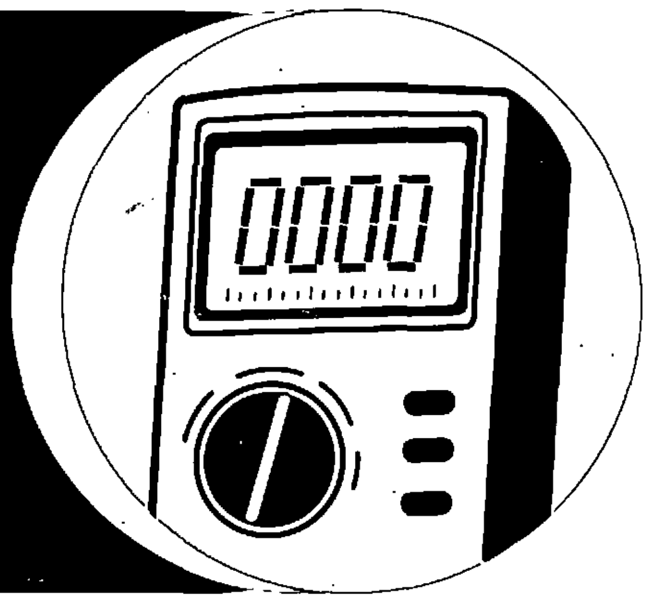
POWERTECH® 10.5 L & 12.5 L Diesel Engines

Operation and Diagnostics for Deere Level 6 ECU

COMPONENT TECHNICAL MANUAL



For complete service information also see:

POWERTECH® 10.5 L & 12.5 L 6105 and 6125 Diesel Engines Repair..................	CTM100

Deere Power Systems Group
CTM188 (15FEB00)

LITHO IN U.S.A.
ENGLISH

JOHN DEERE
DEERE POWER

Introduction

Foreword

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

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 in this manual, be alert to the potential for personal injury.

Use this component technical manual in conjunction with the engine repair manual (CTM100) and the respective machine technical manual. See the repair manual for information on component removal and installation, and gaining access to the components.

This manual is divided in two parts: theory of operation and diagnostics. The theory of operation section contains information that explains how the engine subsystems operate. The diagnostics section helps identify the cause of engine problems.

Applicable special tools needed to do the job, specifications, and helpful reference materials are covered in separate groups toward end of manual.

Engine Training Guide (DSEGET550A) is available to give the service technician a detailed overview of general engine construction and design features. This manual is recommended prior to performing major service procedures on PowerTech® 6105 and 6125 engines.

Fundamental service information is available from other sources covering basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic type of failures and their causes.

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.

CTM115,IFC -19-12JAN99-1/1

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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.

INDX

10.5 L and 12.5 L Engines

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Handle Fluids Safely — Avoid Fires

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

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

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

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

TS227 -UN-23AUG88

Handle Fluids Safely – Avoid Fires

RG,RG34710,1501 -19-30SEP97-1/1

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

Prevent Battery Explosions

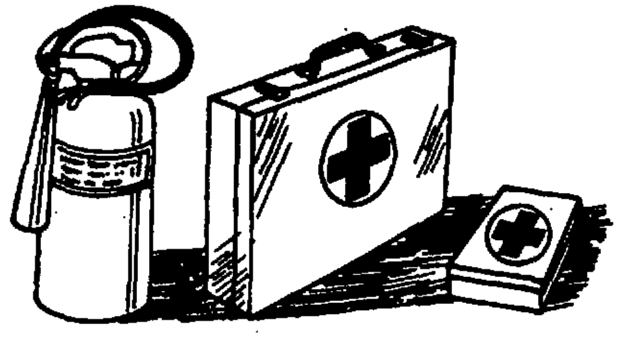
RG,RG34710,1502 -19-30SEP97-1/1

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

Prepare for Emergencies

RG,RG34710,1503 -19-30SEP97-1/1

Prevent Acid Burns

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:

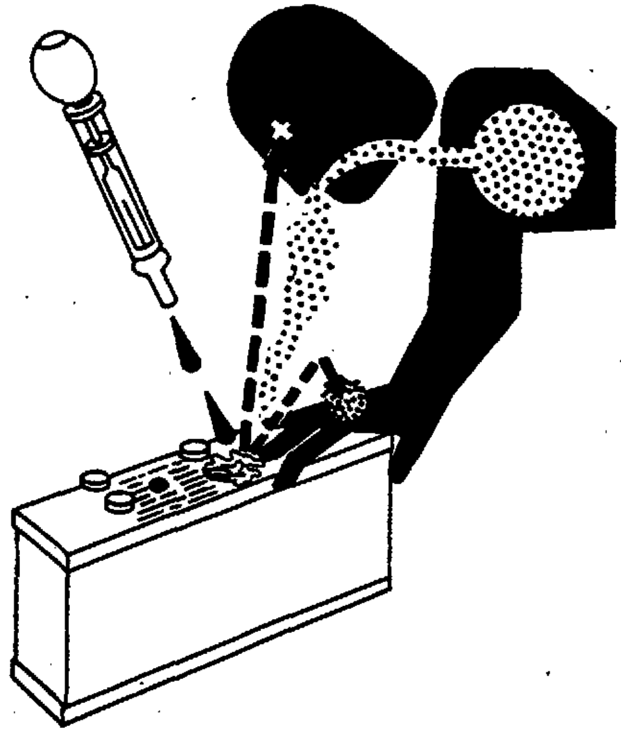
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

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 qt).
3. Get medical attention immediately.



TS203 -UN-23AUG88

Prevent Acid Burns

RG,RG34710,1504 -19-30SEP97-1/1

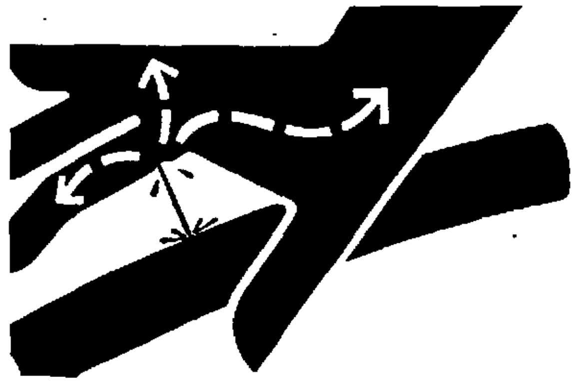
Avoid High-Pressure Fluids

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

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

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

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



X9811 –UN–23AUG88

Avoid High-Pressure Fluids

RG,RG34710,1505 –19–30SEP97–1/1

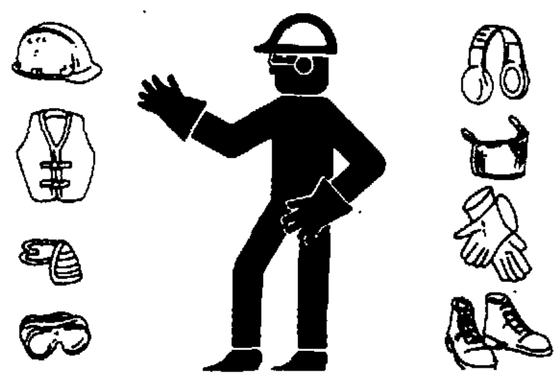
Wear Protective Clothing

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

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

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

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



TS206 –UN–23AUG88

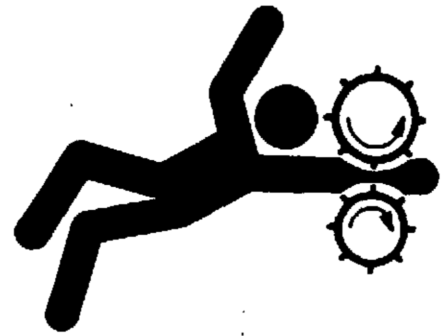
Wear Protective Clothing

RG,RG34710,1506 –19–30SEP97–1/1

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

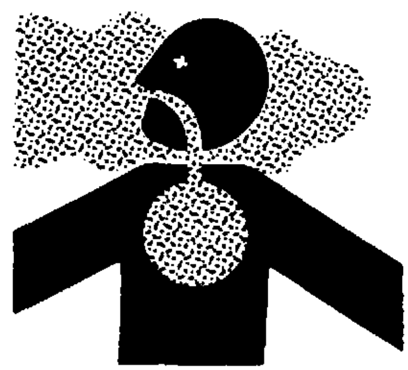
Service Machines Safely

RG,RG34710,1507 —19—30SEP97—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

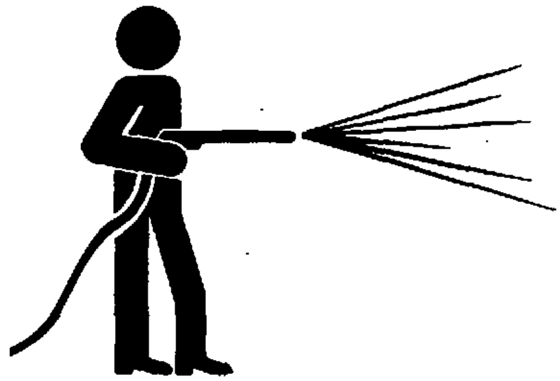
Work in Ventilated Area

RG,RG34710,1508 —19—30SEP97—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

Work in Clean Area

RG,RG34710,1509 –19–30SEP97–1/1

Remove Paint Before Welding or Heating

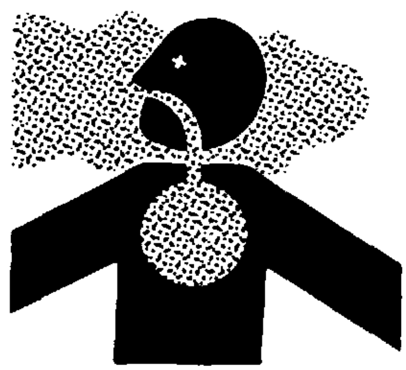
Avoid potentially toxic fumes and dust.

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

Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.



TS220 –UN–23AUG88

Avoid Toxic Fumes and Dust

RG,RG34710,1510 –19–30SEP97–1/1

Avoid Heating Near Pressurized Fluid Lines

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

TS953 –UN–15MAY90

Avoid Heating Near Pressurized Fluid Lines

RG,RG34710,1511 –19–30SEP97–1/1

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 fuel or oil.

TS223 –UN–23AUG88

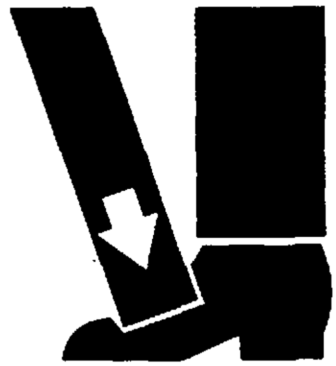
Illuminate Work Area

RG,RG34710,1512 –19–30SEP97–1/1

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

Use Proper Lifting Equipment

RG,RG34710,1513 –19–30SEP97–1/1

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.

Disconnect battery ground cable (–) before making adjustments on electrical systems or welding on machine.

TS218 –UN–23AUG88

Practice Safe Maintenance

RG,RG34710,1514 –19–30SEP97–1/1

Use Proper Tools

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

Use power tools 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

Use Proper Tools

RG,RG34710,1515 –19–30SEP97–1/1

Dispose of Waste Properly

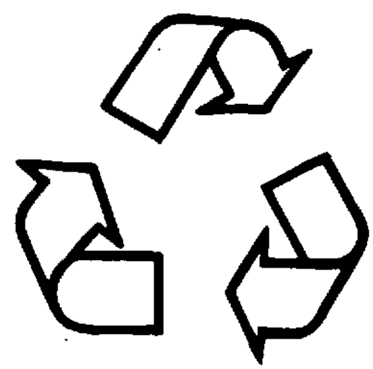
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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

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

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

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



TS1133 –UN–26NOV90

Dispose of Waste Properly

RG,RG34710,1516 –19–30SEP97–1/1

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

Live With Safety

RG,RG34710,1517 -19-30SEP97-1/1

Engine Application Chart

John Deere Agricultural Equipment Applications

Machine Model No.	Engine Model
TRACTORS—4-WHEEL DRIVE	
9200	6105HRW01
9300	6125HRW01
9400	6125HRW02
TRACTORS—LTV TRACKS	
9300T	6125HRW03
9400T	6125HRW04
FORAGE HARVESTERS — SELF-PROPELLED	
6850	6125HZ001
6750	6125HZ002
CANE HARVESTER (CAMECO)	
CH2500	6125AT801

John Deere Construction Equipment Application

Machine Model No.	Engine Model
LOADER—4-WHEEL DRIVE	
744H/MH	6125ADW01
LX230-3 Hitachi	6125ADW70

Original Equipment Manufacturers (OEM) Applications

Machine Model No.	Engine Model
OEM	6105AF001 6105HF001 6125AF001 6125AFM01 6125HF001

RG,RG34710,25 –19–13AUG99–1/1

Distinguishing ECUs

The Deere Level 6 ECU is used on later 10.5L/12.5L Diesel Engines. This manual (CTM 188) supports all diagnostics, theory of operation, and tests for engines that use this controller. This controller (A) has 4 connectors going into it.

The Lucas ECU is used on earlier 10.5L/12.5L Diesel Engines. CTM 115 supports all diagnostic, theory of operation, and tests for engines that use this controller. *The Lucas Controller (B) has 2 connectors going into* it. Please refer to the drawing below to determine the controller that is being used.

Below are tables that show the the serial numbers of the engines that will have the John Deere Level 6 Controller for each engine model on all the applications.

John Deere Agricultural Equipment Applications

Machine Model No.	Engine Model	Engine Serial Number Break between Lucas and Deere Level VI Controllers
TRACTORS—4-WHEEL DRIVE		
9200	6105HRW01	003157—
9300	6125HRW01	008114—
9400	6125HRW02	008114—
TRACTORS—LTV TRACKS		
9300T	6125HRW03	Level VI controllers on ALL 9300 LTVs
9400T	6125HRW04	Level VI controllers on ALL 9400 LTVs
FORAGE HARVESTERS — SELF-PROPELLED		
6850	6125HZ001	008337—
6750	6125HZ002	008337—
CANE HARVESTER (CAMECO)		
CH2500	6125AT801	011053—

John Deere Construction Equipment Applications

Machine Model No.	Engine Model	Engine Serial Number Break between Lucas and Deere Level VI Controllers
LOADER—4-WHEEL DRIVE		
744H/MH	6125ADW01	009798—
LX230-3 Hitachi	6125ADW70	009813—

Original Equipment Manufacturers (OEM) Applications

Machine Model No.	Engine Model	Engine Serial Number Break between Lucas and Deere Level VI Controllers
OEM	6105AF001	003764—
	6105HF001	003764—
	6125AF001	010967—
	6125AFM01	008526—
	6125HF001	010972—

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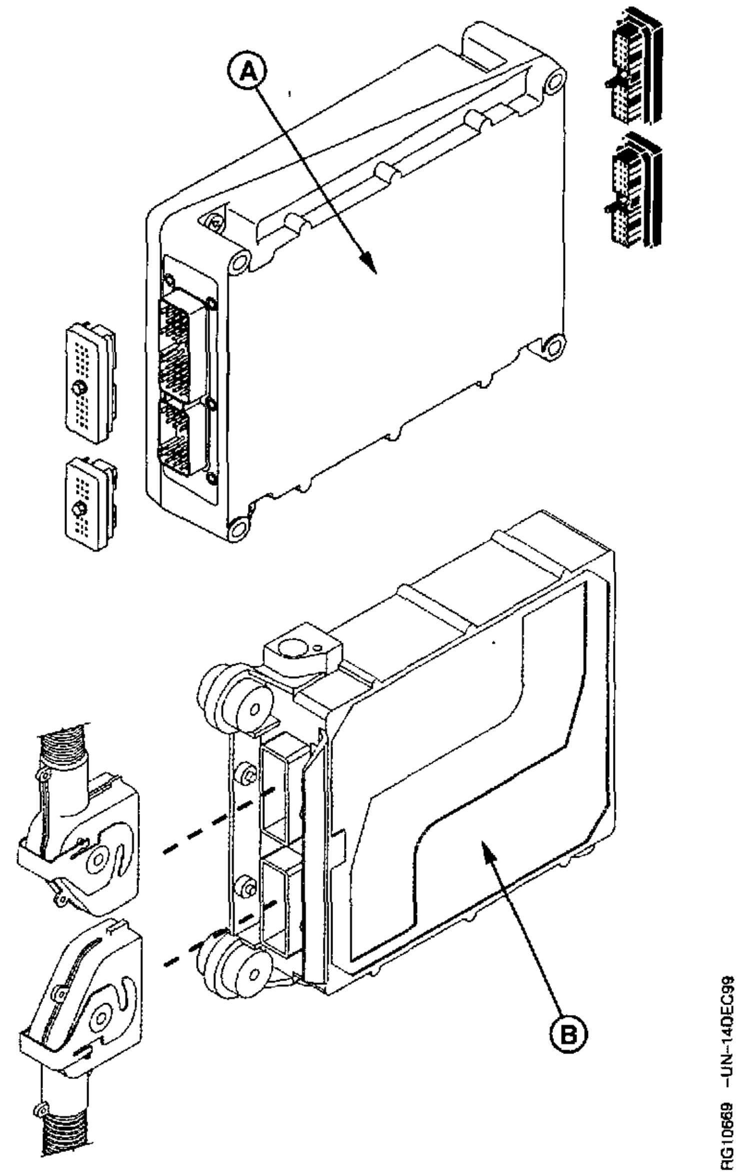


Distinguishing Deere Level 6 ECU from Lucas ECU

A—Deere Level 6 ECU **B—Lucas ECU**

DPSG,RG40854,477 -19-10DEC99-2/2

General Engine Operation

The 6105 and 6125 engines include a cam in head, actuating four valves per cylinder and an electronic unit injector (EUI) fuel system. They are vertical stroke, in-line, valve-in-head, 6-cylinder diesel engines. The firing order is 1-5-3-6-2-4.

The cast block has ribbed walls to add strength and rigidity, and to decrease noise and vibration. The 6105 and 6125 use the same block. The crankshafts and pistons are different to produce a long stroke and short stroke engine.

The engine oil filter mounts to a combination oil filter housing and pressure regulator housing. These items then bolt together with the oil cooler housing (A) located on the right side of the block.

A gear train on the front of the engine consists of four gears connecting the crankshaft with the camshaft. The crankshaft gear drives the oil pump gear (B), which drives the engine coolant pump gear and the idler gear (C). The idler gear then drives the camshaft gear (D). A backlash adjustment is required during assembly. No timing marks are used on the gears.

A timing pin procedure is used to increase the accuracy of the gear train adjustment. To locate top dead center of the crankshaft for number one and number six cylinders, a timing pin is installed through a timing hole on the right side of the block. The pin will engage a slot cut into a counterweight of the crankshaft.

The crankshaft (E) is a heat treated, dynamically balanced steel forging which rotates in replaceable main bearings. Thrust washers are added to the number five main bearing to reduce crankshaft defection and to limit end play during high load operation.

Cylinder liners (F) are wet sleeve, flanged, and centrifugally cast using a strong durable alloy. O-rings (G) are used to seal the connection between the cylinder block and liners. Liners incorporate top liner cooling passages.

6105 engines use an aluminum piston with a 3 ring configuration. The top two rings are compression rings and the lower ring is an oil control ring. Double Ni-Resist ring carriers are cast integrally in the piston to greatly improve the life of the ring grooves.

6125 engines use an articulated or two piece piston (H). The crown of the piston is steel. This adds strength and durability for the higher power output of the 6125 engine. The skirt of the piston is aluminum to reduce the overall weight of the piston.

The 6105 and 6125 pistons have a centered, symmetrical bowl to provide efficient combustion, which allows the engine to produce high power with low exhaust emissions.

The hardened piston pins (I) are highly polished, fully floating, and held in place by snap rings.

Connecting rods (J) are made of forged steel and have replaceable bushing and bearing inserts. They are weight controlled (by machining) on both ends to minimize engine vibration.

WEAR-GARD bearings are used on the connecting rod. These bearing have a lube pocket to provide an extra volume of oil to lubricate and cool the crankshaft.

The engine is equipped with an oil spray jet (K) for each cylinder, installed through the right side of the cylinder block. The spray jets precisely spray a stream of oil directly from the main oil galley onto the bottom of the pistons. This provides piston cooling and lubrication for the piston pin and the connecting rod bushing.

Continued on next page RG,RG34710,1518 –19–30SEP97–1/2

The cylinder head is an air-flow-through design. The exhaust manifold is located on the left side of the head; the intake manifold on the right. Intake and exhaust passages have been optimized for the most efficient air flow, raising the volumetric efficiency of the engine. Intake ports are short to reduce intake air heating. Exhaust ports are short to reduce heat rejection to the head. The head contains the camshaft (L), 4 valves per cylinder (M), the rocker arm assemblies, and the electronic unit injectors (N). The head has replaceable powdered metal valve guides and valve seats.

The camshaft turns in the head on four replaceable bushings. The camshaft directly actuates the rocker arms for the valves and the rocker arm for the electronic unit injectors. Rocker arms rotate on a two-piece rocker arm shaft (O). The rocker arms for cylinders 1, 2, and 3 rotate on one half of the two piece shaft; the rocker arms for cylinders 4, 5, and 6 rotate on the other half. Rollers built in to each rocker arm ride on the camshaft lobes.

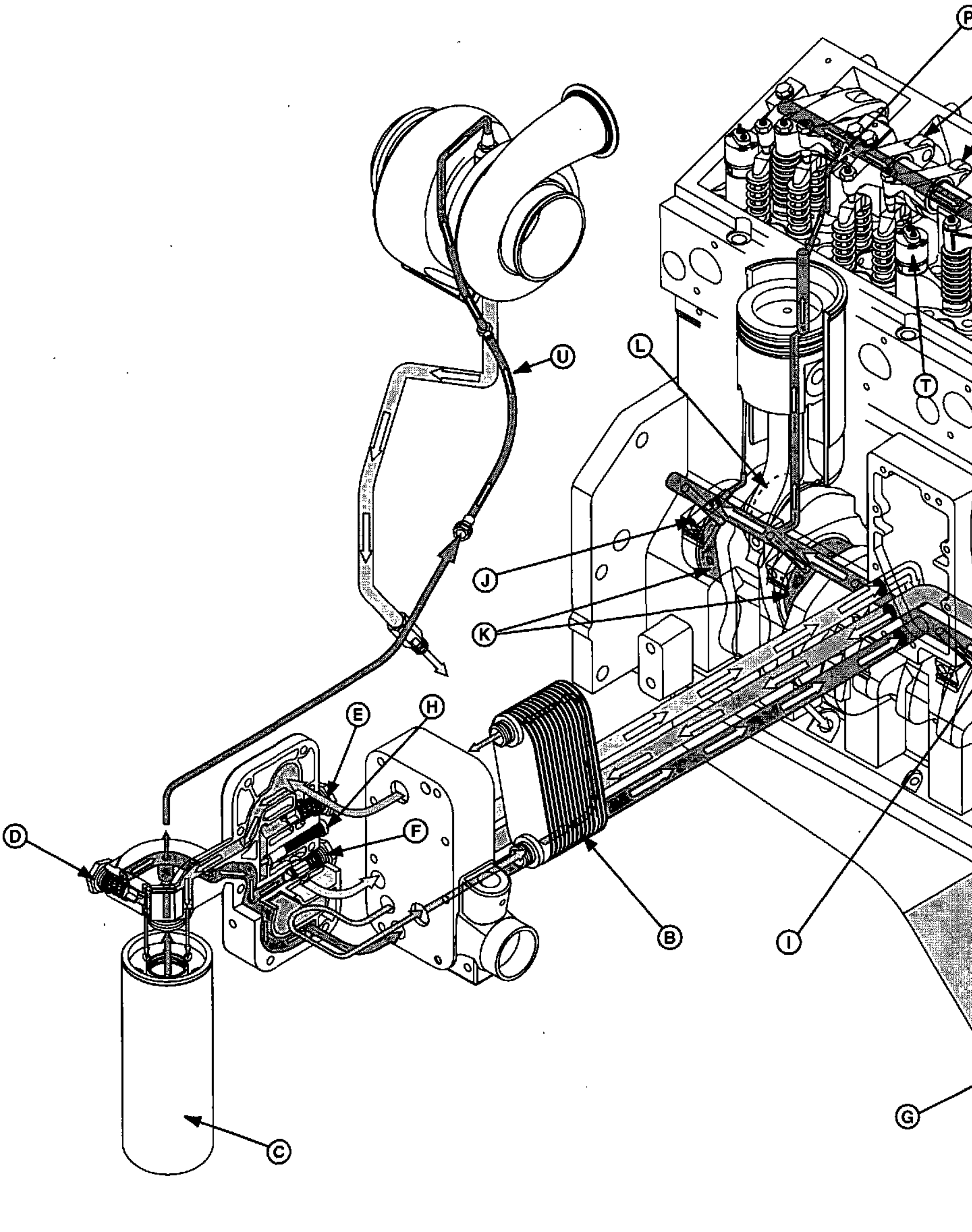
The electronic unit injector rocker arm directly actuates an injector for each cylinder. The injectors are located so that they spray fuel directly into the center of the cylinder. The injectors deliver fuel at a much higher pressure (approximately 23,200 psi) than what is achievable with an in-line or rotary injection pump.

The valve rocker arms push on a short push rod. The push rod actuates a bridge that will then operate two valves.

Four valves per cylinder increases engine air flow compared to using one large intake and one large exhaust valve. The intake valves for each cylinder are located towards the front of engine. The exhaust valves are located towards the rear. The intake valves and exhaust valves are the same size. The difference between the two can be determined by the fact that the intake valves are all magnetic. The head of the exhaust valves are a stellite alloy and are not magnetic.

RG,RG34710,1518 –19–30SEP97–2/2

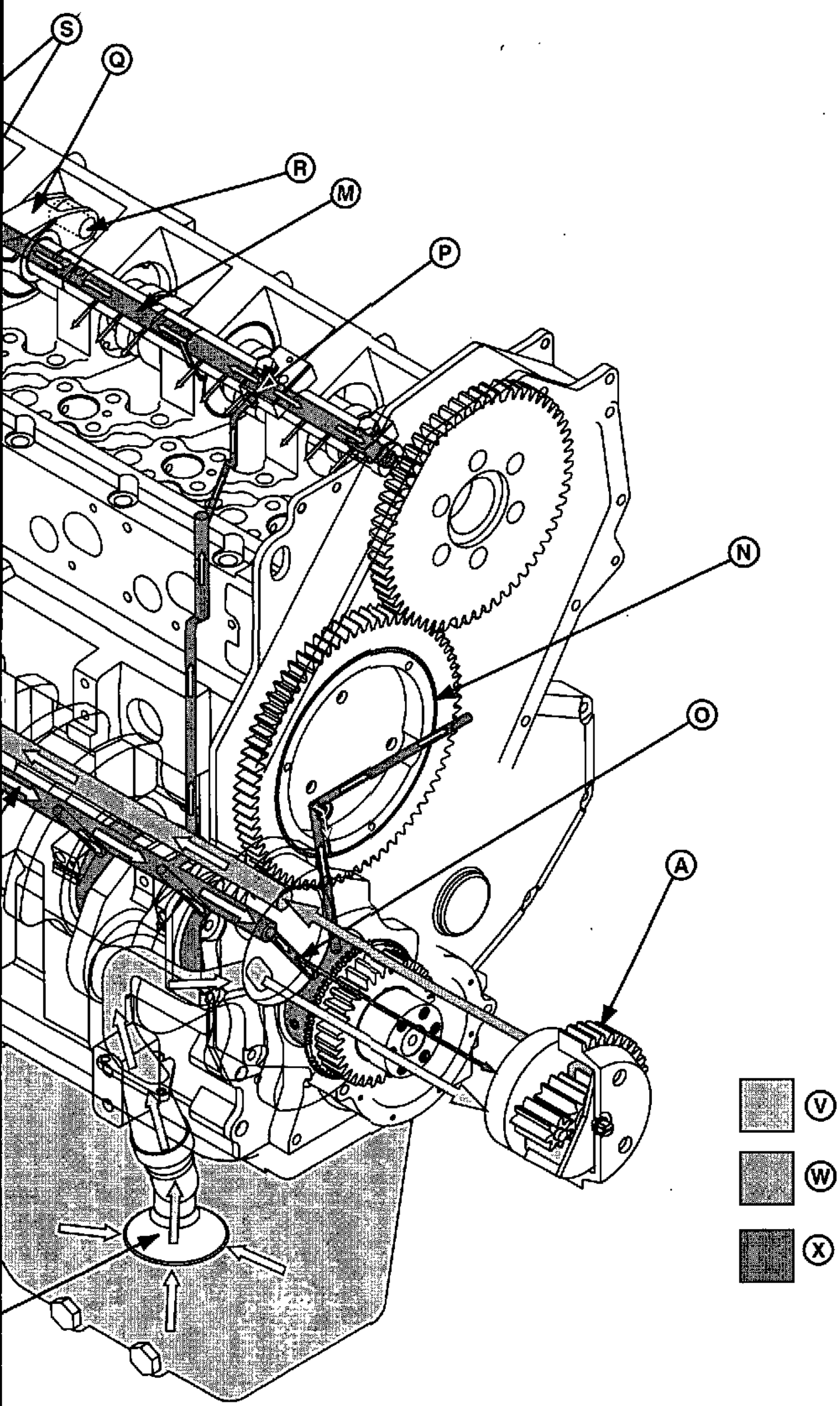
Ge



A—
B—
C—
D—

Lubrication System Operation

RG8691 –UN–11JUN98



Lubrication System

RG,RG34710,1519 –19–30SEP97–1/3

A—Oil Pump
B—Oil Cooler
C—Oil Filter
D—Oil Filter Bypass Valve
E—Oil Cooler Bypass Valve
F—Oil Pressure Regulating Valve
G—Pick-up Tube
H—Oil Cooler Relief Valve
I—Main Oil Galley
J—Piston Spray Jets
K—Crankshaft Main Bearing
L—Connecting Rod Bearing
M—Rocker Arm Shaft Assemblies
N—Idler Gear Bushing
O—Oil Pump Drive Gear Bushing Lube
P—Rocker Arm Shaft Oil Supply
Q—Unit Injector Rocker Arm
R—Unit Injector Rocker Arm Roller Bushing
S—Valve Rocker Arm Rollers
T—Electronic Unit Injector
U—Turbocharger Lube Line
V—Return Oil
W—Pressurized-Nonfiltered Oil
X—Pressurized-Filtered Oil

The lubrication system consists of a crankshaft driven oil pump (A), oil cooler (B), oil filter (C), oil filter bypass valve (D), oil cooler bypass valve (E), and oil pressure regulating valve (F).

Oil is drawn from the sump via a pick-up tube (G) and an internal passage in the cylinder block. The oil pump sends the oil to the pressure regulating valve housing and then to the oil cooler through an internal passage in the cylinder block. An oil cooler relief valve (H) protects the oil cooler during cold oil starting by returning oil to sump. The cooler bypass valve allows oil to bypass the cooler and flow to the filter if the oil cooler is restricted. From the oil cooler oil flows to the oil filter housing and into the filter. If the filter becomes restricted, the oil filter bypass valve will open sending oil to the main oil galley.

Oil flow from the filter is sensed by the oil pressure regulating valve. This valve regulates the pressure in the main oil galley (I). Excess oil is returned to sump.

Clean cool oil is routed directly from the top of the filter base (U) to the turbocharger. Turbocharger return oil is routed through a steel line to the cylinder block and then to sump.

The remaining oil is routed to the main oil galley then distributed to the piston spray jets (J), crankshaft main bearings (K), connecting rod bearings (L), the two rocker arm shaft assemblies (M), upper idler gear bushing (N), and auxiliary drive.

The piston spray jets receive oil directly from the main oil galley. These spray jets allow for precise targeting of the oil spray onto the bottom of the piston.

Drilled passage in the block route oil directly to each crankshaft main journal. The main bearing is slotted to allow oil to flow to the crankshaft cross-drilled passages. The crankshaft cross drilled passages route oil flow from a main journal to each connecting rod bearing.

A drilled passage (O) at the front of the block routes lubrication oil to the oil pump. A cross drilled passage in the pump housing routes this oil to the outside edge of the pump. This oil lubricates the oil pump gear bushing.

A drilled passage from the number one main bearing routes oil to the upper idler gear hub. A drilled passage in the hub routes oil to the outside edge of the hub. This oil lubricates the upper idler gear bushing.

A drilled passage in the cylinder block connects with the upper idler passage. This oil is available to lubricate auxiliary drive components.

Two drilled passages route oil from the main oil galley through the cylinder block towards the head. At the head gasket, oil flows into head bolt holes 19 and 23. Oil flows around these bolts and into a cross-drilled passage at the top of the head. Steel lines (P) connect with the cross drilled passages and routes oil to a rocker arm shaft hold down clamp for each rocker arm shaft.

At the rocker arm hold down clamp, oil flows around a cap screw and enters the rocker arm shaft assemblies (M). The rocker arm shaft is hollow and is sealed on each end. A hollow roll pin connects with each rocker arm shaft drilled passage and routes oil to the two center camshaft bushings.

Continued on next page

The front and rear camshaft bushings receive oil from a hole in the respective rocker arm shaft. A drilled passage lines up with a drilled passage in the head to route oil to the bushings.

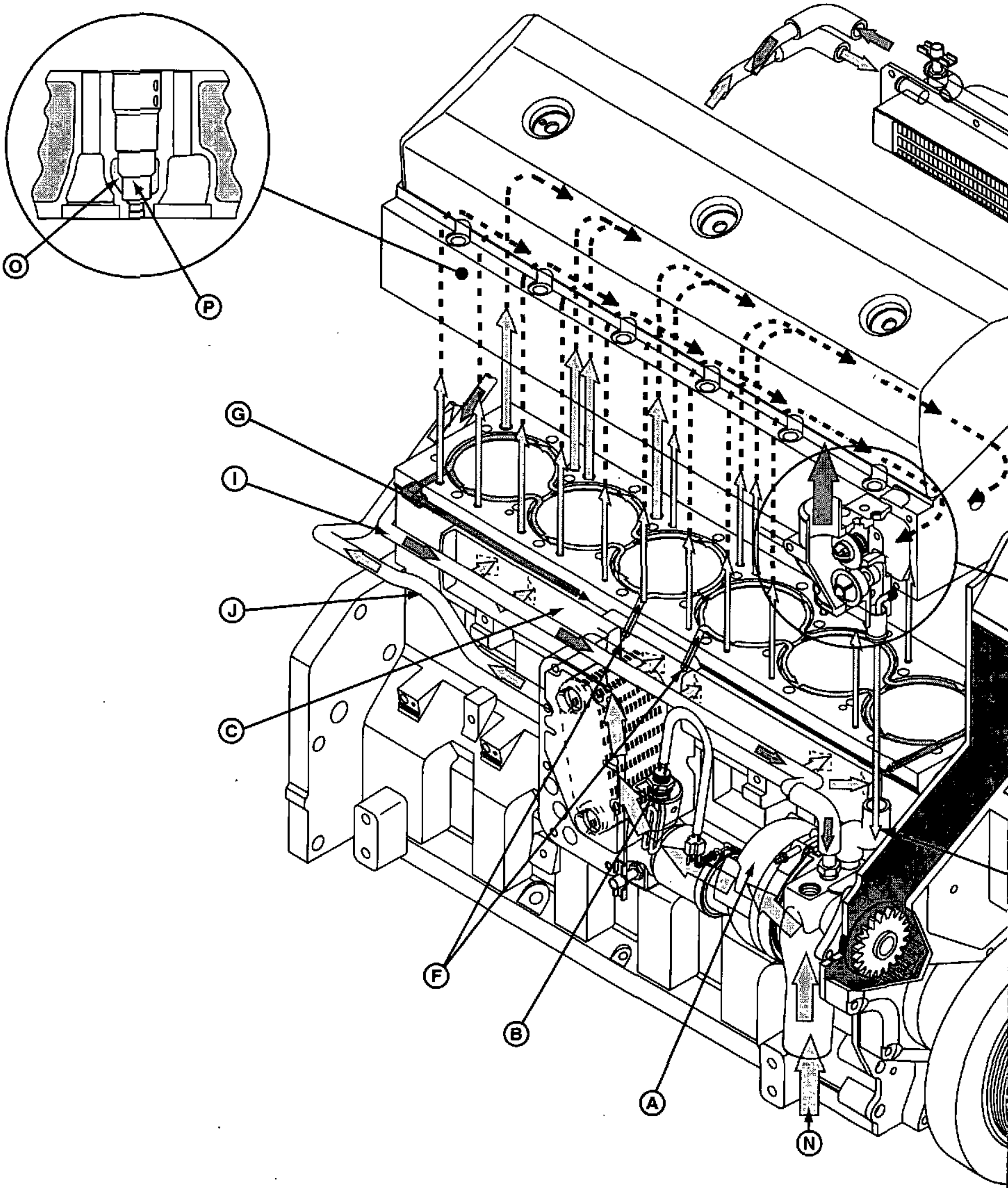
The rocker arm shaft is cross-drilled to provide lubrication to each rocker arm bushing.

The unit injector rocker arms (Q) are cross-drilled to route oil from the bushing to each end of the rocker arm. At the roller end, oil flows through the roller bushing (R) and out to spray and lubricate the adjacent valve rocker arm rollers (S). Oil then sprays on to the camshaft lobes.

At the front of the unit injector rocker arms, oil sprays out the adjusting screw to lubricate the unit injector (T) and the adjacent valves and adjusting screws.

Some oil is routed from the top of the oil filter base through an external line to the turbocharger and is returned to the cylinder block crankcase through another external line.

RG,RG34710,1519 –19–30SEP97–3/3


O
P
G
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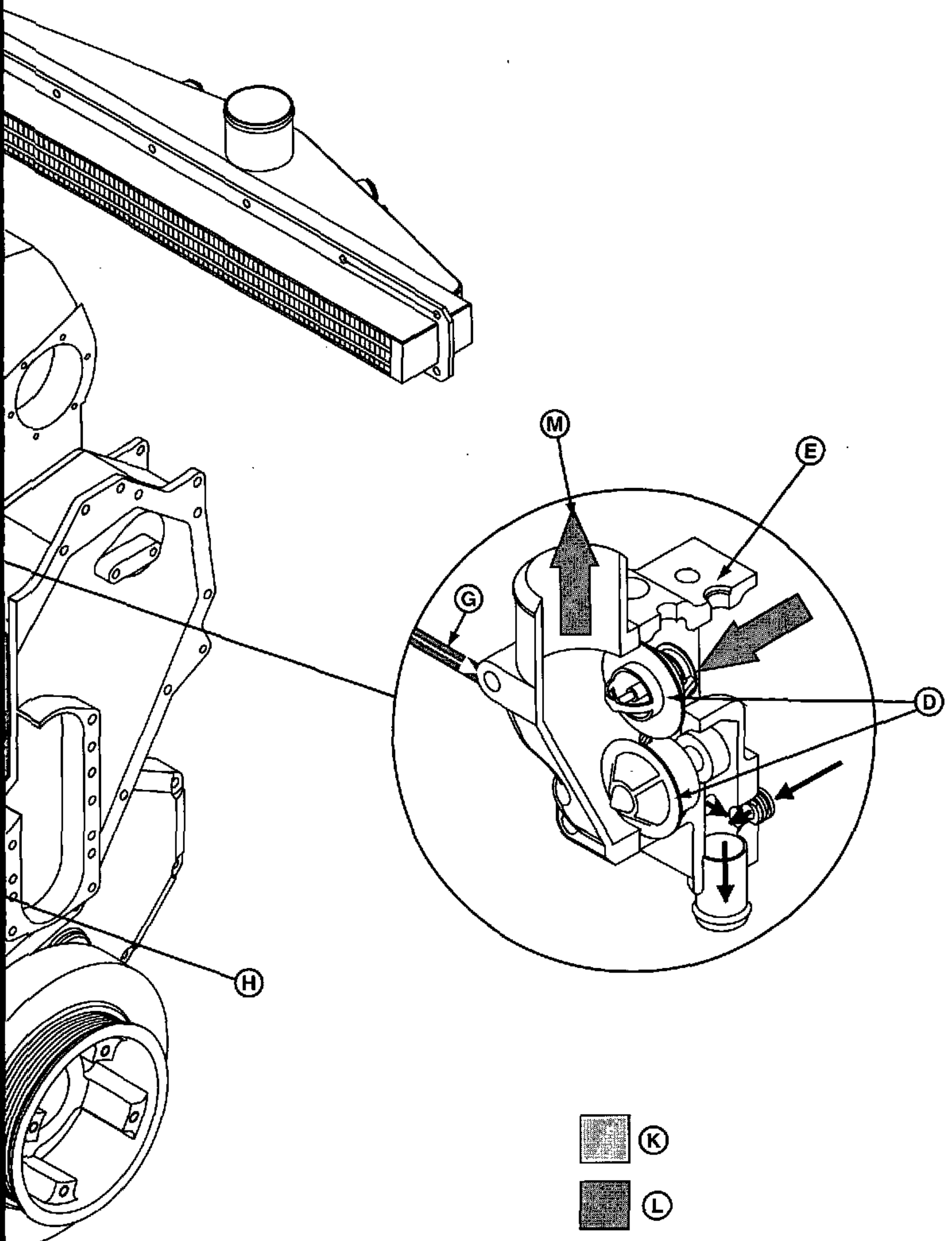
N

Cooling System Operation

RG8464 –UN–11JUN98



Cooling System

RG,RG34710,1521 –19–30SEP97–1/3

A—Coolant Pump
B—Coolant Heater
C—Coolant Manifold
D—Thermostats
E—Thermostat Housing
F—Directed Top Liner Cooling Passages
G—Directed Top Liner Cooling Return Line
H—Coolant Bypass Tube
I—Water-to-Air Aftercooler Supply
J—Water-to-Air Aftercooler Return
K—Low Temperature Coolant
L—High Temperature Coolant
M—To Radiator Top Tank
N—From Radiator

The pressurized cooling system consists of a radiator (not shown), coolant pump (A), coolant heater (B), coolant manifold (C), coolant passages in block and the cylinder head, thermostats (D), and thermostat housing (E).

The coolant pump draws coolant from the radiator through the lower radiator hose. Flow then goes past a coolant heater and into the oil cooler housing. Coolant flows around the oil cooler and then flows into one of two circuits.

The main circuit flows coolant from the oil cooler into the coolant manifold. The coolant manifold extends the length of the right side of the block. From the coolant manifold, coolant flows into each liner cavity. From the liners, coolant flows up into the cylinder head.

The coolant flow through the block and cylinder head is optimized to provide ample flow around each liner and to provide more flow to the rear of the cylinder head than into the front. To achieve this, the coolant passages from the block to the cylinder head vary in size and in number.

The holes on the right side of the block are smaller than the holes on the left side. Therefore, as coolant flows out of the coolant manifold on the right side of the block, it is forced to flow around the liners to escape through larger holes on the left of the block. This assures that each liner is surrounded by coolant flow.

In addition, there are more holes and larger holes at the rear of the cylinder head than at the front. Cylinders 1 and 2 have one 6.3 mm (0.25 in.) and one 9 mm (0.35 in.) hole. Cylinders 3 and 4 have two 6.3 mm (0.25 in.) and two 10 mm (0.39 in.) holes. Cylinders 5 and 6 have two 10 mm (0.39 in.) and two 16 mm (0.63 in.) holes.

The larger and higher number of coolant flow holes around cylinders 5 and 6 force more coolant to flow to the back of the cylinder head than to the front.

Once coolant is in the cylinder head, all flow is towards the front. Coolant from cylinder 6 flows forward and accumulates with flow from other cylinders. All coolant flow then exits out the head at number 1 cylinder to the thermostat housing.

The second circuit is called the "directed top liner cooling" system. Two drilled passages (F) at the top of the oil cooler cavity in the cylinder block route coolant to cylinders 3 and 4 liners for top liner cooling.

Coolant will flow around the top of cylinder 3 liner, then flow forward to cylinder 2 liner and then to cylinder 1 liner. Coolant will leave cylinder 1 through a drill passage to the thermostat housing. Coolant entering number 4 cylinder will flow rearward to number 5 and then to number 6. Coolant leaves number 6 cylinder through a drilled passage and flows though an external steel line (G) to the thermostat housing.

When the engine is cold, the thermostats will be closed. Coolant will flow through the bypass tube (H), into the inlet of the coolant pump.

When the engines warms to operating temperature, the thermostats will open and coolant will flow past the open thermostats to the radiator (M).

The thermostat housing contains two thermostats. The bottom thermostat has a blocking poppet. When the engine gets to operating temperature, this thermostat will open and allow flow to the radiator. The blocking will close off the bypass path to the coolant pump inlet.

Continued on next page

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The top thermostat is a non-blocking type. When it opens, coolant will flow to the radiator. The non-blocking type has a vent notch to provide an air bleed when the cooling system is filled.

On water-to-air aftercooled engines, coolant is routed through an external line (I) to the aftercooler, then back to the oil cooler housing through a second external line (J).

RG,RG34710,1521 –19–30SEP97–3/3

Intake and Exhaust System Operation

Engine suction draws dust-laden outside air through an air inlet stack into the air cleaner. Air is filtered through dry-type primary and final filter elements in the air cleaner canister. Clean air travels through the intake air hose to the turbocharger, through the air-to-air aftercooler, through the air/fuel mixing elbow, and into the intake manifold.

Exhaust, as it is expelled out of the exhaust manifold, drives the turbocharger to deliver a larger quantity of air to meet the engine requirements than what could be delivered under naturally aspirated (non-turbocharged) conditions.

On some engines, an air-to-air aftercooler cools the turbocharger compressor discharge air by routing it through a heat exchanger before it enters the engine. The heat exchanger uses no liquid coolant but relies on air flow to cool the charge air.

On some engines, the aftercooler functions as a heat exchanger. Engine coolant circulates through the aftercooler core and carries heat out of the aftercooler.

RG,RG34710,1522 –19–30SEP97–1/1

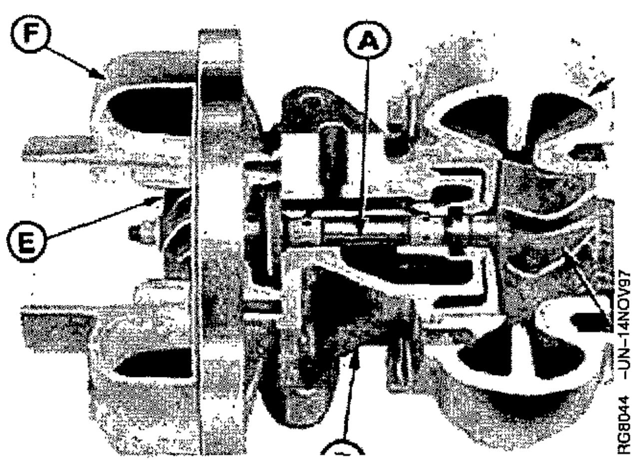
Turbocharger Operation

The turbocharger, which is basically an air pump that is driven by exhaust gases, allows the engine to produce added power without increasing displacement. Turbochargers are specially matched for the power ratio requirements of each specific application.

The turbine wheel (C) is driven by the hot engine exhaust gases. These gases flowing through the turbine housing (B) act on the turbine wheel causing shaft (A) to turn.

Compressor wheel (E) brings in filtered air and discharges the compressed air into the intake manifold where it is then delivered to engine cylinders.

Engine oil under pressure from the engine lubrication system is forced through passages in center housing (D) to bearings.



Turbocharger Components

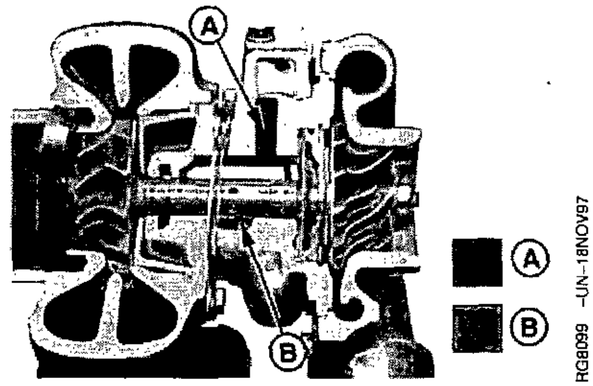
A—Shaft
B—*Turbine Housing*
C—Turbine Wheel
D—Center Housing
E—Compressor Wheel
F—Compressor Housing

RG,RG34710,1523 –19–30SEP97–1/1

How the Turbocharger is Lubricated

Engine oil under pressure from the engine lubrication system is pumped through a passage in the bearing housing and directed to the bearings, thrust plate, and thrust sleeve. Oil is sealed from the compressor and turbine by a piston ring at both ends of the bearing housing.

The turbocharger contains two floating bearings. These bearings have clearance between the bearing OD and the housing bore as well as clearance between the bearing ID and the shaft OD. These clearances are lubricated by the oil supply (A) and the bearings are protected by a cushion of oil. Discharge oil (B) drains by gravity from the bearing housing to the engine crankcase.

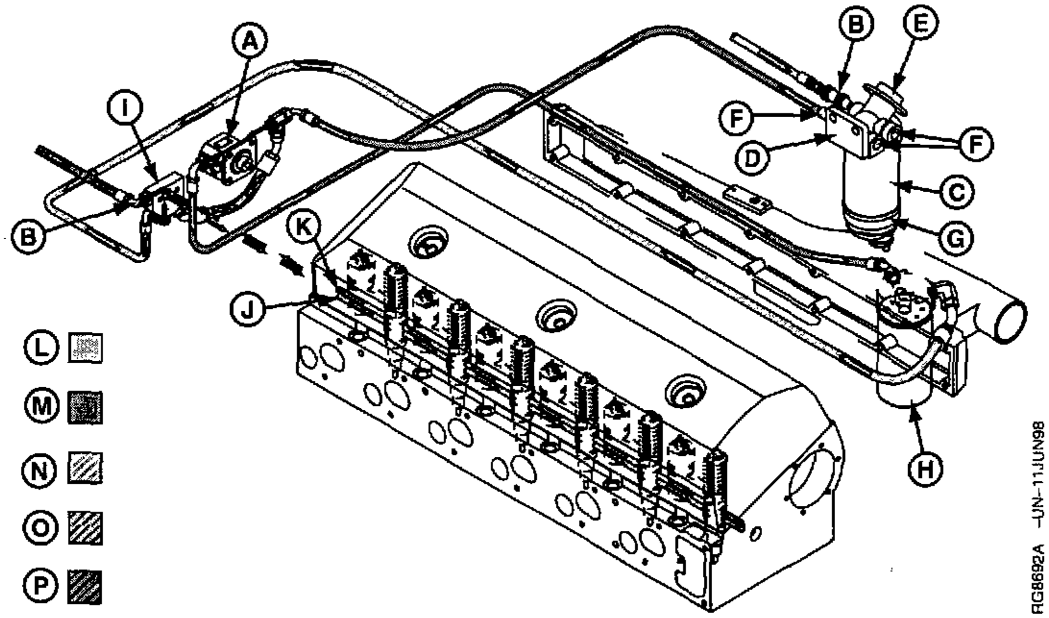


Turbocharger Lubrication

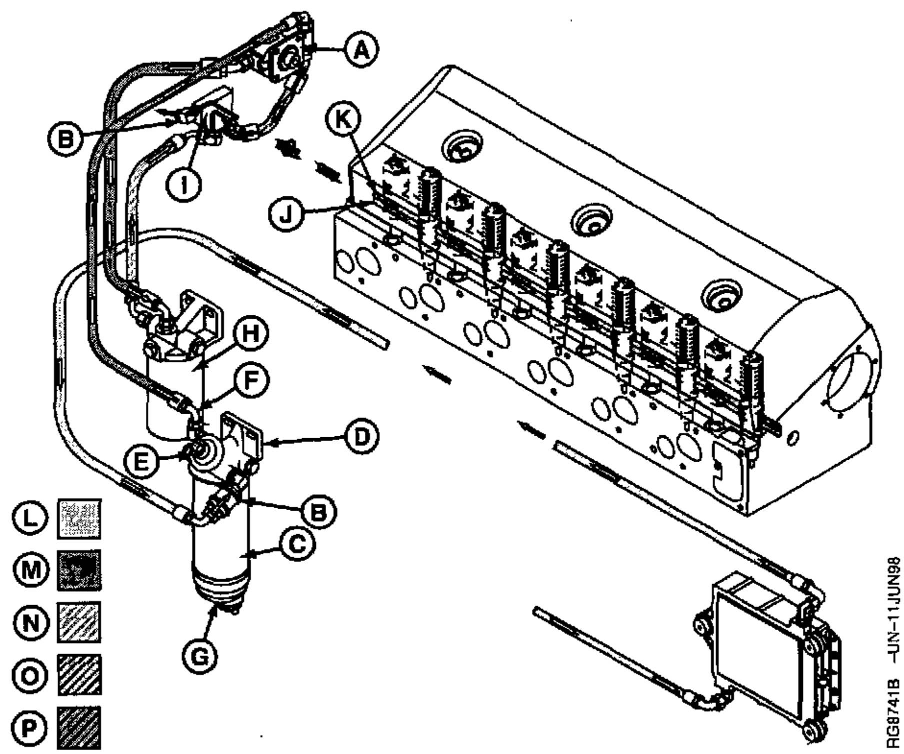
A—Pressure Oil
B—Discharge Oil

RG,RG34710,1524 -19-30SEP97-1/1

Low Pressure Dual Rail Fuel Supply System Operation



John Deere Applications Dual Rail Fuel System



OEM Applications Dual Rail Fuel System

A—Fuel Transfer Pump
B—In-line Check Valves
C—Primary Filter
D—Primary Filter Base
E—Hand Primer Pump
F—Primary Filter Base Outlets
G—Water Separator Bowl
H—Final Filter
I—Fuel Manifold
J—Fuel Supply Rail
K—Fuel Return Rail
L—Suction Fuel from Tank
M—Primary-Filtered Fuel
N—Final-Filtered Fuel
O—Recirculated Fuel
P—Return-to-Tank Fuel

Continued on next page RG,RG34710,1525 –19–30SEP97–1/2

The fuel transfer pump (A) draws fuel from the fuel tank through an in-line check valve (B) into the primary filter base (D) contains a hand-primer pump (E) and three outlet passages (F). The water separator bowl (G), which screws to the bottom of the fuel filter base. A self venting drain valve is mounted on the bottom of the clear bowl.

Fuel flows from one of the primary filter base outlets to the inlet of the fuel transfer pump mounted on the rear of the head. The fuel transfer pump is a gear type pump. The pump shaft is coupled to the end of the camshaft. The fuel transfer pump contains a pressure regulating valve for system over-pressure protection. A bypass valve in the pump base allows fuel to bypass the gears during hand priming.

Fuel flows from the outlet of the fuel transfer pump to the inlet of the final fuel filter (H). The spin-on final filter is the last clean-up of the fuel before entering the engine.

Fuel flows from the outlet of the final filter to the fuel manifold (I) mounted on the rear of the cylinder head. The fuel manifold contains a fuel temperature sensor, pressure regulating valve, return to tank orifice, and passages to route fuel into and out of the cylinder head. On some applications, the fuel manifold also contains a fuel pressure sensing switch. The fuel pressure regulator will maintain fuel pressure at 410–480 kPa (4.1–4.8 Bar) (60–70 psi).

Fuel flows from the fuel manifold into the fuel supply rail in the cylinder head. Fuel rails are drilled passages in the cylinder head that route fuel to each unit injector. The fuel supply rail (J) is the bottom drilled passage; the return fuel rail (K) is the top drilled passage. The two passages are connected at the front of the head.

Excess fuel not needed by the electronic unit injectors flows from the cylinder head into the fuel manifold. The fuel flows past the fuel temperature sensor. At this point the fuel is routed in one of two directions. The return to tank orifice will cause approximately 20% of the fuel to flow back to the fuel tank. The return-to-tank fuel enters the tank at the bottom to prevent fuel drain-back. The remaining 80% of the fuel will flow past the pressure regulating valve and return to the inlet of the fuel transfer pump to be recirculated through the cylinder head.

RG,RG34710,1525 –19–30SEP97–2/2

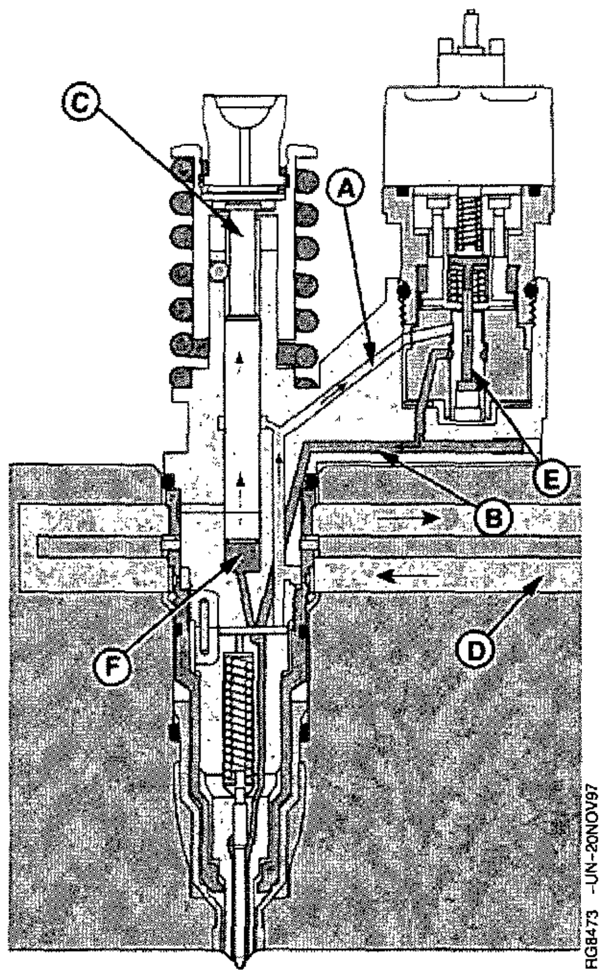
Electronic Unit Injector (EUI) Operation on the Dual Rail Fuel System

The electronic unit injector pumping action is created by the up and down movement of the plunger. The plunger movement is caused by the rotation of the camshaft and the rocking action of the rocker arms. The larger return spring will move the plunger up as the camshaft rotates and relaxes the force on the rocker arm.

RG,RG34710,1527 –19–30SEP97–1/5

EUI Fill Cycle - Dual Rail Fuel System

The electronic unit injector will fill with fuel when the plunger (C) is moving up. Fuel from the fuel supply rail (D) enters fuel passage (A) of the unit injector. Fuel flows past the open spill valve (E) into fuel passage (B). Passage B routes fuel into the plunger cylinder (F), which fills as the plunger moves up.



EUI Fill Cycle

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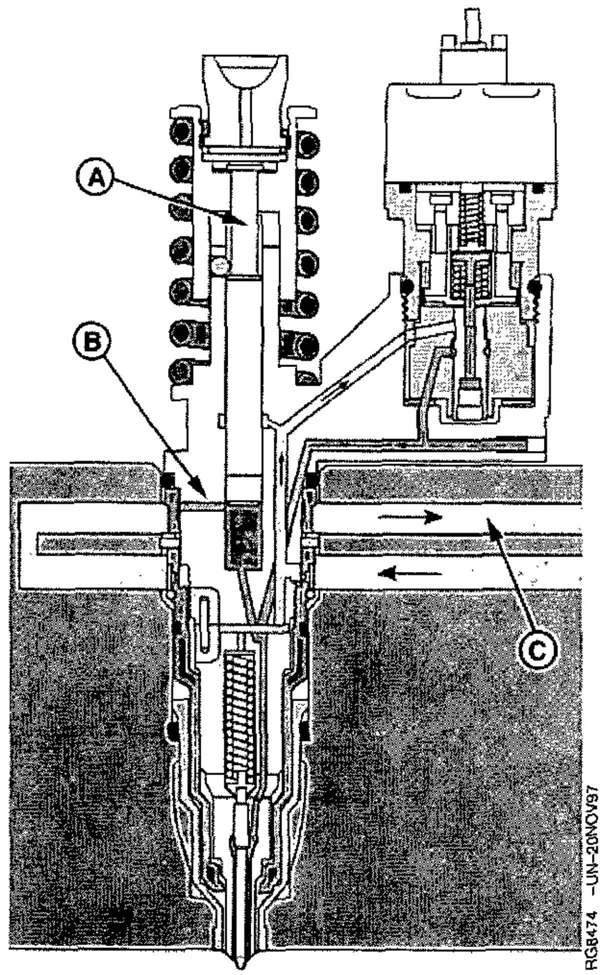
EUI Vent Cycle - Dual Rail Fuel System

The vent cycle begins when the plunger (A) nears the top of the fill cycle stroke. At this point a vent port (B) will be uncovered and fuel and any trapped air can flow to the return fuel rail (C).



EUI Vent Cycle

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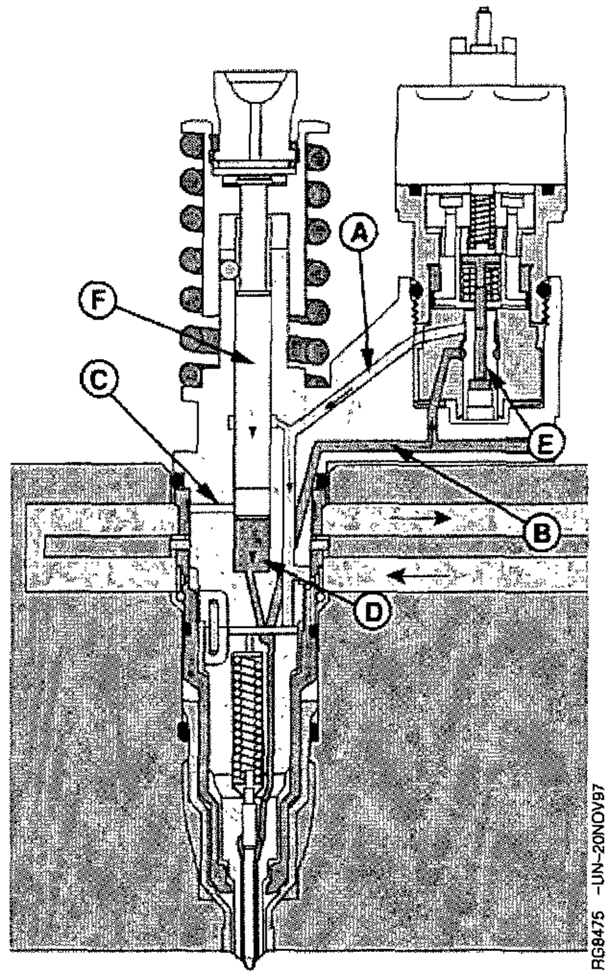
EUI Pumping Cycle - Dual Rail Fuel System

The pumping cycle begins when the camshaft lobe pushes on the rocker arm to cause the plunger (F) to start moving down. During the first downward movement of the plunger, the vent port (C) will close.

Further downward movement of the plunger will force fuel from the plunger cylinder (D). Fuel will flow out fuel passage (B), through the open spill valve (E), into fuel passage (A) and back to the fuel supply rail (G). This flow will continue until the injection cycle begins.



EUI Pumping Cycle

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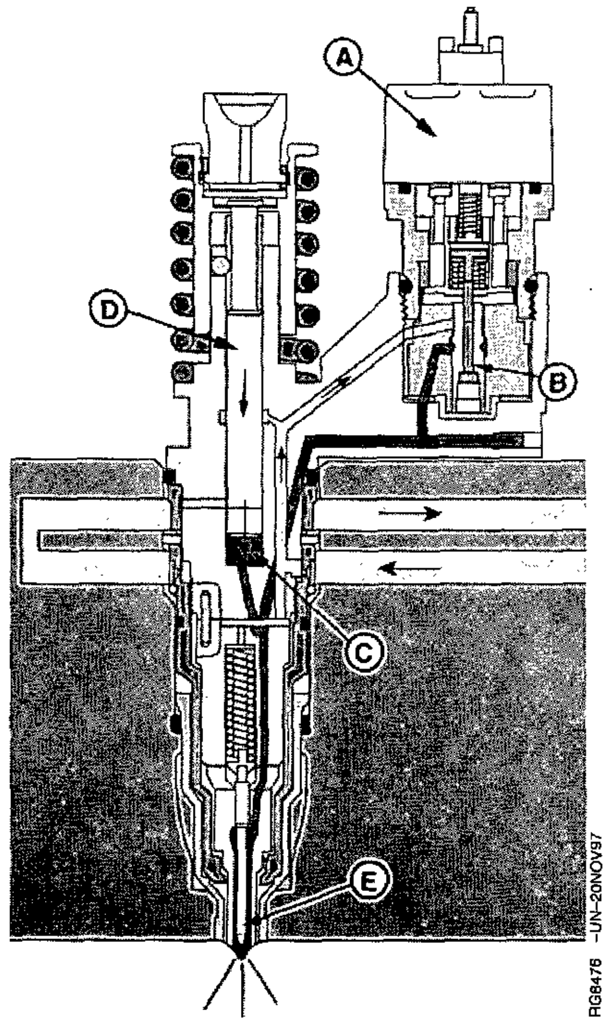
RG,RG34710,1527 -19-30SEP97-4/5

EUI Injection Cycle - Dual Rail Fuel System

The injection cycle will start when the Engine Control Unit (ECU) energizes the EUI solenoid (A). This will occur during the downward stoke of the plunger.

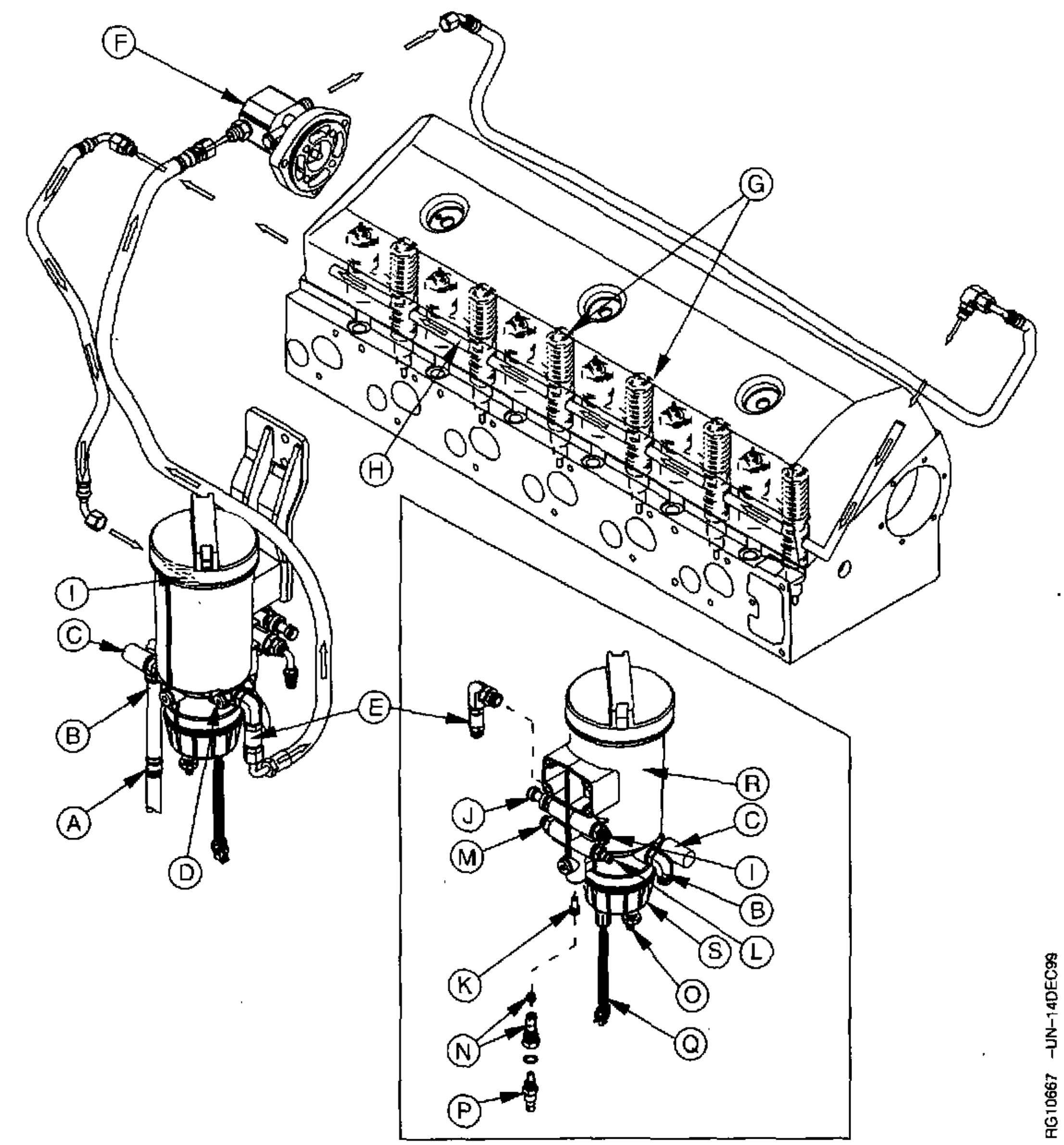
The energized solenoid will close the spill valve (B). With the spill valve closed, fuel can not escape from the plunger cylinder (C). The downward movement of the plunger (D) will cause the fuel pressure to rise. When the pressure reaches 30,000 kPa (300 bar) (4350 psi), the injector needle (E) will start to move up and injection will begin. As the plunger continues to move down, pressure will rapidly rise to approximately 160,000 kPa (1600 bar) (23,200 psi). Injection will continue until the ECU de-energizes the solenoid. The spill valve will then open allowing fuel pressure to drop rapidly. The injector needle will close and injection will stop.



EUI Injection Cycle

RG,RG34710,1527 –19–30SEP97–5/5

Low Pressure Single Rail Fuel Supply System Operation



OEM Applications Single Rail Fuel System

A—Pre-filter
B—Fuel Filter Inlet from Fuel Tank
C—Hand Primer
D—Vacuum Port
E—Fuel Filter Outlet to Transfer Pump (Check Valve)
F—Fuel Transfer Pump
G—EUIs
H—Fuel Rail
I—Fuel Return from Cylinder Head
J—Fuel Pressure Sensor
K—Head Debris Filter
L—Fuel Supply Pressure Quick Connect Port
M—Fuel Filter Housing Outlet to Fuel Tank (Low Pressure Regulating Valve)
N—High Pressure Regulating Valve and Housing
O—Water Drain
P—Fuel Temperature Sensor
Q—Water in Fuel Sensor
R—Fuel Filter Housing
S—Water Separator Bowl

The fuel transfer pump (F) draws fuel from the fuel tank through the pre-filter (A) and fuel filter. The fuel filter is located in the fuel filter housing (R). The fuel filter housing contains a hand primer pump (C) and a water separator bowl (S), which screws to the bottom of the fuel filter housing. A self-venting water drain valve (O) is mounted on the bottom of the clear bowl.

Continued on next page

Fuel flows from the fuel filter outlet (E) to the inlet of the fuel transfer pump which is mounted on the rear of the cylinder head. The pump shaft is coupled to the end of the camshaft. The fuel transfer pump contains a pressure regulating valve for system over-pressure protection. A bypass valve in the pump base allows fuel to bypass the gears during hand priming.

