strip 4.0 mm of Wire Insulation

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).

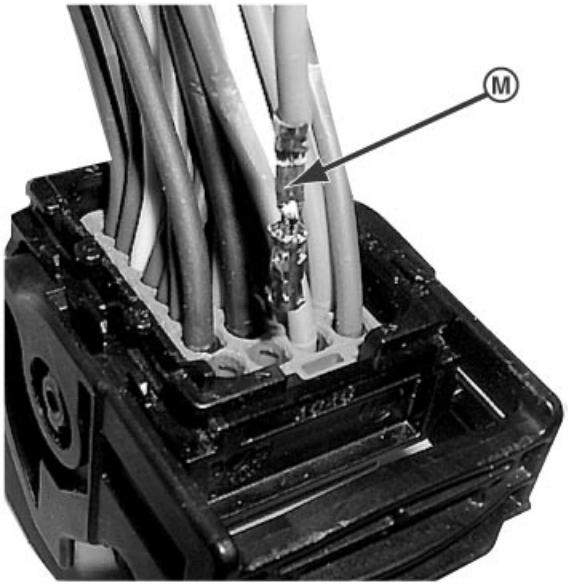
14. Squeeze crimper handles, until they automatically unlock. Remove wire and terminal from crimper.

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

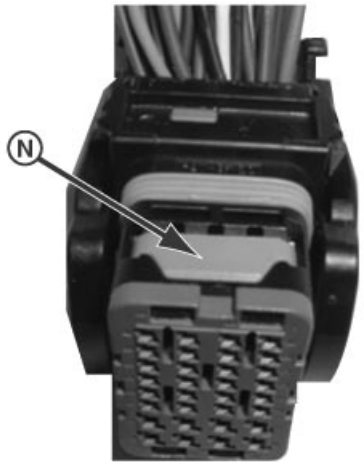
NOTE: If retainer does not slide fully into position, terminal has not been completely seated. Check seating again. Do not force retainer. Retainer slides closed only when all connector terminals are fully seated

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

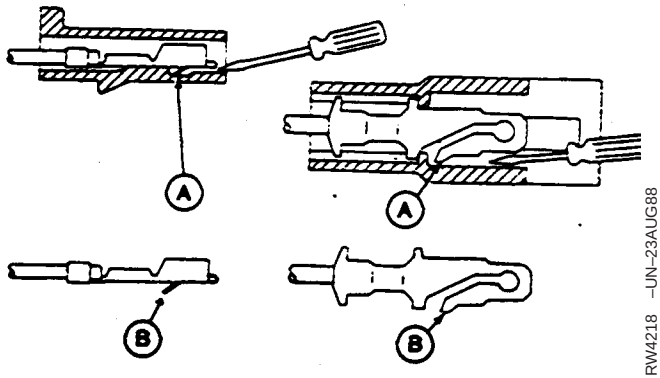
Remove Blade Terminals from Connector Body

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.



RW4218 –UN–23AUG88

A—Locking Tang
B—Original Position

[1]Included in JT07195B Electrical Repair Kit

RG40854,00000CE –19–20MAY02–1/1

METRI-PACK™ *(Push Type)*

NEED NEW GRAPHICS FOR CRIMPING AND REMOVAL

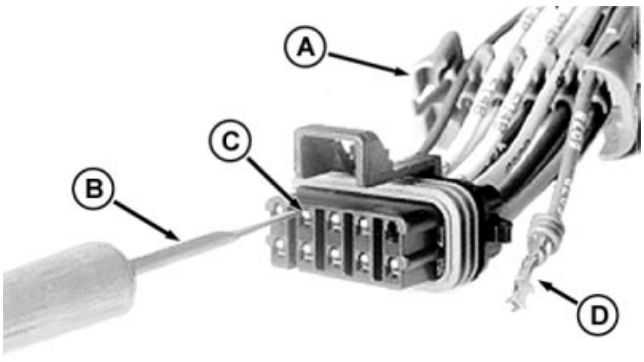
METRI-PACK is a trademark of Delphi Packard Electric Systems

Continued on next page

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

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

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



RW77137 –UN–08DEC98

TS0136 –UN–23AUG88

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

[1]*Included in JT07195B Electrical Repair Kit*

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

Continued on next page

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

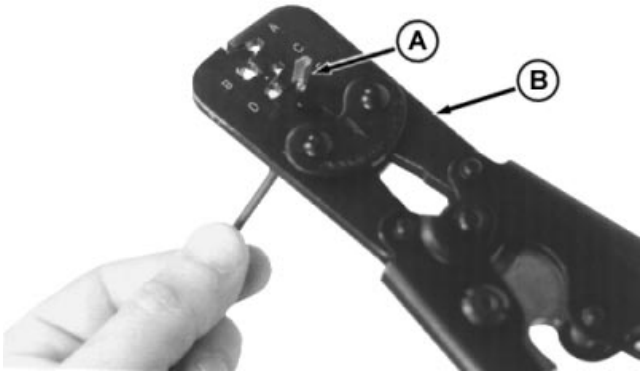
NOTE: Cable seals are color coded for three sizes of wire:

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

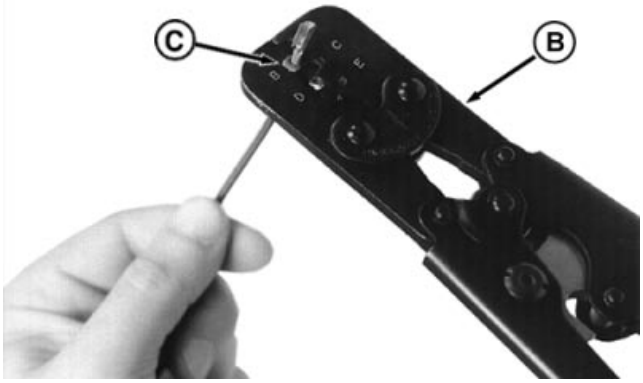
Crimp contact (A) on wire with a “W” type crimp using JDG865 Crimping Tool (B).

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

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



RW77139 –UN–07DEC98



RW77138A –UN–15MAR02

RW77140A –UN–15MAR02

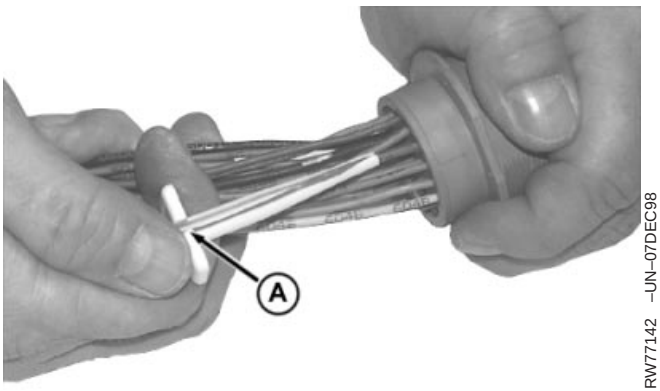
DB92450,000004B –19–20FEB06–3/3

Repair DEUTSCH™ Connectors

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

IMPORTANT: DO NOT twist tool when inserting in connector.

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



RW77142 –UN–07DEC98

A—Handle

DEUTSCH is a trademark of Deutsch Company

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

[2]Included in JDG359 DEUTSCH Electrical Repair Kit

[3]Included in JT07195B Electrical Repair Tool Kit

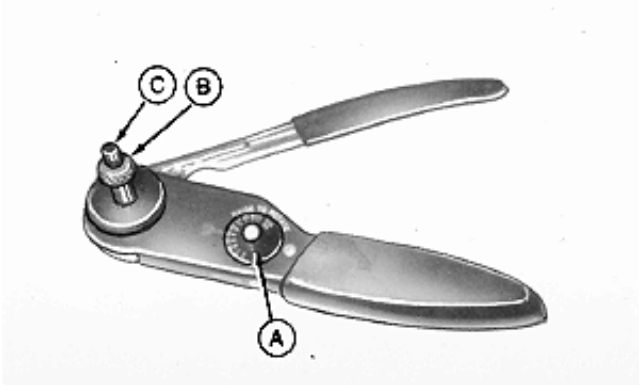
[4]Included in JDG155 Electrical Repair Tool Kit

Continued on next page

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*

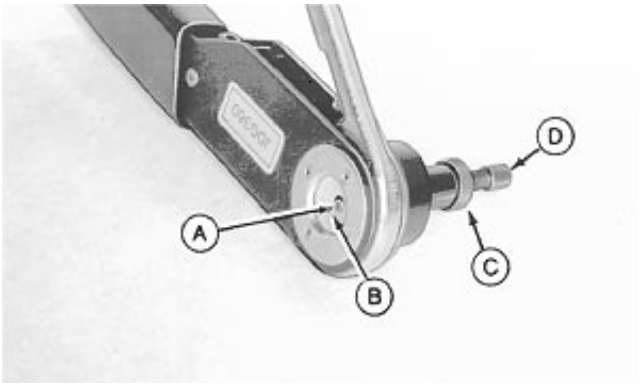
RG40854,00000CB –19–20MAY02–2/4

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

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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.

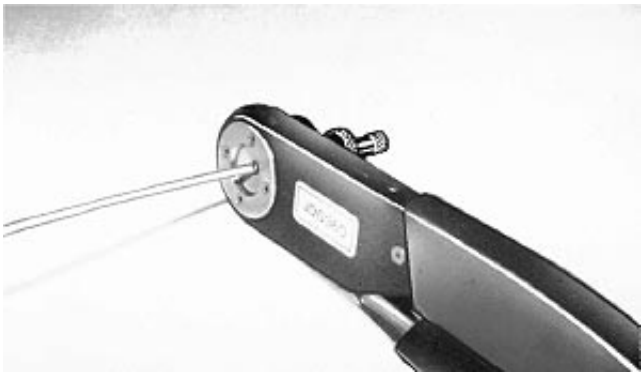
17. Push terminal straight into correct connector cavity until positive stop is felt.

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

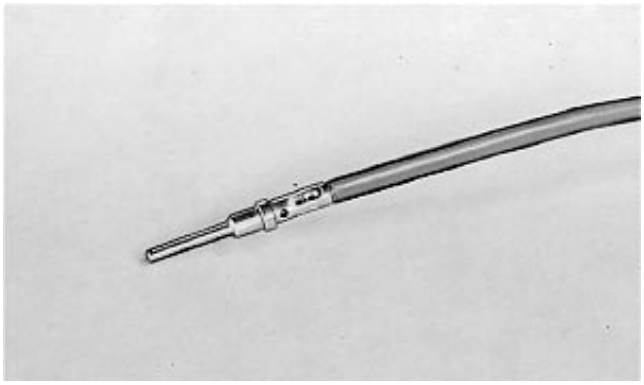
18. Gently pull on wire to verify terminal is locked into the connector.

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

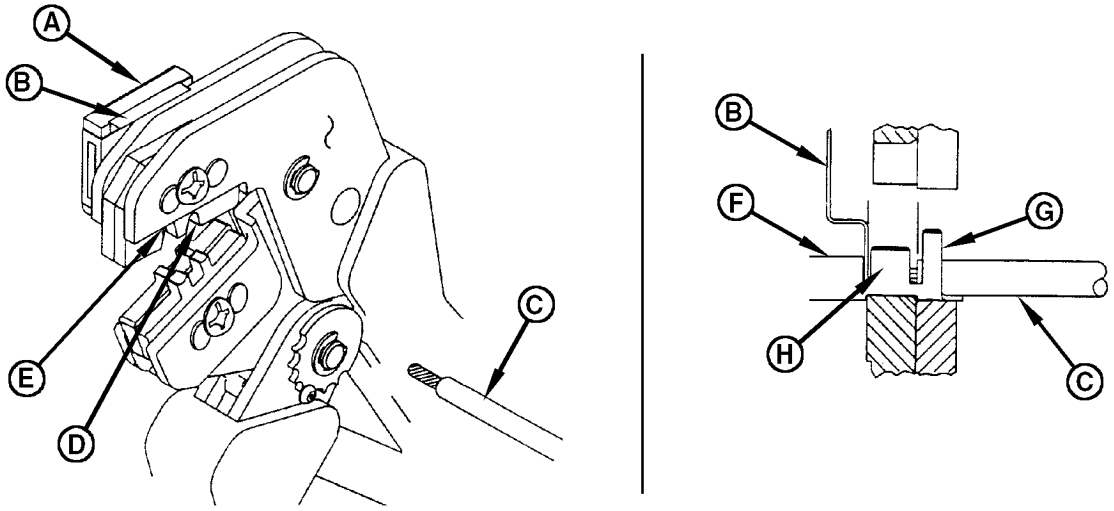


TS0135 –UN–23AUG88

RW77141 –UN–07DEC98

RG40854,00000CB –19–20MAY02–4/4

Repair AMP Connector



RG10742 –UN–31MAY00

Using AMP Crimping Tool

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

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

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

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

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

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

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

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

Continued on next page

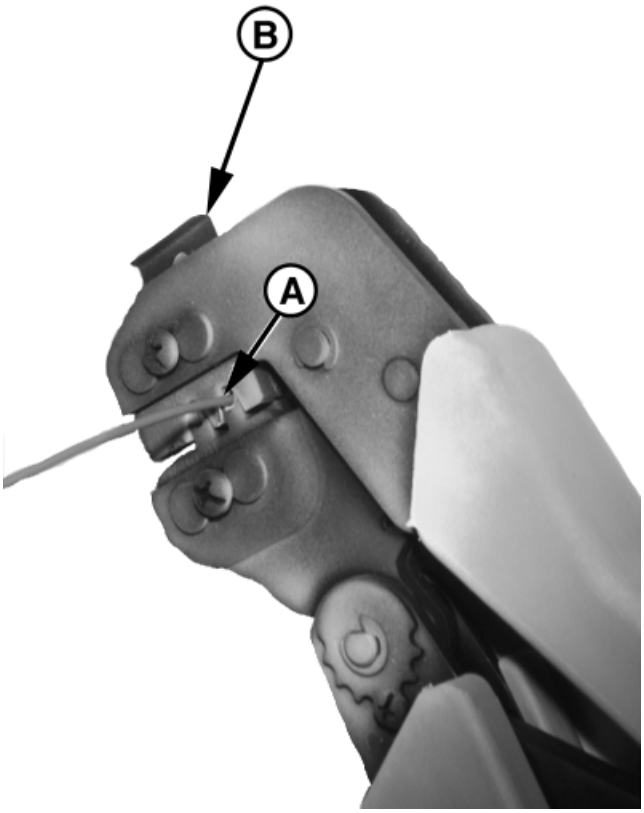
10. Hold the wire and terminal (A) in place. Squeeze tool handles together until ratchet releases. Allow tool handles to open and remove crimped terminal.

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

11. Install wire in correct connector cavity.

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

A—Wire and Terminal
B—Locator



T112335E –UN–15MAR02

RG40854,00000CA –19–20MAY02–2/2

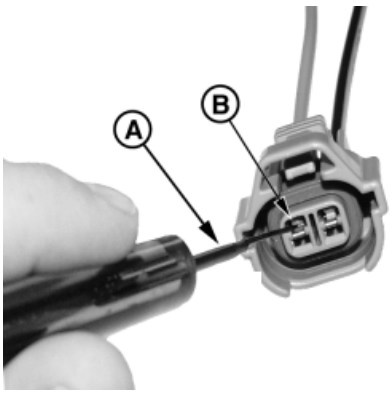
Repair SUMITOMO™ Connectors

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).

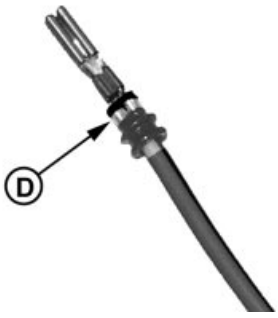
A—Terminal Extraction Tool
B—Connector Locking Tang
C—Terminal Crimping Tool
D—Crimped Cable Seal



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.*

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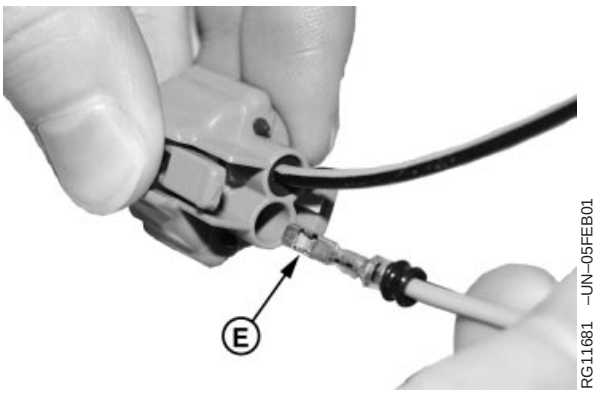
9. Make sure the terminal is positioned correctly (E) for the locking tang inside the connector.
10. Push terminal into correct connector cavity until terminal locks.
11. Gently pull on wire to verify terminal is locked into the connector.
12. Retape the wires and add the required tie bands to the harness.



E—Terminal Orientation

RG40854,00000C9 –19–20MAY02–2/2

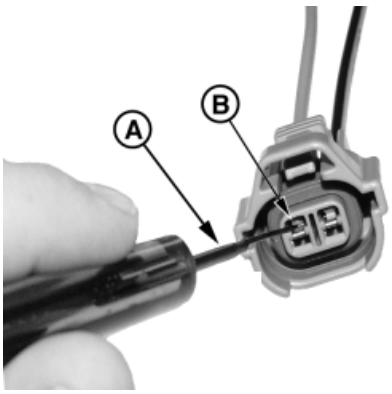
Repair YAZAKI™ Connectors

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.

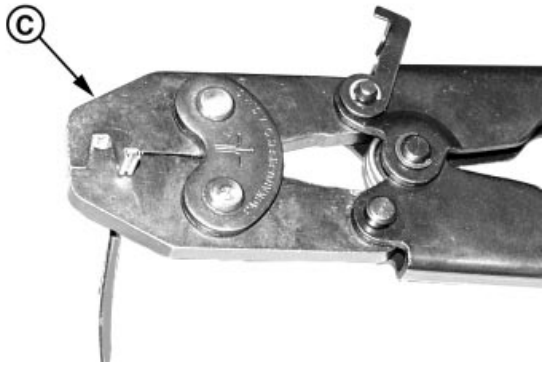
8. Crimp contact on cable seal (D) using JDG707 Crimping Tool (C).

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

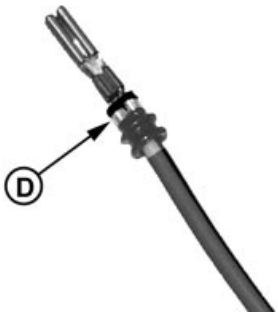


RG11676 –UN–05FEB01


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.*

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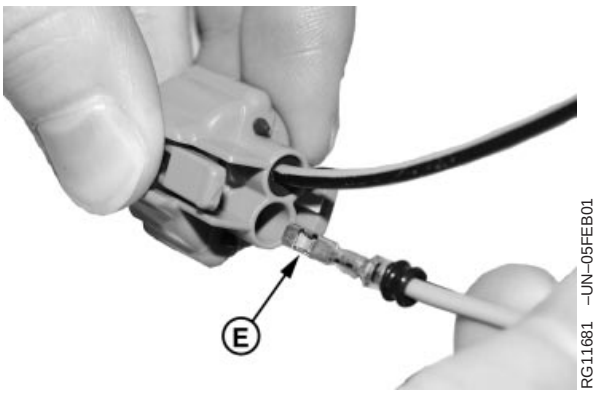
9. Make sure the terminal is positioned correctly (E) for the locking tang inside the connector.
10. Push terminal into correct connector cavity until terminal locks.
11. Gently pull on wire to verify terminal is locked into the connector.
12. Retape the wires and add the required tie bands to the harness.



E—Terminal Orientation

RG40854,00000C8 –19–20MAY02–2/2

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 (shown below).

DB92450,0000085 –19–18MAY06–1/14

RG14764 –UN–22FEB06

Terminal Removal Tool, Deere Part No. JDG10203

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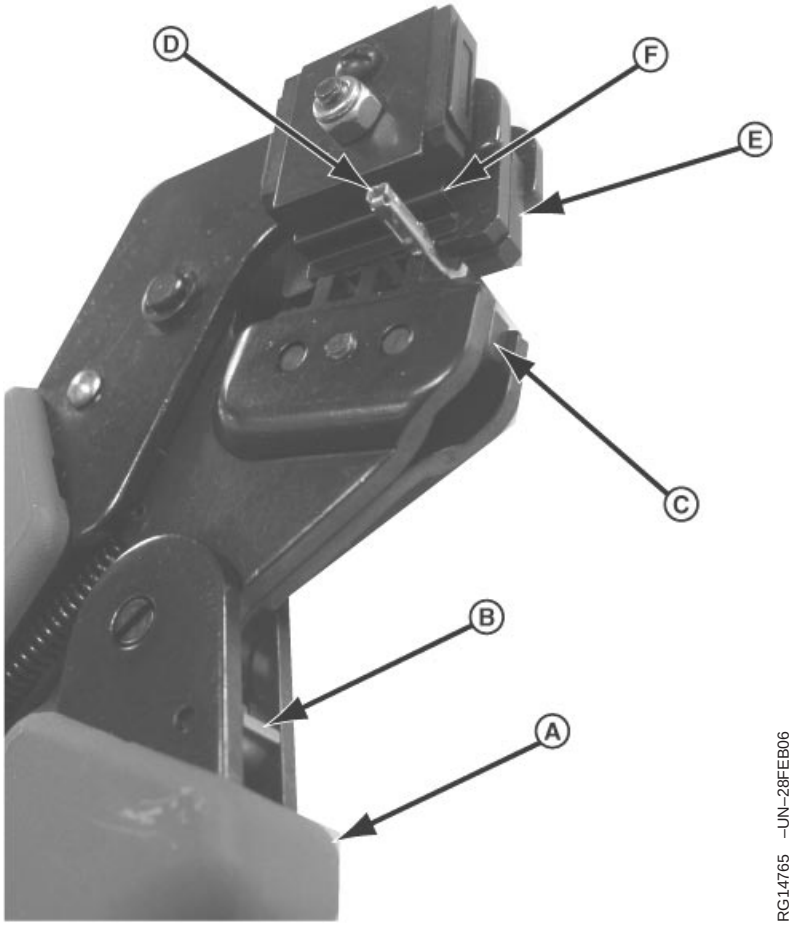
DB92450,0000085 –19–18MAY06–2/14



Terminal Crimp Tool, Deere Part No. JDG102020 (shown below)

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

- Terminal crimp Tool, Deere Part No. JDG10202 (shown below).

Continued on next page

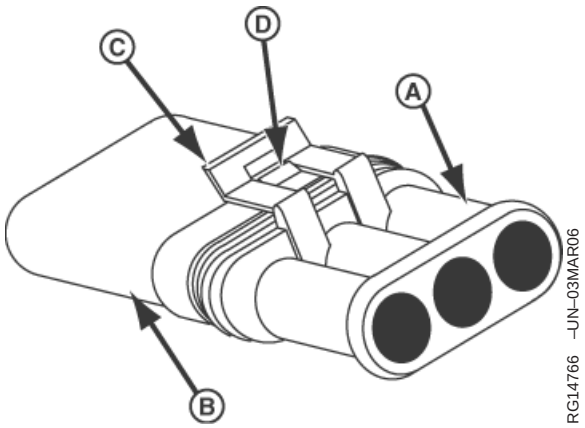
DB92450,0000085 –19–18MAY06–3/14

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)

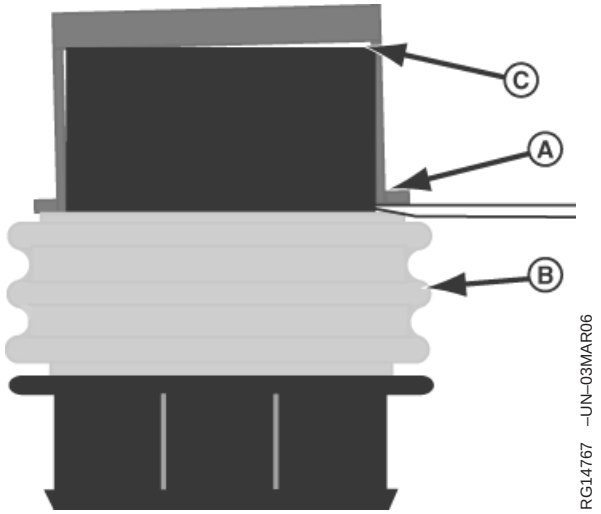
A—Female Connector
B—Male Connector
C—Locking Bar
D—Locking Tab



Separate Connectors

DB92450,0000085 –19–18MAY06–4/14

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



Remove Secondary Lock, Step 1.

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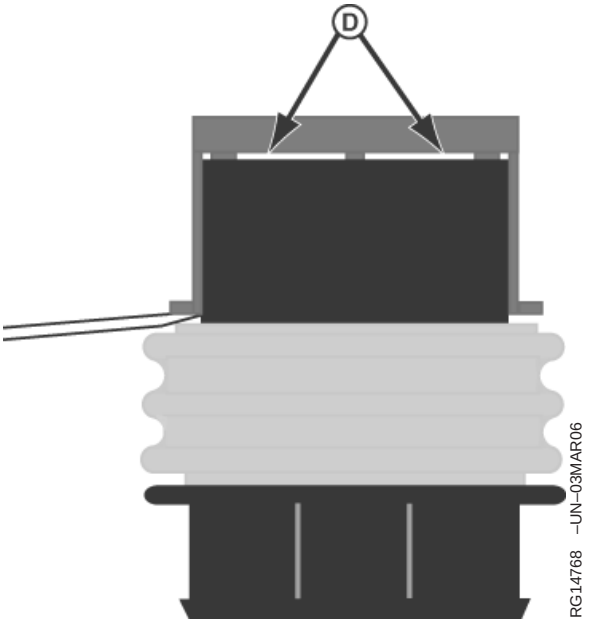
DB92450,0000085 –19–18MAY06–5/14

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, as shown.

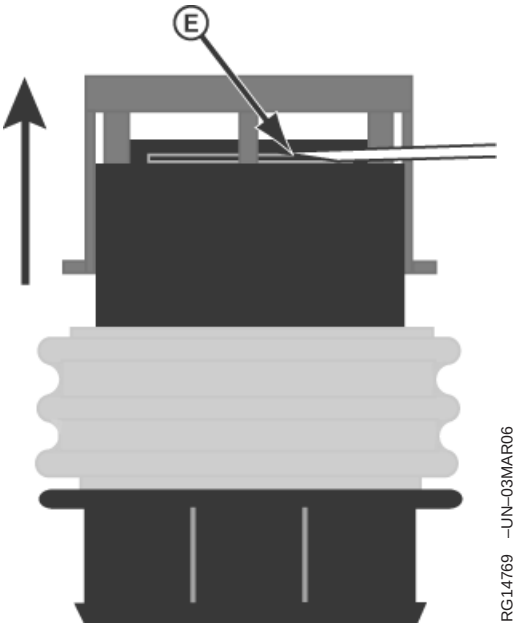


Remove Secondary Lock, Step 2.

DB92450,0000085 –19–18MAY06–6/14

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

3. 3. Remove damaged wire and or terminal from connector.



Remove Secondary Lock, Step 3.

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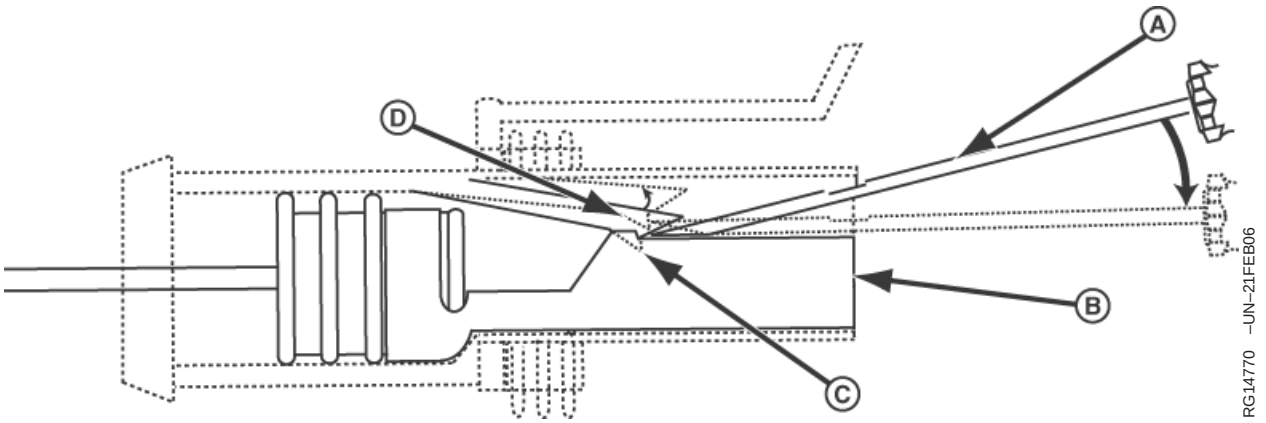
DB92450,0000085 –19–18MAY06–7/14



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.

a. Insert tool (A) into terminal end of connector, as shown.

b. 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.

c. Holding tool in place and applying tension on the wire of the terminal to be replaced, pry lock tab up, until it is freed from terminal slot (D), and terminal begins to move away from terminal edge of connector.

d. 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.

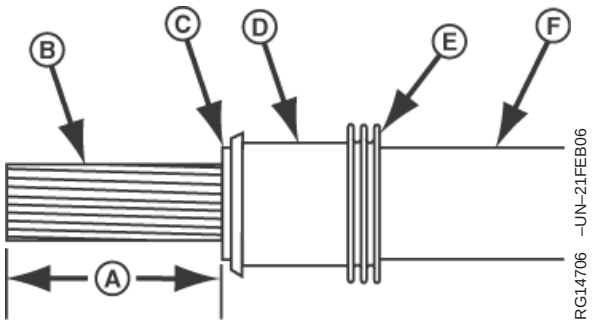
b. Insert wire into ribbed end of seal (E), and pull seal (D) down insulation (F), until non-ribbed end is well past point where insulation is to be stripped from wire.

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

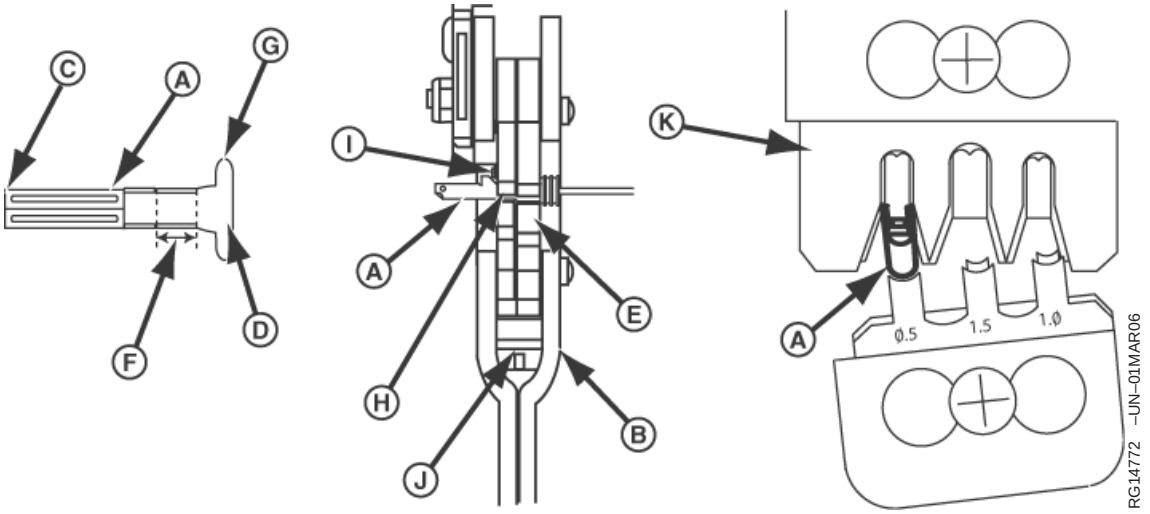
d. Pull seal toward bare wire, until only a small amount of insulation (C) appears beyond non-ribbed end of seal, as shown.

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



Stripped Wire and Seal

DB92450,0000085 –19–18MAY06–9/14



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

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

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 t ool 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.

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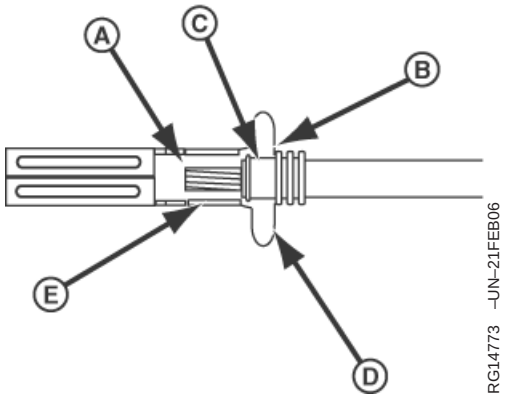
DB92450,0000085 –19–18MAY06–10/14

j. 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.

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

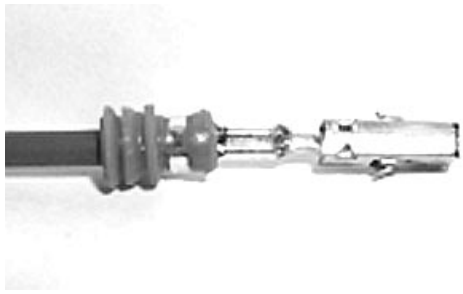


RG14773 –UN–21FEB06

Terminal, Seal, and Wire, Top and Front Views

DB92450,0000085 –19–18MAY06–11/14

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

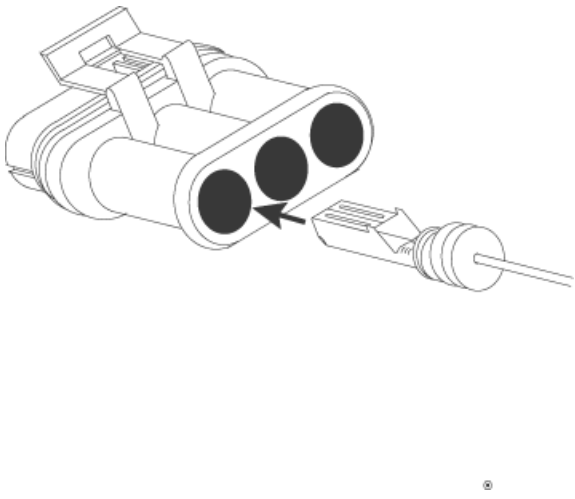


RG14709 –UN–23JAN06

Example of Successful Crimp

DB92450,0000085 –19–18MAY06–12/14

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.



RG14775 –UN–21FEB06

Insert New Terminal and Wire

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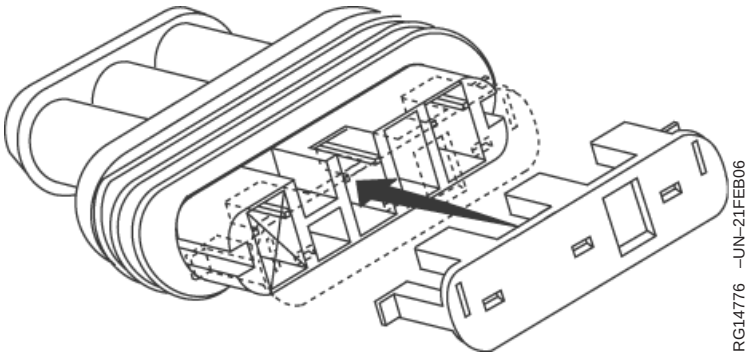


Reattach secondary Lock

6. Reattach the secondary lock, removed in step 2, as shown.
7. Reconnect the repaired, female connector to the male connector.