Fuel flows from the transfer pump into the side of the cylinder head, and then it enters the fuel rail (H). The fuel rail is a drilled passage in the cylinder head that routes fuel to each unit injector. The unused fuel is rejected back from the EUIs (G) into the fuel rail and returned to the back of the fuel filter housing (I).

In this portion of the fuel filter housing, the fuel passes by a fuel pressure sensor (J), and then it travels through a head debris filter (K), which is a 10 micron filter. After flowing through the head debris filter, the fuel enters a chamber that includes the fuel supply pressure quick connect port (L). Once the fuel is in this chamber, it will either travel through the low pressure regulating valve (M) or the high pressure regulating valve (N). If fuel goes through the low pressure regulating valve, it will return to the fuel tank. If fuel goes through the high pressure regulating valve, it will pass the fuel temperature sensor (P), which is mounted into the fuel filter housing. The fuel will return to the fuel filter to be cleaned, and it will be recirculated through this system.

RG,RG34710,1525 –19–30SEP97–2/2

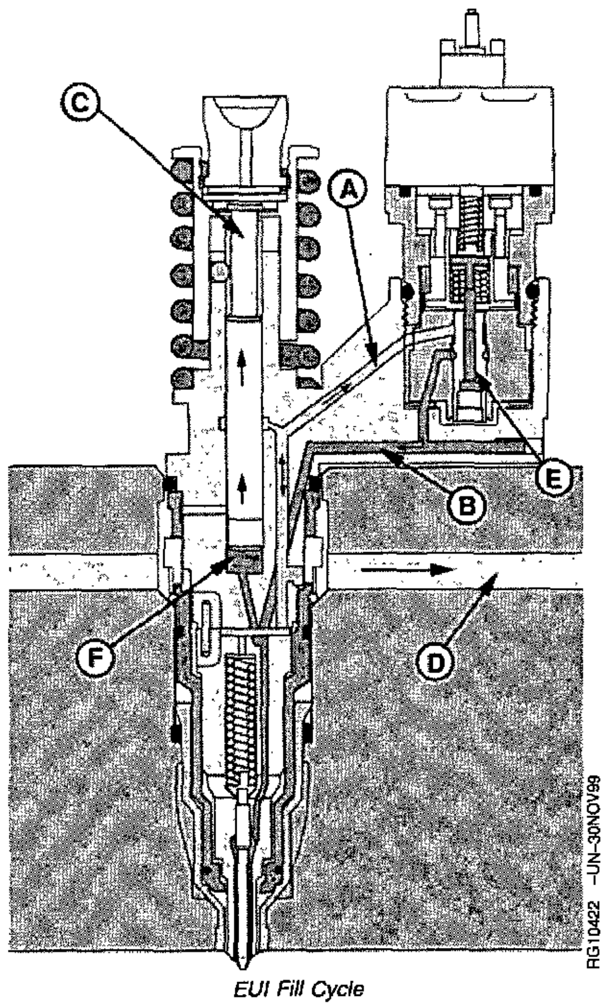
Electronic Unit Injector (EUI) Operation on the Single Rail Fuel System

The electronic unit injector pumping action is created by the up and down movement of the plunger. The plunger movement is caused by the rotation of the camshaft and the rocking action of the rocker arms. The larger return spring will move the plunger up as the camshaft rotates and relaxes the force on the rocker arm.

RG,RG34710,1527 –19–30SEP97–1/5

EUI Fill Cycle - Single Rail Fuel System

The electronic unit injector will fill with fuel when the plunger (C) is moving up. Fuel from the fuel rail (D) enters fuel passage (A) of the unit injector. Fuel flows past the open spill valve (E) into fuel passage (B). Passage B routes fuel into the plunger cylinder (F), which fills as the plunger moves up.



EUI Fill Cycle

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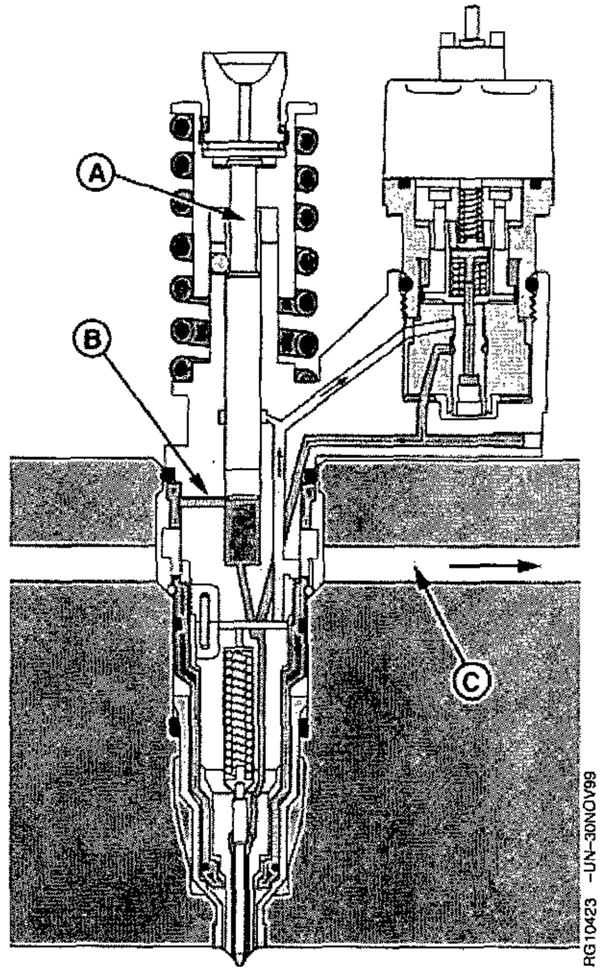
EUI Vent Cycle - Single Rail Fuel System

The vent cycle begins when the plunger (A) nears the top of the fill cycle stroke. At this point a vent port (B) will be uncovered and fuel and any trapped air can flow to the fuel rail (C).



EUI Vent Cycle

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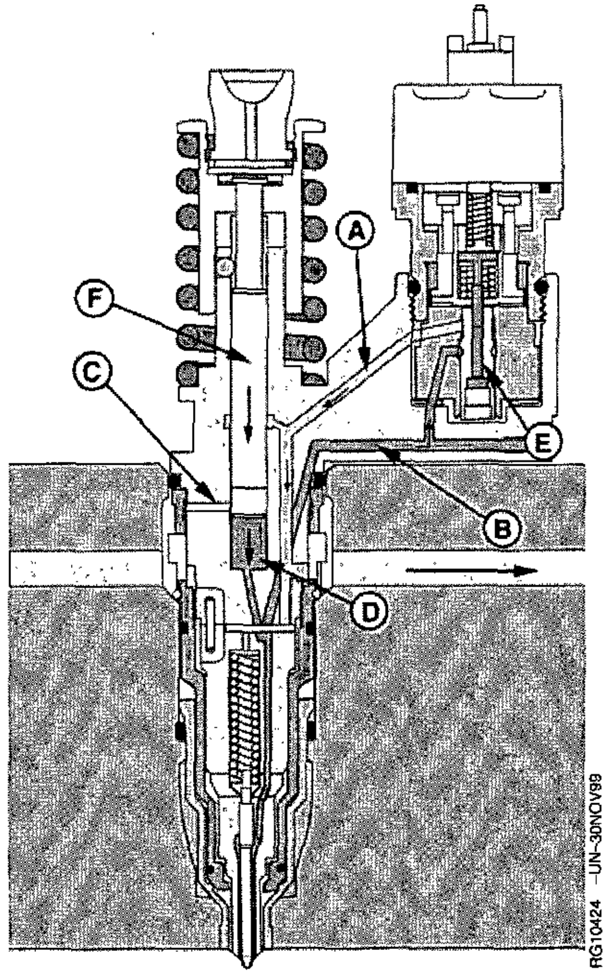
EUI Pumping Cycle - Single Rail Fuel System

The pumping cycle begins when the camshaft lobe pushes on the rocker arm to cause the plunger (F) to start moving down. During the first downward movement of the plunger, the vent port (C) will close.

Further downward movement of the plunger will force fuel from the plunger cylinder (D). Fuel will flow out fuel passage (B), through the open spill valve (E), into fuel passage (A) and back to the fuel rail (G). This flow will continue until the injection cycle begins.



EUI Pumping Cycle

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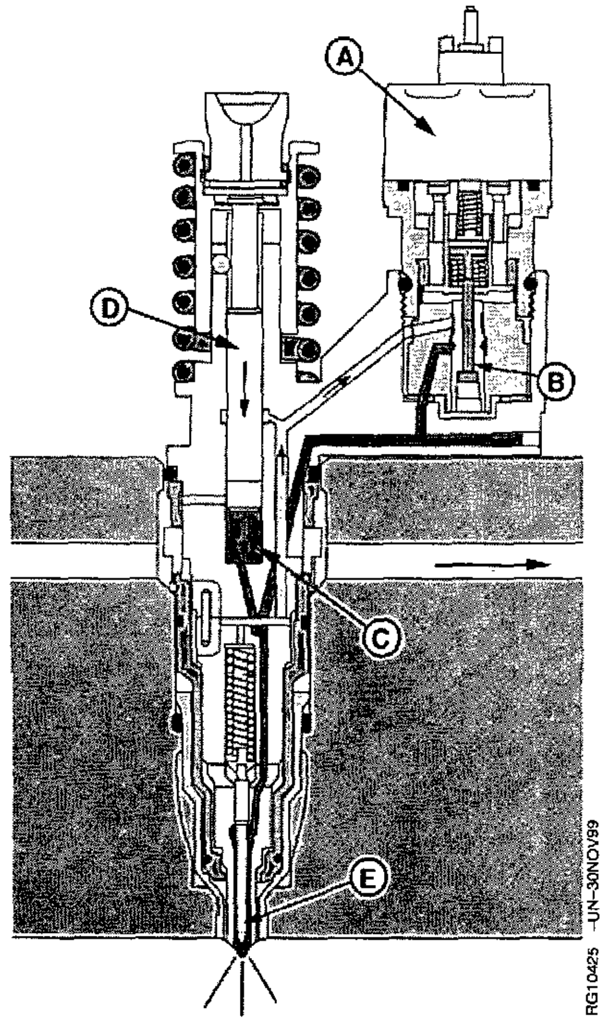
EUI Injection Cycle - Single Rail Fuel System

The injection cycle will start when the Engine Control Unit (ECU) energizes the EUI solenoid (A). This will occur during the downward stoke of the plunger.

The energized solenoid will close the spill valve (B). With the spill valve closed, fuel can not escape from the plunger cylinder (C). The downward movement of the plunger (D) will cause the fuel pressure to rise. When the pressure reaches 30,000 kPa (300 bar) (4350 psi), the injector needle (E) will start to move up and injection will begin. As the plunger continues to move down, pressure will rapidly rise to approximately 160,000 kPa (1600 bar) (23,200 psi). Injection will continue until the ECU de-energizes the solenoid. The spill valve will then open allowing fuel pressure to drop rapidly. The injector needle will close and injection will stop.



EUI Injection Cycle

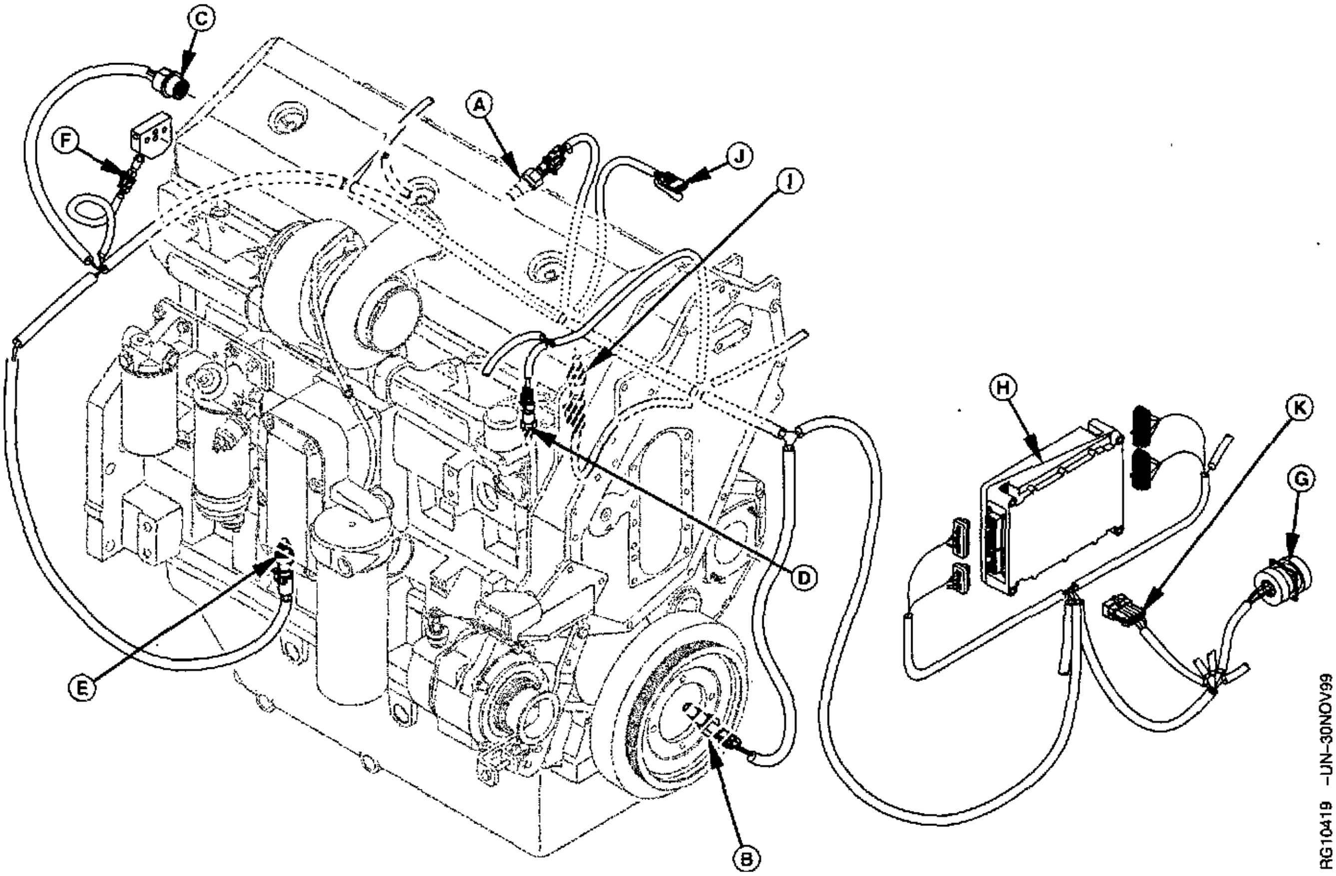
RG,RG34710,1527 -19-30SEP97-5/5

Electronic Control System Glossary of Terms

Actuator	A device controlled by the (ECU) to perform a certain function.
Analog	Signal which has a continuous range of possible voltages. Usually 0 to 5 volt or 0 to 12 volt signals.
Boost	Air pressure in the intake manifold.
CAN	Controller Area Network. The network on vehicles that allows communication between controllers.
DTC	Diagnostic Trouble Code. A code which is stored in the ECU's memory when the ECU detects a problem in the electronic control system.
DST	Diagnostic Scan Tool. The tool used to read and clear DTCs, read sensor and actuator data, and perform engine tests. The DST consists of an Windows ('95 or '98) or NT compatible computer and 2 kits available from John Deere Distribution Service Center (DSC): JDIS121 - 10.5/12.5 ECU Communication Hardware Kit, and JDIS122 - 10.5/12.5 ECU Communication Software Kit.
Digital	A signal which consists of only two-volt levels — usually 0 volts and +5 volts.
ECT	Engine Coolant Temperature (sensor). Measures the temperature of the engine coolant. See MEASURING TEMPERATURE later in this Group for details.
ECU	Engine Control Unit. The computer which controls the fuel, air, and ignition systems on the engine. (See ENGINE CONTROL UNIT (ECU) later in this group for details.)
EUI	Electronic Unit Injector. An EUI is an electronically controlled injection pump and injector combined. The ECU controls the start of injection and the amount of fuel injected by energizing and de-energizing the solenoid in the EUI valve housing. See ELECTRONIC UNIT INJECTOR (EUI) OPERATION ON THE DUAL RAIL FUEL SYSTEM or ELECTRONIC UNIT INJECTOR (EUI) OPERATION ON THE SINGLE RAIL FUEL SYSTEM earlier in this Group for details.
FMI	Failure Mode Identifier. The second part of a two-part code that identifies contorl system fault codes according to the J1939 standard. The FMI identifiesthe type of failure that has occurred. The first half of the code is the Suspect Parameter Number (SPN).
J1587/J1708	The Society of Automotive Engineers (SAE) standard for the electronic components of heavy duty vehicles. J1587 is the software standard. J1708 is the hardware standard.
MAT	Manifold Air Temperature (sensor). Measures the temperature of the air in the intake manifold. See MEASURING TEMPERATURE later in this Group for details.
Multi-State	A type of throttle that allows the engine to run between 1-3 set engine speeds.
PDM	Parallel Data Module. Device used as part of the DST that allows communication with the ECU.
PROM	Programmable, Read-Only Memory. The computer chip which contains the calibration information for the engine control system. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
PWM	Pulse Width Modulation. A digital signal (not analog) which consists of a pulse generated at a fixed frequency. When an actuator is controlled by a PWM signal, the on time of the signal is increased or decreased (modulated) to increase or decrease the output of the actuator.
RAM	Random Access Memory. The portion of computer memory within the ECU which changes as the engine is running and is stored while the engine is off. See ENGINE CONTROL UNIT (ECU) later in this Group for details.
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 (FMI).
TPS	Throttle Position Sensor. The TPS measures the position of the throttle, which is controlled by the machine operator. See MEASURING THROTTLE POSITION later in this Group for details.
WIF	Water In Fuel Sensor. The WIF detects water in fuel in the water separator bowl on the fuel filter housing.

RG,RG34710,1528 –19–30SEP97–1/1

Electronic Control System Overview



Electronic Control System Overview for a Dual Rail Fuel System

A—Cam Position Sensor
B—Crank Position Sensor
C—EUI Harness Connector
D—ECT Sensor
E—Oil Pressure Sensor
F—Fuel Temperature Sensor
G—Diagnostic Connector
H—ECU
I—MAT Sensor
J—MAP Sensor Connector
K—Program Performance Connector

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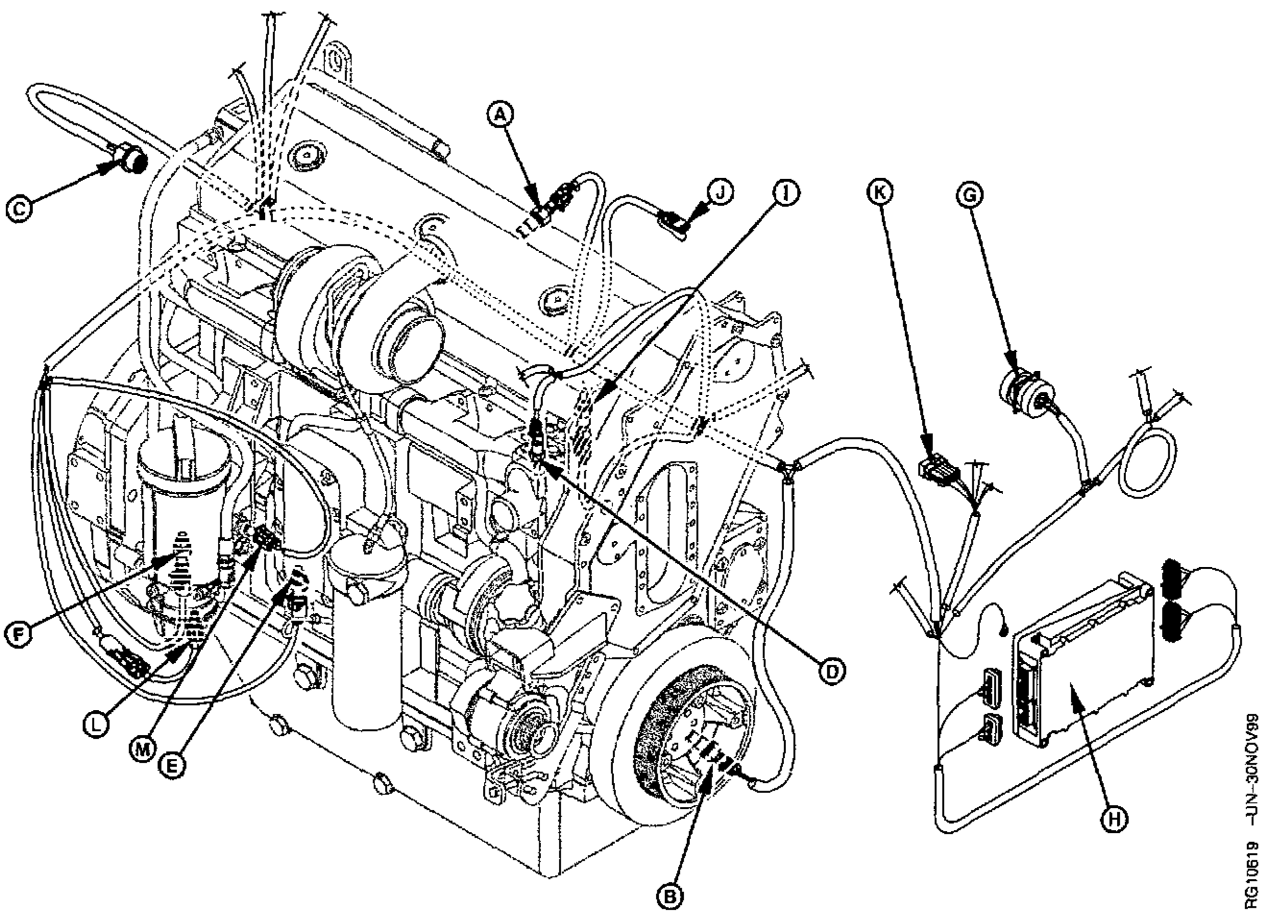

Electronic Control System Overview for a Single Rail Fuel System

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G—Diagnostic Connector
H—ECU
I—MAT Sensor
J—MAP Sensor Connector
K—Program Performance Connector
L—WIF Sensor
M—Fuel Pressure Sensor

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

RG,RG34710,1529 –19–30SEP97–2/2

Electronic Control System Operation

Engine Starting Mode

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

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

As soon as the ECU determines using the crankshaft position sensor input that the engine is cranking, it will determine using the camshaft 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 compression. To provide cold temperature enrichment, the amount of fuel injected is based on the temperature measured by the Engine Coolant Temperature (ECT) sensor. At this point, the engine will start and the ECU will go into the running mode.

Engine Running Mode

In the running mode, the ECU monitors information from the various sensors, then determines the optimum amount of fuel to inject and the optimum injection timing in order to allow the engine to develop high power while maintaining low exhaust emission output. The camshaft and crankshaft position sensors allow the ECU to precisely determine piston position in relation to top-dead-center so that the ECU can command the correct Electronic Unit Injector (EUI) solenoid at the correct time. The ECU controls fuel delivery by energizing and de-energizing the individual solenoids that open and close the EUI spill valves. When the ECU energizes the EUI solenoid, the spill valve closes and injection begins. When the correct amount of fuel has been injected, the ECU de-energizes the solenoid, causing the spill valve to open, and fuel injection to stop.

RG,RG34710,1530 –19–30SEP97–1/1

Monitoring Engine Parameters

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

- Engine Coolant Temperature (ECT)
- Manifold Air Temperature (MAT)
- Fuel Temperature
- Loss of Coolant Temperature Switch
- Fuel Pressure
- Oil Pressure
- Air Vacuum Switch
- Throttle Position
- Engine Speed
- Water in Fuel Sensor (WIF)

RG,RG34710,1531 –19–30SEP97–1/1

Measuring Temperature

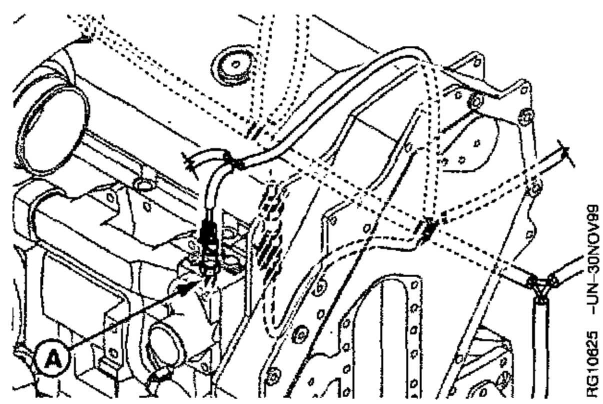
The Engine Coolant Temperature (ECT) sensor, the Manifold Air Temperature (MAT) sensor, and the fuel temperature sensor are all temperature sensitive variable resistors. The sensors' resistance goes down as the temperature that it is exposed to goes up (negative temperature coefficient). The Engine Control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

RG,RG34710,1532 –19–30SEP97–1/4

ECT (Engine Coolant Temperature) Sensor

The ECT (Engine Coolant Temperature) sensor (A) is located in top of the thermostat housing. The ECU monitors coolant temperature for:

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



ECT Sensor

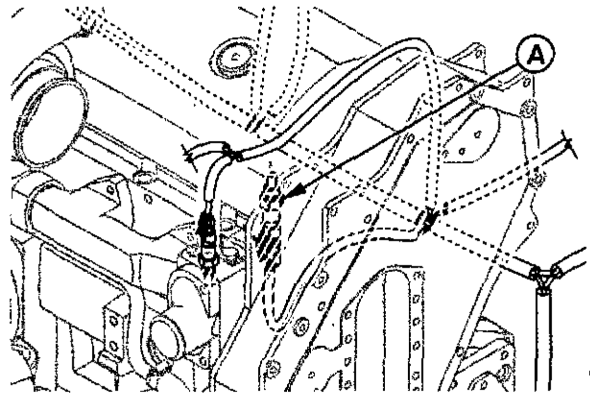
A—ECT Sensor

Continued on next page RG,RG34710,1532 –19–30SEP97–2/4

MAT (Manifold Air Temperature) Sensor

The MAT (Manifold Air Temperature) sensor (A) is an optional component that is located on or near the intake manifold. The ECU monitors manifold air temperature for engine protection purposes. See ENGINE PROTECTION later in this Group.

A—MAT Sensor



MAT Sensor

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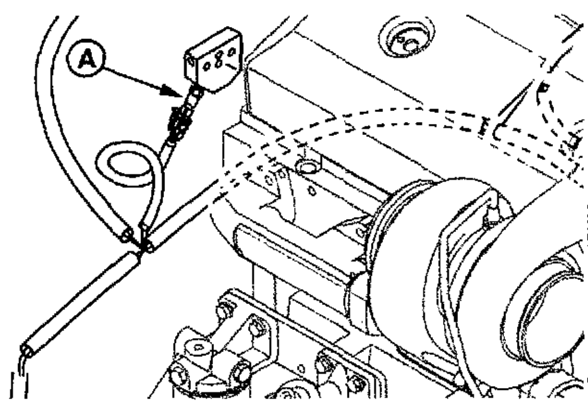
Fuel Temperature Sensor

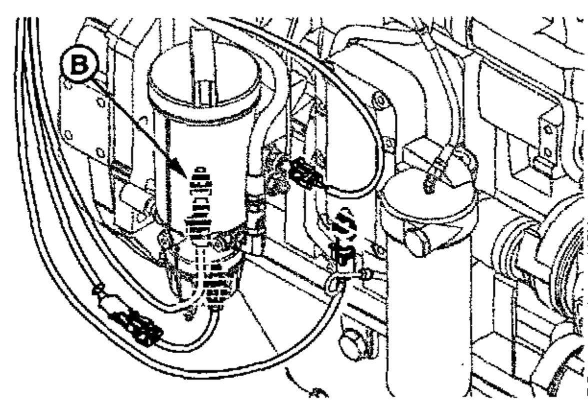
The fuel temperature sensor is located on the fuel manifold at the back of the cylinder head on the dual rail fuel system (A). On the single rail fuel system, it is located on the fuel filter housing behind the fuel filter (B). Using the fuel temperature measurement, the ECU will determine fuel density, and adjust fuel delivery accordingly.

Loss of Coolant Temperature Switch

The loss of coolant temperature switch is an optional component not included on all applications. It is a normally open temperature sensitive switch. The switch is located near the back of the cylinder head. When engine coolant is at the proper level, the temperature sensitive end of the switch is submerged in coolant, and the switch contacts will be open. If coolant level drops, the switch will no longer be submerged causing the temperature of the switch to raise beyond the point that causes the switch contacts to close. The ECU will detect that the switch is closed, and protect the engine from overheating damage by derating or shutting down the engine. See ENGINE PROTECTION later in this Group for more information.



Dual Rail Fuel Temperature Sensor



Single Rail Fuel Temperature Sensor

A—Fuel Temperature Sensor on a Dual Rail Fuel System
B—Fuel Temperature Sensor on a Single Rail Fuel System

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Measuring Pressure

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

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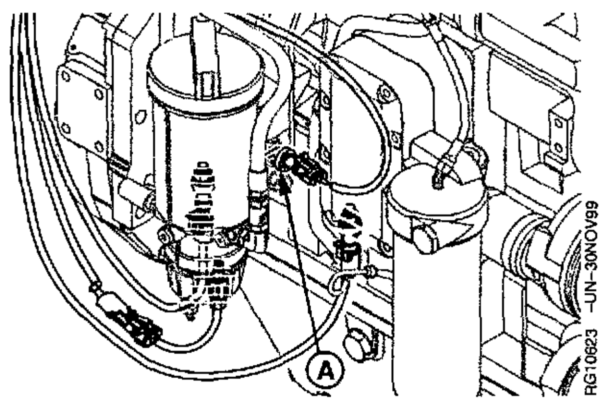
Fuel Pressure Sensor

The fuel pressure sensor is used on some applications that use the single rail fuel system. The sensor is located behind the fuel filter in the fuel manifold (A). The ECU monitors fuel pressure for engine protection purposes. See ENGINE PROTECTION later in this Group for more information.

A—Fuel Pressure Sensor on Single Rail Fuel System



Fuel Pressure Sensor

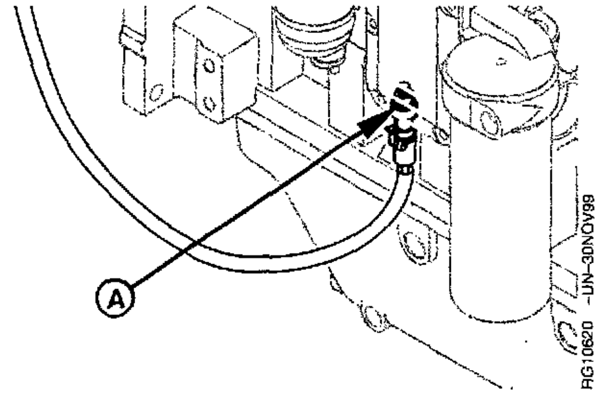
Continued on next page RG,RG34710,1533 –19–30SEP97–2/3

Oil Pressure Sensor

The oil pressure sensor is an optional component that is located in the main engine galley or in the oil cooler (A). The ECU monitors oil pressure for engine protection purposes. See ENGINE PROTECTION later in this Group for more information.

Air Vacuum Switch

The air vacuum switch is an optional component that is used to test for restrictions in the air filter. It's location may vary depending on application. The ECU monitors this for engine protection purposes. See ENGINE PROTECTION later in this Group.



Oil Pressure Sensor

A—Oil Pressure Sensor

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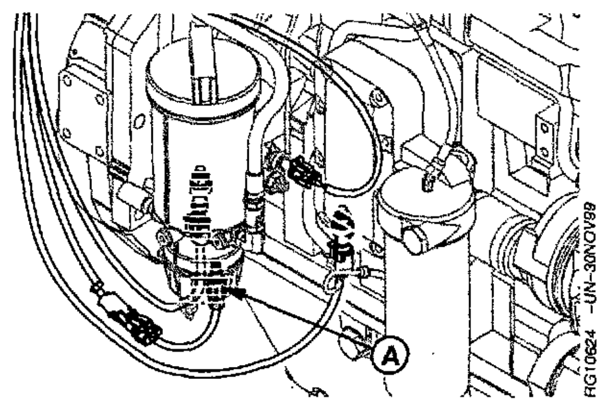
Water In Fuel Sensor

The water in fuel sensor is an optional sensor that is located in the water separator bowl in the fuel filter (A). The ECU monitors this for engine protection purposes. See ENGINE PROTECTION later in this Group.

A—Water in Fuel Sensor



Water in Fuel Sensor

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Measuring Throttle Position

The 10.5 and 12.5 L engines have the option of operating with a pulse-width-modulated (PWM) throttle signal, an analog throttle position sensor output signal, multi-state throttle, or CAN throttle. In some applications, a backup throttle is used.

Pulse-Width-Modulated (PWM) Throttle

The PWM throttle signal is sent to the ECU by another controller. The PWM signal is a square wave signal with a constant frequency. The pulse width of the signal varies and indicates the desired throttle opening.

Analog Throttle

An analog throttle signal comes from a potentiometer-type sensor. The ECU converts the voltage returning from the potentiometer into a percent of full throttle signal.

Multi-State Throttle

The multi-state throttle is used when a few fixed engine speeds are desired.

CAN Throttle

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

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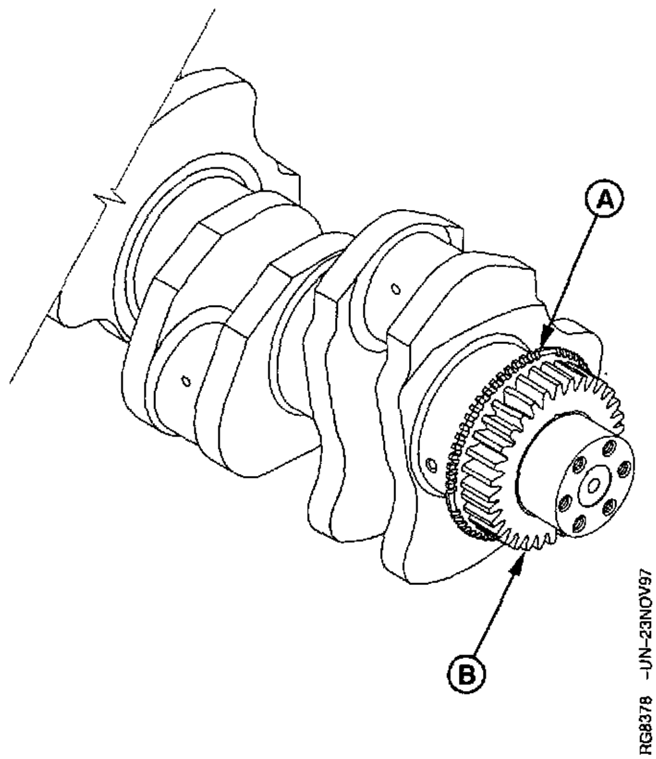
Determining Engine Speed and Piston Position

Engine speed and precise piston position in relation to Top-Dead-Center (TDC) is determined by the ECU using the crankshaft position sensor and the crankshaft timing wheel. Cylinder identification in relation to the engine firing order is determined by the ECU using the camshaft position sensor, and the camshaft timing wheel. Both sensors operate by detecting notches on a timing wheel. When a notch on the timing wheel is directly under the sensor, a voltage is induced. The ECU monitors this voltage to determine timing wheel position.

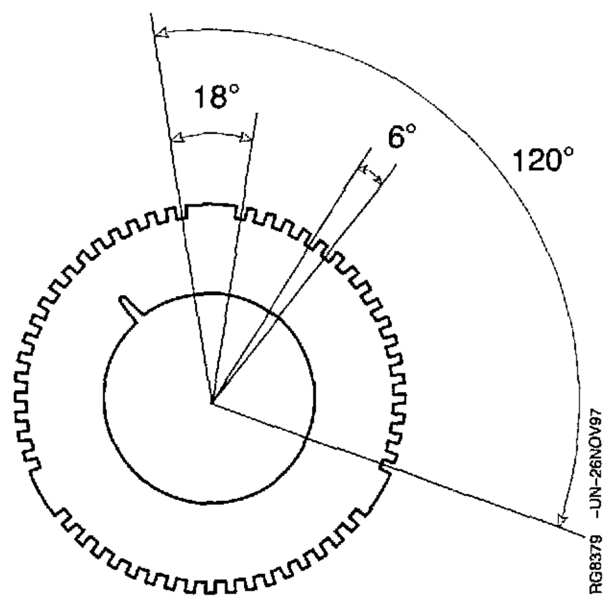
Continued on next page RG,RG34710,1536 –19–30SEP97–1/4

Crankshaft Position

The crank timing wheel (A) is located on the front of the crankshaft, behind the pressed-on crank gear (B). The timing wheel is composed of 54 notches, divided into 3 groups of 18 notches. Before the first notch in each group is a flat area equal to 18° of crankshaft rotation, the following 17 notches are separated by 6° of crankshaft rotation. Each group of 18 notches and a flat area is equal to 120°, or a third of a full turn.



Crankshaft Timing Wheel

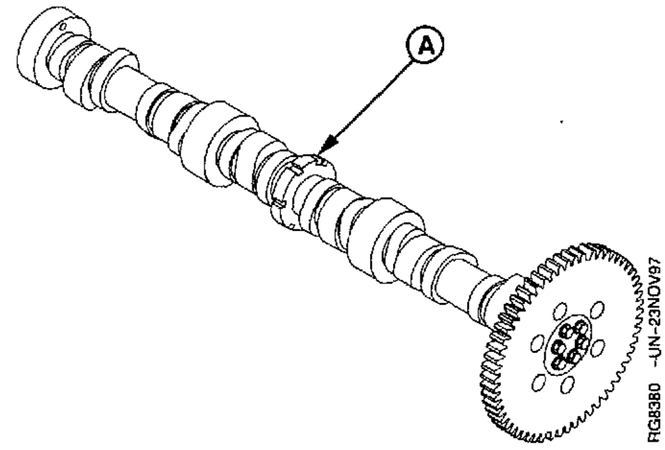


Crankshaft Timing Wheel Notches

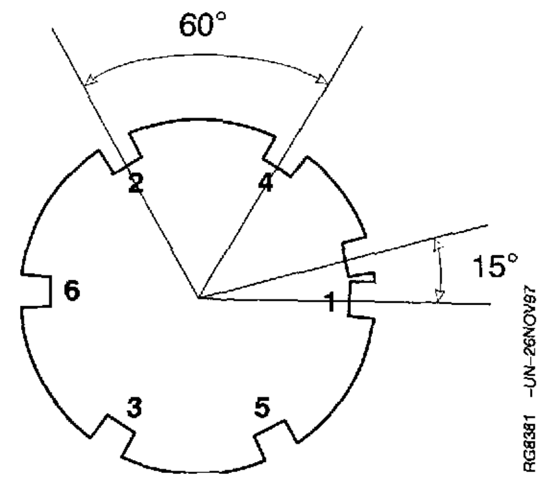
Continued on next page RG,RG34710,1536 -19-30SEP97-2/4

Camshaft Position

The camshaft timing wheel (A) consists of 7 notches cut into the center journal of the camshaft. Six of the 7 notches are evenly spaced at 60° center-to-center. Each of the 6 notches correspond to a cylinder; the 7th notch is located 15° center-to-center before the notch that identifies cylinder number 1. The ECU has the engine firing order stored in memory, therefore it knows that following the notch identifying cylinder 1 will be the notch identifying cylinder 5 etc. The camshaft timing wheel turns at one half the speed of the crankshaft timing wheel.



Camshaft Timing Wheel



Camshaft Timing Wheel Notches

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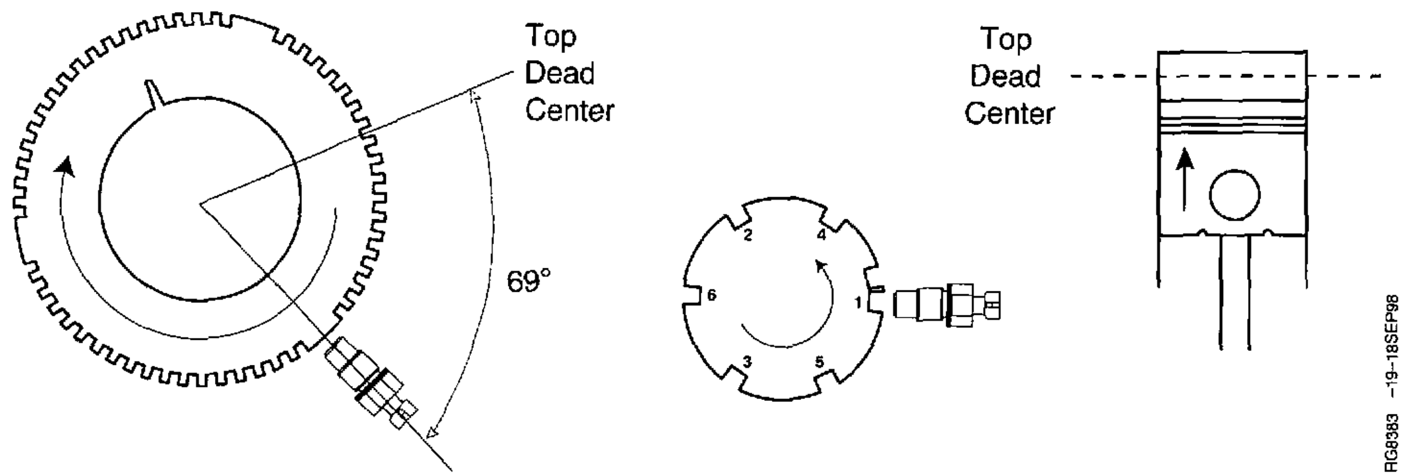


Crankshaft/Camshaft Timing Wheels Relationship

Crankshaft/Camshaft Position Relationship

When the cam position sensor detects the extra notch on the cam timing wheel, the ECU is informed that the notch identifying cylinder 1 is 15° of crank rotation away from the cam position sensor, and the center of the flat area on the crank timing wheel is 30° of crank rotation away from the crank position sensor. One timing cycle will then begin when the cam position sensor is directly in the center of a notch on the cam timing wheel. At this time, the crank position sensor is directly in the center of a flat area on the crank timing wheel, and piston number 1 is 69° of crankshaft rotation away from TDC on the compression stroke. During the previous 120°, the ECU calculated engine speed and determined the optimum time to start injecting fuel and the optimum time to stop injecting (determines fuel amount).

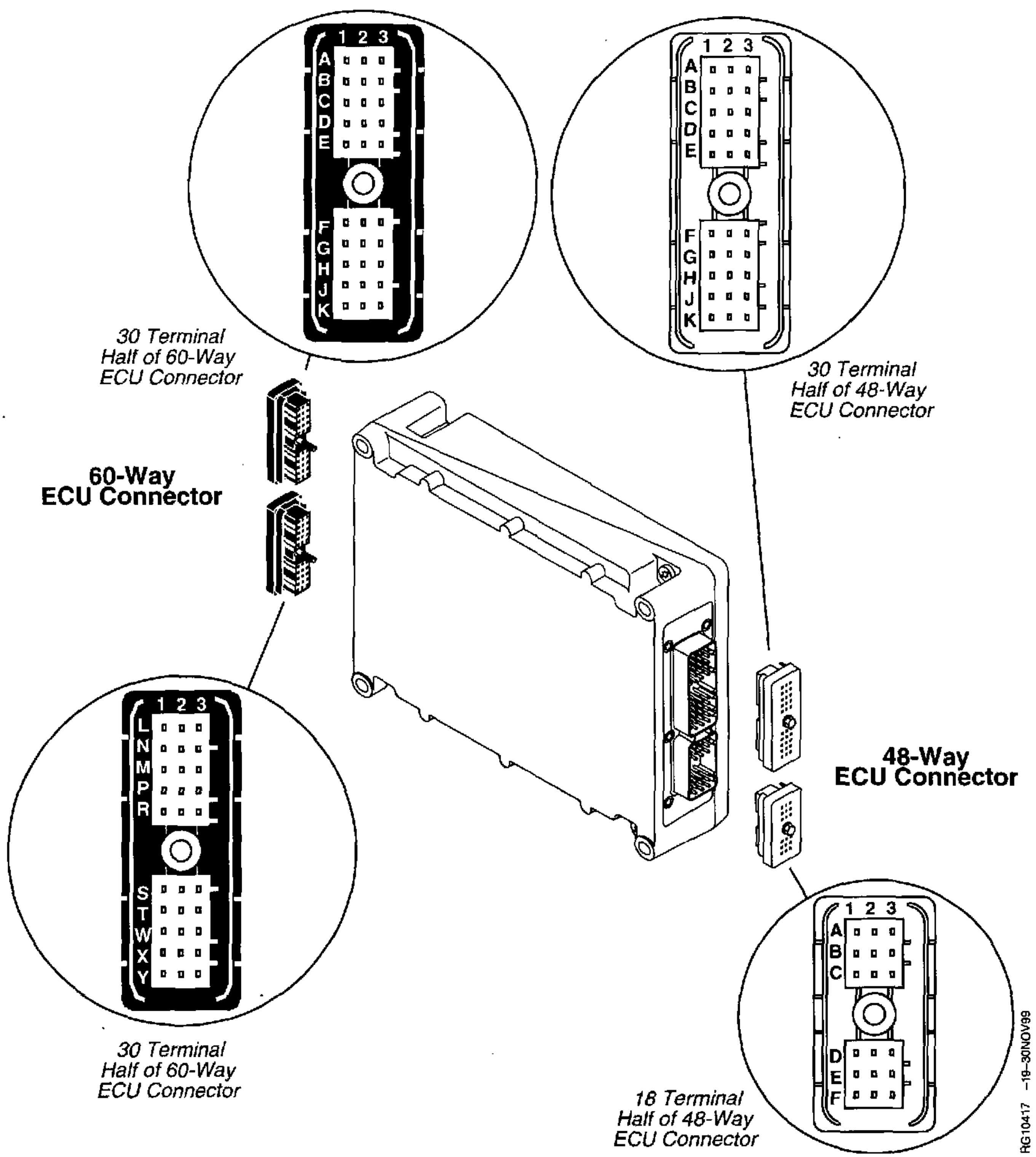
It then monitors each crank timing notch until the time to start injection occurs, at which time it energizes the Electronic Unit Injector (EUI) solenoid to start fuel delivery.

It continues to monitor each crank timing notch until the time to end injection occurs, at which time it will deenergize the EUI solenoid to stop fuel delivery.

In the event of a crank or cam position sensor failure, a "limp-home" mode will allow the ECU to operate with only one position sensor input. If the crank position sensor fails, engine power will be low. If the cam position sensor fails, long cranking times will be required to start the engine. If both sensors fail, the engine will die and won't restart.

RG,RG34710,1536 -19-30SEP97-4/4

Engine Control Unit (ECU)



Deere Level 6 ECU

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

Continued on next page

RG,RG34710,1537 –19–30SEP97–1/2

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

The ECU connects to the wiring harness through a white, 48-way ECU connector, which is composed of a 30 terminal ECU connector and an 18 terminal ECU connector, and a black, 60-way ECU connector, which is composed of two 30 terminal connectors. The connectors are marked by letters and numbers to help identify the terminals.

The ECU is composed of the following subsystems:

Analog/Digital Converters

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

Central Processing Unit (CPU)

The central processing unit performs the mathematical computations and logical functions that are necessary in controlling injection fuel quantity and injection timing. The CPU commands the Electronic Unit Injectors (EUIs) and controls the self diagnostic system.

Memory

The ECU contains 3 different types of memory:

— Random Access Memory - RAM

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

— Read Only Memory - ROM

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

— Electrical Erasable Programmable Read Only Memory - EEPROM

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

RG,RG34710,1537 –19–30SEP97–2/2

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

There are two levels of engine protection:

- **Warning** — The warning lamp (if equipped) turns ON.
  Causes:
  - Lower than normal oil pressure
  - Engine coolant temperature higher than normal
  - Higher than normal manifold air temperature
  - Lower than normal fuel supply pressure
  - Higher than normal fuel supply pressure
  - Water in fuel detected
  - High air filter restriction
  - Power derates
- **Shutdown** — The shutdown lamp (if equipped) turns ON.
  Causes:
  - Extremely low oil pressure
  - Extremely high engine coolant temperature
  - Loss of coolant
  - Extremely low fuel supply pressure
  - Water in fuel continuously detected

There are three different engine protection programs available:

- **No Protection** — The operator must reduce the speed of the engine when the "Warning"trouble light is ON, and shutdown the engine when a "Shutdown" trouble light is ON. If a "Shutdown" trouble light occurs, it is the responsibility of the operator to shut down the engine.
- **Engine Protection WITHOUT Shutdown** — The engine will derate either due to a "Warning" or a "Shutdown" trouble light. If a "Shutdown" trouble light occurs, it is the responsibility of the operator to shutdown the engine.
- **Engine Protection with Shutdown**— The engine will derate either due to a "Warning" or a "Shutdown" trouble light. If a "Shutdown" trouble light is detected, the ECU will shut down the engine 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. The "Warning" fault lamp will remain ON until the power returns to normal, and at that time, it will shut OFF.

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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Different Derate Programs

NOTE: The derate programs shown below apply to OEM engine applications that contain engine protection. Other applications may have similar derate programs. Refer to specific machine manual for application derate programs.

LOW OIL PRESSURE PROTECTION

- **Warning:** A power derate of 2% per minute with a maximum derate of 20% of rated power will start if the "Warning" fault lamp is set. If oil pressure increases over the "Warning" fault pressure, the power will increase at the rate of 2% per minute until full power is reached.
- **Shutdown:** A power derate of 20% per minute with a maximum derate of 40% of rated power occurs if oil pressure becomes lower than the "Shutdown" fault pressure. If this fault stays on for 30 seconds, the engine will shut down. If oil pressure begins to increase above the "Shutdown" fault pressure, the "Warning" fault will activate. The power derate will revert to the "Warning" fault.

NOTE: Shutdown only occurs on engines that have the option in their ECU.

HIGH ECT (ENGINE COOLANT TEMPERATURE) PROTECTION

- **Warning:** A power derate of 2% per minute with a maximum derate of 20% of rated power will start if the "Warning" fault lamp is set. If ECT decreases below the "Warning" fault pressure, the power will increase at the rate of 2% per minute until full power is reached.
- **Shutdown:** A power derate of 20% per minute with a maximum derate of 40% of rated power occurs if ECT exceeds the "Shutdown" fault temperature. If ECT does not decrease below the "Shutdown" fault temperature within 30 seconds, the engine will shut down. If ECT decreases below the "Shutdown" fault temperature within 30 seconds, the power derate will divert to the "Warning" curve.

NOTE: Shutdown only occurs on engines that have the option in their ECU.

LOSS OF COOLANT PROTECTION

- **Shutdown:** A power derate of 20% per minute with a maximum derate of 40% of rated power occurs if the coolant level becomes low. If the loss of coolant switch does not reset within 30 seconds, the engine will shutdown. If the switch resets within 30 seconds, the power increases at 20% per minute until full power is reached.

NOTE: Shutdown only occurs on engines that have the option in their ECU.

LOW FUEL PRESSURE PROTECTION

- **Warning:** A power derate of 2% per minute with a maximum derate of 20% of rated power will start if the "Warning" fault lamp is set. If the fuel pressure increases over the "Warning" fault pressure, the power will increase at the rate of 2% per minute until full power is reached.
- **Shutdown:** A power derate of 20% per minute with a maximum derate of 40% of rated power occurs if the fuel supply pressure becomes lower than the "Shutdown" fault pressure. If this fault stays on for 30 seconds, the engine will shut down. If the fuel pressure begins to increase above the "Shutdown" fault pressure, the "Warning" fault will activate. The power derate will revert to the "Warning" fault.

NOTE: Shutdown only occurs on engines that have the option in their ECU.

HIGH FUEL PRESSURE PROTECTION

Continued on next page DPSG,RG40854,459 –19–14OCT99–1/2

- **Warning:** A power derate of 2% per minute with a maximum derate of 20% of rated power occurs if fuel pressure exceeds the "Warning" fault pressure. If the fuel pressure decreases below the "Warning" fault pressure, the power will increase at the rate of 2% per minute until full power is reached.

WIF (WATER IN FUEL) PROTECTION

- **Warning:** A power derate of 2% per minute with a maximum derate of 20% of rated power will start if the "Warning" fault lamp is set. If WIF decreases past the "Warning" fault pressure, the power will increase at the rate of 2% per minute until full power is reached.
- **Shutdown:** A power derate of 20% per minute with a maximum derate of 40% of rated power occurs if WIF exceeds the "Shutdown" time limit for this detection. If WIF does not decrease below the "Shutdown" detection level within 30 seconds, the engine will shut down. If WIF decreases below the "Shutdown" detection level within 30 seconds, the power derate will divert to the "Warning" curve.

NOTE: Shutdown only occurs on engines that have the option in their ECU.

HIGH MAT (MANIFOLD AIR TEMPERATURE) PROTECTION

- **Warning:** A power derate of 2% per minute with a maximum derate of 20% of rated power occurs if MAT exceeds the "Warning" fault temperature. If MAT decreases past the "Warning" fault pressure, the power will increase at the rate of 2% per minute until full power is reached.

AIR FILTER RESTRICTION PROTECTION

- **Warning:** A power derate of 2% per minute with a maximum derate of 20% of rated power will start if the "Warning" fault lamp is set. If the air pressure increases over the "Warning" fault pressure, the power will increase at the rate of 2% per minute until full power is reached.

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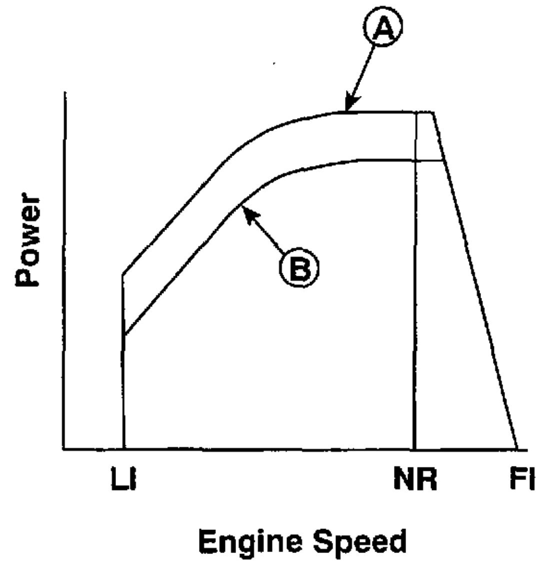
Multiple Torque Curve Selection

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

For example: a machine can choose multiple torque curves using simple switching arrangement. A simple on/off toggle switch and resistor can be used to switch between torque curve 1 (maximum power), and any of the other torque curves. When the switch is open, the ECU will command torque curve 1. When the switch is closed, the ECU will command one of the other curves depending on the resistance in the line. See TORQUE CURVE SELECTION in Group 198 of this manual for torque curve selection specifications.



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

Torque Curves

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Governor Droop Mode Selection

The electronic control system has the ability to provide two types of governing; all-speed governing and min-max speed governing. When operating in the all-speed governor mode, the Engine Control Unit (ECU) controls the engine speed based on the analog throttle input or the PWM throttle input. When operating in the min-max speed governor mode, the ECU provides the same minimum (low idle) and maximum (fast idle) speed governing as with the all-speed governor. However, in between the minimum and maximum speeds, the analog throttle input or PWM throttle input is used by the ECU to select a fuel quantity. Thus, the throttle commands fuel quantity rather than engine speed in the min-max governor mode.

The ECU also has the ability to provide two types of droop; 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 is determined by either switch inputs into the ECU's droop select terminal, or by messages from other controllers on the machine's Controller Area Network (CAN).

See GOVERNOR DROOP MODE SELECTION in Group 198 of this manual for governor droop mode specifications.

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Engine Control Unit (ECU) Self-Diagnosis

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

There are two types of DTCs:

- Active
- Stored

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

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

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

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

SPN/FMI CODES

Some applications output DTCs according to the J1939 standard as a two part code. The first part is a two to four-digit Suspect Parameter Number (SPN) followed by a one or two-digit Failure Mode identifier (FMI) code. In order to determine the exact failure, both parts (SPN and FMI) of the code are needed. This 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 FMI identifies the type of failure that has occurred; for example FMI 4 indicates voltage input below normal. Combining SPN 110 with FMI 4 yields engine coolant temperature input voltage low, or the equivalent of 2-digit trouble code 24.

2-DIGIT CODES

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

CLEARING STORED DTCS

Stored DTCs can be cleared through the OEM instrument panel or through the Diagnostic Scan Tool (DST).

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About this Section of the Manual

This section of the manual contains necessary information to diagnose problems with the base engine, the lubrication system, and the cooling system. Use this information in conjunction with the 6105 and 6125 DIESEL ENGINES REPAIR Manual (CTM 100). This section is divided into two areas: diagnosing malfunctions and testing procedures. The diagnosing malfunction areas are further divided into the following headings, containing the following symptoms:

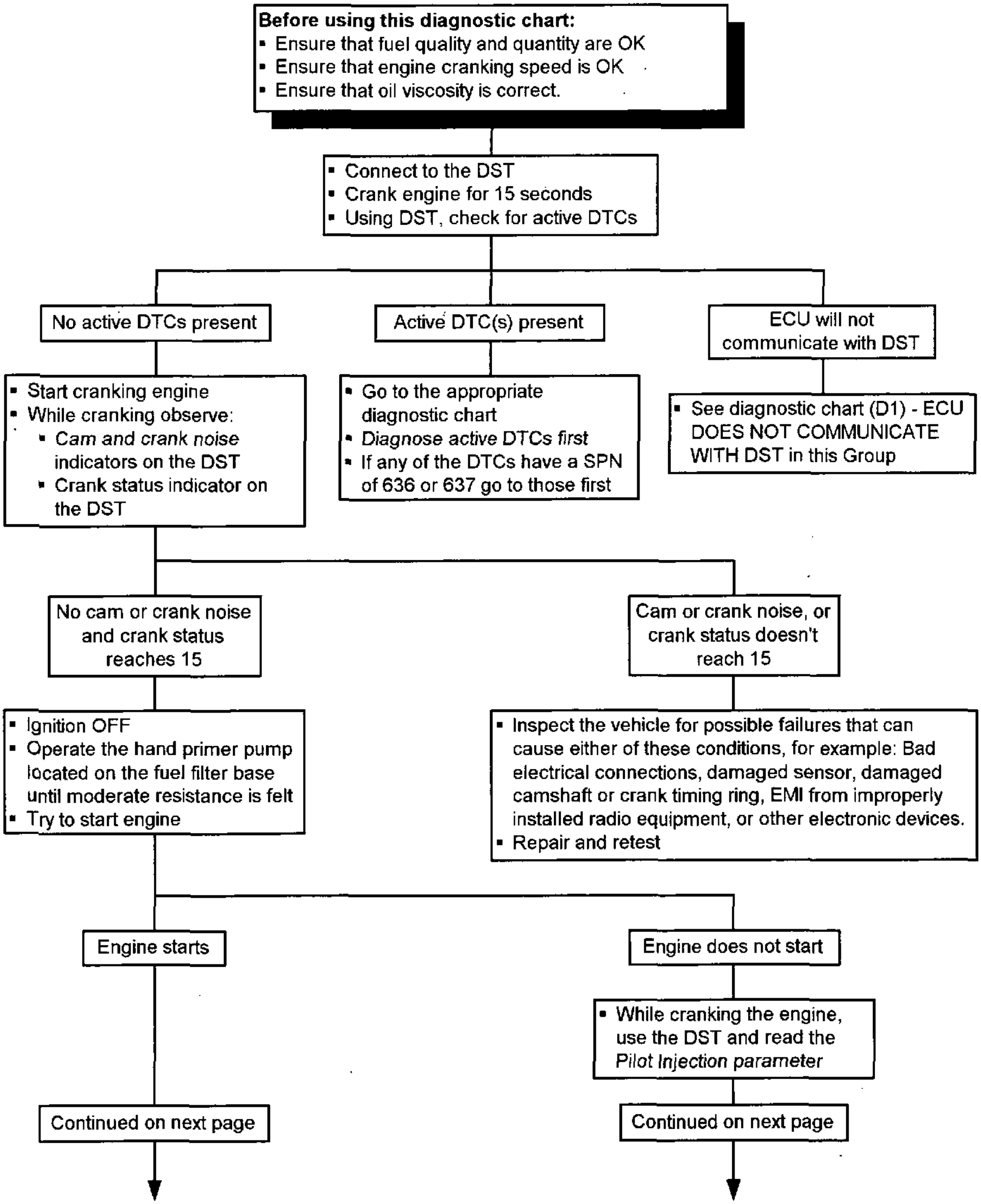
- **(E)** Diagnosing General Engine Malfunctions:
  - E1 - Engine cranks/won't start
  - E2 - Engine misfires/runs irregularly
  - E3 - Engine does not develop full power
  - E4 - Engine emits excessive white exhaust smoke
  - E5 - Engine emits excessive black or gray exhaust smoke
  - E6 - Engine will not crank
  - E7 - Engine idles poorly
  - E8 - Abnormal engine noise
- **(L)** Diagnosing Lubrication System Malfunctions:
  - L1 - Excessive oil consumption
  - L2 - Engine oil pressure low
  - L3 - Engine oil pressure high
- **(C)** Diagnosing Cooling System Malfunctions
  - C1 - Coolant temperature above normal
  - C2 - Coolant temperature below normal
  - C3 - Coolant in oil or oil in coolant
- **(F)** Diagnosing Low Pressure Fuel System Malfunctions
  - F1 - Dual rail fuel supply system check
  - F2 - Excessive fuel consumption on a dual rail fuel system
  - F3 - Fuel in oil on a dual rail fuel system
  - F4 - Single rail fuel supply system check
  - F5 - Excessive fuel consumption on a single rail fuel system
  - F6 - Fuel in oil on a single rail fuel system
- **(D)** Diagnosing Diagnostic Scan Tool (DST) Communication Malfunctions:
  - D1 - ECU does not communicate with DST

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 of the manual contains the following testing procedures:

- Lubrications System Testing Procedures:
  - Check engine oil pressure
  - Check for excessive crankcase pressure (blow-by)
  - Check for turbocharger oil seal leak
- Cooling System Testing Procedures:
  - Inspect thermostat and test opening temperature
  - Pressure test cooling system and radiator cap
  - Check for head gasket failures
- Air Supply and Exhaust Systems Testing Procedures
  - Measure intake manifold pressure (turbo boost)
  - Check for intake and exhaust restrictions
  - Test for intake air leaks
  - Check for exhaust air leaks
- Fuel System Testing Procedures:
  - Check dual rail fuel supply pressure
  - Bleed the dual rail fuel system
  - Check single rail fuel supply pressure
  - Bleed the single rail fuel system
- Timing/Sensor Testing Procedures:
  - Check and adjust camshaft-to-crankshaft timing
  - Check crankshaft position sensor depth

DPSG,RG40854,323 –19–06OCT99–1/1

E1 - Engine Cranks/Won't Start



RG10507 –19–17NOV99

DPSG,RG40854,327 –19–06OCT99–1/1

E1 - Engine Cranks/Won't Start - Continued

Pilot Injection reads ON or N/A

Pilot Injection reads OFF

- Pilot Injection should be ON if the ECT is below 35°C (95°F). If Pilot Injection is OFF under this condition, determine problem in the ECT sensor circuit.

- Check the fuel supply system by referring to chart F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK or F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK in this Group

Fuel supply system OK

- Ignition OFF
- Remove rocker arm cover

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

- Check EUI rocker arms, valve rocker arms, and camshaft operation
- Check that the hold down clamp cap screws on all EUIs are tightened to specification. For Dual Rail fuel systems see Group 35 of 6105 and 6125 Diesel Engine Repair Manual (CTM 100). For Single Rail fuel systems see Group 36 of 6105 and 6125 Diesel Engine Repair Manual (CTM 100)
- Inspect EUI harness and EUI harness connector for damage

Fuel supply system problem found

- Repair fuel supply system problem and retest

All components operating correctly

Continued on next page

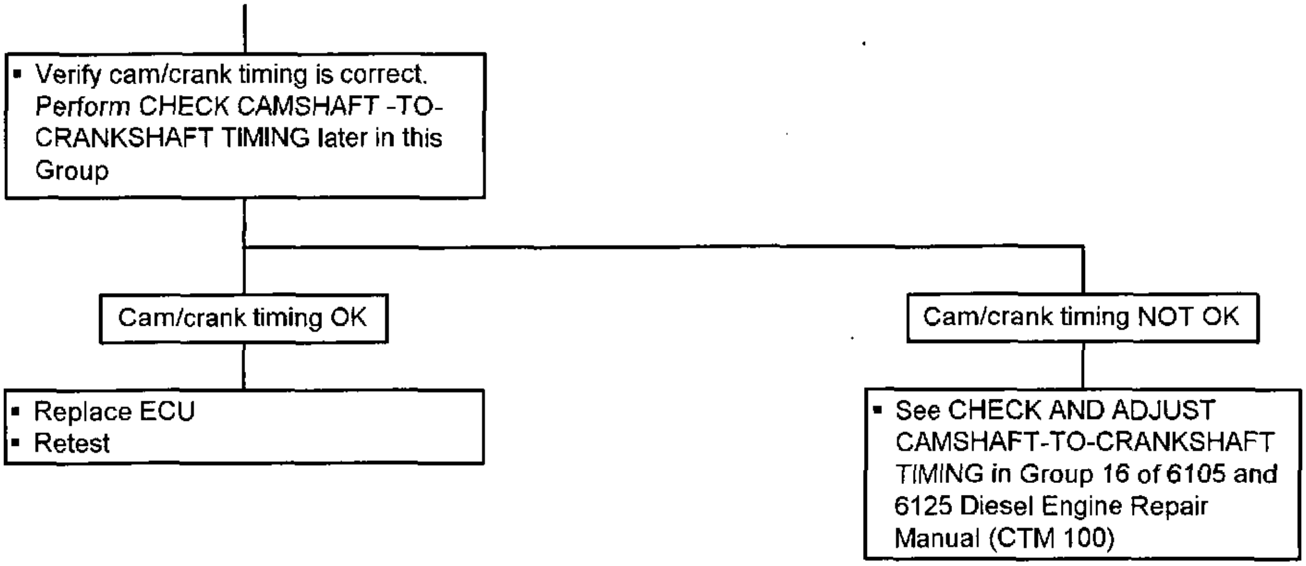
Faulty component found

- Repair faulty component and retest

RG10508 –19–22DEC99

DPSG,RG40854,328 –19–06OCT99–1/1

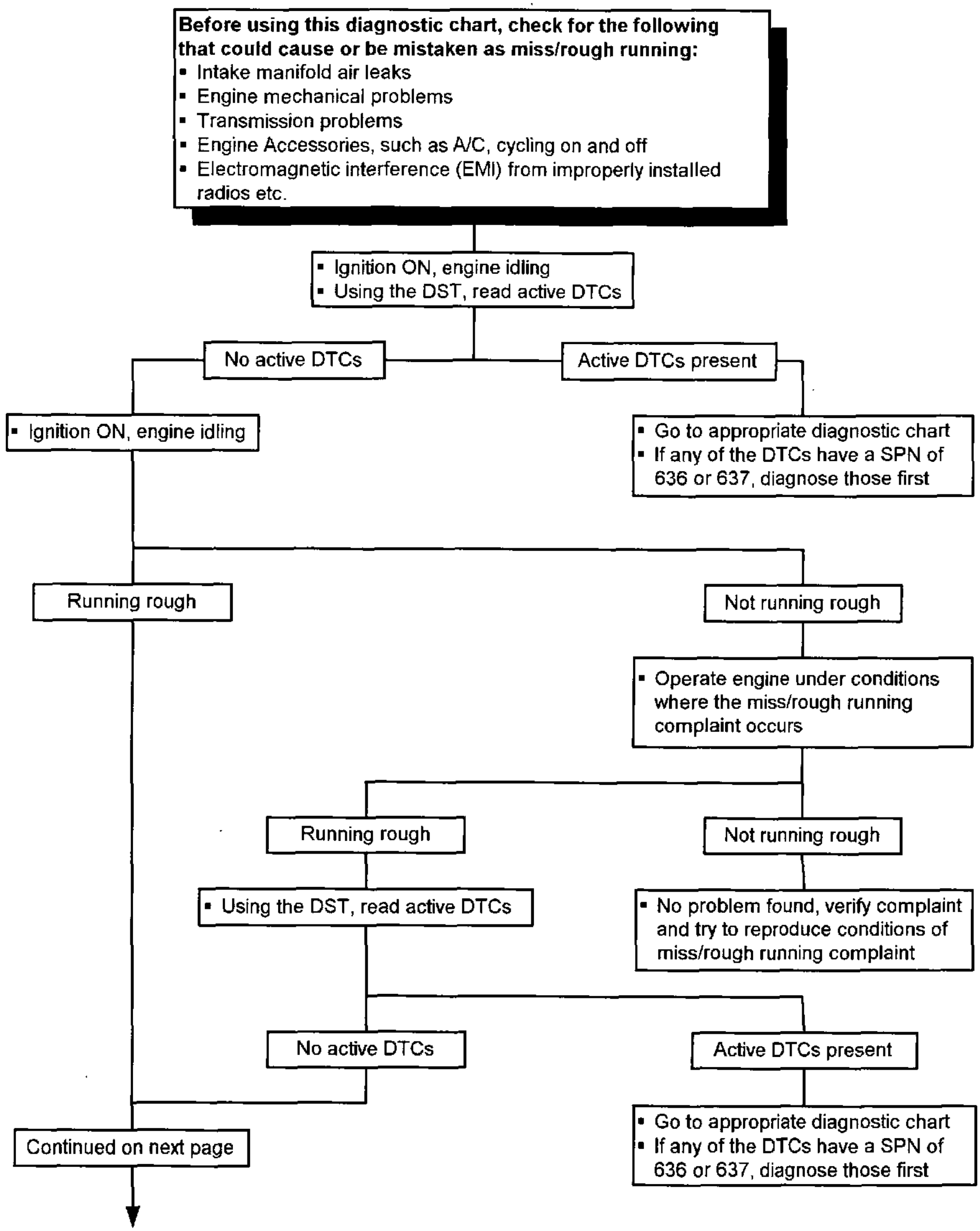
E1 - Engine Cranks/Won't Start - Continued



RG10509 -19-17NOV99

DPSG,RG40854,451 -19-12OCT99-1/1

E2 - Engine Misfires/Runs Irregularly



RG10510 –19–17NOV99

E2 - Engine Misfires/Runs Irregularly - Continued

- Using the DST, perform the Compression Test. For instructions, see DST ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Group 115. Make note of the results.
- Using the DST, perform the Engine Misfire Test. For Instructions, see DST ENGINE TEST INSTRUCTIONS - CYLINDER MISFIRE TEST in Group 115. Make note of the results.