DB92450,0000085 –19–18MAY06–14/14

Section 03
Theory Of Operation

Contents

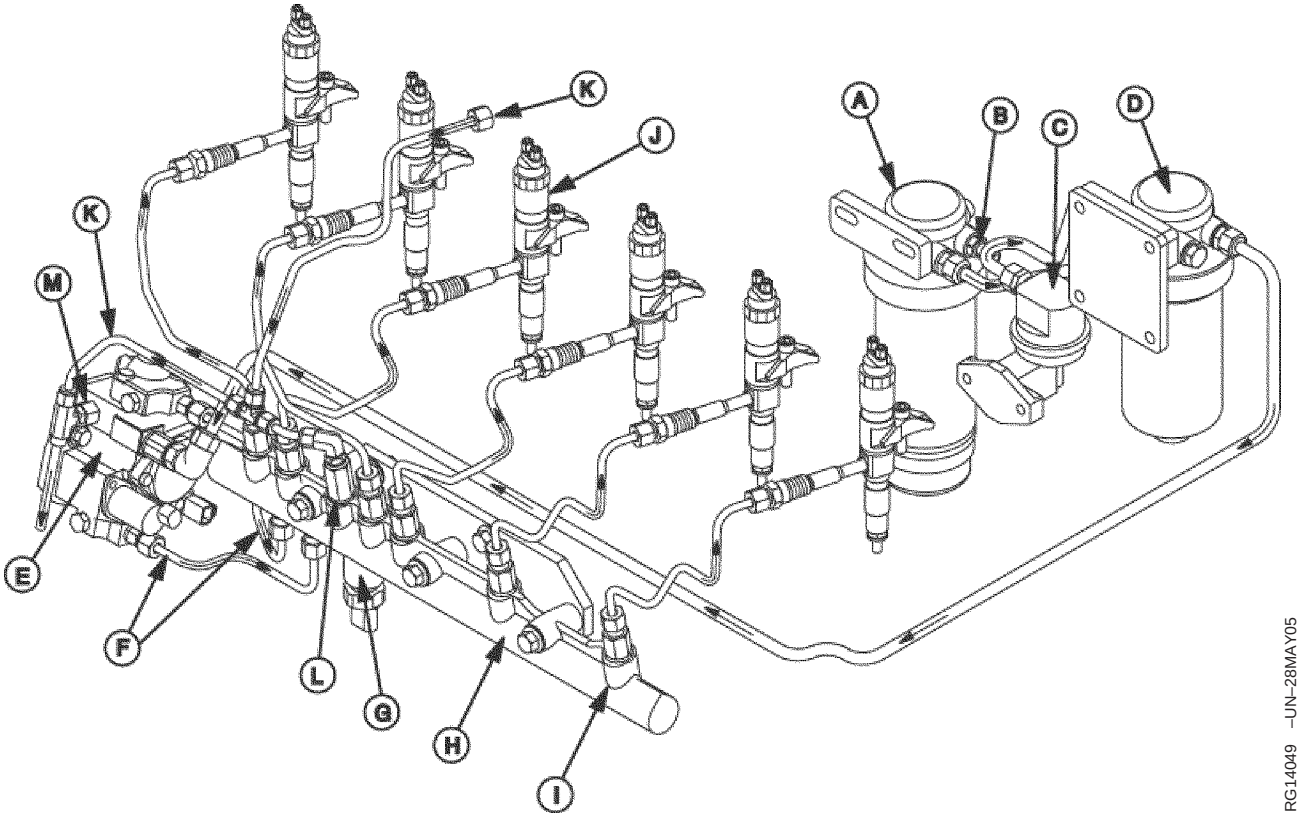
About This Group

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

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

RG40854,0000123 –19–27JAN05–1/1

Fuel System Operation



Fuel System Operation

A—Pre-Filter
B—Fuel Transfer Pump Pressure Sensor
C—Fuel Transfer Pump
D—Final Fuel Filter
E—High Pressure Fuel Pump
F—Pressurized Fuel Lines
G—Fuel Rail Pressure Sensor
H—High Pressure Common Rail (HPCR)
I—Flow Damper
J—Electronic Injector (EI)
K—Fuel Leak-off Line
L—Pressure Limiter
M—Overflow Orifice

The fuel transfer pump (C) draws fuel from the fuel tank through the prefilter (A), and sends it through the final fuel filter (D) on its way to the high pressure fuel pump (E). The type and location of the prefilter and the fuel transfer pump may vary depending on application requirements.

This pump is timed consistent with the engine timing to ensure correct fuel delivery amount for optimum cylinder firing. The high pressure fuel pump raises fuel pressure to the required amount for injection. This high-pressure fuel is routed through the pressurized fuel lines (F) and into the High Pressure Common Rail (HPCR) (H). HPCR evenly distributes fuel to all of the Electronic Injectors (EIs) (J) through the flow dampers (I). The HPCR uses flow dampers to regulate a constant pressure to the EIs. EIs produce measured amounts of fuel into their respective cylinders to be fired. If excess fuel pressure develops in the HPCR, the pressure limiter (L) opens and bleeds off fuel through the fuel leak-off line back to the tank. Excess fuel in the high pressure fuel pump exits the overflow orifice (M) and is routed back to tank through the fuel leak-off line (K).

Continued on next page

The Engine Control Unit (ECU) (A) 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 (K) and back to the fuel tank. On some applications the fuel goes through a fuel cooler prior to returning to the fuel tank.

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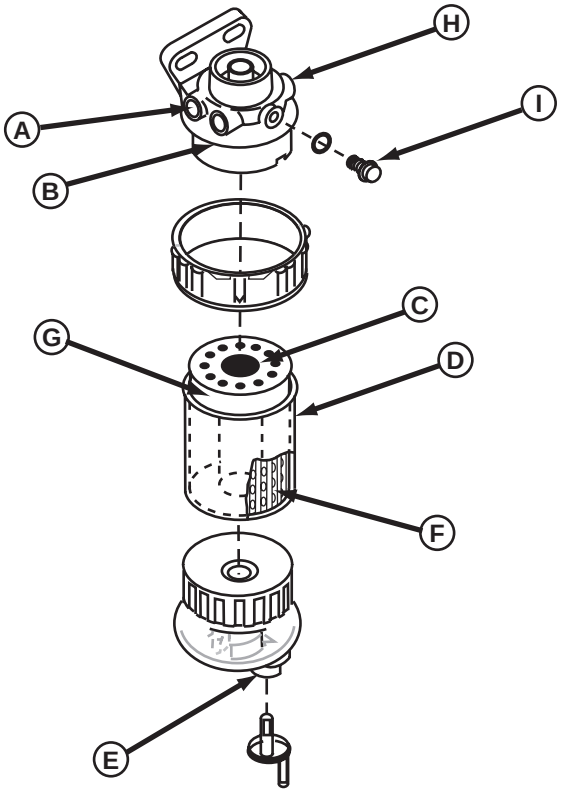
Prefilter Operation

This optional fuel filter is called the prefilter. It is called this whenever it has been placed between the fuel tank and the fuel transfer pump. It is positioned to protect the pump from coarse contaminants, which could damage, clog, or get stuck in, its diaphragm. This filter is also called the primary fuel filter. This is because it is the first filter through which fuel must pass on its way to the fuel injection pump. Being the first filter in line, it captures the coarsest of, and most, fuel contaminants.

Fuel enters the filter through inlet (A) at filter head (B), and flows down through the tube (C) in the center of the canister (D). Water and the heavier fuel contaminants settle to the bottom of the canister, and from there, they pass into the water/sediment bowl (E). Water can be drained off, and contaminants removed, from the bowl, without removing the filter assembly.

Fuel flows up a passage (F) between the outside of the filter element and the inside of the canister, and up through the 30-micron particle filter element (G) and out of the holes in the filter element. From there, fuel exits through the outlet (H) at the filter head.

Air can be bled from this part of the fuel system by loosening the plug (I) in the front of the filter head.



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Primary (Pre) Fuel Filter

A—Fuel Inlet
B—Filter Head
C—Tube
D—Canister
E—Water/Sediment Bowl
F—Passage Between Filter and Canister
G—Filter Element
H—Fuel Outlet
I—Bleed Screw

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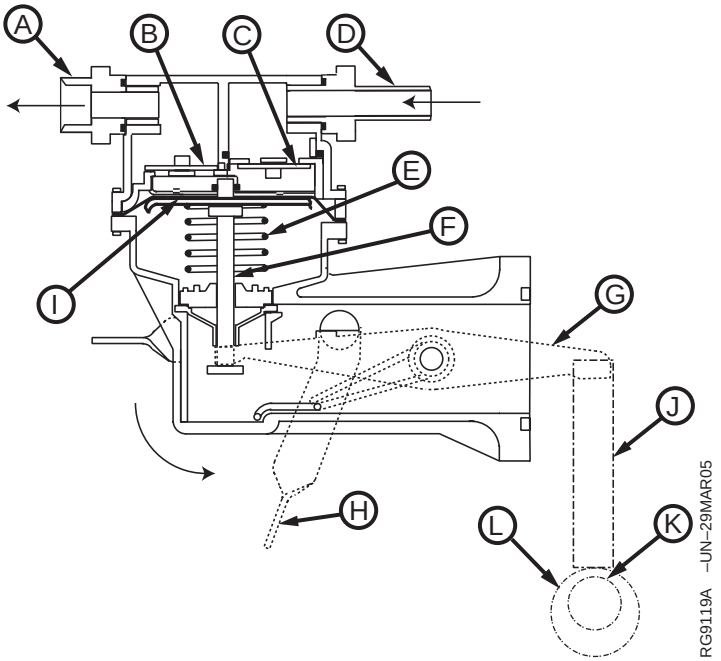
Fuel Transfer Pump Operation



Fuel Transfer Pump

A—Fuel Outlet
B—Outlet Check Valve
C—Inlet Check Valve
D—Fuel Inlet
E—Return Spring
F—Rod
G—Lever Arm
H—Hand Primer Lever
I—Diaphragm
J—Push Rod
K—Eccentric Lobe
L—Engine Camshaft

The mechanical fuel transfer pump is operated by an eccentric lobe (K) on the engine camshaft (L). A push rod (J), positioned between the lobe and the pump's lever (G), is moved up and down, once every engine revolution, corresponding with the lobe's eccentricity. This action moves the lever arm on the transfer pump up and down. As the push rod side of the lever goes up, the lever's opposite side goes down. As the opposite side goes down, it pulls down the rod (F), the diaphragm (I) attached to the rod is also pulled down, and return spring (E) is compressed. Suction pressure from the diaphragm opens the inlet check valve (C), and draws fuel into the chamber above the diaphragm. As the eccentric lobe is turned past its peak height, return spring decompresses, pushing the diaphragm back into its original position. As the diaphragm is returned to its original position, the increased volume of fuel in the chamber above the diaphragm pushes shut the inlet check valve, and opens the outlet check valve, allowing fuel into the fuel outlet chamber. As this sequence is repeated, fuel pressure is developed in the fuel outlet chamber, causing fuel to exit the transfer pump and flow into the final filter.

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

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

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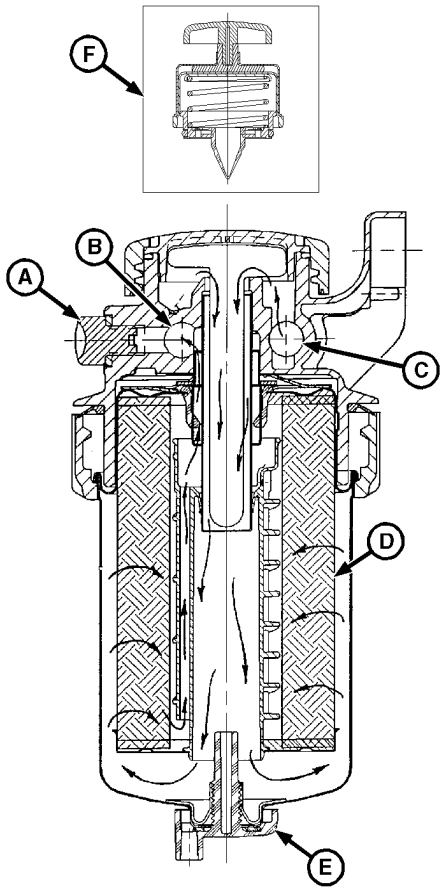
Final Fuel Filter Operation

Fuel enters the filter at inlet (C), flows through filter element (D) and exits through outlet (B) to the fuel injection pump. The 5-micron filter element is housed in a sediment bowl attached to the base with a threaded retaining ring.

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

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

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



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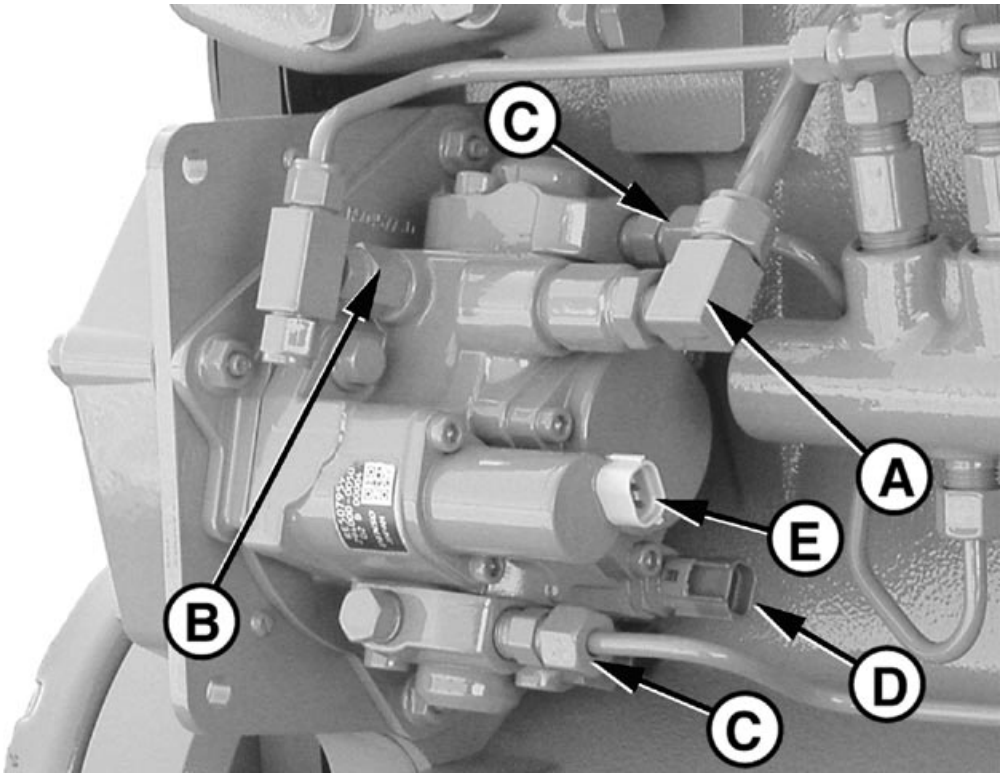
High Pressure Fuel Pump Operation



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

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

There is one chamber on the top of the pump and another chamber on the bottom of the pump. Fuel in each chamber is pressurized when the pump camshaft rotates. Excess fuel leaves the pump through the overflow valve (B), so it can return to the fuel tank.

A fuel temperature sensor (D) is included on the pump to measure the fuel temperature in the pump housing. For more fuel temperature sensor information, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 later in this manual.

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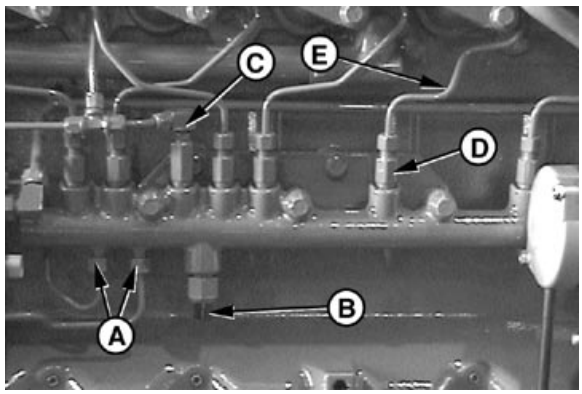
High Pressure Common Rail (HPCR) Operation

High pressure fuel is delivered to the high pressure common rail (HPCR) through two high pressure pump delivery lines (A). The high pressure common rail delivery lines (E) transport the fuel to the Electronic Injectors (EIs). The fuel rail pressure sensor (B) detects the fuel pressure inside the rail. The Engine Control Unit (ECU) uses this sensor to monitor the fuel pressure to determine the timing of the pump control valve on the high pressure fuel pump. For more information on the fuel rail pressure sensor, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 later in this manual. If an abnormally high pressure is generated within the HPCR, the pressure limiter (C) opens to release the excess pressure and drain fuel back to the tank. The flow dampers (D) are used to control the maximum fuel flow to the EIs and prevent damage if the EI should fail, or if a high pressure leak develops, by shutting off fuel flow to the failed EI.



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

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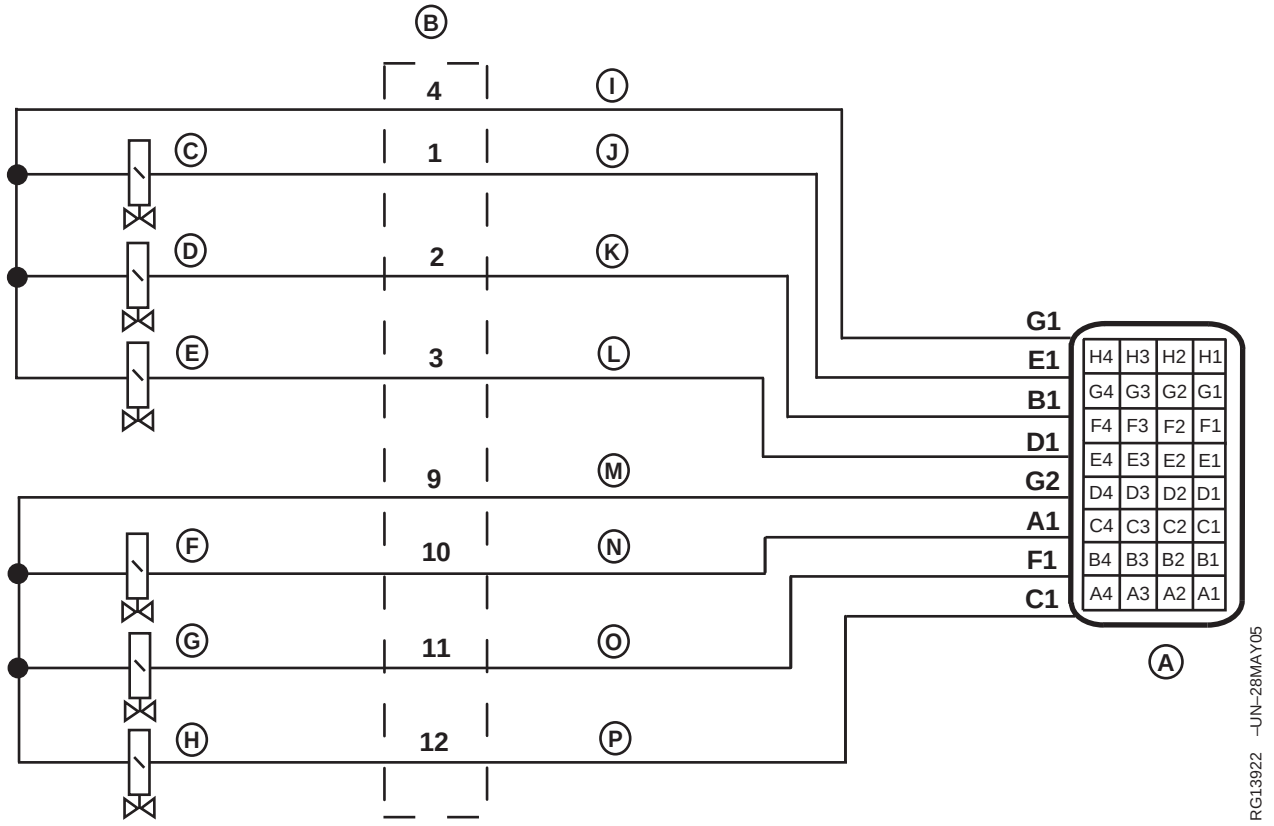
Electronic Injector (EI) Operation



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

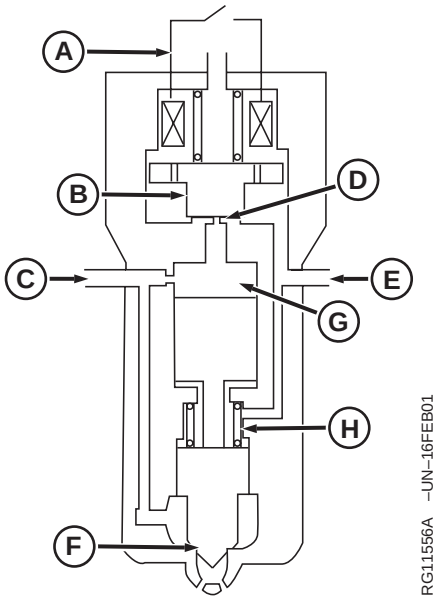
The electronic injectors (EIs) are located inside the engine's cylinder head and are electronically controlled by the ECU. The amount of fuel delivered to the cylinder is in direct proportion with the length of time current is supplied to the two-way electromagnetic valve (TWV) on each EI. The ECU sends 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

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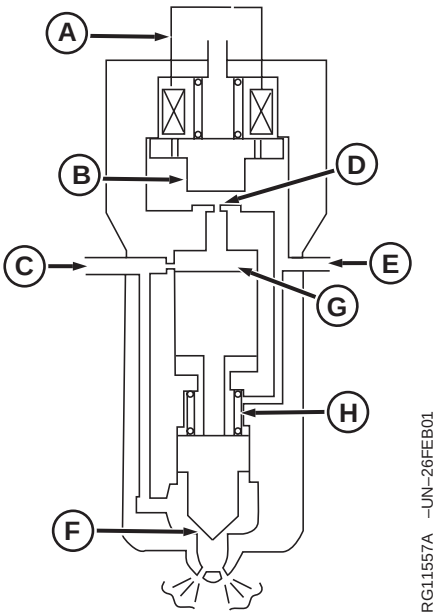
EI - Begin Injection

Injection begins when current is supplied from the ECU to the TWV (A). The electromagnetic force pulls the solenoid valve (B) up, causing the orifice seat (D) to open. The fuel in the control chamber (G) flows out of the injector to the fuel 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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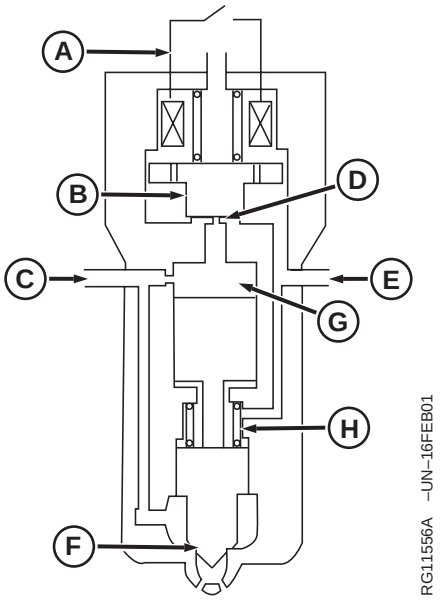
EI - Ending Injection

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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Electronic Air System Control Operation

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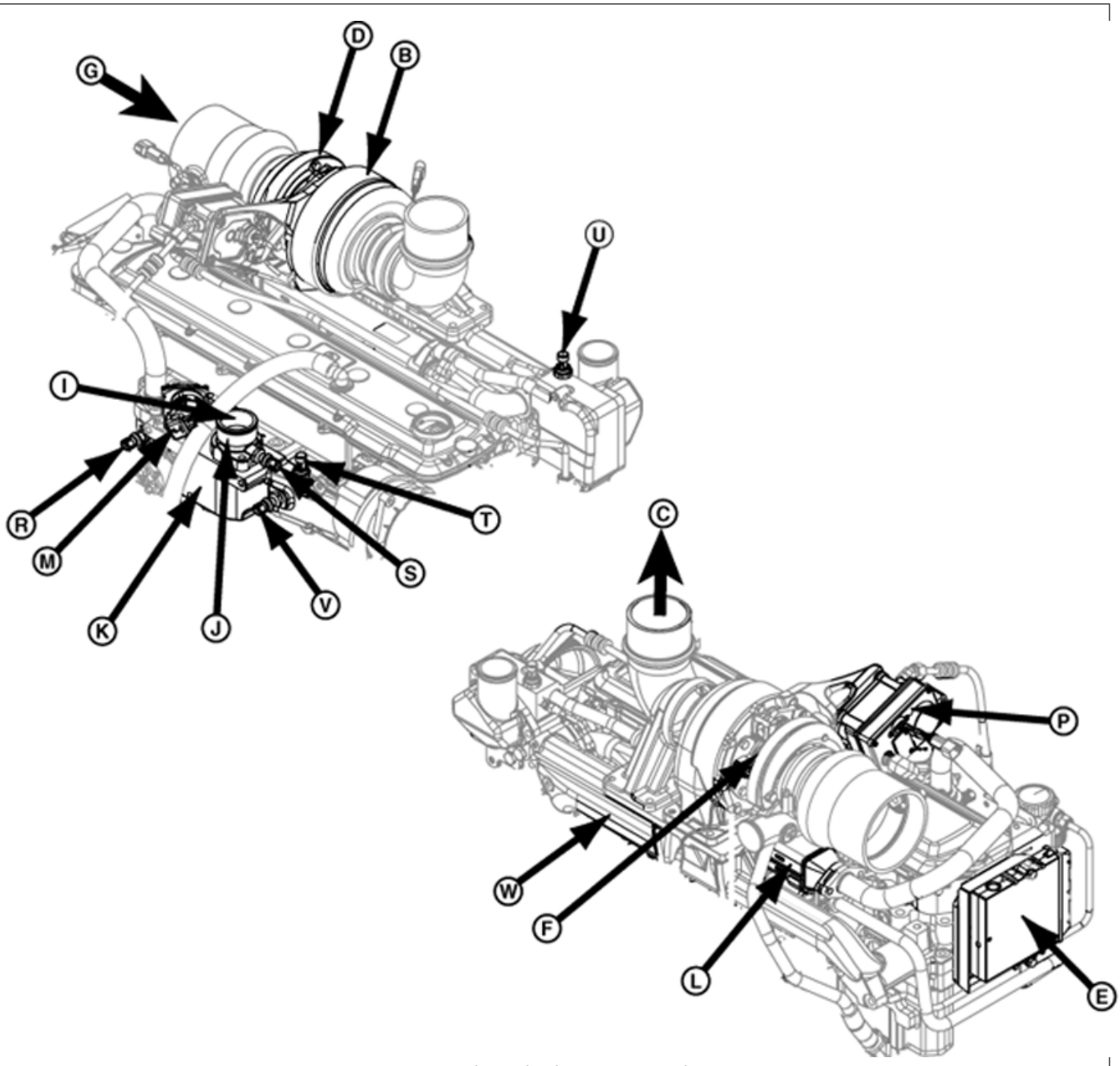

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Electronic Air System Control

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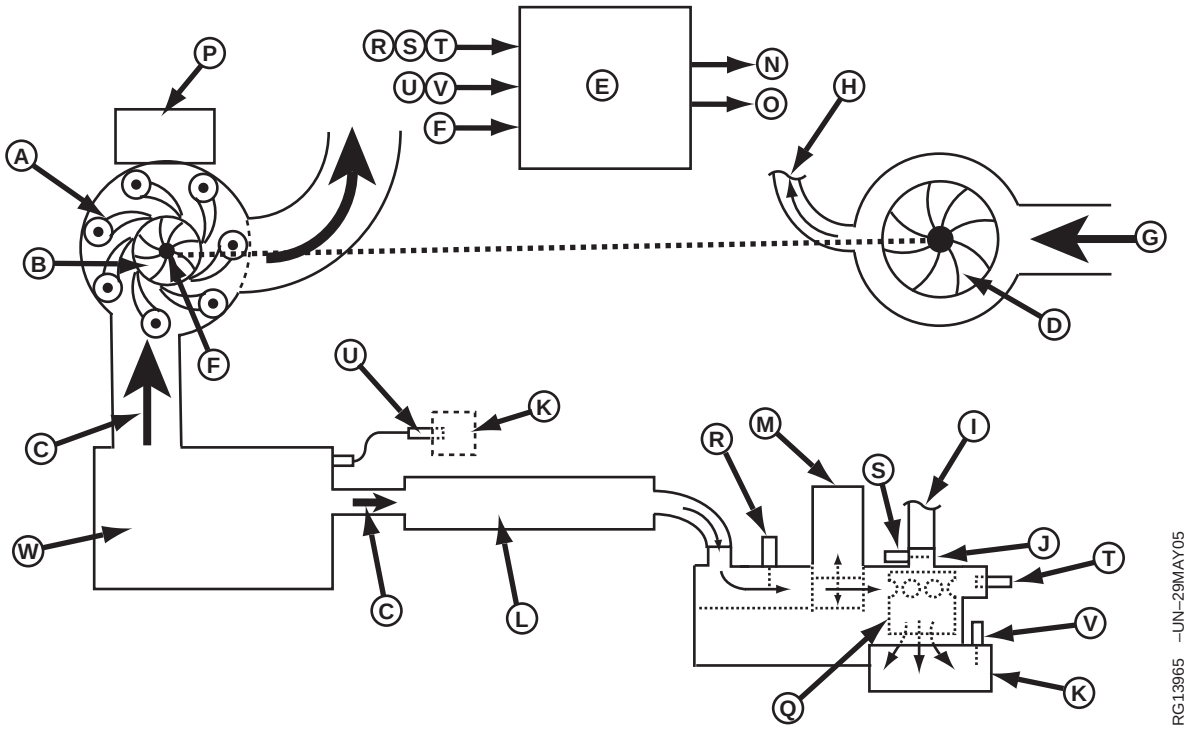

Electronic Air System Diagram

A—Turbo Variable Vanes
B—Turbo - Exhaust Side
C—Exhaust Gas
D—Turbo - Air Inlet Side
E—Engine Control Unit (ECU)
F—Turbo Speed Sensor
G—Fresh Air
H—To Air Cooler
I—From Air Cooler
J—Charge Air Port
K—Air Intake Manifold
L—EGR Cooler
M—EGR Valve
N—EGR Valve Position Signal
O—Turbo Actuator Position Signal
P—Turbo Actuator
Q—EGR Fresh/Exhaust Air Mixer
R—EGR Exhaust Temperature Sensor
S—EGR Fresh Air Temperature Sensor
T—Manifold Air Pressure (MAP) Sensor
U—Removed
V—EGR Mixed Air Temperature Sensor
W—Exhaust Manifold

Engine exhaust gas is expelled from each cylinder into the exhaust manifold (W). From the exhaust manifold, exhaust gas (C) is simultaneously routed in two, different directions:

1. Through the exhaust side of the turbocharger (B) and onto atmosphere.
2. Through the exhaust gas recirculation (EGR) cooler (L), in the EGR valve (M), and onto the air intake manifold (K).

As exhaust gas is pushed through the exhaust side of the turbo, the variable vanes (A) open to allow the gases to escape to atmosphere. During engine startup, the majority of exhaust gas passes through the completely open variable vanes on the exhaust side of the turbo and out to atmosphere. As the exhaust gases exit, they turn the turbo blades. When the blades turn, fresh air (G) is drawn from atmosphere on the turbo inlet side (D). The more exhaust that leaves the turbo, the more fresh air the turbo pulls in.

Fresh air is compressed by the turbo, then travels from the turbo (H) to the air cooler (I), This cooled compressed air becomes charged, hence the name “charged air”. The charged air is combined with the cooled exhaust gases in the intake air manifold. From the manifold, the mixed air enters the engine’s cylinder where it is mixed with fuel and ignited.

Mixing of fresh air and exhaust gases increases the engine’s boost pressure while lowering the NOX emissions released to the atmosphere after combustion.

Continued on next page

At startup, very little exhaust gas enters the exhaust gas recirculation (EGR) passage, through the EGR cooler (L), to the EGR valve (M). EGR cannot get past the EGR valve, because the valve is completely closed. So at this time, only charge air is input to the engine for combustion. The ECU will not open the EGR valve under idle conditions.

The ECU uses a variety of monitored conditions, such as engine load and temperatures, to begin calling for EGR. Once the ECU calculates that all required conditions have been met, it signals (N) the EGR valve to open. It also signals (O) the turbo actuator (P) to begin closing the variable vanes. This allows the exhaust to enter through the EGR valve and on to the air intake manifold. To supply EGR in greater amounts, the ECU varies the degree of closure on the vanes. Vanes closing in this case means that the turbo actuator is turning the vanes more toward touching and overlapping one another. During normal operation, the vanes never close completely, as they provide the only path for exhaust to drive the exhaust side of the turbo. EGR is mixed with charge air in the EGR-charge air mixer (Q) in the air intake manifold, and this mixture enters the engine cylinders for combustion.

As engine operation continues, ECU continuously monitors and compares temperature signal inputs from the EGR (R), fresh air (S), and mixed air (T) temperature sensors. From these comparisons, the ECU calculates a delta temperature that determines the amount of EGR to be mixed with fresh air. Using pressure sensors (U) and (V), the ECU also compares engine exhaust and manifold air pressures, and calculates a delta pressure. This calculation can also be used by the ECU to determine the required amount of EGR. This is done when a calculated delta temperature is suspect, due to such conditions as a faulty temperature sensor, heat transfer to the walls, causing the affected sensor to throw the calculation off, and when engines are operated in significant differences in altitude.

The ECU receives electrical-equivalent signals of temperature, pressure, and speed from the turbo and EGR sensors. According to these values, the ECU responds by sending command signals to the turbo actuator and the EGR valve. This is done to maintain exhaust and air pressures, temperatures, and valve position to maintain the correct gas to fresh air ratios for proper engine performance. The ECU responds to these inputs by raising or lowering the voltage sent to the turbo actuator and EGR valve.

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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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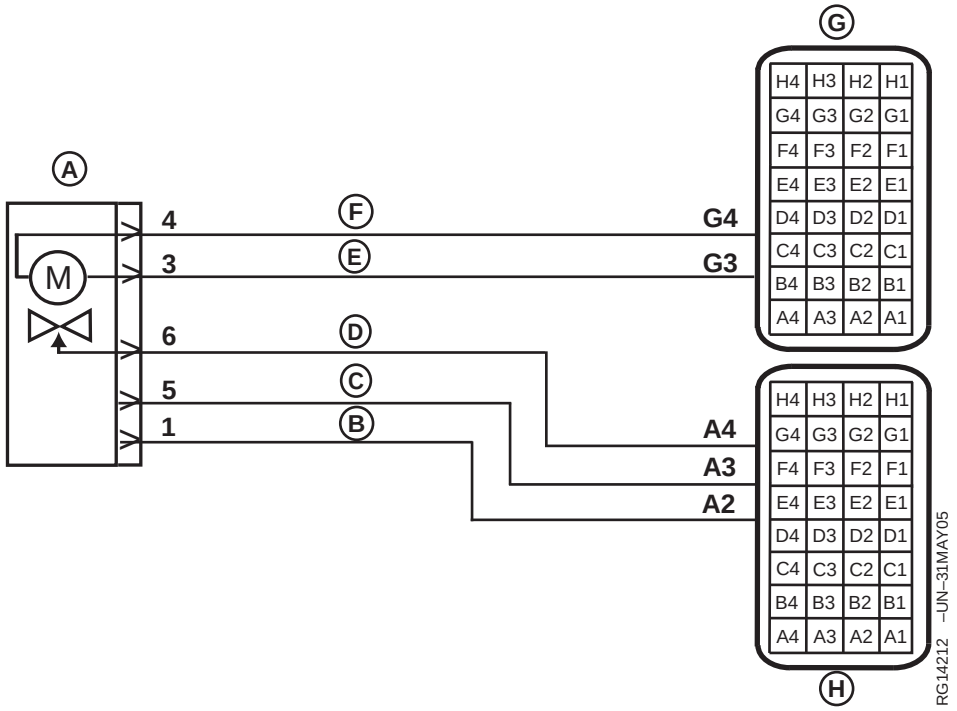
EGR Valve



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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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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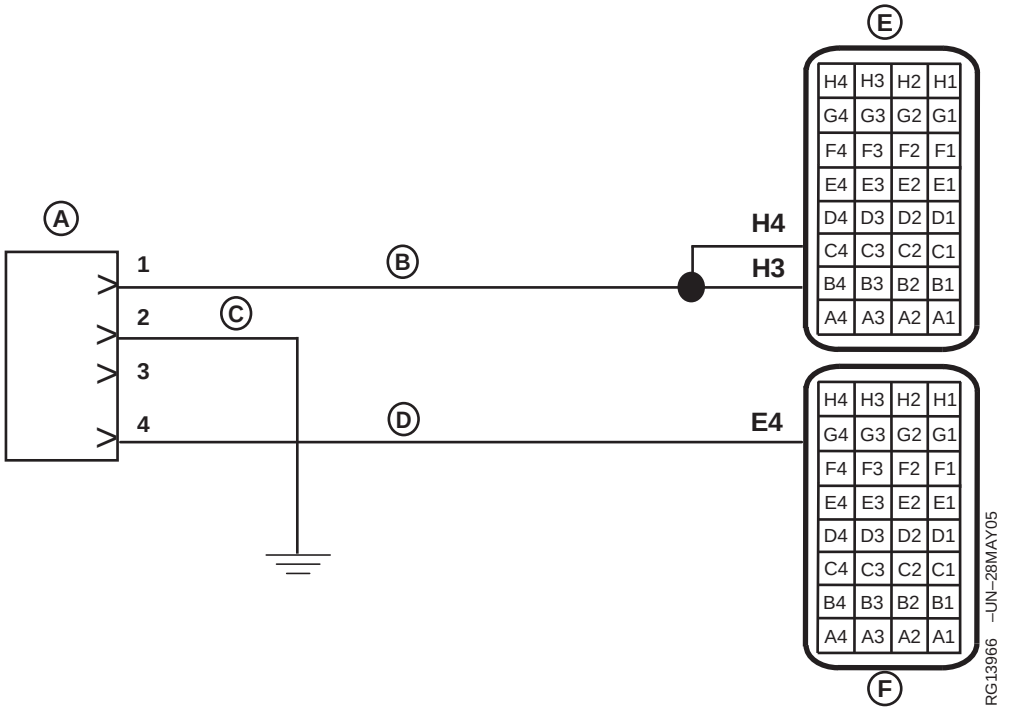
Turbo Actuator



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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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.

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About This Group

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

- Electronic Control System Terminology
- Electronic Control System Operation
- Electronic Control System Overview
- Monitoring Engine Parameters
- Measuring Temperature
- Engine Control Unit (ECU) Temperature Sensor
- Engine Coolant Temperature (ECT) Sensor
- Fuel Temperature Sensor
- Turbo Compressor Inlet Temperature Sensor
- Turbo Turbine Inlet Temperature
- Measuring Pressure
- Barometric Air Pressure (BAP) 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)
- Glow Plug Operation
- Cruise Control Operation
- Engine Protection
- Derate Programs
- Multiple Torque Curve Selection
- Governor Droop Mode Selection
- Engine Control Unit (ECU) Self Diagnosis

RG40854,00000DF –19–18MAR05–1/1

Electronic Control System Terminology

Actuator	A device controlled by the ECU to perform a certain function.
Analog	Signal which has a continuous range of possible voltages, usually 0 to 5 volts or 0 to 12 volts.
BAP	Barometric Air Pressure. Pressure of the atmosphere (atmospheric pressure).
Boost	Pressurized air in the intake manifold.
CAC	Charge Air Cooler
CAN	Controller Area Network. The network on vehicles that allows communication between controllers.
Digital	A signal which consists of only two levels of voltage — usually 0 volts and +5 volts.
DTC	Diagnostic Trouble Code. This is a code that is stored in the ECU's memory when it detects a problem in the electronic control system. There are two types of codes: Active and Stored.
ECT	Engine Coolant Temperature (sensor). Measures the temperature of the engine coolant.
ECU	Engine Control Unit. Computer that controls the fuel, air, and ignition systems on the engine.
EI	Electronic Injector. The EI is an electronic injector that is controller by the ECU. The ECU controls the start of injection and the amount of fuel injected by energizing and de-energizing the two-way valve on the injectors. See ELECTRONIC INJECTOR (EI) OPERATION in Group 130 for details. Failure Mode Identifier. The second part of a two-part code that identifies control system fault codes according to the J1939 standard. The identifies the type of failure that has occurred. The first half of the code is the Suspect Parameter Number (SPN).
HPCR	High Pressure Common Rail. Distributes the high pressure fuel to each individual EI.
J1939	The Society of Automotive Engineers (SAE) standard for communication between the electronic controllers on heavy-duty vehicles, both on- and off-highway.
JDCP	John Deere Custom Performance allows the customer to select software features and feature combinations prior to loading the software into the ECU. It is also the means by which embedded software is managed and updated in controllers without removal of the controller from the machine.
JDPS	John Deere Power Systems.
MAP	Manifold Air Pressure. Sometimes referred to as "boost" pressure.
MAT	Manifold Air Temperature (sensor). Measures the temperature of the air in the intake manifold.
PCV	Pump Control Valve regulates the amount of fuel that the high pressure fuel pump supplies the HPCR.
PROM	Programmable, Read-Only Memory. A computer chip that contains the calibration information for the engine control system.
Position Sensor	Commonly referred to as the Cam or Pump position sensor depending on application. Used to identify the cylinder that is on the compression stroke.
PWM	Pulse Width Modulation. A digital (not analog) electronic signal 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.

Continued on next page

RAM	Random Access Memory. The RAM is the portion of the computer memory within the ECU that changes as the engine is running and is stored while engine is off.
SDS	JDPS Software Delivery System. Used to maintain software and programming records.
Sensor	Device used by the ECU to monitor various engine parameters.
SPN	Suspect Parameter Number. The first half of a two-part code that identifies control system fault codes according to the J1939 Standard. The SPN identifies the system or component that has the failure. The second half of the code is the Failure Mode Identifier ().
TDC	Top Dead Center. Point of uppermost piston travel.
Timing Sensor	Commonly referred to as the Crank sensor. Used to determine the angular position and velocity of the crankshaft in its 360° field of rotation.
TPS	Throttle Position Sensor. The TPS measures the position of the throttle.
Trim Options	Options that can be enabled or disabled in the ECU programming, such as throttle selection, torque adjustment, governor gains, derates and shutdowns, etc.
TWV	Two-Way Valve. The TWV is energized to raise the outer valve, allowing fuel to be injected into the cylinder.
WIF	Water In Fuel (sensor). The WIF sensor sends a signal to the ECU when water is detected in the fuel.

RG40854,00000E0 –19–24JAN06–2/2

Electronic Control System Operation

Engine Starting Mode

When the key is turned to the “ON” position, a switched power voltage is sent to the 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.

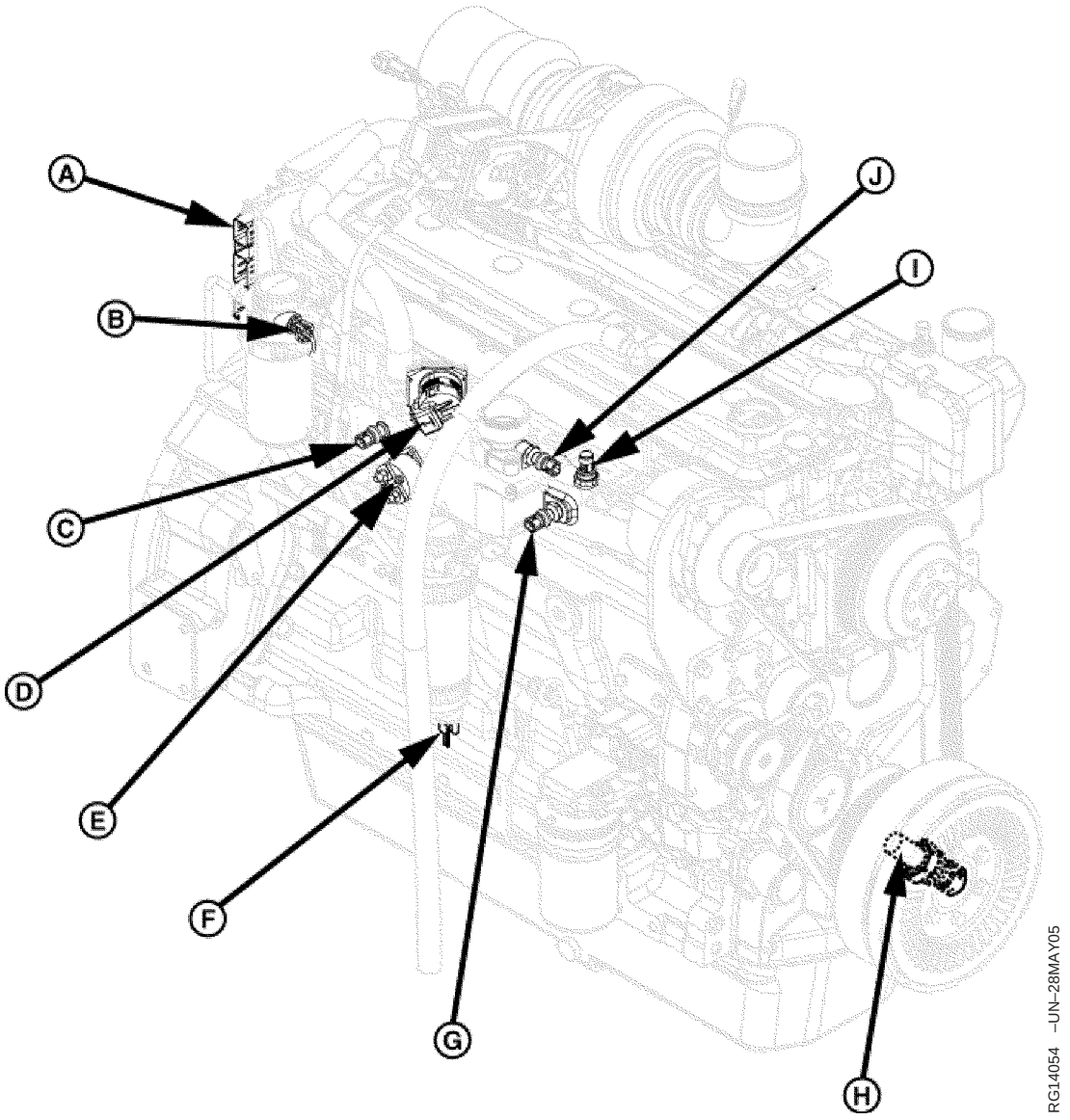
To provide cold temperature enrichment, the amount of fuel injected is based on the temperature measured by the Engine Coolant Temperature (ECT) sensor. At this point, the engine will start and the ECU will go into the running mode.

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.

RG40854,00000E1 –19–28SEP05–1/1

Electronic Control System Overview



Electronic Controls, Filter Side

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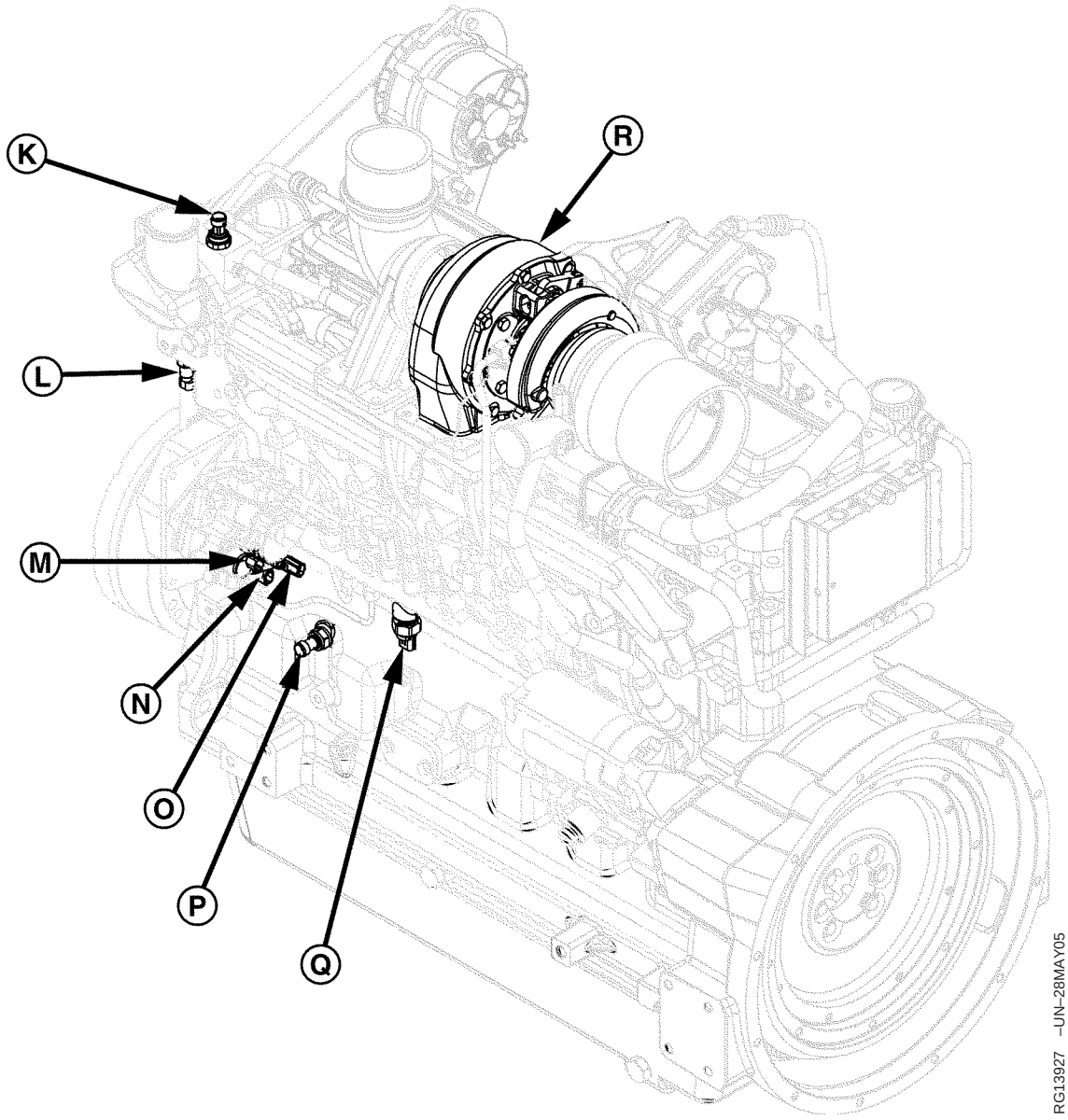
RG40854,00000E2 –19–23JUN06–1/2



Electronic Controls, Injection Pump Side

A—ECU Connectors
B—Fuel Transfer Pump Pressure Sensor
E—Glow Plug Relay
F—WIF Sensor
H—Crank Position Sensor
I—MAP Sensor
K—Removed
L—Engine Coolant Temperature Sensor
M—Pump Control Valve
N—Pump Position Sensor
O—Fuel Temperature Sensor
P—Oil Pressure Sensor
Q—Fuel Rail Pressure Sensor
R—Turbo

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

The electronic control system serves as an engine governor by controlling the Electronic Injectors (EIs) so that fuel is delivered according to a given set of engine conditions, precise amounts, and at precise time in relation to piston position. In order to achieve this, the control system performs the following functions:

- Constantly monitor engine operating conditions
- Precisely determines piston position
- Deliver optimum amount of fuel for a given set of operating conditions
- Deliver fuel at optimum piston position
- Provide multiple control modes
- Perform self-diagnosis

RG40854,00000E2 –19–23JUN06–2/2

Monitoring Engine Parameters

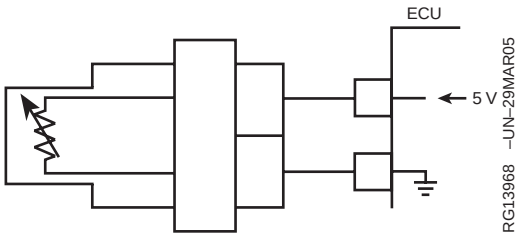
In order for the electronic control system to deliver fuel according to a given set of operating conditions and, on some applications to provide engine protection, the following engine parameters are monitored by the ECU:

- Crank Position
- Engine Control Unit (ECU) Temperature
- Engine Coolant Temperature (ECT)
- 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)

RG40854,00000E3 –19–10FEB05–1/1

Measuring Temperature

The Engine Coolant (ECT), Oil, Fuel, and Compressor Inlet 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.



Typical Temperature Sensor Schematic

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.

RG40854,00000E4 –19–07MAR05–1/1

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.

RG41221,00002A7 –19–15MAY05–1/1

Engine Coolant Temperature (ECT) Sensor

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.

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.

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Exhaust Gas Recirculation (EGR) Exhaust Temperature Sensor

The EGR exhaust temperature sensor is located on the EGR valve near the exhaust inlet tube. The ECU uses this sensor to measure the temperature of the exhaust 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.

DB92450,0000011 –19–10APR06–1/1

Exhaust Gas Recirculation (EGR) Fresh Air Temperature Sensor

The EGR fresh air temperature sensor is located on the EGR valve near the fresh air inlet tube. 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.

RG41221,00002A6 –19–10APR06–1/1

Exhaust Gas Recirculation (EGR) Mixed Temperature Sensor

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 EGR valve 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.

RG41221,00002A6 –19–10APR06–1/1

Fuel Temperature Sensor

The fuel temperature sensor is located towards the bottom of the high pressure fuel pump, on the fuel return line. 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 glow plugs will turn on for a predetermine length of time. For more glow plug information, see GLOW PLUG 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.

DB92450,0000010 –19–10APR06–1/1

Turbo Compressor Inlet Temperature Sensor

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 to calculate 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.

DB92450,0000013 –19–10APR06–1/1

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
- Timing base on the crank position or the pump position sensor
- Fuel Rail Pressure
- Engine Speed
- 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.

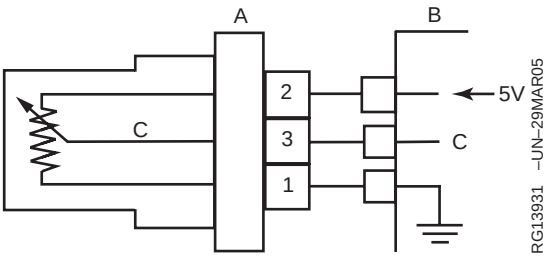
For more information on engine protection and derate programs, see ENGINE PROTECTION or DERATE PROGRAMS later in this Group.

RG41221,00002A8 –19–15MAY05–1/1

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

RG40854,00000E5 –19–30MAR05–1/1

Fuel Rail Pressure Sensor

The fuel rail pressure sensor is located on the bottom 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.

DB92450,0000015 –19–10APR06–1/1

Fuel Transfer Pump Pressure Sensor

The fuel transfer pump pressure sensor is located on the prefilter 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.

DB92450,0000014 –19–10APR06–1/1

Manifold Air Pressure (MAP) Sensor

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.

DB92450,0000018 –19–10APR06–1/1

Oil Pressure Sensor

The oil pressure sensor (A) is located on the engine block below the high pressure common rail. 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.

DB92450,0000016 –19–10APR06–1/1

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

Crank Position Sensor

The crank position sensor is located on the rear of the engine. It is an inductive type pickup sensor that detects teeth on the crankshaft timing gear. The ECU uses the crank position input to determine engine speed and precise piston position in relation to the firing order. The crankshaft timing gear is composed of 45 evenly spaced teeth and a 3 tooth section with no notches. The tooth section helps the ECU determine when cylinder #1 is at Top-Dead-Center (TDC).

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

The ECU provides engine protection for crank 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.

RG41221,00002AF –19–19MAY06–1/1

Pump Position Sensor

The pump position sensor is located on the front end of the engine near the high pressure fuel pump. It is an inductive type pickup sensor that detects teeth on the upper idler gear. The upper idler gear is composed of 12 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.

RG41221,00002B0 –19–19MAY06–1/1

Turbo Speed Sensor

The turbo speed sensor 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.

RG41221,00002B1 –19–10APR06–1/1

Pump Control Valve (PCV)

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.

RG40854,00000EA –19–10APR06–1/1

Water in Fuel (WIF) Sensor

The water in fuel (WIF) sensor is located on the bottom of the final 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.

RG41221,00000A8 –19–10APR06–1/1

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
- 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:

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

Electronic Injector (EI) Wiring Harness Connector

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

For wiring information, see ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.

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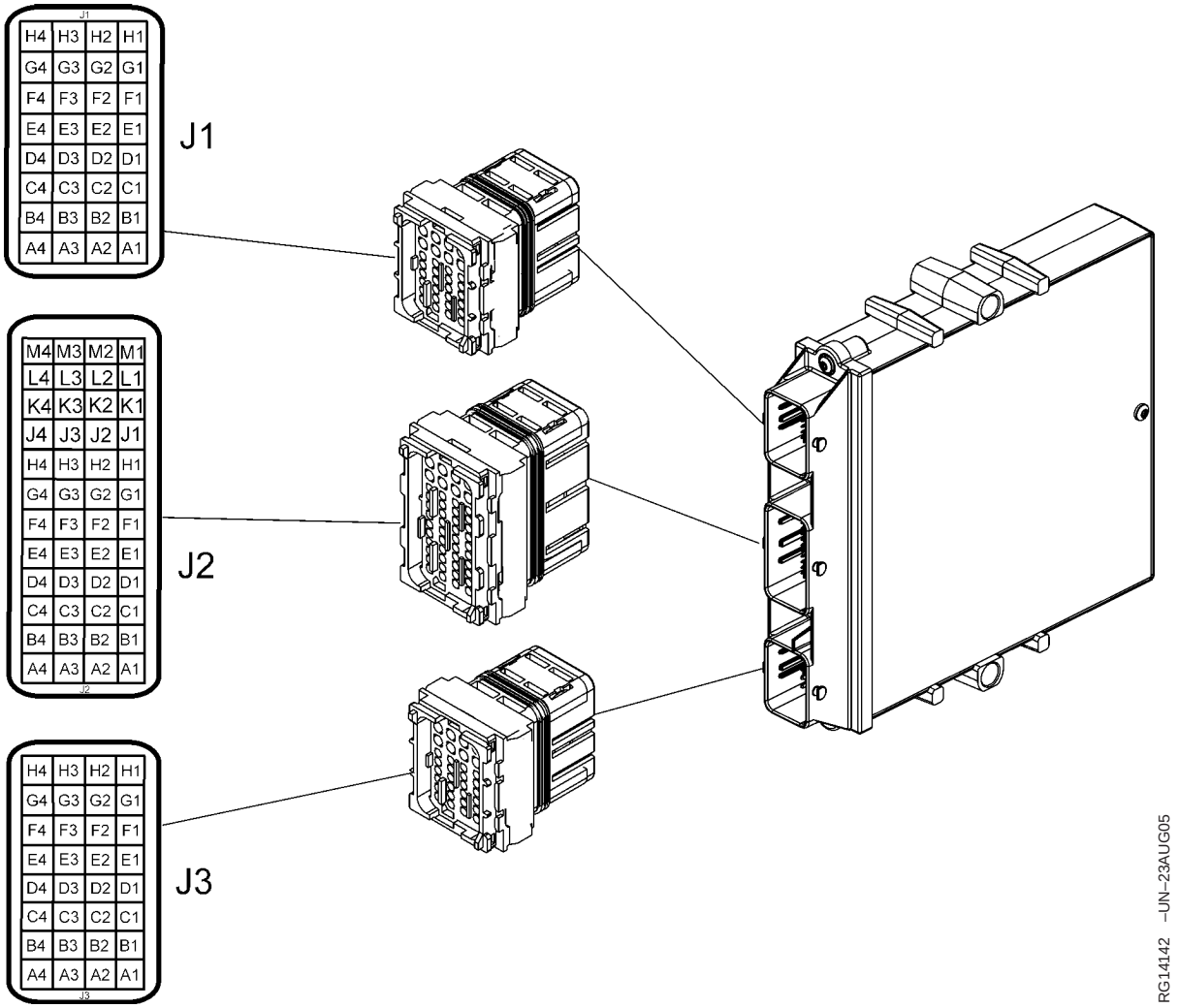
Engine Control Unit (ECU)



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.

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.

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Glow Plug Operation

Glow plugs are located above each cylinder's combustion chamber. The glow plug heaters are used to increase the intake air temperature to improve cold starting. When the operator turns the key from "OFF" to "ON", the ECU receives fuel temperature information from the fuel temperature sensor, determines if the temperature is below the set point, turns on the "Wait to Start" light on and energizes the coil of the glow plug relay . This closes the normally-open glow plug relay contacts which provide current path to the glow plugs located above each cylinder. The ECU will keep the glow plugs energized for an amount of time that is determined by the measured temperature- colder is longer. When the predetermined time has passed, ECU turns off the "Wait to Start" light and de-energizes the glow plug relay. If the operator turns the ignition from "ON" to "START" at this time, the engine will crank and start.

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

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

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

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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.

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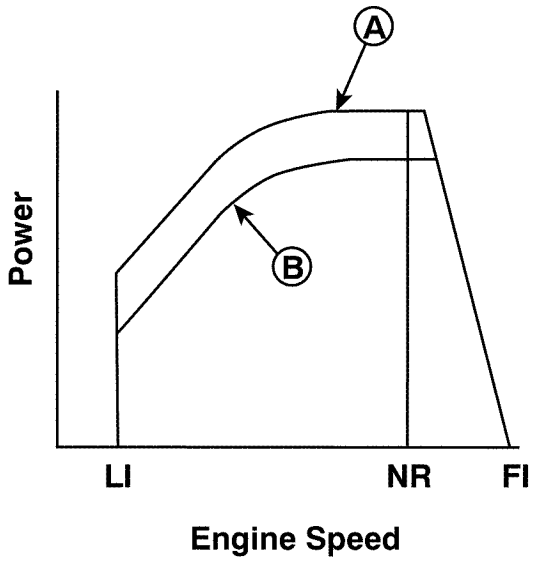
Multiple Torque Curve Selection

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

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



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

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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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Engine Control Unit (ECU) Self-Diagnosis

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

There are two types of DTCs:

- Active
- Stored

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

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

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

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

SPN/FMI CODES

SPN/FMI codes are written from the SAE J1939 standard as a two part code. The first part is called the Suspect Parameter Number (SPN). Typically, it contains between 2 and 6 digits. The SPN identifies the system or the component that has the failure; for example SPN 110 indicates a failure in the engine coolant temperature circuit. The second part of the code is called the Failure Mode Identifier (FMI) code. The FMI contains 2 digits. The FMI identifies the type of failure that has occurred; for example FMI 3 indicates value above normal. In order to determine the exact failure, both the SPN and FMI are required. Combining SPN 110 with FMI 3 yields engine coolant temperature input voltage high.

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

2-DIGIT/3-DIGIT CODES

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

WARNING LAMP

Continued on next page

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™. Refer to the vehicle machine manual or see CLEARING STORED DTCS ON DIAGNOSTIC GAUGE in Group 160 later in this manual to determine how to clear the code reader.

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Section 04
Diagnostics

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About This Group

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

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

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

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

- F1 - Fuel supply system check
- F2 - Excessive fuel consumption
- F3 - Fuel in oil

- D1 - ECU Does Not Communicate With SERVICE ADVISOR™
- D2 - Diagnostic Gauge Does Not Communicate With ECU

- A2 - Glow Plug Check

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

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

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E1 - Engine Cranks/Won't Start

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E1 - Engine Cranks/Won't Start Diagnostic Procedure

NOTE: This procedure applies to engines with John Deere Engine Control Units (ECUs). This procedure should be used if engine cranking speed is OK, but engine will not start, or only starts after prolonged cranking. If engine will not crank, determine problem in the starting/charging system, 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 TEST ENGINE CRANKING SPEED in Section 04, Group 150 of 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104). 3. Ensure that oil viscosity is correct. See DIESEL ENGINE OIL—TIER III ENGINES in Section 01, Group 02 of 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104). Was the problem found?	**YES:** Repair and retest. **NO:** GO TO ❷

– – –1/1

❷ **Active DTC Test**	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. Crank engine for 15 seconds. 6. Read DTCs using SERVICE ADVISOR™. Does diagnostic software connect and display 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 DIAGNOSTIC PROCEDURE later in this Group.

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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 of this manual 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 **Pump 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

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❹ **Pilot Injection Test**	1. Ignition ON, engine OFF 2. Read engine coolant temperature. 3. Ignition ON, engine cranking 4. Read pilot injection If the engine coolant temperature is below 10°C (50°F), is pilot injection ON?	**YES:** Engine coolant temperature is below 10°C (50°F) and pilot injection is ON. GO TO ❺ **YES:** Engine coolant temperature is above 10°C (50°F). GO TO ❺ **NO:** Pilot Injection should be ON if the ECT is below 10°C (50°F). If Pilot Injection is OFF under this condition, determine problem in the ECT sensor circuit.

– – –1/1

❺ **Glow Plug Check**	1. Ignition ON, engine OFF. 2. Read fuel temperature Is fuel temperature above 0°C (32°F)?	**YES:** GO TO ❻ **NO:** See A2 - GLOW PLUG CHECK DIAGNOSTIC PROCEDURE later in this Group.

– – –1/1

❻ **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 ❼ – – –1/1

❼ **EI Cap Screw and EI 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 EI rocker arms and valve rocker arm operation. *NOTE: Verify that hold down clamps are positioned correctly.* 4. Check that the hold down clamp cap screws on all EIs are tightened and torque turned to specification. See INSTALL ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 5. Inspect EI harness and EI harness connector for damage. 6. When diagnostics are completed, reassemble the rocker arm cover and tighten to specifications. Are all components in proper working order?	**YES:** GO TO ❽ **NO:** Repair faulty component and retest. – – –1/1

❽ **Pump Position Timing Check**	Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING later in this Group. Is the pump position timing correct?	**YES:** GO TO ❾ **NO:** Adjust timing and retest. – – –1/1

❾ **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 ❿ **NO:** Replace EGR valve and retest. – – –1/1

10 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 11 – – –1/1

11 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 number of engine that will not start. For instructions on downloading a payload file, see DOWNLOADING PAYLOAD FILE FOR SERVICE ADVISOR™ later in this Group of the manual. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Program the ECU using the payload file downloaded for this engine. For instructions on programming the ECU, see REPROGRAMMING ENGINE CONTROL UNIT (ECU) WITH SERVICE ADVISOR™later in this Group of the manual. 5. Ignition OFF for 2 minutes. 6. Ignition ON, engine cranking Does the engine start?	**YES:** New software repaired ECU. **NO:** Faulty ECU.

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E2 - Engine Misfires/Runs Irregularly

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E2 - Engine Misfires/Runs Irregularly Diagnostic Procedure

– – –1/1

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

– – –1/1

❷ **Active DTC Test**	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 and active DTCs?	**YES:** Diagnose active DTCs first. If any of the DTCs have an SPN of 636 or 637, diagnose those first. **NO:** GO TO ❸

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❸ **Engine Performance Check**	1. Ignition ON, engine idling 2. Observe engine performance Is the engine running rough?	**YES:** GO TO ❻ **NO:** GO TO ❹

– – –1/1

❹ **Recreate Conditions**	Operate engine under conditions where the miss/rough running complaint occurs. Is the engine running rough?	**YES:** GO TO ❺ **NO:** No problem found. Verify complaint and try to reproduce conditions of miss/rough running complaint. – – –1/1

❺ **Active DTC Test With Engine Running Rough**	Read DTCs using the diagnostic software while engine is operating under conditions where the miss/rough running complaint occurs. Does the diagnostic software display and active DTCs?	**YES:** Diagnose active DTCs first. If any of the DTCs have an SPN 636 or 637, diagnose those first. **NO:** GO TO ❻ – – –1/1

❻ **Compression Test**	1. Using the Service ADVISOR, perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 of this manual. 2. Make note of the results. Do all cylinder score within 10% of each other?	**YES:** GO TO ❼ **NO:** GO TO ❼ – – –1/1

❼ **Misfire Test**	1. Using the Service ADVISOR, perform the Misfire Test. For instructions, see ENGINE TEST INSTRUCTIONS - MISFIRE TEST in Section 04, Group 160 of this manual. 2. Make note of the results. Do all cylinder score within 10% of each other?	**YES:** GO TO ❽ **NO:** Each test had different cylinder(s) score 10% or more lower than the rest. GO TO ❾ **NO:** The same cylinder(s) score 10% or more lower than the rest on both the Compression Test and the Misfire Test. GO TO ❿ **NO:** All cylinders scored within 10% of the rest on the Compression Test and 10% or more lower than the rest on the Misfire Test. Replace the EI(s) of the cylinder(s) that tested low on the Misfire Test. – – –1/1
❽ **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 ⓫ – – –1/1
❾ **Inconclusive Test Results**	These types of results indicate either the Misfire Test or Compression Test could not operate correctly. Further engine diagnostics should be performed to determine if the engine misfire is caused by a faulty EI or by a compression problem. Do you have inconclusive test results?	**YES:** Rerun tests and verify results. **NO:** GO TO ❼ – – –1/1
❿ **Low Compression Pressure Check**	Determine the cause of low compression pressure on the low scoring cylinders. Was cause of low compression found?	**YES:** Repair and retest. **NO:** GO TO ❼ – – –1/1
⓫ **Valve Clearance Test**	Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104). Valve clearance on all valves within specification?	**YES:** GO TO ⓬ **NO:** Adjust valve clearance. – – –1/1

12 EI Cap Screw and EI 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 EI rocker arms and valve rocker arm operation. *NOTE: Verify that hold down clamps are positioned correctly.* 4. Check that the hold down clamp cap screws on all EIs are tightened and torque turned to specification. See INSTALL ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 5. Inspect EI harness and EI harness connector for damage. 6. When diagnostics are completed, reassemble the rocker arm cover and tighten to specifications. Are all components in proper working order?	**YES:** GO TO 13 **NO:** Repair faulty component and retest. – – –1/1

13 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 14 **NO:** Replace EGR valve and retest. – – –1/1

14 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 15 – – –1/1

15 Verification Check	1. Ensure there are no engine mechanical problems. 2. Ensure there is not something drawing excessive engine power. Was the problem found?	**YES:** Repair and retest. **NO:** See E3 - ENGINE DOES NOT DEVELOP FULL POWER DIAGNOSTIC PROCEDURE in this Group. – – –1/1

E3 - Engine Does Not Develop Full Power

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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

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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 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

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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 manual. 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 manual. 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

8 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 9 **NO:** Refer to your machine manual and perform the throttle calibration procedure; then retest. – – –1/1

9 Turbocharger Boost Pressure Check	Check Turbo Boost pressure. See MEASURE INTAKE MANIFOLD PRESSURE (TURBOCHARGER BOOST/POWER CHECK) in Section 04, Group 150 of 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM104). Is the intake manifold air pressure in range or above boost specification?	**YES:** See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group. **NO:** GO TO 10 – – –1/1

10 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 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104). Was the problem found?	**YES:** Repair problem and retest. **NO:** GO TO 11 – – –1/1

11 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 12 – – –1/1

12 EI Cap Screw and EI 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 EI rocker arms and valve rocker arm operation. *NOTE: Verify that hold down clamps are positioned correctly.* 4. Check that the hold down clamp cap screws on all EIs are tightened and torque turned to specification. See INSTALL ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 5. Inspect EI harness and EI harness connector for damage. Are all components in proper working conditions?	**YES:** GO TO 13 **NO:** Repair faulty component and retest. – – –1/1

13 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 14 **NO:** Replace ERG valve and retest. – – –1/1

14 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 15 – – –1/1

15 Valve Clearance Check	Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104). Valve clearance on all valve within specification?	**YES:** Faulty high pressure fuel pump OR Faulty ECU. **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 4.5L/6.8L - L1 - EXCESSIVE OIL CONSUMPTION in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104)

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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
		– – –1/1
❷ **Head Gasket Test**	Check for failed head gasket. See CHECK FOR HEAD GASKET FAILURES in Section 04, Group 150 of 4.5L and 6.8L Diesel Engines Base Engine Manual (CTM 104). Is the head gasket in good working condition?	**YES:** GO TO ❸ **NO:** See HEAD GASKET INSPECTION AND REPAIR SEQUENCE in Group 021 of 4.5 L & 6.8 L Diesel Engines Base Engine Manual (CTM 104).
		– – –1/1
❸ **Compression Test**	1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 manual. 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.

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❹ **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 ❺ **NO:** See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group. – – –1/1

❺ **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 ❻ **NO:** See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group. – – –1/1

❻ **Valve Clearance Check**	Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104).	**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 4.5L/6.8L - L1 - EXCESSIVE OIL CONSUMPTION in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).

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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 (TURBOCHARGED ENGINES) in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104) Intake and/or exhaust restriction found?	**YES:** Repair or replace components as necessary. **NO:** GO TO ❸
		– – –1/1
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 in 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104). Was the problem found?	**YES:** Repair problem and retest. **NO:** GO TO ⓫
		– – –1/1

❹ **Valve Clearance Check**	Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104). 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 AND ADJUST 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 up	Check by rotating engine by hand.

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E7 - Engine Idles Poorly

Symptom	Problem	Solution
E7 - Engine Idles Poorly	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Air leak on suction side of air intake system	Check hose and pipe connections for tightness; repair as required. See AIR INTAKE AND EXHAUST SYSTEM SPECIFICATIONS in Section 06, Group 200 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104).
	Electronic control system problem or basic engine problem	See E2 - ENGINE MISFIRE/RUNS IRREGULARLY DIAGNOSTIC PROCEDURE earlier in this Group.

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E8 - Abnormal Engine Noise

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

Continued on next page

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

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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 manual.

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E10 - Analog Throttle (B) Does Not Respond

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

Symptom	Problem	Solution
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 manual.

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F1 - Fuel Supply System Check

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F1 - Fuel Supply System Check Diagnostic Procedure

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❶ **F1 - Preliminary Check**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. If fuel system has been recently opened (filter changed, line removed etc.) perform fuel system bleed procedure. See BLEED THE FUEL SYSTEM later in this Group and retest. 2. Check for ruptured fuel lines. 3. Check for restricted vent in fuel tank. 4. Ensure fuel quantity and quality are OK. See CHECK FUEL SUPPLY QUALITY later in this Group. Was the problem found?	**YES:** Repair and retest **NO:** GO TO ❷

– – –1/1

❷ **Active DTC Test**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR in Section 04, Group 160 earlier in this manual. 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 or running 6. Read DTCs using SERVICE ADVISOR™. Does the diagnostic software connect and display any active DTCs?	**YES:** Diagnose active DTCs first. If any of the DTCs have a SPN 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 DIAGNOSTIC PROCEDURE later in this Group.