All cylinders scored within 10% of each other on both tests

- Check the fuel supply system by referring to chart F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK or F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK

One or more cylinders scored 10% or more lower than the rest on the compression test and DIFFERENT cylinder(s) scored 10% or more lower on the misfire test

- These types of results indicate either the misfire test or the compression test could not operate correctly. Further engine diagnostics should be performed to *determine if the engine misfire is caused* by a faulty EUI or by a compression problem

One or more cylinders scored 10% or more lower than the rest on the compression test and the SAME cylinder(s) scored 10% or more lower on the misfire test

- Determine the cause of low compression pressure on the low scoring cylinders

All cylinders scored within 10% of each other on the compression test and one or more cylinders scored 10% or lower than the rest on the misfire test

- Check EUI pre-load adjustment on the EUI(s) of the cylinder(s) that tested low on the misfire test. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Group 05 of 6105 and 6125 Diesel Engine Repair Manual (CTM 100)
- If EUI pre-load is adjusted properly, replace the EUI(s) of the cylinder(s) that tested low on the misfire test

Continued on next page

RG10511 -19-22DEC99

DPSG,RG40854,332 -19-06OCT99-1/1

E2 - Engine Misfires/Runs Irregularly - Continued

Fuel supply system is OK

- Check EUI pre-load adjustment and check valve adjustment. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Group 05 of 6105 and 6125 Diesel Engine Repair Manual (CTM 100)

  EUIs and valves properly adjusted

  - Ensure there are no engine mechanical problems
  - Ensure there is not something drawing excessive engine power
  - If none of the above problems are found, continue diagnostics by going to diagnostic chart E3 - ENGINE DOES NOT DEVELOP FULL POWER in this Group

  EUIs and valves NOT properly adjusted

  - Adjust EUIs and valves to specification and retest. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Group 05 of 6105 and 6125 Diesel Engine Repair Manual (CTM 100)

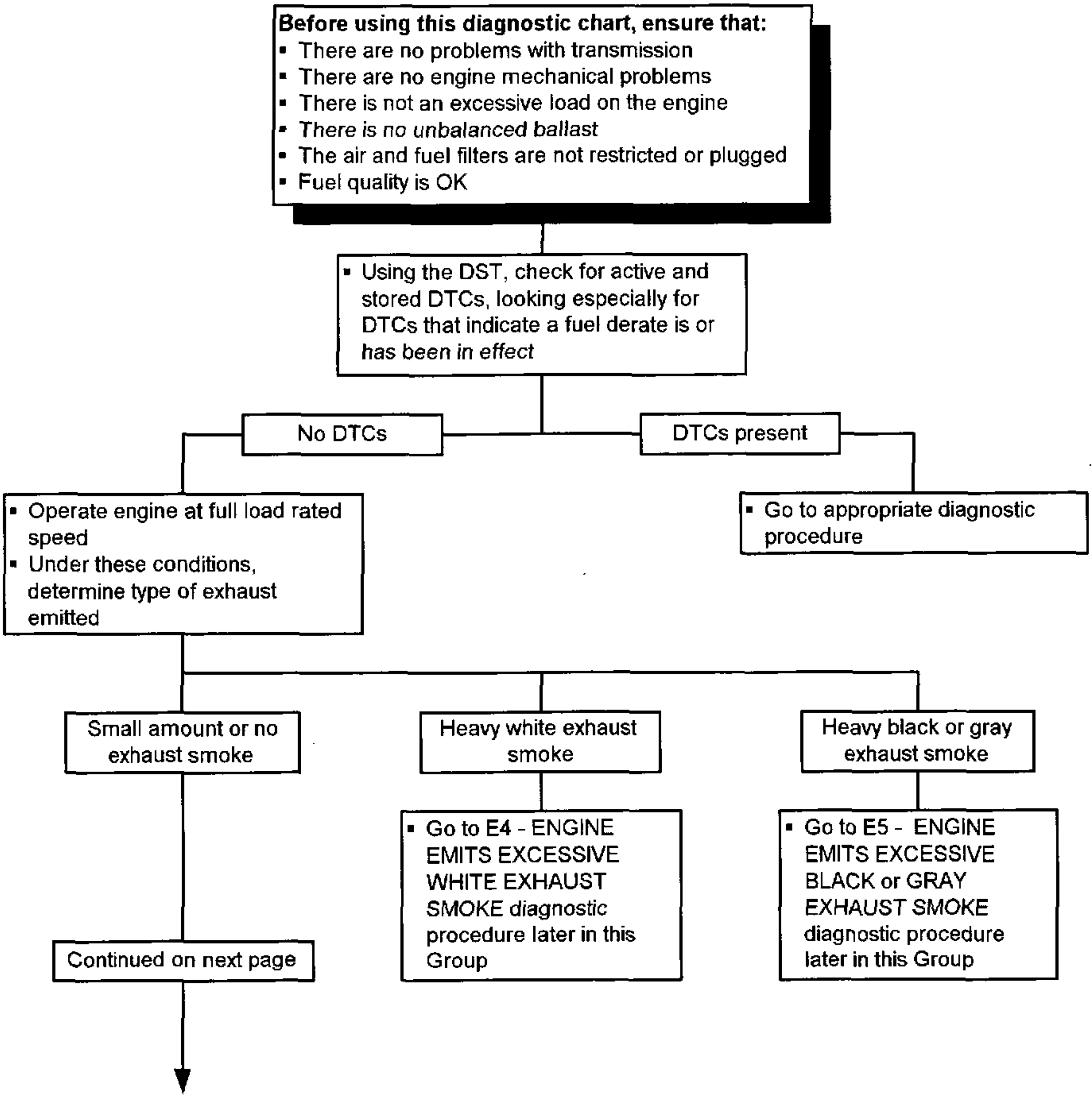
Fuel supply system problem found

- Repair fuel supply system problem and retest

RG10512 –19–17NOV99

DPSG,RG40854,452 –19–12OCT99–1/1

E3 - Engine Does Not Develop Full Power



RG10513 –19–17NOV99

DPSG,RG40854,333 –19–06OCT99–1/1

E3 - Engine Does Not Develop Full Power - Continued

Note: 6750/6850 Self-Propelled Forage Harvester applications only use one torque curve; therefore, this check is not required.

- The ECU on 10.5/12.5 engines has the ability to operate on multiple torque curves. To check that the engine is operating on the correct torque curve under the operating conditions where there is a low power complaint:
  - Recreate the conditions of the low power complaint
  - Using the DST, read the torque curve number
  - Compare the torque curve number to the appropriate torque curve chart in Group 198

The torque curve number displayed IS correct for the operating conditions of the low power complaint

- Operate engine and attempt to recreate the low power condition
- Using DST, observe the governor selection
- Compare governor selection to the appropriate governor mode chart in Group 198

The torque curve number displayed IS NOT correct for the operating conditions of the low power complaint

- Refer to machine manual to determine components that if faulty could prevent the correct torque curve from being selected

OR

- Faulty torque curve select wiring

Governor selection is correct

- Using the DST, perform the Compression Test. For instructions, see DST ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Group 115. Make notes of the results
- Using the DST, perform the Engine Misfire Test. For instructions, see DST ENGINE TEST INSTRUCTIONS -CYLINDER MISFIRE TEST in Group 115. Make note of the results

Continued on next page

Governor selection is incorrect

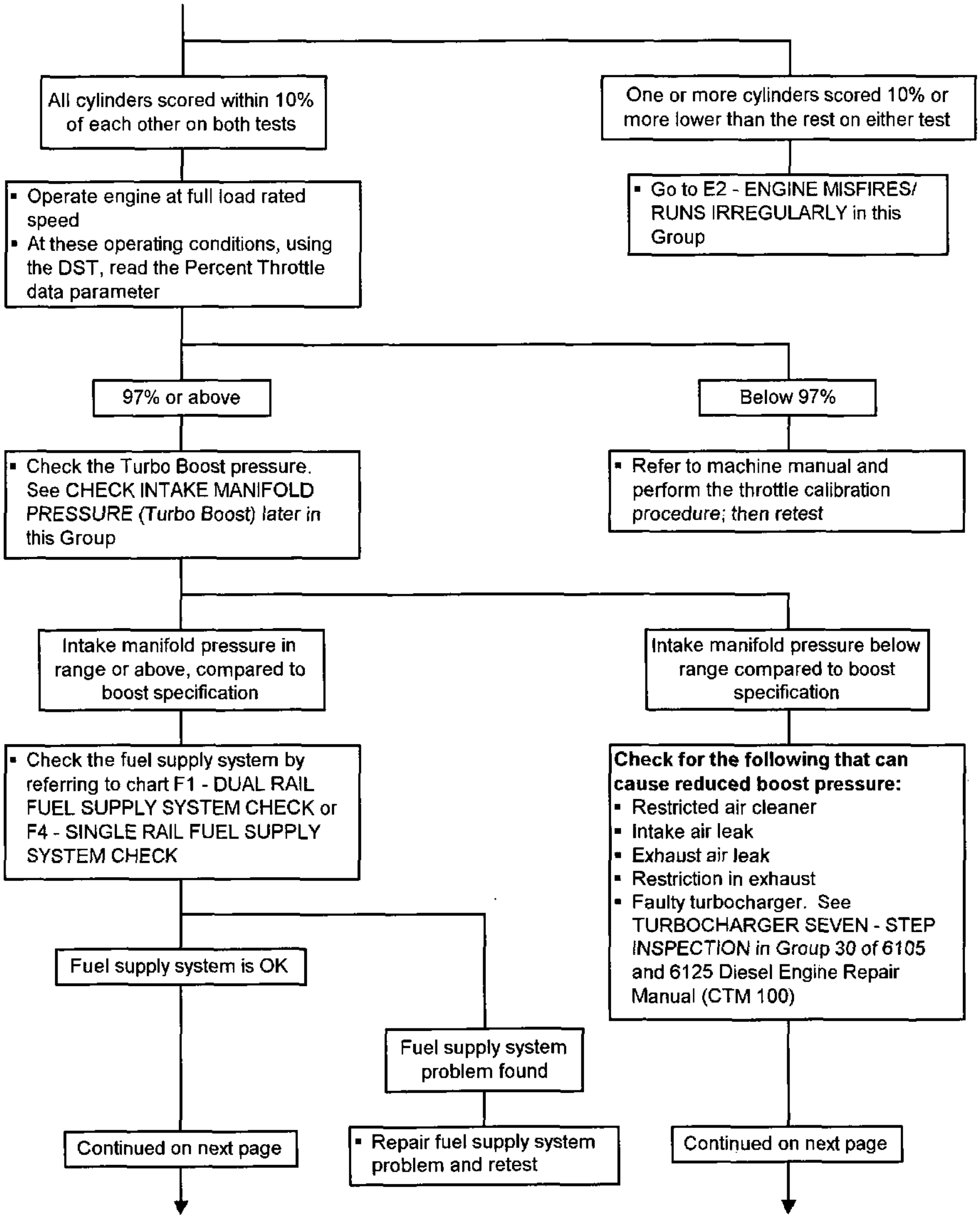
- Refer to machine manual to determine components that if faulty could prevent the correct governor from being selected

OR

- Faulty governor select wiring

RG10514 -19-22DEC99

E3 - Engine Does Not Develop Full Power - Continued



RG10515 –19–06JAN00

DPSG,RG40854,453 –19–12OCT99–1/1

E3 - Engine Does Not Develop Full Power - Continued

- Engine appears to be delivering full power
- Check for vehicle problems that could cause an excessive load on the engine

None of the above problems found

- Check the fuel supply system by referring to chart F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK or F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK

Fuel supply system is OK

- Ensure EUI pre-load is correctly adjusted. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Group 05 of 6105 and 6125 Diesel Engines Repair Manual (CTM 100)
- Ensure there are no engine mechanical problems
- Ensure there isn't something drawing excessive engine power
- If none of above problems are found, the most likely cause of low power is damaged spill valves in the EUIs. Replace and retest.

Fuel supply system problem found

- Repair fuel supply system problem and retest

RG10516 -19-17NOV99

DPSG,RG40854,334 -19-06OCT99-1/1

E4 - Engine Emits Excessive White Exhaust Smoke

Note: This procedure should be used if the engine emits excessive white exhaust smoke. This type of smoke causes a burning sensation to the eyes. If engine emits a less heavy, bluish exhaust smoke go to L1 - EXCESSIVE OIL CONSUMPTION diagnostic procedure later in this group

Before using this diagnostic procedure:
- Ensure fuel quantity and quality are OK.
- Ensure engine coolant temperature is not extremely low

- Check for a failed head gasket. See CHECK FOR HEAD GASKET FAILURE'S in this Group

No signs of head gasket failure

- Check compression pressure. See DST ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Group 115 of this manual

All cylinders score within 10% of each other

- Check fuel pressure. See CHECK DUAL RAIL FUEL SUPPLY PRESSURE or CHECK SINGLE RAIL FUEL SUPPLY PRESSURE

Fuel pressure within specification

- Perform CHECK CAMSHAFT-TO-CRANKSHAFT TIMING in this Group

Continue on next page

Fuel pressure below specification

- Check fuel supply system. See chart F1 - DUAL RAIL FUEL SUPPLY SYSTEM CHECK or F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK later in this Group

One or more cylinders scored 10% or lower than the rest

- Investigate problems related to low compression

Signs of head gasket failure are found

- See HEAD GASKET INSPECTION AND REPAIR SEQUENCE in Group 05 of 6105 and 6125 Diesel Engine Repair Manual (CTM 100)

RG10517 –19–22DEC99

DPSG,RG40854,335 –19–06OCT99–1/1

E4 - Engine Emits Excessive White Exhaust Smoke - Continued

Camshaft to crankshaft timing OK

- Ensure there are no engine mechanical problems
- If no other problems are found, continue diagnostics by going to diagnostic chart E3 - ENGINE DOES NOT DEVELOP FULL POWER in this Group

Camshaft to crankshaft timing not OK

- Perform CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in Group 16 of 6105 and 6125 Diesel Engine Repair Manual (CTM 100)
- Retest

RG10518 –19–17NOV99

DPSG,RG40854,336 –19–06OCT99–1/1

E5 - Engine Emits Excessive Black or Gray Exhaust Smoke

Note: This procedure should be used if the engine emits excessive black or gray smoke. If engine emits a less heavy, bluish exhaust smoke go to L1 - EXCESSIVE OIL CONSUMPTION diagnostic procedure later in this Group

Before using this diagnostic procedure:
- Ensure fuel quantity and quality are OK
- Ensure engine is not excessively loaded
- Ensure air filter is not restricted or plugged

- Check for intake and exhaust restrictions and air leaks. See CHECK FOR INTAKE AND EXHAUST RESTRICTIONS and CHECK FOR INTAKE AIR LEAKS and CHECK FOR EXHAUST AIR LEAKS later in this Group

No restrictions or leaks found

- Check for turbocharger failure. See TURBOCHARGER SEVEN-STEP INSPECTION in Group 30 of 6105 and 6125 Diesel Engine Repair Manual (CTM 100)

Restrictions or leaks found

- Repair or replace components as necessary

No turbocharger failure found

- Check valve lash. See CHECK AND ADJUST VALVE LASH CLEARANCES AND INJECTOR PRELOAD in Group 05 of 6105 and 6125 Diesel Engine Repair Manual (CTM100)

Turbocharger failure found

- Follow appropriate repair procedure in Group 30 of 6105 and 6125 Diesel Engine Repair Manual (CTM100)

Valve lash on all valves within specification

Continue on next page

Valve lash on one or more valves out of specification

- Adjust valve lash and retest

RG10519 –19–22DEC99

DPSG,RG40854,337 –19–06OCT99–1/1

E5 - Engine Emits Excessive Black or Gray Exhaust Smoke - Continued

- Perform CHECK CAMSHAFT-TO-CRANKSHAFT TIMING later in this Group

Camshaft to crankshaft timing OK

- Ensure there are no engine mechanical problems
- If no other problems are found, continue diagnostics by going to diagnostic chart E3 - ENGINE DOES NOT DEVELOP FULL POWER in this Group

Camshaft to crankshaft timing not OK

- Perform CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in Group 16 of 6105 and 6125 Diesel Engine Repair Manual (CTM100)
- Retest

RG10520 –19–17NOV99

DPSG,RG40854,338 –19–06OCT99–1/1

(E) Diagnosing General Engine Malfunctions - Continued

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.
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 Group 30 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Electronic control system problem or basic engine problem	See E2 - ENGINE MISFIRES/RUNS IRREGULARLY earlier in this Group.
E8 - Abnormal Engine Noise	Worn main or connecting rod bearings	Determine bearing clearance. See CYLINDER BLOCK, LINERS, PISTONS, AND RODS SPECIFICATIONS in Group 10 or CRANKSHAFT , MAIN BEARINGS, AND FLYWHEEL SPECIFICATIONS in Group 15 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Excessive crankshaft end play	Check crankshaft end play. See CHECK CRANKSHAFT ENDPLAY in Group 15 of 6105 and 6125 Diesel Engines Repair (CTM 100).

Continued on next page RG,RG34710,1541 -19-30SEP97-1/3

Symptom	Problem	Solution
	Loose main bearing caps	Check bearing clearance; replace bearings and bearing cap screws as required. See CRANKSHAFT , MAIN BEARINGS, AND FLYWHEEL SPECIFICATIONS in Group 15 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Worn connecting rod bushings and piston pins	Inspect piston pins and bushings. See INSPECT PISTON PINS AND ROD BUSHINGS in Group 10 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Scored pistons	Inspect pistons. See PRELIMINARY LINER, PISTON, AND ROD CHECKS in Group 10 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Worn timing gears or excess back lash	Check timing gear back lash. See ADJUST FRONT TIMING GEAR BACKLASH in Group 16 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Excessive valve clearance	Check and adjust valve clearance. See CHECK AND ADJUST VALVE ASSEMBLY CLEARANCES AND INJECTOR PRELOAD in Group 05 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Worn camshaft	Inspect camshaft. See VISUALLY INSPECT CAMSHAFT AND ROLLER FOLLOWERS in Group 16 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Worn rocker arm shaft(s)	Inspect rocker arm shafts. See REMOVE ROCKER ARM ASSEMBLY in Group 05 of 6105 and 6125 Diesel Engines Repair (CTM 100).

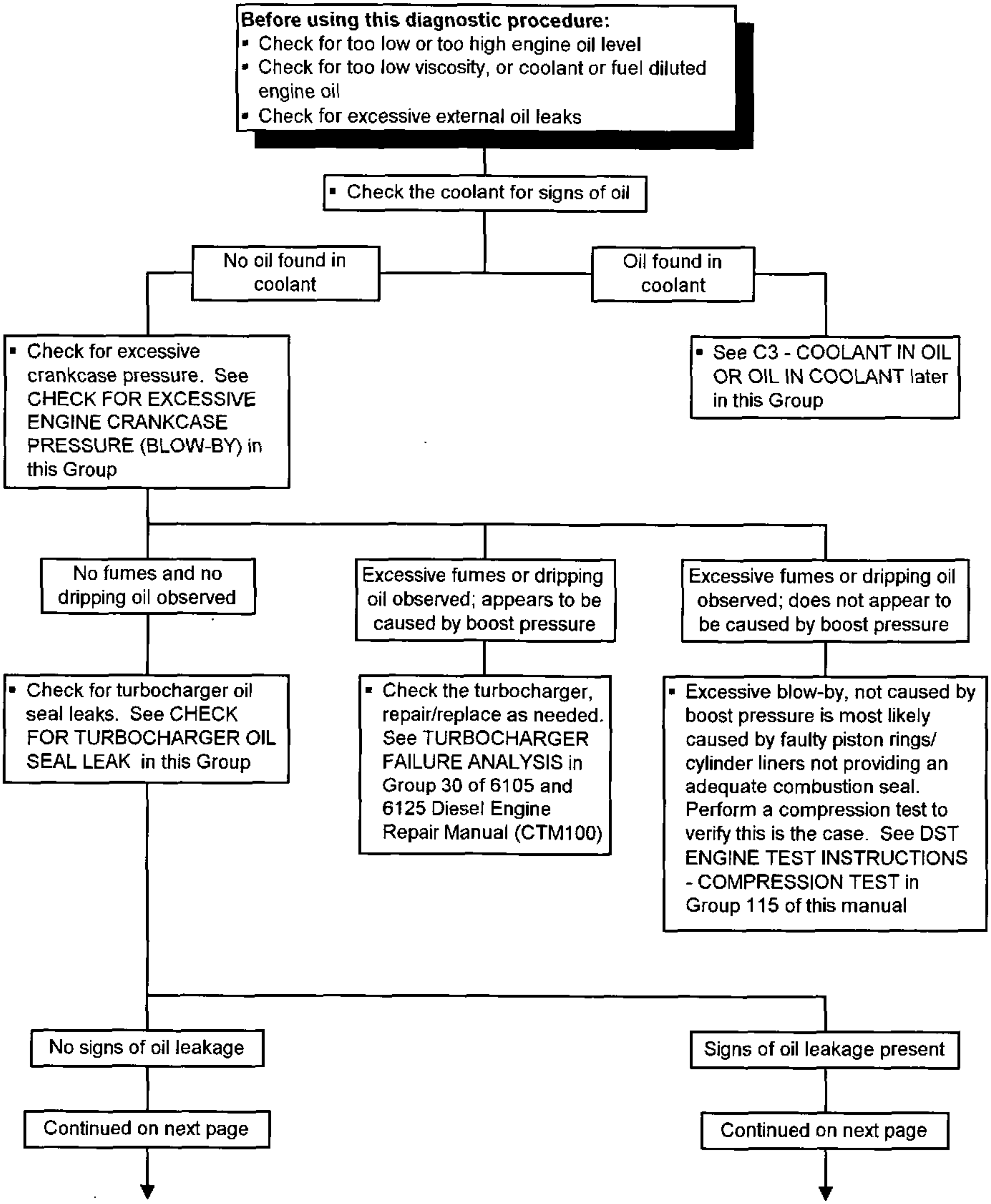
Continued on next page

RG,RG34710,1541 –19–30SEP97–2/3

Symptom	Problem	Solution
	Insufficient engine lubrication	See DIAGNOSING LUBRICATION SYSTEM MALFUNCTIONS, later in this group.
	Turbocharger noise	See TURBOCHARGER SEVEN-STEP INSPECTION in Group 30 of 6105 and 6125 Diesel Engine Repair Manual (CTM 100).

RG,RG34710,1541 –19–30SEP97–3/3

L1 - Excessive Oil Consumption



RG10525 –19–17NOV99

DPSG,RG40854,345 –19–06OCT99–1/1

L1 - Excessive Oil Consumption - Continued

At this point, the most likely cause of the excessive oil consumption is one of the following failures in the pistons, rings, and/or cylinder liners or in the valve guides:

- Oil control rings worn or broken
- *Scored cylinder liners or pistons*
- Piston ring groves excessively worn
- Piston rings stuck in ring groves
- Insufficient piston ring tension
- Piston ring gaps not staggered
- Cylinder liners glazed (insufficient load during break-in)
- Worn valve guides or stems

- Investigate problems associated with oil leakage as outlined in the test procedure, perform necessary repairs and retest

RG10526 –19–17NOV99

DPSG,RG40854,347 –19–06OCT99–1/1

(L) Diagnosing Lubrication System Malfunctions - Continued

Symptom	Problem	Solution
L2 - Engine Oil Pressure Low	Low crankcase oil level	Fill crankcase to proper oil level.
	Clogged oil cooler or filter	Remove and inspect oil cooler. See REMOVE, CLEAN, AND INSPECT ENGINE OIL COOLER in Group 20 of 6105 and 6125 Diesel Engines Repair (CTM 100). Replace oil filter.
	Excessive oil temperature	Remove and inspect oil cooler. See REMOVE, CLEAN, AND INSPECT ENGINE OIL COOLER in Group 20 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Defective oil pump	Remove and inspect oil pump. See CLEAN AND INSPECT OIL PUMP AND DRIVE GEAR in Group 20 of 6105 and 6125 Diesel Engines Repair (CTM 100).]
	Incorrect oil	Drain crankcase and refill with correct oil.
	Oil pressure regulating valve failure	Remove and inspect oil pressure regulating valve. See Group REMOVE, INSPECT, AND INSTALL OIL PRESSURE REGULATING VALVE in Group 20 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Broken piston spray jet	Replace piston spray jet. See REMOVE AND INSTALL PISTON SPRAY JETS in Group 10 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Clogged oil pump screen or cracked pick-up tube	Remove oil pan and clean screen. Replace pick-up tube. See REMOVE AND INSTALL OIL PICKUP TUBE in Group 20 of 6105 and 6125 Diesel Engines Repair (CTM 100).

Continued on next page

RG,RG34710,1542 –19–30SEP97–1/3

Symptom	Problem	Solution
	Excessive main or connecting rod bearing clearance	Determine bearing clearance. See Determine bearing clearance. See CYLINDER BLOCK, LINERS, PISTONS, AND RODS SPECIFICATIONS in Group 10 or CRANKSHAFT , MAIN BEARINGS, AND FLYWHEEL SPECIFICATIONSin Group 15 of 6105 and 6125 Diesel Engines Repair (CTM 100).
L3 - Engine Oil Pressure High	Improper oil classification	Drain crankcase and refill with correct oil.
	Oil pressure regulating valve bushing loose (wanders)	Remove and inspect oil pressure regulating valve. See REMOVE, INSPECT, AND INSTALL OIL PRESSURE REGULATING VALVE in Group 20 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Improperly operating regulating valve	Remove and inspect oil pressure regulating valve. See REMOVE, INSPECT, AND INSTALL OIL PRESSURE REGULATING VALVE in Group 20 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Plugged piston spray jet	Replace piston spray jet. See REMOVE AND INSTALL PISTON SPRAY JETS in Groups 10 of 6105 and 6125 Diesel Engines Repair (CTM 100).

Continued on next page

RG,RG34710,1542 –19–30SEP97–2/3

Symptom	Problem	Solution
	Stuck or damaged filter bypass valve	Remove and inspect filter bypass valve. See REMOVE, INSPECT, AND INSTALL OIL COOLER AND OIL FILTER BYPASS VALVES in Group 20 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Stuck or damaged oil cooler bypass valve	Remove and inspect oil cooler bypass valve. See REMOVE, INSPECT, AND INSTALL OIL COOLER AND OIL FILTER BYPASS VALVES in Group 20 of 6105 and 6125 Diesel Engines Repair (CTM 100).

RG,RG34710,1542 –19–30SEP97–3/3

(C) Diagnosing Cooling System Malfunctions:

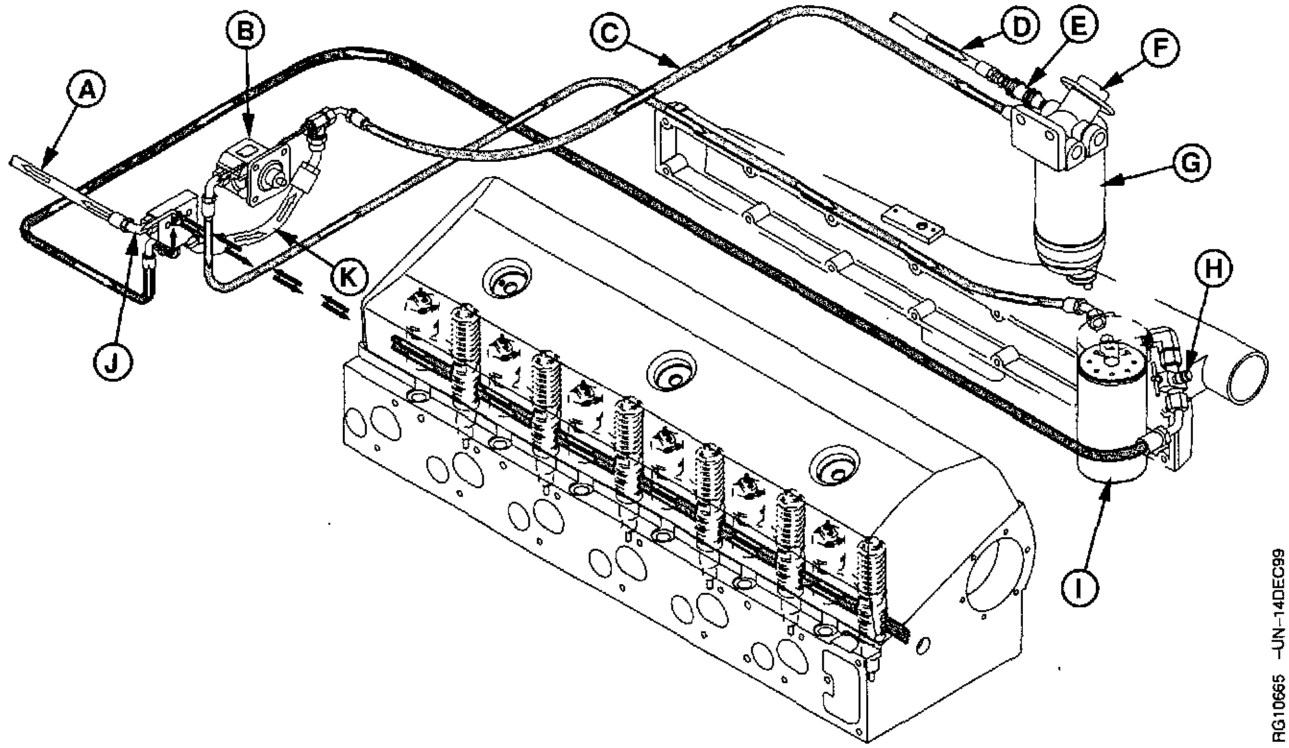
Symptom	Problem	Solution
C1 - Engine Coolant Temperature Above Normal	Lack of coolant in cooling system	Fill cooling system to proper level.
	Radiator core and/or side screens dirty	Clean radiator as required.
	Engine overloaded	Reduce engine load.
	Too low crankcase oil level	Fill crankcase to proper oil level.
	Loose or defective fan belt	Replace/tighten fan belt as required.
	Defective thermostat(s)	Test thermostat opening temperature; replace thermostats as required. See REMOVE THERMOSTATS in Group 25 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Damaged cylinder head gasket	Replace cylinder head gasket. See CHECK FOR HEAD GASKET FAILURES later in this Group.
	Defective water pump	Replace water pump. See REMOVE WATER PUMP in Group 25 of 6105 and 6125 Diesel Engines Repair (CTM 100).]
	Defective radiator cap	Replace radiator cap as required.
C2 - Engine Coolant Temperature Below Normal	Defective thermostat(s)	Test thermostats; replace thermostats as required. See REMOVE THERMOSTATS in Group 25 of 6105 and 6125 Diesel Engines Repair (CTM 100).
C3 - Coolant in Oil or Oil in Coolant	Faulty cylinder head gasket	Look for signs of head gasket failure. See CHECK FOR HEAD GASKET FAILURES later in this Group.

Continued on next page RG,RG34710,1543 –19–30SEP97–1/2

Symptom	Problem	Solution
	Faulty oil cooler	Remove and inspect engine oil cooler. See REMOVE, CLEAN, AND INSPECT ENGINE OIL COOLER in Group 20 of 6105 & 6125 Diesel Engines Repair Manual (CTM 100).
	Leaking cylinder liner seals	Remove and inspect cylinder liners. See VISUALLY INSPECT CYLINDER LINERS in Group 10 of 6105 & 6125 Diesel Engines Repair Manual (CTM 100).
	Cracked cylinder head or block	Locate crack, repair/replace components as required.

RG,RG34710,1543 –19–30SEP97–2/2

F1 - Dual Rail Fuel Supply System Check



A—Return to Tank Fuel Line
B—Fuel Transfer Pump
C—Fuel Line between Primary Fuel Filter and Fuel Transfer Pump
D—Fuel Line before Primary Fuel Filter
E—Check Valve on Primary Filter Inlet
F—Hand Primer
G—Primary Fuel Filter
H—Fuel Pressure Quick Connect Port
I—Final Filter
J—Check Valve on Return to Tank Fuel Line
K—Recirculated Fuel Line

DPSG,RG40854,475 –19–01DEC99–1/1

F1 - Dual Rail Fuel Supply System Check - Continued

- If fuel system has been recently opened (filter changed, line removed etc.) perform fuel system bleed procedure. See BLEED DUEL RAIL FUEL SYSTEM later in this Group and retest.
- Fit Clear Line from JT03513 Fuel Supply System Test Kit after the check valve on the return-to-tank fuel line (A).
- Start engine. This may require several sequences of priming and cranking, priming while cranking, and ether. After engine starts, let run for 10 minutes, then watch clear line for air/bubbles.
- If engine won't start, pump hand primer until moderate resistance is felt. Crank the engine. When the clear line loop fills with fuel, watch for bubbles.
- Air bubbles can be defined as:
  - Normal = bubbles visible on close examination
  - Air infiltration = clusters of bubbles easily visible
  - Foam = fuel discoloration (pink = slight) (white = extreme)

Normal

Continued on next page

Air Infiltration or foam detected

- Check the weep hole on the side of the transfer pump (B). If weep hole is wet or damp with fuel, replace the pump and restart at the beginning of this flow diagram.
- If weep hole is dry, reposition Clear Line between the primary filter outlet and the transfer pump inlet (C).
- Reconnect the return-to-tank fuel line (A).
- Perform bleed procedure. See BLEED DUAL RAIL FUEL SYSTEM later in this Group.
- Crank/start engine.
- If engine will start, let run for 10 minutes then watch clear line for bubbles.
- If engine won't start, watch clear line for bubbles while cranking.

Air Infiltration

- Ensure that bubbles observed aren't a result of the fuel system being opened and that the fuel system is completely bled.
- Using JT03421 and JT02177 fittings, reposition the clear line to the inlet of the primary filter (D).
- Pump hand primer (F) on primary filter until moderate resistance is felt.
- Watch the clear line for several minutes to determine if fuel is draining back to the tank.

Fuel not draining back to tank

Continued on next page

Fuel draining back to tank

Continued on next page

Normal

- Test check valve (J) on the return-to-tank fuel line for leakage
- Ensure that bubbles observed aren't a result of the fuel system being opened and that the fuel system is completely bled.

RG10521 –19–02DEC99

DPSG,RG40854,339 –19–06OCT99–1/1

F1 - Duel Rail Fuel Supply System Check - Continued

- Inspect o-ring face fuel line fitting o-rings for damage; ensure fittings are tightened to 24 Nm (18 lb-ft). DO NOT OVERTIGHTEN.
- Inspect primary filter base, hand primer bulb, primary filter-water separator seal, and fuel strainer canister (if equipped) for signs of leakage. Replace components as necessary.
- Bleed fuel system and retest.

- Replace primary filter inlet check valve (E) and restart at the beginning of this flow diagram.

IMPORTANT: Before disconnecting any fuel line, completely clean any debris from around the fitting. Do not allow debris to enter the fuel line.

- Connect a 0-1000 kPa (0-150 psi) pressure gauge to the fuel supply pressure quick connect port (H).
- Start engine and check fuel pressure at idle and at rated speed
- If engine won't start, check fuel pressure while cranking.

Fuel Pressure: 410-480 kPa (60-70 psi) @ idle, 620-690 kPa (90-100 psi) @ rated speed

- Check the weep hole on the side of the fuel transfer pump (B). If weep hole is wet with fuel, replace pump and retest
- Test the check valve (J) on the return-to-tank fuel line (D) for leakage if it has not been tested.
- If both of these items check OK, it appears that the fuel system is operating correctly.

Fuel Pressure: 410-480 kPa (60-70 psi) @ idle, Below 620-690 kPa (90 psi) @ rated speed

- Change primary (G) and final (I) fuel filters and retest. See Group 35 of CTM 100.

Fuel Pressure: Low pressure all conditions; below 100 kPa (15 psi) cranking

- Pinch-off the recirculation fuel line (K)
- Start/crank engine and check pressure

Continued on next page

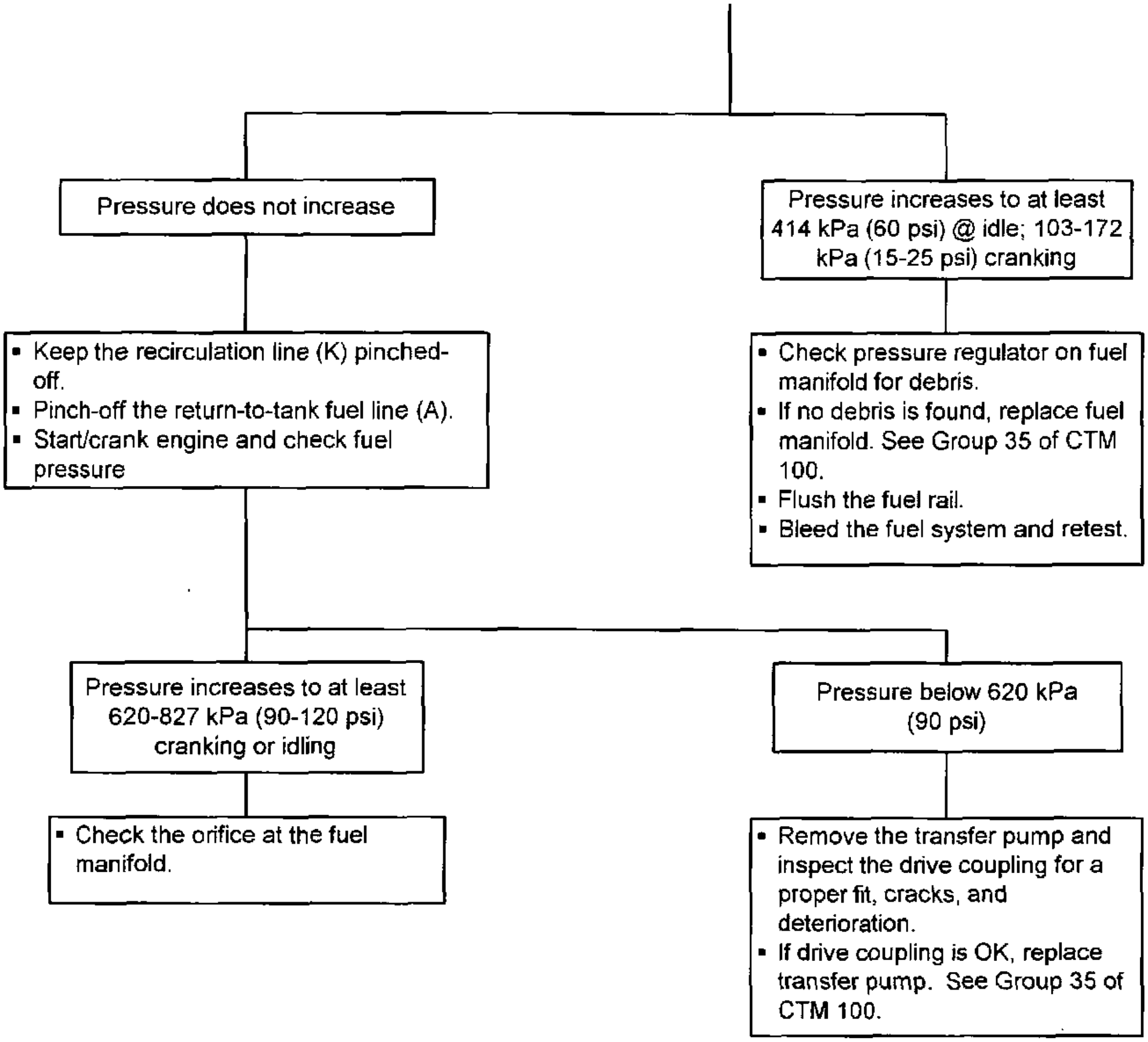
Engine won't start; 100-170 kPa (15-25 psi) cranking

- Return to diagnostic chart E1 - ENGINE CRANKS/WON'T START

RG10522 -19-10FEB00

DPSG,RG40854,340 -19-06OCT99-1/1

F1 - Duel Rail Fuel Supply System Check - Continued



RG10503 –19–02DEC99

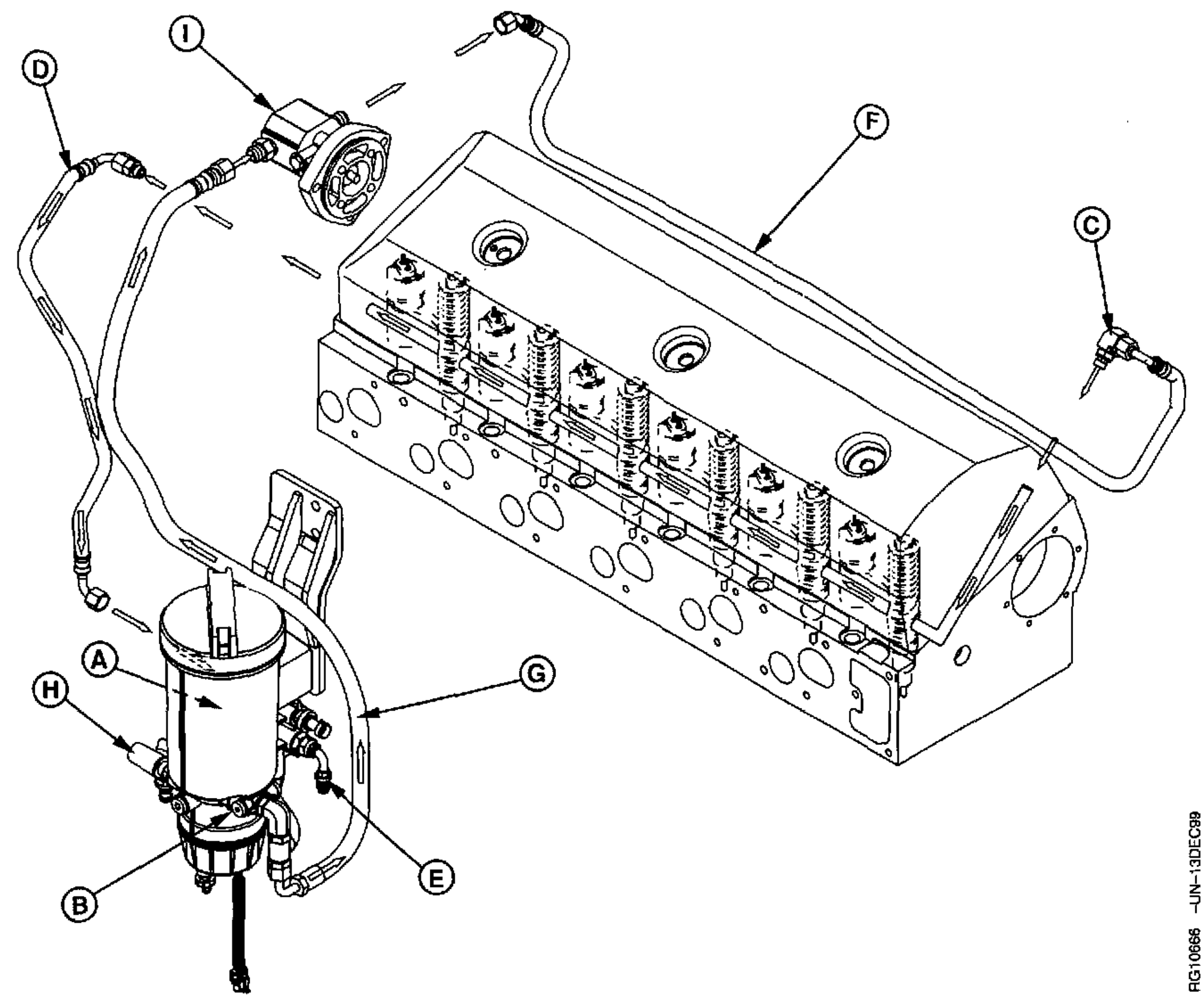
DPSG,RG40854,341 –19–06OCT99–1/1

(F) Diagnosing Low Pressure Dual Rail Fuel System Malfunctions - Continued

Symptom	Problem	Solution
F2 - Excessive Fuel Consumption on a Dual Rail Fuel System	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.
F3 - Fuel in Oil on a Dual Rail Fuel System	Cracked or worn Electronic Unit Injector (EUI) O-ring	Remove suspected EUI, replace EUI O-ring as required. See REMOVE AND INSTALL ELECTRONIC UNIT INJECTORS (DUAL RAIL FUEL SYSTEMS) in Group 35 of *6105 and 6125 Diesel Engines Repair (CTM 100)*.
	Cracked cylinder head	Locate crack, repair/replace components as required.

DPSG,OUOE003,2770 –19–12JAN99–1/1

F4 - Single Rail Fuel Supply System Check



A—Fuel Supply Pressure Quick Connect
B—Vacuum Port
C—Fuel Line Entering Cylinder Head
D—Fuel Line Returning to Fuel Filter Housing
E—Return to Tank Fuel Line from Fuel Filter Housing
F—Fuel Line between Transfer Pump and Cylinder Head
G—Fuel Line between Fuel Filter Housing and Transfer Pump
H—Hand Primer
I—Transfer Pump

DPSG,RG40854,474 –19–01DEC99–1/1

F4 - Single Rail Fuel Supply System Check - Continued

- Check for ruptured fuel lines.
- If fuel system has been recently opened (filter changed, line removed etc.), check affected o-rings on fittings and filter for air leaks.
- If no leaks found or if engine has been run out of fuel, perform fuel system bleed procedure. See BLEED SINGLE RAIL FUEL SYSTEM later in this Group and retest.
- Connect a 0-1000 kPa (0-150 psi) gauge to the fuel supply pressure quick connect port (A).
- Start engine and check fuel pressure at idle and at rated speed.
- If engine won't start, check fuel pressure while cranking.

- Fuel Pressure Specification:
  - Cranking: 135-175 kPa (20-25 psi)
  - Idle: 410-555 kPa (60-80 psi)
  - Rated speed: 480-620 kPa (70-90 psi)

Fuel pressure within specification for ALL conditions

Continued on next page

Fuel pressure below specification for ANY condition

- Install a 0-30" Hg gauge at the vacuum port (B).
- Perform bleed procedure if there is not a quick connect at the vacuum port. See BLEED SINGLE RAIL FUEL SYSTEM later in this Group and retest.
- Start engine and and monitor vacuum at full load rated speed.

20" Hg or less

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

- Connect Pressure Test Fitting from JT03513 Fuel Supply System Test Kit and a 0-1000 kPa (0-150 psi) gauge to the fuel line returning to the fuel filter housing (D) on the fuel filter housing end so the gauge dead ends that line.
- Check fuel pressure at cranking. The specification is listed above.

Continued on next page

Greater than 20" Hg

- Plugged fuel filter
  OR
- Plugged pre-filter

RG10523 –19–08FEB00

F4 - Single Rail Fuel Supply System Check - Continued

Fuel pressure within specification

- Disconnect pressure gauge at end of fuel line returning to fuel filter housing (D) and reconnect that fuel line to the fuel filter housing.
- Perform bleed procedure. See BLEED SINGLE RAIL FUEL SYSTEM later in this Group and retest.
- Connect 0-1000 kPa (0-150 psi) pressure gauge to the fuel supply pressure quick connect port (A).
- Pinch off the return to tank fuel line (E).
- Check fuel pressure at cranking, idle, and rated speed (see specifications on previous page).

Fuel pressure within specification for ALL conditions

- Faulty low pressure regulating valve

Fuel pressure below specification for ANY condition

- Faulty high pressure regulating valve

OR

- Faulty head debris filter (100 micron internal filter).

Fuel pressure below specification

- Faulty transfer pump

- If a hard start symptom is being diagnosed, an attempt should be made to recreate conditions of when the hard starting was observed such as early morning starts.
- Fit clear line from JT03513 Fuel Supply System Test Kit after the low pressure regulating valve on the return-to-tank fuel line.
- Start/crank engine and watch for air/bubbles in return-to-tank fuel line (E).
- Air/bubbles can be defined as:
  - Normal = bubbles visible on close examination
  - Air infiltration = clusters of bubbles easily visible
  - Foam = fuel discoloration (pink = slight) (white = extreme)

Normal amount of bubbles detected

Continued on next page

Air infiltration or foam detected

Continued on next page

RG10524 -19-08FEB00

DPSG,RG40854,343 -19-06OCT99-1/1

F4 - Single Rail Fuel Supply System Check - Continued

IMPORTANT: Before disconnecting any fuel line, completely clean any debris from around the fitting. Do not allow debris to enter the fuel line.

- Fit a clear line from JT03513 Fuel Supply System Test Kit between transfer pump and fuel filter.
- Start/crank engine and watch for air/bubbles in fuel line between transfer pump and fuel filter (G).
- Air/bubbles:
  - Normal = bubbles visible on close examination
  - Air infiltration = clusters of bubbles easily visible
  - Foam = fuel discoloration (pink = slight) (white = extreme)

Normal amount of bubbles detected

- Check the weep hole on the side of the fuel transfer pump. If weep hole is wet, with fuel, replace pump and retest.
- Check that the hold down cap screw on all EUIs is tightened to spec. See Group 36 of 6105 and 6125 Diesel Engines Repair (CTM 100).
- If torques are correct, remove EUIs and inspect seats for combustion gas leaks. See Group 36 of 6105 and 6125 Diesel Engines Repair (CTM 100).

Air infiltration or foam detected

- Inspect fuel filter housing, hand primer, and fuel filter / water separator seal for signs of leakage. Replace components as required.

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

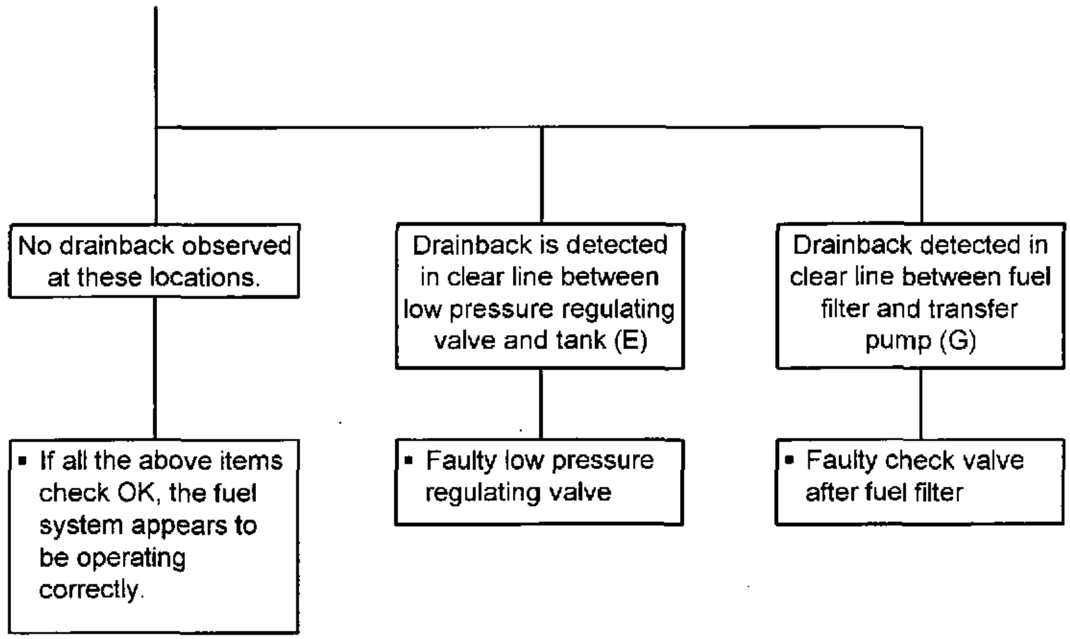
- Install a clear line between:
  - Fuel filter outlet and transfer pump (G)
- Peform bleed procedure. See BLEED SINGLE RAIL FUEL SYTEM later in this Group.
- Pump hand primer on fuel filter until the clear line is full.
- Watch the clear lines for several minutes to see if fuel is draining back through the clear lines between:
  - Fuel filter outlet and transfer pump
  - Low pressure regulating valve and fuel tank

Continued on next page

RG10502 -19-08FEB00

DPSG,RG40854,344 -19-06OCT99-1/1

F4 - Single Rail Fuel Supply System Check - Continued



RG10498 –19–15FEB00

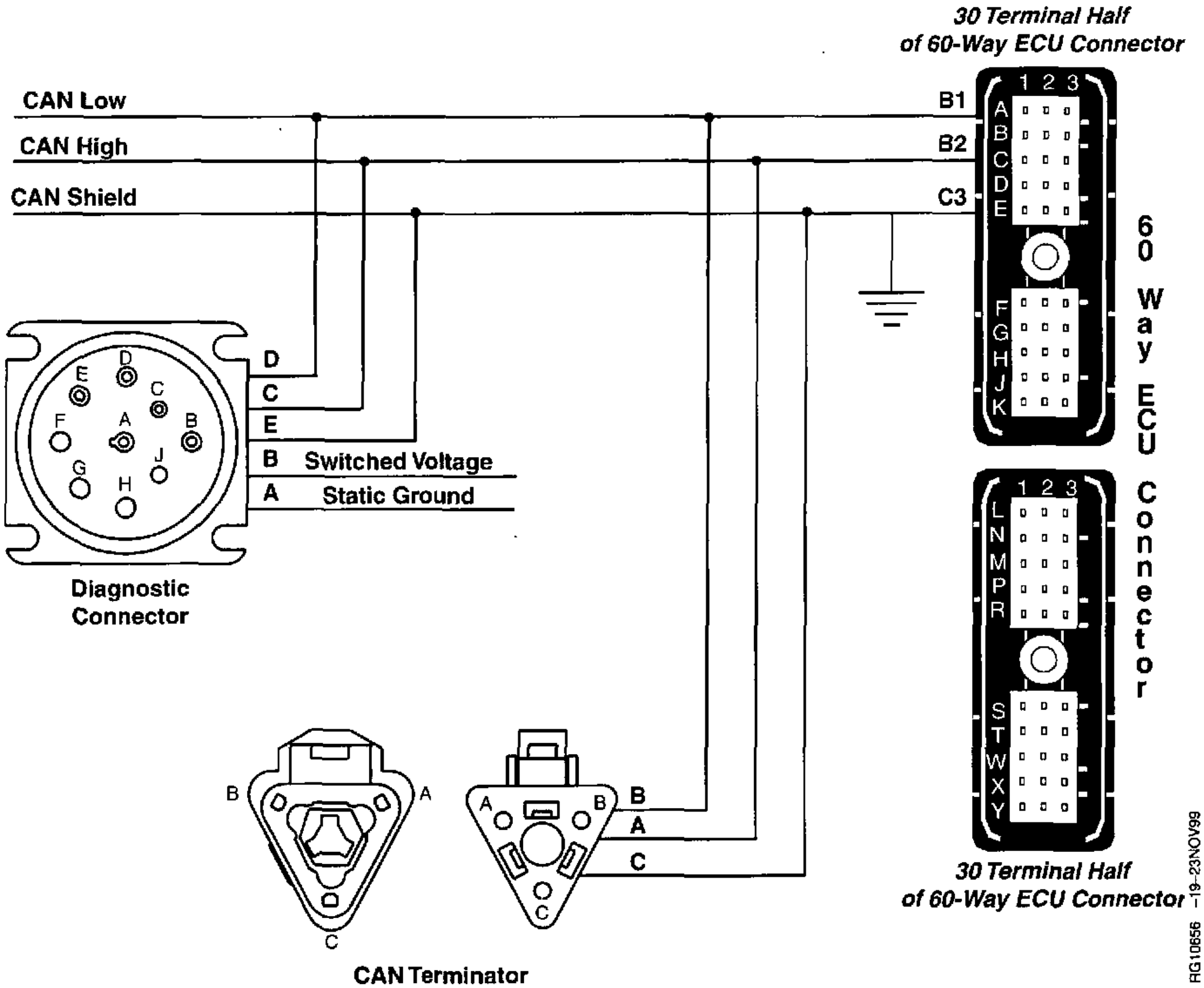
DPSG,RG40854,473 –19–01DEC99–1/1

(F) Diagnosing Low Pressure Single Rail Fuel System Malfunctions - Continued

Symptom	Problem	Solution
F5 - Excessive Fuel Consumption on Single Rail Fuel System	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.
F6 - Fuel in Oil on Single Rail Fuel System	Cracked or worn Electronic Unit Injector (EUI) O-ring	Remove suspected EUI, replace EUI O-ring as required. See REMOVE AND INSTALL ELECTRONIC UNIT INJECTORS (SINGLE RAIL FUEL SYSTEMS) in Group 36 of 6105 and 6125 Diesel Engines Repair (CTM 100).
	Cracked cylinder head	Locate crack, repair/replace components as required.

DPSG,OUOE003,2770 –19–12JAN99–1/1

D1 - ECU Does Not Communicate with DST



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

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

DPSG,RG40854,324 -19-06OCT99-1/1

D1 - ECU Does Not Communicate with DST - Continued

- Connect the DST
- Ignition ON
- Start the ECU Communication Software

DST doesn't communicate with ECU

- Ignition OFF
- Disconnect any of the following:
  - The fuel temperature sensor, MAT sensor or the ECT sensor
- Ignition ON
- Using a multimeter, measure the voltage between both terminals of the selected sensor harness connector

3.0 V or above

- Ignition ON
- Note the power light on the Parallel Data Module (PDM)

Power light ON

Continued on next page

Power light OFF

- Ignition OFF
- Disconnect the diagnostic cable from the diagnostic connector
- Probe terminal A in the diagnostic connector with a test light connected to battery voltage.

Continued on next page

Below 3.0 V

- Ignition OFF
- Disconnect 48-way ECU connector
- Ignition ON
- Using a multimeter, measure the voltage between a good ground and terminal G1 in the harness end of the 30 terminal half of the 48-way ECU connector

3.0 V or above

- Faulty ECU power fuse

OR

- Faulty ECU power wiring

OR

- Faulty ECU

Below 3.0 V

- Key-on signal wire open or shorted to ground

OR

- Faulty ignition switch
- Faulty key-on power fuse

DST communicates with ECU

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10504 -19-10FEB00

DPSG,RG40854,325 -19-06OCT99-1/1

D1 - ECU Does Not Communicate with DST - Continued

- Ignition OFF
- Disconnect 60-way ECU connector and diagnostic cable from the diagnostic connector
- Using a multimeter, measure resistance on the harness end of both connectors between:
  - Terminal D in the diagnostic connector and terminal B1 in the 60-way ECU connector
  - Terminal C in the diagnostic connector and terminal B2 in the 60-way ECU connector

Light ON

- Open or short to ground in diagnostic connector switched power wire

Light OFF

- Open in diagnostic connector ground wire

All measurements 5 Ω or less

- Ignition OFF
- 60-way ECU and diagnostic connector still disconnected
- Using a multimeter, measure resistance between terminals C and D in the harness end of the diagnostic connector

One or more measurements greater than 5 Ω

- Open in harness circuit

OR

- Connector terminals in wrong position

Between 45 - 75 Ω

- Ignition OFF
- Reconnect ECU 60-way connector
- Ignition ON
- Using a multimeter, measure voltage between a good chassis ground and:
  - Terminal C in the diagnostic connector
  - Terminal D in the diagnostic connector

Less than 45 or greater than 75 Ω

- Faulty or missing CAN terminator connector(s)
- Open or short in CAN wiring harness

Continued on next page

RG10505 –19–17NOV99

DPSG,RG40854,326 –19–06OCT99–1/1

D1 - ECU Does Not Communicate with DST - Continued

Both measurements between 1.5 - 3.5 V

- Faulty ECU/Cab Harness connection
  OR
- Faulty diagnostic cable
  OR
- Faulty diagnostic connector
  OR
- Faulty Parallel Port Data Module (PDM)
  OR
- Faulty diagnostic software/computer configuration
  OR
- Faulty ECU

Either measurement less than 1.5 V or greater than 2.5 V

- CAN wiring shorted to ground or voltage
  OR
- Faulty ECU

RG10506 –19–17NOV99

DPSG,RG40854,455 –19–12OCT99–1/1

Check Engine Oil Pressure

1. Remove pipe plug from main oil galley using JDG782 Oil Galley Plug Tool.

2. Attach pressure gauge to oil galley.

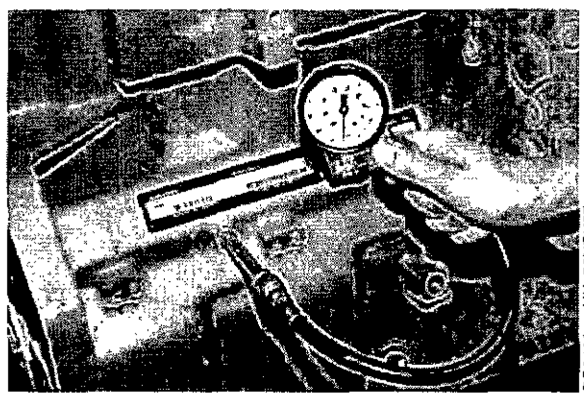
IMPORTANT: To achieve an accurate oil pressure reading, warm engine oil to 105°C (220°F).

3. Start engine, run at speeds given below, measure oil pressure, and compare readings.

Specification

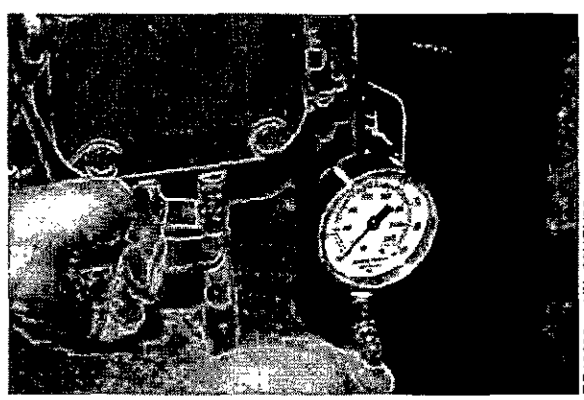
Oil Pressure Minimum No Load (Idle)	100 kPa (1.0 bar) (15 psi)
Maximum Full Load (Rated Speed)	450 kPa (4.5 bar) (65 psi)

NOTE: The oil pressure regulating valve is designed so that adjustment of oil pressure should not be required.



RG8531 –UN–26NOV97

Oil Pressure Gauge at Main Oil Galley

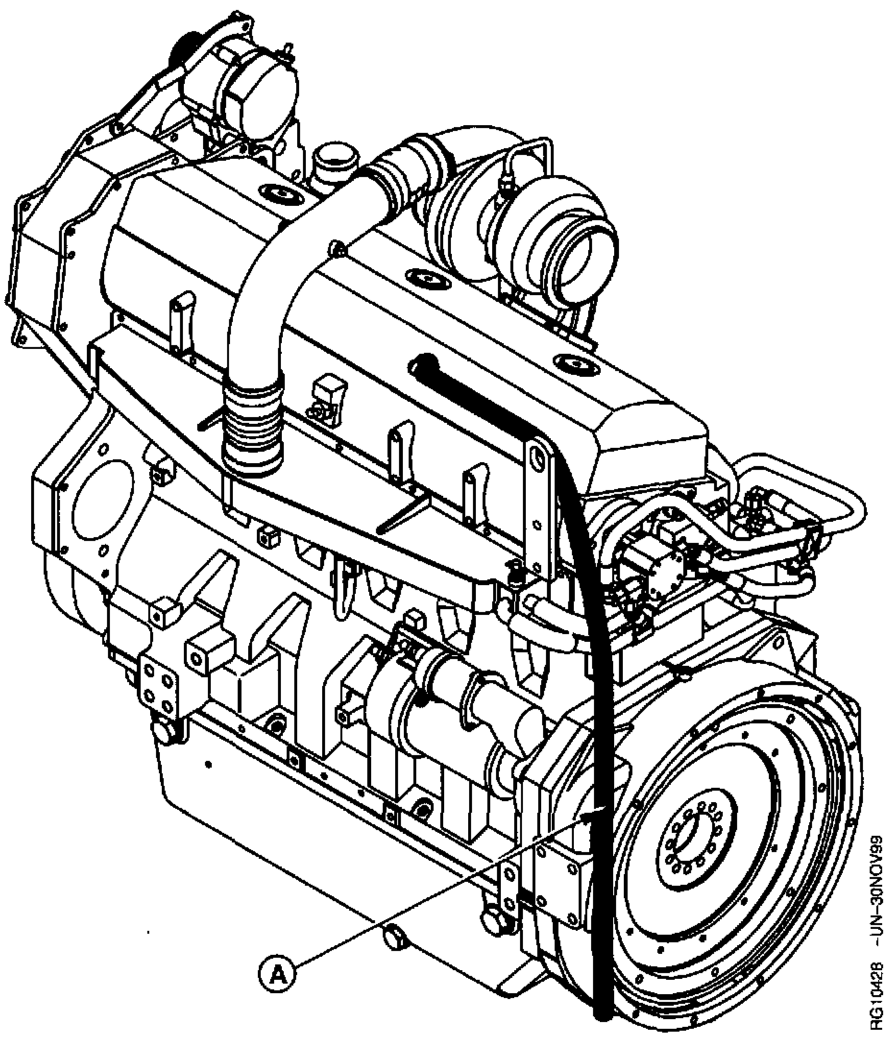


RG10633 –UN–30NOV99

Oil Pressure Gauge at Quick Disconnect on Oil Cooler

RG,RG34710,1547 –19–30SEP97–1/1

Check for Excessive Engine Crankcase Pressure (Blow-By)



Breather Tube

A—Breather Tube

Excessive blow-by coming out of the crankcase breather tube (A) indicates that either the turbocharger seals are faulty or the piston rings and cylinder liners are not adequately sealing off the combustion chamber. This is a comparative check that requires some experience to determine when blow-by is excessive.

Run engine at high idle and check crankcase breather tube. Look for significant fumes and/or dripping oil coming out of the breather tube at fast idle, with no load.

If excessive blow-by is observed, perform the following to determine if the turbocharger is causing the blow-by:

1. Remove the turbocharger oil drain line where it connects to the engine block and run the line into a bucket.

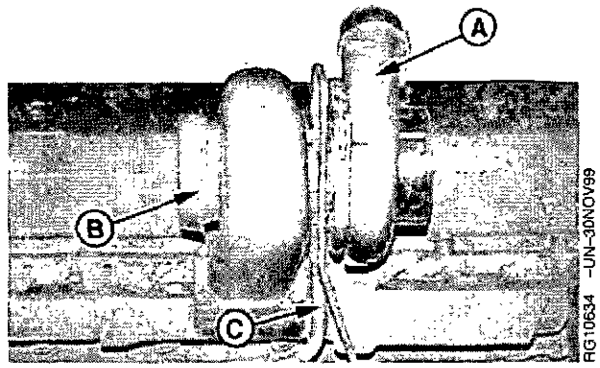
2. Run engine at high idle, slightly loaded and determine if boost pressure is forcing oil through the drain line, and check crankcase breather tube to determine if blow-by has decreased.

Continued on next page

3. If it appears that boost pressure is forcing oil through the drain line, and/or blow-by decreases with the drain line disconnected from the block, replace the turbocharger and retest.

DPSG,RG40854,282 –19–10AUG99–2/2

Check for Turbocharger Oil Seal Leak



Turbocharger Oil Seal Leak

A—Intake Hose
B—Exhaust Pipe
C—Oil Return Line

Seals are used on both sides of the turbocharger rotor assembly. The seals are used to prevent exhaust gases and air from entering the turbocharger housing. Oil leakage past the seals is uncommon but can occur.

A restricted or damaged turbocharger oil return line can cause the housing to pressurize causing oil to leak by the seals. Additionally, intake or exhaust restrictions can cause a vacuum between the compressor and turbocharger housing causing oil to leak by the seals.

1. Remove intake tube (A) and exhaust pipe (B).

NOTE: The intake tube from the air cleaner (not included in picture) would not have to be removed for this test.

2. Inspect the intake tube and turbocharger turbine casing for evidence of oil leakage.

   If oil leakage is present, perform the following:

   - Inspect turbocharger oil return line (C) for kinks or damage. Replace if necessary.
   - Check the air intake filter, hoses, and crossover tube for restrictions.
   - Check the exhaust system for restrictions to include position of exhaust outlet.

3. Perform necessary repairs and retest.

DPSG,RG40854,283 –19–10AUG99–1/1

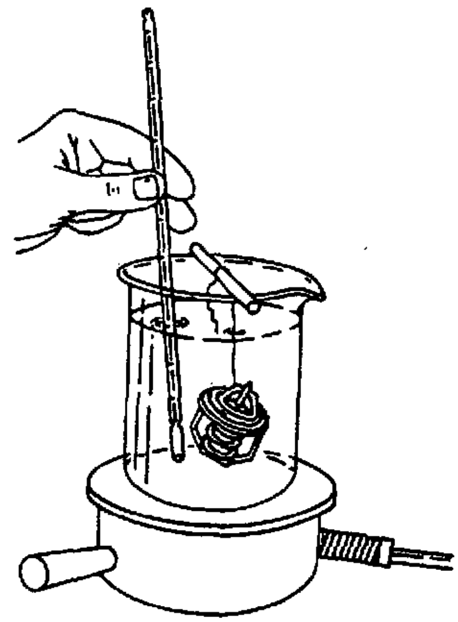
Inspect Thermostat and Test Opening Temperature

Visually inspect thermostat for corrosion or damage. Replace as necessary.

Test thermostat as follows:

CAUTION: DO NOT allow thermostat or thermometer to rest against the side or bottom of container when heating water. Either may rupture if overheated.

1. Remove thermostats. See REMOVE THERMOSTATS in Group 25 of 6105 and 6125 Diesel Engines Repair (CTM 100).
2. Suspend thermostat and a thermometer in a container of water.
3. Stir the water as it heats. Observe opening action of *thermometer and compare temperatures with* specification given in chart below.



RG5971 –UN–23NOV97

Testing Thermostat Opening Temperature

NOTE: Due to varying tolerances of different suppliers, initial opening and full open temperatures may vary slightly from specified temperatures.

THERMOSTAT TEST SPECIFICATIONS

Rating	Initial Opening (Range)	Full Open (Nominal)
71°C (160°F)	69–72°C (156–162°F)	84°C (182°F)
77°C (170°F)	74–78°C (166–172°F)	89°C (192°F)
82°C (180°F)	80–84°C (175–182°F)	94°C (202°F)
89°C (192°F)	86–90°C (187–194°F)	101°C (214°F)
90°C (195°F)	89–93°C (192–199°F)	103°C (218°F)
92°C (197°F)	89–93°C (193–200°F)	105°C (221°F)
96°C (205°F)	94–97°C (201–207°F)	100°C (213°F)
99°C (210°F)	96–100°C (205–212°F)	111°C (232°F)

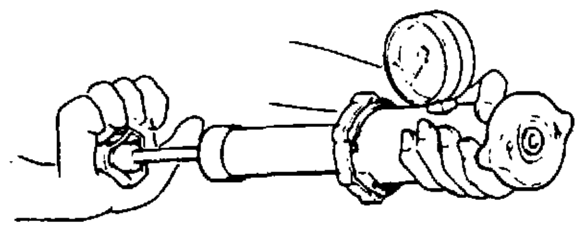
4. Remove thermostat and observe its closing action as it cools. In ambient air the thermostat should close completely. Closing action should be smooth and slow.
5. If any thermostat is defective on a multiple thermostat engine, replace all thermostats.