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❸ **Engine Start Test**	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Ignition ON, engine cranking Does the engine start?	**YES:** GO TO ⓭ **NO:** GO TO ❹ – – –1/1
❹ **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:** Bleed the fuel system. See BLEED THE FUEL SYSTEM later in this Group. **NO:** GO TO ❺ – – –1/1
❺ **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. Using the ECU diagnostic software, read fuel rail pressure - actual. Is the fuel rail pressure - actual 20 MPa (200 bar) (2900 psi) or above?	**YES:** No fuel system problem is apparent. See E1- ENGINE CRANKS/WON'T START DIAGNOSTIC PROCEDURE earlier in this Group. **NO:** GO TO ❻ – – –1/1
❻ **Fuel Pressure at 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 OFF 2. Connect proper pressure gauge from Universal Pressure Kit JT05412 to diagnostic port on final fuel filter base. 3. Ignition ON, engine cranking 4. Using gauge, read pressure Is the fuel pressure 30 kPa (0.3 bar) (4.4 psi) or above?	**YES:** GO TO ⓾ **NO:** GO TO ❼ – – –1/1
❼ **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 OFF 2. Replace the final fuel filter element. See REPLACE FINAL FUEL FILTER ELEMENT in Section 02, Group 090 earlier in this manual. 3. Ignition ON, engine cranking or running at low idle. 4. Using the ECU diagnostic software, read fuel rail pressure - actual. Is the fuel rail pressure - actual 20 MPa (200 bar) (2900 psi) or above?	**YES:** Problem fixed. **NO:** GO TO ❽ – – –1/1

8 Pre-filter Check	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Replace the pre-filter element. See REPLACE PRE-FILTER ELEMENT in Section 02, Group 090 earlier in this manual. 3. Connect proper pressure gauge from Universal Pressure Kit JT05412 to diagnostic port on final fuel filter base. 4. Ignition ON, engine cranking or running at low idle. 5. Using gauge, read pressure Is the fuel pressure 30 kPa (0.3 bar) (4.4 psi) or above?	**YES:** Problem fixed. **NO:** GO TO 9 – – –1/1

9 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 line between the following: • Fuel tank and pre-filter • Pre-filter and transfer pump inlet • Transfer pump outlet and final fuel filter inlet Are there any fuel restrictions?	**YES:** Repair fuel line and retest. **NO:** GO TO 10 – – –1/1

10 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 line between the final fuel filter outlet and the high pressure fuel pump inlet Are there any fuel restrictions?	**YES:** Repair fuel line and retest. **NO:** GO TO 11 – – –1/1

11 High Pressure Fuel Pump Inlet Filter Check	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* 1. Ignition OFF 2. Remove high pressure fuel pump from engine. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP in Section 02, Group 090 of this manual. 3. Remove high pressure fuel pump inlet filter and replace. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP INLET FILTER in Section 02, Group 090 of this manual. 4. Install high pressure fuel pump. See REMOVE AND INSTALL HIGH PRESSURE FUEL PUMP in Section 02, Group 090 of this manual. 5. Bleed the fuel system. See BLEED THE FUEL SYSTEM later in this Group. 6. Try to start engine Does the engine start?	**YES:** Problem fixed. **NO:** GO TO 12 – – –1/1

12 High Pressure Fuel Pump Overflow Valve Check	1. Ignition OFF 2. Disconnect the fuel return line from the high pressure fuel pump overflow valve. 3. Connect a clear hose to the overflow valve routing the other end into a suitable container for diesel fuel. 4. Ignition ON, engine cranking. Is fuel flow present through overflow valve?	**YES:** Faulty high pressure fuel pump. Replace and retest **NO:** Faulty check valve. Replace check valve and bleed the fuel system. See BLEED THE FUEL SYSTEM later in this Group. Retest – – –1/1

13 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. Using the ECU diagnostic software, read fuel rail pressure - actual with engine at low idle Is the fuel rail pressure - actual 35 MPa (350 bar) (5076 psi) or above?	**YES:** No fuel system problem found. **NO:** GO TO 14 – – –1/1

14 Fuel Pressure at 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 OFF 2. Connect proper pressure gauge from Universal Pressure Kit JT05412 to diagnostic port on final fuel filter base. 3. Ignition ON, engine running at low idle 4. Using gauge, read pressure Is the fuel pressure 40 kPa (0.4 bar) (5.8 psi) or above?	**YES:** GO TO 15 **NO:** GO TO 16 – – –1/1

15 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 more than minimal fuel flow present?	**YES:** GO TO 16 **NO:** Faulty pressure limiter valve. Replace pressure limiter and retest. See REMOVE AND INSTALL PRESSURE LIMITER in Section 02, Group 090 earlier in this manual. – – –1/1

16 Final Fuel Filter Check	*NOTE: For fuel system operation information, see FUEL SYSTEM OPERATION in Section 03, Group 130 earlier in this manual.* Replace the final fuel filter element and read fuel rail pressure - actual on the ECU diagnostic software. See REPLACE FINAL FUEL FILTER ELEMENT in Section 02, Group 090 earlier in this manual. Is the fuel rail pressure - actual 35 MPa (350 bar) (5076 psi) or above?	**YES:** Problem fixed. **NO:** Faulty high pressure fuel pump OR Faulty ECU – – –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.
	Exhaust Gas Recirculation (EGR) valve sticking or restricted	Repair or replace the EGR valve.

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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

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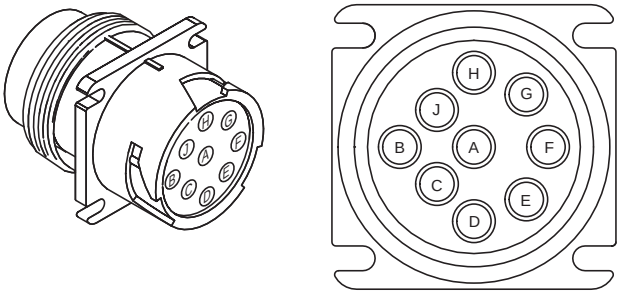
D1 - ECU Does Not Communicate with Service ADVISOR Diagnostic Procedure

– – –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:** Grounded 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

RG41221,00000FF –19–31MAR05–1/1

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 earlier in this Group. – – –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 ELECTRONIC CONTROL SYSTEM OVERVIEW 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

9 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 10 **NO:** Faulty or missing CAN terminator connector(s) OR Open or short in CAN wiring harness – – –1/1

10 CAN High and Low Voltage Test	*NOTE: For wiring 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

A2 - Glow Plug Check

RG41221,0000102 –19–02MAY06–1/1

A2 - Glow Plug Check Diagnostic Procedure

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

Alarm Level:
N/A

Control Unit Response:
Engine will start hard or will not start at all.

Additional References:
For further glow plug information, see GLOW PLUG OPERATION earlier in this Group.

For application specific information on glow plug times vs. temperatures, 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 GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors, glow plug relay connector(s), glow plug connectors , and any connectors between them looking for dirty, damaged, or poorly positioned terminals. Was the problem found?	**YES:** Repair faulty connection(s). **NO:** GO TO ❷

– – –1/1

❷ **Glow Plug Indicator Light Check**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Verify that the glow plug indicator light or monitor message is working Does the light illuminate or the monitor work?	**YES:** GO TO ❸ **NO:** Faulty glow plug indicator light wiring OR Faulty glow plug indicator light

– – –1/1

❸ **Active DTC Test**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR in Group 160 later in this manual. 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 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

❹ **Fuel Temperature Check**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the ECU diagnostic software, read fuel temperature. Is the fuel temperature below 0°C (32°F)?	**YES:** GO TO ❺ **NO:** No glow plug-related problem found

❺ **Voltage at Air Heater Check**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect all glow plug connectors 3. Using a multimeter, measure the voltage between each glow plug connector and a good chassis ground while turning ignition ON (engine OFF). *NOTE: Voltage must be read as ignition is turned ON. Between measurements the ignition switch must be cycled OFF and back ON.* Is the voltage at or near battery voltage?	**YES:** GO TO ❻ **NO:** GO TO ❼

❻ **Glow Plugs Check**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Remove glow plugs from engine. 3. Using a multimeter, check the continuity of the glow plug(s) Is there good continuity through the glow plug?	**YES:** No glow plug related problem found **NO:** Faulty glow plug(s) – – –1/1

❼ **Glow Plug Control Relay Enable Wire Check**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect glow plug control relay enable wire at terminal 86 of the glow plug control relay. *NOTE: Check will not work if fuel temperature is above 0°C (32°F).* 3. Using a multimeter, measure the voltage between the glow plug control relay enable wire at terminal 86 of the glow plug control relay and a good chassis ground while turning ignition ON (engine OFF). *NOTE: Voltage must be read as ignition is turned ON. Between measurements the ignition switch must be cycled OFF and back ON.* Is the voltage at or near battery voltage?	**YES:** GO TO ❽ **NO:** Faulty glow plug control relay enable wire OR Faulty ECU – – –1/1

❽ **Glow Plug Relay Enable Wire Check**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Disconnect glow plug relay enable wire at glow plug relay *NOTE: Check will not work if fuel temperature is above 0°C (32°F).* 3. Using a multimeter, measure the voltage between glow plug relay enable wire at glow plug relay and a good chassis ground while turning ignition ON (engine OFF). *NOTE: Voltage must be read as ignition is turned ON. Between measurements the ignition switch must be cycled OFF and back ON.* Is the voltage at or near battery voltage?	**YES:** Faulty battery voltage wire to glow plug relay OR Faulty glow plug relay ground OR Faulty glow plug harness wiring (between glow plug relay and glow plugs) OR Faulty glow plug relay **NO:** Faulty glow plug relay enable wire OR Faulty glow plug control relay ground OR Faulty battery voltage wire to glow plug control relay OR Faulty glow plug control relay

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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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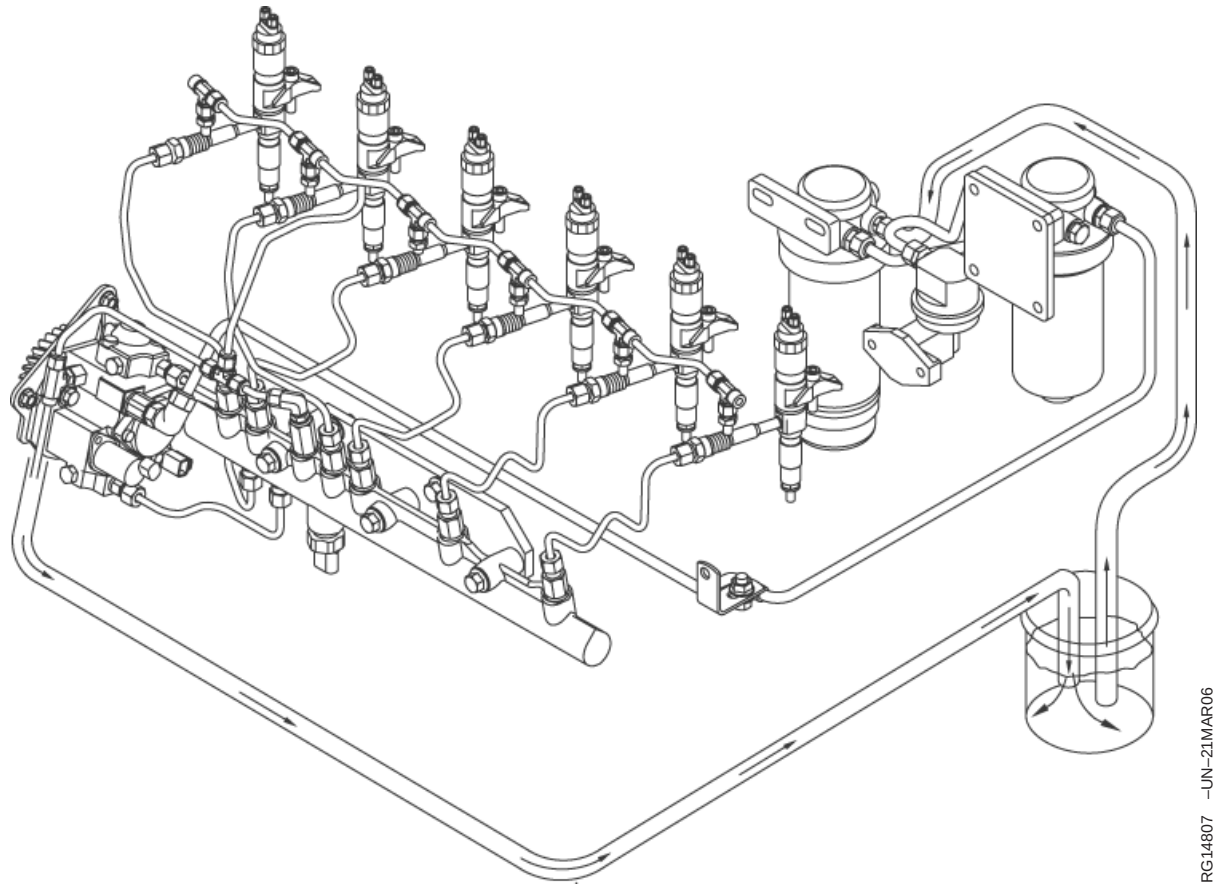
DB92450,0000065 –19–23MAR06–1/2



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.

DB92450,0000065 –19–23MAR06–2/2

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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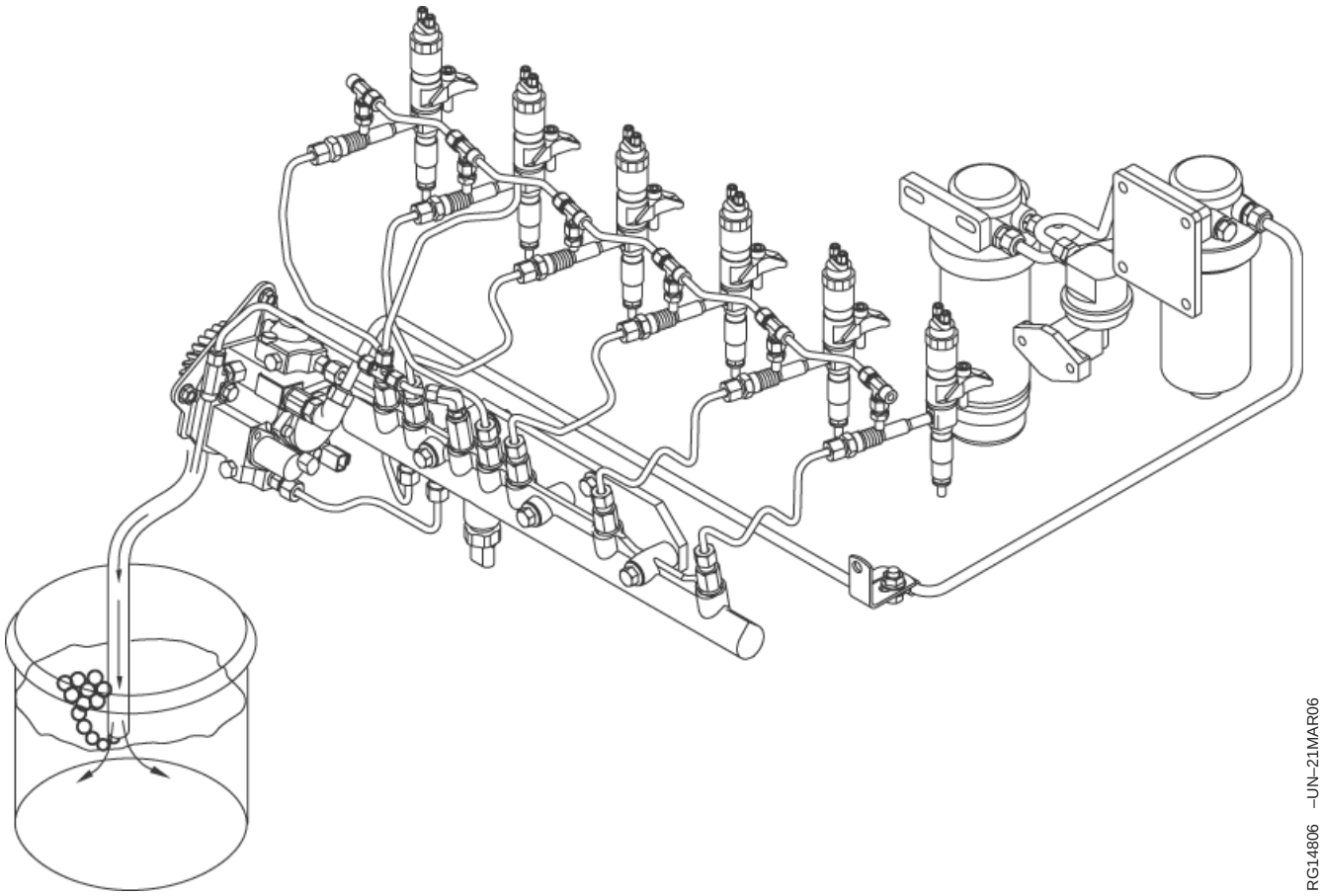


RG14806 –UN–21MAR06

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.

DB92450,0000066 –19–23MAR06–3/3

Check Fuel Supply Pressure

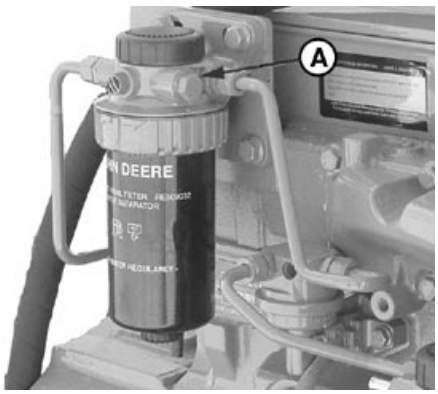
IMPORTANT: Before disconnecting and fuel lines, completely clean any debris from around the fitting. DO NOT allow debris to enter fuel line.

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

Specification

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

A—Final Fuel Filter Outlet

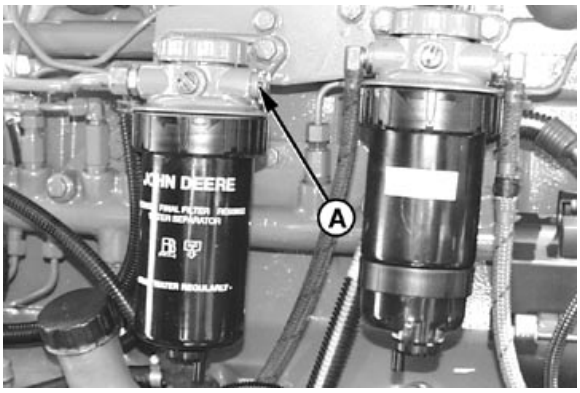


RG12452C –UN–23JUL02

Final Fuel Filter (OEM engines)

RG12345C –UN–23JUL02

Final Fuel Filter (Combine engines)



RG12344C –UN–23JUL02

Final Fuel Filter (6020 Tractors)

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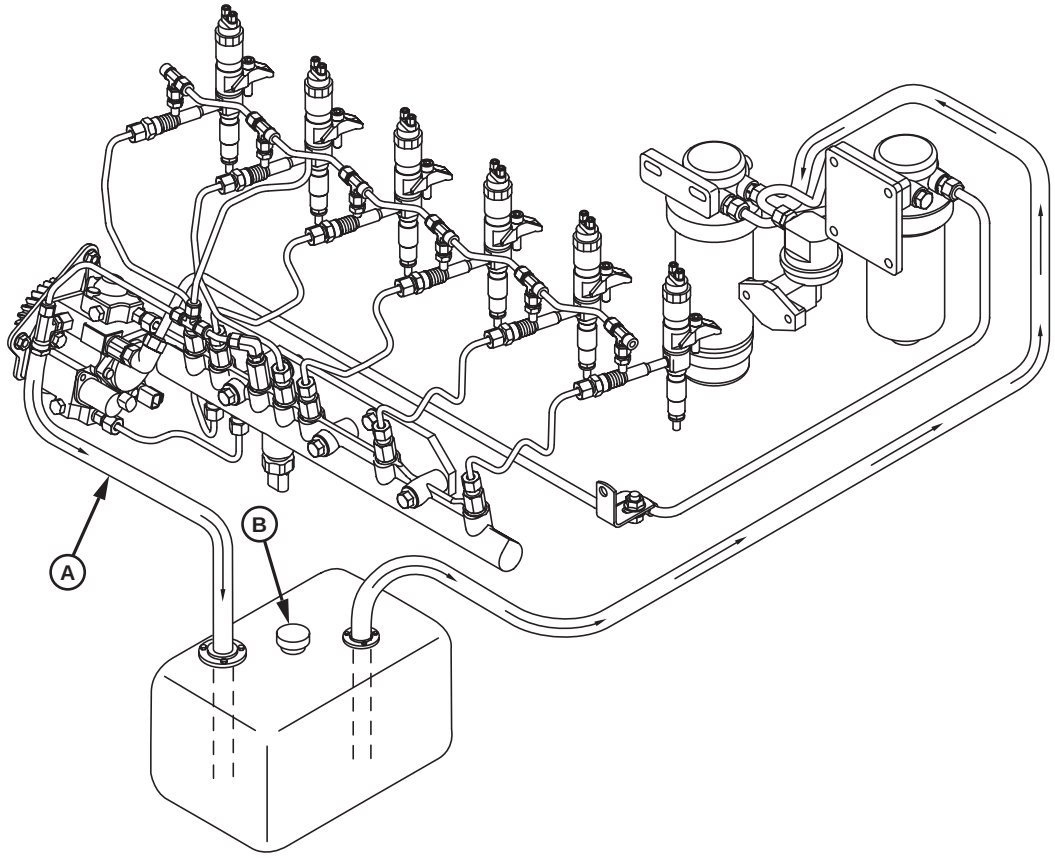
Check for Restricted Fuel Leak-off Line



RG12311 –UN–24JUN02

A—Fuel Leak-off Line **B—Fuel Tank Cap**

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

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

Continued on next page

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

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

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

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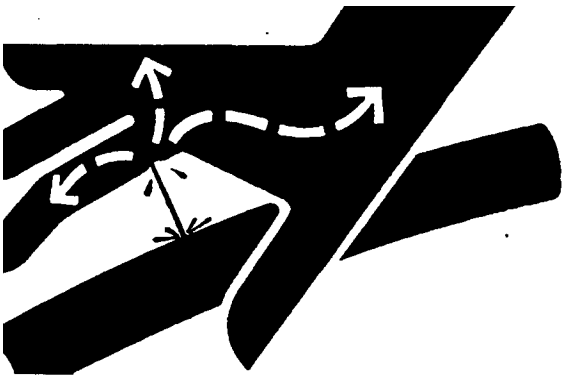
Bleed the Fuel System



X9811 –UN–23AUG88

High Pressure Fluids

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

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

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

RG41221,0000107 –19–31MAR05–1/2

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

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

RG12220 –UN–24MAY02

A—Bleed Vent Screw

RG41221,0000107 –19–31MAR05–2/2

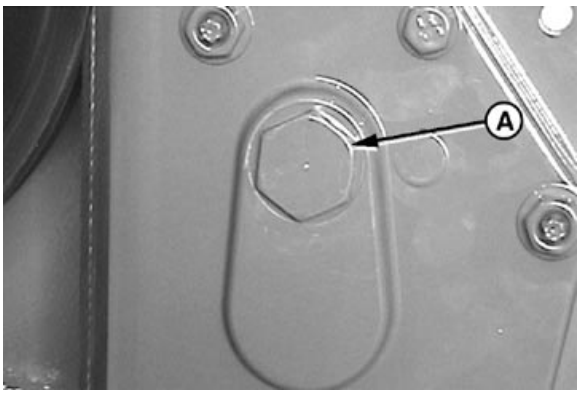
Check and Adjust High Pressure Fuel Pump Static Timing

1. Rotate engine with JDG820 Flywheel Turning Tool until JDE81-4 Timing Pin engages timing hole in flywheel. Engine should be at No.1 “TDC-Compression”.

2. Verify engine is at No.1 “TDC-Compression”. Remove screw (A) for window on injection pump gear. A marked line on the gear (B) should be visible through the window.

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

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



High pressure pump window screw

High pressure pump gear timing mark

RG41221,0000108 –19–31MAR05–1/1

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About This Group

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

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

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

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

To help diagnose electronic control system problems, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual. It contains useful information, such as system wiring schematic and ECU terminal identification.

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

NOTE: Instruction is given throughout the diagnostic charts to make resistance and voltage measurements in the ECU/Cab connector and the ECU/Engine connector. Note that these measurements are always made in the harness end of the connector. Measurements should never be made in the ECU end of the connection.

RG41221,00001DC –19–03APR05–1/1

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

RG41221,00001DD –19–03APR05–1/1

Using a Digital Multimeter

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

Instructions for measuring voltages take the following form:

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

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

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

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

RG11126 –UN–19JUN00

Digital Multimeter

RG41221,00001DE –19–03APR05–1/1

Electrical Circuit Malfunctions

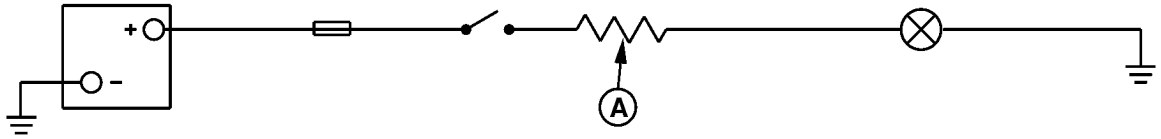
Circuit Malfunctions

There are four major circuit malfunctions. They are:

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

RG41221,00001DF –19–03APR05–1/6

RG9891 –UN–06JAN99



High Resistance Circuit

A—Unwanted Resistance

Definition of Circuit Malfunctions

1. **High Resistance Circuit:**
   A circuit having unwanted resistance (A) that causes a voltage drop and reduces current flow.

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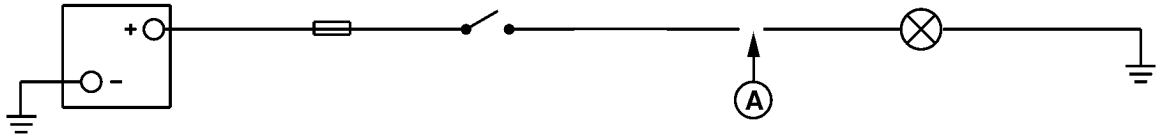
RG9892 –UN–06JAN99



Open Circuit

A—Break or Separation in Circuit

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

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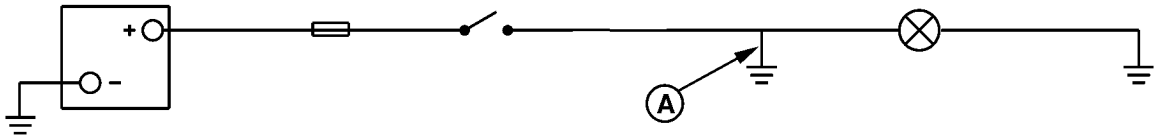
RG9893 –UN–06JAN99



Grounded Circuit

A—Voltage Wire in Contact with Machine Frame

3. **Grounded Circuit:**
   A voltage wire in contact with the machine frame (A), providing continuity with the battery ground terminal.

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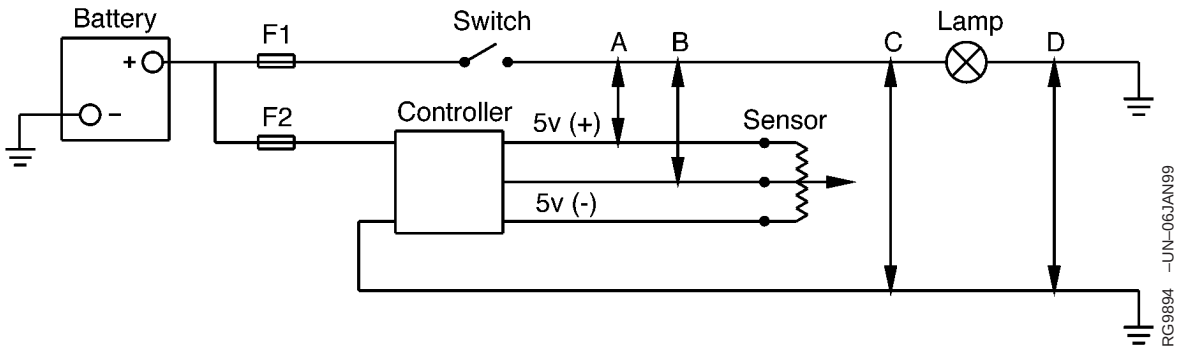

Shorted Circuit

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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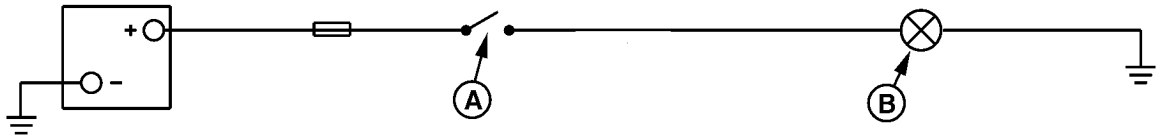

Locations of Circuit Malfunctions

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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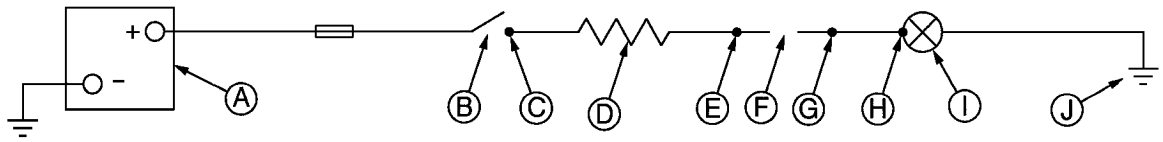

Troubleshooting Circuit Malfunctions

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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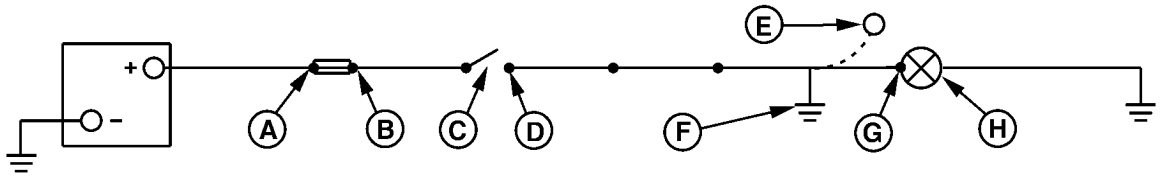
RG41221,00001E0 –19–03APR05–1/4

RG9897 –UN–06JAN99



Ground Circuit

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

3. **Ground Circuit:**

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

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

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

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

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

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

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

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

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

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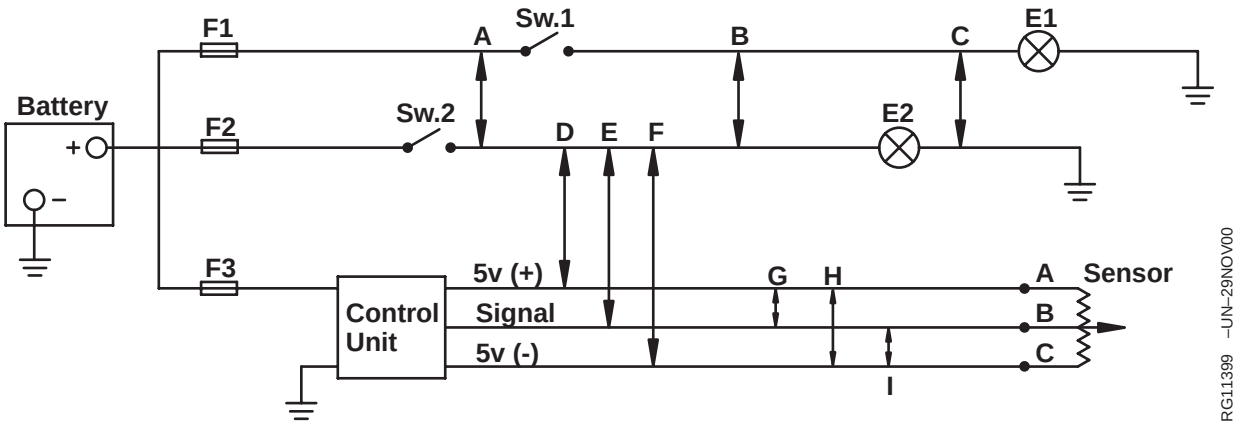
RG41221,00001E0 –19–03APR05–2/4



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

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.

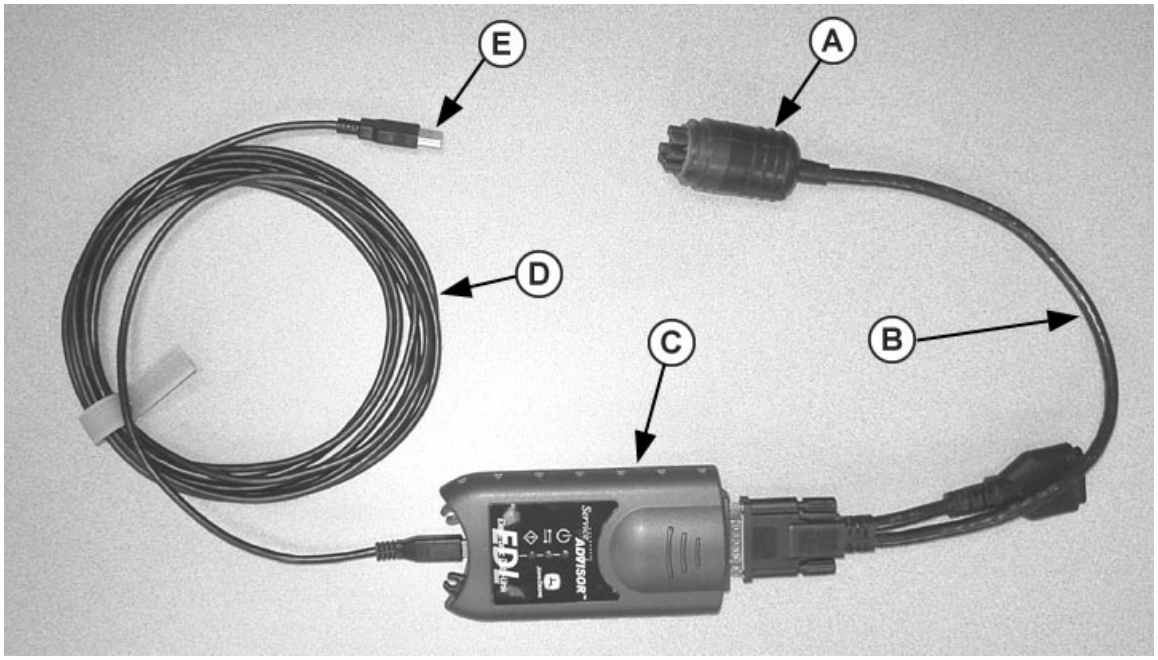
h. Perform an operational check-out on the component after completing the repair.

RG41221,00001E0 –19–03APR05–4/4

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
RG41221,00001E1 –19–02MAY06–2/5

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.

RG12277 –UN–22APR02

Power Adapter

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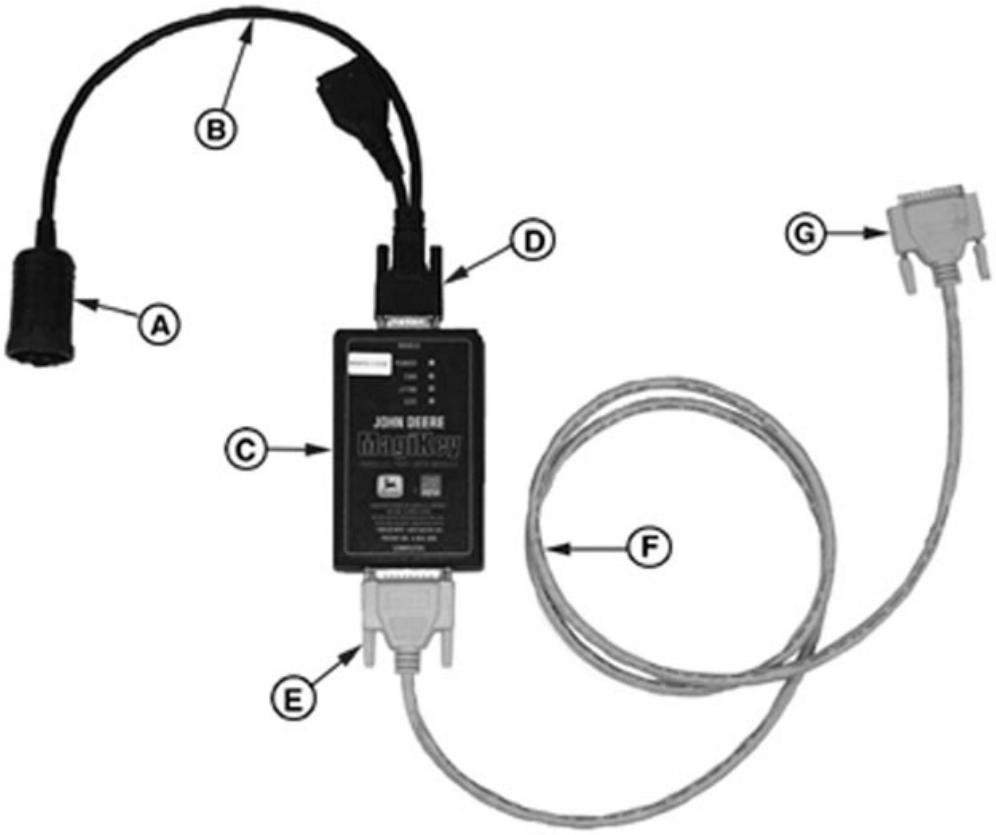
RG41221,00001E1 –19–02MAY06–3/5



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.