RG,RG34710,1548 –19–30SEP97–1/1

Pressure Test Cooling System and Radiator Cap

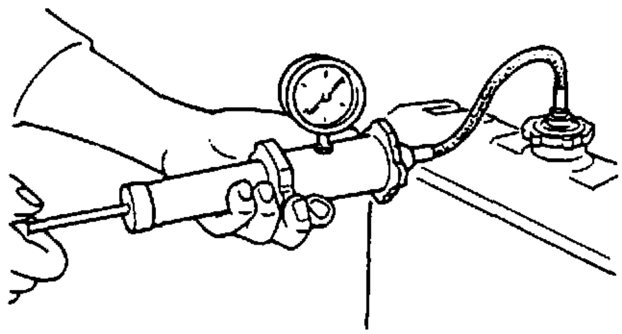
CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

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.



RG6557 –UN–20JAN93

Pressure Testing Radiator Cap



RG6558 –UN–20JAN93

Pressure Testing Cooling System

Test Radiator Cap:

1. Remove radiator cap and attach to D05104ST Tester as shown.
2. Verify with the applications specification manual that the correct cap is being used.
3. Pressurize cap to cap's specified pressure[1] . Gauge should hold pressure for 10 seconds within normal range if cap is acceptable.
4. Remove the cap from gauge, turn it 180°, and retest cap. This will verify that the first measurement was accurate.

Test Cooling System:

NOTE: Engine should be warmed up to test overall cooling system.

1. Allow engine to cool, then carefully remove radiator cap.
2. Fill radiator with coolant to the normal operating level.

[1] *If gauge does not hold pressure, replace radiator cap.*

Continued on next page DPSG,RG40854,284 –19–10AUG99–1/2

IMPORTANT: DO NOT apply excessive pressure to cooling system, doing so may damage radiator and hoses.

3. Connect gauge and adapter to radiator filler neck. Pressurize cooling system to specified pressure for application.[2].

4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

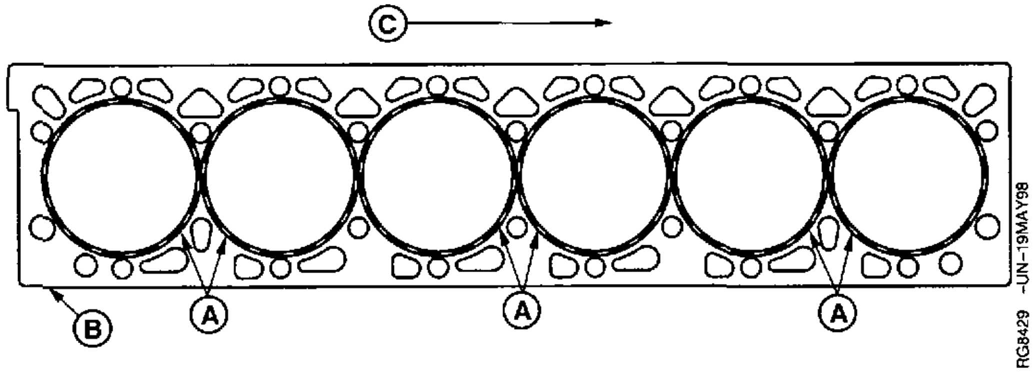
If leakage is detected, correct as necessary and pressure test system again.

If no leakage is detected, but the gauge indicated a drop in pressure, coolant may be leaking internally within the system or at the block-to head gasket. See CHECK FOR HEAD GASKET FAILURES later in this Group.

[2] *Test pressures recommended are for all Deere OEM cooling systems. On specific vehicle applications, test cooling system and pressure cap according to the recommended pressure for that vehicle.*

DPSG,RG40854,284 –19–10AUG99–2/2

Check for Head Gasket Failures



Head Gasket

A—Combustion Seals (Flanges) **B—Gasket Body** **C—Front of Engine**

Head gasket failures generally fall into three categories:

- Combustion seal failures
- Coolant seal failures
- Oil seal failures

Combustion seal failures occur when combustion gases escape between cylinder head and head gasket combustion flange, or between combustion flange and cylinder liner. Leaking combustion gases may vent to an adjacent cylinder, to a coolant or oil passage, or externally.

Coolant or oil seal failures occur when oil or coolant escapes between cylinder head and gasket body, or between cylinder block and gasket body. The oil or coolant may leak to an adjacent coolant or oil passage, or externally. Since oil and coolant passages are primarily on right hand (camshaft) side of the engine, fluid leaks are most likely to occur in that area.

Follow these diagnostic procedures when a head gasket joint failure occurs, or is suspected.

1. Start and warm up engine if it can be safely operated. Examine all potential leakage areas again as outlined previously. Using appropriate test and measurement equipment, check the following:
   - White smoke, excessive raw fuel, or moisture in exhaust system.
   - Rough, irregular exhaust sound, or misfiring.
   - Air bubbles, gas trapped in radiator/overflow tank.
   - Loss of coolant from overflow.
   - Excessive cooling system pressure.
   - Coolant overheating.
   - Low coolant flow.
   - Loss of cab heating (air lock)
2. Shut engine down. Recheck crankcase, radiator, and overflow tank for any significant differences in fluid levels, viscosity, or appearance.
3. Compare your observations from above steps with the diagnostic charts on the following pages. If diagnostic evaluations provide conclusive evidence of combustion gas, coolant, or oil leakage from head gasket joint, the cylinder head must be removed for inspection and repair of gasket joint components.

COMBUSTION SEAL LEAKAGE

Symptoms:

- Exhaust from head gasket crevice.
- Air bubbles in radiator/overflow tank.
- Coolant discharge from overflow tube.

Continued on next page

- Engine overheating.
- Power loss.
- Engine runs rough.
- White exhaust smoke.
- Loss of cab heat.
- Gasket section dislodged, missing (blown).
- Coolant in cylinder.
- Coolant in crankcase oil.
- Low coolant level.

Possible Causes:

- Insufficient liner standout.
- Excessive liner standout differential between cylinders.
- Low head bolt clamping loads.
- Rough/damaged liner flange surface.
- Cracked/deformed gasket combustion flange.
- Out-of-flat/damaged/rough cylinder head surface.
- Missing/mislocated gasket firing ring.
- Block cracked in liner support area.
- Excessive fuel delivery.
- Advanced injection pump timing.
- Hydraulic or mechanical disturbance or combustion seal.

NOTE: Cracked cylinder head or liners may also allow combustion gas leakage into coolant.

If above symptoms are found, see HEAD GASKET INSPECTION AND REPAIR SEQUENCE in Group 05 of 6105 and 6125 Diesel Engines Repair Manual (CTM100).

COOLANT SEAL LEAKAGE

Symptoms:

- Coolant discharge from head gasket crevice.
- Coolant in crankcase oil.
- Low coolant level.
- High oil level.
- Coolant discharge form crankcase vent.

Possible Causes:

- Excessive liner standout.
- Excessive liner standout differential between cylinders.
- Low head bolt clamping loads.
- Out-of-flat/damaged/rough block surface.
- Out-of-flat/damaged/rough cylinder head surface.
- Oil or coolant overheating.
- Cracks/creases in gasket body surfaces.
- Damage/voids in elastomer beading.

If above symptoms are found, see HEAD GASKET INSPECTION AND REPAIR SEQUENCE in Group 05 of 6105 and 6125 Diesel Engines Repair Manual (CTM100).

OIL SEAL LEAKAGE

Symptoms:

- Oil discharge from head gasket crevice.
- Oil in coolant.
- Low crankcase oil level.
- Reduced oil to rocker arms (noisy).

Possible Causes:

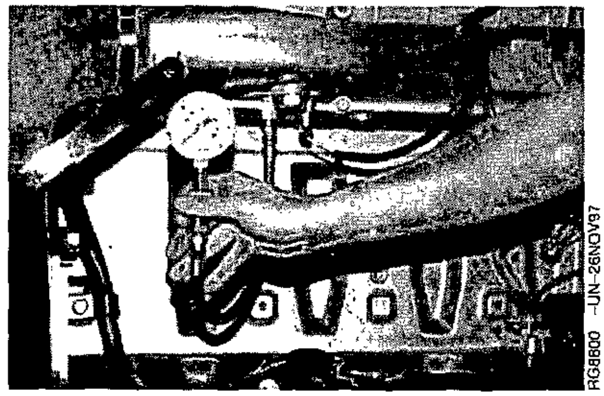
- Excessive liner standout
- Excessive liner standout differential between cylinders.
- Low head bolt clamping loads
- Out-of-flat/damaged/rough block surface.
- Out-of-flat/damaged/rough cylinder head surface.
- Oil or coolant overheating.
- Cracks/creases in gasket body surfaces.
- Damage/voids in elastomer beading.
- Damaged/missing O-ring seal at oil port to rocker arms.

If above symptoms are found, see HEAD GASKET INSPECTION AND REPAIR SEQUENCE in Group 05 of 6105 and 6125 Diesel Engines Repair Manual (CTM100).

NOTE: Defective oil cooler may also allow oil leakage into coolant.

DPSG,RG40854,281 –19–10AUG99–2/2

Check Intake Manifold Pressure (Turbo Boost)



Measuring Intake Manifold Pressure

The preferred method of measuring intake manifold pressure (turbo boost) is to use the Diagnostic Scan Tool (DST) and read the Manifold Air Pressure (MAP) parameter when engine is developing rated power at full load rated speed. If the DST is not available, use the procedure below to manually test intake manifold pressure.

1. Remove ether starting aid assembly adapter or plug from intake manifold cover, as equipped. Connect pressure gauge to intake manifold using JT05412 Universal Pressure Test Kit. Be sure all connections are tight.

2. Before checking boost pressure, warm up engine to allow the lubricating oil to reach operating temperature.

IMPORTANT: Engine speed and load should be stabilized before taking a gauge reading. Be sure that gauge works properly and familiarize yourself with the use of the gauge.

3. Observe pressure reading on gauge. Compare reading to the specification below when engine is developing rated power at full load rated speed.

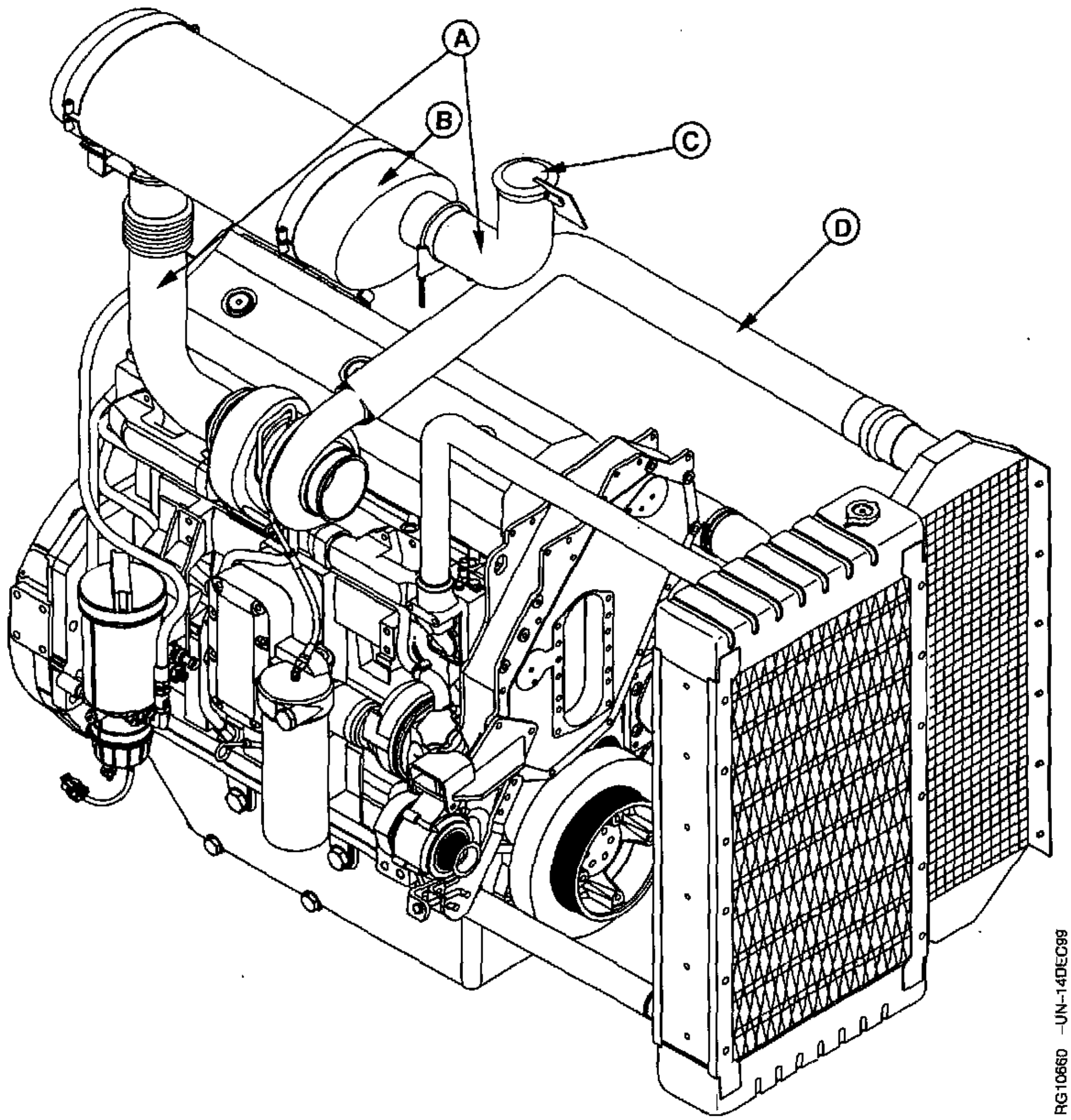
   If boost pressure is too low, check for the following:

   - Restricted air filter elements.
   - Incorrect fast idle adjustment.
   - Exhaust manifold leaks.
   - Intake manifold leaks.
   - Low compression pressure.
   - Carbon build-up in turbocharger.
   - Turbocharger compressor or turbine wheel rubbing housing.
   - Restricted exhaust.

4. After completing test, remove test equipment and reinstall plug. Tighten securely. See INTAKE MANIFOLD PRESSURE (TURBOCHARGER BOOST) SPECIFICATIONS in Group 198 of this manual.

RG,RG34710,1549 -19-30SEP97-1/1

Check for Intake and Exhaust Restrictions



Check for Intake and Exhaust Restrictions

A—Exhaust piping **B—Muffler** **C—Rain Cap** **D—Intake Piping**

Low power, low boost pressure, and excessive black exhaust smoke can be caused by an intake air or exhaust restriction.

1. Inspect exhaust piping (A), the muffler (B), and the rain cap (C) for damage or any possible restrictions.
2. Inspect the intake piping (D), elbows, and any connections. Look for collapsed pipes, dented pipes and loose connections. Replace components as needed.

DPSG,RG40854,285 –19–10AUG99–1/1

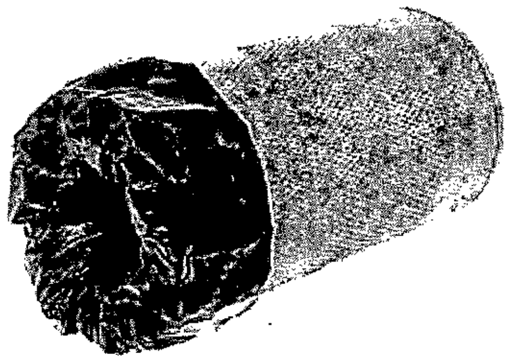
Test for Intake Air Leaks

Loose connections or cracks in the suction side of the air intake pipe can allow debris to be ingested into the engine causing rapid wear in the cylinders. Additionally, on turbocharged engines, compressor damage may occur and cause an imbalance resulting in bearing failure. Air leaking form loose connections or cracks on the pressure side of the turbocharger can cause excessive smoke and low power.

NOTE: The following test procedure requires that the air intake be sealed off to pressurize the system. Using a plastic bag to seal the intake air filter is used as an example.

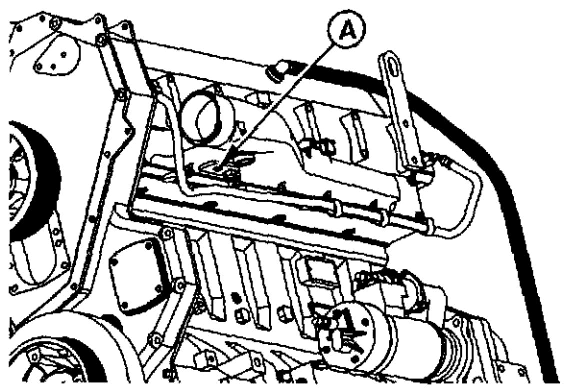
CAUTION: Do not start engine during this test procedure. Plastic bag (or whatever material/object is used to seal intake) can be sucked into the engine.

1. Remove air cleaner cover and main filter element.
2. Put a plastic bag over secondary filter element and install main element cover.
3. Remove plug from manifold and using a suitable adapter, connect a regulated air source.
4. Pressurize air intake system to 13.8-20.8 kPa (0.13-0.21 bar) (2-3 psi).
5. Spray soap and water solution over all connections from the air cleaner to the turbocharger or air inlet to check for leaks. Repair all leaks.
6. Remove plastic bag from filter element and reinstall element and cover.



T5906AP -UN-23FEB89

Air Filter



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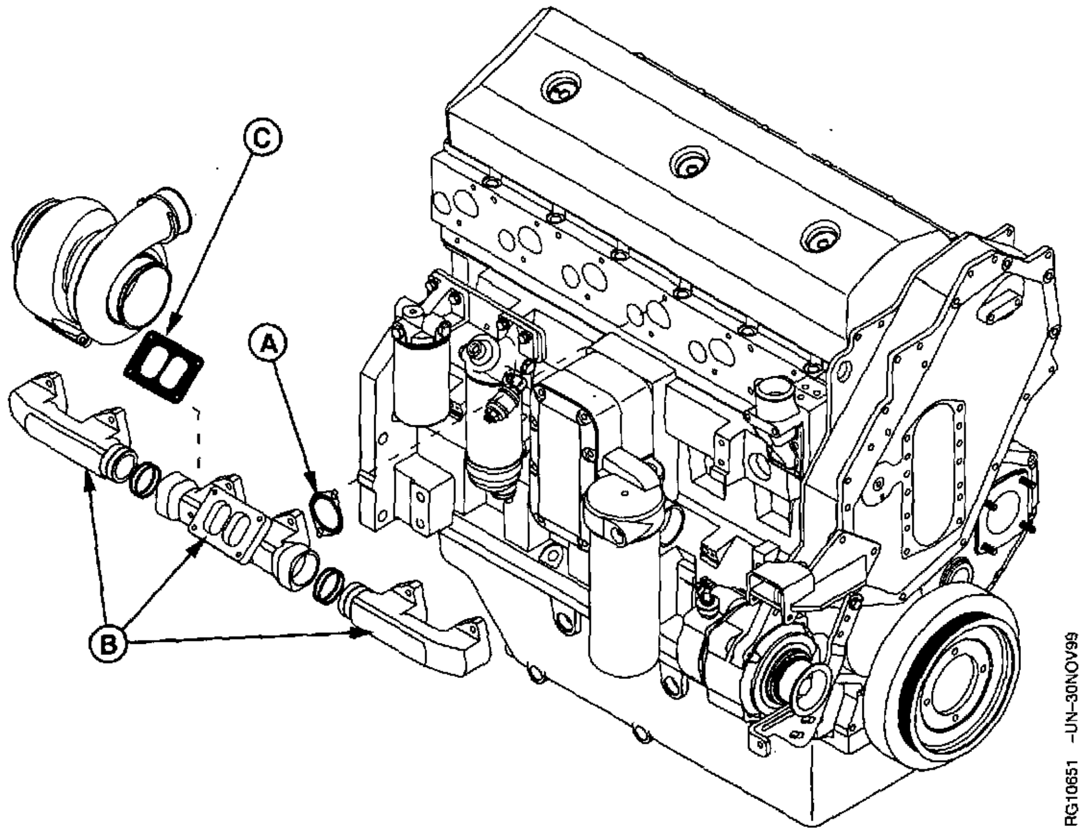
Intake Plug

A—Intake Plug

DPSG,RG40854,286 -19-10AUG99-1/1

Check for Exhaust Air Leaks



Check for Exhaust Leaks

A—Exhaust Manifold Gasket **B—Exhaust Manifold Gasket** **C—Turbocharger Gasket**

Exhaust leaks, upstream of the turbocharger will cause the turbocharger turbine to rotate at reduced speed resulting in low boost pressure, low power, and excessive black smoke.

Inspect the exhaust manifold gasket, the exhaust manifold, and turbocharger gasket for damage and any signs of leakage. Replace components as needed.

DPSG,RG40854,287 -19-10AUG99-1/1

Check Dual Rail Fuel Supply Pressure

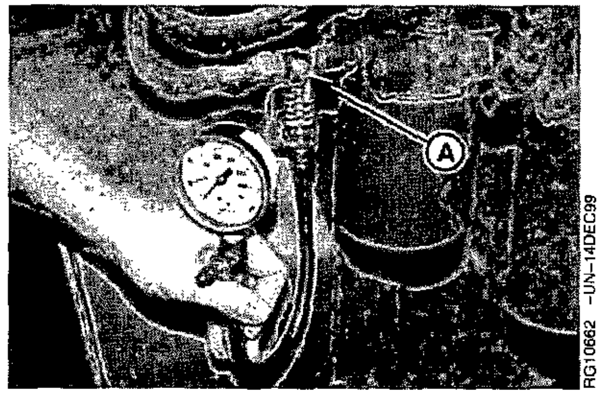
1. Connect a 0-1000 kPa (0-150 psi) gauge to the Diagnostic Quick-connect on the air purge valve after removing the dust cap and cleaning the quick-disconnect.

2. Open bleed valve

3. Start/crank engine. Fuel transfer pump should maintain minimum pressure shown in specification.

Specification

Fuel Transfer Pump Pressure Cranking (Minimum 200 RPM)	70–170 kPa (0.7–1.7 bar) (15–25 psi)
Normal (Idle)	410–480 kPa (4.1–4.8 bar) (60–70 psi)
Rated Speed	620–690 kPa (6.2–6.9 bar) (90–100 psi)



Checking Fuel Supply Pressure

A—Fuel Supply Pressure Quick Connect Port

DPSG,RG40854,355 –19–07OCT99–1/1

Bleed Dual Rail Fuel System

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

1. Drain water and contaminants from clear water separator sediment bowl (C) by opening drain valve (A), then operate hand primer (B) until bowl is clear of water and debris.

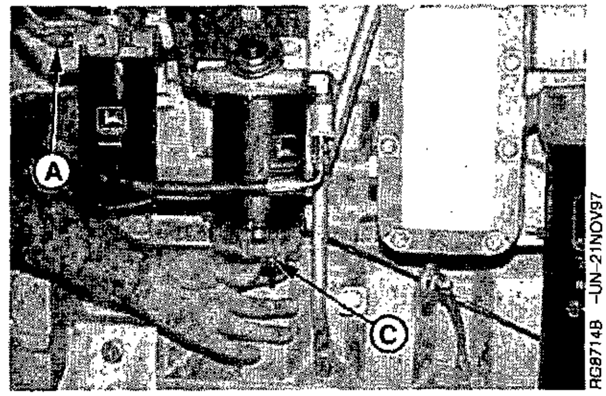
2. Loosen secondary (final) fuel filter outlet line (a) or remove cap and open air purge valve (D), (if equipped).

3. Pump hand primer (B) on primary filter until a steady flow of fuel (without bubbles) comes out of connection.

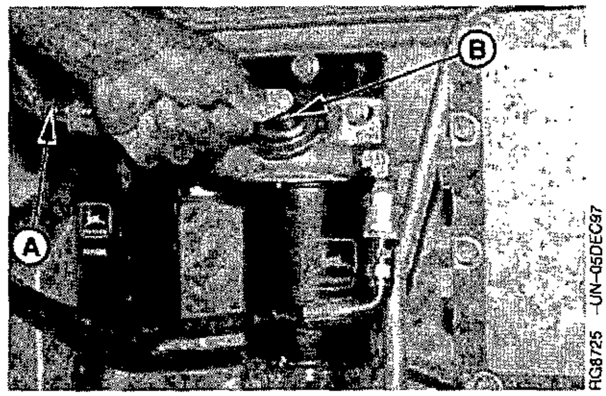
4. Continue pumping hand primer and simultaneously tighten outlet line connection to 24 N•m (18 lb-ft). DO NOT overtighten.

5. Start engine and run at high idle for 3–5 minutes.

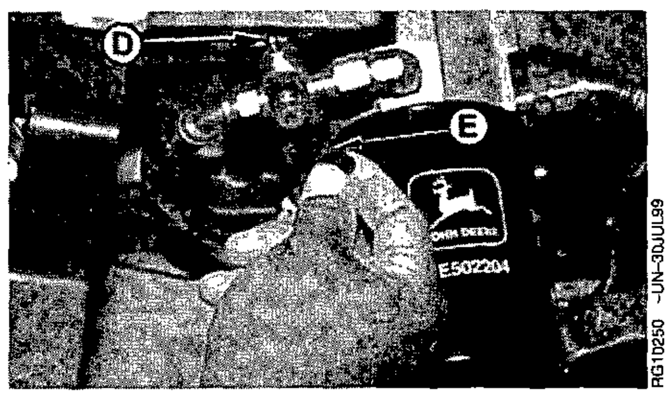
NOTE: If both filters were replaced, hand priming will purge air form the secondary filter followed by clean fuel, followed by air from the primary filter. Failure to bleed air from both filters will cause the engine to die due to air trapped in the system



Draining Water Separator



Bleeding Fuel System



Air Purge Valve

RG,RG34710,1551 -19-30SEP97-1/1

Check Single Rail Fuel Supply Pressure

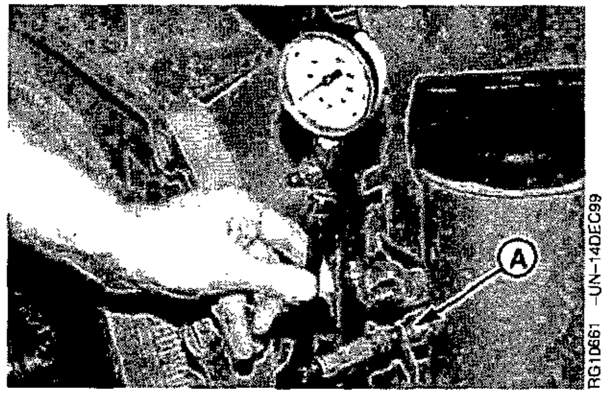
1. Connect a 0-1000 kPa (0-150 psi) gauge to the Diagnostic Quick-connect on the air purge valve after removing the dust cap and cleaning the quick-disconnect.

2. Open bleed valve

3. Start/crank engine. Fuel transfer pump should maintain minimum pressure shown in specification.

Specification

Fuel Transfer Pump Pressure	135–175 kPa (1.35–1.75 bar)
Cranking (Minimum 200 RPM)	(20–25 psi)
Normal (Idle)	410–555 kPa (4.1–5.5 bar) (60–80 psi)
Rated Speed	480–620 kPa (4.8–6.2 bar) (70–90 psi)

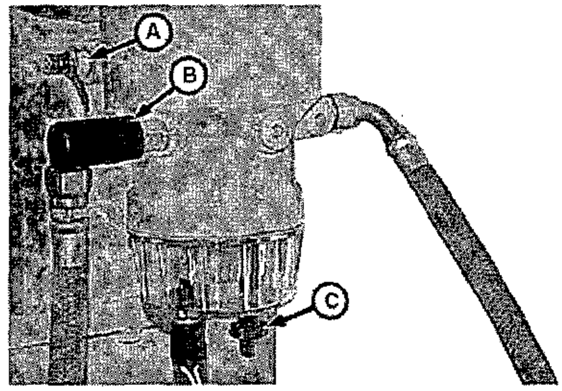


Checking Fuel Supply Pressure

A—Fuel Supply Pressure Quick Connect Port

DPSG,RG40854,355 –19–07OCT99–1/1

Bleed Single Rail Fuel System



RG10309 –UN–02SEP99

Bleeding Fuel System

A—Diagnostic Port
B—Hand Primer
C—Water Drain Valve

NOTE: Under normal conditions, fuel system bleeding is not required. Priming system with hand primer (B) is normally sufficient. If necessary to bleed the system, use the following procedure.

1. Drain water and contaminates from clear water separator sediment bowl by opening drain valve (C) and operating primer (B) until bowl is clear of water.
2. Attach an open line to diagnostic port (A) and place end of line in suitable container for diesel fuel.
3. Pump hand primer (B) until a steady flow of fuel (without bubbles) comes out of line.

NOTE: It can take up to 200 strokes until fuel comes out steadily.

4. Disconnect line from diagnostic port (A).
5. Pump hand primer (B).

NOTE: If engine has been run out of fuel, 200 strokes will be necessary.

6. Start engine and run for five minutes.

NOTE: If engine does not start after 20 seconds of cranking, pump hand primer an additional 100 strokes, and attempt to start engine again.

DPSG,RG40854,356 –19–07OCT99–1/1

Check Camshaft-to-Crankshaft Timing

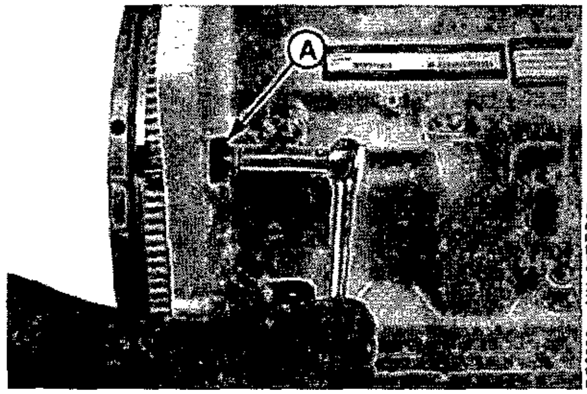
- **Check Camshaft-to-Crankshaft Timing:**

1. Remove rocker arm cover.
2. Remove plug from cylinder block and install JDG820 Flywheel Turning Tool (A).

IMPORTANT: JDG971 Timing Pin MUST BE installed into camshaft timing slot (B) first before attempting to install second timing pin into crankshaft timing slot.

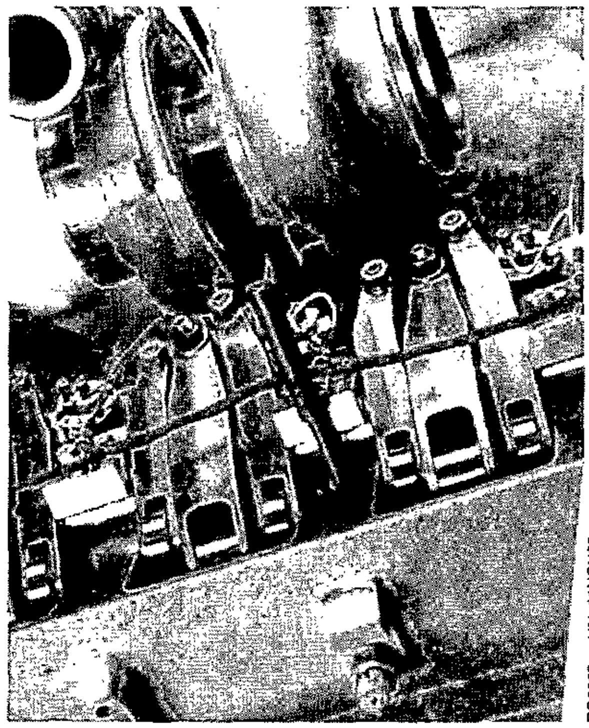
3. Rotate engine flywheel in running direction until JDG971 Timing Pin (B) engages timing slot in camshaft. This ensures that engine is locked at TDC of No. 1 cylinder's compression stroke. Intake and exhaust rocker arms on No. 1 cylinder should be loose.
4. Remove threaded plug from crankshaft timing hole below oil cooler and filter housing assembly.
5. Slightly move engine flywheel back and forth with turning tool until a second JDG971 timing Pin (C) can be installed in slot in crankshaft. This ensures that camshaft and crankshaft are in sync (properly timed).

If timing pin does not enter crankshaft timing slot, crankshaft MUST BE timed to camshaft. See CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in Group 16 of 6105 & 6125 Diesel Engines Repair Manual (CTM 100).



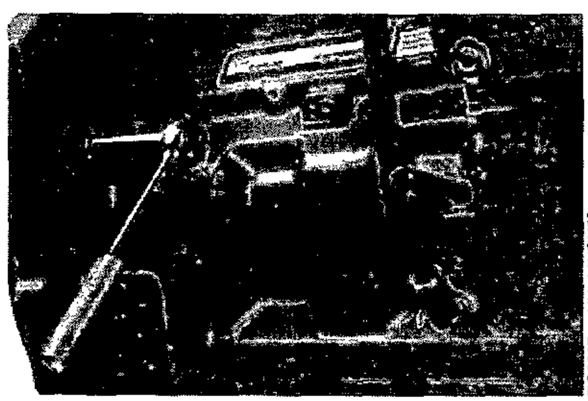
RG8226 -UN-05DEC97

Rotating Flywheel with JDG820



RG8228 -UN-11NOV98

JD971 Timing Pin in Camshaft



RG8227 -UN-11NOV98

Check Crankshaft Position Sensor Depth

NOTE: Crankshaft vibration damper and front seal shown removed

The ECU monitors the position of the crankshaft and camshaft to determine piston position and the optimum time to start and stop injecting fuel. This crank sensor sends the crank position to the ECU.

1. Disconnect crankshaft position sensor wiring connector.

2. Remove sensor (B) from timing gear cover.

3. Install JDG1334 Tool (C) in sensor bore in timing gear cover until the tool is hand tight within the timing gear cover.

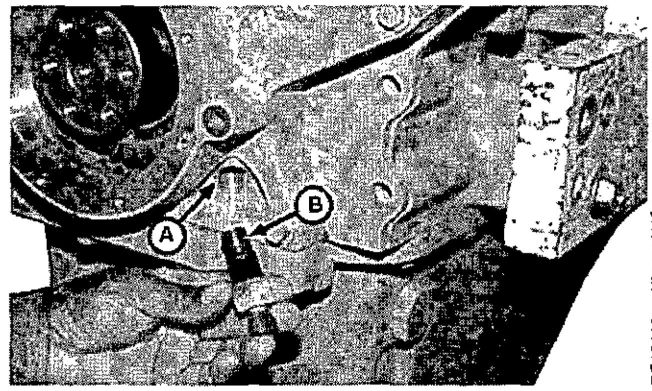
4. Push in on pin (C) until it contacts crankshaft timing wheel (H).

5. Check position of pin end in relation to end of tool as shown in (D, E, F)

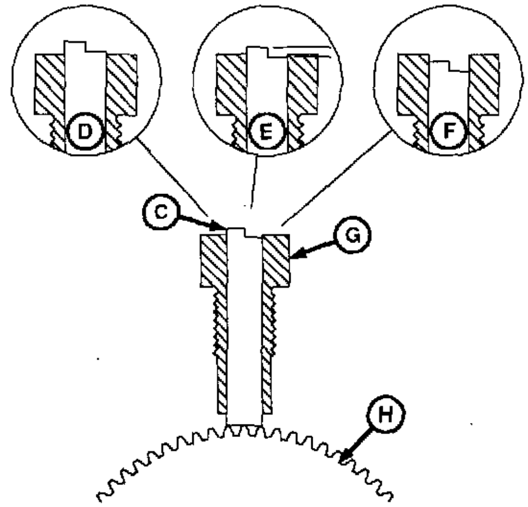
   - If pin's lower shoulder extends above end of tool (D), add one R60756 shim to sensor.
   - If pin's lower shoulder is within range of marks (E), no shim is required on sensor.
   - If pin is below end of tool (F), call DTAC.

6. Grease O-ring with JDT405 High Temperature Grease

7. Install sensor in timing gear cover. Tighten to 14 N•m (10 lb-ft).



Crankshaft Position Sensor



Using JDG1334 Depth Checking Tool

A—Machined Mounting Surface (Spotface)
B—Crankshaft Position Sensor
C—Pin (In JDG1334 Depth Tool)
D—Sensor Depth Low (Shim Required)
E—Sensor Depth Correct (No Shim Required)
F—Sensor Depth too High (Requires Investigation)
G—JDG1334 Depth Checking Tool
H—Crankshaft Timing Wheel

DPSG,RG40854,466 -19-20OCT99-1/1

About This Section of the Manual

This section of the manual contains necessary information to diagnose the electronic control system. Use this information in conjunction with the 6105 and 6125 DIESEL ENGINES REPAIR (CTM100).

See the 6105 and 6125 ENGINE REPAIR manual for:

- Removal of components
- Repair procedures
- Disassembly
- Inspection
- Assembly

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

To help diagnose electronic control system problems, Group 198 SPECIFICATIONS contains useful information, such as ECU terminal identification, system wiring schematic, and component location.

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.

RG,RG34710,1552 –19–30SEP97–1/1

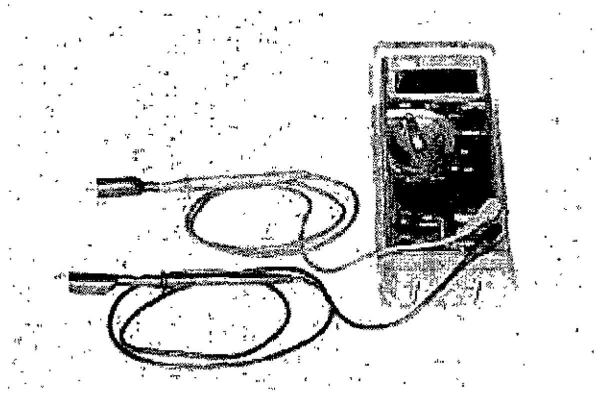
Electrical Concepts

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

RG,RG34710,1553 –19–30SEP97–1/1

Using a Digital Multimeter



Digital Multimeter

It is recommended that a digital multimeter (JT05791 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.

Operation of JT05791 Digital Multimeter

Digital Display—The digital display reads values of variables measured. It is updated 2-1/2 times a second. In normal operation the meter selects the range which will show the most accurate reading. When the value being measured is too large for the meter to display, an "OL" (overload) will be shown. Position of decimal point will change, depending upon range in use. The display also verifies the type and size of measurement being made.

Analog Display—This is a bar graph located below the digital display. The analog display is updated 25 times per second. It is more responsive to help see trends developing in variable readings. The polarity indicator is also part of this display. The full bar graph indicates the maximum reading for a scale. The arrowhead indicates OL.

Continued on next page

Selector—The selector is the rotary switch which allows the operator to select the type of variable to be measured. For amperage readings, the red (+) contact must also be moved to the desired terminal.

Diode Test—The "diode test" position can be used to test diodes. A single tone will sound in the forward bias direction along with a display of forward voltage drop. The meter also can be used to test continuity. If the circuit is open, there will be no tone. if the circuit made has continuity (less than 150 ohms) a continuous tone will sound.

Autoranging—The meter powers up in the autorange mode. Range is selected automatically. The digital display indicates the range.

Manual Ranging—When the violet button in the middle of the selector knob is pressed with the meter on, the range is selected manually. You can "dial" through ranges by repeatedly depressing the button. As in the autorange mode, range in use will be shown in the digital display. To return to autorange mode, press range button for 1 second. Meter will "chirp" once and return to autorange mode.

Touch Hold—If the violet button in the selector us depressed and held down while the meter is being turned on, and held until the display reaches full brightness the meter is in the "touch hold" mode. In touch hold, any reading which is constant for a minimum of 1/2 second and differs from the previous reading by at least one bar of the analog display will be "captured" by the meter. A tone (beep) will sound when the reading has been held. The operator can then remove the probes and the reading will be retained. Touch hold is always in autorange mode. Turn the selector switch to "OFF" to deactivate touch hold.

RG,RG34710,1554 –19–30SEP97–2/2

Electrical Circuit Malfunctions

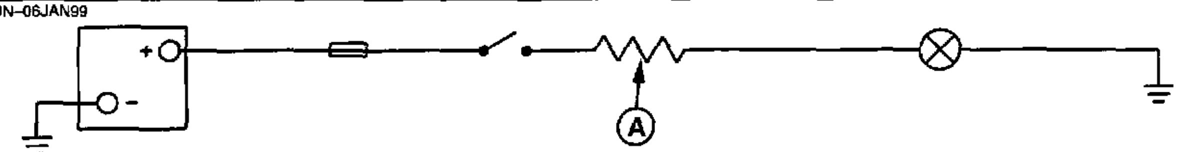
Circuit Malfunctions

There are four major circuit malfunctions. They are:

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

DPSG,RG40854,37 –19–15DEC98–1/6

RG9891 –UN–06JAN99



A—Unwanted Resistance

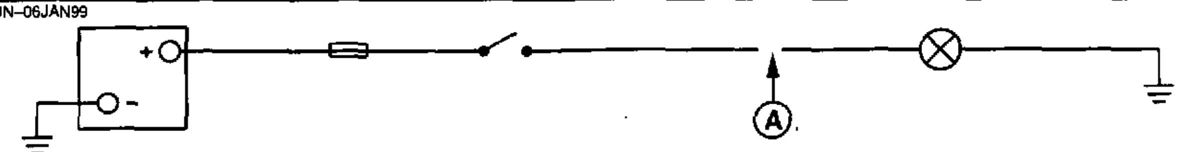
Definition of Circuit Malfunctions

1. **High Resistance Circuit:**

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

DPSG,RG40854,37 –19–15DEC98–2/6

RG9892 –UN–06JAN99



A—Break or Separation in Circuit

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

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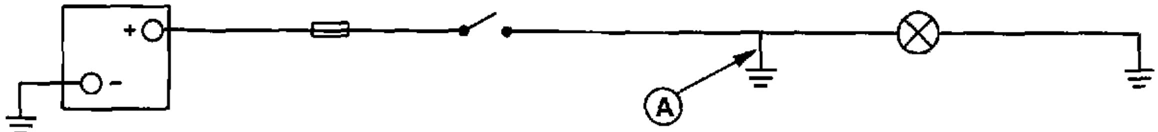
RG9893 –UN–06JAN99



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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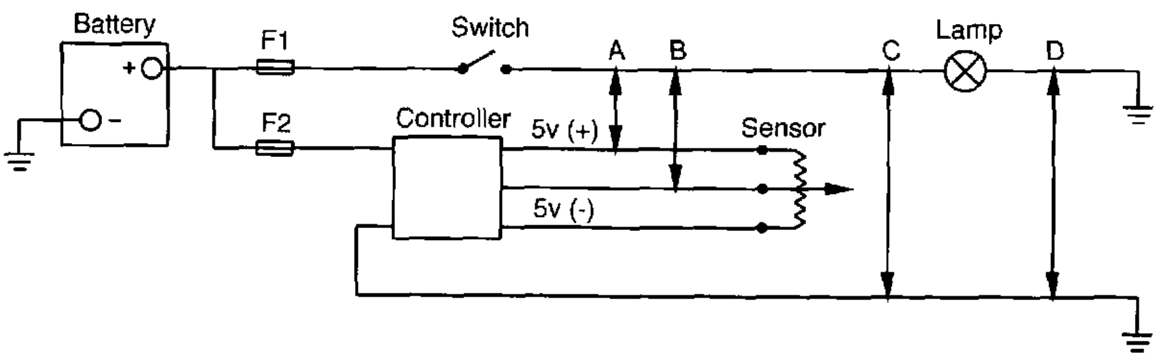


4. **Shorted Circuit:**
   A wire-to-wire contact of two adjacent wires that provides unwanted continuity between the two wires. The following are types of short circuits:
   - Voltage wire shorted to another voltage wire (wires of equal or unequal voltage).
   - Voltage wire shorted to a sensor signal 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.

Continued on next page

DPSG,RG40854,37 –19–15DEC98–5/6

RG9895 -UN-06JAN99

A—Controlling Switch B—Load

Locations of Circuit Malfunctions:

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

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

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

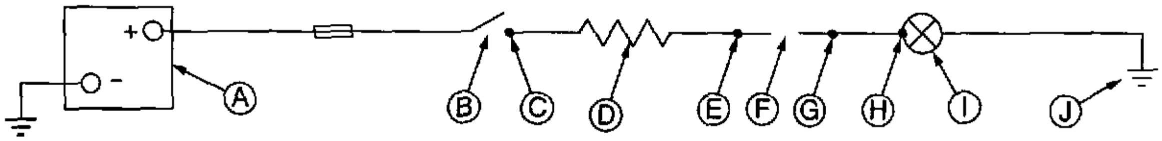
Example: A component may not operate before *disconnecting an electrical connection, but it operates* after reconnecting the connector.

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

DPSG,RG40854,37 -19-15DEC98-6/6

Troubleshooting Circuit Malfunctions

RG9896 -UN-06JAN99



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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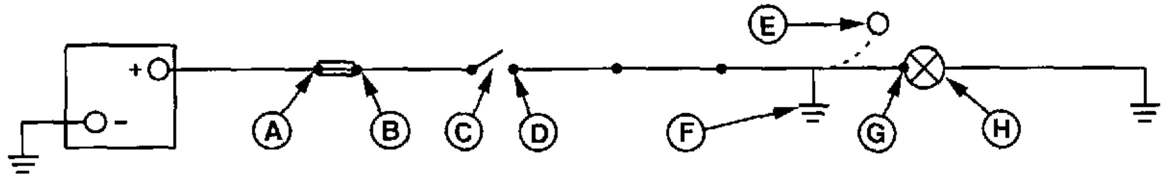
RG9897 –UN–06JAN99



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

3. **Ground Circuit:**

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

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

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

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

c. With the controlling switch (C) open (off), check for continuity to ground between (D) and (E).
   - If there is continuity, there is a grounded circuit between (D) and (E). Repair the circuit.

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

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

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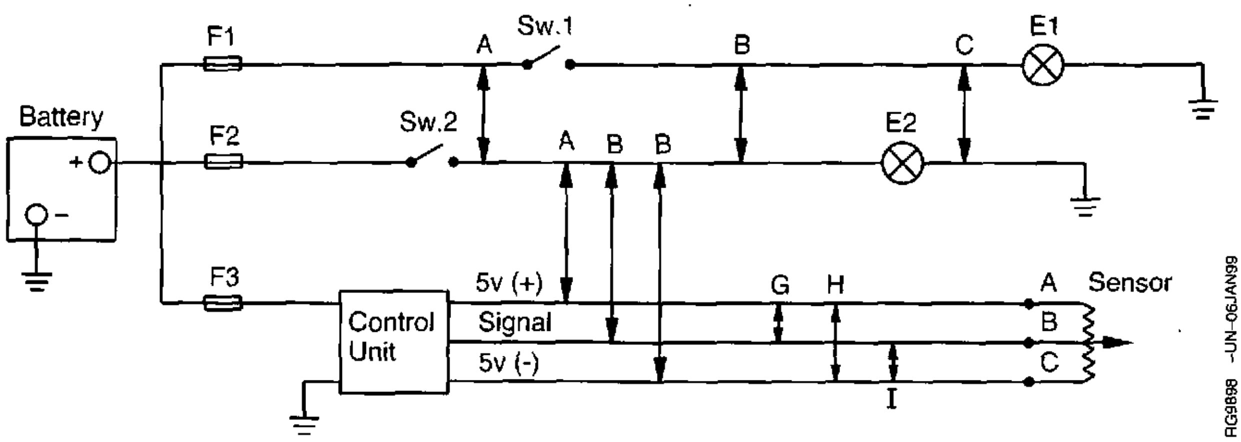

4. **Shorted Circuit:**

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

1. Battery wire from fuse (F1) is shorted at (A) to another battery wire after switch (Sw.2).
   - Result: Lamp (E1) is on all of the time.
2. Battery wire from fuse (F1) is shorted at (B) to another battery wire after switches (Sw.1 & 2).
   - Result: Both lamps (E1 & E2) operate on either switch (Sw. 1 or 2).
3. Battery wire from fuse (F1) is shorted at (C) to a ground wire.
   - Result: Fuse (F1) opens after closing switch (Sw. 1)
4. Battery wire from switch (Sw. 2) is shorted at (D) to a regulated voltage wire.
   - Result: The sensor signal voltage is distorted.[1]
5. Battery wire from switch (Sw. 2) is shorted at (E) to the sensor signal voltage wire.
   - Result: The sensor signal is distorted.[1]
6. Battery wire from switch (Sw. 2) is shorted at (F) to the sensor ground wire.
   - Result: Fuse (F2) opens after closing switch (Sw. 2) and the sensor signal is distorted.[1]
7. Controller regulated voltage wire is shorted at (G) to the sensor signal voltage wire.
   - Result: The sensor signal is distorted.
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.

DPSG,RG40854,38 –19–15DEC98–4/4

Data Parameter Description

Following is a list of the data parameters that can be read on the Diagnostic Scan Tool (DST). The DST consists of a Windows ('95 or '98) or NT compatible computer, JDIS121 - 10.5/12.5 ECU Communication Hardware Kit, and JDIS122 - 10.5/12.5 ECU Communication Software Kit, available from John Deere. Included in the list below is a brief description of each parameter, the range of possible readings, and each parameter's unit of measurement.

Parameter	Range	Units	Description
Analog Throttle (A) Input Voltage	0-5	volts	Optional component, not included on all applications. The voltage from the analog throttle (A) position sensor (potentiometer).
Analog Throttle (B) Input Voltage	0-5	volts	Optional component, not included on all applications. The voltage from analog throttle (B) position sensor (potentiometer).
Cam Improper Pattern Indicator	0-100	%	A "0" reading means that there is NO improper pattern. Between 0—100, the cam pattern becomes progressively more improper. When 100 is reached, a trouble code is thrown.
Cam Position Input Noise Indicator	0-100	%	A "0" reading means that there is NO noise. Between 0—100, cam noise becomes progressively worse. When 100 is reached, a trouble code is thrown.
Cam Position Sensor Speed	0-6000	rpm	The speed of the cam timing wheel. The speed of the cam timing wheel should be 1/2 the speed of the crank timing wheel.
Cam Position Status	0-15	NA	When status is 15, the ECU is receiving ALL of the signal. When the status is below 15, it means that the ECU is not receiving all of the signal.
Crank Position noise Indicator	0-100	%	A "0" reading means that there is NO noise. Between 0—100, crank noise becomes progressively worse. When 100 is reached, a trouble code is thrown.
Crank Improper Pattern Indicator	0-100	%	A "0" reading means that there is NO improper pattern. Between 0—100, the crank pattern becomes progressively more improper. When 100 is reached, a trouble code is thrown.
Crank Position Sensor Speed	0-6000	rpm	The speed of the crank timing wheel. The speed of the crank timing wheel should be 2X's the speed of the cam timing wheel.
Crank Position Sensor Status	0-15	NA	When status is 15, the ECU is receiving ALL of the signal. When the status is below 15, it means that the ECU is not receiving all of the signal.
Desired Speed Governor	0-7 and 10-14	NA	The mode selected is dependent on the application. See Governor Droop Mode Selection in Group 198 of this manual.

Continued on next page RG,RG34710,1560 –19–30SEP97–1/3

Parameter	Range	Units	Description
Engine Coolant Temperature	-184—+149 (-300—+300)	°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	0—5	volts	Engine Coolant Temperature sensor input voltage to the ECU
Engine Hour Meter	N/A[a]	hr -min- sec	Total hours the ECU has run on an engine.
Engine Oil Pressure	0-1000 (0-145)	kPa (psi)	Engine Oil Pressure value
Engine Speed	0—6000	rpm	The speed that the crank sensor detects the crank timing wheel to be moving at.
Fuel Mode	16 bit code	NA	This code explains the operation mode of the engine.
Fuel Pressure	0—1000 0—146	kPa (psi)	On single rail fuel system applications, the ECU monitors fuel pressure.
Fuel Temperature	-184—+149 (-300—+300)	°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	0-5	volts	Fuel Temperature sensor input voltage to the ECU.
Fuel Usage Rate	N/A[a]	L (gal)	Total amount of fuel the ECU has commanded the EUIs to deliver during the total hours shown by the Engine Hour Meter parameter.
Manifold Absolute Pressure	0—400 (0—58)	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 Air Temperature	-184—+149 (-300—+300)	°C (°F)	Manifold Air Temperature value. *NOTE: If there is an active fault for the MAP circuit, the MAP value displayed will be the "limp-home" value.*
Manifold Air Temperature Input Voltage	0—5	volts	Manifold Air Temperature sensor input voltage to the ECU.
Maximum Speed Governor	9 or 10	NA	The mode selected is dependent on the application. See Governor Droop Mode Selection in Group 198 of this manual.
Oil Pressure Input Voltage	0—5	volts	Oil Pressure sensor input voltage to the ECU.

[a]N/A = Not Applicable

Continued on next page RG,RG34710,1560 –19–30SEP97–2/3

Parameter	Range	Units	Description
Pilot Injection	*ON or OFF or N/A*	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.
Torque Curve Number	0—7	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. Definition of the possible torque curves is found in Group 198 Specifications.
[a]N/A = Not Applicable			

RG,RG34710,1560 –19–30SEP97–3/3

Diagnostic Scan Tool (DST) Engine Test Instructions—Cylinder Misfire Test

The Diagnostic Scan Tool (DST) consists of a Windows ('95 or '98) or NT compatible computer, JDIS121 - 10.5/12.5 ECU Communication Hardware Kit, and JDIS122 - 10.5/12.5 ECU Communication Software Kit, available from John Deere.

The Cylinder Misfire Test is used to compare the output of each cylinder relative to each of the other cylinders. The test will help identify problems such as an engine misfire or irregularly running engine. During the test, the Engine Control Unit (ECU) will disable a cylinder, then accelerate the engine with a fixed amount of fuel and measure the time taken to accelerate the engine from one speed to the next with that cylinder disabled. The ECU will then repeat the procedure for the remaining 5 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 an Electronic Unit Injector (EUI). Other information such as the results of a Compression test and other engine diagnostic procedures should be used to accurately determine the source of an engine problem.

Before executing the Cylinder Misfire Test

- Warm engine to normal operating temperature
- Repair the cause of any Diagnostic Trouble Codes (DTCs)

NOTE: *The ECU will not allow the test to run if there are any active DTCs.*

- Remove any load to the engine that may change during the test. For example, turn the air conditioner off.

Performing the Cylinder Misfire Test

1. Engine idling.
2. Select Cylinder Misfire Test on the DST.
3. Follow instruction given by the DST. The DST will instruct that the throttle lever be moved from low idle position to wide open throttle position, then back to low idle position 6 times.

NOTE: *On most Marine applications, either throttle may be used to run this test. However, on some early applications, only analog throttle (B) can run this test. In this situation the connectors for analog throttle (A) and analog throttle (B) need to be switched to allow operation from analog throttle (A). After this test is completed, the connectors need to be switched back.*

The DST will inform the test operator if the test was not successfully completed. If the test was successfully completed, the results will be displayed on the screen.

Results shown will represent each cylinders' performance as a percentage in relation to the average of all cylinders. If any cylinder is above or below the average by more than 10%, that indicates the cylinder is contributing too much (above average) or not contributing enough (below average).

NOTE: *It is recommended that the test be run at least 3 times to ensure repeatable, accurate results.*

The Compression Test should be performed to help determine the cause of the problem in the cylinder(s) that was above or below average.

RG,RG34710,1561 –19–30SEP97–1/1

Diagnostic Scan Tool (DST) Engine Test Instructions—Compression Test

The Diagnostic Scan Tool (DST) consists of a Windows ('95 or '98) or NT compatible computer, JDIS121 - 10.5/12.5 ECU Communication Hardware Kit, and JDIS122 - 10.5/12.5 ECU Communication Software Kit, available from John Deere.

The Compression Test is used to compare the compression of each cylinder to the average compression of all cylinders. The test will help determine if a cylinder has low compression compared to all other cylinders. During the test, the Engine Control Unit (ECU) will disable the engine from starting (by not pulsing the unit injectors), then measure the time it takes the piston of each cylinder to accelerate through and past TDC. A piston that accelerated faster than the rest would indicate that cylinder has lower compression than the other cylinders.

The Compression Test cannot determine the true compression pressure of any cylinder, it can only compare each cylinder to the average. The test results are only a guide to help determine if a cylinder has lower compression. The results alone should not be used as a conclusive reason for performing any major engine work. Other information such as the results of the Cylinder Misfire Test and other engine diagnostic procedures should be used to accurately determine the source of an engine problem.

Before executing the Compression Test

- Warm engine to normal operating temperature
- Repair the cause of any Diagnostic Trouble Codes (DTCs)

NOTE: *The ECU will not allow the test to run if there are any active DTCs.*

- Ensure that the battery and starter are in good working condition

Performing the Compression Test

1. Engine OFF.

2. Select Compression Test on the DST.

3. Follow instruction given by the DST. The DST will instruct that the engine be cranked for up to 15 seconds. Typically, it should take less than 5 seconds. The DST should be observed carefully for instructions during the test.

   The DST will inform the test operator if the test was not successfully completed. If the test was successfully completed, the results will be displayed on the screen.

   Results shown will represent each cylinders' compression as a percentage in relation to the average of all cylinders. If any cylinder is more than 10% below the rest, that indicates the cylinder's compression is lower than the rest.

NOTE: *It is recommended that the test be run at least 3 times to ensure repeatable, accurate results.*

   Further engine diagnostics should be performed to determine the cause of low compression.

RG,RG34710,1562 -19-30SEP97-1/1

Diagnostic Scan Tool (DST) Engine Test Instructions— Cylinder Cutout Test

The Diagnostic Scan Tool (DST) consists of a Windows ('95 or '98) or NT compatible computer, JDIS121 - 10.5/12.5 ECU Communication Hardware Kit, and JDIS122 - 10.5/12.5 ECU Communication Software Kit, available from John Deere.

The Cylinder Cutout Test is used to aid in identifying a cylinder that is having a problem or to help in diagnosing mechanical or intermittent problems. During the test, the Engine Control Unit (ECU) will disable the cylinder(s) that the technician selects on the DST. More than one cylinder can be selected at a time, and can be performed while operating the vehicle under the conditions that the problem occurs.

The Cylinder Cutout Test can not determine if an engine is developing low power. The test is only a guide to help determine if there is a problem in a cylinder. The results alone should not be used as a conclusive reason for replacing an Electronic Unit Injector (EUI). Other information such as the results of a Compression Test and other engine diagnostic procedures should be used to accurately determine the source of the engine problem.

Before executing the Cylinder Cutout Test

- Warm engine to normal operating temperature
- Repair the cause of any Diagnostic Trouble Codes (DTCs)

NOTE: The ECU will not allow the test to run if there are any active DTCs.

- Ensure that the battery and starter are in good working condition

Performing the Cylinder Cutout Test

1. Engine idling or under the conditions that the problem occurred.
2. Select Cylinder Cutout Test on the DST.
3. Follow instructions given by the DST.
4. Select the cylinder(s) to be cut out.
5. Observe engine operation and the parameters on the DST. These parameters include: Engine load at current speed, engine speed, and manifold air pressure.
6. Use this data and observations to help in the diagnosis of the problem.

NOTE: It is recommended that the test be run at least 3 times to ensure repeatable, accurate results.

DPSG,RG40854,358 –19–12OCT99–1/1

Diagnostic Trouble Codes (DTCs)

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

2-DIGIT CODES

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

SPN/FMI CODES

On some applications, the DTCs are output according to the J1939 standard as a two part code. The first part is a two to four-digit Suspect Parameter Number (SPN) followed by a one or two-digit Failure Mode Identifier (FMI) code. In order to determine the exact failure, both parts (SPN and FMI) of the code are needed. 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 FMI identifies the type of failure that has occurred; for example FMI 3 indicates value above normal. Combining SPN 110 with FMI 3 yields engine coolant temperature input voltage high, or the equivalent of 2-digit trouble code 25.

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

CLEARING STORED DTCS

Stored DTCs can be cleared through the OEM instrument panel or through the Diagnostic Scan Tool (DST).

DPSG,RG40854,467 –19–20OCT99–1/1

Listing of Diagnostic Trouble Codes (DTCs) for OEM and Marine Applications

Following is a list of Diagnostic Trouble Codes (DTCs) that can occur in the electronic control system on OEM and Marine applications.

SPN	FMI	Definition
91	3	Throttle #1 Input Voltage High
	4	Throttle #1 Input Voltage Low
	8	Throttle #1 Abnormal Pulse Width
	9	Throttle #1 CAN invalid
29	3	Throttle #2 Input Voltage High
	4	Throttle #2 Input Voltage Low
28	3	Throttle #3 Input Voltage High
	4	Throttle #3 Input Voltage Low
94	1	Fuel Supply Pressure Extremely Low
	3	Fuel Supply Pressure Input Voltage High
	4	Fuel Supply Pressure Input Voltage Low
	16	Fuel Supply Pressure Moderately High
	18	Fuel Supply Pressure Moderately Low
97	0	Water in Fuel Continuously Detected
	3	Water in Fuel Signal Voltage High
	4	Water in Fuel Signal Voltage Low
	16	Water in Fuel Detected
	31	Water in Fuel Detected
100	0	Engine Oil Pressure Extremely Low
	3	Engine Oil Pressure Input Voltage High
	4	Engine Oil Pressure Input Voltage Low
	18	Engine Oil Pressure Moderately Low
105	3	MAT Input Voltage High
	4	MAT Input Voltage Low
	16	MAT Moderately High
110	0	ECT Extremely High
	3	ECT Input Voltage High
	4	ECT Input Voltage Low
	16	ECT Moderately High
111	1	Engine Coolant Level Low
158	17	ECU Power Down Error
174	3	Fuel Temperature Input Voltage High
	4	Fuel Temperature Input Voltage Low

RG,RG34710,1563 –19–30SEP97–1/1

Listing of Diagnostic Trouble Codes (DTCs) for OEM and Marine Applications - Continued

SPN	FMI	Definition
611	3	Injector Wiring Shorted to Power Source
	4	Injector Wiring Shorted to Ground
627	1	Injector Supply Voltage Problem
629	12, 13	ECU Error
636	2	Cam Position Input Noise
	8	Cam Position Input Missing
	10	Cam Position Input Pattern Error
637	2	Crank Position Input Noise
	7	Crank Position/Cam Position Out of Sync
	8	Crank Position Input Missing
	10	Crank Position Input Pattern Error
651	5	Cylinder #1 EUI Circuit Open
	6	Cylinder #1 EUI Circuit Shorted
652	5	Cylinder #2 EUI Circuit Open
	6	Cylinder #2 EUI Circuit Shorted
653	5	Cylinder #3 EUI Circuit Open
	6	Cylinder #3 EUI Circuit Shorted
654	5	Cylinder #4 EUI Circuit Open
	6	Cylinder #4 EUI Circuit Shorted
655	5	Cylinder #5 EUI Circuit Open
	6	Cylinder #5 EUI Circuit Shorted
656	5	Cylinder #6 EUI Circuit Open
	6	Cylinder #6 EUI Circuit Shorted
970	2	Auxiliary Engine Shutdown Switch Signal Invalid
	31	Auxiliary Engine Shutdown Switch Active
971	31	External Fuel Derate Switch Active
1109	31	Engine Shutdown Warning
1110	31	Engine Shutdown
1569	31	Fuel Derate

DPSG,RG40854,484 –19–22DEC99–1/1

Listing of Diagnostic Trouble Codes (DTCs) for Tractors and LTVs

Following is a list of Diagnostic Trouble Codes (DTCs) that can occur in the electronic control system on 9200-9400 4WD Tractors and LTV applications. The following table allows for the conversion of the 2-digit code into an SPN/FMI.

NOTE: If the DST is available, it will show the SPN/FMI trouble code. This is helpful for DTCs in the table below that show 2 FMIs for a 2-digit code.

2-Digit Code	SPN	FMI	Definition
13	91	3	Throttle #1 Input Voltage High
14	91	4	Throttle #1 Input Voltage Low
15	91	8	Throttle #1 Abnormal Pulse Width
25	110	3	ECT Input Voltage High
26	110	4	ECT Input Voltage Low
27	94	3	Fuel Supply Pressure Input Voltage High
28	629	12, 13	ECU Error
29	94	4	Fuel Supply Pressure Input Voltage Low
31	651	5, 6	Cylinder #1 EUI Circuit Open/Shorted
32	652	5, 6	Cylinder #2 EUI Circuit Open/Shorted
33	653	5, 6	Cylinder #3 EUI Circuit Open/Shorted
34	654	5, 6	Cylinder #4 EUI Circuit Open/Shorted
35	655	5, 6	Cylinder #5 EUI Circuit Open/Shorted
36	656	5, 6	Cylinder #6 EUI Circuit Open/Shorted
37	174	3	Fuel Temperature Input Voltage High
38	174	4	Fuel Temperature Input Voltage Low
41	637	8	Crank Position Input Missing
42	637	2, 10	Crank Position Input Noise / Pattern Error
43	636	8	Cam Position Input Missing
44	636	2, 10	Cam Position Input Noise / Pattern Error
45	637	7	Crank Position/Cam Position Out of Sync
49	970	2	Auxiliary Engine Shutdown Switch Signal Invalid
52	970	31	Auxiliary Engine Shutdown Switch Active
57	94	18	Fuel Supply Pressure Moderately Low
58	94	1	Fuel Supply Pressure Extremely Low
59	94	16	Fuel Supply Pressure Moderately High
62	110	16	ECT Moderately High
63	110	0	ECT Extremely High
68	1569	31	Fuel Derate
75	97	31	Water in Fuel Detected
76	97	3, 4	Water in Fuel Signal Voltage High/Low
84	158	17	ECU Power Down Error

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Listing of Diagnostic Trouble Codes (DTCs) for Tractors and LTVs - Continued

2-Digit Code	SPN	FMI	Definition
91	651	6	Cylinder #1 EUI Circuit Shorted
92	652	6	Cylinder #2 EUI Circuit Shorted
93	653	6	Cylinder #3 EUI Circuit Shorted
94	654	6	Cylinder #4 EUI Circuit Shorted
95	655	6	Cylinder #5 EUI Circuit Shorted
96	656	6	Cylinder #6 EUI Circuit Shorted
97	627	1	Injector Supply Voltage Problem
98	611	3	Injector Wiring Shorted to Power Source
99	611	4	Injector Wiring Shorted to Ground

DPSG,RG40854,484 –19–22DEC99–1/1

Listing of Diagnostic Trouble Codes (DTCs) for Self-Propelled Forage Harvesters

Following is a list of Diagnostic Trouble Codes (DTCs) that can occur in the electronic control system on 6750 and 6850 Self-Propelled Forage Harvester applications. The following table allows for the conversion of the 2-digit code into an SPN/FMI.

NOTE: If the DST is available, it will show the SPN/FMI trouble code.

2-Digit Code	SPN	FMI	Definition
11	91	3	Throttle #1 Input Voltage High
12	91	4	Throttle #1 Input Voltage Low
23	105	3	MAT Input Voltage High
24	105	4	MAT Input Voltage Low
25	110	3	ECT Input Voltage High
26	110	4	ECT Input Voltage Low
27	94	3	Fuel Supply Pressure Input Voltage High
28	629	12, 13	ECU Error
29	94	4	Fuel Supply Pressure Input Voltage Low
31	651	5	Cylinder #1 EUI Circuit Open
32	652	5	Cylinder #2 EUI Circuit Open
33	653	5	Cylinder #3 EUI Circuit Open
34	654	5	Cylinder #4 EUI Circuit Open
35	655	5	Cylinder #5 EUI Circuit Open
36	656	5	Cylinder #6 EUI Circuit Open
37	174	3	Fuel Temperature Input Voltage High
38	174	4	Fuel Temperature Input Voltage Low
41	637	8	Crank Position Input Missing
42	637	2, 10	Crank Position Input Noise / Pattern Error
43	636	8	Cam Position Input Missing
44	636	2, 10	Cam Position Input Noise / Pattern Error
57	94	18	Fuel Supply Pressure Moderately Low
58	94	1	Fuel Supply Pressure Extremely Low
59	94	16	Fuel Supply Pressure Moderately High
62	110	16	ECT Moderately High
66	105	16	MAT Moderately High
68	1569	31	Fuel Derate
75	97	31	Water in Fuel Detected
76	97	3, 4	Water in Fuel Signal Voltage High/Low
84	158	17	ECU Power Down Error

RG,RG34710,1563 –19–30SEP97–1/1

Listing of Diagnostic Trouble Codes (DTCs) for Self Propelled Forage Harvesters - Continued

2-Digit Code	SPN	FMI	Definition
91	651	6	Cylinder #1 EUI Circuit Shorted
92	652	6	Cylinder #2 EUI Circuit Shorted
93	653	6	Cylinder #3 EUI Circuit Shorted
94	654	6	Cylinder #4 EUI Circuit Shorted
95	655	6	Cylinder #5 EUI Circuit Shorted
96	656	6	Cylinder #6 EUI Circuit Shorted
97	627	1	Injector Supply Voltage Problem
98	611	3	Injector Wiring Shorted to Power Source
99	611	4	Injector Wiring Shorted to Ground

DPSG,RG40854,484 –19–22DEC99–1/1

Listing of Diagnostic Trouble Codes (DTCs) for Loaders

Following is a list of Diagnostic Trouble Codes (DTCs) that can occur in the electronic control system on 744H/MH and LX 230 Loaders. The following table allows for the conversion of the 2-digit code into an SPN/FMI.

NOTE: If the DST is available, it will show the SPN/FMI trouble code. This is helpful for DTCs in the table below that show 2 FMIs for a 2-digit code.

2-Digit Code	SPN	FMI	Definition
11	29	3	Throttle #2 Input Voltage High
12	29	4	Throttle #2 Input Voltage Low
13	91	3, 8	Throttle #1 Input Voltage High OR Throttle #1 Abnormal Pulse Width
14	91	4, 8	Throttle #1 Input Voltage Low OR Throttle #1 Abnormal Pulse Width
23	105	3	MAT Input Voltage High
24	105	4	MAT Input Voltage Low
25	110	3	ECT Input Voltage High
26	110	4	ECT Input Voltage Low
27	94	3	Fuel Supply Pressure Input Voltage High
28	629	12, 13	ECU Error
29	94	4	Fuel Supply Pressure Input Voltage Low
31	651	5, 6	Cylinder #1 EUI Circuit Open/Shorted
32	652	5, 6	Cylinder #2 EUI Circuit Open/Shorted
33	653	5, 6	Cylinder #3 EUI Circuit Open/Shorted
34	654	5, 6	Cylinder #4 EUI Circuit Open/Shorted
35	655	5, 6	Cylinder #5 EUI Circuit Open/Shorted
36	656	5, 6	Cylinder #6 EUI Circuit Open/Shorted
37	174	3	Fuel Temperature Input Voltage High
38	174	4	Fuel Temperature Input Voltage Low
41	637	8	Crank Position Input Missing
42	637	2, 10	Crank Position Input Noise / Pattern Error
43	636	8	Cam Position Input Missing
44	636	2, 10	Cam Position Input Noise / Pattern Error
57	94	18	Fuel Supply Pressure Moderately Low
58	94	1	Fuel Supply Pressure Extremely Low
59	94	16	Fuel Supply Pressure Moderately High
62	110	16	ECT Moderately High
68	1569	31	Fuel Derate
75	97	31	Water in Fuel Detected
76	97	3, 4	Water in Fuel Signal Voltage High/Low

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Listing of Diagnostic Trouble Codes (DTCs) for Loaders - Continued

2-Digit Code	SPN	FMI	Definition
91	651	6	Cylinder #1 EUI Circuit Shorted
92	652	6	Cylinder #2 EUI Circuit Shorted
93	653	6	Cylinder #3 EUI Circuit Shorted
94	654	6	Cylinder #4 EUI Circuit Shorted
95	655	6	Cylinder #5 EUI Circuit Shorted
96	656	6	Cylinder #6 EUI Circuit Shorted
97	627	1	Injector Supply Voltage Problem
98	611	3	Injector Wiring Shorted to Power Source
99	611	4	Injector Wiring Shorted to Ground

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Diagnostic Procedure

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

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

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

4. If no DTC(s) are present, proceed to the appropriate symptom diagnostic chart in Group 105.
5. After any repairs are made, recheck to make sure all DTCs have been eliminated.