RG12277 –UN–22APR02

Power Adapter

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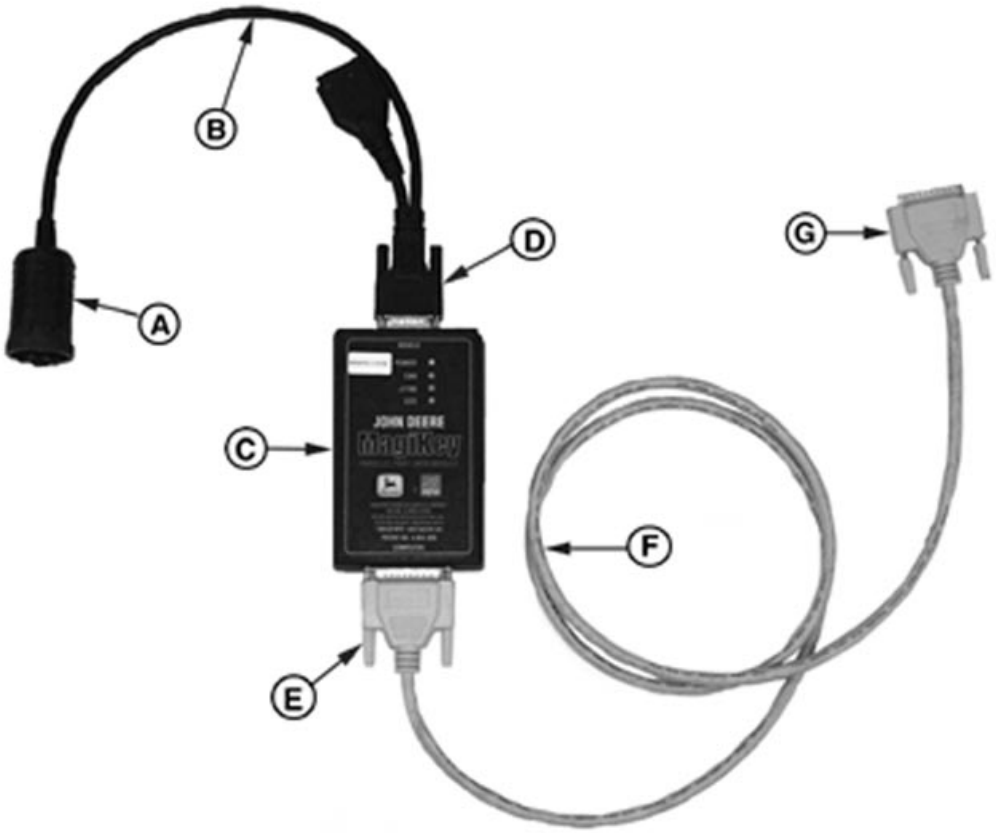
Connecting PC to the ECU



RG11737A –UN–18MAY01

Connecting a Computer to the ECU

A—Diagnostic Connector Mate
B—John Deere Controller Cable
C—MagiKey
D—26 Pin MagiKey Connector
E—25 Pin MagiKey Connector
F—PC Cable
G—PC Connector

The diagnostic connector is a black, circular connector with a square mounting flange and a dust cap. There are nine available pins. Depending on application, the location of the diagnostic connector may vary. On OEM the connector is located near the ECU on the engine wiring harness.

1. Locate diagnostic connector on engine and remove dust cap.
2. Connect John Deere Controller Cable (B) to the diagnostic connector on the engine harness using the diagnostic connector mate (A).
3. Connect the other end of the John Deere Controller Cable (B) to the MagiKey (C) module at the 26 pin MagiKey connector (D).
4. Connect the PC cable (F) to the MagiKey (C) module at the 25 pin MagiKey connector (E).
5. Connect the PC cable (F) to the computer through the PC connector (G).

Continued on next page

6. Key ON, engine off or running, verify that power light on MagiKey is illuminated green.
7. Connect to the application. The CAN light on the MagiKey should illuminate red when the connection to the ECU is made.
8. If power to the PDM is lost during cranking the engine for the Compression Test, use the Power Adapter. The Power Adapter connects between the PDM and the 26 pin MagiKey connector.
9. When finished, replace the dust cap on the diagnostic connector.

Power Adapter

RG41183,00000FC –19–02MAY06–2/2

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.

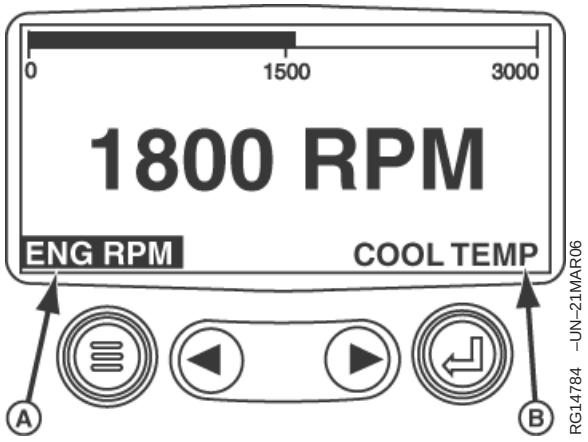


Figure 1. Normal Operation, Single-Parameter Display

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DB92450,000005F –19–25APR06–1/8

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

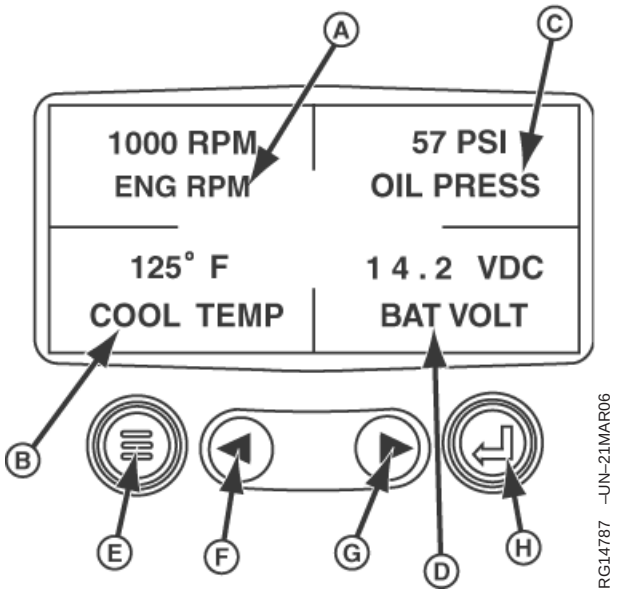

Figure 2. Normal Operation, Four-Parameter Display

DB92450,000005F –19–25APR06–2/8

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.

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

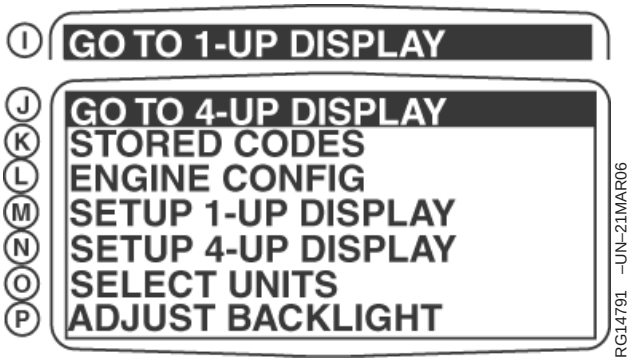

Figure 3. Main Menu, Select Go To 1 or 4-Up Display

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DB92450,000005F –19–25APR06–3/8

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)).

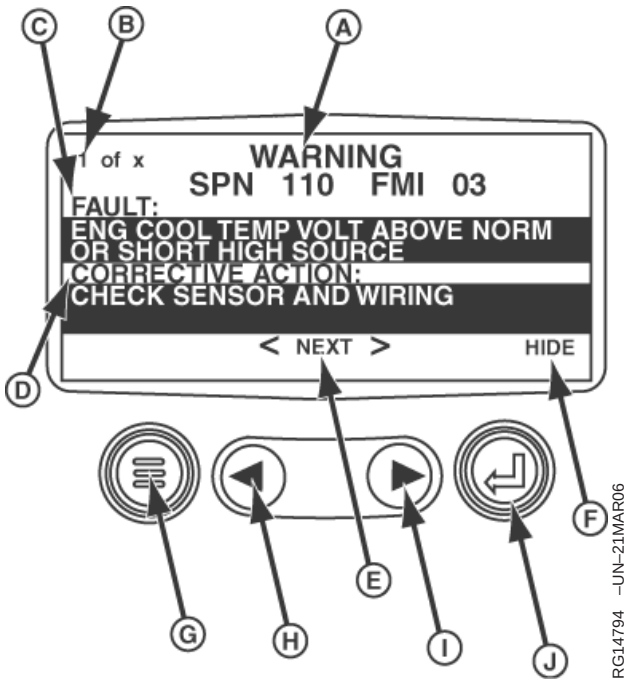

Figure 4. Active Trouble Codes Displayed

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

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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)

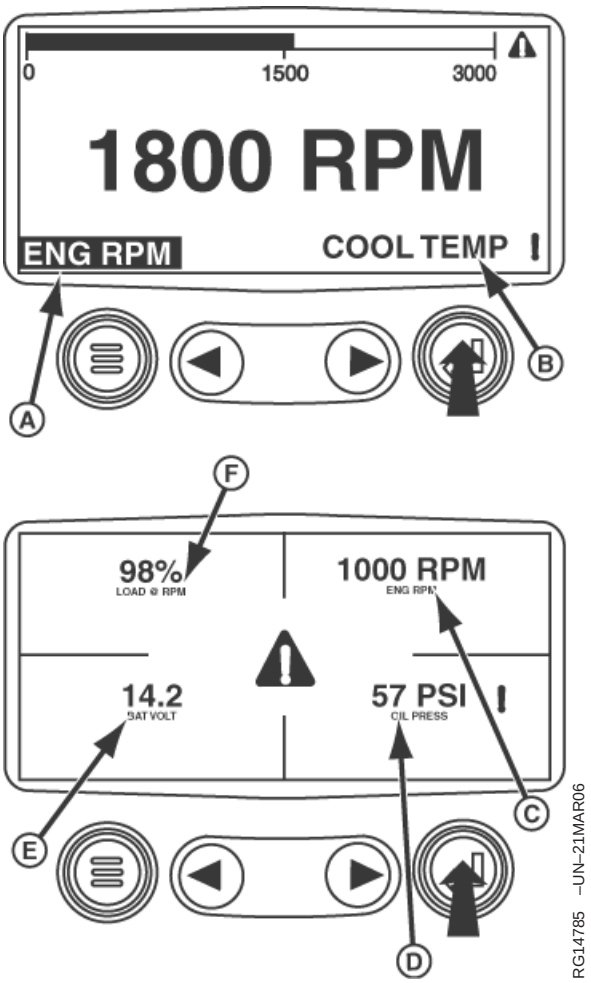

Figure 5. One and Four -Parameter Displays, With Icon Examples

DB92450,000005F –19–25APR06–5/8

RG14795 –UN–21MAR06

Figure 6. Indicates Fault Warning

DB92450,000005F –19–25APR06–6/8

RG14796 –UN–21MAR06

Figure 7. Indicates Engine Derate or Shutdown Condition Fault

DB92450,000005F –19–25APR06–7/8

RG14793 –UN–21MAR06

Figure 8. Indicates Auxiliary Gauge Fault

DB92450,000005F –19–25APR06–8/8

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.)

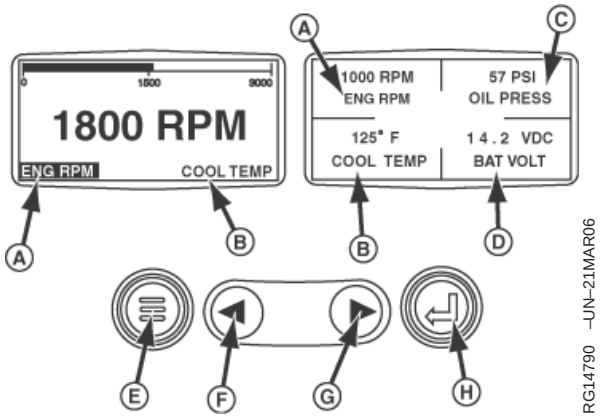

Figure 1. Normal Operation, Single and Four -Parameter Displays

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.

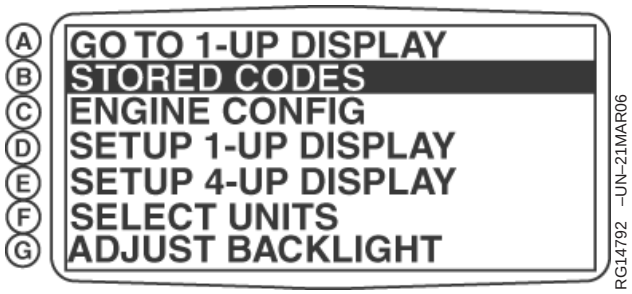

Figure 2. Main Menu, "Stored Codes" Item Highlighted

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.

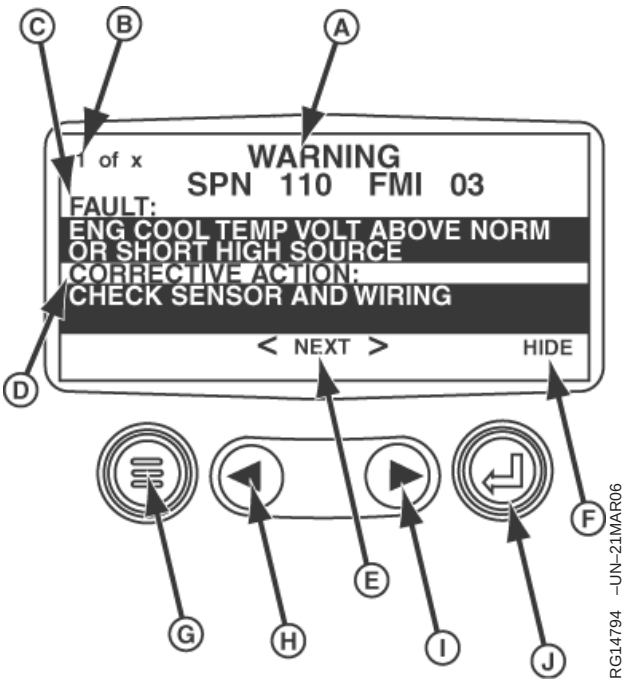

Figure 3. Fault Code Display Screen

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.

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

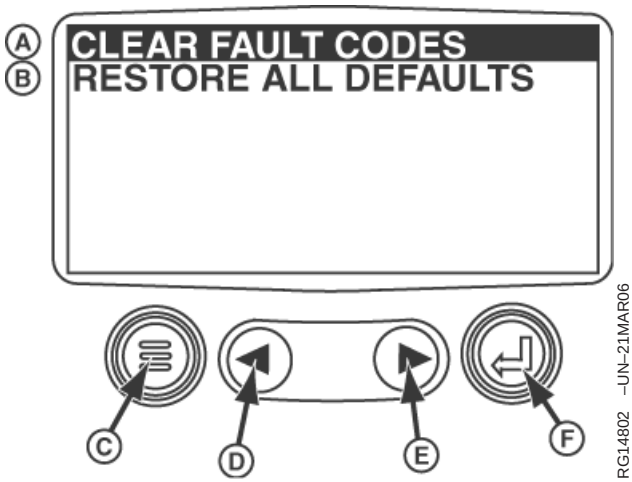

Figure 1. Clear Faults Restore Defaults

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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.

A—Cleared All Fault Codes

Figure 2. Cleared All Fault Codes Screen

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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 (C) 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.
Timing Position Improper Pattern Indicator	%	A "0" reading means that there is NO improper pattern.
Timing Position Input Noise Indicator	%	A "0" reading means that there is NO noise.
Timing Position Sensor Speed	rpm	The speed of the crank timing wheel.
Timing Position Status	N/A[a]	Indicates the ECU is receiving proper signal information from the sensor.
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.
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
[a]N/A = Not Applicable		

Continued on next page

Parameter	Units	Description
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.
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.
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.
[a]N/A = Not Applicable		

Continued on next page

Parameter	Units	Description
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.
Pump Position Sensor Input Noise Indicator	%	A "0" reading means that there is NO noise.
Pump Position Sensor Speed	rpm	The speed of the pump position timing wheel.
Position Sensor Status	N/A[a]	Indicates the ECU is receiving proper signal information from the sensor.
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.
[a]N/A = Not Applicable		

Continued on next page

Parameter	Units	Description
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.
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.
[a]N/A = Not Applicable		

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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”.

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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.

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NOTE: 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.
- 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.

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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.

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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.

   Any cylinder reading that is more than 10% greater than the rest indicates a possible injector leaking fuel into the cylinder.

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.

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

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 RESET 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 minimum. 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 –19–21JUN06–1/1

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

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 RESET 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 minimum. 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 –19–21JUN06–1/1

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

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

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

Diagnostic Trouble Codes (DTCs)

SPN/FMI CODES

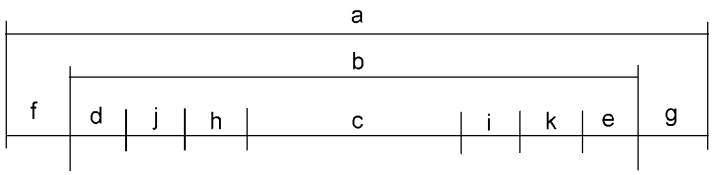
SPN/FMI codes are written from the SAE J1939 standard as a two-part code. The first part is called the Suspect Parameter Number (SPN). Typically, it contains between 2 and 4 digits. The SPN identifies the system or the component that has the failure; for example SPN 110 indicates a failure in the engine 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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Continued on next page

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

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

T1 — Multi-state Throttle Input High

The multi-state throttle input voltage exceeds the high voltage specification.

RG41221,00001F4 –19–02MAY06–1/1

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 **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 MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the multi-state throttle 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 MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the multi-state throttle through all positions. 7. Read DTCs using SERVICE ADVISOR™. 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.

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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. Install a jumper wire between both terminals of the switch connector on the instrument panel harness. 4. Ignition ON, engine OFF 5. Read DTCs using SERVICE ADVISOR™. Does 000091.03 reoccur?	**YES:** GO TO ❹ **NO:** Faulty multi-state throttle switch connector. OR Faulty multi-state throttle switch.

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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

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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 –19–02MAY06–1/1

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 **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 MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the multi-state throttle 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 MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the multi-state throttle through all positions. 7. Read DTCs using SERVICE ADVISOR™. 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.

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 using SERVICE ADVISOR™. Does 000091.04 reoccur?	**YES:** GO TO ❺ **NO:** GO TO ❹

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.

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 –19–02MAY06–1/1

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 **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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the analog throttle (A) 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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (A) through full travel. 7. Read DTCs using SERVICE ADVISOR™. 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.

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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 (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

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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.

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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.

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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 **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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the analog throttle (A) 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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (A) through full travel. 7. Read DTCs using SERVICE ADVISOR™. 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.

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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 (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

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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.

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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.

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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 **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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the analog throttle (B) 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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (B) through full travel. 7. Read DTCs using SERVICE ADVISOR™. 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.

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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

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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.

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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.

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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 **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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the analog throttle (B) 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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (B) through full travel. 7. Read DTCs using SERVICE ADVISOR™. 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.

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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 0.5 volts or less?	**YES:** GO TO ❺ **NO:** GO TO ❹

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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.

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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

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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.

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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 **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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the analog throttle (A) 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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (A) through full travel. 7. Read DTCs using SERVICE ADVISOR™. 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.

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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

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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

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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 using SERVICE ADVISOR™. Do additional DTCs set related to analog throttle (A)?	**YES:** Diagnose this code first. **NO:** Faulty ECU

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T23 — Multi-State Voltage Out of Range

Throttle voltage is above or below the specification.

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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 **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 MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the multi-state throttle 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 MULTI-STATE THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the multi-state throttle through full travel. 7. Read DTCs using SERVICE ADVISOR™. 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.

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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

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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

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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 using SERVICE ADVISOR™. Do additional DTCs set related to multi-state throttle?	**YES:** Diagnose this code first. **NO:** Faulty ECU

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T24 — Analog Throttle (B) Input Voltage Out of Range

Throttle voltage is above or below the specification.

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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 **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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the analog throttle (B) 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 ANALOG THROTTLE in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Move the analog throttle (B) through full travel. 7. Read DTCs using SERVICE ADVISOR™. 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.

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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

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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

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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 using SERVICE ADVISOR™. Do additional DTCs set related to analog throttle (B)?	**YES:** Diagnose this code first. **NO:** Faulty ECU

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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 –19–03APR05–1/1

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 –19–03APR05–1/1

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 –19–03APR05–1/1

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 –19–03APR05–1/1

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 –19–03APR05–1/1

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 –19–03APR05–1/1

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 –19–03APR05–1/1

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 –19–03APR05–1/1

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 –19–03APR05–1/1

000094.03 — Fuel Transfer Pump Pressure Input Voltage High

The fuel transfer pump pressure input voltage exceeds the sensor's high voltage specification.

RG41221,0000206 –19–02MAY06–1/1

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.

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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 FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* Perform a preliminary inspection of the ECU connectors and the fuel transfer pump pressure 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 FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. 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.

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❸ **Fuel Transfer Pump Pressure Signal Shorted 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 the fuel transfer pump pressure sensor connector. 3. Ignition ON, engine OFF 4. Using the ECU diagnostic software, read fuel transfer pump pressure input voltage. Is the voltage 0.1 volts or below?	**YES:** GO TO ❹ **NO:** Short to voltage in fuel transfer pump pressure sensor input circuit. OR Faulty ECU

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❹ **Fuel Transfer Pump Pressure Ground Circuit Open 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, engine OFF 2. Fuel transfer pump pressure sensor still disconnected. 3. Probe the fuel transfer pump pressure sensor connector ground terminal (terminal 1) on the engine harness with a test light connected to battery voltage. Does the light illuminate?	**YES:** Faulty fuel transfer pump pressure sensor. OR Faulty ECU connection OR Faulty ECU **NO:** Open in fuel transfer pump pressure sensor ground circuit. OR Faulty ECU connection OR Faulty ECU

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000094.04 — Fuel Transfer Pump Pressure Input Voltage Low

The fuel transfer pump pressure input voltage drops below the sensor's low voltage specification.

RG41221,0000207 –19–02MAY06–1/1

000094.04 — Fuel Transfer Pump Pressure Input Voltage Low Diagnostic Procedure

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 **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 FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* Perform a preliminary inspection of the ECU connectors and the fuel transfer pump pressure 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 FUEL TRANSFER PUMP PRESSURE SENSOR in Section 03, Group 140 earlier in this manual* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING 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 SERVICE ADVISOR™. 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 **Fuel Transfer Pump Pressure 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 the fuel transfer pump pressure sensor connector. 3. Install a jumper wire between fuel transfer pump pressure sensor 5V supply and input terminals (terminals 2 and 3) in the sensor connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read fuel transfer pump pressure input voltage. Is voltage below 4.5 volts?	**YES:** GO TO ❹ **NO:** GO TO ❺

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❹ **Fuel Transfer Pump Pressure 5V Supply 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 the jumper wire. 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between the 5V supply (terminal 2) of the fuel transfer pump pressure sensor connector on the engine harness and a good chassis ground. Is voltage above 4.0 volts?	**YES:** GO TO ❺ **NO:** Open in fuel transfer pump pressure sensor 5V supply circuit. OR Short to ground in fuel transfer pump pressure sensor 5V supply circuit. OR Faulty ECU connection OR Faulty ECU

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❺ **Fuel Transfer Pump Pressure Input Wire 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. Fuel transfer pump pressure sensor connector still disconnected. 3. Using a multimeter, measure resistance between terminal 3 in the fuel transfer pump pressure sensor connector on the engine harness and a good chassis ground. Is the resistance 5 ohms or less?	**YES:** Short to ground in fuel transfer pump pressure sensor input circuit. **NO:** GO TO ❻ – – –1/1

❻ **Fuel Transfer Pump Pressure Input Wire 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. Fuel transfer pump pressure sensor connector still disconnected. 3. Disconnect the ECU connector #J3. 4. Using a multimeter, measure resistance between terminal 3 in the fuel transfer pump pressure sensor connector and terminal C2 in ECU connector #J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Open in fuel transfer pump pressure sensor input circuit – – –1/1

000097.03 — Water in Fuel Signal Voltage High

The Water in Fuel input voltage exceeds the sensor's high voltage specification.

RG41221,0000208 –19–02MAY06–1/1

000097.03 — Water in Fuel Signal Voltage High Diagnostic Procedure

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Related Information:
The water in fuel voltage exceeds the maximum threshold. The voltage is higher than what is physically possible for the water in fuel sensor to achieve.

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 **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 WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the WIF 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 WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. Does 000097.03 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 **WIF 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. Install a jumper wire between both terminals in the WIF sensor connector on the engine harness. 4. Ignition ON engine OFF 5. Make note of all DTCs, then clear all DTCs. 6. Using the ECU diagnostic software, read DTCs. Does 000097.03 reoccur?	**YES:** GO TO ❸ **NO:** Faulty WIF sensor connector OR Faulty WIF sensor

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❹ **WIF Input 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. Remove jumper wire between both terminals. 3. Ignition ON, engine OFF 4. Using a multimeter, measure voltage between the WIF input terminal (terminal A) in the sensor connector on the engine harness and a good chassis ground. Does the voltage measure above 4.0 volts?	**YES:** Open in WIF sensor ground circuit OR Faulty ECU connector OR Fault ECU **NO:** Open in WIF sensor input circuit OR Faulty ECU connector OR Fault ECU

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000097.04 — Water in Fuel Signal Voltage Low

The Water in Fuel input voltage drops below the sensor's low voltage specification.

RG41221,0000209 –19–02MAY06–1/1

000097.04 — Water in Fuel Signal Voltage Low Diagnostic Procedure

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Related Information:
The water in fuel voltage drops below the minimum threshold. The voltage is lower than what is physically possible for the water in fuel sensor to achieve.

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 **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 WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the WIF 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 WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **WIF 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 connector. 3. Ignition ON, engine OFF 4. Make note of all DTCs, then clear all DTCs. 5. Using the ECUs diagnostic software, read DTCs. Does 000097.04 reoccur?	**YES:** Short to ground in WIF sensor input circuit OR Faulty ECU **NO:** Faulty WIF sensor

000097.16 — Water in Fuel Detected

The ECU detects water in fuel.

RG41221,000020A –19–02MAY06–1/1

000097.16 — Water in Fuel Detected Diagnostic Procedure

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Related Information:
The ECU detects water in fuel.

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 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.

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 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 **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 WATER IN FUEL (WIF) SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the WIF 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 **Moisture Buildup 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™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECUs diagnostic software. 4. Make note of all DTCs, then clear all DTCs. 5. Drain the sediment bowl of the primary fuel filter until all water is out. 6. Operate engine in normal use. 7. Read DTCs using SERVICE ADVISOR™. Does 000097.16 reoccur?	**YES:** GO TO ❸ **NO:** Problem was most likely caused by moisture build up over time. Monitor the sediment bowl periodically, drain as needed.
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❸ **Water in Fuel Test**	*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. Was cause of water in fuel determined?	**YES:** Repair problem, drain sediment bowl, and retest. **NO:** GO TO ❹ – – –1/1

❹ **Wiring 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 all three ECU connectors. 3. Using a multimeter, measure resistance between terminal D2 in ECU connector #J3 on the engine harness and the following: • A good chassis ground. • All other terminals in all ECU connectors. Are any measurements below 2000 ohms?	**YES:** Short to wire that measure less than 2000 ohms. OR Faulty WIF sensor connector. **NO:** GO TO ❺ – – –1/1

❺ **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 connector. 3. Drain all fuel and water from the water separator bowl on the bottom of the final fuel filter. 4. Using a multimeter, measure resistance between both terminals in the WIF sensor. Is the resistance between 200k and 240k ohms?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Faulty WIF sensor – – –1/1

000100.01 — Engine Oil Pressure Extremely Low

For engines with an oil pressure sensor, the ECU senses an extremely low oil pressure. For engines with an oil pressure switch, the ECU senses the oil pressure switch is open after the engine is above cranking RPM for several seconds.

RG41221,000020B –19–03APR05–1/1

000100.01 — Engine Oil Pressure Extremely Low Diagnostic Procedure

Related Information:
For engines with an oil pressure sensor, the ECU senses an extremely low engine oil pressure.
For engines with an oil pressure switch, the ECU senses the oil pressure switch is open after the engine is above cranking RPM for several seconds.

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 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 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 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 **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 OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the oil pressure 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 **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, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104). Is engine oil pressure below specification?	**YES:** See L2 - ENGINE OIL PRESSURE LOW diagnostic procedure in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104). **NO:** GO TO ❸ – – –1/1

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❸ **Oil Pressure 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 the oil pressure sensor connector and ECU connector #J3 on the engine harness. 3. Using a multimeter, measure resistance between the following: • Terminal 1 in the oil pressure sensor connector and terminal H3 in ECU connector #J3 on the engine harness. • Terminal 2 in the oil pressure sensor connector and terminal H4 in ECU connector #J3 on the engine harness. • Terminal 3 in the oil pressure sensor connector and terminal C3 in ECU connector #J3 on the engine harness. All measurements measure 5 ohms or less?	**YES:** Faulty oil pressure sensor. **NO:** GO TO ❹ – – –1/1

❹ **Oil Pressure Sensor 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 all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 3 (terminal C3, H3, or H4 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 200 ohms. **NO:** Open in wire that was more than 5 ohms in step 3 – – –1/1

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000100.03 — Engine Oil Pressure Input Voltage High

The oil pressure input voltage exceeds the sensor's high voltage specification.

RG41221,000020C –19–02MAY06–1/1

000100.03 — Engine Oil Pressure Input Voltage High Diagnostic Procedure

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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.

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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 OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the oil pressure 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 OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. 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.

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❸ **Oil Pressure Input Shorted 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. Ignition ON, engine OFF 4. Using the ECUs diagnostic software, read engine oil pressure input voltage. Is voltage 0.1 volts or below?	**YES:** GO TO ❹ **NO:** Short to voltage in oil pressure sensor input circuit. OR Faulty ECU

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❹ **Oil Pressure Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Probe the oil pressure sensor ground terminal (terminal 1) of the sensor connector on the engine harness with a test light connected to battery voltage. Does the light illuminate?	**YES:** Faulty oil pressure sensor OR Faulty ECU connection OR Faulty ECU. **NO:** Open in oil pressure sensor ground circuit OR Faulty ECU connection OR Faulty ECU

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000100.04 — Engine Oil Pressure Input Voltage Low

For oil pressure sensors, the oil pressure input voltage drops below the sensor's low voltage specification. For oil pressure switches, the oil pressure switch is closed when key is on and there is no engine speed.

RG41221,000020D –19–02MAY06–1/1

000100.04 — Engine Oil Pressure Input Voltage Low Diagnostic Procedure

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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.

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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 OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the oil pressure 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 OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **Oil Pressure 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 the oil pressure sensor connector. 3. Install a jumper wire between oil pressure sensor 5V supply and input terminals (terminals 2 and 3) in the sensor connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read engine oil pressure input voltage. Is voltage below 4.95 volts?	**YES:** GO TO ❹ **NO:** GO TO ❺

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❹ **Oil Pressure 5V Supply 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 the jumper wire. 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between the 5V supply (terminal 2) of the oil pressure sensor connector on the engine harness and a good chassis ground. Is voltage above 4.0 volts?	**YES:** GO TO ❺ **NO:** Open in oil pressure sensor 5V supply circuit OR Short to ground in oil pressure sensor 5V supply circuit OR Faulty ECU connection OR Faulty ECU

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❺ **Oil Pressure Input Wire 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. Oil pressure sensor connector still disconnected. 3. Using a multimeter, measure resistance between terminal 3 in the oil pressure sensor connector on the engine harness and a good chassis ground. Is the resistance 5 ohms or less?	**YES:** Short to ground in oil pressure sensor input circuit. **NO:** GO TO ❻ – – –1/1

❻ **Oil Pressure Input Wire 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. Oil pressure sensor connector still disconnected. 3. Disconnect the ECU connector #J3. 4. Using a multimeter, measure resistance between terminal 3 in the oil pressure sensor connector and terminal C3 in ECU connector #J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Open in oil pressure sensor input circuit – – –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 –19–03APR05–1/1

Engine Oil Pressure Moderately Low Diagnostic Procedure

Related Information:
The ECU senses an oil pressure below the warning value set point in the ECU. The warning value set point is dependent on engine speed.

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 **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 OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the oil pressure 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 **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, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104). Is engine oil pressure below specification?	**YES:** See L2 - ENGINE OIL PRESSURE LOW diagnostic procedure in Section 04, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104). **NO:** GO TO ❸ – – –1/1

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❸ **Oil Pressure 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 the oil pressure sensor connector and ECU connector #J3 on the engine harness. 3. Using a multimeter, measure resistance between the following: • Terminal 1 in the oil pressure sensor connector and terminal H3 in ECU connector #J3 on the engine harness. • Terminal 2 in the oil pressure sensor connector and terminal H4 in ECU connector #J3 on the engine harness. • Terminal 3 in the oil pressure sensor connector and terminal C3 in ECU connector #J3 on the engine harness. All measurements measure 5 ohms or less?	**YES:** Faulty oil pressure sensor. **NO:** GO TO ❹ – – –1/1

❹ **Oil Pressure Sensor 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 all three ECU connectors. 3. Using a multimeter, measure resistance between the terminal that measured above 5 ohms in step 3 (terminal C3, H3, or H4 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 200 ohms. **NO:** Open in wire that was more than 5 ohms in step 3 – – –1/1

000100.31 — Engine Oil Pressure Invalid

The ECU receives an engine oil pressure when engine speed is zero.

RG41221,000020F –19–02MAY06–1/1

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 **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 OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the oil pressure 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 OIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING 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 SERVICE ADVISOR™. Did 000100.31 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 **Oil Pressure Sensor Ground Wire 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 engine oil pressure sensor connector and the ECU connector #J3. 3. Using a multimeter, measure resistance between terminal 1 in the oil pressure sensor connector on the engine harness and a good chassis ground. Is resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open or short in oil pressure ground wire.

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❹ **Oil Pressure Sensor 5V Supply Wire 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. Engine oil pressure sensor connector and the ECU connector #J3 still disconnected. 3. Using a multimeter, measure resistance between terminal 2 in the oil pressure sensor connector and terminal H4 in the ECU connector #J3 on the engine harness. Is resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open or short in oil pressure 5V supply wire.

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❺ **Oil Pressure Sensor Input Wire 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. Engine oil pressure sensor connector and the ECU connector #J3 still disconnected. 3. Using a multimeter, measure resistance between terminal 3 in the oil pressure sensor connector and terminal C3 in the ECU connector #J3 on the engine harness. Is resistance 5 ohms or less?	**YES:** Faulty engine oil pressure sensor connector. Replace and retest. **NO:** Open or short in engine oil pressure sensor input wire. – – –1/1

000102.02 — Manifold Air Pressure Invalid

The ECU receives and invalid pressure from the manifold air pressure sensor.

RG41221,0000210 –19–02MAY06–1/1

000102.02 — Manifold Air Pressure Invalid Diagnostic Procedure

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Related Information:
The manifold air pressure sensor is invalid compared to the Barometric Air 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 **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 MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the manifold air pressure 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 MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. 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.

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❸ **Manifold Air Pressure Sensor Ground 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 the manifold air pressure sensor connector and the ECU connector #J3. 3. Using a multimeter, measure resistance between terminal 1 in the manifold air pressure sensor connector on the engine harness and a good chassis ground. Is resistance 5 ohms or less?	**YES:** GO TO ❹ **NO:** Open or short in manifold air pressure ground wire.

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❹ **Manifold Air Pressure 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. Engine manifold air pressure sensor connector and the ECU connector #J3 still disconnected. 3. Using a multimeter, measure resistance between terminal 2 in the manifold air pressure sensor connector and terminal H4 in the ECU connector #J3 on the engine harness. Is resistance 5 ohms or less?	**YES:** GO TO ❺ **NO:** Open or short to ground in manifold air pressure 5V supply wire.

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❺ **Manifold Air Pressure 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. Engine manifold air pressure sensor connector and the ECU connector #J3 still disconnected. 3. Using a multimeter, measure resistance between terminal 3 in the manifold air pressure sensor connector and terminal C4 in the ECU connector #J3 on the engine harness. Is resistance 5 ohms or less?	**YES:** Faulty manifold air pressure sensor. **NO:** Open or short in manifold air pressure sensor input wire. – – –1/1

000102.03 — Manifold Air Pressure Input Voltage High

The manifold air pressure input voltage exceeds the sensor's high voltage specification.

RG41221,0000211 –19–02MAY06–1/1

000102.03 — Manifold Air Pressure Input Voltage High Diagnostic Procedure

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Related Information:
The manifold ail 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 manifold air pressure.

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 **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 MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the manifold air pressure 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 MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. 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.

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❸ **Manifold Air Pressure Input Shorted 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 manifold air pressure sensor connector. 3. Ignition ON, engine OFF 4. Using the ECUs diagnostic software, read manifold air pressure input voltage. Is voltage below 0.1 volts?	**YES:** GO TO ❹ **NO:** Short to voltage in manifold air pressure sensor input circuit. OR Faulty ECU connection. OR Faulty ECU –––1/1

❹ **Manifold Air Pressure Ground Circuit Open Test**	*NOTE: For wiring and theory of operation, see MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Probe the manifold air pressure sensor ground terminal (terminal 1) of the sensor connector on the engine harness with a test light connected to battery voltage. Does the light illuminate?	**YES:** Faulty manifold air pressure sensor OR Faulty ECU connection OR Faulty ECU. **NO:** Open in manifold air pressure sensor ground circuit OR Faulty ECU connection OR Faulty ECU –––1/1

000102.04 — Manifold Air Pressure Input Voltage Low

The manifold air pressure input voltage drops below the sensor's low voltage specification.

RG41221,0000212 –19–02MAY06–1/1

000102.04 — Manifold Air Pressure Input Voltage Low Diagnostic Procedure

Related Information:
The manifold ail 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.

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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 MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the manifold air pressure 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 MANIFOLD AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **Manifold Air Pressure 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 the manifold air pressure sensor connector. 3. Install a jumper wire between manifold air pressure sensor 5V supply and input terminals (terminals 2 and 3) in the sensor connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read manifold air pressure input voltage. Is voltage below 4.5 volts?	**YES:** GO TO ❹ **NO:** GO TO ❺

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❹ **Manifold Air Pressure 5V Supply 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 the jumper wire. 3. Ignition ON, engine OFF 4. Using a multimeter, measure the voltage between the 5V supply (terminal 2) of the manifold air pressure sensor connector on the engine harness and a good chassis ground. Is voltage above 4.0 volts?	**YES:** GO TO ❺ **NO:** Open in manifold air pressure sensor 5V supply circuit OR Short to ground in manifold air pressure sensor 5V supply circuit OR Faulty ECU connection OR Faulty ECU

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❺ **Manifold Air Pressure 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. Manifold air pressure sensor connector still disconnected. 3. Using a multimeter, measure resistance between terminal 3 in the manifold air pressure sensor connector on the engine harness and a good chassis ground. Is the resistance 5 ohms or less?	**YES:** Short to ground in manifold air pressure sensor input circuit. **NO:** GO TO ❻ – – –1/1

❻ **Manifold Air Pressure 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. Manifold air pressure sensor connector still disconnected. 3. Disconnect the ECU connector #J3. 4. Using a multimeter, measure resistance between terminal 3 in the manifold air pressure sensor connector and terminal C4 in ECU connector #J3 on the engine harness. Is the resistance 5 ohms or less?	**YES:** Faulty ECU connection OR Faulty ECU **NO:** Open in manifold air pressure sensor input circuit – – –1/1

000103.00 — Turbo Overspeed Most Severe

The ECU detects a turbo speed above the specification.

RG41221,0000213 –19–02MAY06–1/1

000103.00 — Turbo Overspeed Most Severe Diagnostic Procedure

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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
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 CTM104. – – –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

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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 –19–02MAY06–1/1

000103.02 — Turbo Speed Mismatch Diagnostic Procedure

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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

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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

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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 **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 TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the turbo speed 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 **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

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

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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 **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 TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the turbo speed 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 **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 –19–02MAY06–1/1

000103.08 — Turbo Speed Invalid Diagnostic Procedure

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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 **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 TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the turbo speed 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 TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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.

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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

000103.31 — Turbo Speed Missing

The ECU does not detect a signal coming from the turbo speed sensor.

RG41221,0000218 –19–02MAY06–1/1

000103.31 — Turbo Speed Missing Diagnostic Procedure

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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 **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 TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the turbo speed 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 TURBO SPEED SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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.

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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

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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

000105.03 — 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 –19–02MAY06–1/1

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 SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 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 04 160 ,143 – – –1/1

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 –19–02MAY06–1/1

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 SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 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

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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
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

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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
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

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,150

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:

– – –1/1

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 –19–02MAY06–1/1

000108.02 — Barometric Air Pressure Invalid Diagnostic Procedure

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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.

– – –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:** Replace ECU. **NO:** If no other active or stored codes exists, clear codes. Return to service and monitor further. – – –1/1

000108.31 — Barometric Air Pressure Error

The ECU detects a barometric air pressure sensor error.

RG41221,000021F –19–02MAY06–1/1

000108.31 — Barometric Air Pressure Error Diagnostic Procedure

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Related Information:
The barometric air pressure sensor is invalid compared to the Manifold Air Pressure sensor.

The barometric air pressure sensor is an internal ECU sensor. There are no wiring or sensors on the engine related to the barometric air pressure sensor.

Alarm Level:
Warning

Control Unit Response:
If this code sets, the ECU uses a default barometric air pressure model 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 **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 BAROMETRIC AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors 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 BAROMETRIC AIR PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. Did 000108.31 reoccur?	**YES:** Faulty ECU **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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000110.00 — Engine Coolant Temperature Extremely High

The ECU senses a coolant temperature above the 3rd threshold specification.

RG41221,0000220 –19–02MAY06–1/1

000110.00 — Engine Coolant Temperature Extremely High Diagnostic Procedure

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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.

RG41221,0000221 –19–02MAY06–1/1

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 **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 COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the engine coolant 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 ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **Engine Coolant Temperature Sensor and Connector 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 engine coolant temperature sensor connector 3. Install a jumper wire between both terminals in the engine coolant temperature sensor connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read engine coolant temperature input voltage Is the voltage 0.15 volts or below?	**YES:** Faulty engine coolant temperature sensor connector OR Faulty engine coolant temperature sensor **NO:** GO TO ❹ – – –1/1

❹ **Engine Coolant Temperature Sensor Open 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. Ignition OFF 2. Remove jumper wire between both terminals. 3. Install a jumper wire between the engine coolant temperature input terminal (terminal 1) of the sensor connector on the engine harness and a good chassis ground. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read engine coolant temperature input voltage Is the voltage 0.15 volts or below?	**YES:** Open in engine coolant temperature sensor ground circuit OR Faulty ECU connection OR Faulty ECU **NO:** Open in engine coolant temperature sensor input circuit OR Faulty ECU connection OR Faulty ECU – – –1/1

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000110.04 — Engine Coolant Temperature Input Voltage Low

The engine coolant temperature input voltage drops below the sensor's low voltage specification.

RG41221,0000222 –19–02MAY06–1/1

000110.04 — Engine Coolant Temperature Input Voltage Low Diagnostic Procedure

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 **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 COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the engine coolant 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 ENGINE COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **Engine Coolant 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. 3. Ignition ON, engine OFF 4. Using the ECU diagnostic software, read the engine coolant temperature input voltage. Is the voltage below 4.95 volts?	**YES:** Short to ground in engine coolant temperature sensor input circuit. OR Faulty ECU connector OR Faulty ECU **NO:** Faulty engine coolant temperature sensor connector. OR Faulty engine coolant temperature sensor.

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000110.15 — Engine Coolant Temperature High Least Severe

The ECU senses a engine coolant temperature above specification.

RG41221,0000223 –19–03APR05–1/1

000110.15 — Engine Coolant Temperature High Least Severe Diagnostic Procedure

NOTE: If 000110.15 is accompanied with 000110.00 and 000110.16, diagnose 000110.00 first. If 000110.15 is only accompanied with 000110.16, diagnose 000110.16 first

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 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 **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 COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the engine coolant 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 **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, Group 150 of 4.5L & 6.8L Diesel Engines Base Engine Manual (CTM 104). **NO:** GO TO ❸ – – –1/1

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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

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 –19–02MAY06–1/1

000110.16 — Engine Coolant Temperature Moderately High Diagnostic Procedure

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.

RG41221,00002C4 –19–02MAY06–1/1

000110.15 — Engine Coolant Temperature Low Least Severe Diagnostic Procedure

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 **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 COOLANT TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the engine coolant 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 **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 CTM104. Is the thermostat functioning properly?	**YES:** GO TO ❸ **NO:** Replace the thermostat. – – –1/1

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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 –19–02MAY06–1/1

000111.01 — Engine Coolant Level Low Diagnostic Procedure

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 **Preliminary 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 ❷ **NO:** Reprogramming ECU. Make sure that the option for Engine Coolant Level Switch is NOT selected from the trim page. – – –1/1

❷ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see ENGINE COOLANT LEVEL SWITCH in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the engine coolant level switch 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 ❸ – – –1/1

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❸ **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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. Did 000111.01 reoccur?	**YES:** GO TO ❹ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❹ 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 ❺ **NO:** Determine cause of low coolant level, repair problem, refill coolant, and retest. – – –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 –19–02MAY06–1/1

000157.03 — Fuel Rail Pressure Input Voltage High Diagnostic Procedure

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 **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 FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the fuel rail pressure 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 FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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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 –19–02MAY06–1/1

000157.04 — Fuel Rail Pressure Input Voltage Low Diagnostic Procedure

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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 **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 FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the fuel rail pressure 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 FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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. 04 160 ,177

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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

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 –19–02MAY06–1/1

000157.10 — Fuel Rail Pressure Loss Detected Diagnostic Procedure

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 **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 FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the fuel rail pressure 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 FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. 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 using SERVICE ADVISOR™. 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.

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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

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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.

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000157.17 — Fuel Rail Pressure Not Developed Diagnostic Procedure

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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 **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 FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the fuel rail pressure 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 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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking for at least 10 seconds. 6. Read DTCs using SERVICE ADVISOR™. 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. 04 160 ,183
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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 **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 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 final fuel filter element. See REPLACE FINAL FUEL FILTER ELEMENT 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

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❼ **Faulty Pre-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 pre-filter element. See REPLACE PRE-FILTER ELEMENT in Section 02, Group 090 earlier in this manual. 3. Ignition ON, engine cranking Do the engine start?	**YES:** Faulty pre-filter element. Replacing fixed the problem. **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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⑨ **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.

RG41221,000022A –19–02MAY06–1/1

000158.17 — ECU Power Down Error Diagnostic Procedure

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 **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 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the battery connections 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 ENGINE CONTROL UNIT in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **Wiring 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. 3. Using a multimeter, measure voltage between terminal B2 in ECU connector #J2 on the engine harness and a good chassis ground. Is the voltage above 3.0 volts?	**YES:** GO TO ❹ **NO:** Faulty ECU connector OR Faulty ECU

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❹ **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. ECU connector #J2 still disconnected. 3. Remove the ignition switch connection(s). 4. Using a multimeter, measure resistance between terminal B2 in ECU connector #J2 on the engine harness and the ignition switch input wire terminal removed in the step 3. Is the resistance 5 ohms or less.	**YES:** Faulty ignition switch. **NO:** Short to power in the ignition switch input wire. See application for interconnect connector information to assist in finding the short.

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000174.00 — Fuel Temperature Extremely High

The ECU senses a fuel temperature above specification.

RG41221,000022B –19–03APR05–1/1

000174.00 — Fuel Temperature Extremely High Diagnostic Procedure

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 cooler is clean. Cause of extremely high fuel temperature found?	**YES:** Repair and retest. **NO:** GO TO ❷ – – –1/1

❷ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the fuel 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 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 form 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

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000174.03 — Fuel Temperature Input Voltage High

The fuel temperature input voltage exceeds the sensor's high voltage specification.

RG41221,000022C –19–02MAY06–1/1

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 **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 FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the fuel 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 FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **Fuel Temperature Sensor and Connector 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. Disconnect the fuel temperature sensor connector. 3. Install a jumper wire between both terminals in the fuel temperature sensor connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read fuel temperature input voltage. Is the voltage above 0.1 volts?	**YES:** GO TO ❹ **NO:** Faulty fuel temperature sensor connector. OR Faulty fuel temperature sensor.

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❹ **Fuel Temperature Ground Circuit Open 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 jumper wire between both terminals. 3. Install a jumper wire between the fuel temperature input terminal (terminal 1) of the sensor connector on the engine harness and a good chassis ground. Is the voltage above 0.1 volts?	**YES:** Open in fuel temperature sensor ground circuit. OR Faulty ECU connection OR Faulty ECU **NO:** Open in fuel temperature sensor input circuit. OR Faulty ECU connection OR Faulty ECU – – –1/1

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000174.04 — Fuel Temperature Input Voltage Low

The fuel temperature input voltage drops below the sensor's low voltage specification.

RG41221,000022D –19–02MAY06–1/1

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 **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 FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the fuel 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 FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **Fuel Temperature Sensor 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 fuel temperature sensor connector. 3. Ignition ON, engine OFF 4. Using the ECU diagnostic software, read fuel temperature input voltage. Is the voltage below 4.9 volts?	**YES:** Short to ground in fuel temperature sensor input circuit. OR Faulty ECU connection OR Faulty ECU **NO:** Faulty fuel temperature sensor connector. OR Faulty fuel temperature sensor. – – –1/1

000174.16 — Fuel Temperature Moderately High

The ECU senses a fuel temperature above specification.

RG41221,000022E –19–03APR05–1/1

000174.16 — Fuel Temperature Moderately High Diagnostic Procedure

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

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❷ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation, see FUEL TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the fuel 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 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

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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 form 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

000189.00 — Engine Speed Derate

The ECU detects a condition that requires an engine speed derate.

RG41221,000022F –19–02MAY06–1/1

000189.00 — Engine Speed Derate

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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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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

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.

– – –1/1

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

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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

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.

DB92450,0000076 –19–02MAY06–1/1

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.

– – –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.

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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.

DB92450,0000075 –19–02MAY06–1/1

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

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.

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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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000237.31 — 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.

DB92450,0000074 –19–02MAY06–1/1

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

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 –19–02MAY06–1/1

000412.00 — Exhaust Gas Recirculation (EGR) Exhaust Temperature Extremely High Diagnostic Procedure

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.

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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 EXHAUST TEMPERATURE SENSOR supporting information.* Perform a preliminary inspection of the ECU connectors and the EGR exhaust 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 EXHAUST TEMPERATURE SENSOR supporting information.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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.

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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 coolant thermostat and test for proper operation. See REMOVE AND INSTALL THERMOSTAT COVER AND THERMOSTATS (TIER 3) and TEST THERMOSTATS in Section 02, Group 070, of CTM104. Is the thermostat functioning properly?	**YES:** GO TO ❻ **NO:** Replace thermostat. See REMOVE AND INSTALL THERMOSTAT COVER AND THERMOSTATS (TIER 3) in Section 02, Group 070, of CTM104. – – –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 (EGR) COOLER in Section 02, Group 100 earlier in this manual. 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 (EGR) COOLER in Section 02, Group 100 earlier in this manual. **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 3 (terminal B2 or E2 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

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.

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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 **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 EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR exhaust 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 EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **EGR Exhaust Temperature Sensor and Connector Check**	*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 EGR exhaust temperature sensor connector. 3. Install a jumper wire between both terminals in the EGR exhaust temperature sensor connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read exhaust gas recirculation exhaust temperature input voltage. Is the voltage above 0.15 volts?	**YES:** GO TO ❹ **NO:** Faulty EGR exhaust temperature sensor connector. OR Faulty EGR exhaust temperature sensor.

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❹ **EGR Exhaust Temperature Open in 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. Ignition OFF 2. Remove jumper wire between both terminals. 3. Install jumper wire between the EGR exhaust 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 software, read exhaust gas recirculation exhaust temperature input voltage. Is the voltage above 0.15 volts?	**YES:** Open in EGR exhaust temperature sensor input circuit. OR Faulty ECU connection OR Faulty ECU **NO:** Open in EGR exhaust temperature sensor ground circuit. OR Faulty ECU connection OR Faulty ECU – – –1/1

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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.

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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 **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 EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR exhaust 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 EXHAUST TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **EGR 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. Disconnect the EGR exhaust temperature sensor connector. 3. Ignition ON, engine OFF 4. Using the ECU diagnostic software, read exhaust gas recirculation exhaust temperature input voltage. Is the voltage below 4.9 volts?	**YES:** Short to ground in EGR exhaust temperature sensor input circuit. OR Faulty ECU connection OR Faulty ECU **NO:** Faulty EGR exhaust temperature sensor connector. OR Faulty EGR exhaust temperature sensor. – – –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 –19–02MAY06–1/1

Exhaust Gas Recirculation (EGR) Exhaust Temperature Moderately High Diagnostic Procedure

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Related Information
The ECU senses an EGR exhaust temperature above 280° C (536° F) on OEM engines.

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 **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 EXHAUST TEMPERATURE SENSOR supporting information.* Perform a preliminary inspection of the ECU connectors and the EGR exhaust 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 EXHAUST TEMPERATURE SENSOR supporting information.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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.

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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 coolant thermostat and test for proper operation. See REMOVE AND INSTALL THERMOSTAT COVER AND THERMOSTATS (TIER 3) and TEST THERMOSTATS in Section 02, Group 070, of CTM104. Is the thermostat functioning properly?	**YES:** GO TO ❻ **NO:** Replace thermostat. See REMOVE AND INSTALL THERMOSTAT COVER AND THERMOSTATS (TIER 3) in Section 02, Group 070, of CTM104. – – –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 (EGR) COOLER in Section 02, Group 100 earlier in this manual. 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 (EGR) COOLER in Section 02, Group 100 earlier in this manual. **NO:** GO TO ❼ – – –1/1

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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 3 (terminal B2 or E2 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

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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

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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 **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 ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the electronic injector interconnect 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 ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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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

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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

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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

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 **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 ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the electronic injector interconnect 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 ELECTRONIC INJECTOR (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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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

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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

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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 – – –1/1

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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. – – –1/1

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.

RG41221,00002A4 –19–02MAY06–1/1

000627.16 — ECU Power Supply Voltage Higher Than Expected

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 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 **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 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 ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR™ earlier in this Group. 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.

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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

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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

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 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 **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 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 ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR™ earlier in this Group. 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.

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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 STARTING AND CHARGING SYSTEM DIAGNOSTICS in Section 110 earlier in this manual. **NO:** GO TO ❹

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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.

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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

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Related Information:
The ECU detects an internal problem caused by either an incorrectly programmed ECU 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 **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 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors 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 ENGINE CONTROL UNIT in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. Did 000629.13 reoccur?	**YES:** GO TO ❸ **NO:** Diagnostic software does NOT communicate with ECU. See D1 - ECU DOES NOT COMMUNICATE WITH SERVICE ADVISOR DIAGNOSTIC PROCEDURE later in this Group. **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❸ **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 DOWNLOADING A PAYLOAD FILE FOR DOWNLOADING PAYLOAD FILE FOR SERVICE ADVISOR™ earlier in this Group. 2. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 3. Ignition ON, engine OFF 4. Start the ECU diagnostic software. 5. Program the ECU using the payload file downloaded for this engine. For instructions on programming the ECU, see REPROGRAMMING ENGINE CONTROL UNIT (ECU) WITH REPROGRAMMING ENGINE CONTROL UNIT (ECU) WITH SERVICE ADVISOR™ 6. Ignition OFF for 2 minutes. 7. Ignition ON, engine OFF 8. Read DTCs using SERVICE ADVISOR™. Did 000629.12 reoccur?	**YES:** New software repaired ECU. Run engine to verify engine functions properly. **NO:** Diagnostic software does NOT communicate with ECU. See D1 - ECU DOES NOT COMMUNICATE WITH SERVICE ADVISOR DIAGNOSTIC PROCEDURE later in this Group. **NO:** DTC did not reoccur. Faulty ECU.

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000636.02 — Pump Position Sensor Input Noise

The ECU detects excessive noise (extra pulses) on the pump position sensor input.

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000636.02 — Pump Position Sensor Input Noise Diagnostic Procedure

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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 **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 PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the pump position 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 PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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

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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 **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 PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the pump position 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 **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

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.

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000636.06 — Pump Position Sensor Current High Diagnostic Procedure

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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 **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 PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the pump position 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 **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
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.

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000636.08 — Pump Position Sensor Input Missing Diagnostic Procedure

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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 **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 PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the pump position 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 PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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.

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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

000636.10 — Pump Position Sensor Input Pattern Error

The ECU detects an improper pattern on the pump position sensor input.

RG41221,0000242 –19–02MAY06–1/1

000636.10 — Pump Position Sensor Input Pattern Error Diagnostic Procedure

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 **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 PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the pump position 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 PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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000637.02 — Crank Position Input Noise Diagnostic Procedure

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 **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 CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the crank position 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 CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running 6. Read DTCs using SERVICE ADVISOR™. 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.

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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

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 **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 CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the crank position 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 **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

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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.

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000637.06 — Crank Position Sensor Current High Diagnostic Procedure

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 **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 CRANK POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the crank position 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 **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

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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.

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000637.07 — Crank Position/Pump Position Timing Moderately Out of Sync Diagnostic Procedure

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 **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 CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors, crank position sensor connector, and the pump position 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 CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running or cranking 6. Read DTCs using SERVICE ADVISOR™. 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.

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❸ **Pump Position Timing Check**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR and PUMP POSITION SENSOR in Section 03, Group 130 earlier in this manual.* Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING in Section 04, Group 150 earlier in this manual. Is the timing correct?	**YES:** GO TO ❹ **NO:** Adjust timing and retest.

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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.

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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 8 **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 9 **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 –19–02MAY06–1/1

000637.08 — Crank Position Input Missing Diagnostic Procedure

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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 **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 CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the crank position 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 CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running 6. Read DTCs using SERVICE ADVISOR™. 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

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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

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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 –19–02MAY06–1/1

000637.10 — Crank Position Input Pattern Error Diagnostic Procedure

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Related Information:
The ECU detects an improper pattern 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 000637.10, 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 **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 CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the crank position 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 CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running 6. Read DTCs using SERVICE ADVISOR™. 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. 04 160 ,265

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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 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

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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**	*NOTE: For wiring and theory of operation, see CRANK POSITION SENSOR in Section 03, Group 140 earlier in this manual. or PUMP POSITION SENSOR in Section 03, Group 140 earlier in this manual.* Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING in Section 04, Group 150 earlier in this manual. Is pump position timing correct?	**YES:** Faulty crank position sensor connector. OR Faulty crank position sensor. OR Faulty ECU connector OR Faulty ECU **NO:** Adjust timing and recheck. – – –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 –19–02MAY06–1/1

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. – – –1/1

000640.31 — Engine Shutdown—Vehicle Request

The ECU receives a valid engine shutdown signal.

WL30140,000002E –19–02MAY06–1/1

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

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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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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

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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

12 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
13 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 14. – – –1/1
14 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 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 000641.04 active?	**YES:** GO TO 16. **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

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000641.12 — ECU/Turbo Actuator Communication Error

The ECU and turbo actuator controller have lost communication.

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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 – – –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 ❸ **NO:** GO TO ❹ – – –1/1
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. – – –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 **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. – – –1/1

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
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 Resistance 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

11 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 12. **NO:** Problem fixed. Bad connection. – – –1/1
12 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 13. **NO:** Problem fixed. Bad actuator. – – –1/1
13 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
14 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 15. – – –1/1
15 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 16. – – –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. Check 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
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

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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. Recalibrate 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 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

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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

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

14 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. – – –1/1

000651.02 — Cylinder #1 Electronic Injector Part Number Invalid

The ECU detects an incorrect injector part number was installed or calibrated into cylinder #1.

RG41221,000024E –19–02MAY06–1/1

000651.02 — Cylinder #1 Electronic Injector Part Number Invalid Diagnostic Procedure

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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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000651.02 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 **Installation of New Injector #1 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was injector #1 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **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 reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **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 and record Injector #1 Part Number. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #1 Part Number from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #1 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the part number etched on the side of the injector to that of the diagnostic software. Do the injector part numbers match?	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector #1 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.

RG41221,000024F –19–02MAY06–1/1

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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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 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 #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 –19–02MAY06–1/1

000651.06 — Cylinder #1 Electronic Injector Circuit Shorted Diagnostic Procedure

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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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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 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 #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 –19–03APR05–1/1

000651.07 — Cylinder #1 Electronic Injector Mechanical Failure Diagnostic Procedure

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Related Information:
The ECU does not detects 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 is not 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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 **Electronic 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. 3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification. **Specification** Injector Solenoid Wire Retaining Nut— Torque ..... 2 N•m (1.5 lb-ft)(18 lb-in) 4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM104. All connections tightened per specification?	**YES:** GO TO ❸ **NO:** Tighten retaining nut(s) to specification and retest? – – –1/1
❸ **Electronic 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 (HPCR) and the inlet at electronic injector #1. 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line and retest. **NO:** GO TO ❹ – – –1/1

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❹ **Flow Limiter 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. 3. Continue to refresh the active code list until 000651.07 resets. 4. Listen to flow limiter that corresponds to electronic injector #1 while turning ignition OFF. *NOTE: It is very difficult to distinguish the difference between electronic injector #1 and the other flow limiters clicking. Make sure electronic injector #1 makes the click. It will take 5-10 seconds for the ball to reseat.* Does electronic injector #1 flow limiter click?	**YES:** GO TO ❺ **NO:** Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1

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❺ **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.* **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 2. Disconnect the high pressure fuel delivery line for injector #1. Remove the side feed tube retaining nut from the cylinder head. 3. Using a 1/2” hose grip pliers, remove the side feed tube from the cylinder head. 4. Inspect the side feed tube for nicks, burrs, or other damage. 5. Inspect side feed tube o-ring for damage. 6. When inspection is completed, reinstall inspected or install new side feed tube and tighten retaining nuts to specification. **Specification** Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft) 7. Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification. **Specification** High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft) Did everything pass inspection?	**YES:** Faulty electronic injector #1. OR Faulty ECU **NO:** Replace side feed tube and retest. – – –1/1

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000651.13 — Cylinder #1 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,0000252 –19–02MAY06–1/1

000651.13 — Cylinder #1 Electronic Injector QR Code Invalid Diagnostic Procedure

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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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000651.13 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 **Installation of New Injector #1 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was injector #1 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **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 reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **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 and record Injector #1 QR Code. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #1 QR Code from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #1 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the QR Code etched on the side of the injector to that of the diagnostic software. Do the injector QR coeds match?	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate injector #1 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 –19–02MAY06–1/1

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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. Did 000652.02 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 **Installation of New Injector #2 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was injector #2 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **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 reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **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 and record Injector #2 Part Number. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #2 Part Number from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #2 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the part number etched on the side of the injector to that of the diagnostic software. Do the injector part numbers match?	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector #2 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 –19–02MAY06–1/1

000652.05 — Cylinder #2 Electronic Injector Circuit Open Diagnostic Procedure

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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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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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.

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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 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 #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 –19–02MAY06–1/1

000652.06 - Cylinder #2 Electronic Injector Circuit Shorted Diagnostic Procedure

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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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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 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 #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 –19–03APR05–1/1

000652.07 - Cylinder #2 Electronic Injector Mechanical Failure Diagnostic Procedure

Related Information:
The ECU does not detects 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 is not 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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 **Electronic 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. 3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification. **Specification** Injector Solenoid Wire Retaining Nut— Torque ..... 2 N•m (1.5 lb-ft)(18 lb-in) 4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM104. All connections tightened per specification?	**YES:** GO TO ❸ **NO:** Tighten retaining nut(s) to specification and retest? – – –1/1

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❸ **Electronic 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 (HPCR) and the inlet at electronic injector #2. 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line and retest. **NO:** GO TO ❹ – – –1/1

❹ **Flow Limiter 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. 3. Continue to refresh the active code list until 000652.07 resets. 4. Listen to flow limiter that corresponds to electronic injector #2 while turning ignition OFF. *NOTE: It is very difficult to distinguish the difference between electronic injector #2 and the other flow limiters clicking. Make sure electronic injector #2 makes the click. It will take 5-10 seconds for the ball to reseat.* Does electronic injector #2 flow limiter click?	**YES:** GO TO ❺ **NO:** Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1

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❺ **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.* **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 high pressure fuel delivery line for injector #2. Remove the side feed tube retaining nut from the cylinder head. 3. Using a 1/2” hose grip pliers, remove the side feed tube from the cylinder head. 4. Inspect the side feed tube for nicks, burrs, or other damage. 5. Inspect side feed tube o-ring for damage. 6. When inspection is completed, reinstall inspected or install new side feed tube and tighten retaining nuts to specification. **Specification** Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft) 7. Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification. **Specification** High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft) Did everything pass inspection?	**YES:** Faulty electronic injector #2. OR Faulty ECU **NO:** Replace side feed tube and retest. – – –1/1

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000652.13 — Cylinder #2 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,0000257 –19–02MAY06–1/1

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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000652.13 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 **Installation of New Injector #2 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was injector #2 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

– – –1/1

❹ **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 reprogrammed with new software or replaced with a new ECU?	**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 ❺

– – –1/1

❺ **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 and record Injector #2 QR Code. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #2 QR Code from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #2 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the QR Code etched on the side of the injector to that of the diagnostic software. Do the injector QR coeds match?	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate injector #2 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 –19–02MAY06–1/1

000653.02 — Cylinder #3 Electronic Injector Part Number Invalid Diagnostic Procedure

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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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000653.02 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 **Installation of New Injector #3 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR in Section 03, Group 140 earlier in this manual.* Was injector #3 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

– – –1/1

❹ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR in Section 03, Group 140 earlier in this manual.* Was the ECU reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **Injector Part Number Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read and record Injector #3 Part Number. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #3 Part Number from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #3 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the part number etched on the side of the injector to that of the diagnostic software. Do the injector part numbers match?	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector #3 with the correct part number and recalibrate ECU. – – –1/1

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000653.05 — Cylinder #3 Electronic Injector Circuit Open

The ECU detects an open in the cylinder #3 electronic injector circuit.

RG41221,0000259 –19–02MAY06–1/1

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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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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.

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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 –19–02MAY06–1/1

000653.06 - Cylinder #3 Electronic Injector Circuit Shorted Diagnostic Procedure

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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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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 –19–03APR05–1/1

000653.07 - Cylinder #3 Electronic Injector Mechanical Failure Diagnostic Procedure

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Related Information:
The ECU does not detects 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 is not 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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 **Electronic 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. 3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification. **Specification** Injector Solenoid Wire Retaining Nut— Torque ..... 2 N•m (1.5 lb-ft)(18 lb-in) 4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM104. All connections tightened per specification?	**YES:** GO TO ❸ **NO:** Tighten retaining nut(s) to specification and retest? – – –1/1

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❸ **Electronic 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 (HPCR) and the inlet at electronic injector #3. 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line and retest. **NO:** GO TO ❹ – – –1/1

❹ **Flow Limiter 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. 3. Continue to refresh the active code list until 000653.07 resets. 4. Listen to flow limiter that corresponds to electronic injector #3 while turning ignition OFF. *NOTE: It is very difficult to distinguish the difference between electronic injector #3 and the other flow limiters clicking. Make sure electronic injector #3 makes the click. It will take 5-10 seconds for the ball to reseat.* Does electronic injector #3 flow limiter click?	**YES:** GO TO ❺ **NO:** Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1

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❺ **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.* **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 high pressure fuel delivery line for injector #3. Remove the side feed tube retaining nut from the cylinder head. 3. Using a 1/2” hose grip pliers, remove the side feed tube from the cylinder head. 4. Inspect the side feed tube for nicks, burrs, or other damage. 5. Inspect side feed tube o-ring for damage. 6. When inspection is completed, reinstall inspected or install new side feed tube and tighten retaining nuts to specification. **Specification** Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft) 7. Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification. **Specification** High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft) Did everything pass inspection?	**YES:** Faulty electronic injector #3. OR Faulty ECU **NO:** Replace side feed tube and retest. – – –1/1

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000653.13 — Cylinder #3 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,000025C –19–02MAY06–1/1

000653.13 - Cylinder #3 Electronic Injector QR Code Invalid Diagnostic Procedure

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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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000653.13 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 **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 injector #3 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **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 reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **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 and record Injector #3 QR Code. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #3 QR Code from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #3 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the QR Code etched on the side of the injector to that of the diagnostic software. Do the injector QR coeds match?	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate injector #3 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 –19–02MAY06–1/1

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.

Alarm Level:
STOP

Control Unit Response:
If the 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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000654.02 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 **Installation of New Injector #4 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR in Section 03, Group 140 earlier in this manual.* Was injector #4 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **ECU Programming Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR in Section 03, Group 140 earlier in this manual.* Was the ECU reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **Injector Part Number Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Using the diagnostic software, read and record Injector #4 Part Number. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #4 Part Number from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #4 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the part number etched on the side of the injector to that of the diagnostic software. Do the injector part numbers match?	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector #4 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 –19–02MAY06–1/1

000654.05 - Cylinder #4 Electronic Injector Circuit Open Diagnostic Procedure

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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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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 –19–02MAY06–1/1

000654.06 - Cylinder #4 Electronic Injector Circuit Shorted Diagnostic Procedure

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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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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 –19–03APR05–1/1

000654.07 - Cylinder #4 Electronic Injector Mechanical Failure Diagnostic Procedure

Related Information:
The ECU does not detects 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 is not 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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 **Electronic 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. 3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification. **Specification** Injector Solenoid Wire Retaining Nut— Torque ..... 2 N•m (1.5 lb-ft)(18 lb-in) 4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM104. All connections tightened per specification?	**YES:** GO TO ❸ **NO:** Tighten retaining nut(s) to specification and retest? – – –1/1

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❸ **Electronic 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 (HPCR) and the inlet at electronic injector #3. 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line and retest. **NO:** GO TO ❹ – – –1/1

❹ **Flow Limiter 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. 3. Continue to refresh the active code list until 000654.07 resets. 4. Listen to flow limiter that corresponds to electronic injector #4 while turning ignition OFF. *NOTE: It is very difficult to distinguish the difference between electronic injector #4 and the other flow limiters clicking. Make sure electronic injector #4 makes the click. It will take 5-10 seconds for the ball to reseat.* Does electronic injector #4 flow limiter click?	**YES:** GO TO ❺ **NO:** Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1

❺ **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.* **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 high pressure fuel delivery line for injector #4. Remove the side feed tube retaining nut from the cylinder head. 3. Using a 1/2” hose grip pliers, remove the side feed tube from the cylinder head. 4. Inspect the side feed tube for nicks, burrs, or other damage. 5. Inspect side feed tube o-ring for damage. 6. When inspection is completed, reinstall inspected or install new side feed tube and tighten retaining nuts to specification. **Specification** Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft) 7. Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification. **Specification** High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft) Did everything pass inspection?	**YES:** Faulty electronic injector #4. OR Faulty ECU **NO:** Replace side feed tube and retest. – – –1/1

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000654.13 — Cylinder #4 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,0000261 –19–02MAY06–1/1

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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000654.13 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 **Installation of New Injector #4 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was injector #4 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **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 reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **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 and record Injector #4 QR Code. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #4 QR Code from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #4 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the QR Code etched on the side of the injector to that of the diagnostic software. Do the injector QR coeds match?	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate injector #4 with the correct QR code. – – –1/1

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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 –19–02MAY06–1/1

000655.02 - Cylinder #5 Electronic Injector Part Number Invalid Diagnostic Procedure

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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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000655.02 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 **Installation of New Injector #5 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was injector #5 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **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 reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **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 and record Injector #5 Part Number. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #5 Part Number from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #5 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the part number etched on the side of the injector to that of the diagnostic software. Do the injector part numbers match?	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector #5 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 –19–02MAY06–1/1

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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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 –19–02MAY06–1/1

000655.06 — Cylinder #5 Electronic Injector Circuit Shorted Diagnostic Procedure

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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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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 –19–03APR05–1/1

000655.07 - Cylinder #5 Electronic Injector Mechanical Failure Diagnostic Procedure

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Related Information:
The ECU does not detects a drop in fuel rail pressure when 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 is not 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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 **Electronic 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. 3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification. **Specification** Injector Solenoid Wire Retaining Nut— Torque ..... 2 N•m (1.5 lb-ft)(18 lb-in) 4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM104. All connections tightened per specification?	**YES:** GO TO ❸ **NO:** Tighten retaining nut(s) to specification and retest? – – –1/1
❸ **Electronic 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 (HPCR) and the inlet at electronic injector #3. 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line and retest. **NO:** GO TO ❹ – – –1/1

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❹ **Flow Limiter 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. 3. Continue to refresh the active code list until 000655.07 resets. 4. Listen to flow limiter that corresponds to electronic injector #5 while turning ignition OFF. *NOTE: It is very difficult to distinguish the difference between electronic injector #5 and the other flow limiters clicking. Make sure electronic injector #5 makes the click. It will take 5-10 seconds for the ball to reseat.* Does electronic injector #5 flow limiter click?	**YES:** GO TO ❺ **NO:** Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1

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❺ 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.* **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 high pressure fuel delivery line for injector #5. Remove the side feed tube retaining nut from the cylinder head. 3. Using a 1/2” hose grip pliers, remove the side feed tube from the cylinder head. 4. Inspect the side feed tube for nicks, burrs, or other damage. 5. Inspect side feed tube o-ring for damage. 6. When inspection is completed, reinstall inspected or install new side feed tube and tighten retaining nuts to specification. **Specification** Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft) 7. Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification. **Specification** High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft) Did everything pass inspection?	**YES:** Faulty electronic injector #5. OR Faulty ECU **NO:** Replace side feed tube and retest. – – –1/1

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000655.13 — Cylinder #5 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

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000655.13 - Cylinder #5 Electronic Injector QR Code Invalid Diagnostic Procedure

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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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000655.13 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 **Installation of New Injector #5 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was injector #5 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **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 reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **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 and record Injector #5 QR Code. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #5 QR Code from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #5 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the QR Code etched on the side of the injector to that of the diagnostic software. Do the injector QR coeds match?	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate injector #5 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 –19–02MAY06–1/1

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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000656.02 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 **Installation of New Injector #6 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was injector #6 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **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 reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **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 and record Injector #6 Part Number. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #6 Part Number from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #6 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the part number etched on the side of the injector to that of the diagnostic software. Do the injector part numbers match?	**YES:** Faulty ECU **NO:** Incorrect part number installed. Replace injector #6 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 –19–02MAY06–1/1

000656.05 - Cylinder #6 Electronic Injector Circuit Open Diagnostic Procedure

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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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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 –19–02MAY06–1/1

000656.06 - Cylinder #6 Electronic Injector Circuit Shorted Diagnostic Procedure

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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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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 –19–03APR05–1/1

000656.07 - Cylinder #6 Electronic Injector Mechanical Failure Diagnostic Procedure

Related Information:
The ECU does not detects a drop in fuel rail pressure when 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 is not 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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 **Electronic 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. 3. Verify all wiring harness eyelet connector retaining nuts are tightened to specification. **Specification** Injector Solenoid Wire Retaining Nut— Torque ..... 2 N•m (1.5 lb-ft)(18 lb-in) 4. Install rocker arm cover with vent tube. See INSTALL ROCKER ARM COVER in Section 02, Group 021 of CTM104. All connections tightened per specification?	**YES:** GO TO ❸ **NO:** Tighten retaining nut(s) to specification and retest? – – –1/1

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❸ **Electronic 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 (HPCR) and the inlet at electronic injector #3. 3. Check fuel line for restrictions. Is the fuel line restricted?	**YES:** Repair or replace fuel line and retest. **NO:** GO TO ❹ – – –1/1

❹ **Flow Limiter 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. 3. Continue to refresh the active code list until 000656.07 resets. 4. Listen to flow limiter that corresponds to electronic injector #6 while turning ignition OFF. *NOTE: It is very difficult to distinguish the difference between electronic injector #6 and the other flow limiters clicking. Make sure electronic injector #6 makes the click. It will take 5-10 seconds for the ball to reseat.* Does electronic injector #6 flow limiter click?	**YES:** GO TO ❺ **NO:** Faulty flow limiter. Replace flow limiter and retest. See REMOVE AND INSTALL FLOW DAMPERS in Section 02, Group 090 earlier in this manual. – – –1/1

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❺ **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.* **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 high pressure fuel delivery line for injector #6. Remove the side feed tube retaining nut from the cylinder head. 3. Using a 1/2” hose grip pliers, remove the side feed tube from the cylinder head. 4. Inspect the side feed tube for nicks, burrs, or other damage. 5. Inspect side feed tube o-ring for damage. 6. When inspection is completed, reinstall inspected or install new side feed tube and tighten retaining nuts to specification. **Specification** Side Feed Tube Retaining Nut—Torque ..... 35 N•m (25.5 lb-ft) 7. Install the high pressure fuel delivery line to the side feed tube retaining nut. Tighten to specification. **Specification** High Pressure Delivery Line Fitting— Torque ..... 27 N•m (19.9 lb-ft) Did everything pass inspection?	**YES:** Faulty electronic injector #6. OR Faulty ECU **NO:** Replace side feed tube and retest. – – –1/1

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000656.13 — Cylinder #6 Electronic Injector QR Code Invalid

The ECU detects an incorrect QR Code was calibrated into the ECU.