NOTE: *After using the DST, always replace the dust cover on the diagnostic connector.*

IMPORTANT: Care should be used during diagnostic procedures to avoid damaging the terminals of connectors, sensors, and actuators. Probes should not be poked into or around the terminals or damage will result. Probes should only be touched against the terminals to make measurements. It is recommended that JT07328 Connector Adapter Test Kit be used to make measurements in connectors, sensors, and actuators. These adapters will ensure that terminal damage does not occur.

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Intermittent Fault Diagnostics

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

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

Suggestions for diagnosing intermittent faults:

- If diagnostic chart indicates that the problem is intermittent, try to reproduce the operating conditions that were present when the DTC set. The Diagnostic Scan Tool (DST) can be used to help locate intermittent problems, as it includes a function called. Snap Shot. The Snap Shot function permits the recording of data parameter values during a diagnostic session. If a DTC sets during a certain diagnostic session, the parameters can be played back and observed to see what each parameter's value was when the DTC occurred.
- If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the DST 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.

RG,RG34710,1565 –19–30SEP97–1/1

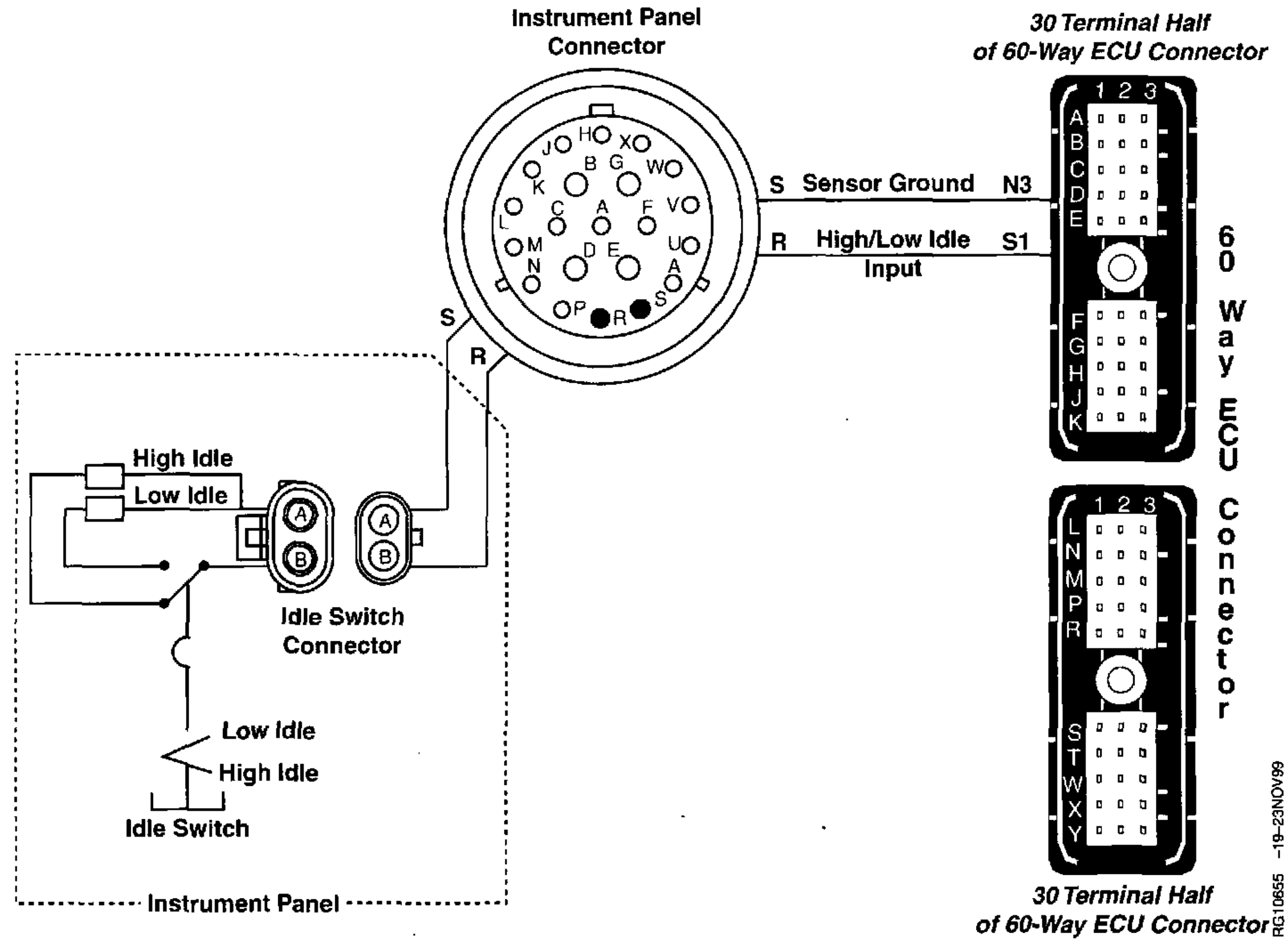
DTC SPN 91, 29, 28 FMI 3, 4, 8, 9

NOTE: For each different application, a SPN-FMI might refer to a different diagnostic procedure than another application. To get to the correct procedure, identify the application and the DTC, and proceed to the page that the table below lists.

Application	DTC SPN/FMI	Go to page that reads:
Tractor	91 - 3 - Throttle 1	T8 - PWM Throttle Input High
	91 - 4 - Throttle 1	T9 - PWM Throttle Input Low
	91 - 8 - Throttle 1	T10 - PWM Throttle Abormal Pulse Width
Marine	91 - 3 - Throttle 1	T3 - Analog Throttle (A) Input High
	91 - 4 - Throttle 1	T4 - Analog Throttle (A) Input Low
	29 - 3 - Throttle 2	T5 - Analog Throttle (B) Input High
	29 - 4 - Throttle 2	T6 - Analog Throttle (B) Input Low
SPFH	91 - 3 - Throttle 1	T3 - Analog Throttle (A) Input High
	91 - 4 - Throttle 1	T4 - Analog Throttle (A) Input Low
Loader	91 - 3 - Throttle 1	T8 - PWM Throttle InputHigh
	91 - 4 - Throttle 1	T9 - PWM Throttle Input Low
	91 - 8 - Throttle 1	T10 - PWM Throttle Abnormal Pulse Width
	91 - 9 - Throttle 1	T7 - CAN Throttle Invalid
	29 - 3 - Throttle 2	T3 - Analog Throttle (A) Input High
	29 - 4 - Throttle 2	T4 - Analog Throttle (A) Input Low
OEM	91 - 3 - Throttle 1	T1 - Multi-state Throttle Input High
	91 - 4 - Throttle 1	T2 - Multi-state Throttle Voltage Low
	29 - 3 - Throttle 2	T3 - Analog Throttle (A) Input High
	29 - 4 - Throttle 2	T4 - Analog Throttle (A) Input Low
	28 - 3 - Throttle 3	T5 - Analog Throttle (B) Input High
	28 - 4 - Throttle 3	T6 - Analog Throttle (B) Input Low

DPSG,RG40854,290 –19–20AUG99–1/1

T1 - Multi-state Throttle Input High



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

Multi-state Throttle Switch

Multi-state throttle is composed of an idle switch that allows engine speed to be at high or low idle. On some applications, there is a bump up and a bump down feature. This allows for high and low idle to be controlled.

On certain applications, an additional throttle is used in addition to the multi-state throttle. If the desired engine speed of the additional throttle is greater than the multi-state throttle, the multi-state throttle will be overridden. When the desired engine speed of the multi-state throttle is greater than the additional throttle, the multi-state throttle will be in total control.

This code will set if:

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

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the multi-state throttle, and will use the input values from another throttle.

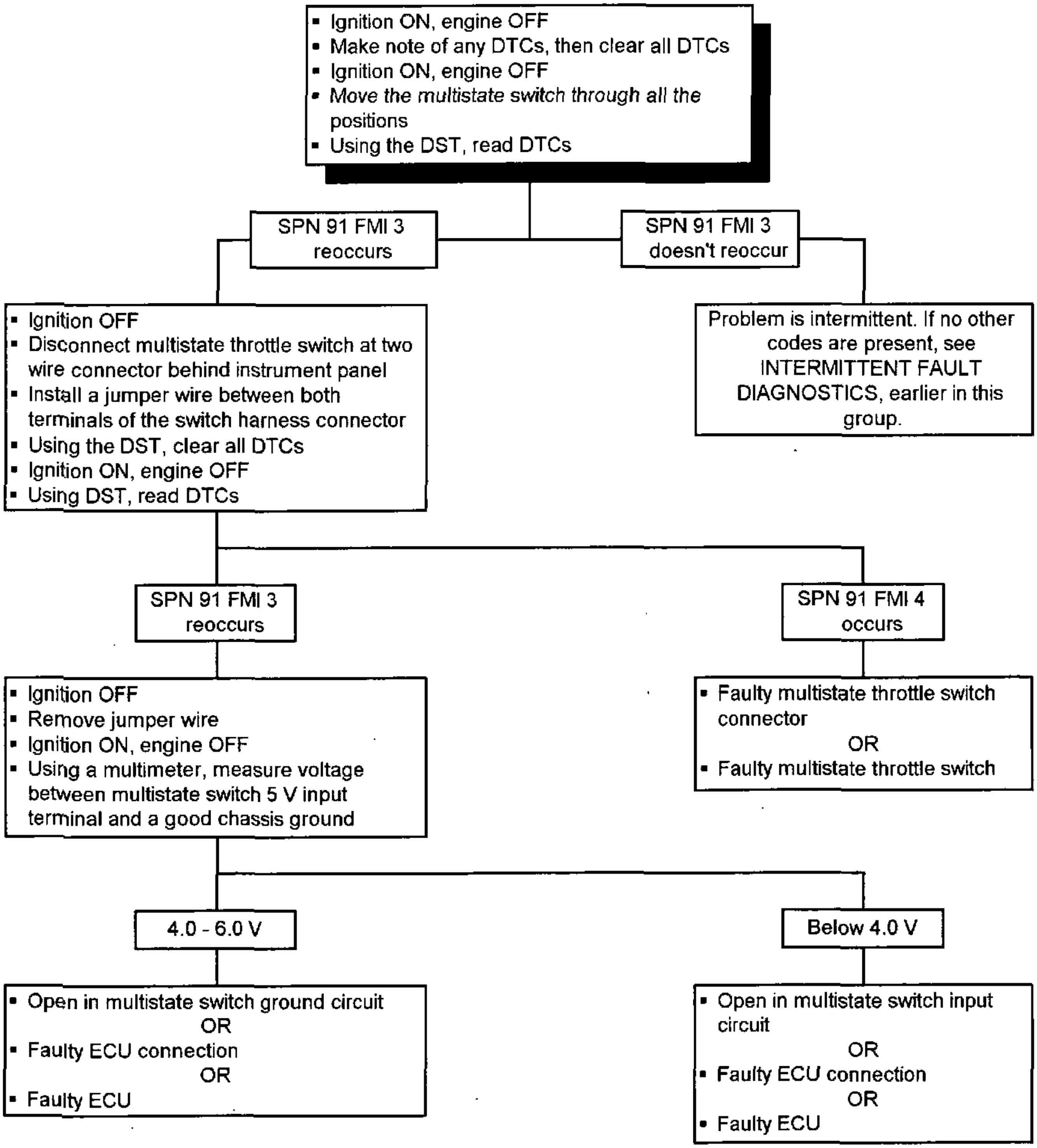
Continued on next page DPSG,RG40854,298 –19–26AUG99–1/2

- If the multi-state throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

DPSG,RG40854,298 –19–26AUG99–2/2

T1 - Multi-state Throttle Input High - Continued

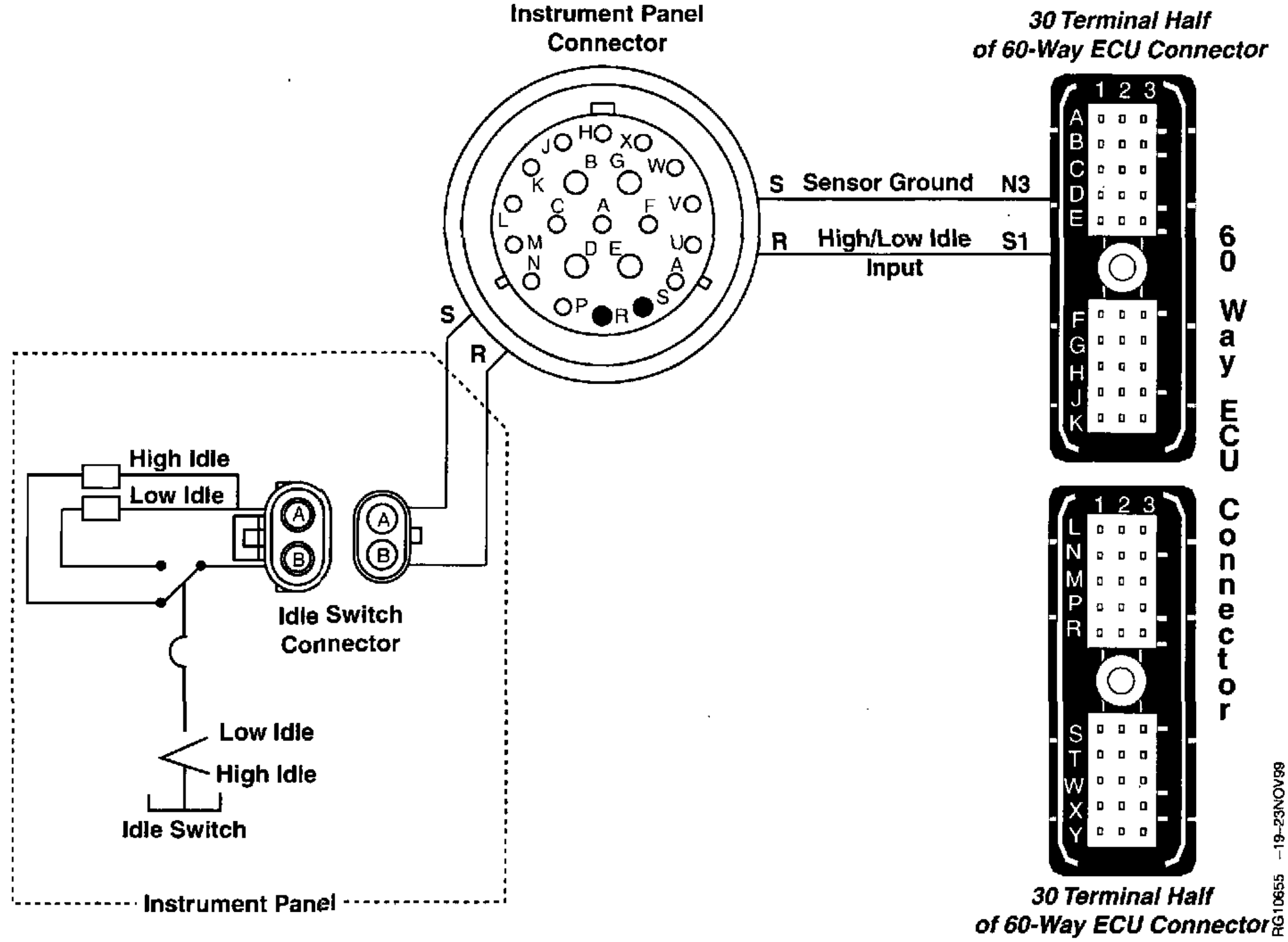
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the multistate throttle connector looking for dirty, damaged, or poorly positioned terminals.



RG10641 –19–22DEC99

DPSG,RG40854,359 –19–12OCT99–1/1

T2 - Multi-state Throttle Input Low



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

Multi-state Throttle Switch

Multi-state throttle is composed of an idle switch that allows engine speed to be at high or low idle. On some applications, there is a bump up and a bump down feature. This allows for high and low idle to be controlled.

On certain applications, an additional throttle is used in addition to the multi-state throttle. If the desired engine speed of the additional throttle is greater than the multi-state throttle, the multi-state throttle will be overridden. When the desired engine speed of the multi-state throttle is greater than the additional throttle, the multi-state throttle will be in total control.

This code will set if:

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

If this code sets, the following will occur:

- If more than one throttle is available, the ECU will ignore the input from the multi-state throttle, and will use the input values from another throttle.

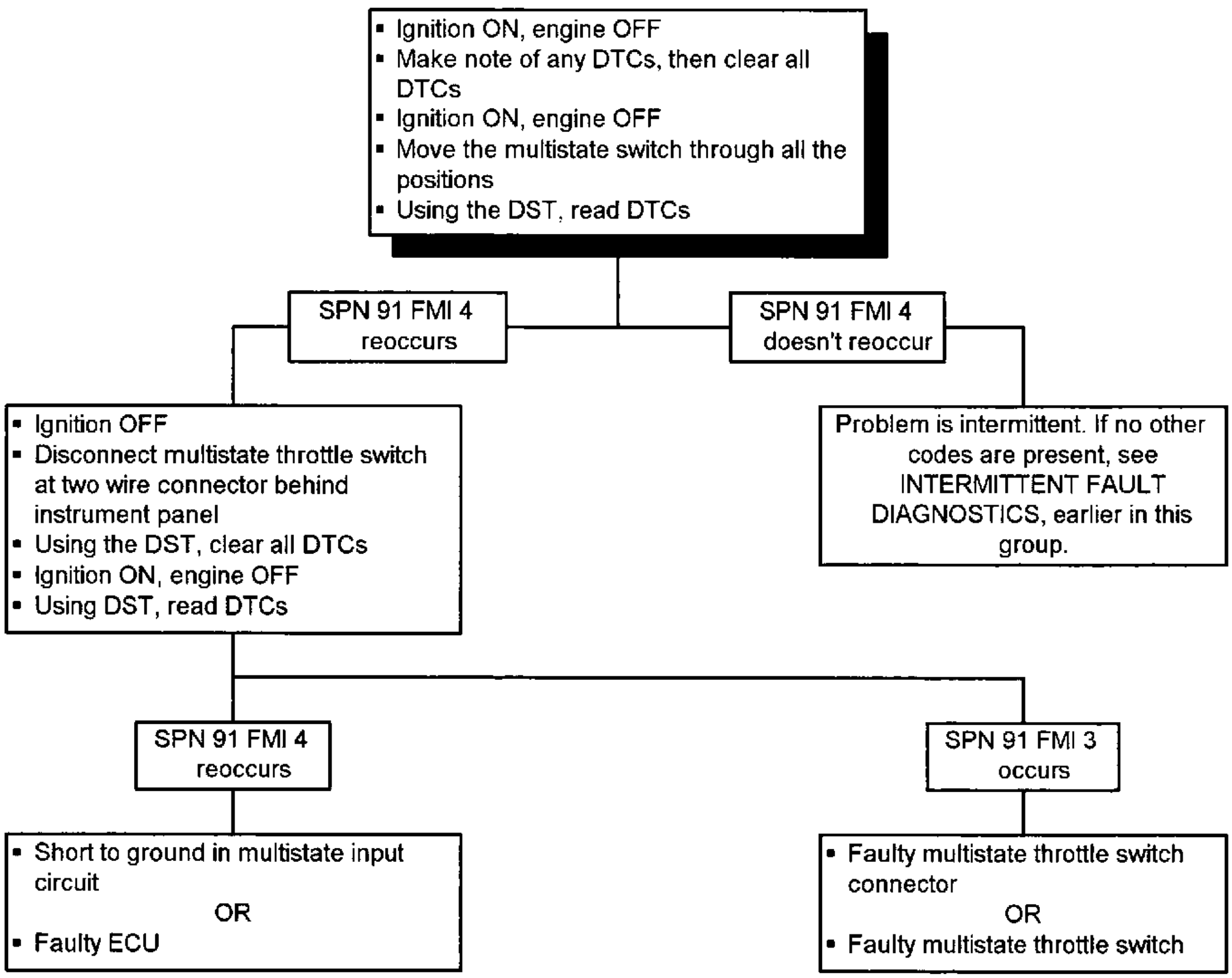
Continued on next page

- If the multi-state throttle is the only throttle or all additional throttles are also faulted, the ECU will use a default "limp-home" throttle value that will only allow idle engine speed.

DPSG,RG40854,299 –19–26AUG99–2/2

T2 - Multi-state Throttle Input Low - Continued

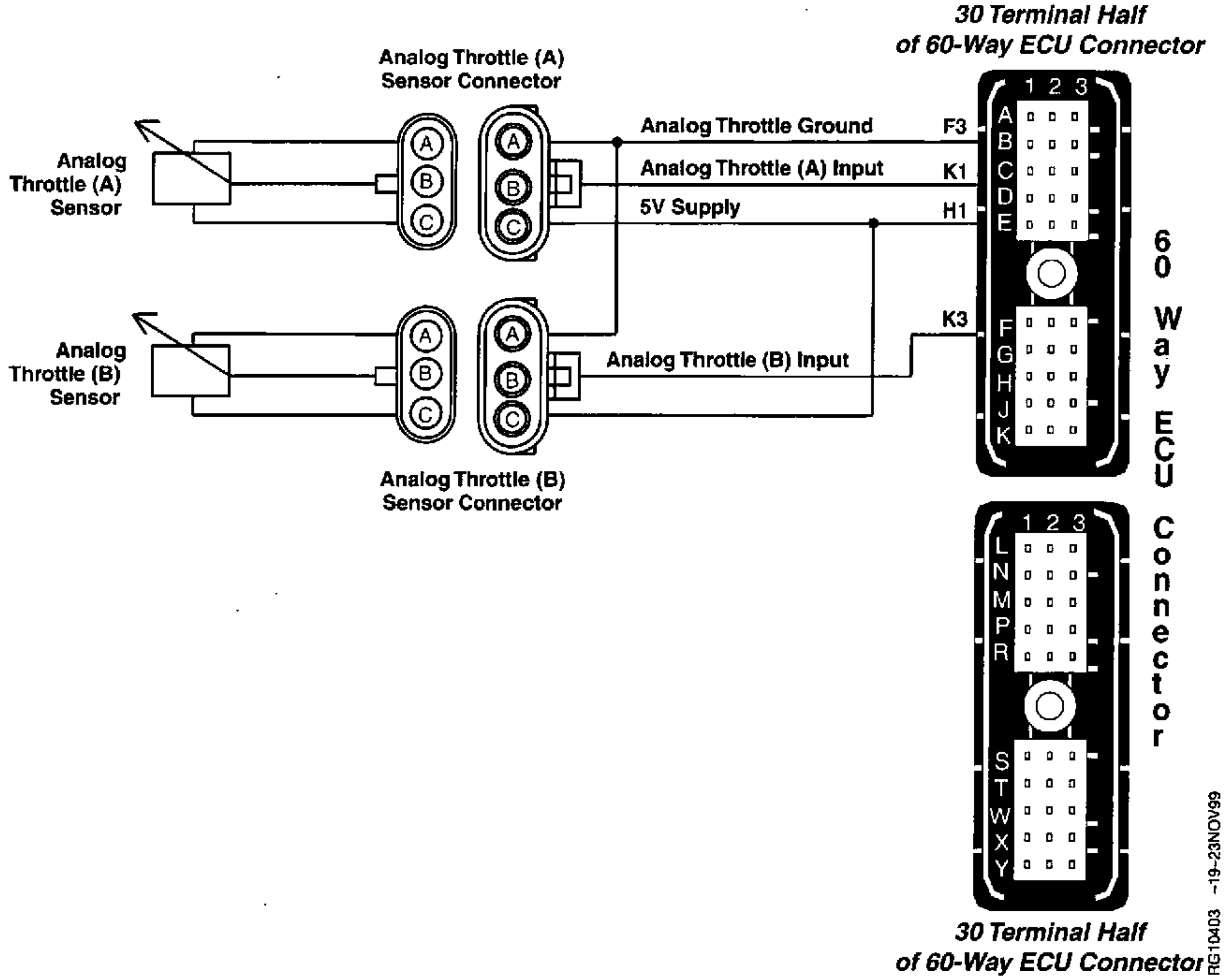
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the multistate throttle connector looking for dirty, damaged, or poorly positioned terminals.



RG10642 –19–22DEC99

DPSG,RG40854,360 –19–12OCT99–1/1

T3 - Analog Throttle (A) Input High



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle.

NOTE: The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

This code will set if:

- The analog throttle input voltage exceeds the 4.75 volts. The voltage is higher than what is physically possible for the throttle lever to achieve.

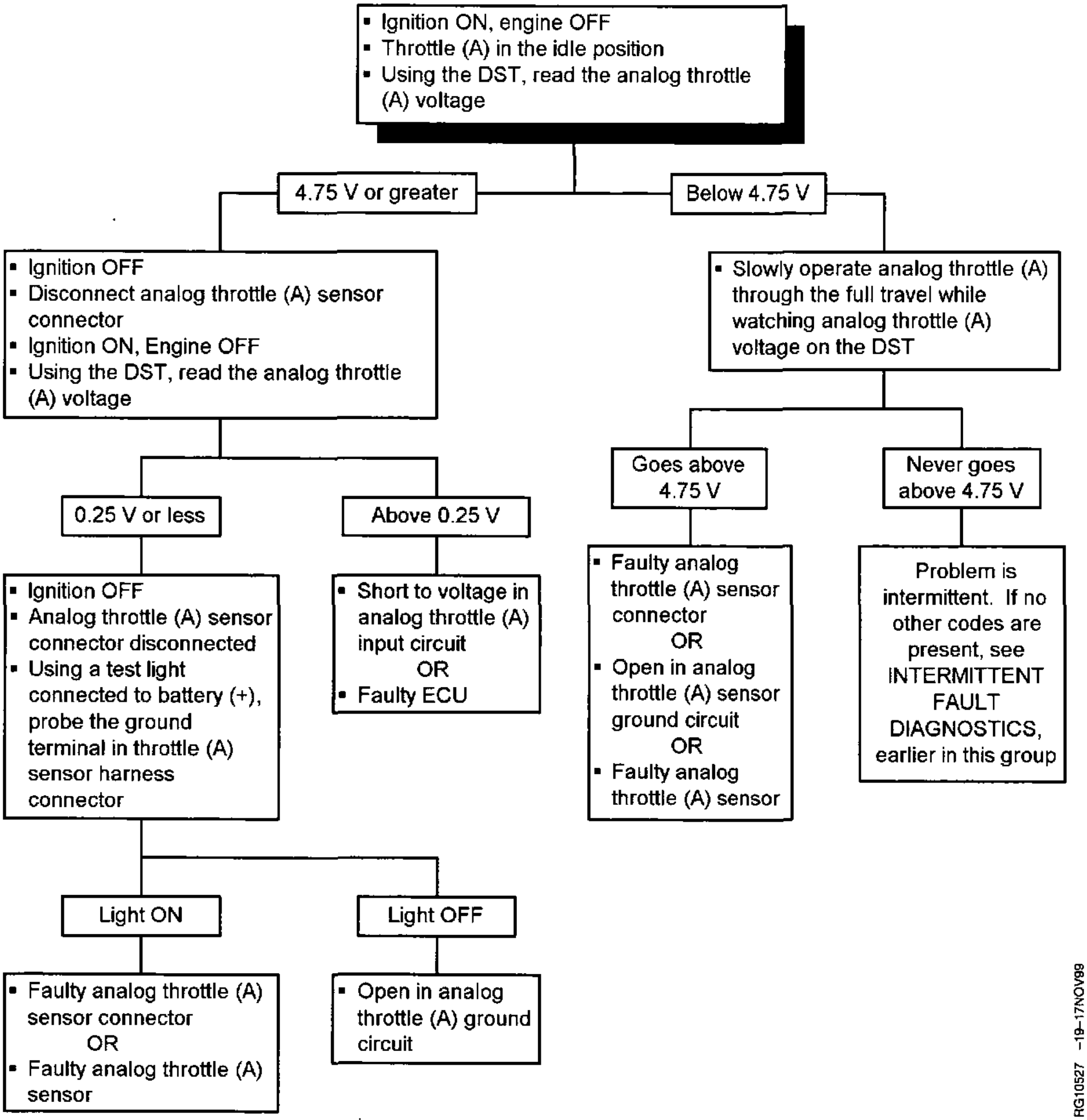
If this code sets, the following will occur:

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

DPSG,RG40854,77 –19–26MAY99–1/1

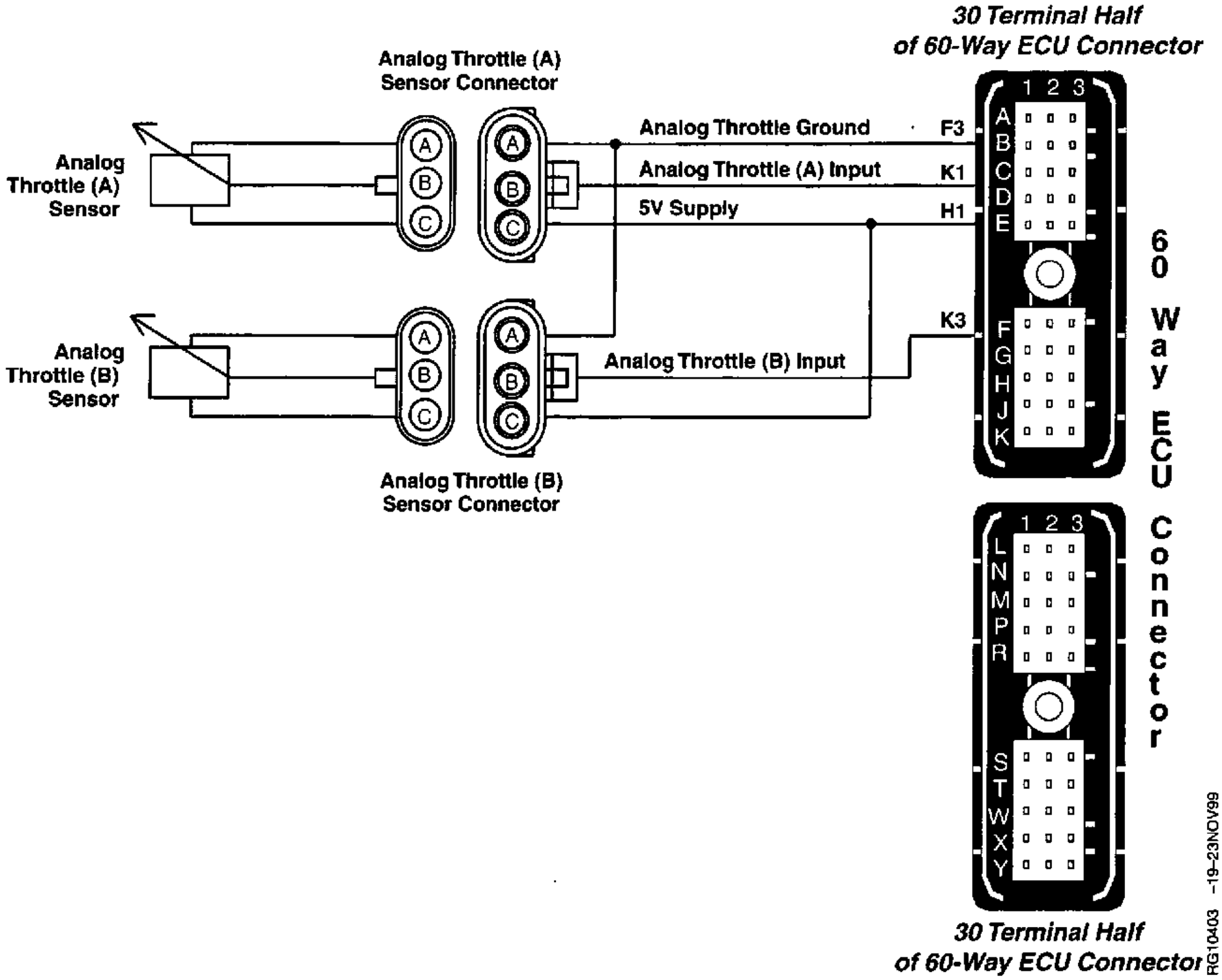
T3 - Analog Throttle (A) Input High - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of black 60-way ECU connector and the analog throttle (A) sensor connector looking for dirty, damaged, or poorly positioned terminals.



DPSG,RG40854,361 –19–12OCT99–1/1

T4 - Analog Throttle (A) Input Low



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle.

NOTE: The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

This code will set if:

- The analog throttle input voltage drops below 0.25 volts. The voltage is lower than what is physically possible for the throttle lever to achieve.

If this code sets, the following will occur:

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

DPSG,RG40854,170 –19–28JUN99–1/1

T4 - Analog Throttle (A) Input Low - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of black 60 way ECU connector and the analog throttle (A) sensor connector looking for dirty, damaged, or poorly positioned terminals.

- Ignition ON, engine OFF
- Throttle (A) in the idle position
- Using the DST, read the analog throttle (A) voltage

0.25 V or less

- Ignition OFF
- Disconnect analog throttle (A) sensor connector
- Install a jumper wire between the 5 V supply terminal and the input terminal in the harness side of the sensor connector
- Ignition ON, engine OFF
- Using the DST read the analog throttle (A) voltage

Below 4.75 V

- Ignition OFF
- Remove jumper wire between the two terminals
- Ignition ON, engine OFF
- Using a multimeter, measure the voltage between the throttle (A) ground terminal and the 5 V supply terminal in the sensor harness connector

Continued on next page

4.75 V or greater

- Faulty analog throttle (A) sensor connector

OR

- Faulty analog throttle (A) sensor

Above 0.25 V

- Slowly operate analog throttle (A) through the full travel while watching the analog throttle (A) voltage on the DST

Goes below 0.25 V

- Faulty analog throttle (A) sensor connector

OR

- Open in analog throttle (A) sensor ground circuit

OR

- Faulty analog throttle (A) sensor

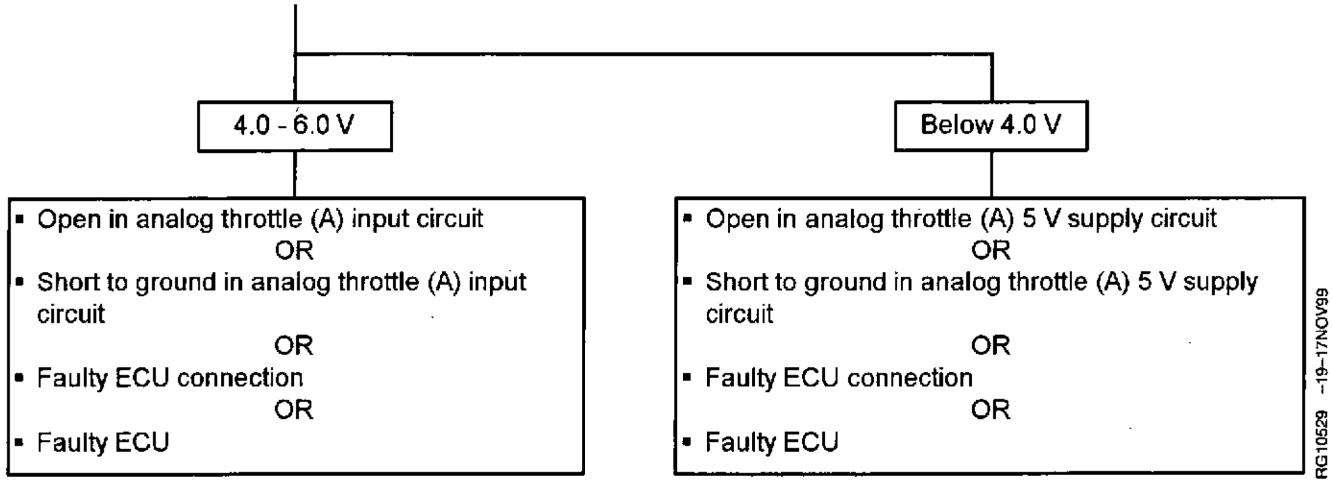
Never goes below 0.25 V

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group

RG10528 -19-17NOV99

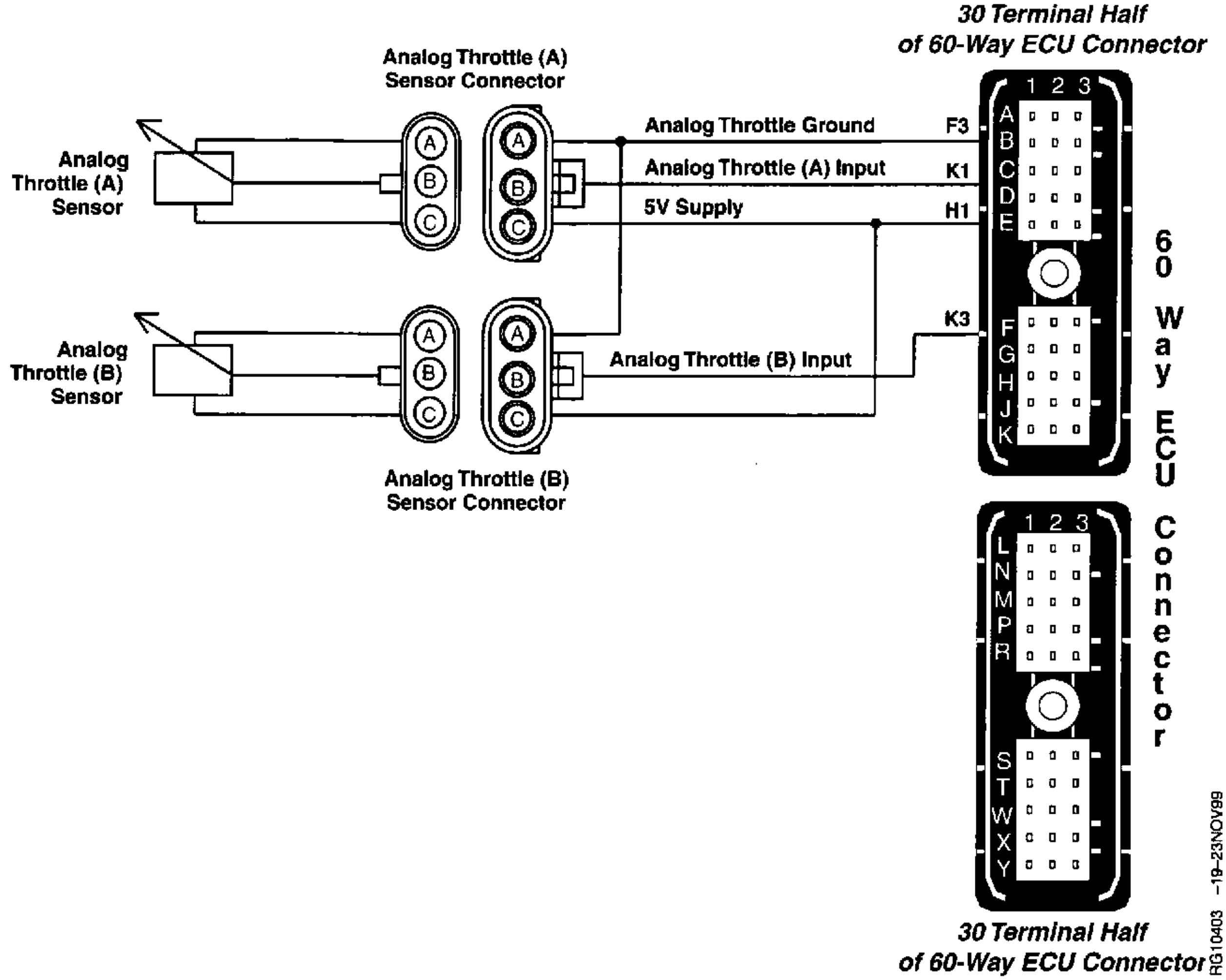
DPSG,RG40854,362 -19-12OCT99-1/1

T4 - Analog Throttle (A) Input Low - Continued



DPSG,RG40854,363 –19–12OCT99–1/1

T5 - Analog Throttle (B) Input High



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle.

NOTE: The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

This code will set if:

- The analog throttle input voltage exceeds 4.75 volts. The voltage is higher than what is physically possible for the throttle lever to achieve.

If this code sets, the following will occur:

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

DPSG,RG40854,296 –19–26AUG99–1/1

T5 - Analog Throttle (B) Input High - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of 60-way ECU connector and the analog throttle (B) sensor connector looking for dirty, damaged, or poorly positioned terminals.

- Ignition ON, engine OFF
- Analog throttle (B) in the idle position
- Using the DST, read analog throttle (B) voltage

4.75 V or greater

- Ignition OFF
- Disconnect analog throttle (B) sensor connector
- Ignition ON, Engine OFF
- Using the DST, read the analog throttle (B) voltage

0.25 V or less

- Ignition OFF
- Analog throttle (B) sensor connector disconnected
- Using a test light connected to battery (+), probe the ground terminal (B) in analog throttle sensor harness connector

Light ON

- Faulty analog throttle (B) sensor connector

OR

- Faulty analog throttle (B) sensor

Light OFF

- Open in analog throttle (B) ground circuit

Above 0.25 V

- Short to voltage in analog throttle (B) input circuit

OR

- Faulty ECU

Below 4.75 V

- Slowly operate analog throttle (B) through the full travel while watching the analog throttle (B) voltage on the DST

Goes above 4.75 V

- Faulty analog throttle (B) sensor connector

OR

- Open in analog throttle (B) sensor ground circuit

OR

- Faulty analog throttle (B) sensor

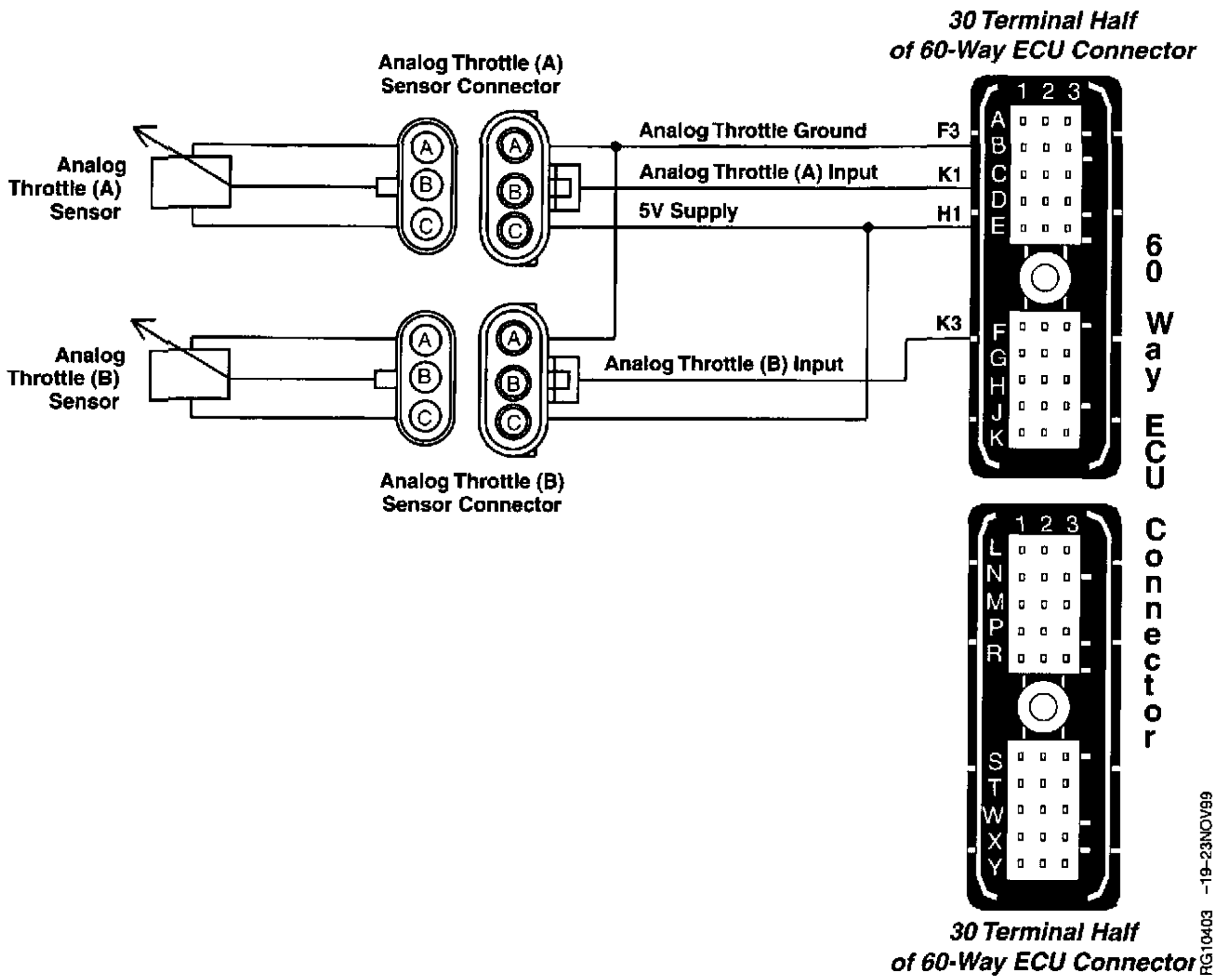
Never goes above 4.75 V

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group

RG10534 –19–17NOV99

DPSG,RG40854,364 –19–12OCT99–1/1

T6 - Analog Throttle (B) Input Low



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

Analog Throttle Position Sensor

- The analog throttle position sensor is a variable resistor (potentiometer) used to measure the position of the throttle. The throttle input voltage normally varies between 1.0 and 4.0 volts depending on throttle position. Analog throttle voltage at low idle will be approximately 1.0 volt and 4.0 volts at high idle.

NOTE: The ECU has the ability to learn different voltages for low and high idle, so the voltages above may change depending on application.

This code will set if:

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

If this code sets, the following will occur:

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

DPSG,RG40854,297 -19-26AUG99-1/1

T6 - Analog Throttle (B) Input Low - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of 60-way ECU connector and the analog throttle (B) sensor connector looking for dirty, damaged, or poorly positioned terminals.

- Ignition ON, engine OFF
- Analog throttle (B) in the idle position
- Using the DST, read the analog throttle (B) voltage

0.25 V or less

- Ignition OFF
- Disconnect analog throttle (B) sensor connector
- Install a jumper wire between the 5 V supply terminal and the input terminal in the harness side of the sensor connector
- Ignition ON, engine OFF
- Using the DST read analog throttle (B) voltage

Below 4.75 V

- Ignition OFF
- Remove jumper wire between the two terminals
- Ignition ON, engine OFF
- Using a multimeter, measure the voltage between the throttle ground terminal and the 5 V supply terminal in the sensor harness connector

Continued on next page

4.75 V or greater

- Faulty analog throttle (B) sensor connector

OR

- Faulty analog throttle (B) sensor

Above 0.25 V

- Slowly operate analog throttle (B) through the full travel while watching analog throttle (B) voltage on the DST

Goes below 0.25 V

- Faulty analog throttle (B) sensor connector

OR

- Open in analog throttle (B) sensor ground circuit

OR

- Faulty analog throttle (B) sensor

Never goes below 0.25 V

Problem is intermittent. If no other codes are *present*, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group

RG10535 –19–17NOV99

DPSG,RG40854,365 –19–12OCT99–1/1

T6 - Analog Throttle (B) Input Low - Continued

4.0 - 6.0 V

- Open in analog throttle (B) input circuit

  OR
- Short to ground in analog throttle (B) input circuit

  OR
- Faulty ECU connection

  OR
- Faulty ECU

Below 4.0 V

- Open in analog throttle (B) 5 V supply circuit

  OR
- Short to ground in analog throttle (B) 5 V supply circuit

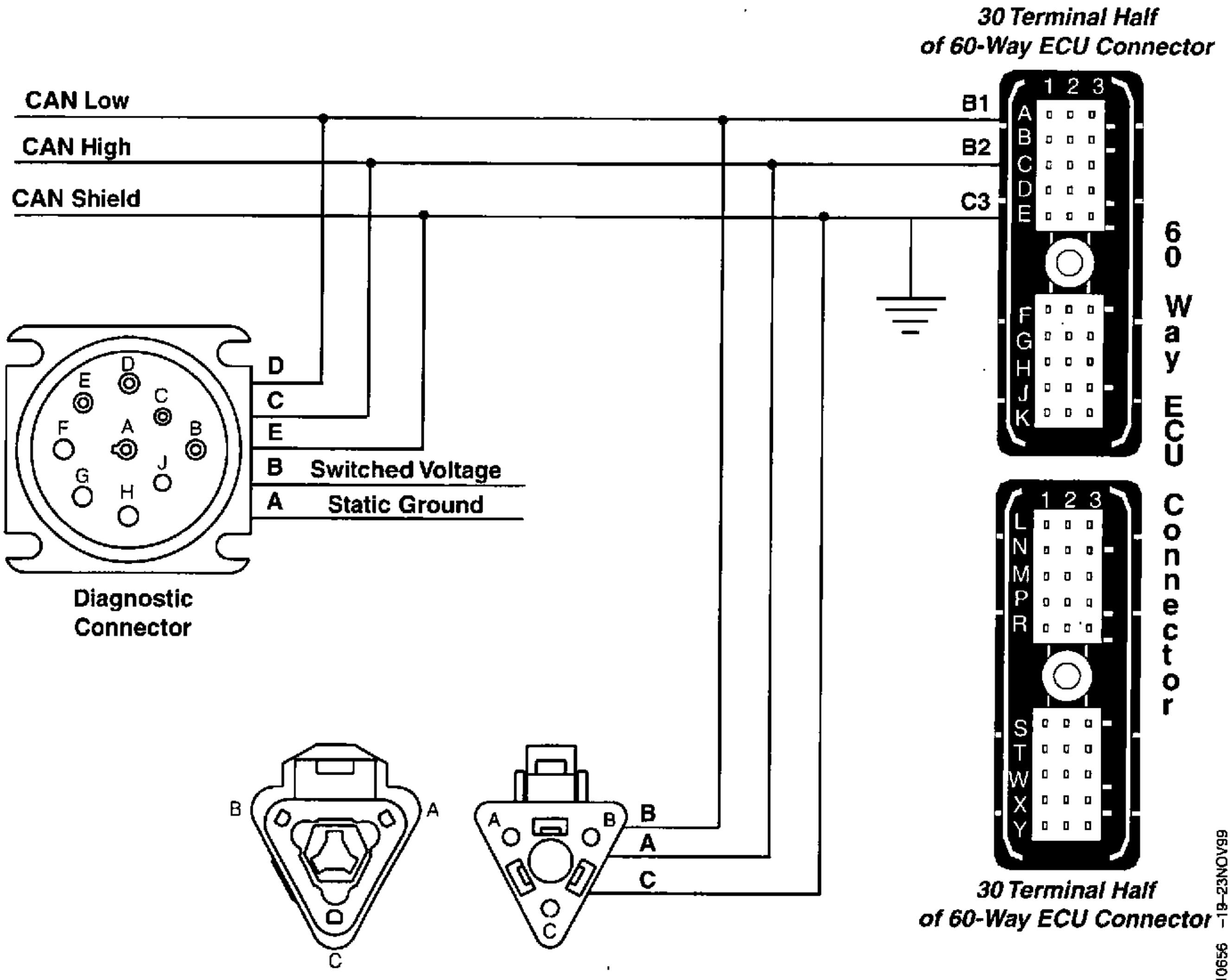
  OR
- Faulty ECU connection

  OR
- Faulty ECU

RG10536 –19–17NOV99

DPSG,RG40854,366 –19–12OCT99–1/1

T7 - CAN Throttle Invalid



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

CAN (Controller Area Network) Throttle

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

This code will set if:

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

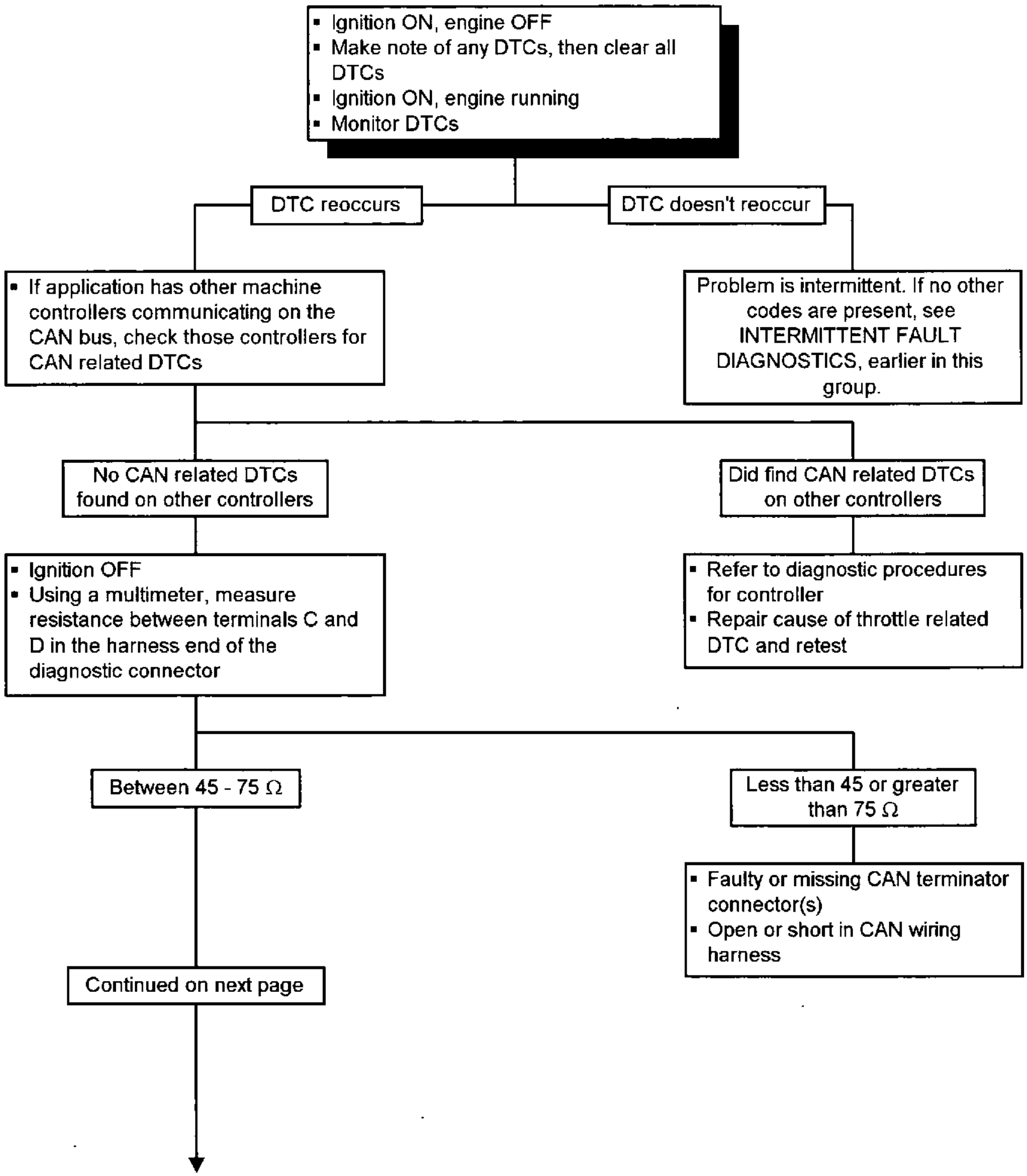
If this code sets, the following will occur:

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

DPSG,RG40854,209 -19-29JUN99-1/1

T7 - CAN Throttle Invalid - Continued

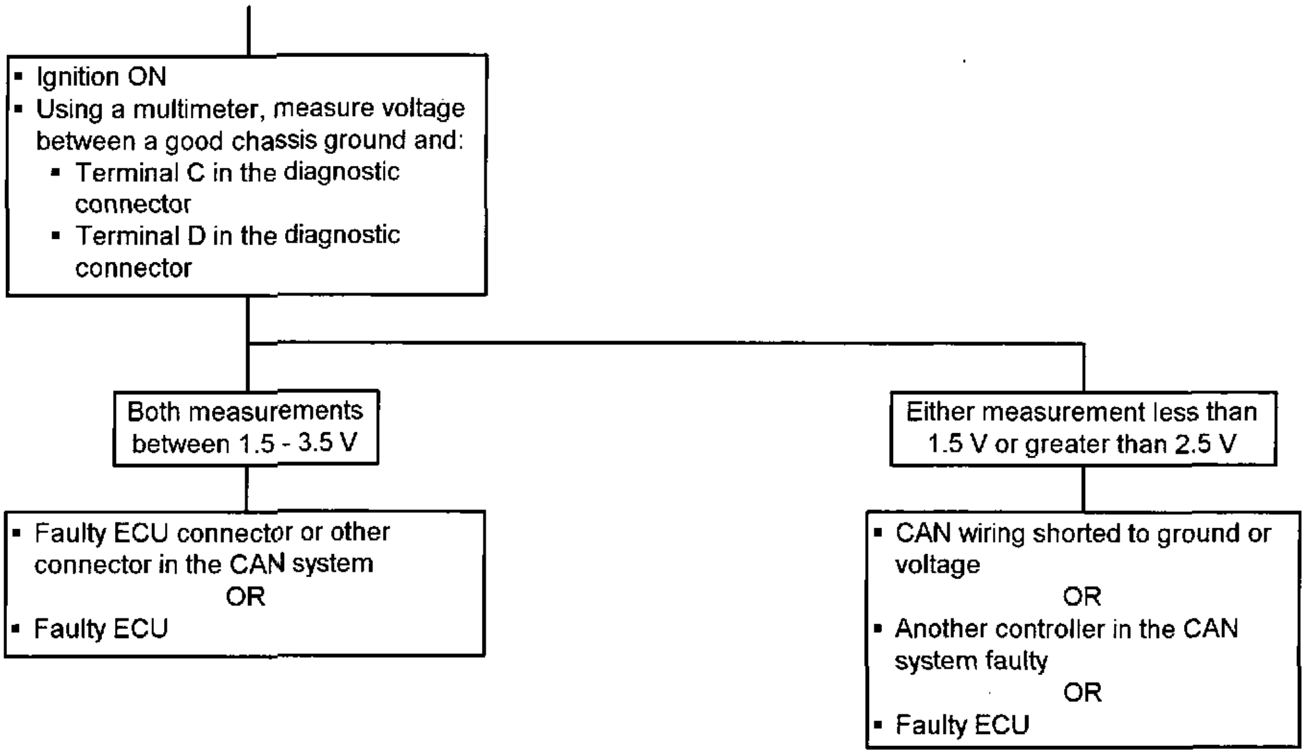
Note: Before using this diagnostic procedure, perform a preliminary inspection of 60-way ECU connector looking for dirty, damaged, or poorly positioned terminals.



RG10537 –19–17NOV99

DPSG,RG40854,367 –19–12OCT99–1/1

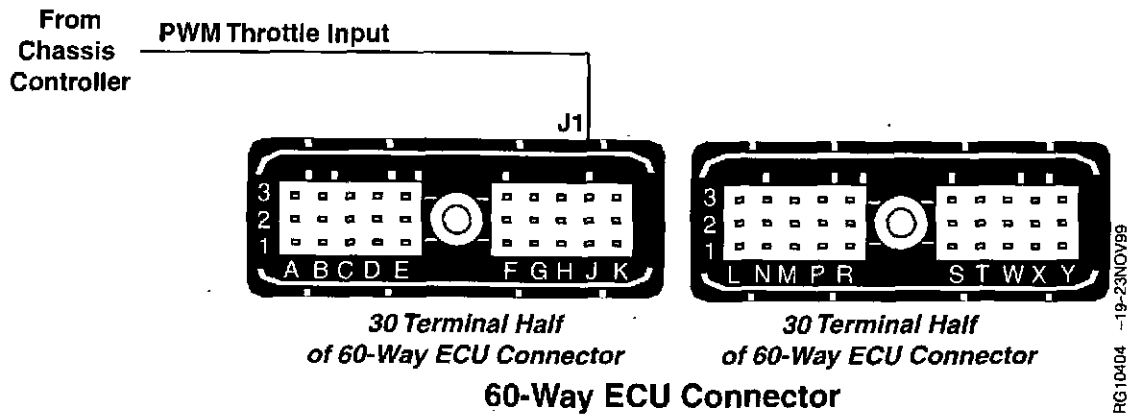
T7 - CAN Throttle Invalid - Continued



RG10538 –19–17NOV99

DPSG,RG40854,368 –19–12OCT99–1/1

T8 - PWM Throttle Input High



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

PWM (Pulse Width Modulated) Throttle Position Input

- The PWM throttle signal is sent to the ECU by the Chassis Computer. The PWM signal is a square wave signal with a constant frequency. The pulse-width of the signal (amount of time the signal is high) varies as throttle input from the Chassis Computer varies.

This code will set if:

- The pulse-width of the PWM signal is greater than the normal operating range of the signal.

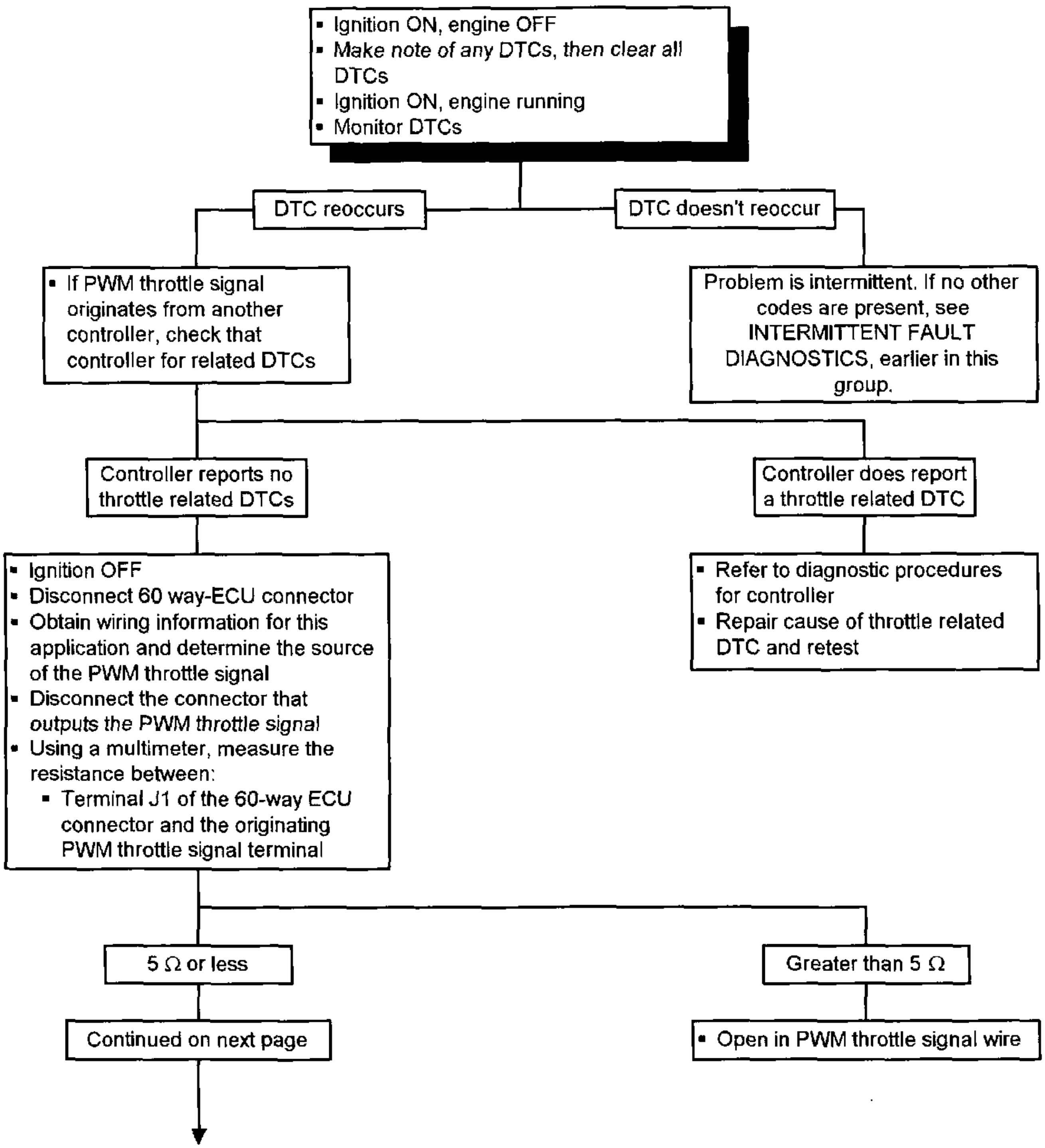
If this code sets, the following will occur:

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

DPSG,RG40854,294 -19-26AUG99-1/1

T8 - PWM Throttle Input High - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of 60-way ECU connector and the throttle sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10530 –19–17NOV99

DPSG,RG40854,369 –19–12OCT99–1/1

T8 - PWM Throttle Input High - Continued

- Ignition OFF
- 60-way ECU connector and the other signal source controller still disconnected
- Using a multimeter measure resistance between terminal J1 in the harness end of the 60-way ECU connector and:
  - All other terminals in that connector
  - A good chassis ground

All measurements greater than 2 kΩ

- Ignition OFF
- 60-way ECU connector still disconnected
- Reconnect PWM signal source connector
- Ignition ON
- Using a multimeter, measure voltage while operating the throttle, between:
  - Terminal J1 in the harness end of the 60-way ECU connector and a good chassis ground

Between 0.5 V and 4.8V

- Faulty PWM signal source controller

  OR
- Wrong ECU for the vehicle

  OR
- Faulty ECU connector

  OR
- Faulty ECU

Less than 0.5 V or greater than 4.8V

- Faulty PWM throttle signal source controller connector

  OR
- Faulty PWM throttle signal source controller

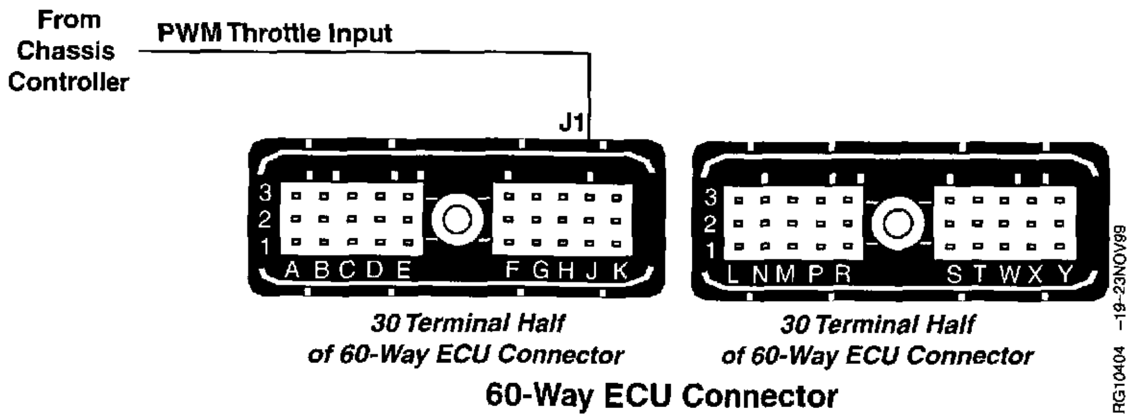
Any measurement less than 2 kΩ

- Short in PWM circuit

RG10531 –19–22DEC99

DPSG,RG40854,370 –19–12OCT99–1/1

T9 - PWM Throttle Input Low



60-Way ECU Connector

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

PWM (Pulse Width Modulated) Throttle Position Input

- The PWM throttle signal is sent to the ECU by the Chassis Computer. The PWM signal is a square wave signal with a constant frequency. The pulse-width of the signal (amount of time the signal is high) varies as throttle input from the Chassis Computer varies.

This codes will set if:

- The ECU senses that the pulse-width of the PWM signal is lower than the normal operating range of the signal.