RG41221,000026B –19–02MAY06–1/1

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.

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 #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 **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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the injector harness connector (located at the side of the cylinder head) 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 ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. Did 000656.13 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 **Installation of New Injector #6 Check**	*NOTE: For wiring and theory of operation, see ELECTRONIC INJECTORS (EI) OPERATION in Section 03, Group 130 earlier in this manual.* Was injector #6 previously replaced with a new injector?	**YES:** GO TO ❺ **NO:** GO TO ❹

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❹ **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 reprogrammed with new software or replaced with a new ECU?	**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 ❺

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❺ **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 and record Injector #6 QR Code. 3. If the injector information page is still available from the new injector box gather this. 4. Compare the Injector #6 QR Code from the page to that of the diagnostic software. 5. If the page is not available, Ignition OFF. 6. Remove injector #6 from the cylinder head. See REMOVE ELECTRONIC INJECTORS (EIs) in Section 02, Group 090 earlier in this manual. 7. Compare the QR Code etched on the side of the injector to that of the diagnostic software. Do the injector QR coeds match?	**YES:** Faulty ECU **NO:** Incorrect QR code input. Recalibrate injector #6 with the correct QR code. – – –1/1

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000676.03 — Glow Plug Relay Voltage High

The ECU detects the glow plug relay output is high when the ECU is not energizing the relay.

RG41221,00002A1 –19–14MAY05–1/1

000676.03 Glow Plug Relay Voltage High Diagnostic Procedure

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Related Information:
The ECU detects the glow plug relay output is high when the ECU is not energizing the relay.

Alarm Level:
Warning

Control Unit Response:
Engine may run rough or be hard to start.

Additional References:
For further glow plug information, see GLOW PLUG OPERATION 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 GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the glow plug relay and glow plug connections 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 GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Disconnect glow plug connector on any of the glow plugs. 3. Using a multimeter, measure voltage between glow plug connector and a good chassis ground. Is the voltage at or near battery voltage?	**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 **Glow Plug Relay Diagnostic Wire Test**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION 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 A4 in the harness end of the ECU connector #J1 and all terminals in all three ECU connectors. Are all measurements above 2000 ohms?	**YES:** GO TO ❹ **NO:** Glow plug relay diagnostic wire shorted to wire(s) that measured below 2000 ohms. – – –1/1

❹ **Glow Plug Relay Test**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Ignition OFF 2. Keep all three ECU connectors disconnected 3. Using a multimeter, measure resistance between terminal F4 in the harness end of the ECU connector #J1 and all terminals in the ECU connectors. Are all measurements above 2000 ohms?	**YES:** Faulty glow plug relay **NO:** Glow plug relay enable wire shorted to wire(s) that measured below 2000 ohms. – – –1/1

000676.04 — Glow Plug Relay Voltage Low

The ECU is sending current to the glow plug relay, but does not detect 12 volts going to the glow plugs.

RG41221,00002A3 –19–02MAY06–1/1

000676.04 Glow Plug Relay Voltage Low Diagnostic Procedure

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Related Information:
The ECU is sending current to the glow plug relay, but does not detect 12 volts going to the glow plugs.

Alarm Level:
Warning

Control Unit Response:
Engine performance will not be affected while running.

The engine may start hard under extremely cold conditions.

Additional References:
For further glow plug information, see GLOW PLUG OPERATION 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 GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the glow plug relay and glow plug connections 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 GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 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 running 6. Read DTCs using SERVICE ADVISOR™. Did 000676.05 reset?	**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 **Glow Plug Relay Test**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Identify location of glow plug relay. 2. Cycle ignition from OFF to ON. 3. Listen to glow plug relay. Does the relay click?	**YES:** GO TO ❹ **NO:** Open in glow plug relay enable wire OR Open in glow plug relay ground OR Faulty glow plug relay

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❹ **Glow Plug Relay Voltage Test**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Disconnect the glow plug relay power wire from the glow plug relay. 3. Using a multimeter, measure voltage between the glow plug relay power wire at the relay and a good chassis ground Is the voltage approximately battery voltage?	**YES:** GO TO ❺ **NO:** Open in glow plug relay power wire OR Short to ground in glow plug relay power wire

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❺ **Glow Plug Coil Power Test**	*NOTE: For wiring and theory of operation, see GLOW PLUG OPERATION in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine OFF 2. Disconnect one glow plug connector. 3. Using a multimeter, measure voltage between the disconnected glow plug connector and a good chassis ground. Is the voltage approximately battery voltage?	**YES:** Open in glow plug relay return wire **NO:** Open in wire between glow plug relay and glow plugs OR Short to ground in wire between glow plug relay and glow plugs – – –1/1

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 –19–02MAY06–1/1

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 **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 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 ENGINE CONTROL UNIT (ECU) in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. 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.

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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).

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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.

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000970.31 — Engine Shutdown - Auxiliary Request

The ECU does not detect voltage on the engine shutdown input.

RG41221,000026D –19–02MAY06–1/1

000970.31 — Engine Shutdown - Auxiliary Request Diagnostic Procedure

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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running 6. Read DTCs using SERVICE ADVISOR™. 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.

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000971.31 — Engine Derate - Auxiliary Request

The ECU does not detect voltage on the engine shutdown input.

RG41221,000026E –19–02MAY06–1/1

000971.31 — Engine Derate - Auxiliary Request Diagnostic Procedure

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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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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:

- If DTC 000097.16 is active, see DTC 000097.16 — WATER IN FUEL DETECTED DIAGNOSTIC PROCEDURE earlier in this Group.
- If DTC 000100.01 is active, see DTC 000100.01 — ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group.
- If DTC 000110.00 is active, see DTC 000110.00 — ENGINE COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group.
- If DTC 000174.00 is active, see DTC 000174.00 — FUEL TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group.

RG41221,0000273 –19–03APR05–1/1

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:

- If DTC 000097.16 is active, see DTC 000097.16 — WATER IN FUEL DETECTED DIAGNOSTIC PROCEDURE earlier in this Group.
- If DTC 000100.01 is active, see DTC 000100.01 — ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE earlier in this Group.
- If DTC 000110.00 is active, see DTC 000110.00 — ENGINE COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group.
- If DTC 000174.00 is active, see DTC 000174.00 — FUEL TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE earlier in this Group.

RG41221,0000274 –19–03APR05–1/1

001136.00 — ECU Temperature Extremely High

The ECU detects an internal temperature above specification.

RG41221,0000275 –19–02MAY06–1/1

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 –19–02MAY06–1/1

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:
If this code sets, the ECU will control the engine to run under normal operation.

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 **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 ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors 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 ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. Did 001136.16 reoccur?	**YES:** GO TO ❹ **NO:** GO TO ❸

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❸ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation, see ECU TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Ignition ON, engine running 2. Warm engine to normal operating temperatures. 3. Run engine under heavy load for several minutes. 4. Read DTCs using SERVICE ADVISOR™. Did 001136.00 reoccur?	**YES:** GO TO ❹ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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❹ **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 ❺ **NO:** Torque cap screws to specification and retest. – – –1/1

❺ **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 ❻ **NO:** Clean ECU and modify mounting location to prevent future cleanliness problems. Retest. – – –1/1

❻ **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:** Faulty 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.

RG41221,0000277 –19–02MAY06–1/1

001172.03 — Turbo Compressor Inlet Temperature Input Voltage High Diagnostic Procedure

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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 **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 TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the turbo compressor inlet 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 TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **Turbo Compressor Inlet Temperature Sensor and Connector 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 turbo compressor inlet temperature sensor connector 3. Install a jumper wire between both terminals in the turbo compressor inlet temperature sensor connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read turbo compressor inlet temperature input voltage Is the voltage 0.25 volts or below?	**YES:** Faulty turbo compressor inlet temperature sensor connector OR Faulty turbo compressor inlet temperature sensor **NO:** GO TO ❹

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❹ **Turbo Compressor Inlet Temperature Sensor Open 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. Ignition OFF 2. Remove jumper wire between both terminals. 3. Install a jumper wire between the turbo compressor inlet temperature input terminal (terminal 1) of the sensor connector on the engine harness and a good chassis ground. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read turbo compressor inlet temperature input voltage. Is the voltage 0.25 volts or below?	**YES:** Open in turbo compressor inlet temperature sensor ground circuit OR Faulty ECU connection OR Faulty ECU **NO:** Open in turbo compressor inlet temperature sensor input circuit OR Faulty ECU connection OR Faulty ECU 04 160 ,413 – – –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.

RG41221,0000278 –19–02MAY06–1/1

001172.04 — Turbo Compressor Inlet Temperature Input Voltage Low Diagnostic Procedure

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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 **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 TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the turbo compressor inlet 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 TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **Turbo Compressor Inlet Temperature 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 the turbo compressor inlet temperature sensor connector. 3. Ignition ON, engine OFF 4. Using the ECU diagnostic software, read the turbo compressor inlet temperature input voltage. Is the voltage below 4.9 volts?	**YES:** Short to ground in turbo compressor inlet temperature sensor input circuit. OR Faulty ECU connector OR Faulty ECU **NO:** Faulty turbo compressor inlet temperature sensor connector. OR Faulty turbo compressor inlet temperature sensor.

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001172.16 — Turbo Compressor Inlet Temperature Moderately High

The ECU senses a turbo compressor inlet temperature above specification.

RG41221,0000279 –19–02MAY06–1/1

001172.16 — Turbo Compressor Inlet Temperature Moderately High Diagnostic Procedure

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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 **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 TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the turbo compressor inlet 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 TURBO COMPRESSOR INLET TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under condition that set 001172.16 to set. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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

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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.

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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

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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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,418

001180.00 — Turbo Turbine Inlet Temperature Extremely High

The ECU senses a turbo turbine inlet temperature above specification.

RG41221,000027A –19–02MAY06–1/1

001180.00 — Turbo Turbine Inlet Temperature Extremely High Diagnostic Procedure

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,419

Related Information:
The ECU senses a turbo turbine inlet temperature above specification.

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 **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 TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors 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 **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

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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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Read DTCs using SERVICE ADVISOR™. 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

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❺ **Charge Air System Check**	*NOTE: For wiring and theory of operation, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* 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:** Check and adjust the timing. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING in Section 04, Group 150 earlier in this manual. – – –1/1

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,421

001180.16 — Turbo Turbine Inlet Temperature Moderately High

The ECU senses a turbo turbine inlet temperature above specification.

RG41221,000027B –19–02MAY06–1/1

001180.16 - Turbo Turbine Inlet Temperature Moderately High Diagnostic Procedure

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,422

Related Information:
The ECU senses a turbo turbine inlet temperature above specification.

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 sensor 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 **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 TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors 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 **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

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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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Read DTCs using SERVICE ADVISOR™. 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

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❺ **Charge Air System Check**	*NOTE: For wiring and theory of operation, see TURBO TURBINE INLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* 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:** Check and adjust the timing. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING in Section 04, Group 150 earlier in this manual. – – –1/1

001347.03 — Pump Control Valve Current High

ECU detects high current in the pump control return wire.

RG41221,000027F –19–02MAY06–1/1

001347.03 — Pump Control Valve Current High Diagnostic Procedure

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 **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 PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the pump control valve 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 PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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001347.05 — Pump Control Valve Current Mismatch

The ECU is unable to match the measured pump current with the commanded pump current.

RG41221,0000280 –19–02MAY06–1/1

001347.05 — Pump Control Valve Current Mismatch Diagnostic Procedure

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 **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 PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the pump control valve 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 PUMP CONTROL VALVE (PCV) in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 cranking or running. 6. Read DTCs using SERVICE ADVISOR™. 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.

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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.

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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.

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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 –19–02MAY06–1/1

001347.07 — Fuel Rail Pressure Control Error Diagnostic Procedure

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NOTE: If DTC 0001347.07 is accompanied with DTC 000157.03, 000157.04 or 000157.10, follow that diagnostic procedure first.

Related Information:
The ECU detects fuel rail pressure 5 MPa (50 Bar) (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.

The engine could miss or run rough.

Engine may have low power.

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 **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 FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the fuel rail pressure 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 FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine running or cranking 3. Start the ECU diagnostic software. 4. Read and compare fuel rail pressure - desired and fuel rail pressure - actual parameters using SERVICE ADVISOR™. See DATA PARAMETER DESCRIPTION earlier in this Group for an explanation of each parameter. Is desired and actual fuel rail pressure within 5 MPa (50 bar) (725 psi) of each other?	**YES:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. **NO:** Desired is 5 MPa (50 bar) (725 psi) above Actual. GO TO ❸ **NO:** Actual is 5 MPa (50 bar) (725 psi) above Desired. GO TO ❹

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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 or cranking. 2. Inspect all fuel lines and fittings for leakage. Fuel leak(s) present?	**YES:** Tighten loose fitting(s) to proper specification and retest. **NO:** Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE in Section 04, Group 150 earlier in this manual. – – –1/1

❹ **Pump Position Timing Check**	*NOTE: For wiring and theory of operation, see FUEL RAIL PRESSURE SENSOR in Section 03, Group 140 earlier in this manual.* Verify pump position timing is correct. See CHECK AND ADJUST HIGH PRESSURE FUEL PUMP STATIC TIMING later in this Group. Is pump position timing out of sync.	**YES:** Adjust timing and retest. **NO:** Replace ECU and retest. – – –1/1

001569.31 — Fuel Derate

Fuel Derate

Fuel Derate

The fuel derate trouble code is information to the operator that the ECU has detected a condition such as low fuel pressure, high fuel pressure, water in fuel, low oil pressure, high 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.

DTC 001569.31 will set if:

- The ECU detects water in fuel above the threshold quantity for an extended period of time.
- ECU detects a low oil pressure.
- ECU detects high turbo speed.
- ECU detects a high exhaust gas recirculation mixed air temperature.
- ECU detects a high engine coolant temperature.
- The ECU detects a loss of engine coolant.
- ECU detects an out of range voltage on the fuel rail pressure sensor.
- ECU detects a high fuel temperature.
- ECU detects high exhaust gas recirculation exhaust temperature.
- ECU detect a timing problem with the crankshaft position sensor.
- ECU detects an auxiliary request to derate engine.
- ECU detects high turbo turbine inlet temperature.
- ECU detects a high exhaust gas recirculation fresh air temperature.
- ECU detects a low exhaust gas recirculation flow rate.
- ECU detects a problem with the exhaust gas recirculation valve position.
- ECU detects an invalid turbo actuator position.

If DTC 001569.31 sets, the following will occur:

- The ECU will limit the amount of fuel available to the engine in an attempt to protect the engine.

If DTC 001569.31 sets:

- If DTC 000097.16 is active, see the following procedure earlier in this Group:
  - DTC 000097.16 WATER IN FUEL DETECTED DIAGNOSTIC PROCEDURE
- If DTC 000100.01 or DTC 000100.18 is active, see one of the following procedures earlier in this Group:
  - DTC 000100.01 ENGINE OIL PRESSURE EXTREMELY LOW DIAGNOSTIC PROCEDURE
  - DTC 000100.18 ENGINE OIL PRESSURE MODERATELY LOW DIAGNOSTIC PROCEDURE
- If DTC 000103.00 is active, see the following procedure earlier in this Group:
  - DTC 000103.00 TURBO OVERSPEED MOST SEVERE DIAGNOSTIC PROCEDURE
- If DTC 000105.00 or DTC 000105.16 is active, see one of the following procedures earlier in this Group:
  - DTC 000105.00 EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE
  - DTC 000105.16 EXHAUST GAS RECIRCULATION MIXED AIR TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE
- If DTC 000110.00 or DTC 000110.16 is active, see one of the following procedures earlier in this Group:
  - DTC 000110.00 ENGINE COOLANT TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE
  - DTC 000110.16 ENGINE COOLANT TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE
- If DTC 000111.01 is active, see DTC 000111.01 ENGINE COOLANT LEVEL LOW DIAGNOSTIC PROCEDURE earlier in this Group.

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Continued on next page

- If DTC 000157.03 or DTC 000157.04 is active, see one of the following procedures earlier in this Group:
  - DTC 000157.03 FUEL RAIL PRESSURE INPUT VOLTAGE HIGH DIAGNOSTIC PROCEDURE
  - DTC 000157.04 FUEL RAIL PRESSURE INPUT VOLTAGE LOW DIAGNOSTIC PROCEDURE
- If DTC 000174.00 is active, see the following procedure earlier in this Group:
  - DTC 000174.00 FUEL TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE
- If DTC 000412.00 or DTC 000412.16 is active, see one of the following procedures earlier in this Group:
  - DTC 000412.00 EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE
  - DTC 000412.16 EXHAUST GAS RECIRCULATION EXHAUST TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE
- If DTC 000637.02, DTC 000637.07, DTC 000637.08, or DTC 000637.10 is active, see one of the following procedures earlier in this Group:
  - DTC 000637.02 CRANK POSITION INPUT NOISE
  - DTC 000637.08 CRANK POSITION INPUT MISSING
  - DTC 000637.10 CRANK POSITION INPUT PATTERN ERROR
- If DTC 000971.31 is active, see the following procedure earlier in this Group:
  - DTC 000971.31 ENGINE DERATE - AUXILIARY REQUEST DIAGNOSTIC PROCEDURE
- If DTC 001180.00 or DTC 001180.16 is active, see one of the following procedures earlier in this Group:
  - DTC 001180.00 TURBO TURBINE INLET TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE
  - DTC 001180.16 TURBO TURBINE INLET TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE
- If DTC 002630.00 or DTC 002630.16 is active, see one of the following procedures earlier in this Group:
  - DTC 002630.00 EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE EXTREMELY HIGH DIAGNOSTIC PROCEDURE
  - DTC 002630.16 EXHAUST GAS RECIRCULATION FRESH AIR TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE
- If DTC 002659.17 is active, see the following procedure earlier in this Group:
  - DTC 002659.17 EXHAUST GAS RECIRCULATION FLOW RATE LOW LEAST SEVERE DIAGNOSTIC PROCEDURE
- If DTC 002790.16 is active, see the following procedure earlier in this Group:
  - DTC 002790.16 TURBO COMPRESSOR OUTLET TEMPERATURE MODERATELY HIGH DIAGNOSTIC PROCEDURE
- If DTC 002791.02, 002791.13, OR 002791.14 is active, see one of the following procedure earlier in this Group:
  - DTC 002791.02 EXHAUST GAS RECIRCULATION VALVE POSITION INVALID DIAGNOSTIC PROCEDURE
  - DTC 002791.13 EXHAUST GAS RECIRCULATION VALVE LEARNED VALUE ERROR DIAGNOSTIC PROCEDURE
  - DTC 002791.02 EXHAUST GAS RECIRCULATION ACTUATOR SHUT DOWN DIAGNOSTIC PROCEDURE
- If DTC 002795.07 is active, see the following procedure earlier in this Group:
  - DTC 002795.07 TURBO ACTUATOR POSITION MISMATCH DIAGNOSTIC PROCEDURE

RG41221,0000282 –19–03APR05–2/2

001639.01 — Fan Speed Signal Missing

The ECU detects that fan speed input is missing.

WL30140,0000035 –19–02MAY06–1/1

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:** Replace ECU. **NO:** If no other active or stored codes exists, clear codes. Return to service and monitor further.

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001639.16 — Fan Speed Higher Than Expected

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The ECU detects fan speed higher than expected.

WL30140,0000036 –19–02MAY06–1/1

001639.61 — Fan Speed Higher 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 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.

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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.

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001639.18 — Fan Speed Lower Than Expected

The ECU detects fan speed lower than expected.

WL30140,0000037 –19–02MAY06–1/1

001639.61 — 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:** Replace ECU. **NO:** If no other active or stored codes exists, clear codes. Return to service and monitor further. – – –1/1

002000.13 — Security Violation

The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

Security Violation

- When the ignition is first turned on, all of the controllers on the machine communicate with each other to make sure that all controllers are correct for the particular machine.

DTC 002000.13 will set if:

- The ECU determines that it, OR another controller on the machine is not the right controller for the particular machine.

If DTC 002000.13 sets, the following will occur:

- The ECU will allow the engine to start, but will only allow low idle engine speed.

If DTC 002000.13 sets:

- If one of the controllers on the machine has just been replaced, make sure the correct controller was installed.
- If all controllers on the machine are the correct part numbers, check to see if any of the controllers have active or stored CAN related DTCs. If they do, go to the appropriate diagnostic procedure.

RG40854,000000B –19–16APR02–1/1

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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 –19–02MAY06–1/1

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:** Further troubleshooting procedures are being developed.

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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:** Further troubleshooting procedures are being developed.

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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 –19–02MAY06–1/1

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:** Further troubleshooting procedures are being developed. – – –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:** Further troubleshooting procedures are being developed. – – –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 –19–02MAY06–1/1

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:** Further troubleshooting procedures are being developed. – – –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:** Further troubleshooting procedures are being developed. – – –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 –19–02MAY06–1/1

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.

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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 FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR fresh 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 FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. 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:** Remove and clean the charge air cooler. **NO:** Check for obstruction in the charge air cleaner. – – –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 ❹ – – –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 3 (terminal B2 or F2 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

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.

RG41221,0000284 –19–02MAY06–1/1

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 **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 FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR fresh 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 FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **EGR Fresh Air Temperature Sensor and Connector 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 EGR fresh air temperature sensor connector 3. Install a jumper wire between both terminals in the EGR fresh air temperature sensor connector on the engine harness. 4. Ignition ON, engine OFF 5. Using the ECU diagnostic software, read exhaust gas recirculation fresh air temperature input voltage Is the voltage 0.15 volts or below?	**YES:** Faulty EGR fresh air temperature sensor connector OR Faulty EGR fresh air temperature sensor **NO:** GO TO ❹

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❹ **EGR Fresh Air Temperature Sensor Open 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. Ignition OFF 2. Remove jumper wire between both terminals. 3. Install a jumper wire between the EGR fresh 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 software, read exhaust gas recirculation fresh air temperature input voltage Is the voltage 0.15 volts or below?	**YES:** Open in EGR fresh air temperature sensor ground circuit OR Faulty ECU connection OR Faulty ECU **NO:** Open in EGR fresh air temperature sensor input circuit OR Faulty ECU connection OR Faulty ECU 04 160 ,451 – – –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.

RG41221,0000285 –19–02MAY06–1/1

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 **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 FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR fresh 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 FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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❸ **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. 3. Ignition ON, engine OFF 4. Using the ECU diagnostic software, read the exhaust gas recirculation fresh air temperature input voltage. Is the voltage below 4.9 volts?	**YES:** Short to ground in EGR fresh air temperature sensor input circuit. OR Faulty ECU connector OR Faulty ECU **NO:** Faulty EGR fresh air temperature sensor connector. OR Faulty EGR fresh air temperature sensor.

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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 –19–02MAY06–1/1

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 **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 FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR fresh 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 FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. 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:** Remove and clean the charge air cooler. **NO:** Check for obstruction in the charge air cleaner. – – –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 ❹ – – –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 3 (terminal B2 or F2 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

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 –19–02MAY06–1/1

002630.16 - Exhaust Gas Recirculation (EGR) Fresh Air Temperature Moderately 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:
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 **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 FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR fresh 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 FRESH AIR TEMPERATURE SENSOR in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. 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:** Remove and clean the charge air cooler. **NO:** Check for obstruction in the charge air cleaner. – – –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 ❹ – – –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 3 (terminal B2 or F2 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

002659.02 — Exhaust Gas Recirculation (EGR) Flow/Temperature Mismatch

The ECU senses a mismatch between the exhaust gas recirculation flow and temperature.

RG41221,0000288 –19–02MAY06–1/1

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 **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 VALVE in Section 03, Group 135 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR valve 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 VALVE in Section 03, Group 135 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running under load 6. Read DTCs using SERVICE ADVISOR™. Did 002659.02 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 **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 ❺ **NO:** GO TO ❹

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❹ **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.

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❺ **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 ❼ **NO:** GO TO ❻ – – –1/1

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❻ **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

❼ **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 ❾ **NO:** GO TO ❽ – – –1/1

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❽ **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

9 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 10 **NO:** Faulty manifold air pressure sensor. – – –1/1

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10 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.

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Exhaust Gas Recirculation (EGR) Flow Rate High Least Severe Diagnostic Procedure

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 **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 VALVE in Section 03, Group 135 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR valve 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 VALVE in Section 03, Group 135 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. Did 002659.15 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 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 ❹ **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 –––1/1

❹ **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 ❺ **NO:** Open in EGR valve ground circuit. OR Faulty ECU connection OR Faulty ECU –––1/1

❺ **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 ❻ **NO:** Open in EGR valve input circuit. OR Faulty ECU connection OR Faulty ECU

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❻ **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 ❼ **NO:** GO TO ❽

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❼ **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 and retest.

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❽ **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. **NO:** EGR valve learned value needed reset. EGR is functioning correctly. – – –1/1

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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.

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Exhaust Gas Recirculation (EGR) Flow Rate Low Least Severe Diagnostic Procedure

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 **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 VALVE in Section 03, Group 135 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and the EGR valve 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 VALVE in Section 03, Group 135 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF. 3. Start the ECU diagnostic software. 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using SERVICE ADVISOR™. Did 002659.17 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 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. Manually move the valve and using the ECU diagnostic software, read exhaust gas recirculation valve position - actual. Did exhaust gas recirculation valve position - actual change as the valve moved?	**YES:** GO TO ❹ **NO:** GO TO ❺

– – –1/1

❹ **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 ❺ **NO:** Replace EGR cooler.

– – –1/1

❺ **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 ❻ **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 – – –1/1

❻ **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 ❼ **NO:** Open in EGR valve ground circuit. OR Faulty ECU connection OR Faulty ECU – – –1/1

❼ **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 ❽ **NO:** Open in EGR valve input circuit. OR Faulty ECU connection OR Faulty ECU – – –1/1

❽ **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 and retest. **NO:** GO TO ❾ – – –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 for ten minutes. 5. Using the ECU diagnostic software, read DTCs. Did 002659.15 reoccur?	**YES:** Replace the EGR valve and retest. **NO:** EGR valve learned value needed reset. EGR is functioning correctly. – – –1/1

002790.16 — Turbo Compressor Outlet Temperature Moderately High

The ECU senses a turbo compressor outlet temperature above specification.

RG41221,000028B –19–02MAY06–1/1

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 **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 theory of operation, see TURBO COMPRESSOR OUTLET TEMPERATURE in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors 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 **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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software. 4. Read DTCs using SERVICE ADVISOR™. 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

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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 ❸

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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 –19–02MAY06–1/1

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

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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
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.

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002791.03 — Exhaust Gas Recirculation (EGR) Valve Signal Out Of Range High (OORH)

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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 ⓰ – – –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

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

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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

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.

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002791.04 — Exhaust Gas Recirculation (EGR) Valve Position Signal Out Of Range Low Diagnostic Procedure

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 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 002791.04 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.

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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 wires 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

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
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

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⓴ **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.

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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 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 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 002971.02?	**YES:** Troubleshoot those active codes first. **NO:** GO TO ❷ – – –1/1

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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

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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

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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

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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

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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

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. Recalibrate 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

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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

003509.03 — Sensor Supply #1 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG41183,000012C –19–02MAY06–1/1

003509.03 — Sensor Supply #1 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:
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 **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 SENSOR SUPPLY #1 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals. 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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. Did 003509.03 reoccur?	**YES:** GO TO ❸ **NO:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group. 04 160 ,511
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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.

RG41183,000012B –19–02MAY06–1/1

003509.04 — Sensor Supply #1 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:
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 **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 SENSOR SUPPLY #1 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals. 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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 OFF 6. Disconnect all components supplied voltage by ECU terminal G1 in ECU connector #J3. 7. Ignition ON, engine OFF 8. Read DTCs using SERVICE ADVISOR™. Did 003509.04 reoccur?	**YES:** GO TO ❸ **NO:** GO TO ❹ 04 160 ,513

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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

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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 003509.04 set after making a component connection?	**YES:** Sensor that caused 003509.04 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

003510.03 — Sensor Supply #2 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG41183,0000129 –19–02MAY06–1/1

003510.03 — Sensor Supply #2 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 #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, 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 **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 SENSOR SUPPLY #2 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals. 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 SENSOR SUPPLY #2 in Section 03, Group 140 earlier in this manual.* 1. Connect SERVICE ADVISOR™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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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

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003510.04 — Sensor Supply #2 Voltage Low

The ECU detects a supply voltage below specification on the ECU 5 volt supply circuit.

RG41183,000012E –19–02MAY06–1/1

003510.04 — Sensor Supply #2 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 #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, 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 **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 SENSOR SUPPLY #2 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals. 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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 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 using SERVICE ADVISOR™. Did 000620.04 reoccur?	**YES:** GO TO ❸ **NO:** GO TO ❹

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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.

RG41183,000012F –19–02MAY06–1/1

003511.03 — Sensor Supply #3 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 #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 **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 SENSOR SUPPLY #3 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals. 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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

RG41183,0000130 –19–02MAY06–1/1

003511.04 — Sensor Supply #3 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 #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 **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 SENSOR SUPPLY #3 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals. 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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 OFF 6. Disconnect all components supplied voltage by ECU terminal A3 in ECU connector #J2. 7. Ignition ON, engine OFF 8. Read DTCs using SERVICE ADVISOR™. 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

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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

003512.03 — Sensor Supply #4 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG41183,0000131 –19–02MAY06–1/1

003512.03 — Sensor Supply #4 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 #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 **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 SENSOR SUPPLY #4 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals. 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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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.

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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.

RG41183,0000132 –19–02MAY06–1/1

003512.04 — Sensor Supply #4 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 #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 **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 SENSOR SUPPLY #4 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals. 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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 OFF 6. Disconnect all components supplied voltage by ECU terminal G2 in ECU connector #J2. 7. Ignition ON, engine OFF 8. Read DTCs using SERVICE ADVISOR™. Did 523229.04 reoccur?	**YES:** GO TO ❸ **NO:** GO TO ❹

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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

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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

003513.03 — Sensor Supply #5 Voltage High

The ECU detects a supply voltage above specification on the ECU 5 volt supply circuit.

RG41183,0000133 –19–02MAY06–1/1

003513.03 — Sensor Supply #5 Voltage High Diagnostic Procedure

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,530

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 **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 SENSOR SUPPLY #5 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals. 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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 SERVICE ADVISOR™. 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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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.

RG41183,0000134 –19–02MAY06–1/1

003513.04 — Sensor Supply #5 Voltage Low Diagnostic Procedure

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,532

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 **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 SENSOR SUPPLY #5 in Section 03, Group 140 earlier in this manual.* Perform a preliminary inspection of the ECU connectors and all of the sensor connectors using the 5V supply terminal looking for dirty, damaged, or poorly positioned terminals. 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™. For instructions on connecting to SERVICE ADVISOR™, see CONNECTING 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 OFF 6. Disconnect all components supplied voltage by ECU terminal A2 in ECU connector #J3. 7. Ignition ON, engine OFF 8. Read DTCs using SERVICE ADVISOR™. Did 523222.04 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 #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

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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

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).

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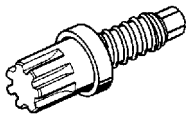
DB92450,000008E –19–22MAY06–1/7

RG7056 –UN–17JUN05

Flywheel Turning Tool JDG820



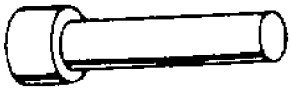
Used to rotate engine flywheel to lock engine at “TDC” to check high pressure fuel pump timing. Use with JDE81-4 Timing Pin.

DB92450,000008E –19–22MAY06–2/7

RG5068 –UN–05DEC97

Timing Pin JDE81-4

Used to lock engine at “TDC”. Use with JDG820 Flywheel Turning Tool.



RG5068

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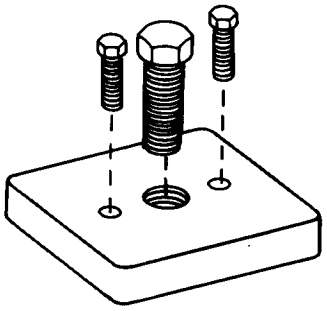
DB92450,000008E –19–22MAY06–3/7

Injection Pump Drive Gear Puller JDG10015

Remove drive gear from tapered shaft on Denso HP4 high pressure fuel pump.



RG6032 –UN–13JAN92

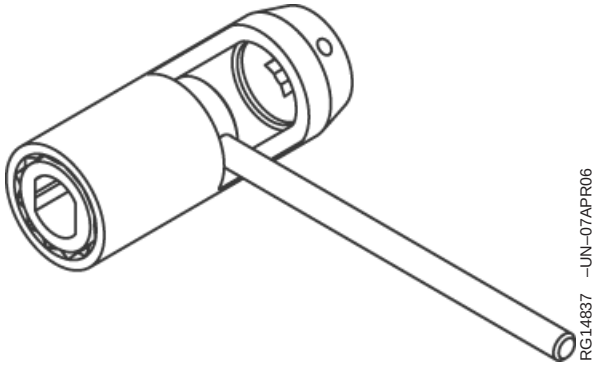
JDG10015

DB92450,000008E –19–22MAY06–4/7

05
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.



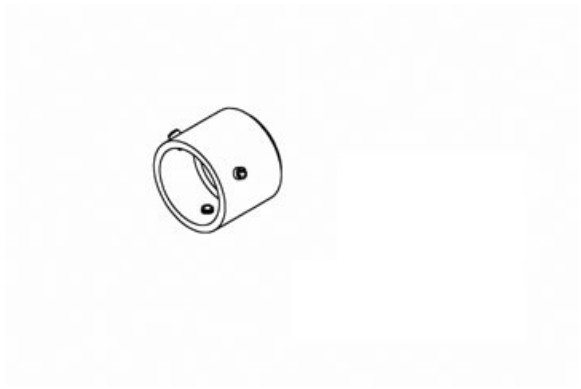
RG14837 –UN–07APR06

Feed Tube Torque Tool

DB92450,000008E –19–22MAY06–5/7

Wiring Harness Nut Socket JDG1949

Used to remove and connect the injector harness coupling.



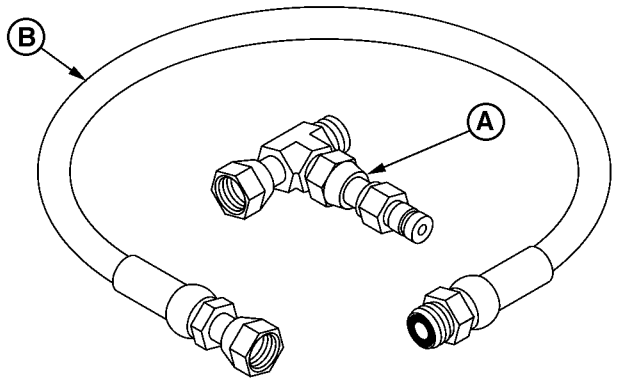
RG14219 –UN–26OCT05

Continued on next page

DB92450,000008E –19–22MAY06–6/7

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.



DB92450,000008E –19–22MAY06–7/7

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

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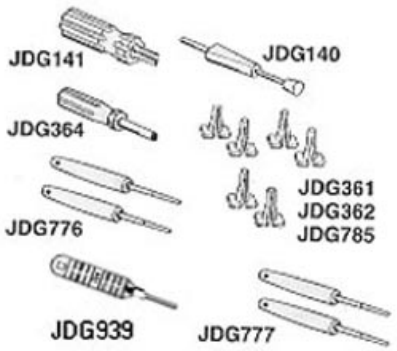
DB92450,000008F –19–22MAY06–1/10

Technician's Electrical Repair Kit JT07195B

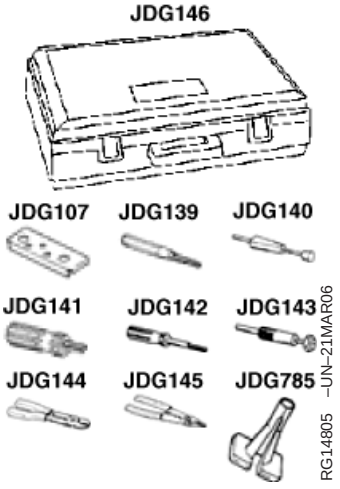
This kit is assembled with the most commonly used tools used to repair wiring harnesses. This kit includes the following: **JDG140** - CPC and Metrimate terminal extraction tool, **JDG141** - CPC Blade Type terminal extraction tool, **JDG361** - Deutsch 12-14 gauge terminal extraction/insertion tool, **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.