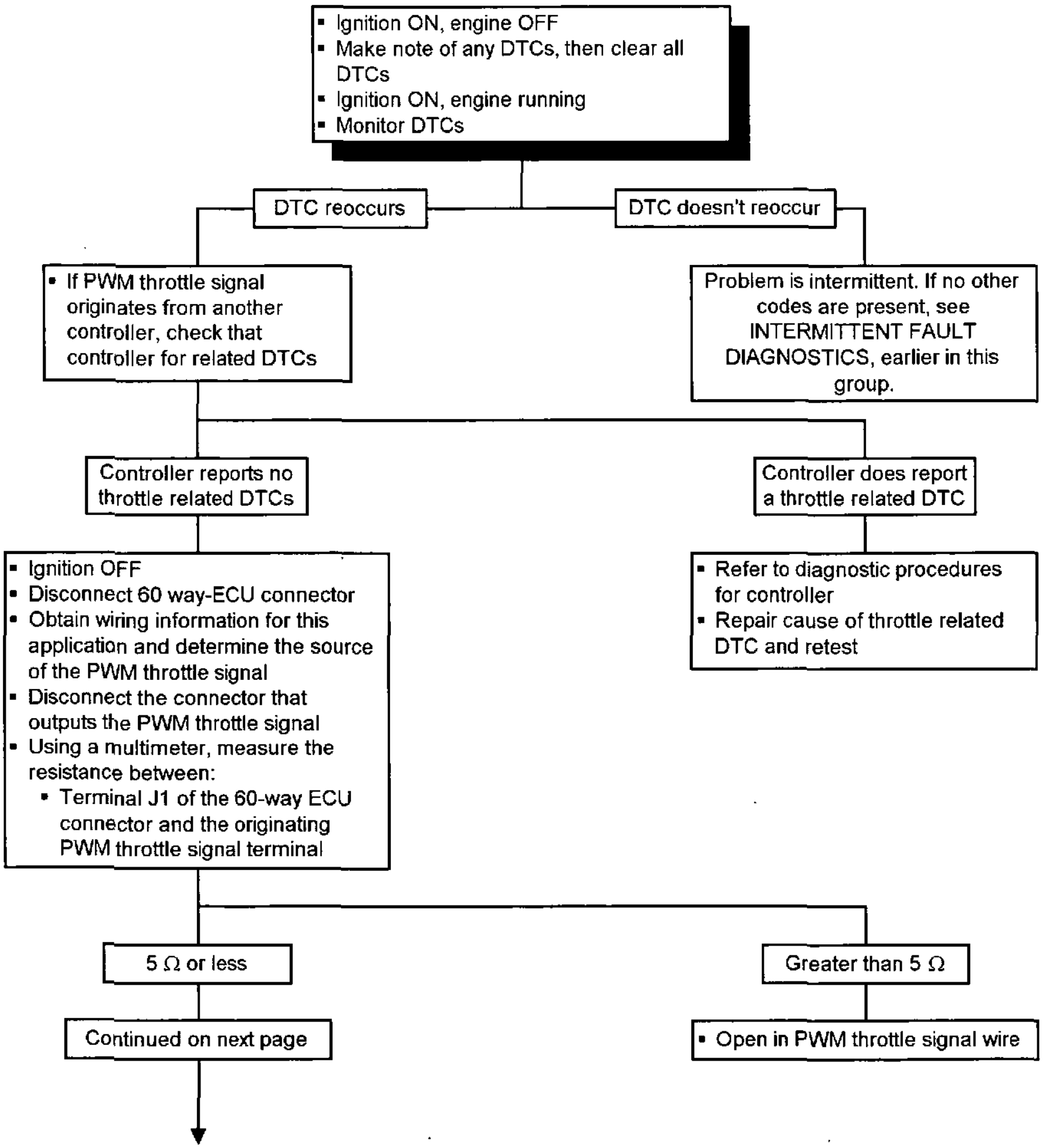
If this code sets, the following will occur:

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

DPSG,RG40854,295 -19-26AUG99-1/1

T9 - PWM Throttle Input Low - Continued

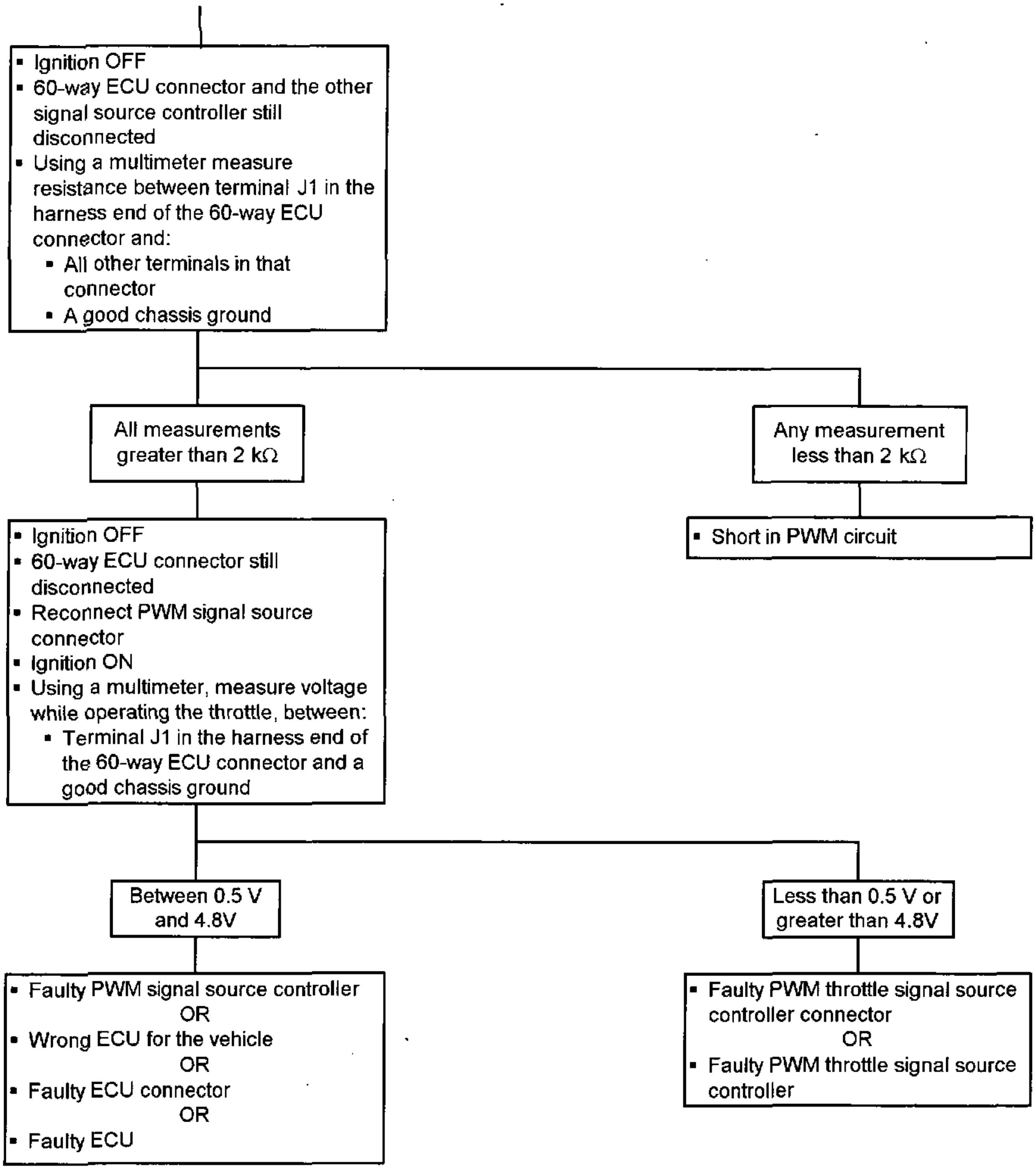
Note: Before using this diagnostic procedure, perform a preliminary inspection of 60-way ECU connector and the throttle sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10532 –19–17NOV99

DPSG,RG40854,371 –19–12OCT99–1/1

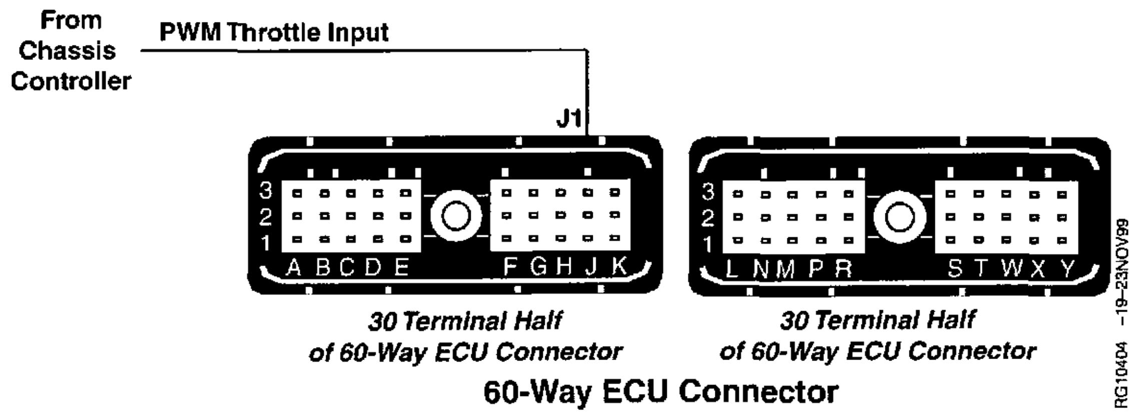
T9 - PWM Throttle Input Low - Continued



RG10533 -19-22DEC99

DPSG,RG40854,372 -19-12OCT99-1/1

T10 - PWM Throttle Abnormal Pulse Width



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

PWM (Pulse Width Modulated) Throttle Position Input

- The PWM throttle signal is sent to the ECU by the Chassis Computer. The PWM signal is a square wave signal with a constant frequency. The pulse-width of the signal (amount of time the signal is high) varies as throttle input from the Chassis Computer varies.

This code will set if:

- The ECU senses that the frequency of the PWM signal is not within range.

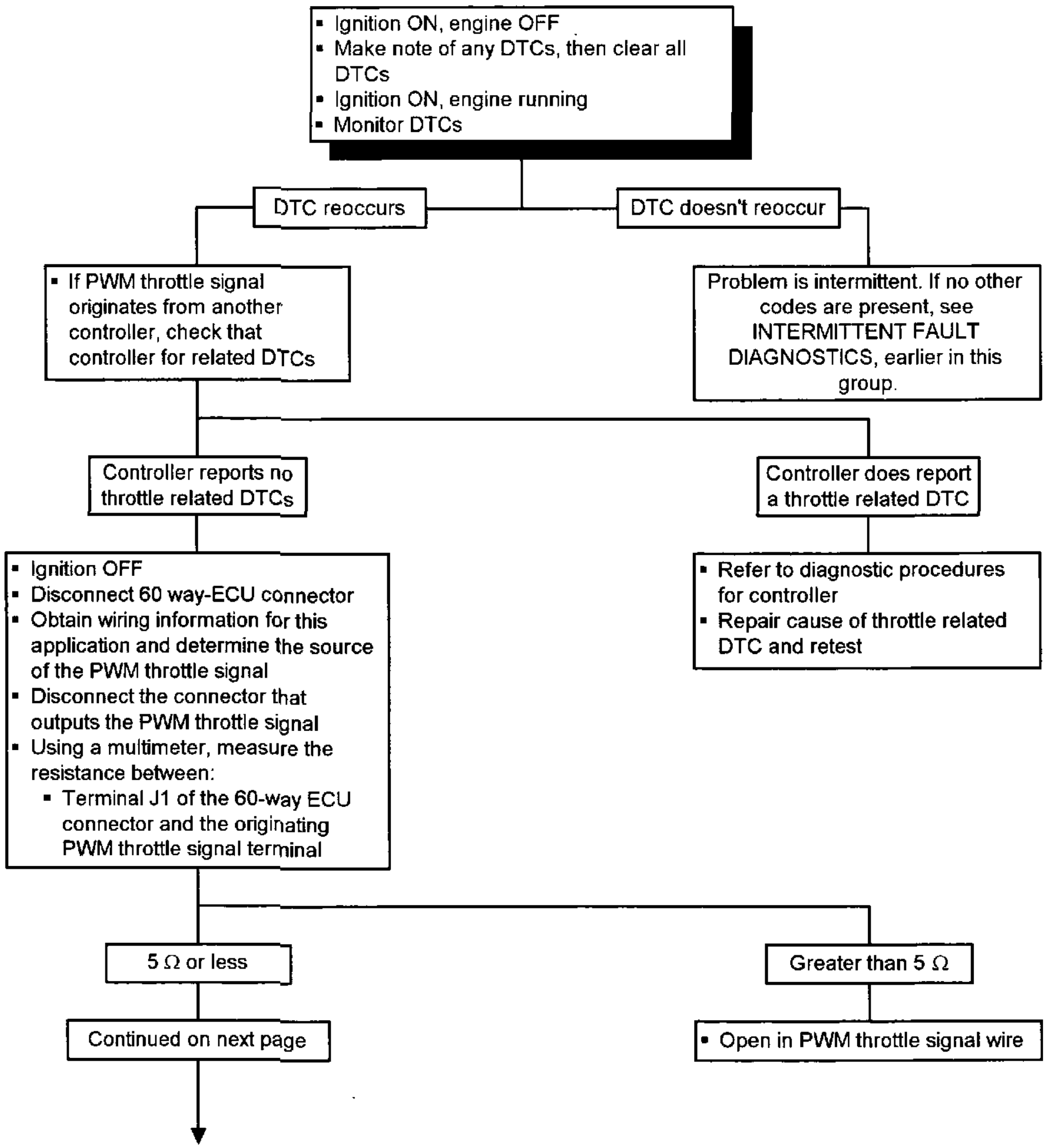
If this code sets, the following will occur:

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

DPSG,RG40854,171 –19–28JUN99–1/1

T10 - PWM Throttle Abnormal Pulse Width - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of 60-way ECU connector and the throttle sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10530 –19–17NOV99

DPSG,RG40854,373 –19–12OCT99–1/1

T10 - PWM Throttle Abnormal Pulse Width - Continued

- Ignition OFF
- 60-way ECU connector and the other signal source controller still disconnected
- Using a multimeter measure resistance between terminal J1 in the harness end of the 60-way ECU connector and:
  - All other terminals in that connector
  - A good chassis ground

All measurements greater than 2 kΩ

- Ignition OFF
- 60-way ECU connector still disconnected
- Reconnect PWM signal source connector
- Ignition ON
- Using a multimeter, measure voltage while operating the throttle, between:
  - Terminal J1 in the harness end of the 60-way ECU connector and a good chassis ground

Between 0.5 V and 4.8V

- Faulty PWM signal source controller

OR

- Wrong ECU for the vehicle

OR

- Faulty ECU connector

OR

- Faulty ECU

Less than 0.5 V or greater than 4.8V

- Faulty PWM throttle signal source controller connector

OR

- Faulty PWM throttle signal source controller

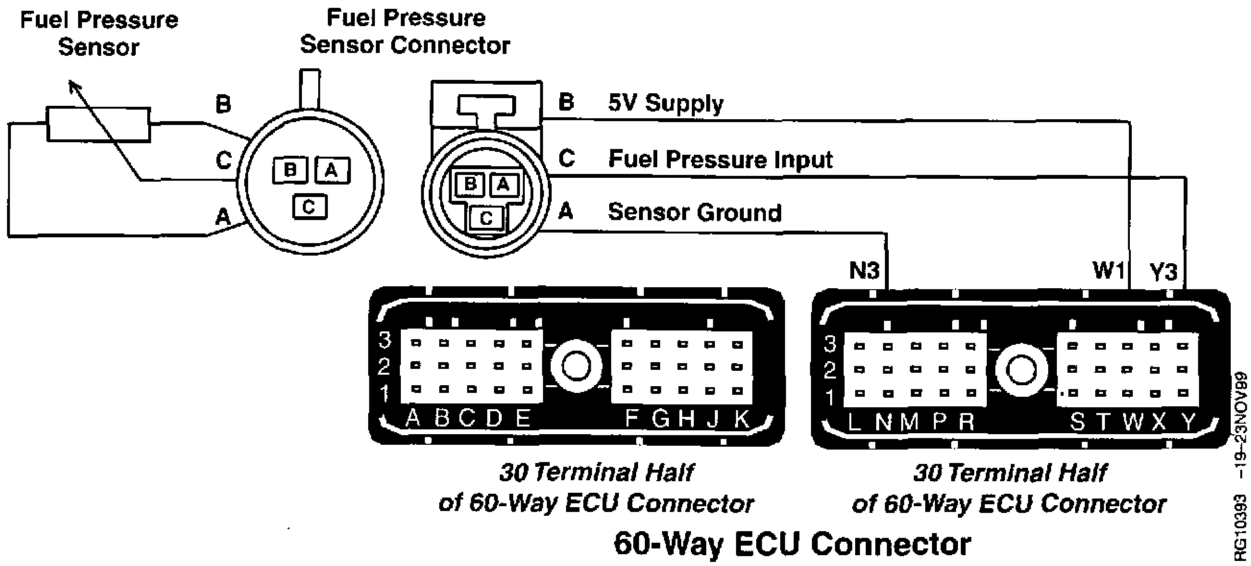
Any measurement less than 2 kΩ

- Short in PWM circuit

RG10531 –19–22DEC99

DPSG,RG40854,468 –19–17NOV99–1/1

DTC SPN 94 FMI 1 Fuel Supply Pressure Extremely Low



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

Fuel Pressure Sensor

- The fuel pressure sensor uses a pressure transducer to measure the fuel pressure before the transfer pump. It is located in a fuel manifold behind the fuel filter. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases.

DTC SPN 94 FMI 1 will set if:

- The fuel pressure is below 200 kPa (43.5 psi) (2 bar) at any engine speed.

If DTC SPN 94 FMI 1 sets, the following will occur:

- ECUs that have engine protection with shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 and DTC SPN 1109 FMI 31 may also be present). If fuel pressure does not set within the shutdown value within 30 seconds, the ECU will shut down the engine.

NOTE: For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%.

- ECUs that have engine protection without shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 will also be present), but will not shut the engine down.

NOTE: For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%.

- ECUs that have no engine protection:
  - There will be no derate and the ECU will not shut the engine down.

DPSG,RG40854,300 –19–26AUG99–1/1

DTC SPN 94 FMI 1 Fuel Supply Pressure Extremely Low - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the fuel pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.

Before using this diagnostic chart, check for the following that could cause or be mistaken as low fuel pressure:

- If fuel system has been recently opened (filter changed, line removed etc.), check affected o-rings on fitting and filter for air leaks.
- If no leaks detected, perform fuel system bleed procedure. See BLEED SINGLE RAIL FUEL SYSTEM in Group 105 and retest.
- Check fuel quantity
- Check for ruptured fuel line.

- Connect a 0-1000 kPa (0-150 psi) gauge to the quick disconnect after removing the dust cap and cleaning the quick disconnect.
- Start engine and check fuel pressure at idle and at rated speed.
- If engine won't start, check fuel pressure while cranking.

- Fuel Pressure Specification:
  - Cranking: 135-175 kPa (20-25 psi)
  - Idle: 410-555 kPa (60-80 psi)
  - Rated speed: 480-620 kPa (70-90 psi)

Fuel pressure below specification for any condition

- Check fuel system for low supply pressure. See F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK in Group 105.

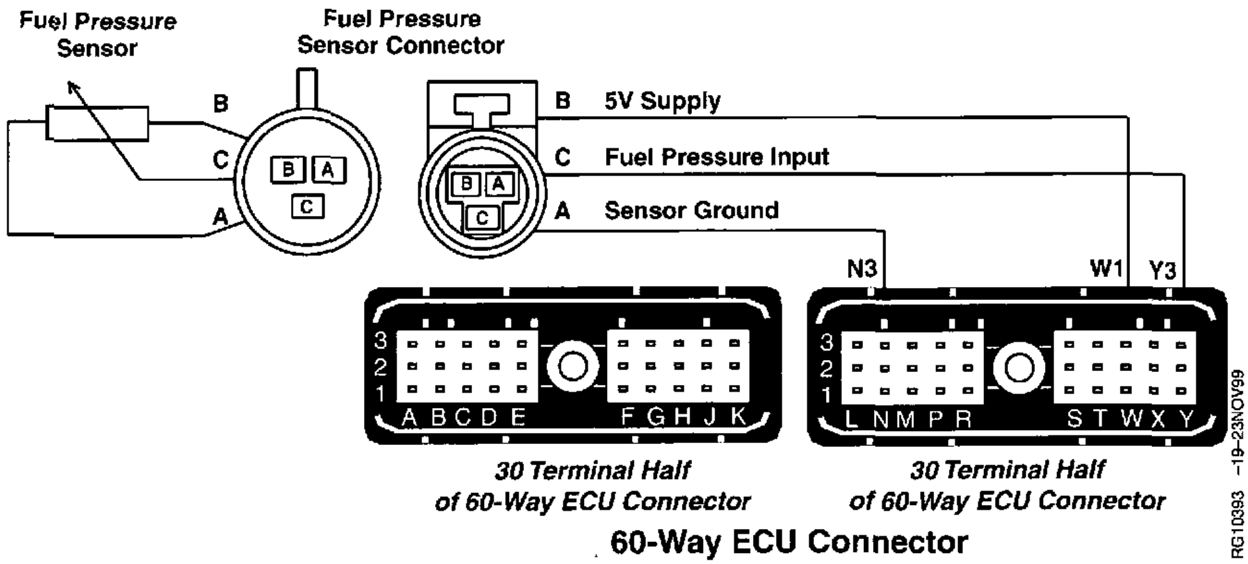
Fuel Pressure within specification for ALL conditions

- Verify that fuel pressure sensor 5 V supply, input, and ground circuits are OK.
- If fuel pressure sensor circuits are OK, replace fuel pressure sensor and retest

RG10494 -19-05JAN00

DPSG,RG40854,374 -19-12OCT99-1/1

DTC SPN 94 FMI 3 Fuel Supply Pressure Input Voltage High



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

Fuel Pressure Sensor

- The fuel pressure sensor uses a pressure transducer to measure the fuel pressure before the transfer pump. It is located in a fuel manifold behind the fuel filter. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases.

DTC SPN 94 FMI 3 will set if:

- The fuel pressure input voltage exceeds 4.75 volts. This voltage corresponds to a pressure that is higher than what is physically possible for fuel pressure.

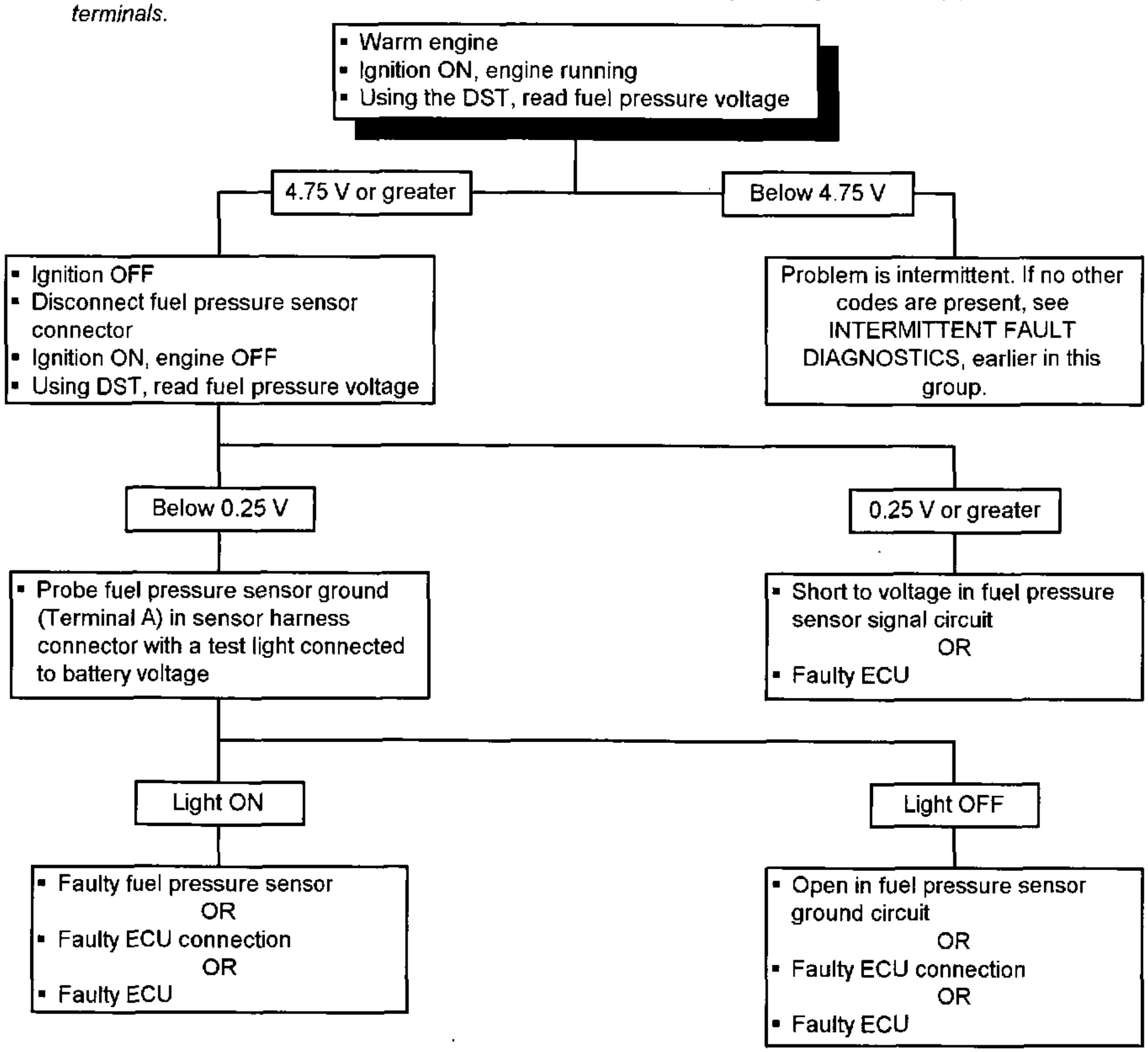
If DTC SPN 94 FMI 3 sets, the following will occur:

- ECU's fuel pressure engine protection feature disabled.

DPSG,RG40854,301 –19–26AUG99–1/1

DTC SPN 94 FMI 3 Fuel Supply Pressure Input Voltage High - Continued

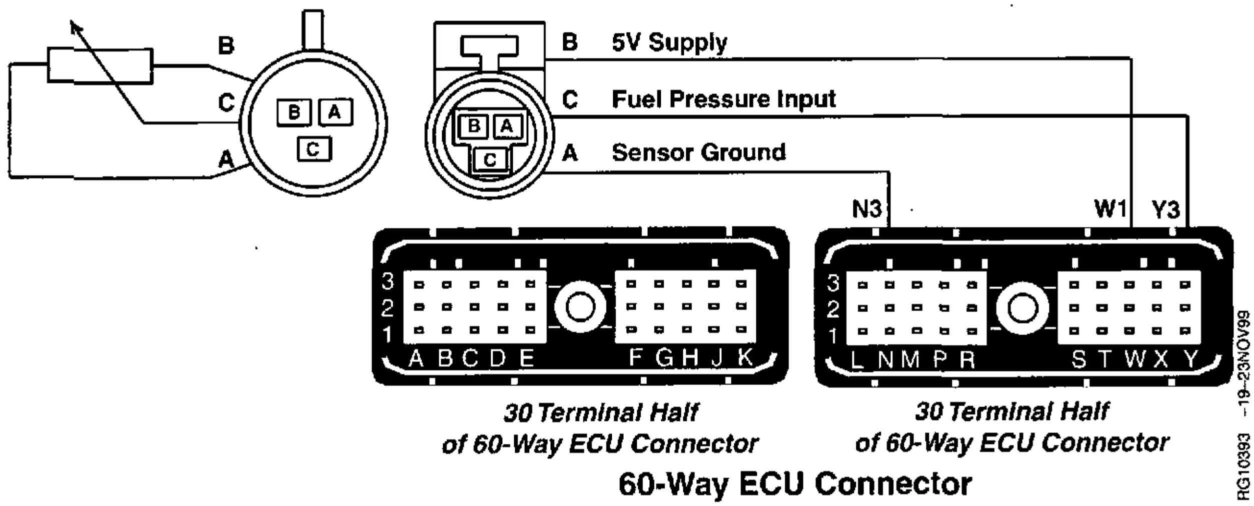
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the fuel pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10495 –19–22NOV99

DPSG,RG40854,375 –19–12OCT99–1/1

DTC SPN 94 FMI 4 Fuel Supply Pressure Input Voltage Low



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

Fuel Pressure Sensor

- The fuel pressure sensor uses a pressure transducer to measure the fuel pressure before the transfer pump. It is located in a fuel manifold behind the fuel filter. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases.

DTC SPN 94 FMI 4 will set if:

- The fuel pressure input voltage drops below 0.25 volts. This voltage corresponds to a pressure that is lower than what is physically possible for fuel pressure.

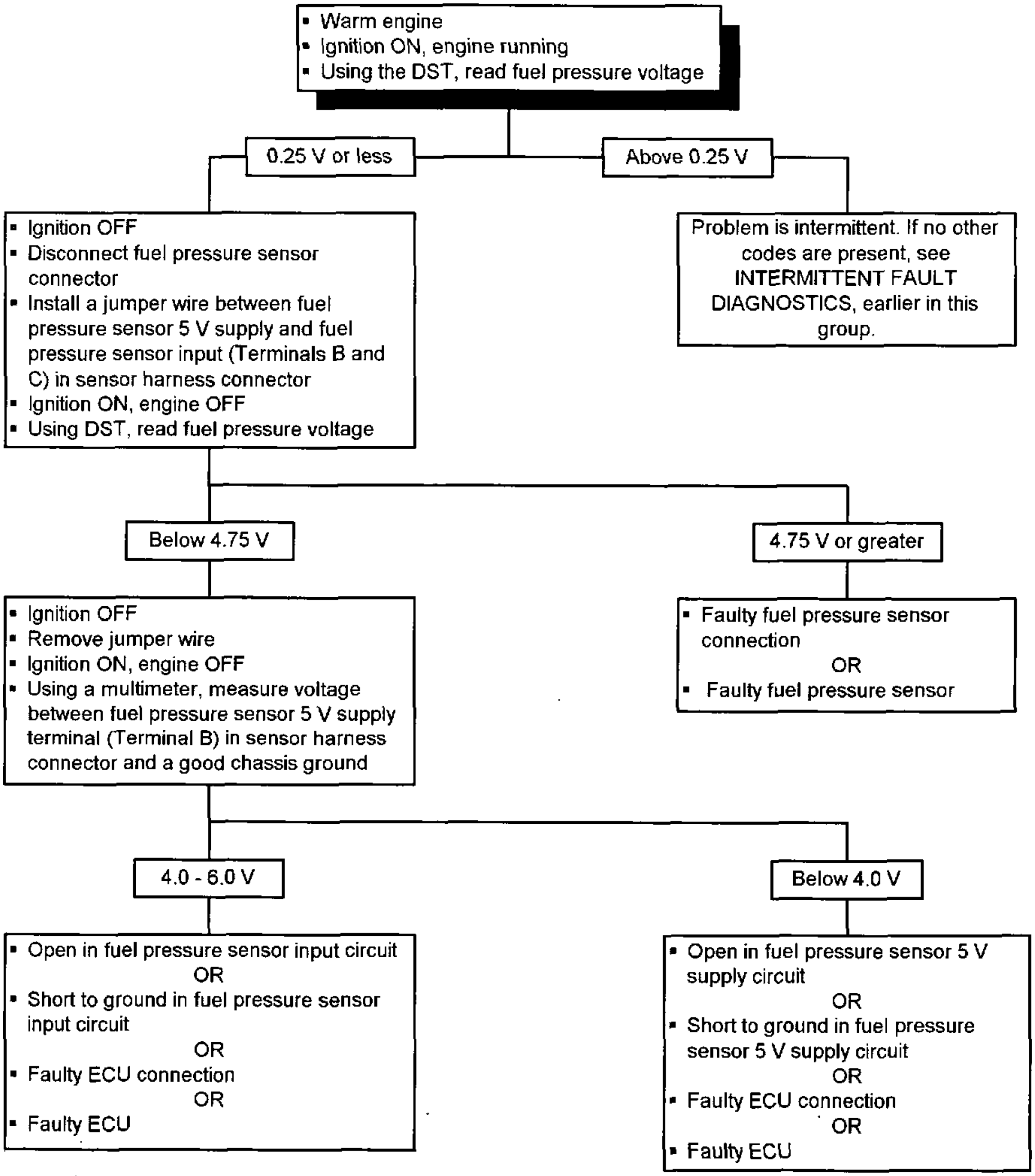
If DTC SPN 94 FMI 4 sets, the following will occur:

- ECU's fuel pressure engine protection feature disabled.

DPSG,RG40854,302 -19-26AUG99-1/1

DTC SPN 94 FMI 4 Fuel Supply Pressure Input Voltage Low - Continued

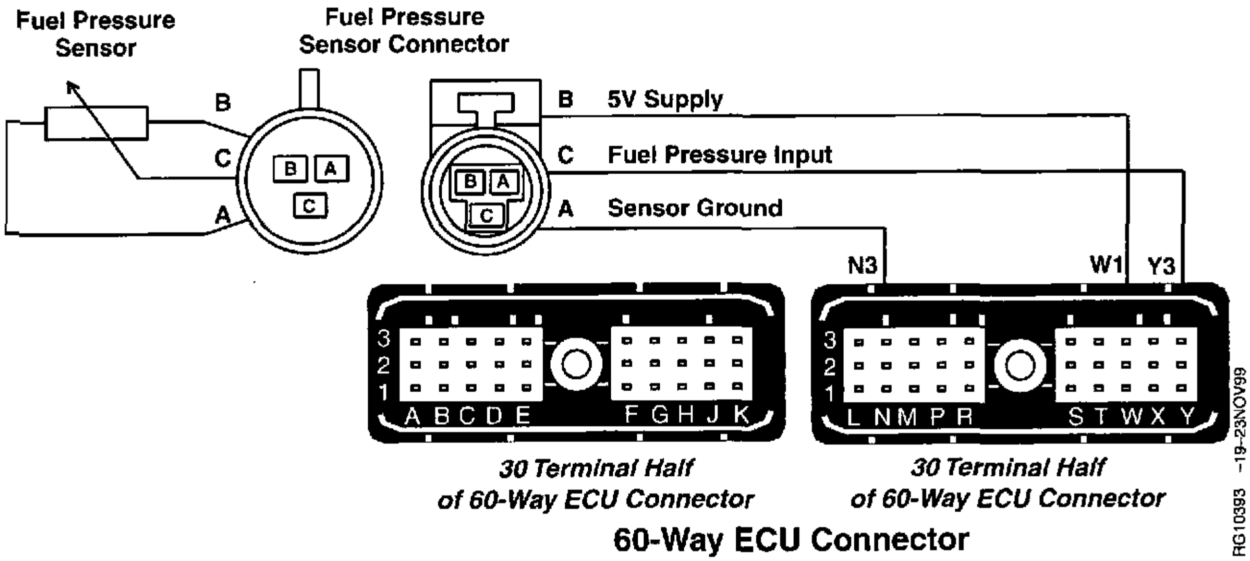
Note: Before using this diagnostic procedure, perform a preliminary inspection of 60-way ECU connector and the fuel pressure sensor connector, looking for dirty, damaged, or poorly positioned terminals.



RG10496 –19–17NOV99

OPSG,RG40854,376 –19–12OCT99–1/1

DTC SPN 94 FMI 16 Fuel Supply Pressure Moderately High



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

Fuel Pressure Sensor

- The fuel pressure sensor uses a pressure transducer to measure the fuel pressure before the transfer pump. It is located in a fuel manifold behind the fuel filter. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases.

DTC SPN 94 FMI 16 will set if:

- The ECU senses a fuel pressure above the warning value set point in the ECU. The warning value set point is dependent of engine speed.

If DTC SPN 94 FMI 16 sets, the following will occur:

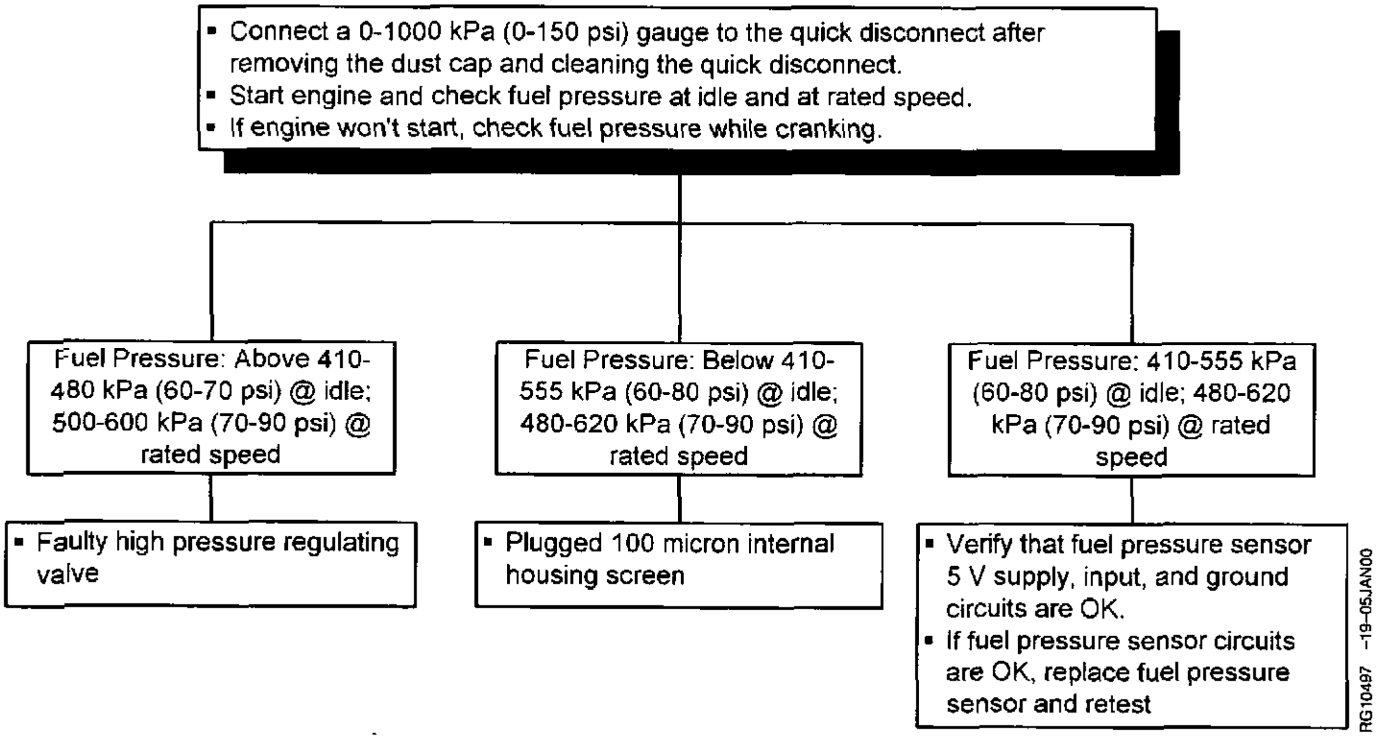
- ECU's that have engine protection:
  - Will derate the engine (DTC SPN 1569 FMI 31 will also be present) 2% per minute to a maximum derate of 20%. When fuel pressure drops back below the maximum value set point, power will be increased 2% per minute until either full power is reached or if the maximum value set point is surpassed again.

NOTE: The derate program shown applies to OEM engine applications that contain engine protection. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.

DPSG,RG40854,303 –19–26AUG99–1/1

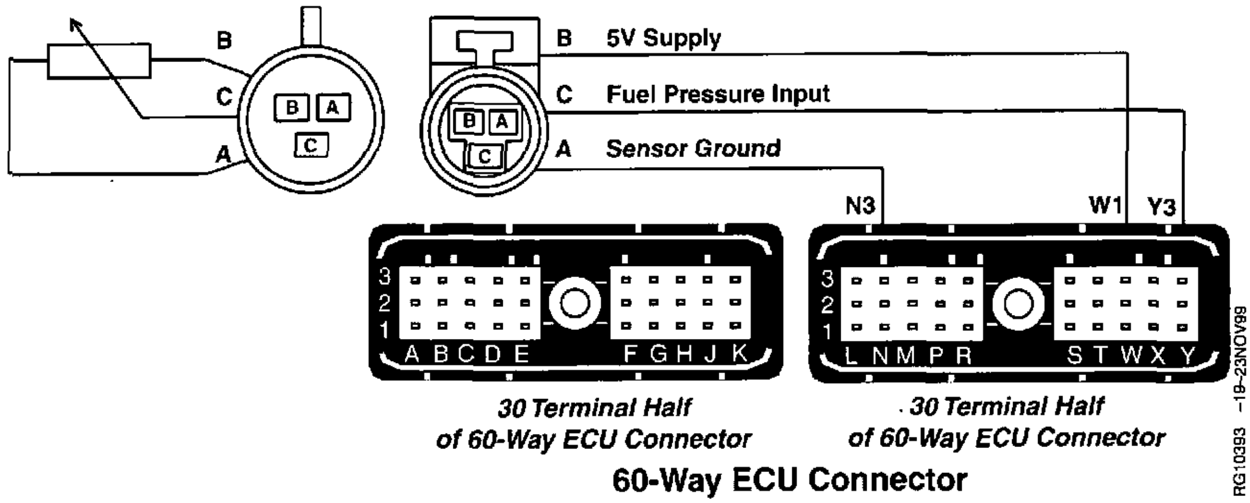
DTC SPN 94 FMI 16 Fuel Supply Pressure Moderately High - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the fuel pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.



DPSG,RG40854,377 –19–12OCT99–1/1

DTC SPN 94 FMI 18 Fuel Supply Pressure Moderately Low



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

Fuel Pressure Sensor

- The fuel pressure sensor uses a pressure transducer to measure the fuel pressure before the transfer pump. It is located in a fuel manifold behind the fuel filter. The fuel pressure intake voltage varies as fuel pressure varies. As the pressure increases, the input voltage to the ECU increases.

DTC SPN 94 FMI 18 will set if:

- The fuel pressure is below 300 kPa (29 psi) (3 bar) at any engine speed.

If DTC SPN 94 FMI 18 sets, the following will occur:

- ECU's that have engine protection:
  - Will derate the engine (DTC SPN 1569 FMI 31 will also be present) at 2% per minute to a maximum derate of 20%. When fuel pressure increases above the minimum value set point, power will be increased 2% per minute until full power is reached or fuel pressure drops below the minimum value set point again.
  - If in spite of the derate, fuel pressure continues to drop, ECUs that have engine protection with shutdown will shut the engine down when fuel pressure drops below the shutdown value set point in the ECU. The shutdown value set point is dependent on engine speed.

NOTE: The derate program shown applies to OEM engine applications that contain engine protection. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.

DPSG,RG40854,304 –19–26AUG99–1/1

DTC SPN 94 FMI 18 Fuel Supply Pressure Moderately Low - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the fuel pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.

Before using this diagnostic chart, check for the following that could cause or be mistaken as low fuel pressure:

- If fuel system has been recently opened (filter changed, line removed etc.), check affected o-rings on fitting and filter for air leaks.
- If no leaks detected, perform fuel system bleed procedure. See BLEED SINGLE RAIL FUEL SYSTEM in Group 105 and retest.
- Check fuel quantity.
- Check for ruptured fuel line.

- Connect a 0-1000 kPa (0-150 psi) gauge to the quick disconnect after removing the dust cap and cleaning the quick disconnect.
- Start engine and check fuel pressure at idle and at rated speed.
- If engine won't start, check fuel pressure while cranking.

- Fuel Pressure Specification:
  - Cranking: 135-175 kPa (20-25 psi)
  - Idle: 410-555 kPa (60-80 psi)
  - Rated speed: 480-620 kPa (70-90 psi)

Fuel pressure below specification for any condition

- Check fuel system for low supply pressure. See F4 - SINGLE RAIL FUEL SUPPLY SYSTEM CHECK in Group 105.

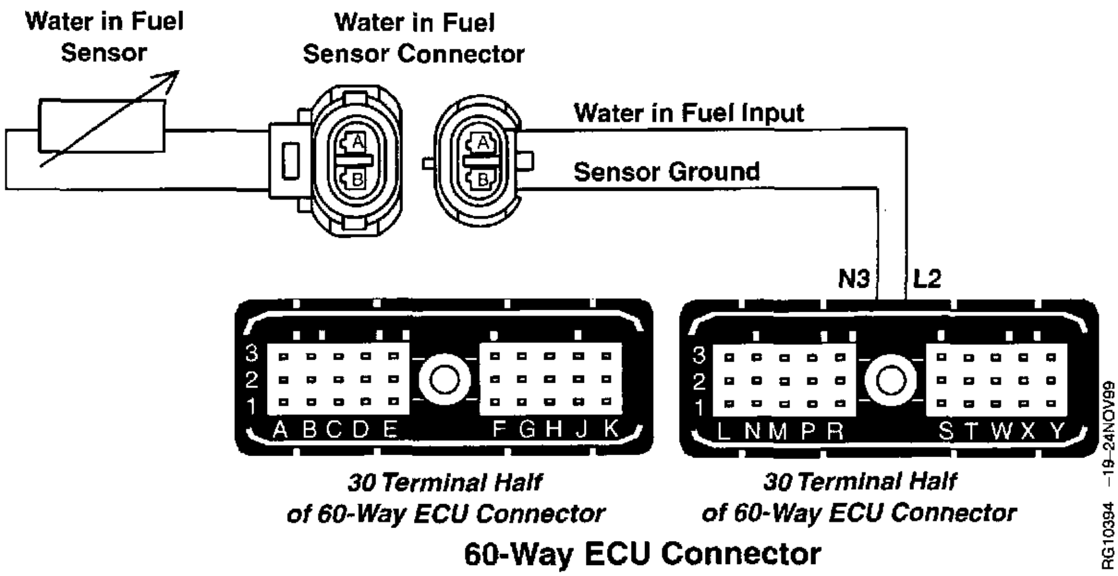
Fuel Pressure within specification for ALL conditions

- Verify that fuel pressure sensor 5 V supply, input, and ground circuits are OK.
- If fuel pressure sensor circuits are OK, replace fuel pressure sensor and retest

RG10494 -19-05JAN00

DPSG,RG40854,378 -19-12OCT99-1/1

DTC SPN 97 FMI 0 Water in Fuel Continuously Detected



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, the water in fuel sensor will read a lower voltage when water is present than when it is not present.

DTC SPN 97 FMI 0 will set if:

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

If DTC SPN 97 FMI 0 sets, the following will occur:

- ECU's that have engine protection with shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 and DTC SPN 1109 FMI 31 may also be present). If WIF does not set within the shutdown value within 30 seconds, the ECU will shut down the engine.

NOTE: For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%.

- ECUs that have engine protection without shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 will also be present), but will not shut the engine down.

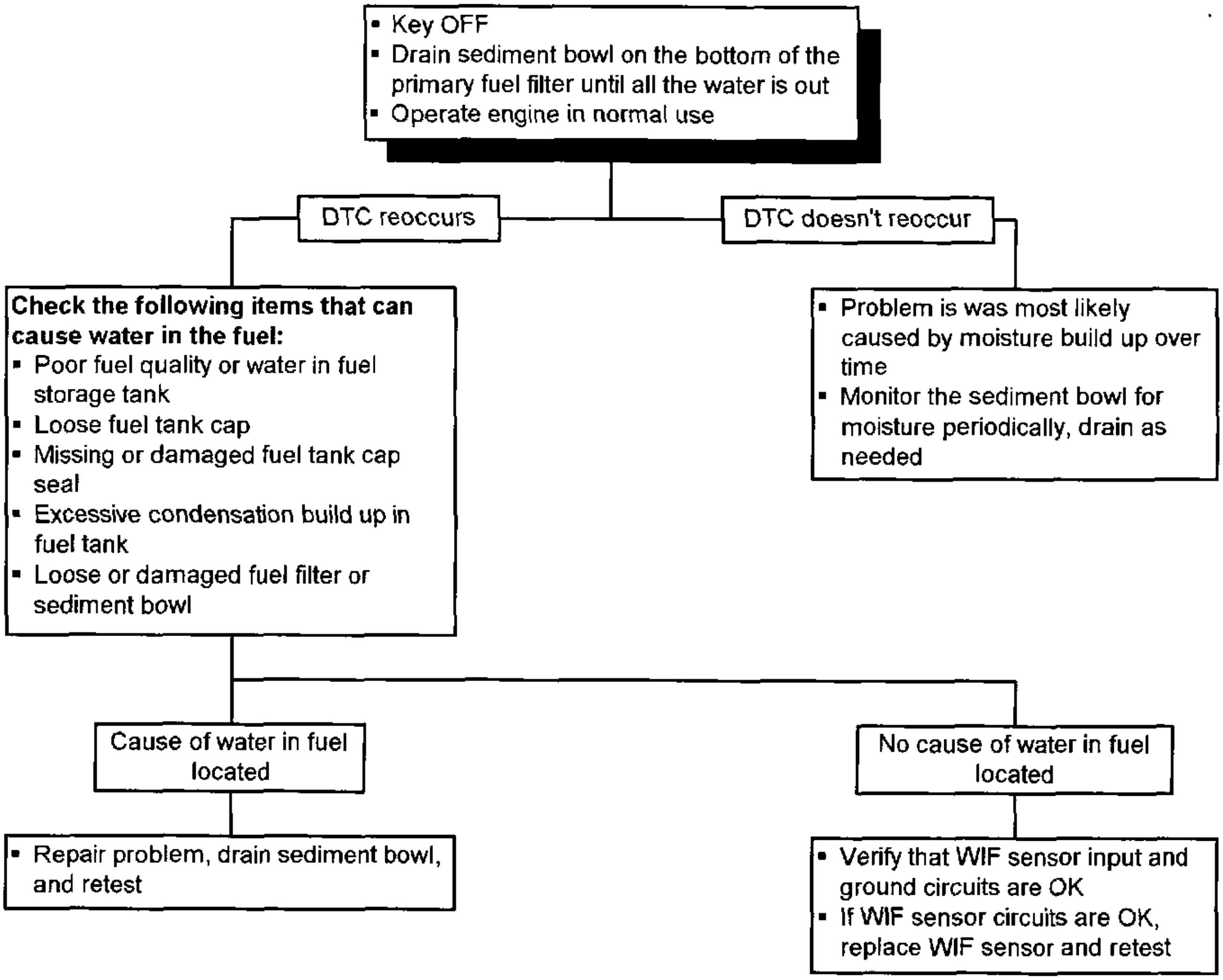
NOTE: For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%.

- ECUs that have no engine protection:
  - There will be no derate and the ECU will not shut the engine down.

DPSG,RG40854,305 –19–26AUG99–1/1

DTC SPN 97 FMI 0 Water in Fuel Continuously Detected - Continued

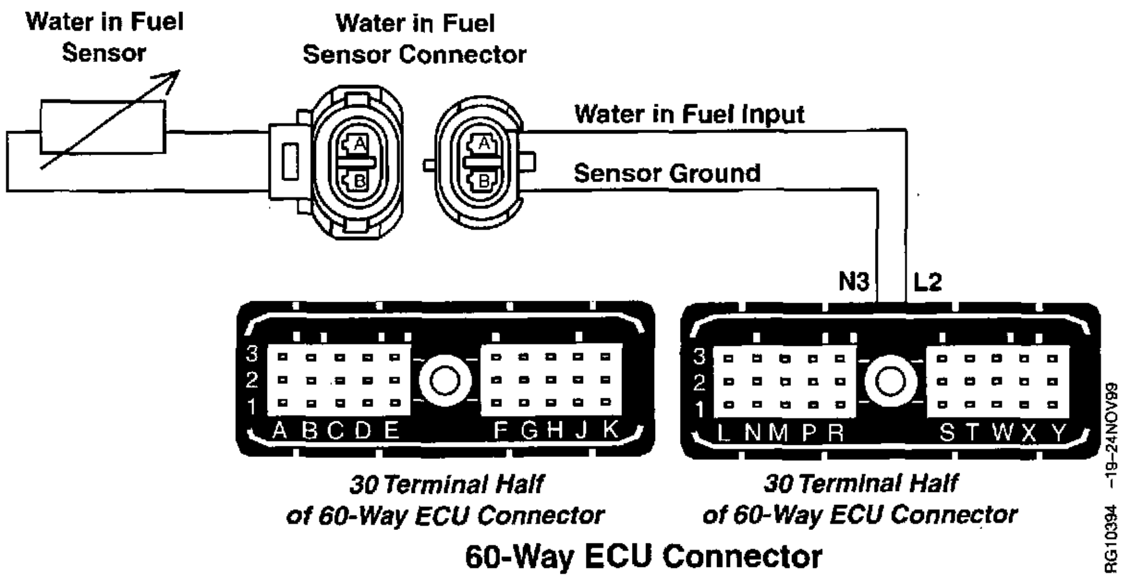
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10499 -19-22DEC99

DPSG,RG40854,379 -19-12OCT99-1/1

DTC SPN 97 FMI 3 Water in Fuel Signal Voltage High



NOTE: *Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.*

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, the water in fuel sensor will read a lower voltage when water is present than when it is not present.

DTC SPN 97 FMI 3 will set if:

- The WIF input voltage exceeds a 4.85 volts. This voltage corresponds to an amount of water in fuel that is not possible.

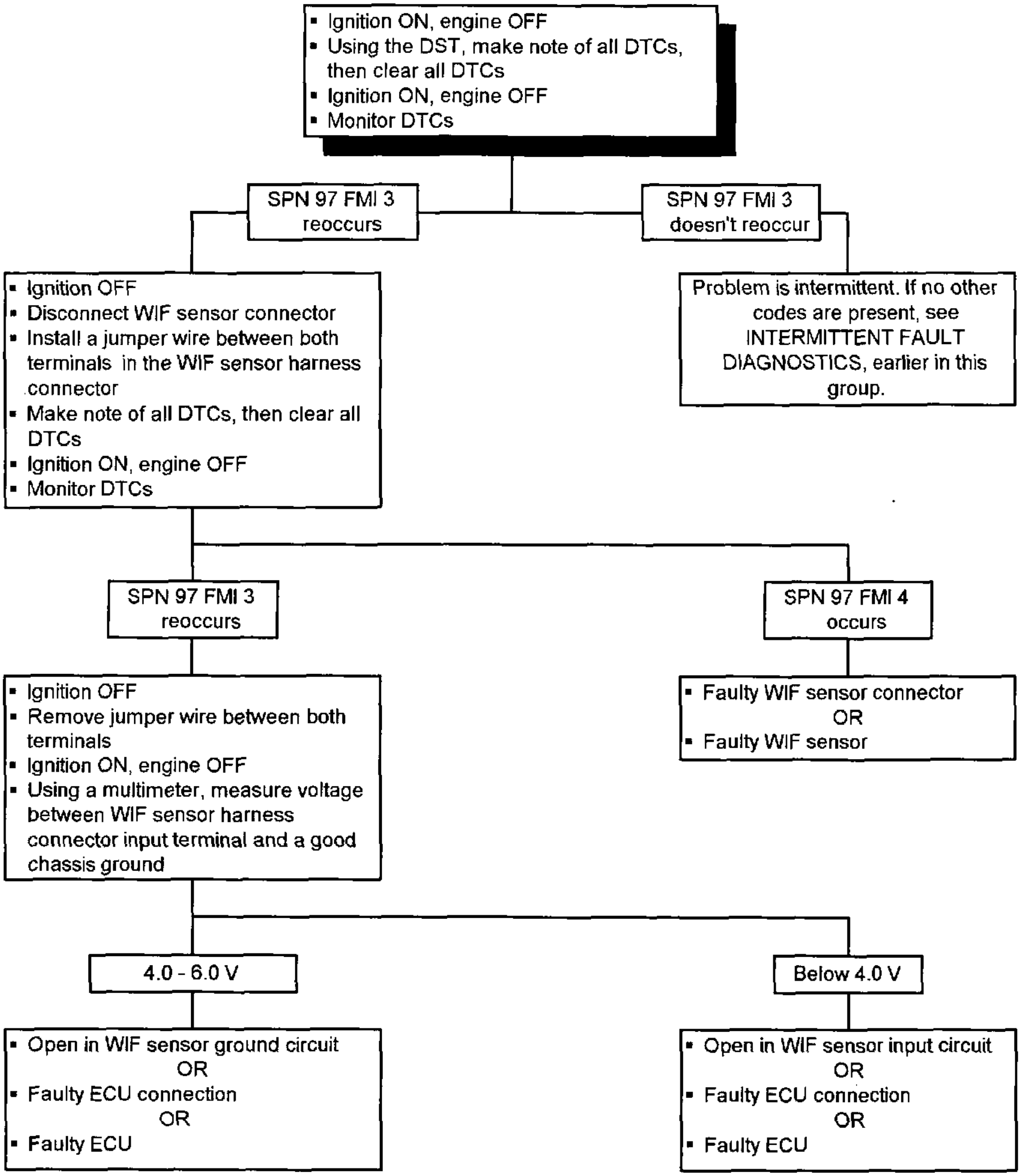
If DTC SPN 97 FMI 3 sets, the following will occur:

- ECU's WIF engine protection feature disabled.

DPSG,RG40854,306 –19–26AUG99–1/1

DTC SPN 97 FMI 3 Water in Fuel Signal Voltage High - Continued

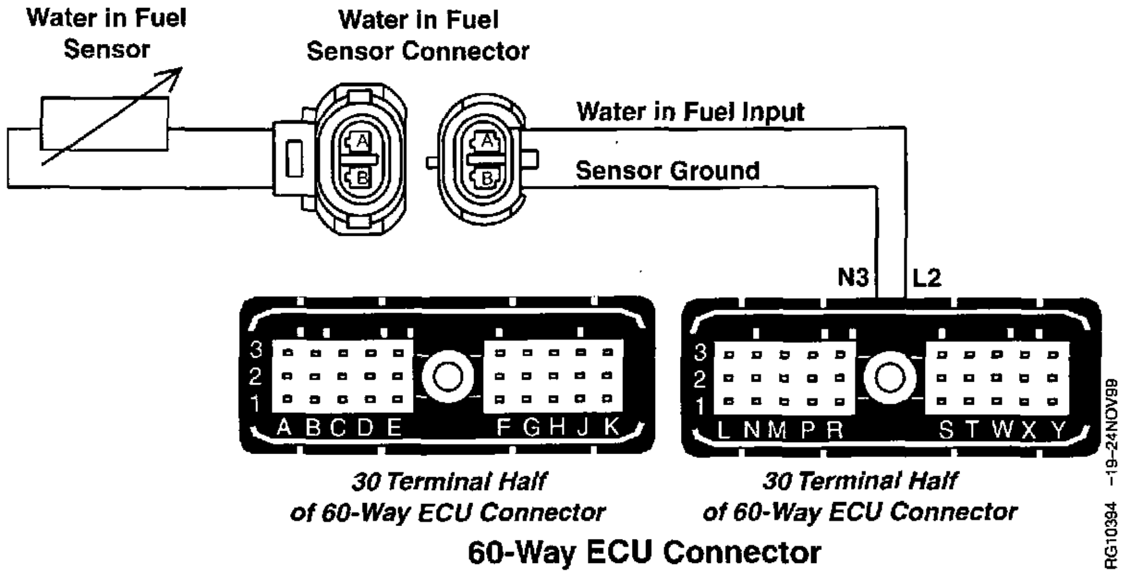
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10500 –19–22NOV99

DPSG,RG40854,380 –19–12OCT99–1/1

DTC SPN 97 FMI 4 Water in Fuel Signal Voltage Low



NOTE: *Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.*

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, the water in fuel sensor will read a lower voltage when water is present than when it is not present.

DTC SPN 97 FMI 4 will set if:

- The WIF input voltage is below a 0.5 volts. This voltage corresponds to an amount of water in fuel that is not possible.

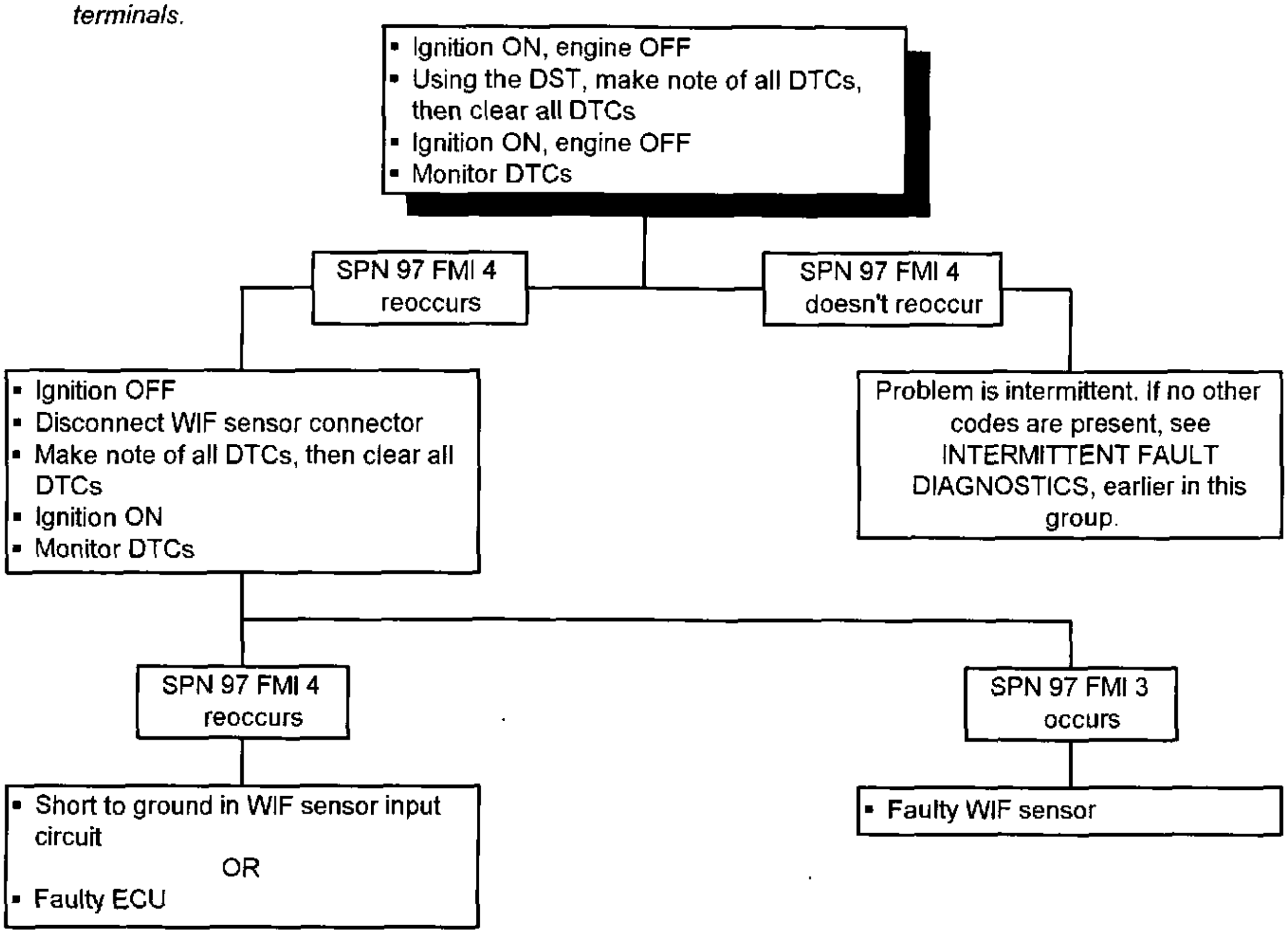
If DTC SPN 97 FMI 4 sets, the following will occur:

- ECU's WIF engine protection feature disabled.

DPSG,RG40854,307 –19–26AUG99–1/1

DTC SPN 97 FMI 4 Water in Fuel Signal Voltage Low - Continued

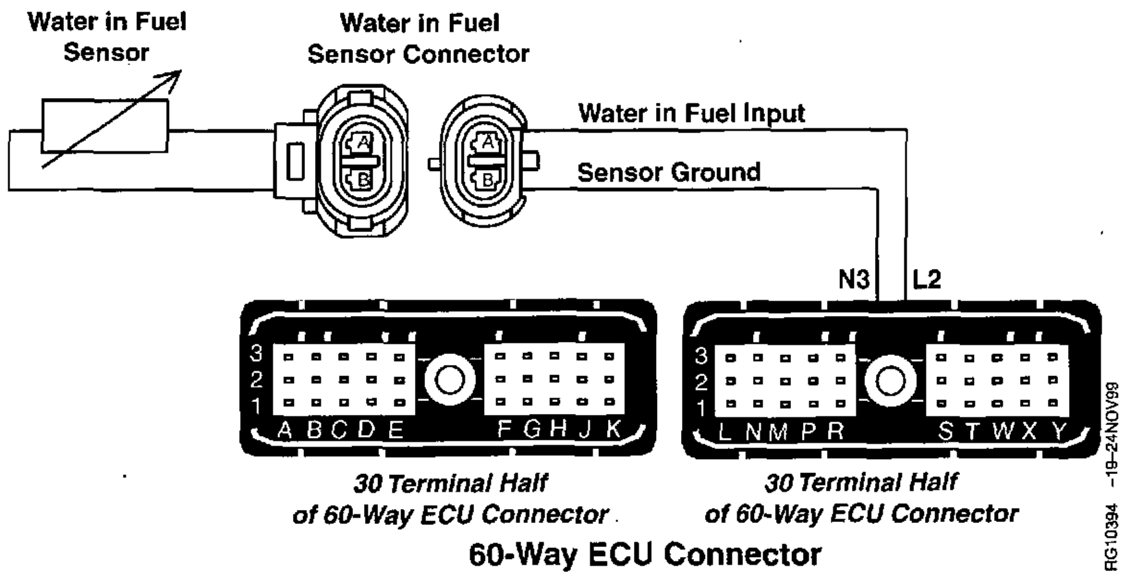
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the WIF sensor connector or looking for dirty, damaged, or poorly positioned terminals.



RG10501 –19–17NOV99

DPSG,RG40854,381 –19–12OCT99–1/1

DTC SPN 97 FMI 16 Water in Fuel Detected



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, water in fuel sensor will read a lower voltage when water is present than when it is not present.

DTC SPN 97 FMI 16 will set if:

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

If DTC SPN 97 FMI 16 sets, the following will occur:

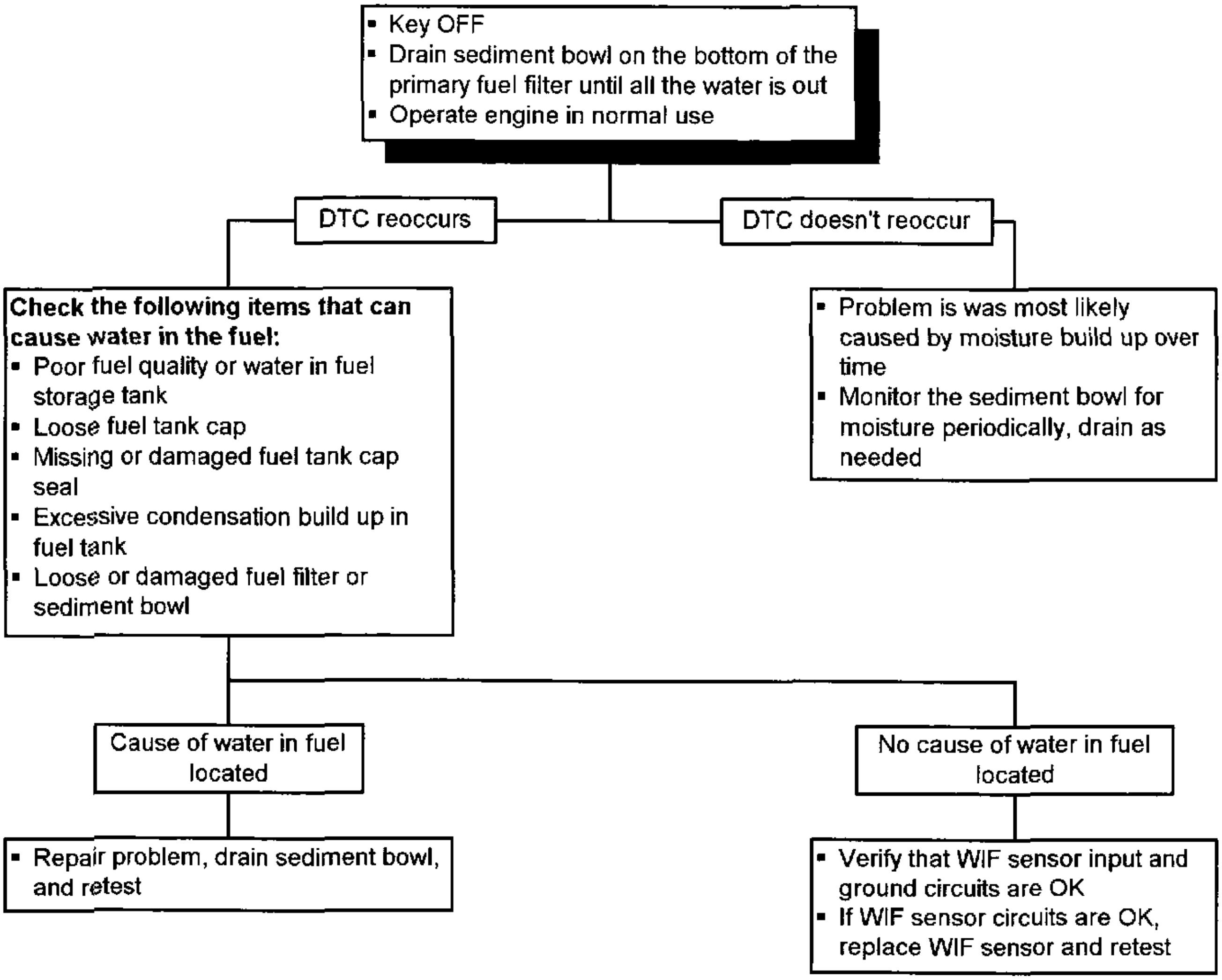
- ECU's that have engine protection:
  - Will derate the engine (DTC SPN 1569 FMI 31 will also be present) 2% per minute to a maximum derate of 20%. When WIF drops back below the maximum value set point, power will be increased 2% per minute until either full power is reached or if the maximum value set point is surpassed again.

NOTE: The derate program shown applies to OEM engine applications that contain engine protection. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.

DPSG,RG40854,308 -19-26AUG99-1/1

DTC SPN 97 FMI 16 Water in Fuel Detected - Continued

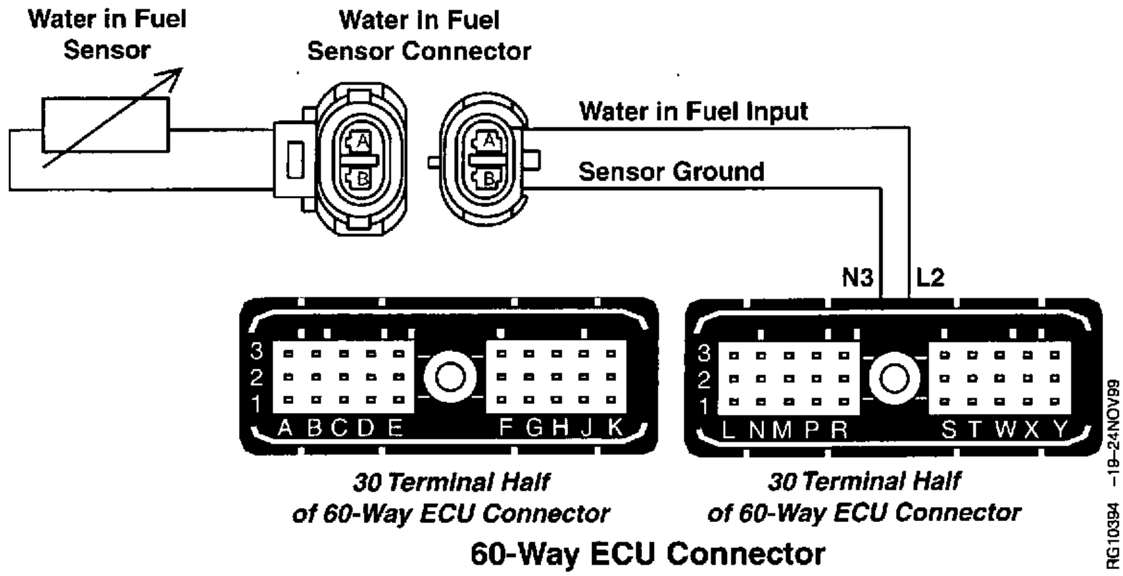
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10499 –19–22DEC99

DPSG,RG40854,382 –19–12OCT99–1/1

DTC SPN 97 FMI 31 Water in Fuel Detected



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

WIF (Water in Fuel) Sensor

- The WIF sensor uses the resistance of water and fuel to detect the presence of water in the fuel system. This uses the principle that water is a better conductor of electricity than fuel is. Because of this, the water in fuel sensor will read a lower voltage when water is present than when it is not present.

DTC SPN 97 FMI 31 will set if:

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

If DTC SPN 97 FMI 31 sets, the following will occur:

WIF detected:

- ECU's that have engine protection:
  - Will derate the engine (DTC SPN 1569 FMI 31 will also be present) 2% per minute to a maximum derate of 20%. When WIF drops back below the maximum value set point, power will be increased 2% per minute until either full power is reached or if the maximum value set point is surpassed again.

If WIF detected in spite of the derate above:

- ECU's that have engine protection with shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 will also be present). If WIF does not set within the shutdown value within 30 seconds, the ECU will shut down the engine.

NOTE: For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%.

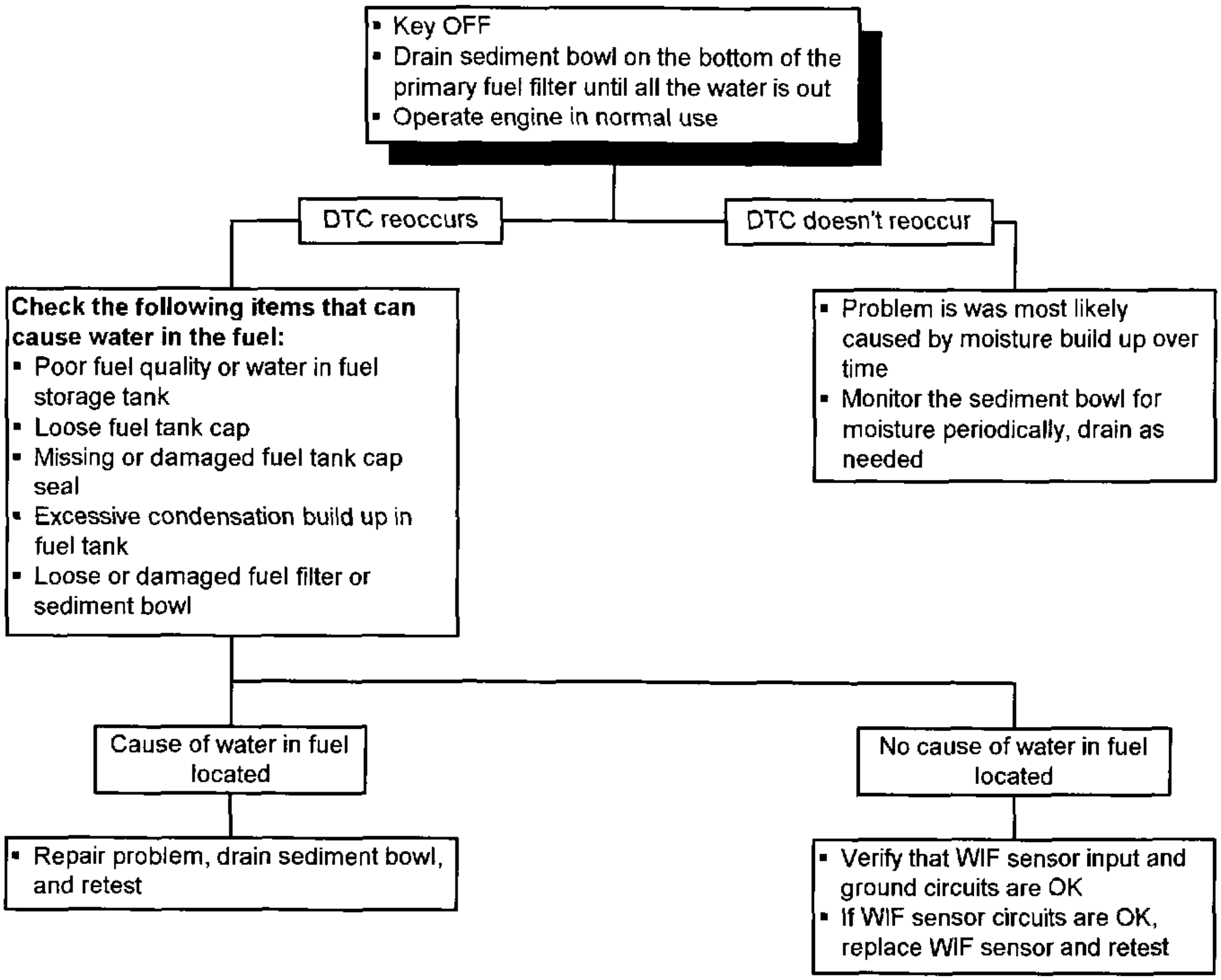
- ECUs that have engine protection without shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 will also be present), but will not shut the engine down.

NOTE: For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%.

DPSG,RG40854,309 –19–26AUG99–1/1

DTC SPN 97 FMI 31 Water in Fuel Detected - Continued

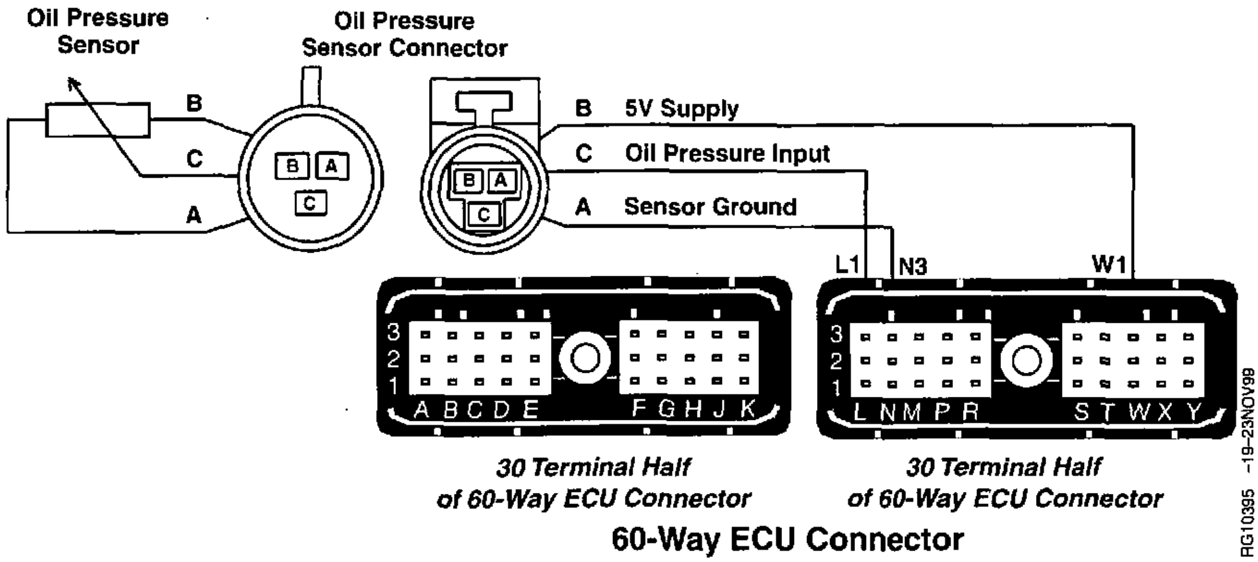
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the WIF sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10499 –19–22DEC99

DPSG,RG40854,383 –19–12OCT99–1/1

DTC SPN 100 FMI 1 Engine Oil Pressure Extremely Low



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

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil gallery or oil cooler. The oil pressure input voltage varies as oil pressure varies. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition.

DTC SPN 100 FMI 1 will set if:

- The ECU senses an oil pressure below the shutdown value set point in the ECU. The shutdown value set point is dependent on engine speed.

If DTC SPN 100 FMI 1 sets, the following will occur:

- ECUs that have engine protection with shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 and DTC SPN 1109 FMI 31 may also be present). If oil pressure does not increase above the shutdown value set point within 30 seconds, the ECU will shut the engine down.

NOTE: For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%.

- ECUs that have engine protection without shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 will also be present), but will not shut the engine down.

NOTE: For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%.

- ECUs that have no engine protection:
  - There will be no derate and the ECU will not shut the engine down.

DPSG,RG40854,310 -19-26AUG99-1/1

DTC SPN 100 FMI 1 Engine Oil Pressure Extremely Low - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the oil pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.

- Under the conditions where DTC SPN 100 FMI 1 occurs, measure engine oil pressure. See CHECK ENGINE OIL PRESSURE in Group 105 of this manual

Oil pressure below specification

- Low oil pressure problem. See L2 - ENGINE OIL PRESSURE LOW diagnostic procedure in Group 105 in this manual

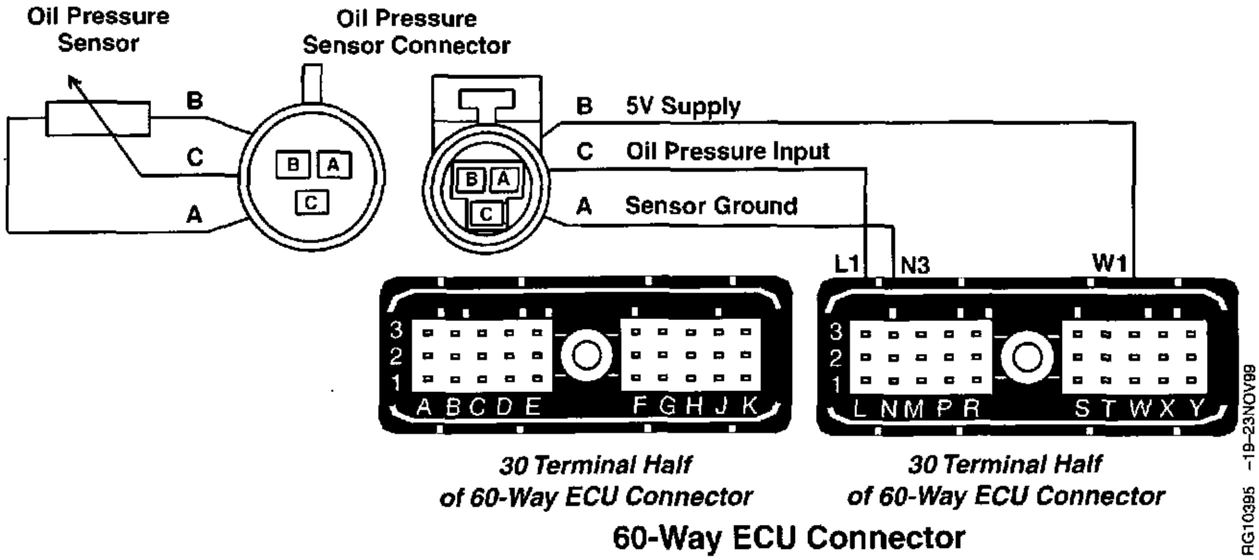
Oil pressure within specification

- Verify that oil pressure sensor 5 V supply, input, and ground circuits are OK.
- If oil pressure sensor circuits are OK, replace oil pressure sensor and retest

RG10432 -19-17NOV99

DPSG,RG40854,384 -19-12OCT99-1/1

DTC SPN 100 FMI 3 Engine Oil Pressure Input Voltage High



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

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil gallery or oil cooler. The oil pressure input voltage varies as oil pressure varies. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition.

DTC SPN 100 FMI 3 will set if:

- The oil pressure input voltage exceeds a 4.5 volts. This voltage corresponds to an oil pressure that is higher that what is physically possible for oil pressure.

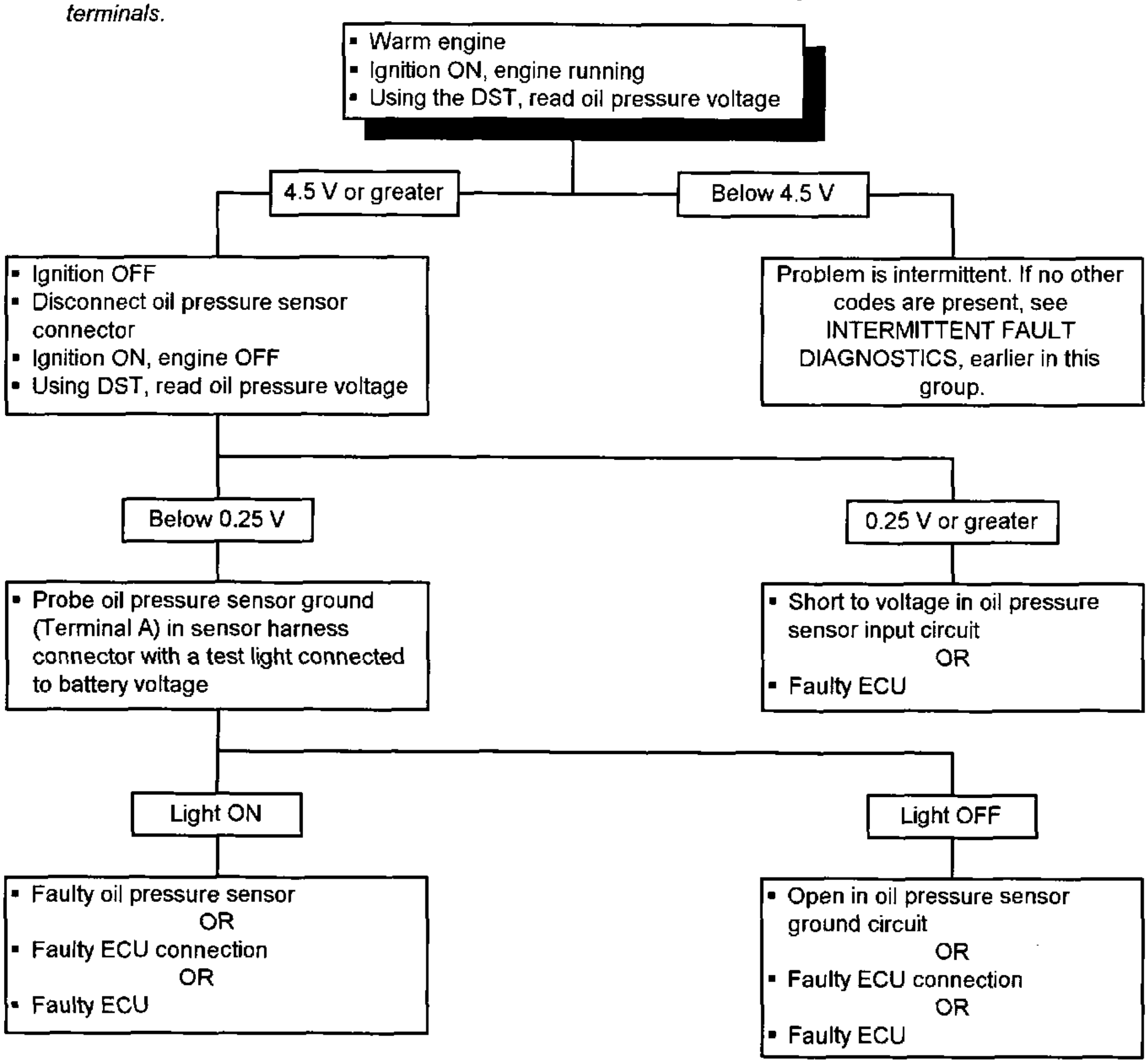
If DTC SPN FMI 3 sets, the following will occur:

- ECU's low oil pressure engine protection feature disabled.

DPSG,RG40854.311 –19–26AUG99–1/1

DTC SPN 100 FMI 3 Engine Oil Pressure Input Voltage High - Continued

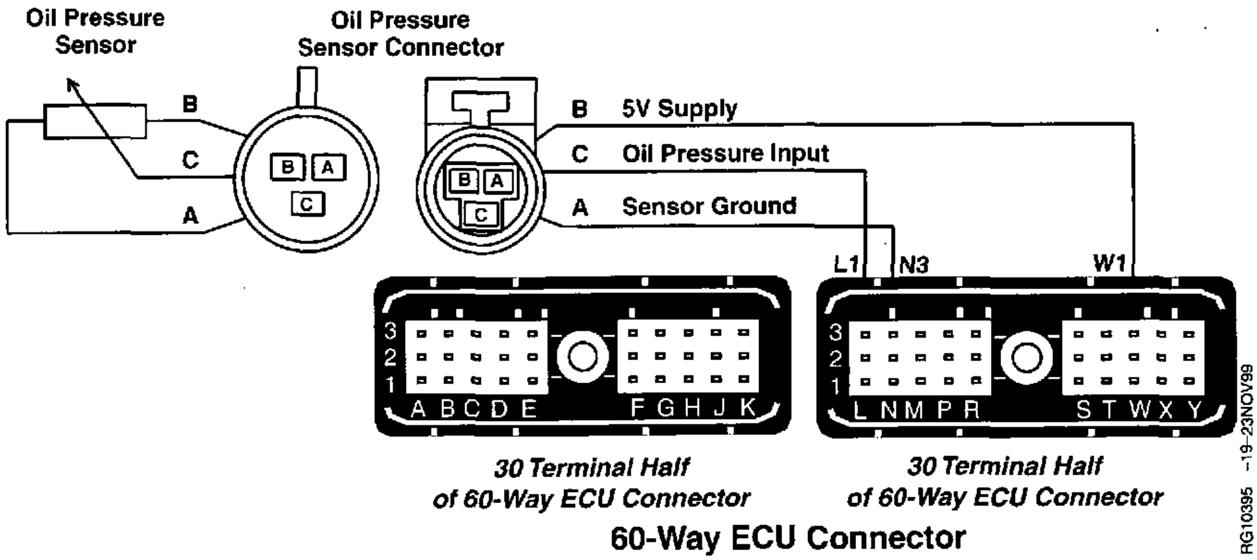
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the oil pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10433 –19–17NOV99

DPSG,RG40854,385 –19–12OCT99–1/1

DTC SPN 100 FMI 4 Engine Oil Pressure Input Voltage Low



30 Terminal Half of 60-Way ECU Connector　*30 Terminal Half of 60-Way ECU Connector*

60-Way ECU Connector

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

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil gallery or oil cooler. The oil pressure input voltage varies as oil pressure varies. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition.

DTC SPN 100 FMI 4 will set if:

- The oil pressure input voltage drops below 0.25 volts. This voltage corresponds to an oil pressure that is lower that what is physically possible for oil pressure.

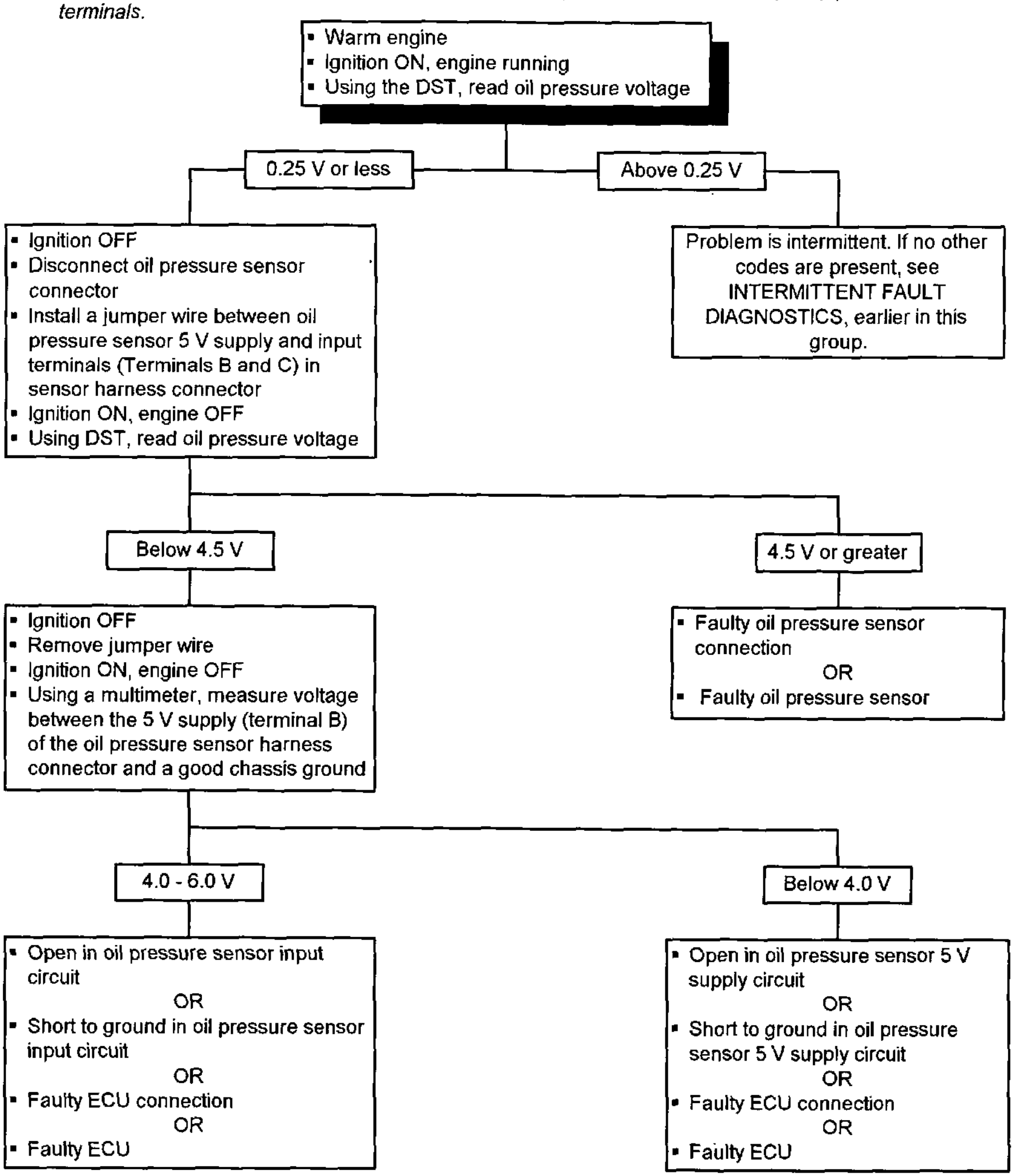
If DTC SPN 100 FMI 4 sets, the following will occur:

- ECU's low oil pressure engine protection feature disabled.

DPSG,RG40854,312 -19-26AUG99-1/1

DTC SPN 100 FMI 4 Engine Oil Pressure Input Voltage Low - Continued

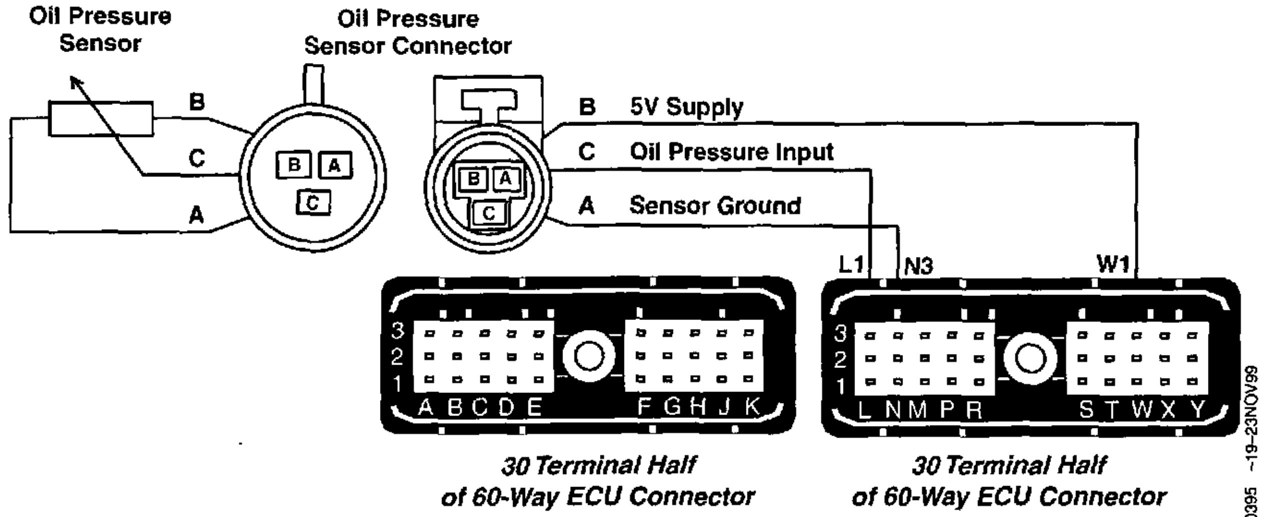
Note: Before using this diagnostic procedure, perform a preliminary inspection of 60-way ECU connector and the oil pressure sensor connector, looking for dirty, damaged, or poorly positioned terminals.



RG10434 -19-17NOV99

DPSG,RG40854,386 -19-12OCT99-1/1

DTC SPN 100 FMI 18 Engine Oil Pressure Moderately Low



60-Way ECU Connector

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

Oil Pressure Sensor

- The oil pressure sensor is a pressure transducer connected to the main oil gallery or oil cooler. The oil pressure input voltage varies as oil pressure varies. As engine oil pressure increases, the oil pressure sensor input voltage increases. The ECU monitors oil pressure in order to protect the engine in case of a low oil pressure condition.

DTC SPN 100 FMI 18 will set if:

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

If DTC SPN 100 FMI 18 sets, the following will occur:

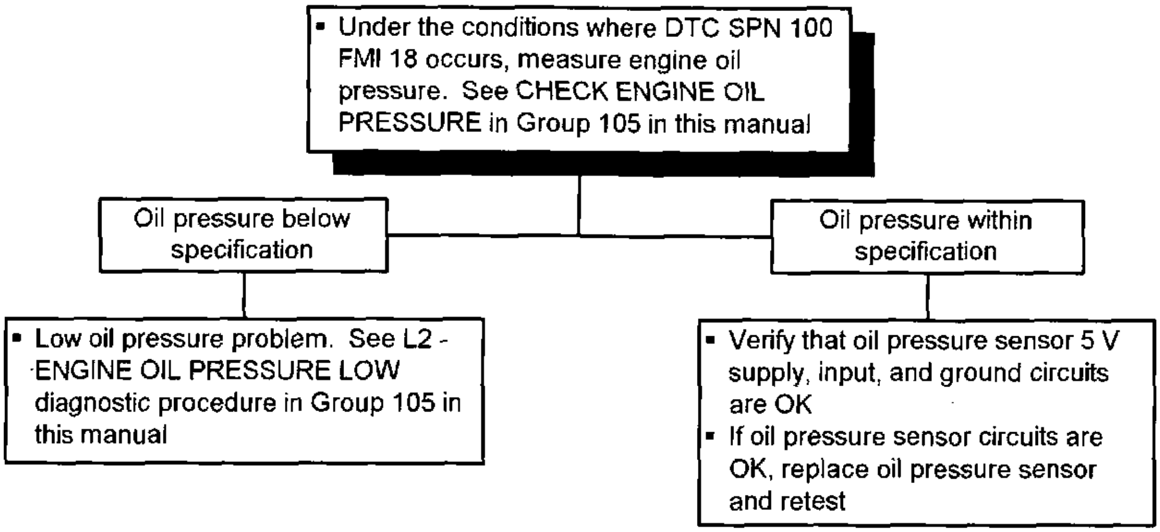
- ECUs that have engine protection:
  - Will derate 2% per minute to a maximum derate of 20%. When oil pressure increases above the minimum value set point, power will be increased 2% per minute until either full power is reached or if the maximum value set point is surpassed again.
  - If in spite of the derate, oil pressure continues to drop, ECUs that have engine protection with shutdown, will shut down the engine when oil pressure drops below the shutdown value set point in the ECU. The shutdown value setpoint is dependent of engine speed.

NOTE: The derate program shown applies to OEM engine applications that contain engine protection. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.

DPSG,RG40854,313 –19–26AUG99–1/1

DTC SPN 100 FMI 18 Engine Oil Pressure Moderately Low - Continued

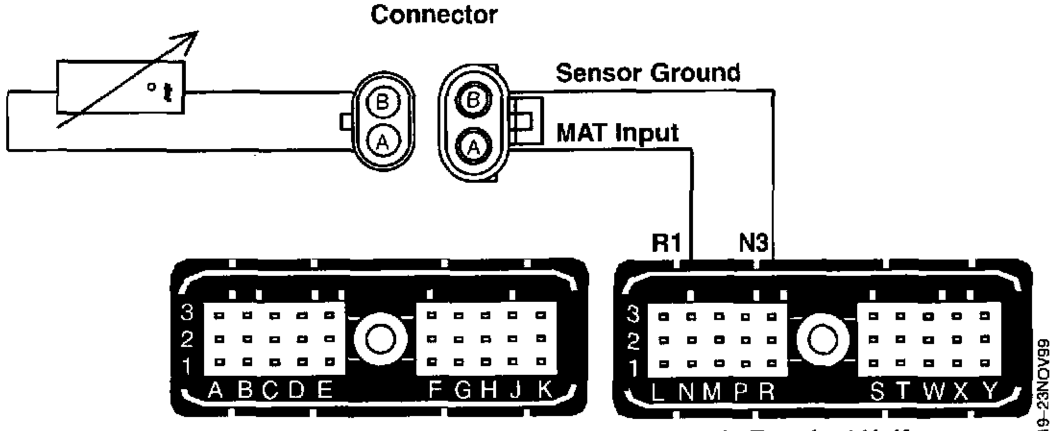
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the oil pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10435 -19-22DEC99

DPSG,RG40854,387 -19-12OCT99-1/1

DTC SPN 105 FMI 3 Manifold Air Temperature Input Voltage High



30 Terminal Half of 60-Way ECU Connector

30 Terminal Half of 60-Way ECU Connector

60-Way ECU Connector

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

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the MAT sensor input in conjunction with the MAP sensor input to determine engine air flow.

DTC SPN 105 FMI 3 will set if:

- The MAT input voltage exceeds 4.8 volts. This voltage corresponds to a temperature that is lower than what is physically possible for manifold air.

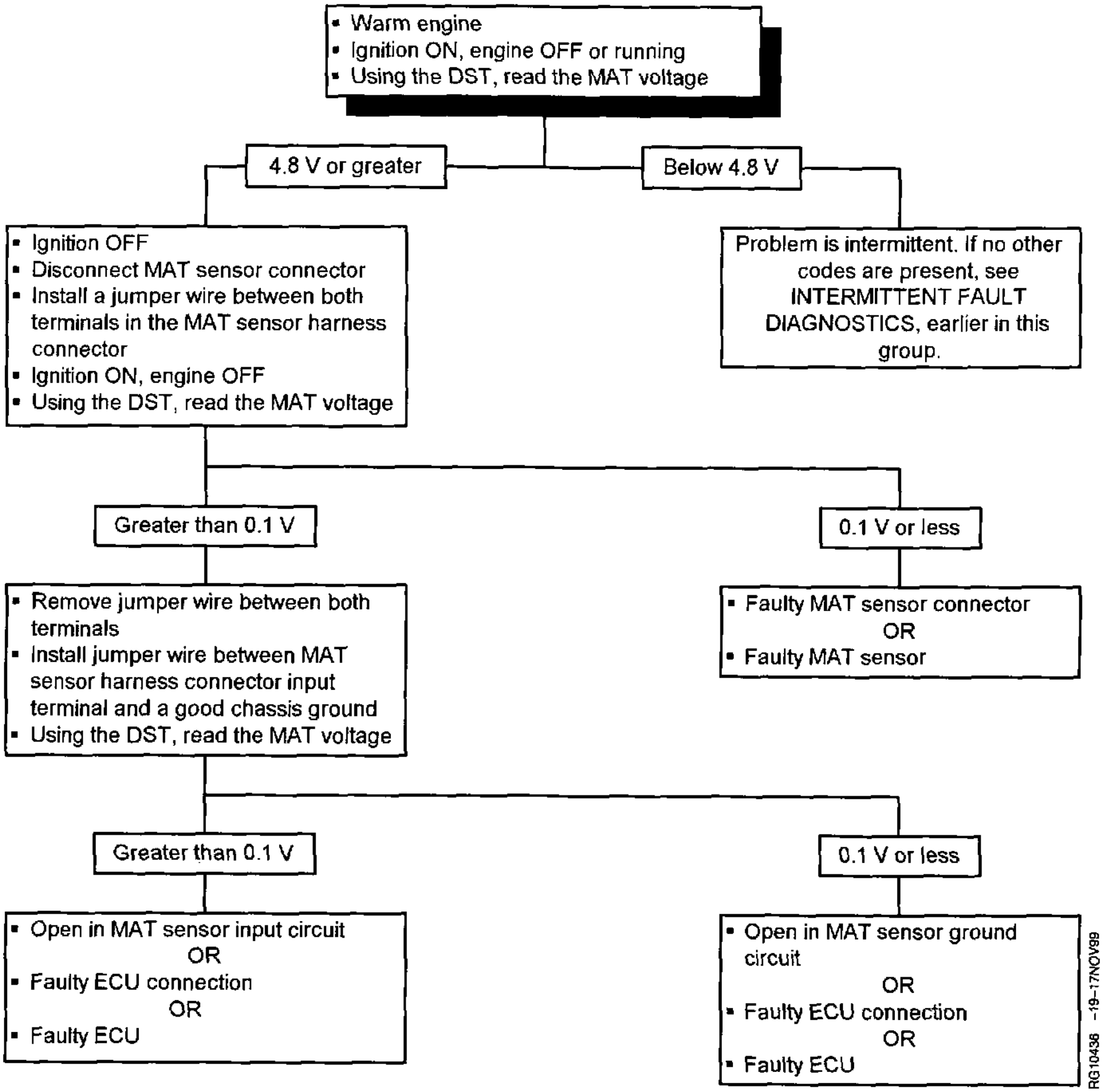
If DTC SPN 105 FMI 3 sets, the following will occur:

- The ECU will use a default "limp-home" MAT value of 50°C (122°F).
- ECU's high manifold air temperature engine protection feature disabled.

DPSG,RG40854,172 -19-28JUN99-1/1

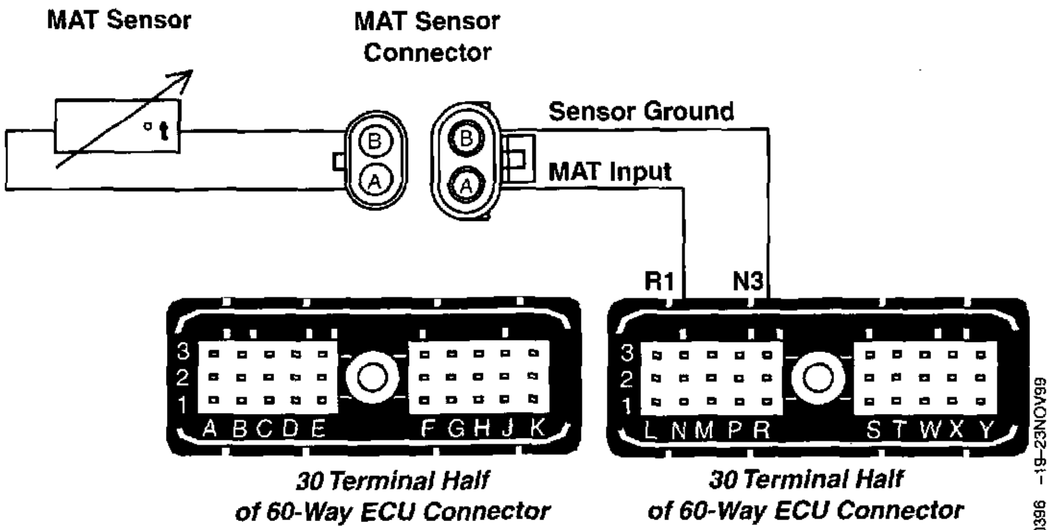
DTC SPN 105 FMI 3 Manifold Air Temperature Input Voltage High - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the MAT sensor connector looking for dirty, damaged, or poorly positioned terminals.



DPSG,RG40854,388 –19–12OCT99–1/1

DTC SPN 105 FMI 4 Manifold Air Temperature Input Voltage Low



60-Way ECU Connector

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

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the MAT sensor input in conjunction with the MAP sensor input to determine engine air flow.

DTC SPN 105 FMI 4 will set if:

- The MAT input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for manifold air.

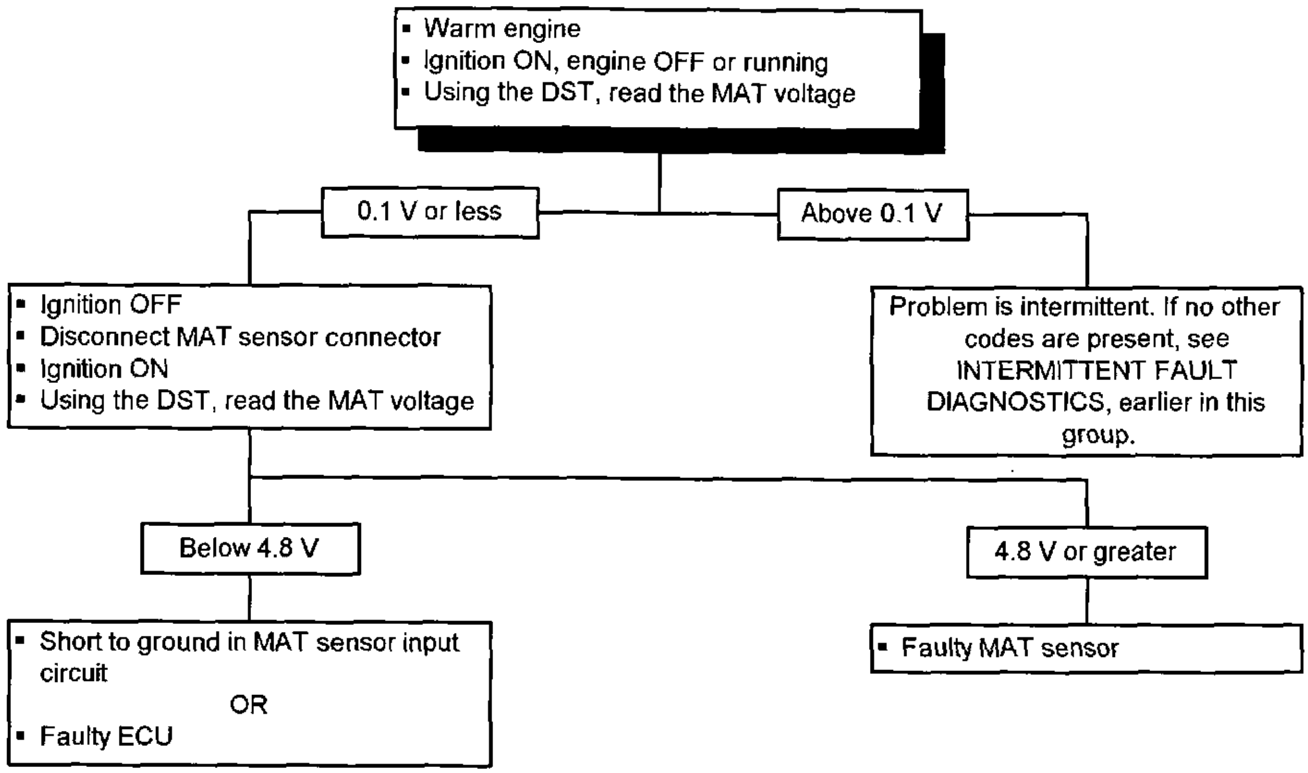
If DTC SPN 105 FMI 4 sets, the following will occur:

- The ECU will use a MAT default "limp-home" MAT value of 50°C (122°F).
- ECU's high manifold air temperature engine protection feature disabled.

DPSG,RG40854,173 -19-28JUN99-1/1

DTC SPN 105 FMI 4 Manifold Air Temperature Input Voltage Low - Continued

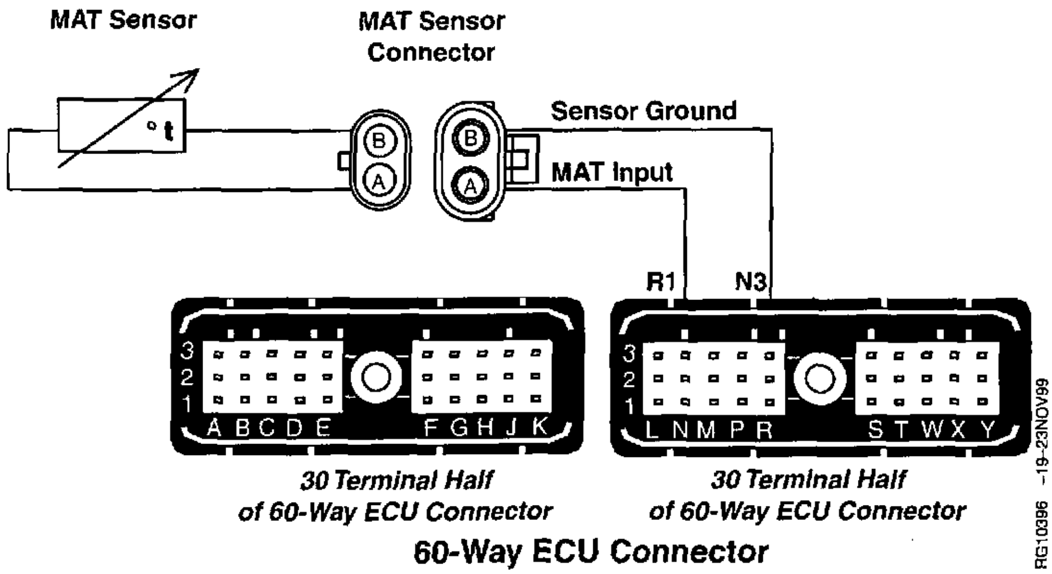
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the MAT sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10437 -19-17NOV99

DPSG,RG40854,389 -19-12OCT99-1/1

DTC SPN 105 FMI 16 Manifold Air Temperature Moderately High



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

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the MAT sensor input in conjunction with the MAP sensor input to determine engine air flow.

DTC SPN 105 FMI 16 will set if:

- The ECU senses a manifold air temperature above the warning value set point in the ECU. The maximum value set point is 90°C (194°F).

NOTE: Temperature value shown applies to OEM engine applications. Other applications may have the same or a similar temperature values. Refer to machine manual for high coolant temperature value.

If DTC SPN 105 FMI 16 sets, the following will occur:

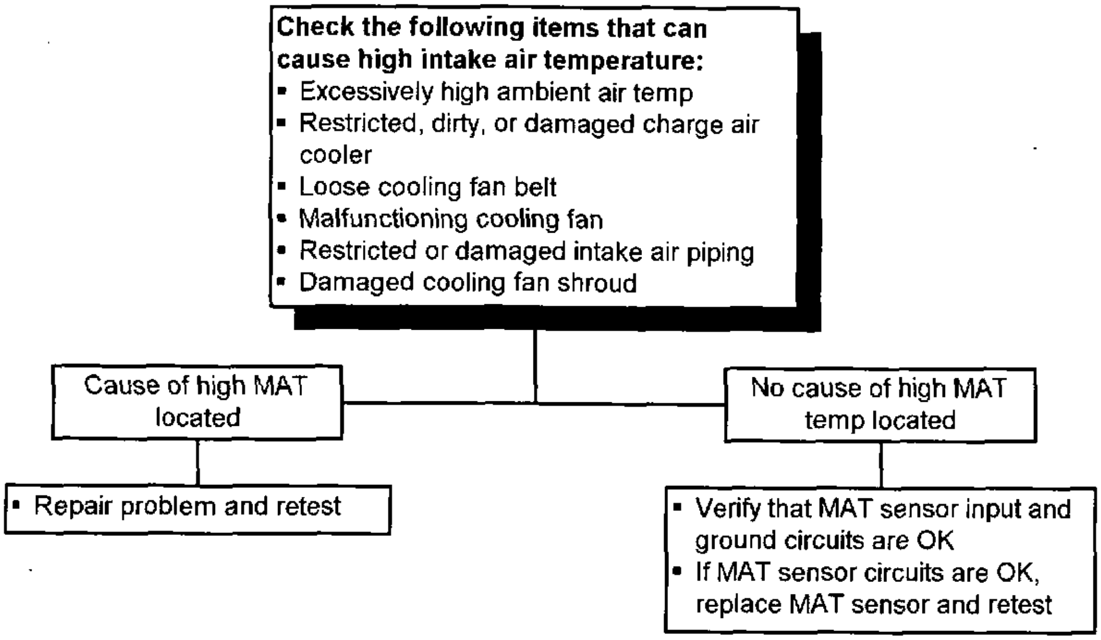
- ECU's that have engine protection:
  - Will derate the engine (DTC SPN 1569 FMI 31 will also be present) 2% per minute to a maximum derate of 20%. When MAT drops back below the maximum value set point, power will be increased 2% per minute until either full power is reached or if the maximum value set point is surpassed again.

NOTE: The derate program shown applies to OEM engine applications that contain engine protection. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.

DPSG,RG40854,174 -19-28JUN99-1/1

DTC SPN 105 FMI 16 Manifold Air Temperature Moderately High - Continued

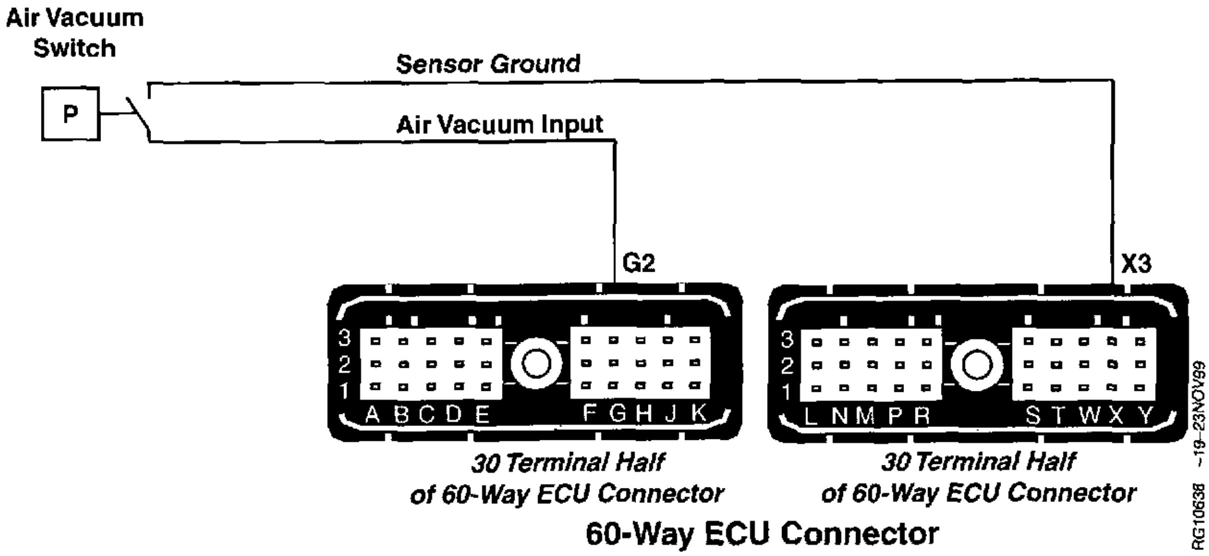
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the MAT sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10438 –19–17NOV99

DPSG,RG40854,390 –19–12OCT99–1/1

DTC SPN 107 FMI 31 Air Filter Restriction High



60-Way ECU Connector

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

Air Vacuum Switch

- The air vacuum switch is located on the clean side of the air filter. Higher air pressure causes the contacts on the air vacuum switch to close.

DTC SPN 107 FMI 31 will set if:

- The ECU senses a high air pressure from the air vacuum switch.

If DTC SPN 107 FMI 31 sets, the following will occur:

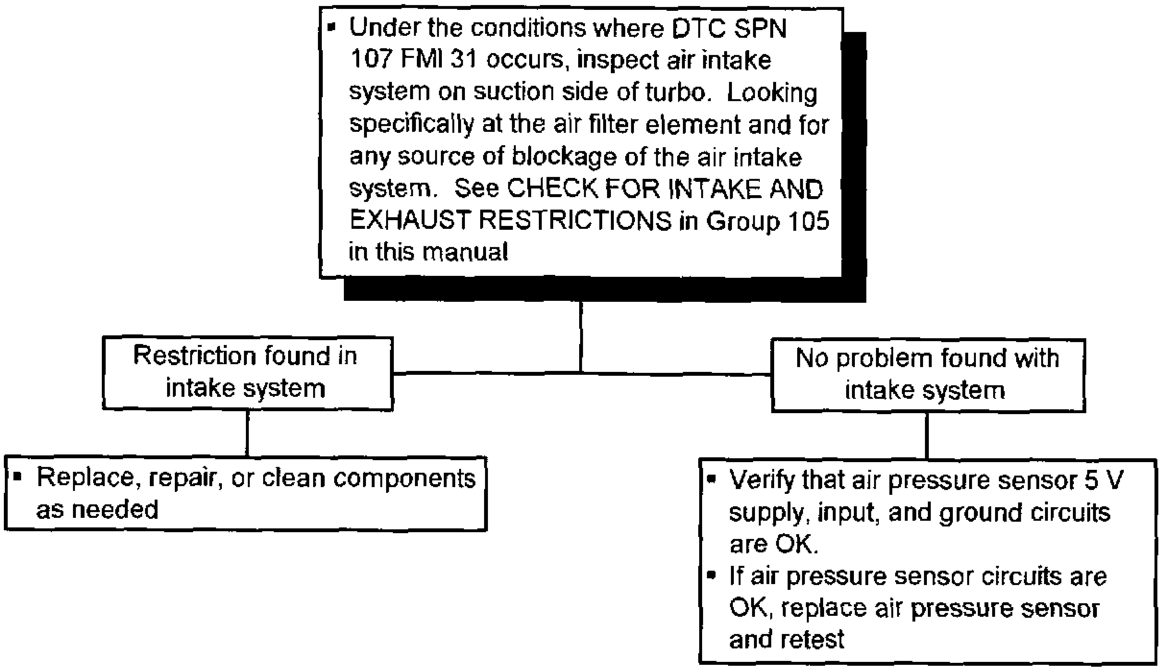
- ECU's that have engine protection:
  - Will derate the engine (DTC SPN 1569 FMI 31 will also be present) 2% per minute to a maximum derate of 20%. When air filter restriction drops back below the maximum value set point, power will be increased 2% per minute until either full power is reached or if the maximum value set point is surpassed again.

NOTE: The derate program shown applies to OEM engine applications that contain engine protection. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.

DPSG,RG40854,315 -19-26AUG99-1/1

DTC SPN 107 FMI 31 Air Filter Restriction High - Continued

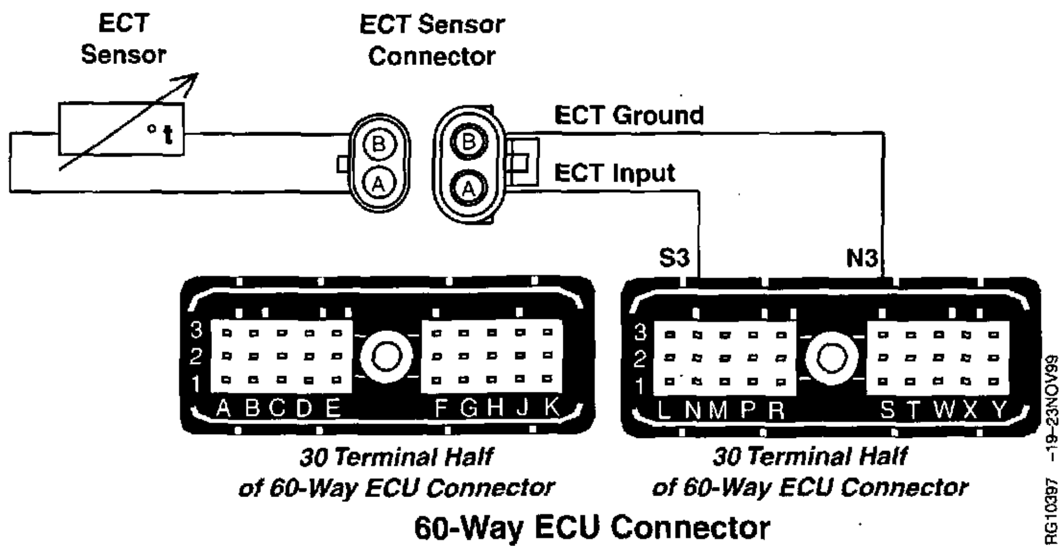
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the air pressure sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10439 –19–17NOV99

DPSG,RG40854,391 –19–12OCT99–1/1

DTC SPN 110 FMI 0 Engine Coolant Temperature Extremely High



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

ECT (Engine Coolant Temperature) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the ECU; lower temperatures result in higher voltages.

DTC SPN 110 FMI 0 will set if:

- The ECU senses a coolant temperature of 115°C (239°F).

NOTE: *Temperature value shown applies to OEM engine applications. Other applications may have the same or a similar temperature values. Refer to machine manual for high coolant temperature value.*

If DTC SPN 110 FMI 0 sets, the following will occur:

- ECUs that have engine protection with shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 and DTC SPN 1109 FMI 31 may also be present). If ECT does not go below the shutdown value set point within 30 seconds, the ECU will shut the engine down.

NOTE: *For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.*

- ECUs that have engine protection without shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 will also be present), but will not shut the engine down.

NOTE: *For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.*

- ECUs that have no engine protection:

Continued on next page

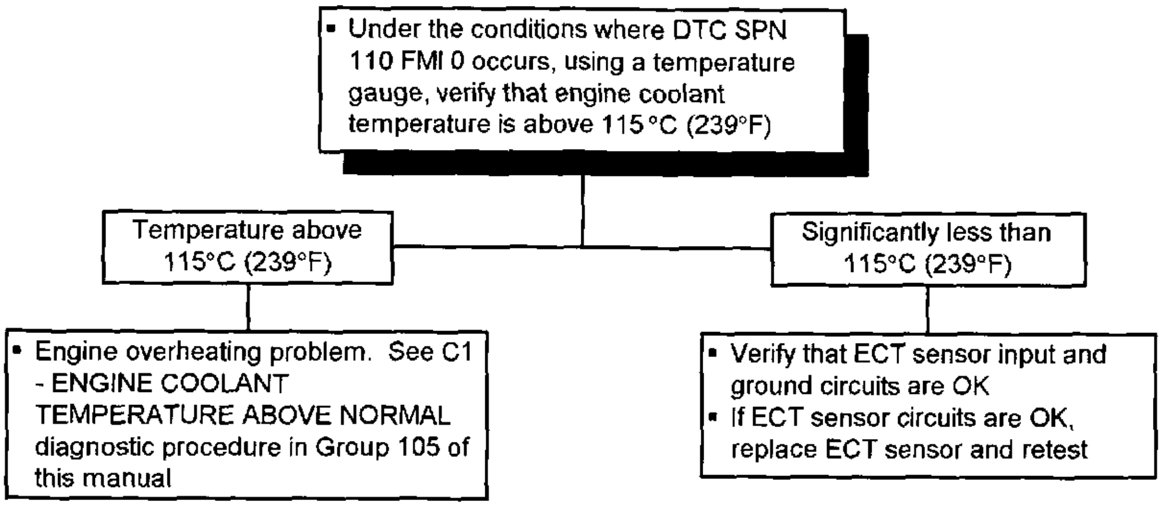
DPSG,RG40854,175 –19–28JUN99–1/2

– There will be no derate and the ECU will not shut the engine down.

DPSG,RG40854,175 –19–28JUN99–2/2

DTC SPN 110 FMI 0 Engine Coolant Temperature Extremely High - Continued

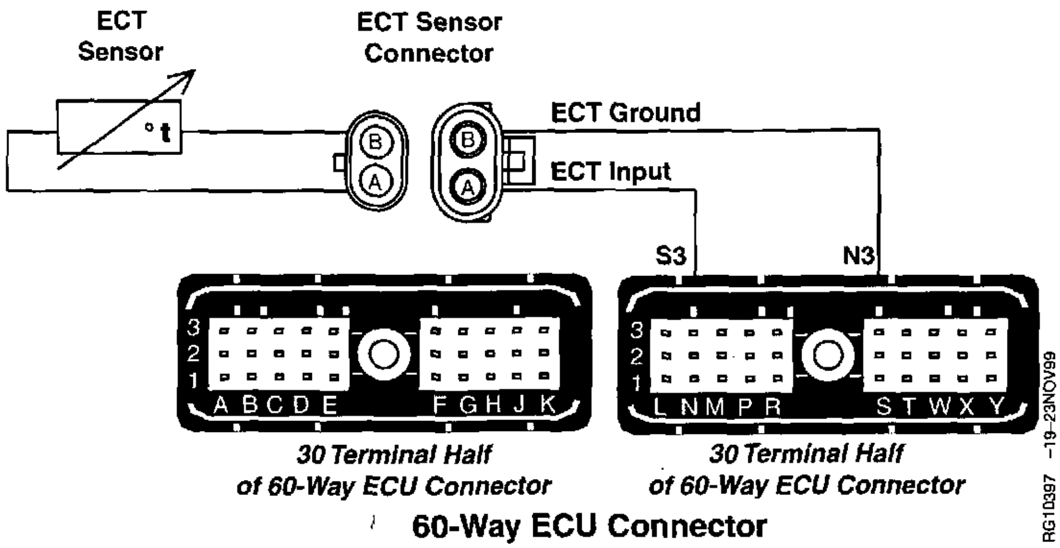
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10440 –19–17NOV99

DPSG,RG40854,392 –19–12OCT99–1/1

DTC SPN 110 FMI 3 Engine Coolant Temperature Input Voltage High



60-Way ECU Connector

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

ECT (Engine Coolant Temperature) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the ECU; lower temperatures result in higher voltages.

DTC SPN 110 FMI 3 will set if:

- The ECT input voltage exceeds 4.95 volts. This voltage corresponds to a temperature that is lower than what is physically possible for engine coolant.

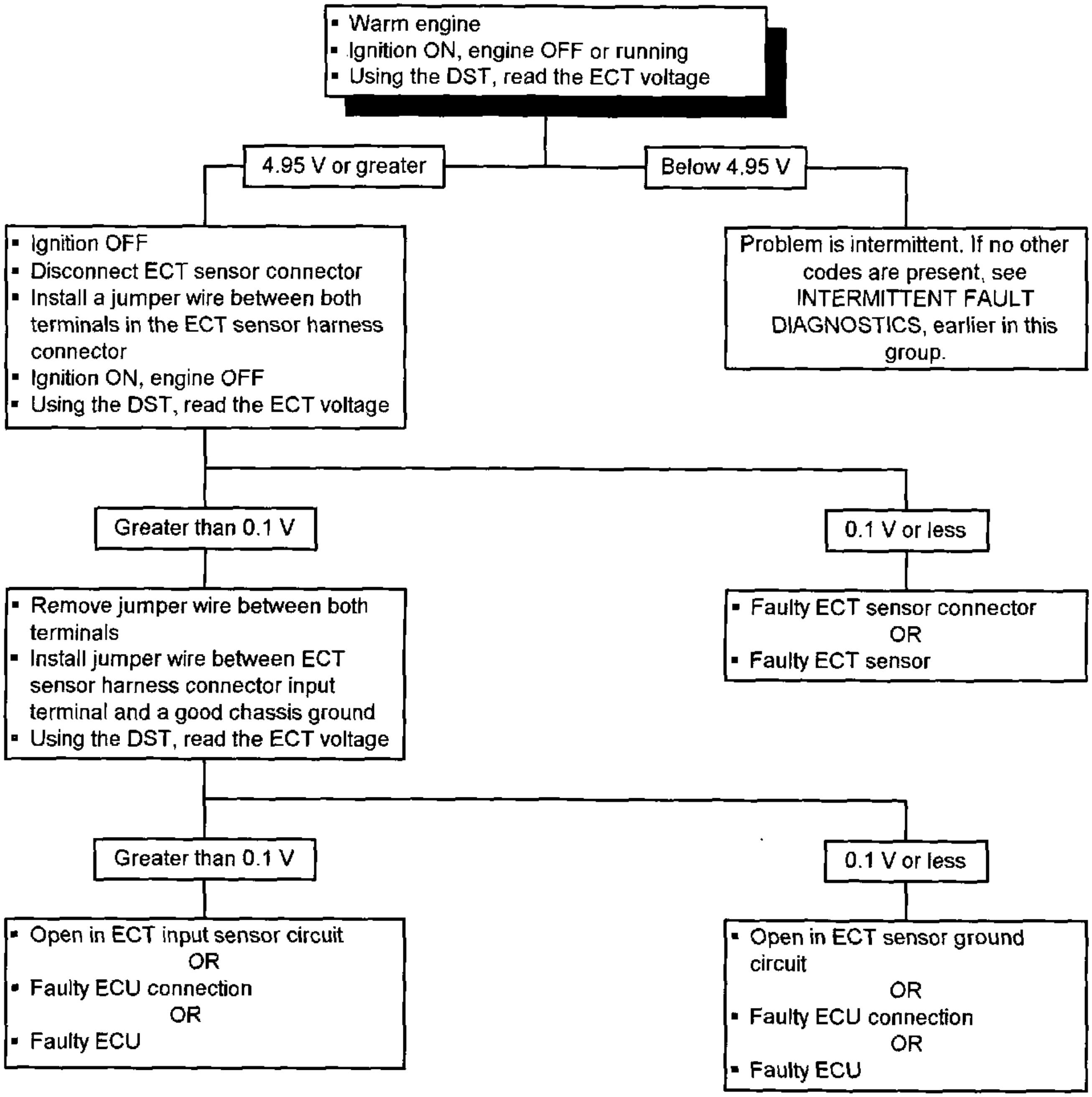
If DTC SPN 110 FMI 3 sets, the following will occur:

- The ECU will use a default "limp-home" ECT value of 90°C (194°F).
- ECU's high coolant temperature engine protection feature disabled.

DPSG,RG40854,176 -19-28JUN99-1/1

DTC SPN 110 FMI 3 Engine Coolant Temperature Input Voltage High - Continued

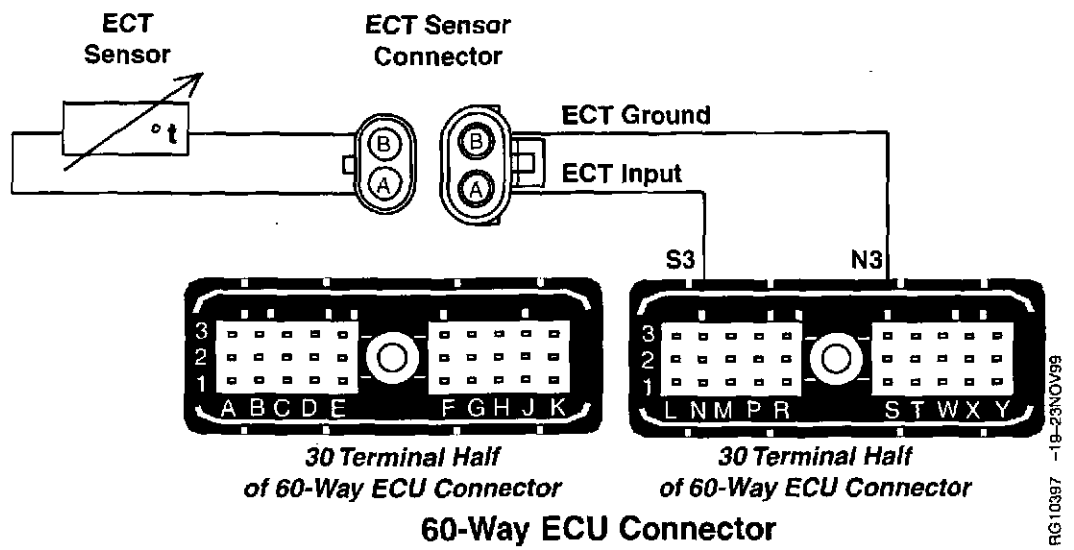
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10441 –19–17NOV99

DPSG,RG40854,393 –19–12OCT99–1/1

DTC SPN 110 FMI 4 Engine Coolant Temperature Input Voltage Low



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

ECT (Engine Coolant Temperature) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the ECU; lower temperatures result in higher voltages.

DTC SPN 110 FMI 4 will set if:

- The ECT input voltage drops below 0.1 volts. This voltage corresponds to a temperature that is higher than what is physically possible for engine coolant.

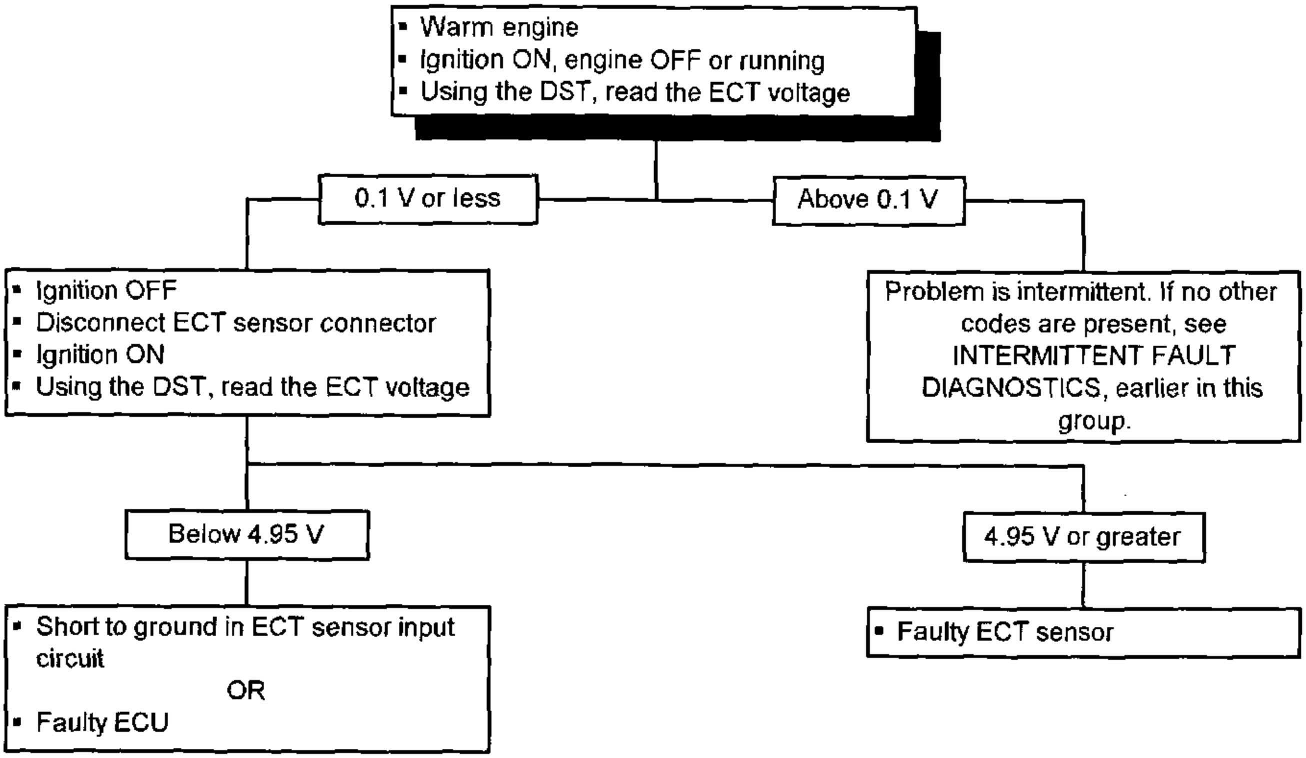
If DTC SPN 110 FMI 4 sets, the following will occur:

- The ECU uses a default "limp-home" ECT value of 90°C (194°F).
- ECU's high coolant temperature engine protection feature disabled.

DPSG,RG40854,177 –19–28JUN99–1/1

DTC SPN 110 FMI 4 Engine Coolant Temperature Input Voltage - Continued

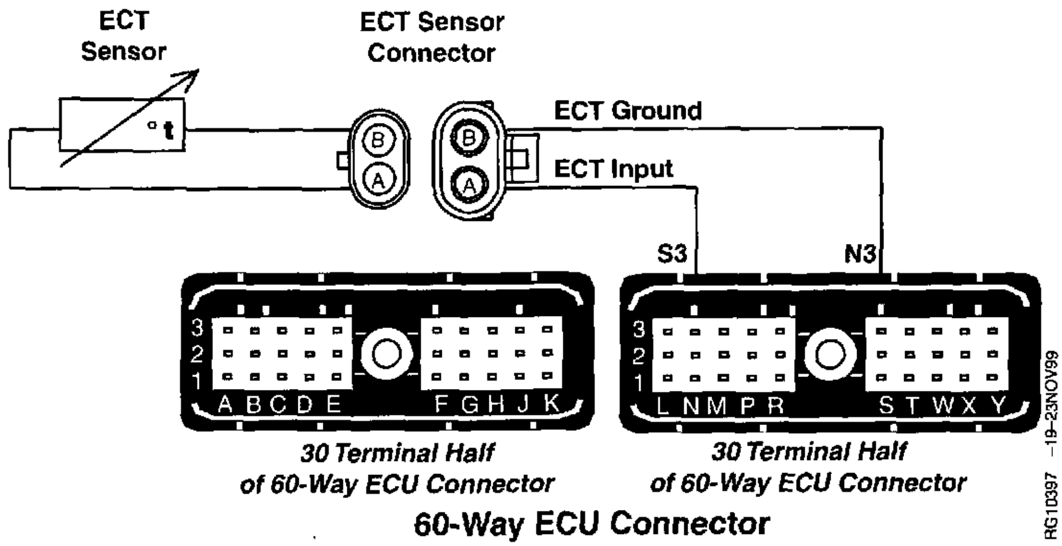
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10442 –19–17NOV99

DPSG,RG40854,394 –19–12OCT99–1/1

DTC SPN 110 FMI 16 Engine Coolant Temperature Moderately High



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

ECT (Engine Coolant Temperature) Sensor

- The ECT sensor is a thermistor (temperature sensitive resistor) mounted on the thermostat housing. It is used to measure the coolant temperature. The ECT's variable resistance causes the input voltage to the ECU to vary. Higher coolant temperatures result in lower ECT input voltages to the ECU; lower temperatures result in higher voltages.

DTC SPN 110 FMI 16 will set if:

- The ECU senses a coolant temperature of 105°C (221°F).

NOTE: Temperature value shown applies to OEM engine applications. Other applications may have the same or a similar temperature values. Refer to machine manual for high coolant temperature value.

If DTC SPN 110 FMI 16 sets, the following will occur:

- ECUs that have engine protection:
  - Will derate 2% per minute to a maximum derate of 20% (DTC SPN 1569 FMI 31 will also be present). When ECT goes below 105°C (221°F), power will be increased 2% per minute until either full power is reached or until coolant temperature again exceeds 105°C (221°F).
  - If in spite of the derate coolant temperature continues to climb, ECUs that have engine protection with shutdown will shut down the engine and set a DTC SPN 110 FMI 1 at a coolant temperature of 115°C (239°F).

NOTE: The derate program shown applies to OEM engine applications that contain engine protection. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.

DTC SPN 110 FMI 16 Engine Coolant Temperature Moderately High - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the ECT sensor connector looking for dirty, damaged, or poorly positioned terminals.