DB92450,000008F –19–22MAY06–2/10

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.



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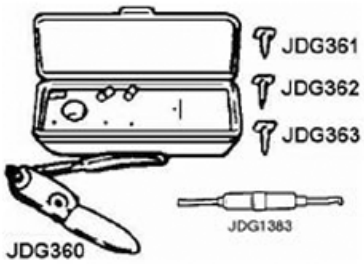
DB92450,000008F –19–22MAY06–3/10

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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DB92450,000008F –19–22MAY06–4/10

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

DB92450,000008F –19–22MAY06–5/10

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

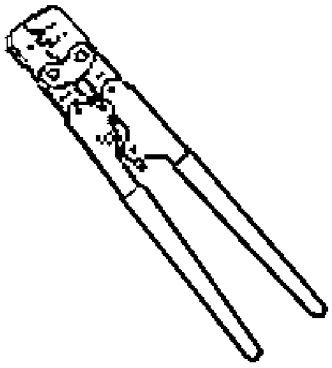
DB92450,000008F –19–22MAY06–6/10

Recommended Repair Tools

DB92450,000008F –19–22MAY06–7/10

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

DB92450,000008F –19–22MAY06–8/10

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.

DB92450,000008F –19–22MAY06–9/10

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

DB92450,000008F –19–22MAY06–10/10

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.

DB92450,0000090 –19–22MAY06–1/1

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.**

SERVICEGARD is a trademark of Deere & Company.

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.

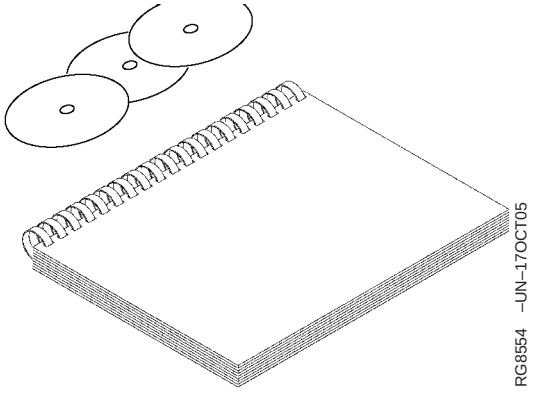
RG5162 –UN–14OCT05

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.



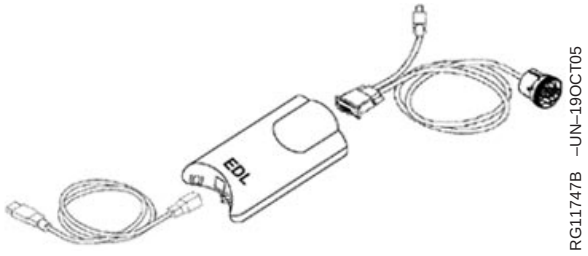
RG8554 –UN–17OCT05

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.



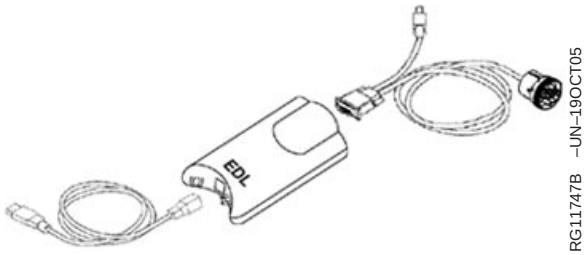
Not all kit components shown

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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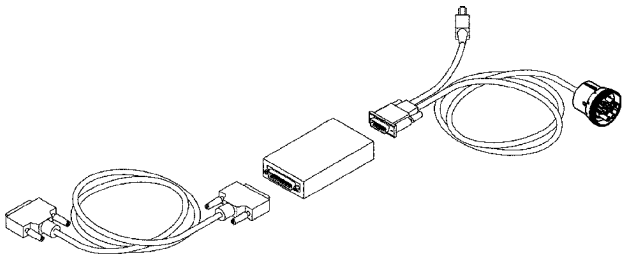
RG41221,00001CB –19–23FEB06–5/9

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).

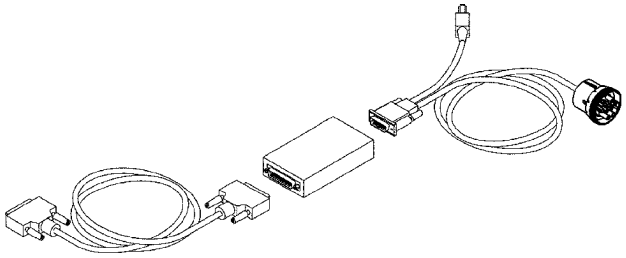


RG11747 –UN–19OCT05

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

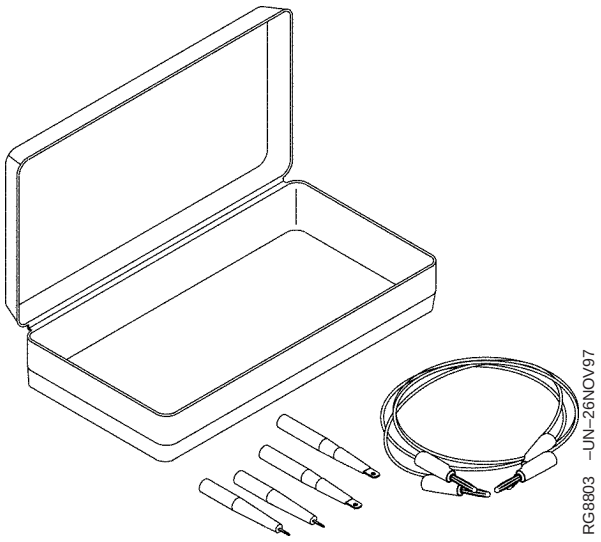
JT07306 - Digital Multimeter

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

05
180
4

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.

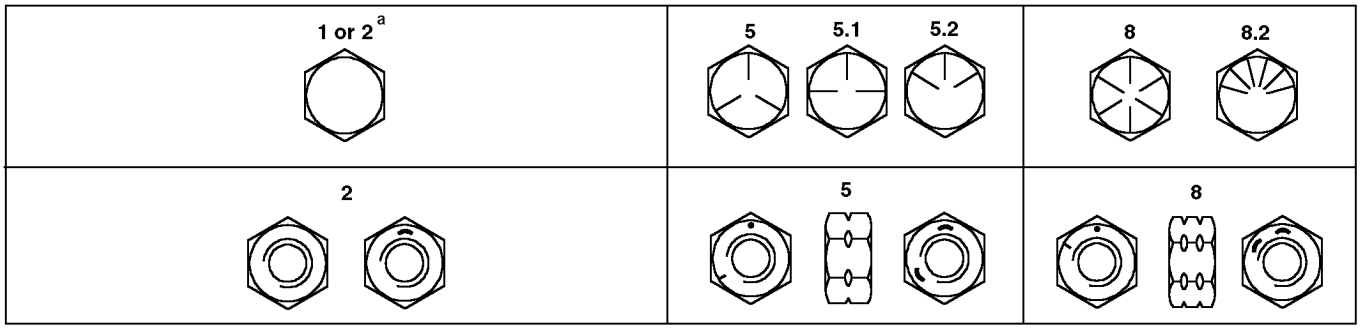
LOCTITE is a registered trademark of Loctite Corp.

DB92450,0000086 –19–22MAY06–1/1

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.

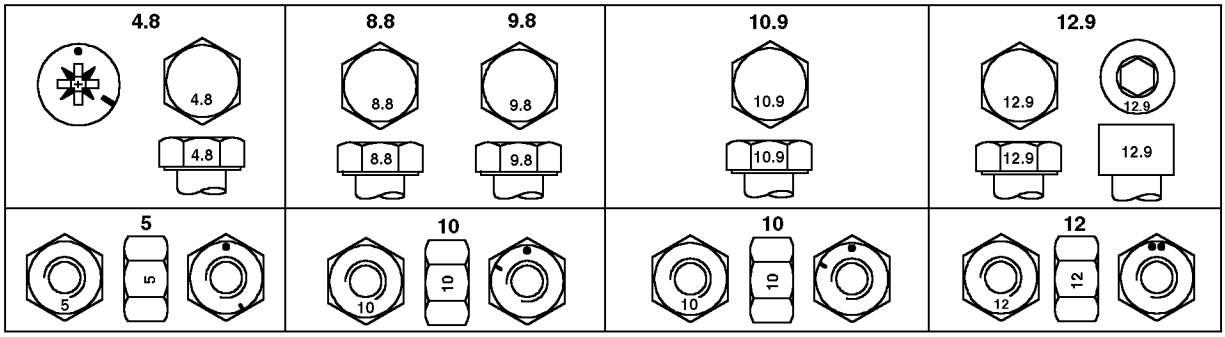
Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

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

Electronic Fuel System Repair and Adjustment Specifications

Item	Measurement	Specification
Pre-filter Inlet and Outlet Lines	Torque	9 N•m (6.6 lb-ft)
Pre-filter Mounting Bracket-to-Cylinder Head Cap Screws	Torque	73 N•m (53.8 lb-ft)
Pre-filter Fuel Filter Base-to-Bracket Cap Screws	Torque	50 N•m (36.9 lb-ft)
Final Fuel Filter Inlet and Outlet Lines	Torque	9 N•m (6.6 lb-ft)
Final Fuel Filter Outlet Line	Torque	9 N•m (6.6 lb-ft)
Air Bleed Valve Fitting (Combine engines)	Torque	20 N•m (14.8 lb-ft)
Final Fuel Filter Base-to-Bracket	Torque	50 N•m (36.9 lb-ft)
Final Fuel Filter Bracket to Cylinder Head	Torque	73 N•m (53.4 lb-ft)
Fuel Transfer Pump Cap Screws (OEM engines only)	Torque	30 N•m (22 lb-ft)
High Pressure Fuel Pump to Adapter Plate	Torque	40 N•m (29.5 lb-ft)
High Pressure Fuel Pump Gear Nut	Torque	68 N•m (50.1 lb-ft)
High Pressure Fuel Pump Adapter Plate to Front Cover	Torque	40 N•m (29.5 lb-ft)
High Pressure Fuel Lines - Injection Pump Fitting	Torque	27 N•m (19.9 lb-ft)
High Pressure Fuel Lines - High Pressure Common Rail Fitting	Torque	27 N•m (19.9 lb-ft)
High Pressure Fuel Pump Leak-off Line Fitting	Torque	6 N•m (4.4 lb-ft)
High Pressure Fuel Pump Inlet Filter Plug	Torque	18 N•m (13.3 lb-ft)

Continued on next page

Item	Measurement	Specification
High Pressure Common Rail Bracket to Engine	Torque	52 N•m (38.4 lb-ft)
High Pressure Common Rail to Bracket	Torque	52 N•m (38.4 lb-ft)
High Pressure Common Rail - Delivery Lines to Electronic Injectors	Torque	27 N•m (19.9 lb-ft)
High Pressure Common Rail - Fuel Inlet Lines	Torque	27 N•m (20 lb-ft)
High Pressure Pump - Fuel Outlet Lines	Torque	27 N•m (20 lb-ft)
High Pressure Rail Leak-off Line Fitting	Torque	6 N•m (4.4 lb-ft)
Flow Damper	Torque	176 N•m (130 lb-ft)
Fitting - High Pressure Injection Line to High Pressure Common Rail	Torque	27 N•m (20 lb-ft)
High Pressure Rail Delivery Fuel Line - Fitting at Side Feed Tube Retaining Nut	Torque	27 N•m (20 lb-ft)
First Torque - Side Feed Tube Retaining Nut	Torque	5 N•m (3.7 lb-ft)
Hold Down Clamp Bolt	Torque	47 N•m (34.7 lb-ft)
Second Torque - Side Feed Tube Retaining Nut	Torque	35 N•m (25.8 lb-ft)
High Pressure Delivery Line Fitting	Torque	27 N•m (19.9 lb-ft)
Injector Solenoid Wire Retaining Nut	Torque	2 N•m (1.5 lb-ft) (18 lb-in.)
Heat Shield Cylinder Head Cap Screws	Torque	60 N•m (44 lb-ft)
Heat Shield Rocker Arm Carrier Cap Screws	Torque	10 N•m (7.4 lb-ft)
Injector Leak-off Fitting	Torque	18 N•m (13.3 lb-ft)

RG41221,00001CE –19–23FEB06–2/2

Electronic Engine Control Repair and Adjustment Specifications

Item	Measurement	Specification
Fuel Temperature Sensor	Torque	10 N•m (7 lb-ft)
Manifold Air Temperature (MAT) Sensor	Torque	10 N•m (7 lb-ft)
EGR Exhaust Temperature Sensor	Torque	60 N•m (44 lb-ft)
Oil Pressure Sensor	Torque	9 N•m (7 lb-ft)
Fuel Rail Pressure Sensor	Torque	98 N•m (72 lb-ft)
Crankshaft Position Sensor	Torque	14 N•m (10 lb-ft)
Pump Position Sensor	Torque	14 N•m (10 lb-ft)
Glow Plug	Torque	15 N•m (11 lb-ft)
Heat Shield Cylinder Head Cap Screws	Torque	60 N•m (44 lb-ft)
Heat Shield Rocker Arm Carrier Cap Screws	Torque	10 N•m (7.4 lb-ft)

RG41221,00001CF –19–28JUN06–1/1

Fuel System Diagnostic Specifications

Item	Measurement	Specification
Minimum Fuel Transfer Pump Pressure	Cranking	30 kPa (0.3 bar) (4.4 psi)
	Running (Low Idle)	40 kPa (0.4 bar) (5.8 psi)
Minimum Fuel Rail Pressure	Cranking	20 MPa (200 bar) (2900 psi)
	Running (Low Idle)	35 MPa (350 bar) (5076 psi)

RG41221,00001D0 –19–02APR05–1/1

Application Specifications

Below is an overview of the specifications listed for applications in the next few pages.

- **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.
  - Glow Plug Specifications - See OEM ENGINES - GLOW PLUG SPECIFICATIONS later in this Group.
  - ECU Terminal Identification - See OEM ENGINES - ECU TERMINAL IDENTIFICATION later in this Group.
  - Electronic Control System Wiring Diagram - See OEM ENGINES - ELECTRONIC CONTROL SYSTEM WIRING DIAGRAM later in this Group.
  - 4.5L & 6.8L OEM Application Instrument Panel/Engine Start Components Electrical Wiring Diagram - See OEM ENGINES - 4.5L & 6.8L INSTRUMENT PANEL/ENGINE START COMPONENTS ELECTRICAL WIRING DIAGRAM later in this Group.

RG41221,00001D1 –19–02APR05–1/1

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

IMPORTANT: The values are those displayed in Service ADVISOR, not read with a meter.

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

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	000103.02	ECU/Turbo Speed Mismatch		ECU uses model based on MAP.
Manifold Air Temperature	000105.00	Temperature	Above 123°C (253°F)	40% of full power.
	000105.03	Input Voltage	Above 4.95 Volts	ECU uses default temperature of 60°C (140°F). High Manifold Air temperature protection disabled.
	000105.04	Input Voltage	Below 0.15 Volts	ECU uses default temperature of 60°C (140°F). High Manifold 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.
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%

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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.
Charge Air Cooler Outlet 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 Charge Air Cooler OutletTemperature engine protection disabled.
	002630.04	Input Voltage	Below 0.15 Volts	ECU uses default temperature of 50°C (122°F). High Charge Air Cooler OutletTemperature 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

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OEM Engines - Torque Curve Selection

Torque Curve Selection for OEM Engines	
Torque Curve # on SERVICE ADVISOR™	Conditions for Torque Curve
1	Normal Curve

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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)

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OEM Engines - Glow Plug Specifications

NOTE: Preheat time has an additional 5 seconds after the light turns off.

Glow Plug Operating Conditions - OEM -Glow Plug Operation - OEM		
Fuel Temperature	**Preheat Time**	**Reheat Time**
-30°C (-22°F)	15 seconds	10 seconds
-25°C (-13°F)	15 seconds	10 seconds
-20°C (-4°F)	15 seconds	10 seconds
-15°C (5°F)	15 seconds	10 seconds
-10°C (14°F)	10 seconds	10 seconds
-5°C (23°F)	5 seconds	10 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 #	Component Terminal #
Switched Battery	J2	B2	N/A[a]
Unswitched Battery	J2	L1, L4, M1, M4	N/A[a]
System Ground	J2	L2, L3, M2	N/A[a]
CAN High	J2	A1	C
CAN Low	J2	A2	D
Sensor Supply # 1	J3	G1	Varies on sensor connected to
Sensor Supply Ground #1	J3	G2	Varies on sensor connected to
Sensor Supply #2	J3	H4	Varies on sensor connected to
Sensor Supply Ground #2	J3	H3	Varies on sensor connected to
Sensor Supply # 3	J2	A3	Varies on sensor connected to
Sensor Supply Ground #3	J2	C3	Varies on sensor connected to
Sensor Supply # 4	J2	G2	Varies on sensor connected to
Sensor Supply Ground #4	J2	G2	Varies on sensor connected to
Sensor Supply # 5	J3	A2	Varies on sensor connected to
Sensor Supply Ground #5	J3	A3	Varies on sensor connected to
Analog Throttle (A) Input	J2	A4	C
Analog Throttle (B) Input	J2	F3	C
Multi-state Throttle Input	J2	B4	A
Fuel Rail Pressure Input	J3	C1	3
Engine Oil Pressure Input	J3	C3	3
Exhaust Gas Recirculation Mixed Air Temperature Input	J3	F1	A
Engine Coolant Temperature (ECT) Input	J3	D3	1
Fuel Temperature Input	J3	B1	1
Crank Position Input	J3	F4	A
Crank Position Return	J3	F3	B
Pump Position Input	J3	G4	A
Pump Position Return	J3	G3	B
Pump Solenoid Return	J1	H2	2
Pump Solenoid Supply	J1	H1	1
Glow Plug Control	J1	F4	NA[a]
Cylinder 1, 2, and 3 90V Supply (6 cylinder engines)	J1	G1	4
Cylinder 4, 5, and 6 90V Supply (6 cylinder engines)	J1	G2	9
Cylinder 1 Control (6 cylinder engines)	J1	E1	1
Cylinder 2 Control (6 cylinder engines)	J1	B4	2
Cylinder 3 Control (6 cylinder engines)	J1	D1	3
Cylinder 4 Control (6 cylinder engines)	J1	A1	10
Cylinder 5 Control (6 cylinder engines)	J1	F1	11
[a]N/A = Not Applicable			

Continued on next page

Cylinder 6 Control (6 cylinder engines)	J1	C1	12
Fuel Transfer Pump Pressure Input	J3	C2	3
Manifold Air Pressure Input	J3	C4	3
Turbo Compressor Inlet Temperature Input	J3	D1	1
Water In Fuel Input	J3	D2	A
Exhaust Gas Recirculation Exhaust Temperature Input	J3	E2	A
Exhaust Gas Recirculation Fresh Air Temperature Input	J3	F2	A
Oil Temperature Input	J3	E3	1
Turbo Actuator Communication Input	J3	E4	4
Glow Plug Relay Diagnostic	J1	A4	NA[a]
Glow Plug Power Supply	J1	F4	NA[a]
Turbo Speed Input	J1	B4	1
Turbo Speed Ground	J1	B3	2
Turbo Actuator Power	J1	H3, H4	1
EGR Valve Power	J1	G3	3
EGR Valve Ground	J1	G4	4
EGR Valve Input	J3	A4	6
Tachometer	J2	D1	NA[a]
Warning Lamp	J2	C1	NA[a]
Wait To Start Lamp	J2	C2	NA[a]
STOP Engine Lamp	J2	D2	NA[a]
Throttle Bump Up Input	J2	D4	NA[a]
Throttle Bump Down Input	J2	F1	NA[a]
Throttle Bump Enable	J2	E4	NA[a]
Loss of Coolant Switch Input	J2	G4	NA[a]
External Shutdown Input	J2	K1	NA[a]
Shutdown Override Input	J2	E3	NA[a]
Droop/Isochronous Input	J2	H4	NA[a]
[a]N/A = Not Applicable			

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ECU/Engine Wiring Schematic

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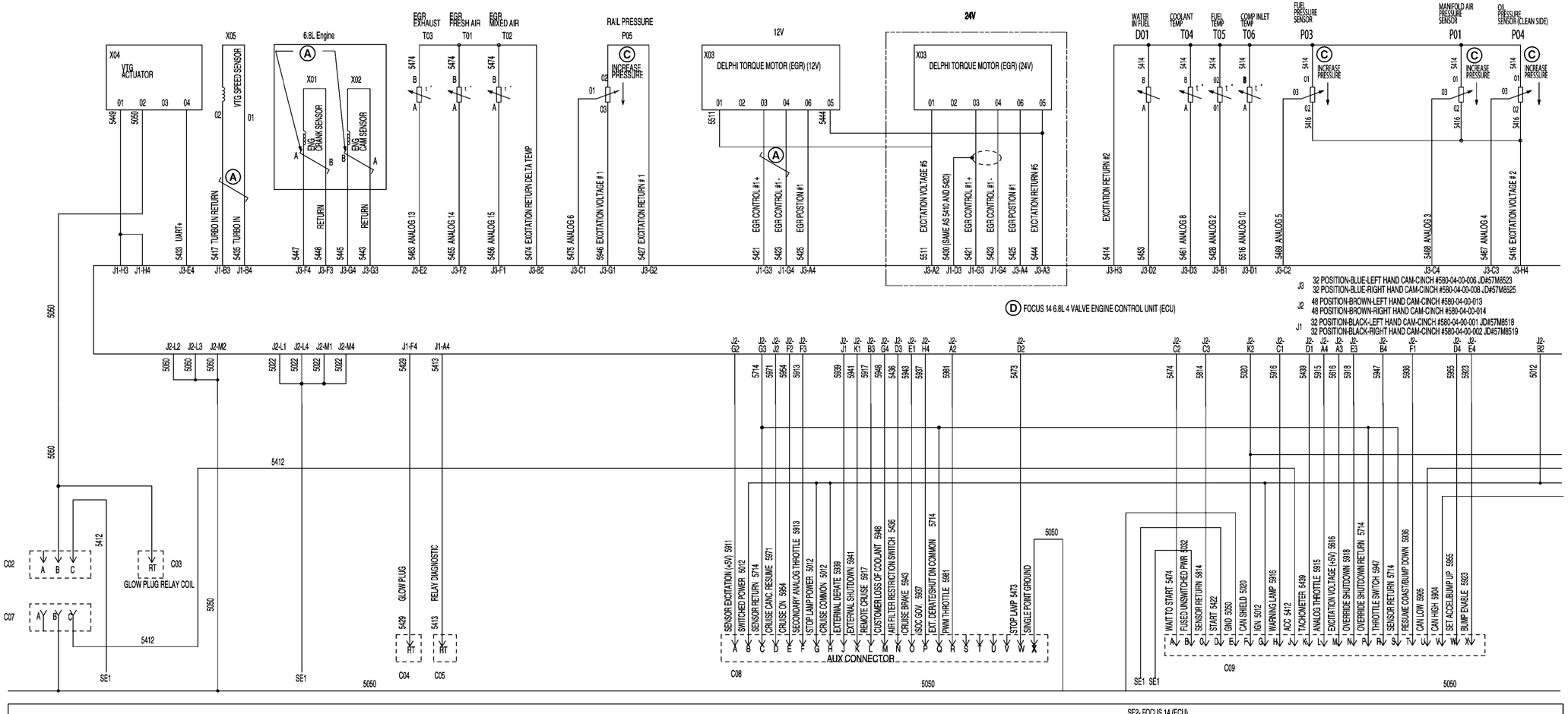

ECU-4.5L & 6.8L Engine Wiring Schematic (Part 1 of 2)

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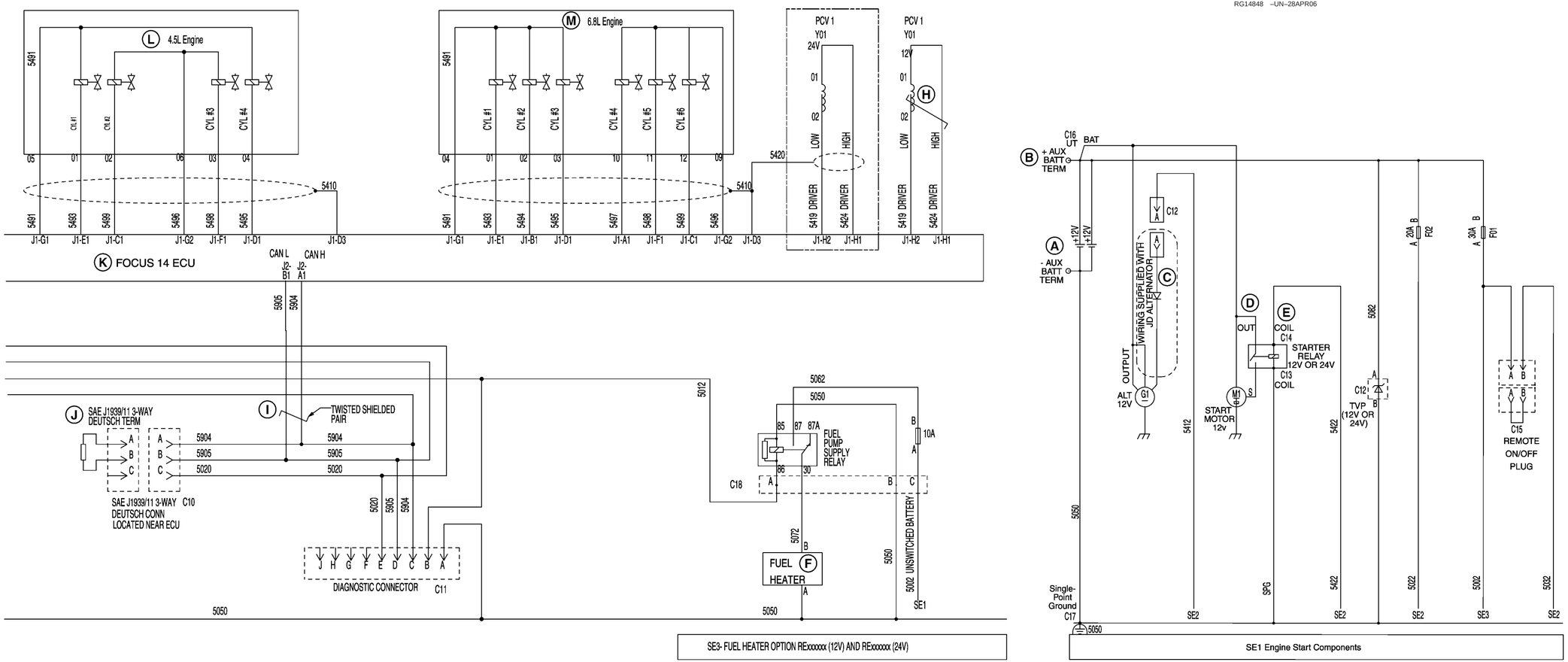
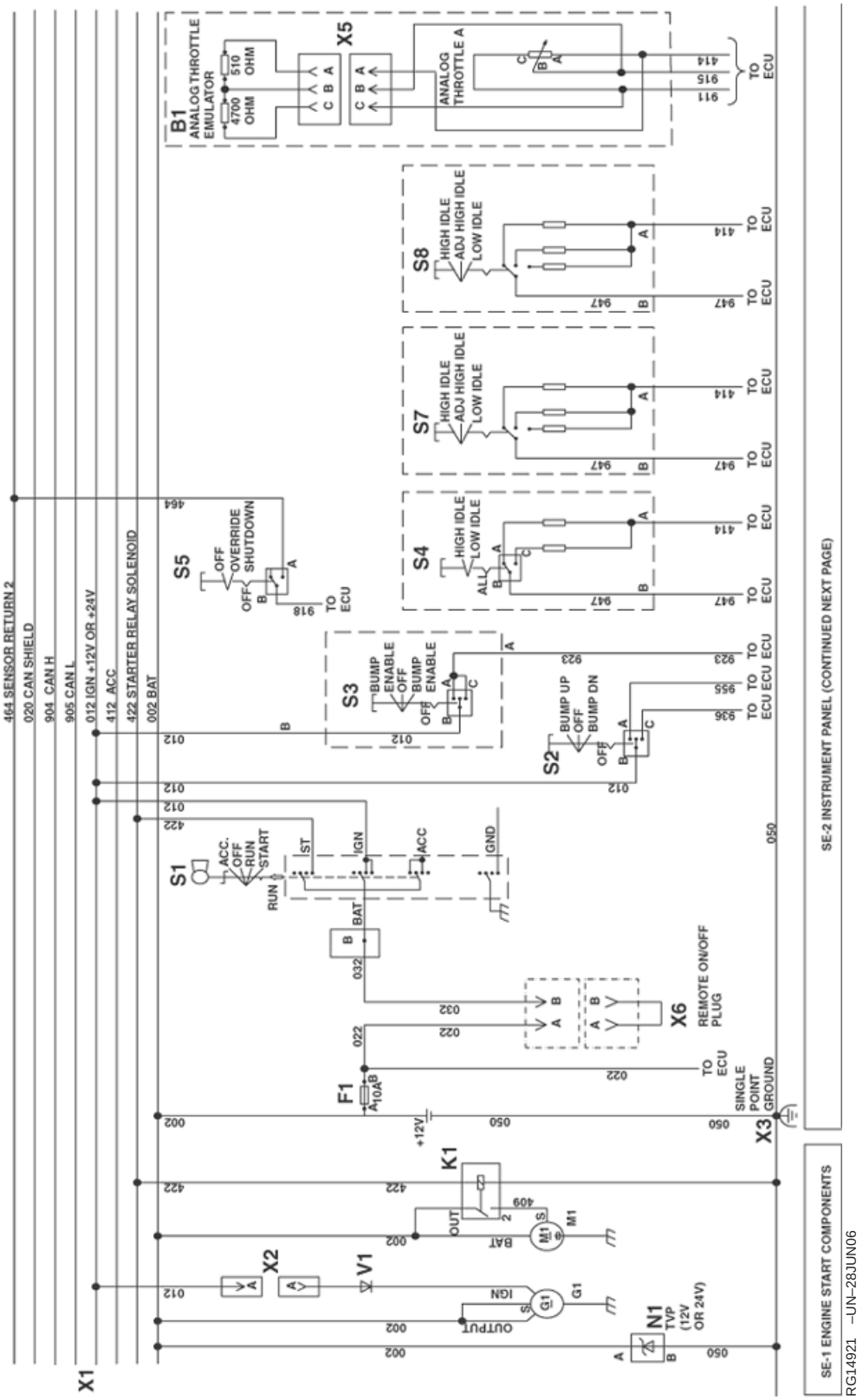


ECU-4.5L & 6.8L Engine Wiring Schematic (Part 2 of 2)

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

Control Panel Wiring Harness Schematic



Control Panel-Engine Start Components Wiring Diagram (sh.1)

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B1—Analog Throttle Emulator
F1—Fuse (10 Amp)
G1—Alternator
K1—Starter Relay
M1—Starter Motor
N1—Transient Voltage Protector (TVP) (12V or 24V)
SE-1—Engine Start Components
SE-2—Instrument Panel (Continued Next Page)
S1—Ignition Key Switch
S2—Speed Select Switch (Momentary)
S3—Bump Enable Switch (Momentary)
S4—Dual State Throttle Switch
S5—Override Shutdown Switch (Momentary)
S7—Tri-State Throttle Switch
S8—Ramp Throttle Switch
V1—Diode
X1—Vehicle Harness Connector
X2—Alternator Harness Connector
X3—Single Point Ground
X5—Analog Throttle Connector
X6—Remote ON/OFF Plug
002—Battery (BAT)
012—Ignition (IGN) +12V or +24V
020—CAN Shield
412—Accelerate (ACC)
422—Starter Relay Solenoid
464—Override Shutdown Return
904—CAN High (H)
905—CAN Low (L)
A—Output
B—Ignition (IGN)
C—Battery (BAT)
D—Output (OUT)
E—Start (ST)
F—Accelerate (ACC)
G—Ground (GND)
H—To ECU (10 Places)
I—Analog Throttle A

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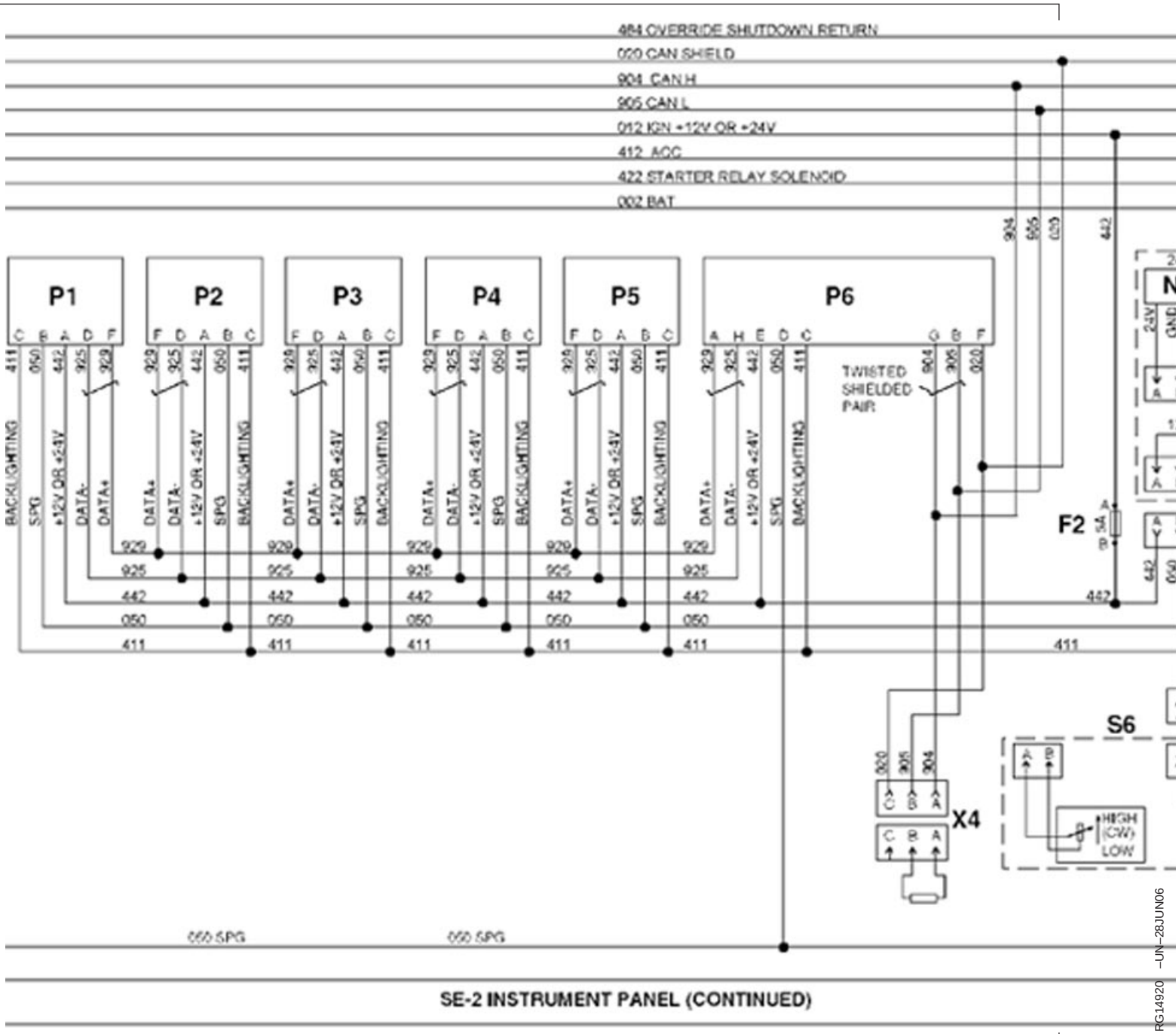

Control Panel-Engine Start Components Wiring Diagram (sh.2)

E1—Back Light Regulator (24V) or Plug (12V)
F2—Fuse (5 Amp)
N2—Voltage Regulator (for 24V Operation
P1—Optional Gauge
P2—Optional Gauge
P3—Oil Pressure Gauge
P4—Coolant Temperature gauge
P5—Tachometer Display
P6—Hourmeter/Diagnostic Meter
SE-2—Instrument Panel (Continued)
S6—Dimmer Control or Jumper Plug
X4—CAN Terminator
002—Battery (BAT)
012—Ignition (IGN) +12V or +24V
020—CAN Shield
050—Single Point Ground (SPG)
411—Backlighting
412—Accelerate (ACC)
422—Starter Relay Solenoid
442—+12V or +24V
464—Override Shutdown Return
904—CAN High (H)
905—CAN Low (L)
925—Data-
929—Data+
A—Twisted Shielded Pair
B—High, (Clockwise CW), Low

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