- Under the conditions where DTC SPN 110 FMI 16 occurs, using a temperature gauge, verify that engine coolant temperature is above 105 °C (221°F)

Temperature above 105°C (221°F)

- Engine overheating problem. See C1 - ENGINE COOLANT TEMPERATURE ABOVE NORMAL diagnostic procedure in Group 105 in this manual

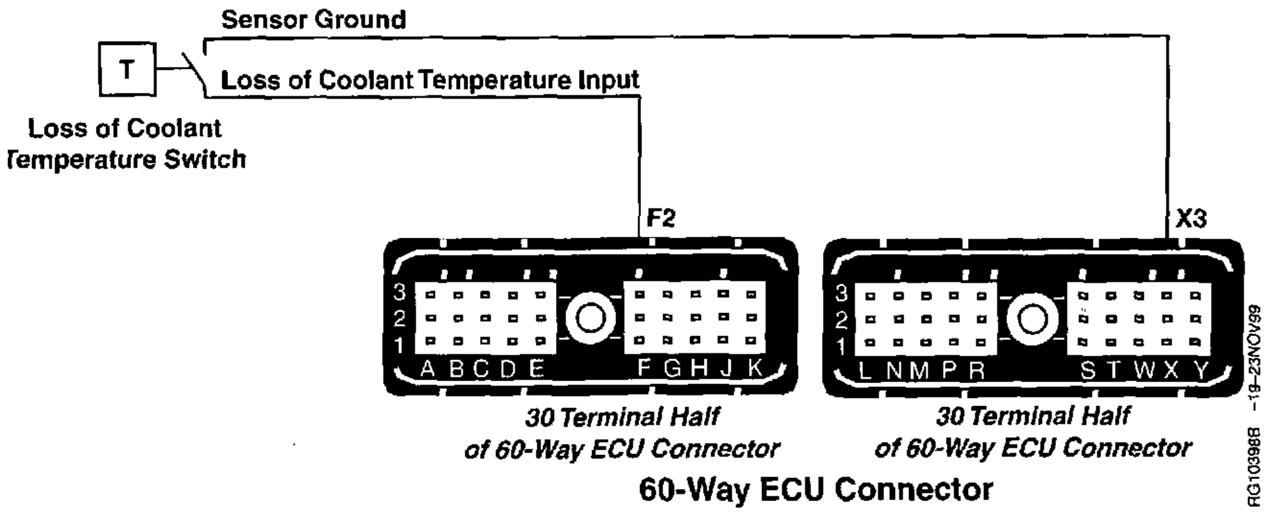
Significantly less than 105°C (221°F)

- Verify that ECT sensor input and ground circuits are OK
- If ECT sensor circuits are OK, replace ECT sensor and retest

RG10443 –19–17NOV99

DPSG,RG40854,395 –19–12OCT99–1/1

DTC SPN 111 FMI 1 Engine Coolant Level Low



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

Loss of Coolant Temperature Switch

- The loss of coolant temperature switch is a normally open temperature sensitive switch. When engine coolant is at the proper level, the temperature sensitive end of the switch is submerged in coolant, and the switch contacts will be open. If coolant level drops, the switch will no longer be submerged causing the temperature of the switch to raise beyond the point that causes the switch contacts to close. This causes the ECU to sense continuity to ground through the external shutdown/derate input terminal.

DTC SPN 111 FMI 1 will set if:

- The loss of coolant temperature switch contacts close causing the ECU to sense continuity to ground through the external shutdown/derate input terminal.

If DTC SPN 111 FMI 1 sets, the following occur:

- ECUs that have engine protection with shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 and DTC SPN 1109 FMI 31 may also be present). If the problem is still present after 30 seconds, the ECU will shut the engine down.

NOTE: *For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.*

- ECUs that have engine protection without shutdown:
  - Will severely derate the engine (DTC SPN 1569 FMI 31 will also be present), but will not shut the engine down.

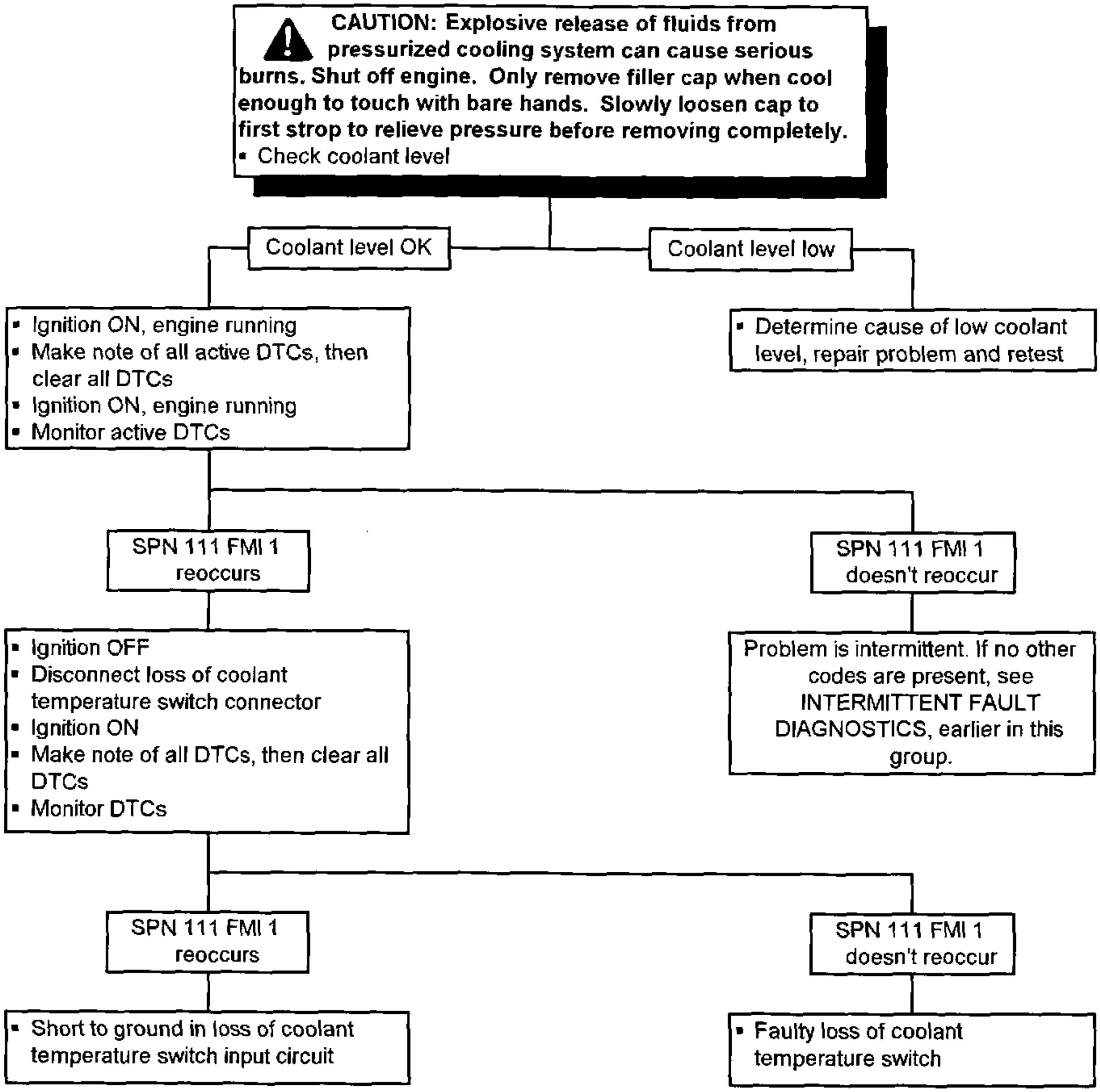
NOTE: *For OEM applications, the engine derates 20% per minute until the engine has been derated by 40%. Other applications may have a similar derate program. Refer to specific machine manual for application derate programs.*

- ECUs that have no engine protection:
  - There will be no derate and the ECU will not shut the engine down.

DPSG,RG40854,179 –19–28JUN99–1/1

DTC SPN 111 FMI 1 Engine Coolant Level Low - Continued

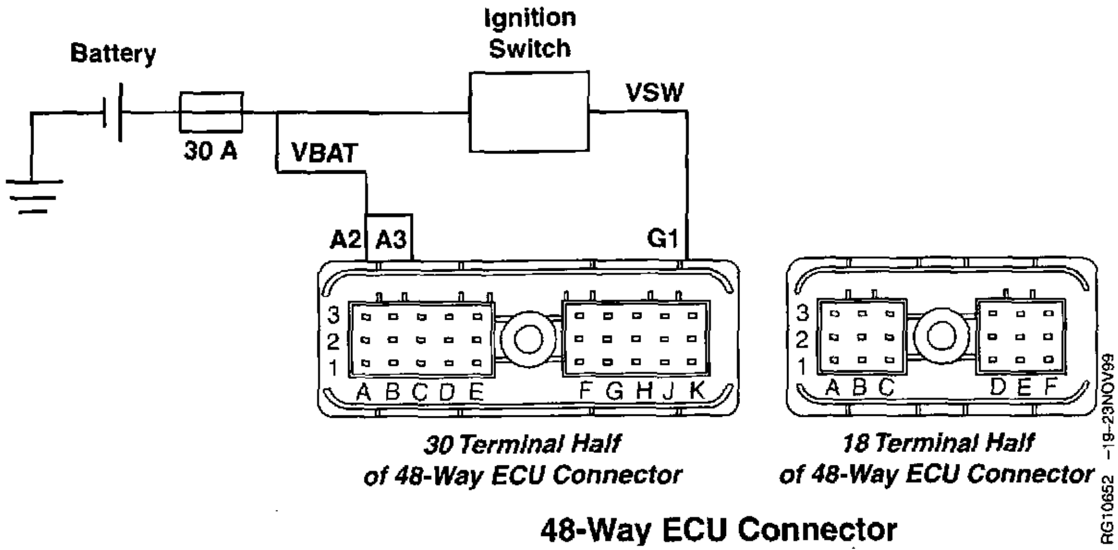
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the loss of coolant temperature switch connector, looking for dirty, damaged, or poorly positioned terminals.



RG10444 –19–17NOV99

DPSG,RG40854,396 –19–12OCT99–1/1

DTC SPN 158 FMI 17 ECU Power Down Error



48-Way ECU Connector

NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

DTC SPN 158 FMI 17 will set if:

- ECU is unable to complete proper power down procedures after detecting a key off condition.

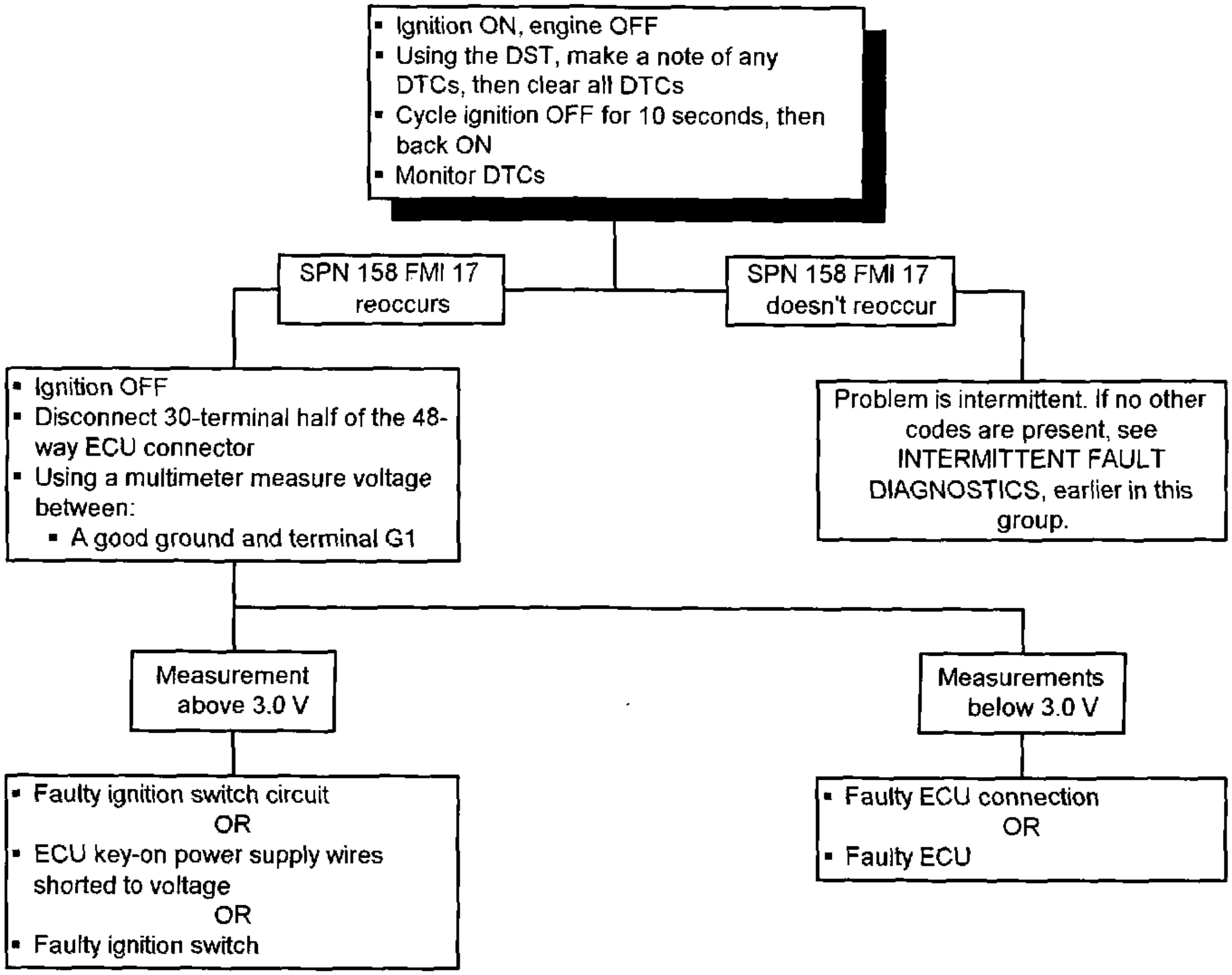
If DTC SPN 158 FMI 17 sets, the following will occur:

- Vehicle battery may be drained.

DPSG,RG40854,210 –19–29JUN99–1/1

DTC SPN 158 FMI 17 ECU Power Down Error - Continued

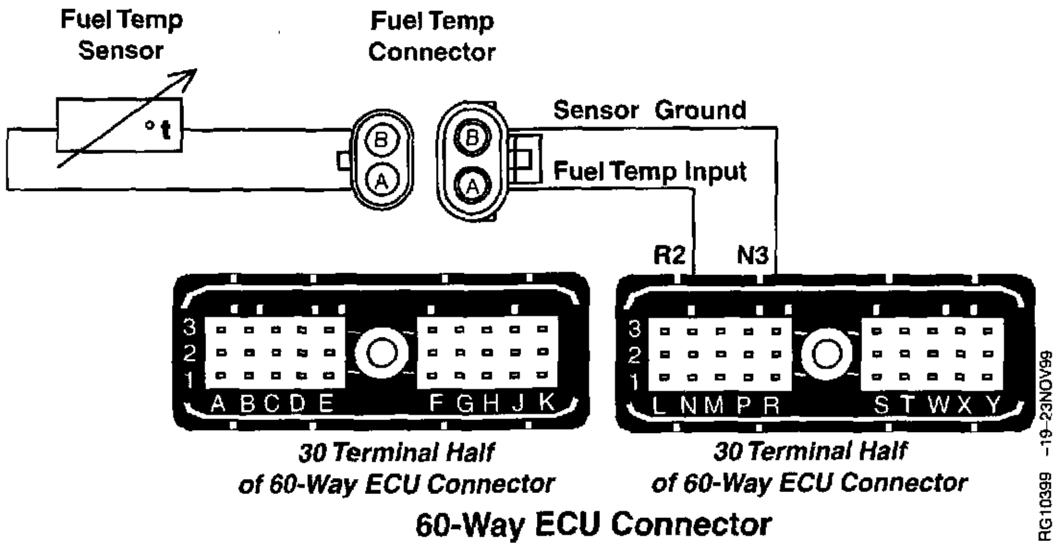
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the ignition power circuit, looking for dirty, damaged, or poorly positioned terminals.



RG10445 –19–17NOV99

DPSG,RG40854,397 –19–12OCT99–1/1

DTC SPN 174 FMI 3 Fuel Temperature Input Voltage High



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

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the fuel manifold. It is used to measure the fuel temperature. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for variation in fuel density caused by varying fuel temperatures.

DTC SPN 174 FMI 3 will set if:

- The fuel temperature input voltage exceeds 4.95 volts. The voltage corresponds to a temperature that is lower than what is physically possible for fuel.

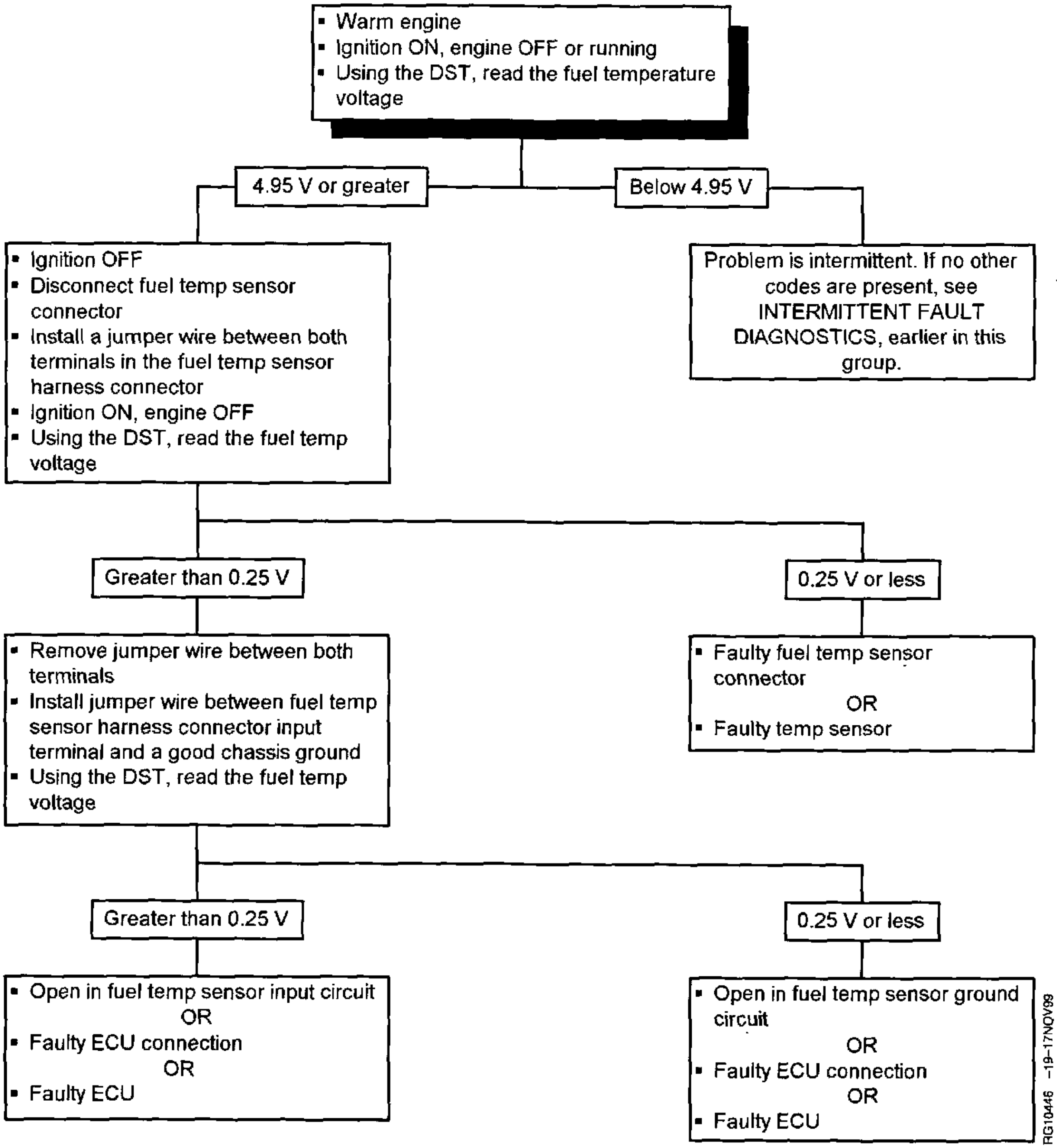
If DTC SPN 174 FMI 3 sets, the following will occur:

- The ECU will use a default "limp-home" value of 90°C (194°F).

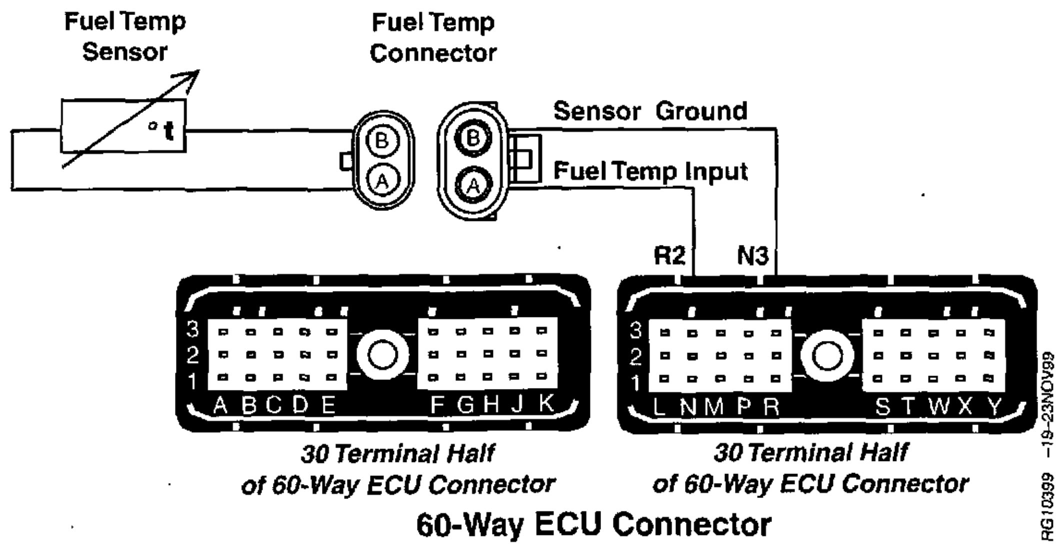
DPSG,RG40854,211 -19-29JUN99-1/1

DTC SPN 174 FMI 3 Fuel Temperature Input Voltage High - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the fuel temperature sensor connector looking for dirty, damaged, or poorly positioned terminals.



DTC SPN 174 FMI 4 Fuel Temperature Input Voltage Low



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

Fuel Temperature Sensor

- The fuel temperature sensor is a thermistor (temperature sensitive resistor) located on the fuel manifold. It is used to measure the fuel temperature. The fuel temperature sensor's variable resistance causes the input voltage to the ECU to vary. Higher fuel temperatures result in lower fuel temperature input voltages to the ECU; lower temperatures result in higher voltages. The ECU uses the fuel temperature sensor input to adjust the fuel delivery for variation in fuel density caused by varying fuel temperatures.

DTC SPN 174 FMI 4 will set if:

- The fuel temperature input voltage is below 0.25 volts. This voltage corresponds to a temperature that is lower than what is physically possible for fuel.

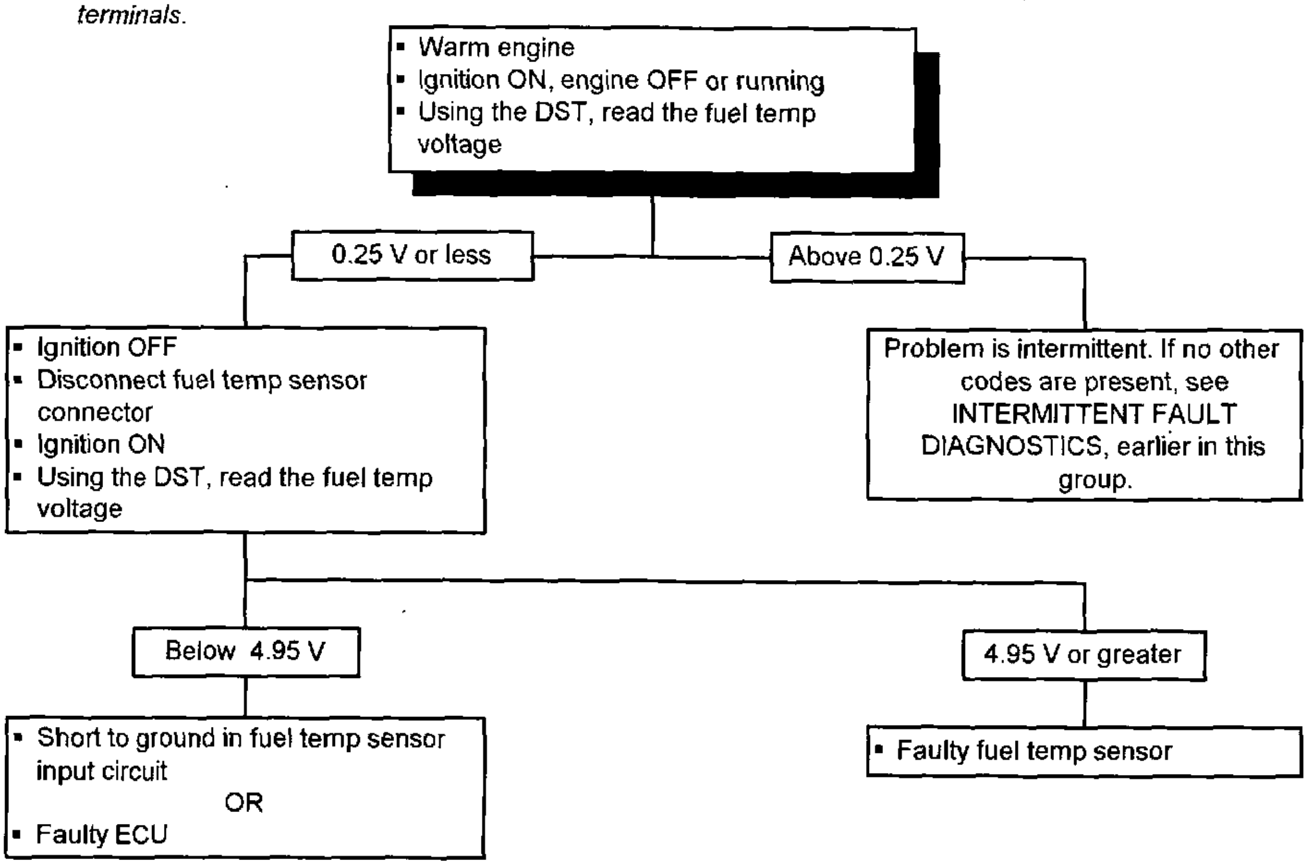
If DTC SPN 174 FMI 4 sets, the following will occur:

- The ECU will use a default "limp-home" value of 90°C (194°F).

DPSG,RG40854,212 –19–30JUN99–1/1

DTC SPN 174 FMI 4 Fuel Temperature Input Voltage Low - Continued

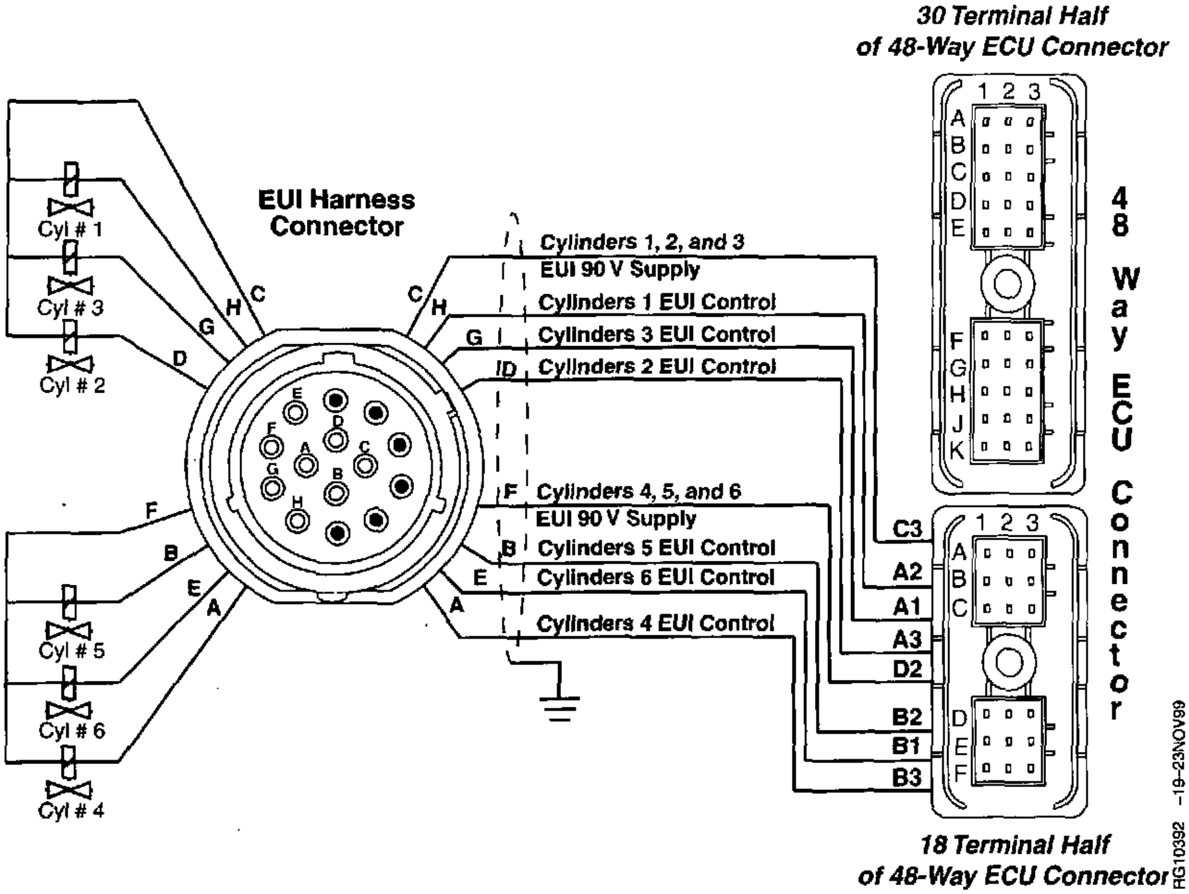
Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the fuel temp sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10447 –19–17NOV99

DPSG,RG40854,399 –19–12OCT99–1/1

DTC SPN 611 FMI 3 Injector Wiring Shorted To Power Source



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUI's for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 611 FMI 3 will set if:

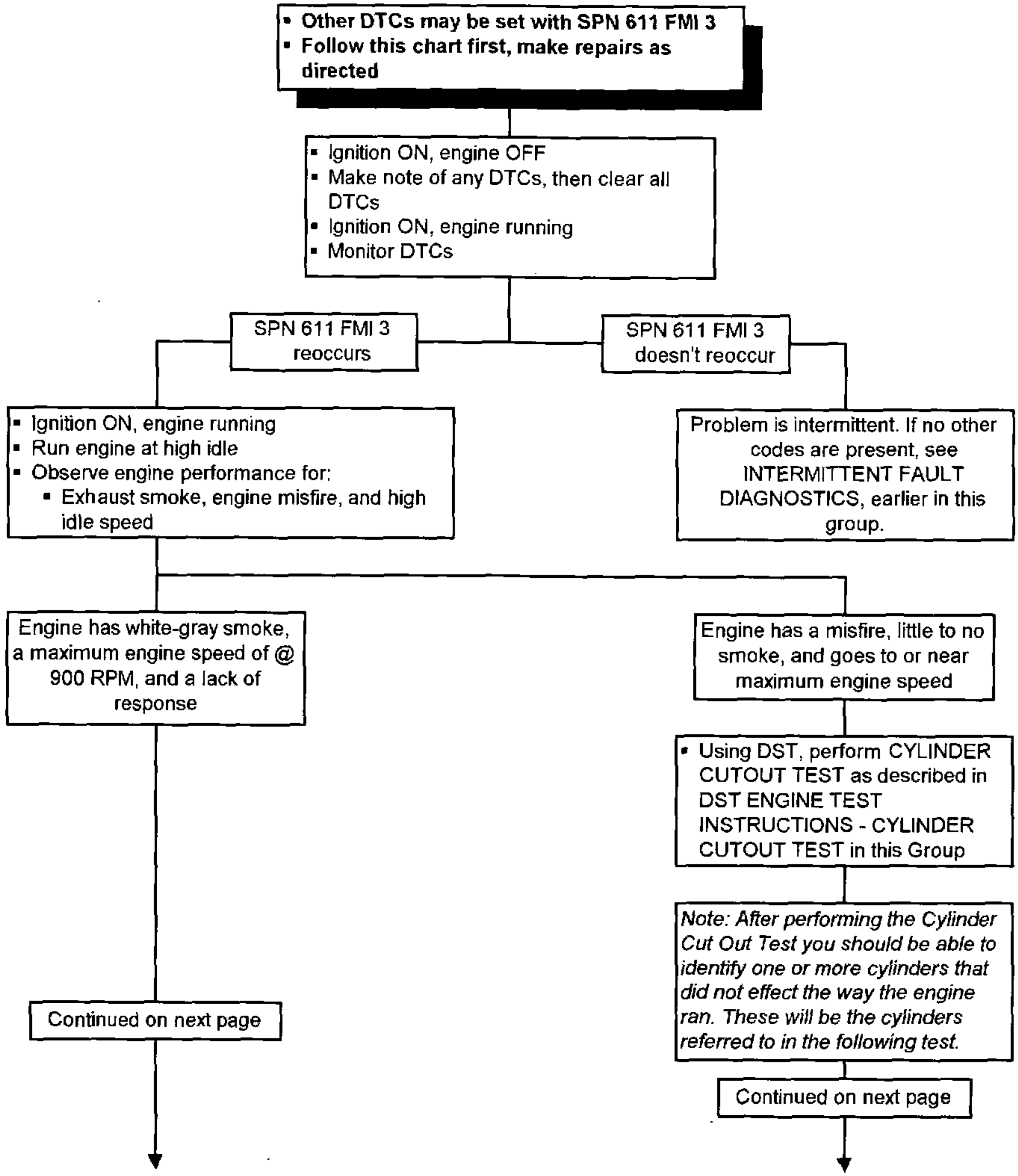
- The ECU detects that injector wiring is shorted to a power source.

If DTC SPN 611 FMI 3 sets, the following will occur:

- With DTC SPN 611 FMI 3 active, the ECU doesn't control the system any differently. Depending on the cause of this code, a cylinder misfire or gray smoke may be observed.

DTC SPN 611 FMI 3 Injector Wiring Shorted To Power Source - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48 and 60-way ECU connectors and the EUI harness connector looking for dirty, damaged, or poorly positioned terminals.



RG10448 –19–17NOV99

DPSG,RG40854,400 –19–12OCT99–1/1

DTC SPN 611 FMI 3 Injector Wiring Shorted To Power Source - Continued

Make note of the cylinder that changes the running of the engine the least, during the Cylinder Cut Out Test

- Ignition OFF
- Disconnect 48 and 60-way ECU connectors
- Disconnect EUI wiring harness connector at rear of cylinder head
- Using a multimeter, measure resistance between:
  - The control terminal of the EUI identified in the CYLINDER CUTOUT TEST, at the harness end of the 18-terminal half of the 48-way ECU connector
  - To all the terminals in both, the 48 and 60-way ECU connectors

All measurements greater than 20 kΩ

- Faulty ECU connection
  OR
- Faulty EUI wiring harness connection
  OR
- Faulty ECU

One or more measurements less than 20 kΩ

- Short in EUI control circuit

- Ignition OFF
- Disconnect 48 and 60-way ECU connectors
- Disconnect EUI wiring harness connector at rear of cylinder head
- Using a multimeter, measure resistance between:
  - The EUI 90 V terminal C3 in the harness end of the 18 terminal half of the 48-way ECU connector and all the terminals in both the 48 and 60-way connectors
  - The EUI 90 V terminal D2 in the harness end of the 18 terminal half of the 48-way ECU connector to all the terminals in both the 48 and 60-way connectors

All measurements greater than 20 kΩ

- Faulty ECU connection
  OR
- Faulty EUI wiring harness connection
  OR
- Faulty ECU

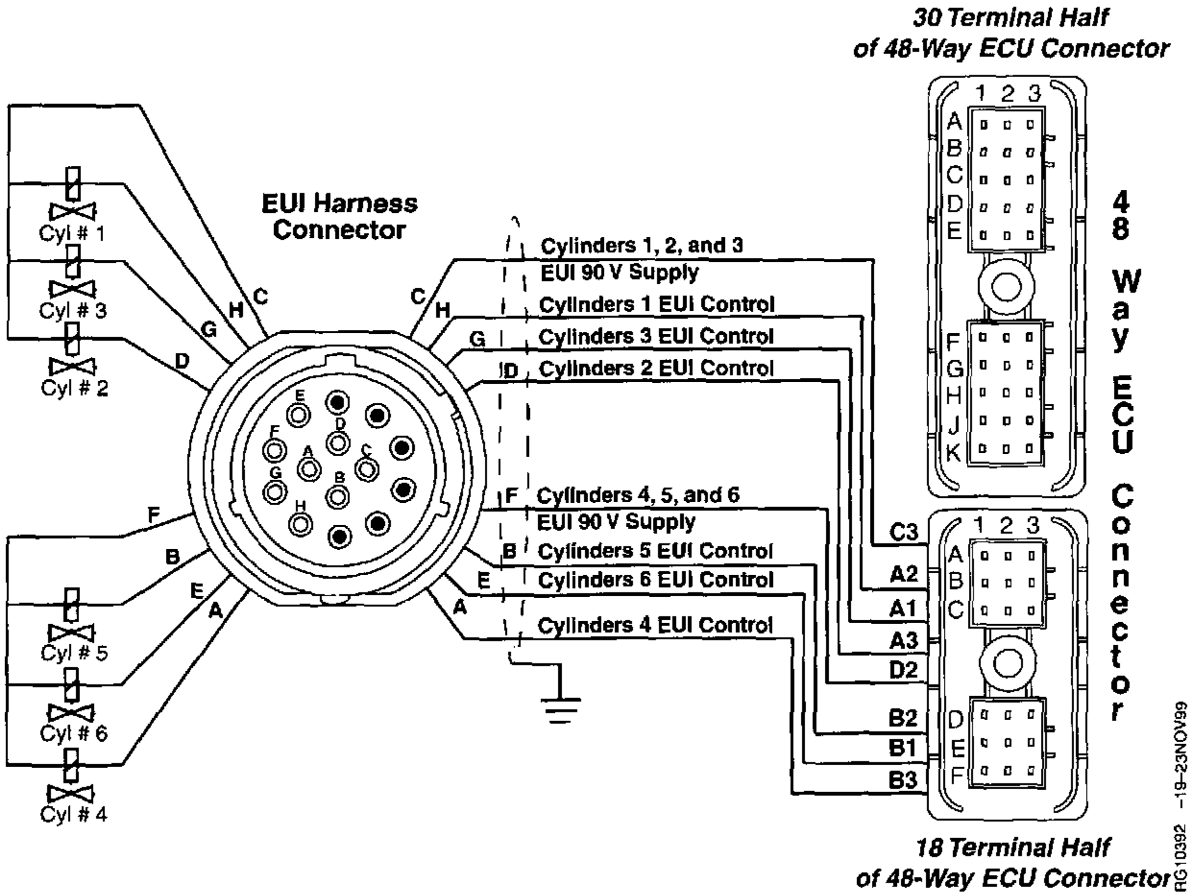
One or more measurements less than 20 kΩ

- Short in EUI 90 V circuit

RG10449 –19–17NOV99

DPSG,RG40854,401 –19–12OCT99–1/1

DTC SPN 611 FMI 4 Injector Wiring Shorted To Ground



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 611 FMI 4 will set if:

- The ECU detects that injector wiring is shorted to ground.

If DTC SPN 611 FMI 4 sets, the following will occur:

- With DTC SPN 611 FMI 4 active, the ECU doesn't control the system any differently. Depending on the cause of this code, the engine may not start, run rough, or have excessive black smoke.

DTC SPN 611 FMI 4 Injector Wiring Shorted To Ground - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector looking for dirty, damaged, or poorly positioned terminals.

- **Other DTCs may be set with SPN 611 FMI 4**
- **Follow this chart first, make repairs as directed**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running at high idle or cranking for 15 seconds
- Monitor DTCs

SPN 611 FMI 4 reoccurs

- Ignition ON, engine cranking for 15 seconds or running at high idle
- Observe engine performance

Engine will not start

- Ignition OFF
- Disconnect 48 and 60-way ECU connectors
- Disconnect EUI wiring harness connector at rear of cylinder head
- Using a multimeter, measure resistance between:
  - Terminal C3 in the harness end of the 18 terminal half of the 48-way ECU connector and all other terminals in the 48 and 60-way ECU connectors and a good chassis ground
  - Terminal D2 in the harness end of the 18 terminal half of the 48-way ECU connector and all other terminals in the 48 and 60-way ECU connector and a good chassis ground

Continued on next page

Engine runs rough and has excessive black smoke

- Using DST, perform CYLINDER CUTOUT TEST as described in DST ENGINE TEST INSTRUCTIONS - CYLINDER CUT OUT TEST in this Group

Continued on next page

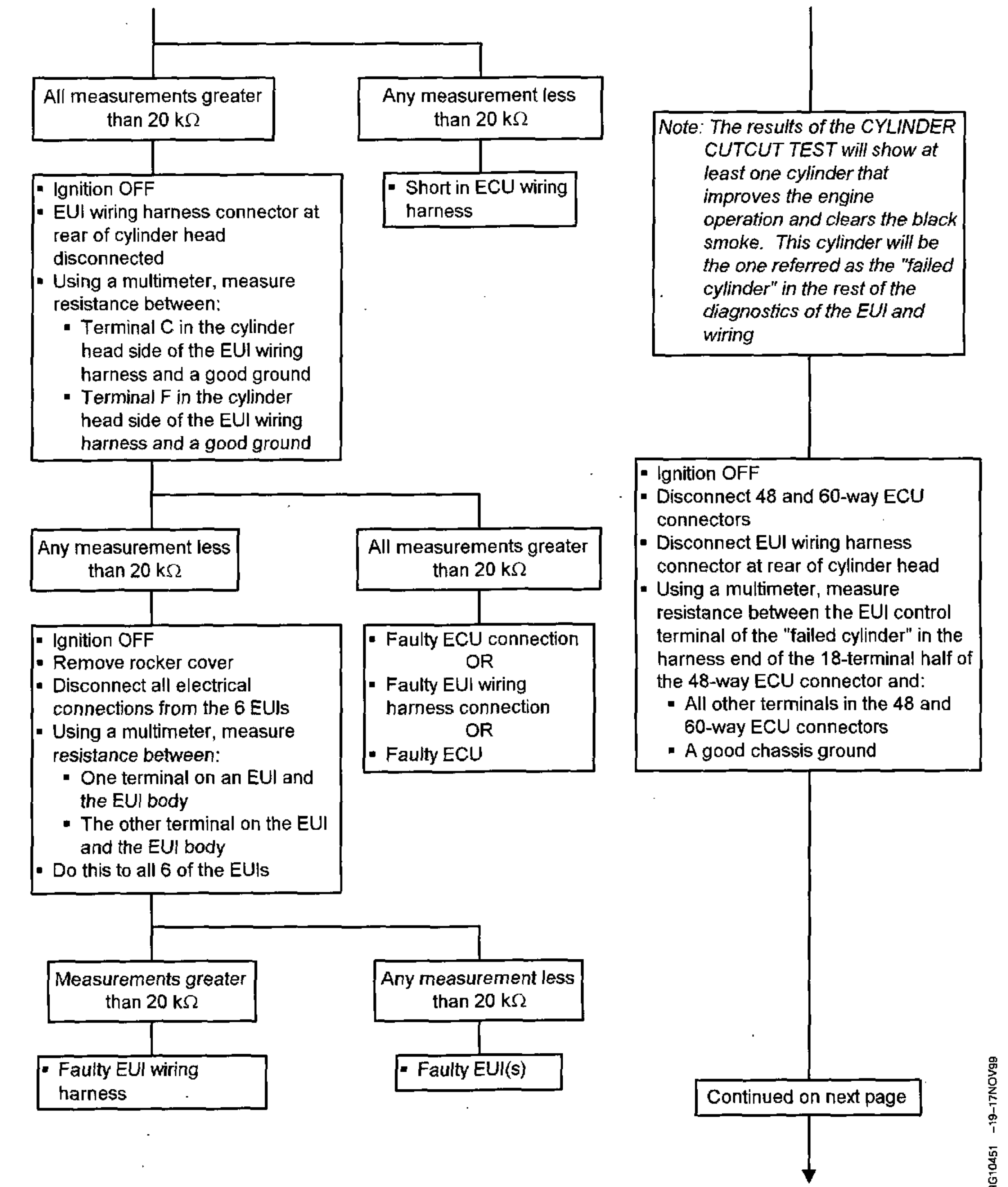
SPN 611 FMI 4 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10450 –19–17NOV99

DPSG,RG40854,402 –19–12OCT99–1/1

DTC SPN 611 FMI 4 Injector Wiring Shorted To Ground - Continued



DPSG,RG40854,403 -19-12OCT99-1/1

DTC SPN 611 FMI 4 Injector Wiring Shorted To Ground - Continued

- **All measurements greater than 20 kΩ**
  - Ignition OFF
  - EUI wiring harness connector at rear of cylinder head disconnected
  - Using a multimeter, measure resistance between:
    - The EUI control terminal of the "failed cylinder" on the cylinder head side of the EUI wiring harness and a good ground
  - **Any measurement less than 20 kΩ**
    - Ignition OFF
    - Remove rocker cover
    - Disconnect all electrical connections from the EUI of the "failed cylinder"
    - Using a multimeter, measure resistance between:
      - One terminal on an EUI and the EUI body
      - The other terminal on the EUI and the EUI body
    - **Any measurement less than 20 kΩ**
      - Faulty EUI(s)
    - **All measurements greater than 20 kΩ**
      - Faulty EUI wiring harness
  - **All measurements greater than 20 kΩ**
    - Faulty ECU connection

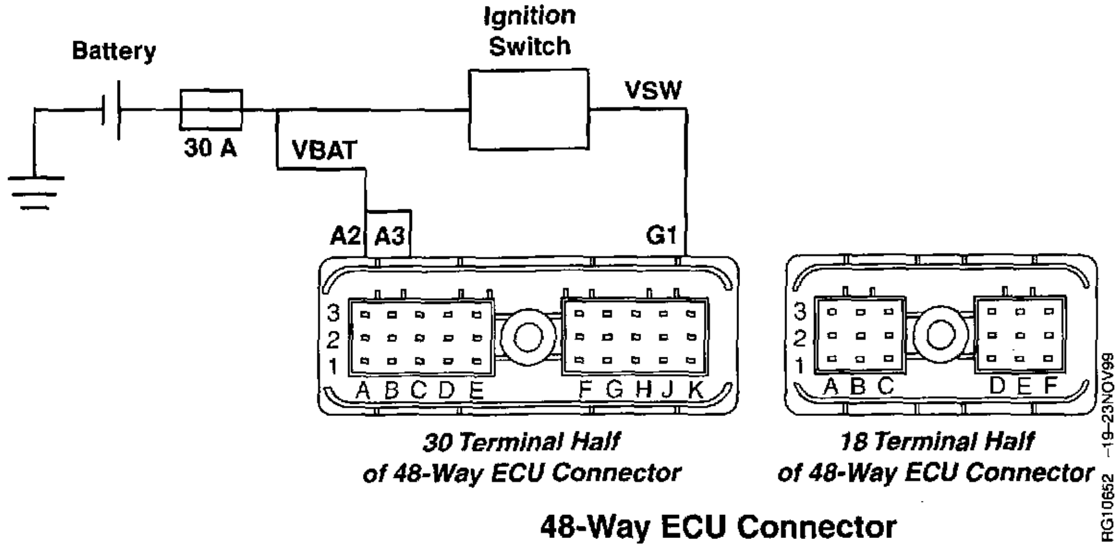
      OR
    - Faulty EUI wiring connection

      OR
    - Faulty ECU
- **Any measurement less than 20 kΩ**
  - Short in ECU wiring harness

RG10452 -19-17NOV99

DPSG,RG40854,404 -19-12OCT99-1/1

DTC SPN 627 FMI 1 Injector Supply Voltage Problem



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 627 FMI 1 will set if:

- The ECU detects an injector voltage supply problem.

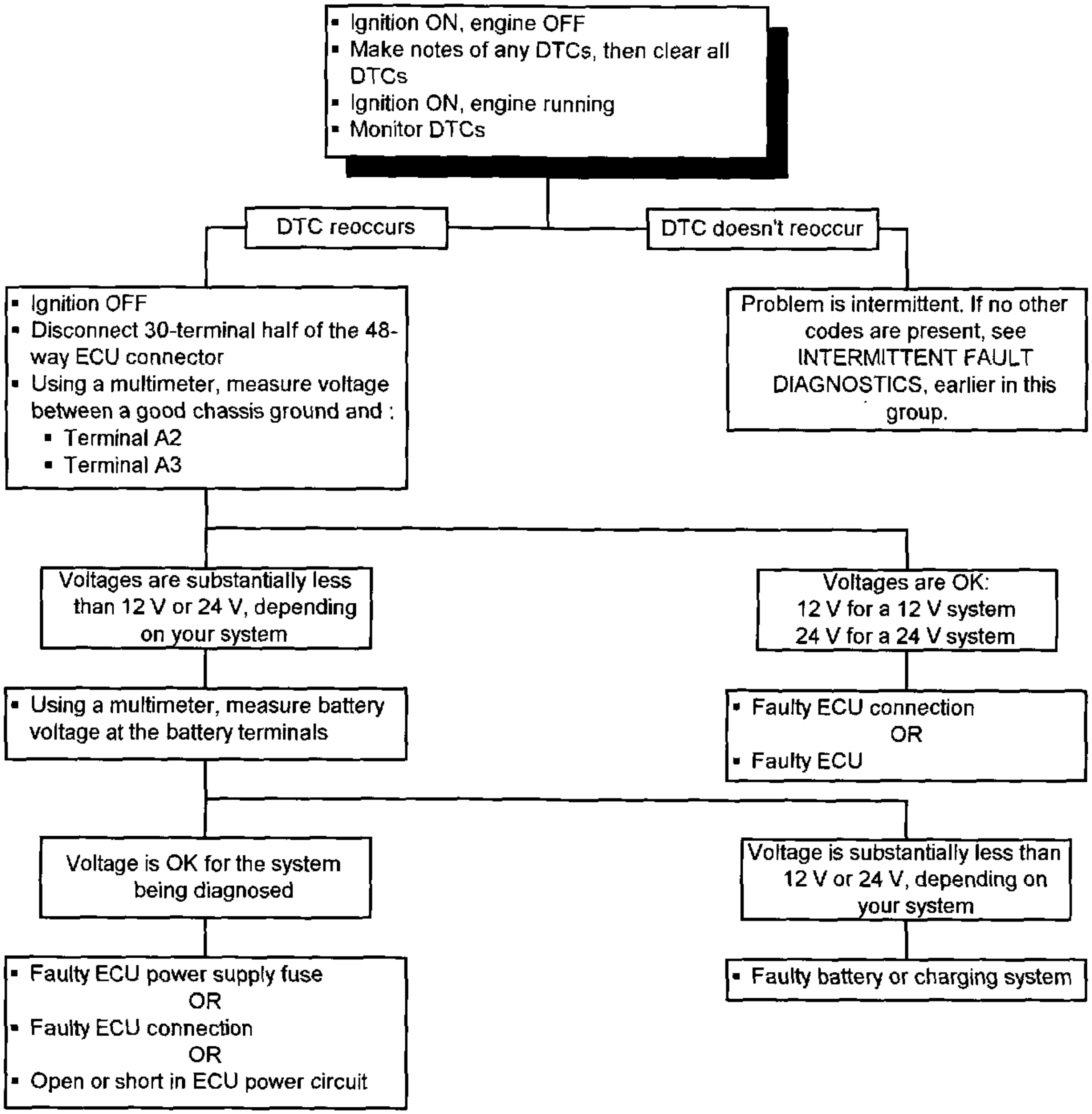
If DTC SPN 627 FMI 1 sets, the following will occur:

- The EUIs will not work properly.

DPSG,RG40854,215 -19-30JUN99-1/1

DTC SPN 627 FMI 1 Injector Supply Voltage Problem - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and all ECU grounds looking for dirty, damaged, or poorly positioned terminals.



RG10629 –19–17NOV99

DPSG,RG40854,470 –19–17NOV99–1/1

DTC SPN 629 FMI 12, 13 ECU Error

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

DTC SPN 629 FMI 12 or 13 will set if:

- *The ECU detects an internal problem.*

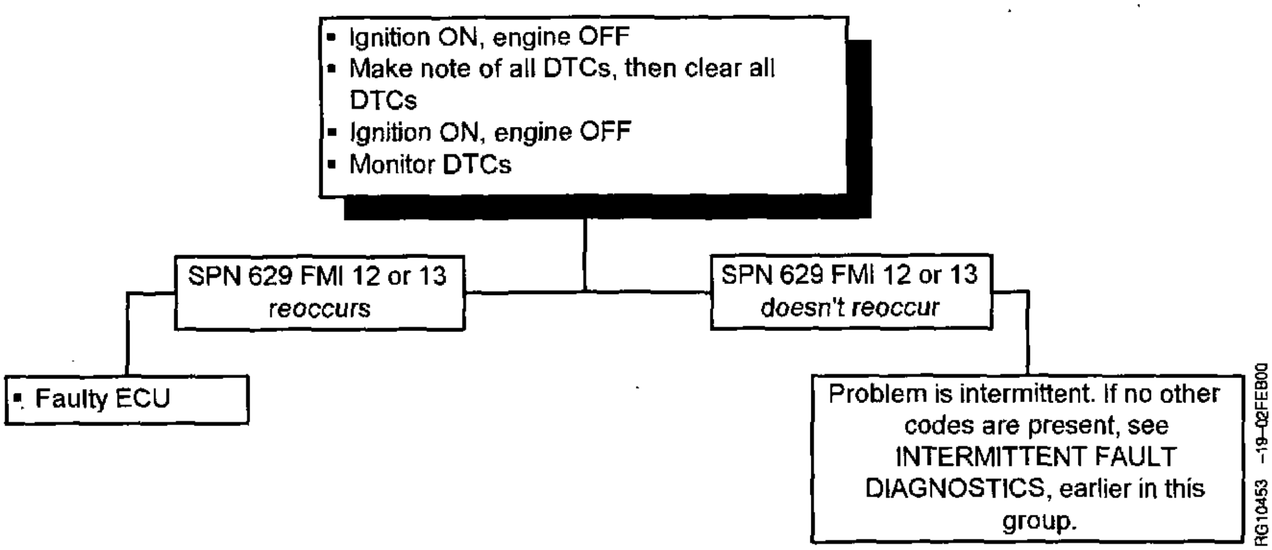
If DTC SPN 629 FMI 12 or 13 sets, the following will occur:

- Engine will not start or run.

DPSG,RG40854,216 –19–30JUN99–1/1

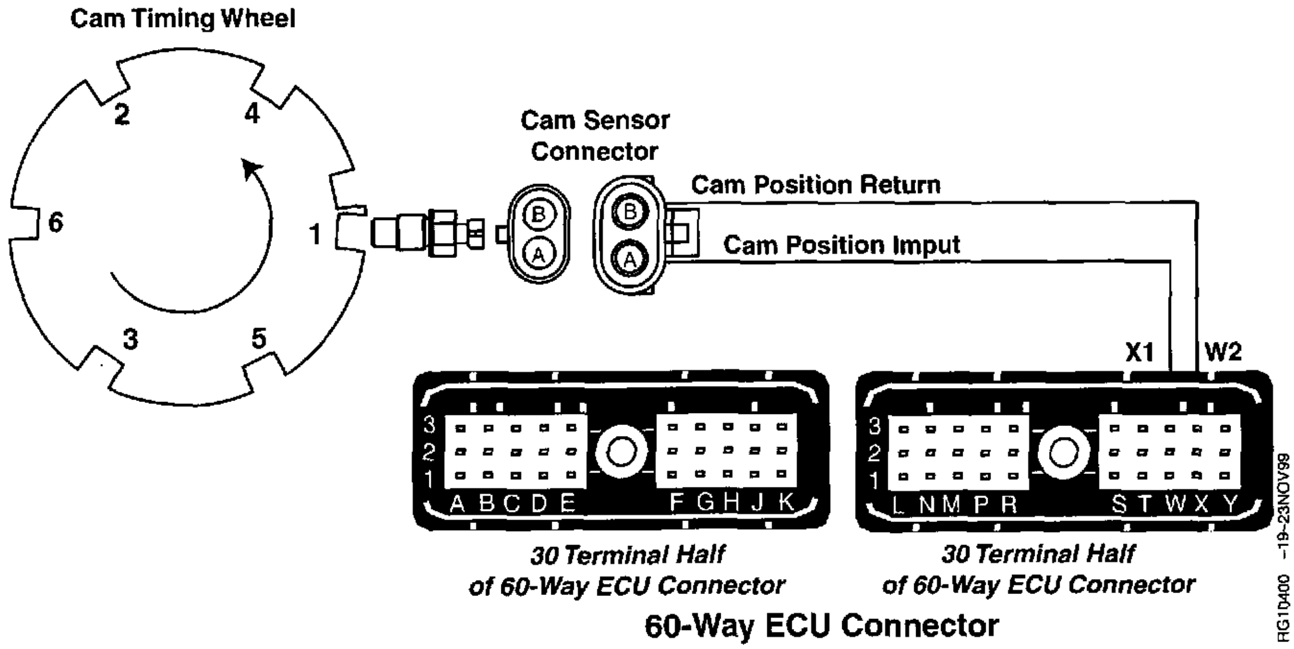
DTC SPN 629 FMI 12, 13 ECU Error - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the 48-way ECU connector sensor connector looking for dirty, damaged, or poorly positioned terminals.



DPSG,RG40854,405 –19–12OCT99–1/1

DTC SPN 636 FMI 2 Cam Position Input Noise



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

Camshaft Position Sensor

- The Cam position sensor is an inductive type pickup sensor that detects 7 notches on the camshaft timing wheel. 6 of the 7 notches correspond to a cylinder; the 7th notch allows the ECU to identify cylinder number 1. Using the Cam position input, the ECU is able to determine when a cylinder is at the end of the compression stroke. The ECU uses the crank position input to determine engine speed and precise piston position in relation to TDC. Based on this information, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC SPN 636 FMI 2 will set if:

- The ECU detects excessive noise (extra pulses) on the cam position input.

If DTC SPN 636 FMI 2 sets, the following will occur:

- If a crank position sensor trouble code accompanies DTC SPN 636 FMI 2, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the crank position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,217 -19-30JUN99-1/1

DTC SPN 636 FMI 2 Cam Position Input Noise - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the cam sensor connector looking for dirty, damaged, or poorly positioned terminals.

- Warm engine
- Ignition ON, engine OFF
- Make note of all DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor DTCs

SPN 636 FMI 2 reoccurs

- SPN 636 FMI 2 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections anywhere on the machine. Things to check :
  - All harness connectors
  - Alternator connections
  - Chassis ground connections, battery ground connection
  - Corrosion, dirt, or paint can cause intermittent and "noisy" connections
  - Check the wiring for intermittent open and short circuits; particularly the cam sensor wiring
  - Check wiring for proper pin location in the cam sensor and ECU connectors
- Other possible causes of SPN 636 FMI 2:
  - Electromagnetic interference (EMI) from an incorrectly installed 2-way radio
  - Interference from some radar source
  - Possible burrs on the camshaft notches, should be clean, square edges

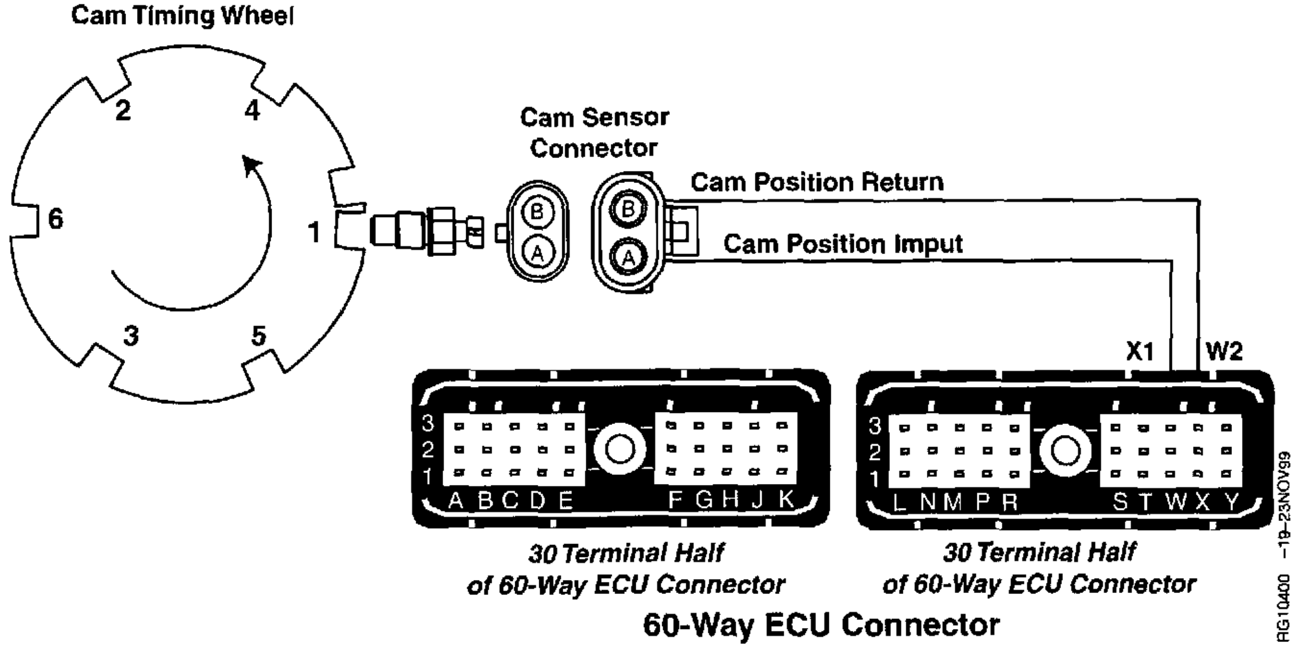
SPN 636 FMI 2 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10457 -19-17NOV99

DPSG,RG40854,406 -19-12OCT99-1/1

DTC SPN 636 FMI 8 Cam Position Input Missing



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

Camshaft Position Sensor

- The cam position sensor is an inductive type pickup sensor that detects 7 notches on the camshaft timing wheel. 6 of the 7 notches correspond to a cylinder; the 7th notch allows the ECU to identify cylinder number 1. Using the cam position input, the ECU is able to determine when a cylinder is at the end of the compression stroke. The ECU uses the crank position input to determine engine speed and precise piston position in relation to TDC. Based on this information, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC SPN 636 FMI 8 will set if:

- The ECU does not detect the cam position input.

If DTC SPN 636 FMI 8 sets, the following will occur:

- If a crank position sensor trouble code accompanies DTC SPN 636 FMI 8, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the crank position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,218 -19-30JUN99-1/1

DTC SPN 636 FMI 8 Cam Position Input Missing - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the cam position sensor connector looking for dirty, damaged, or poorly positioned terminals.

- Ignition ON, engine OFF
- Make notes of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor DTCs

SPN 636 FMI 8 reoccurs

- Ignition OFF
- Disconnect cam position sensor connector
- Using a multimeter, measure resistance between both terminals of the cam position sensor

SPN 636 FMI 8 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

Between 2500 and 3500 Ω

- Ignition OFF
- Disconnect cam position sensor connector
- Disconnect 60-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal A of the cam position sensor harness connector and terminal X1 in the harness end of the 60-way ECU connector

    and
  - Terminal B of the cam position sensor harness connector and terminal W2 in the harness end of the 60-way ECU connector

Continued on next page

Below 2500 Ω or above 3500 Ω

- Faulty cam position sensor

RG10458 –19–17NOV99

DPSG,RG40854,407 –19–12OCT99–1/1

DTC SPN 636 FMI 8 Cam Position Input Missing - Continued

Both measurements 5 Ω or less

- Ignition OFF
- Cam position sensor connector and 60-way ECU connector still disconnected
- Using a multimeter measure resistance between terminal X1 in the harness end of the 60-way ECU connector and the following:
  - A good ground
  - All other terminals in both ECU connectors

Either measurement greater than 5 Ω

- Open in cam position sensor input wire

  OR
- Open in cam position sensor return wire

  OR
- Terminals A and B in the cam position sensor harness connector possibly inverted

All measurements greater than 2 kΩ

- Ignition OFF
- Cam position sensor connector and 60-way ECU connector still disconnected
- Using a multimeter measure resistance between terminal W2 in the harness end of the 60-way ECU connector and the following:
  - A good ground
  - All other terminals in both ECU connectors

Any measurement less than 2 kΩ

- Faulty cam position sensor input wiring harness

All measurements greater than 2 kΩ

- Faulty cam position sensor connector

  OR
- Damaged cam position sensor

  OR
- Faulty ECU connector

  OR
- Faulty ECU

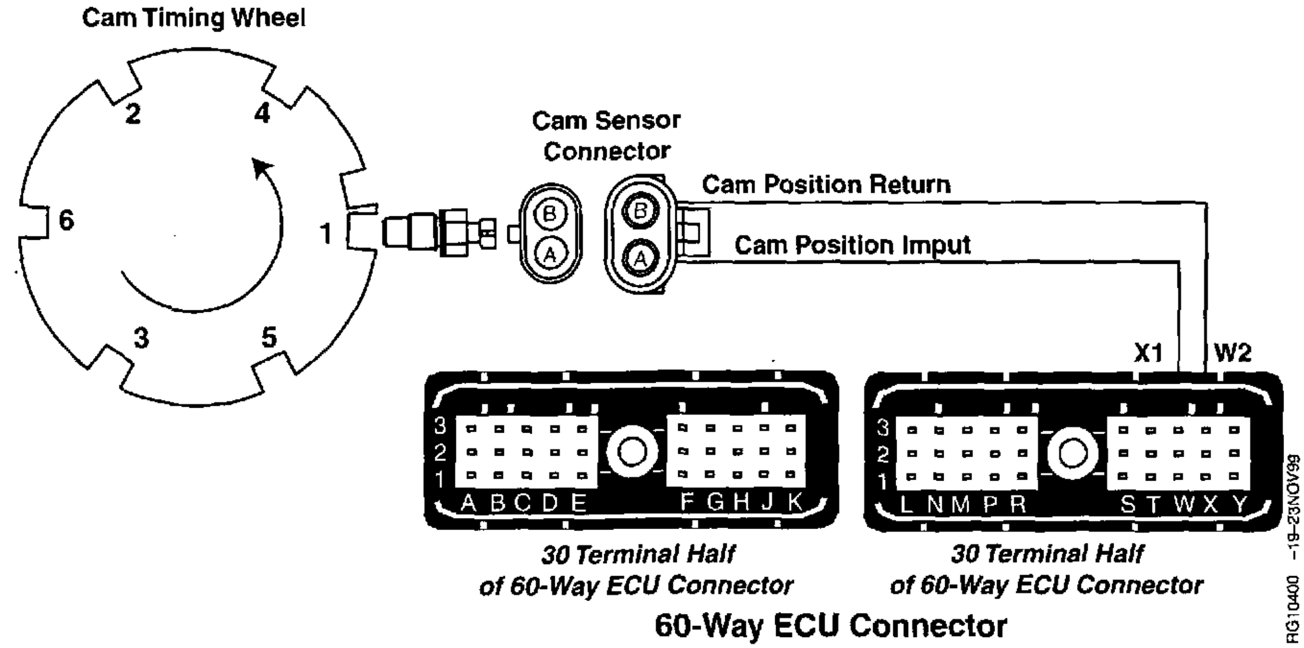
Any measurement less than 2 kΩ

- Faulty cam position sensor return wiring harness

RG10459 –19–17NOV99

DPSG,RG40854,409 –19–12OCT99–1/1

DTC SPN 636 FMI 10 Cam Position Input Pattern Error



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

Camshaft Position Sensor

- The cam position sensor is an inductive type pickup sensor that detects 7 notches on the camshaft timing wheel. 6 of the 7 notches correspond to a cylinder; the 7th notch allows the ECU to identify cylinder number 1. Using the cam position input, the ECU is able to determine when a cylinder is at the end of the compression stroke. The ECU uses the crank position input to determine engine speed and precise piston position in relation to TDC. Based on this information, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC SPN 636 FMI 10 will set if:

- The ECU detects an improper pattern on the cam position input.

If DTC SPN 636 FMI 10 sets, the following will occur:

- If a crank position sensor trouble code accompanies DTC SPN 636 FMI 10, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the crank position sensor input to determine piston position.
- The moment that the trouble code sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,219 –19–30JUN99–1/1

DTC SPN 636 FMI 10 Cam Position Input Pattern Error - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the cam position sensor connector looking for dirty, damaged, or poorly positioned terminals.

- Ignition ON, engine OFF
- Make notes of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor DTCs

SPN 636 FMI 10 reoccurs

SPN 636 FMI 10 doesn't reoccur

- Ignition OFF
- Disconnect cam position sensor connector
- Using a multimeter, measure resistance between both terminals of the cam position sensor

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

Between 2500 and 3500 Ω

Below 2500 Ω or above 3500 Ω

- Ignition OFF
- Disconnect cam position sensor connector
- Disconnect 60-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal A of the cam position sensor harness connector and terminal X1 in the harness end of the 60-way ECU connector

    and
  - Terminal B of the cam position sensor harness connector and terminal W2 in the harness end of the 60-way ECU connector

- Faulty cam position sensor

Continued on next page

RG10454 -19-06JAN00

DPSG,RG40854,408 -19-12OCT99-1/1

DTC SPN 636 FMI 10 Cam Position Input Pattern Error - Continued

Both measurements 5 Ω or less

- *Ignition OFF*
- Cam position sensor connector and 60-way ECU connector still disconnected
- Using a multimeter measure resistance between terminal X1 in the harness end of the 60-way ECU connector and the following:
  - A good ground
  - All other terminals in both ECU connectors

Either measurement greater than 5 Ω

- *Open in cam position sensor* input wire

OR

- Open in cam position sensor return wire

OR

- Terminals A and B in the cam position sensor harness connector possibly inverted

All measurements greater than 2 kΩ

- Ignition OFF
- Cam position sensor connector and 60-way ECU connector still disconnected
- Using a multimeter measure resistance between terminal W2 in the harness end of the 60-way ECU connector and the following:
  - A good ground
  - All other terminals in both ECU connectors

Any measurement less than 2 kΩ

- Faulty cam position sensor input wiring harness

All measurements greater than 2 kΩ

Continued on next page

Any measurement less than 2 kΩ

- Faulty cam position sensor return wiring harness

RG10455 -19-17NOV99

DPSG,RG40854,411 -19-12OCT99-1/1

DTC SPN 636 FMI 10 Cam Position Input Pattern Error - Continued

- Remove cam sensor from cylinder head
- Inspect sensor for cracks, corrosion, or any foreign material on the end of the sensor
- Remove the rocker arm cover
- Inspect the camshaft timing notches for burrs or chips

All components OK

- Ignition OFF
- Perform CHECK CAMSHAFT-TO-CRANKSHAFT TIMING in Group 105 in this manual

Crank timing pin engages in slot

- Faulty cam sensor connector

OR

- Faulty ECU connector

OR

- Faulty ECU

Crank timing pin won't engage slot

- Cam and crank out of time
- Perform CHECK AND ADJUST CAMSHAFT-TO-CRANKSHAFT TIMING in Group 16 of the 6105 and 6125 Diesel Engine Repair Manual (CTM 100)

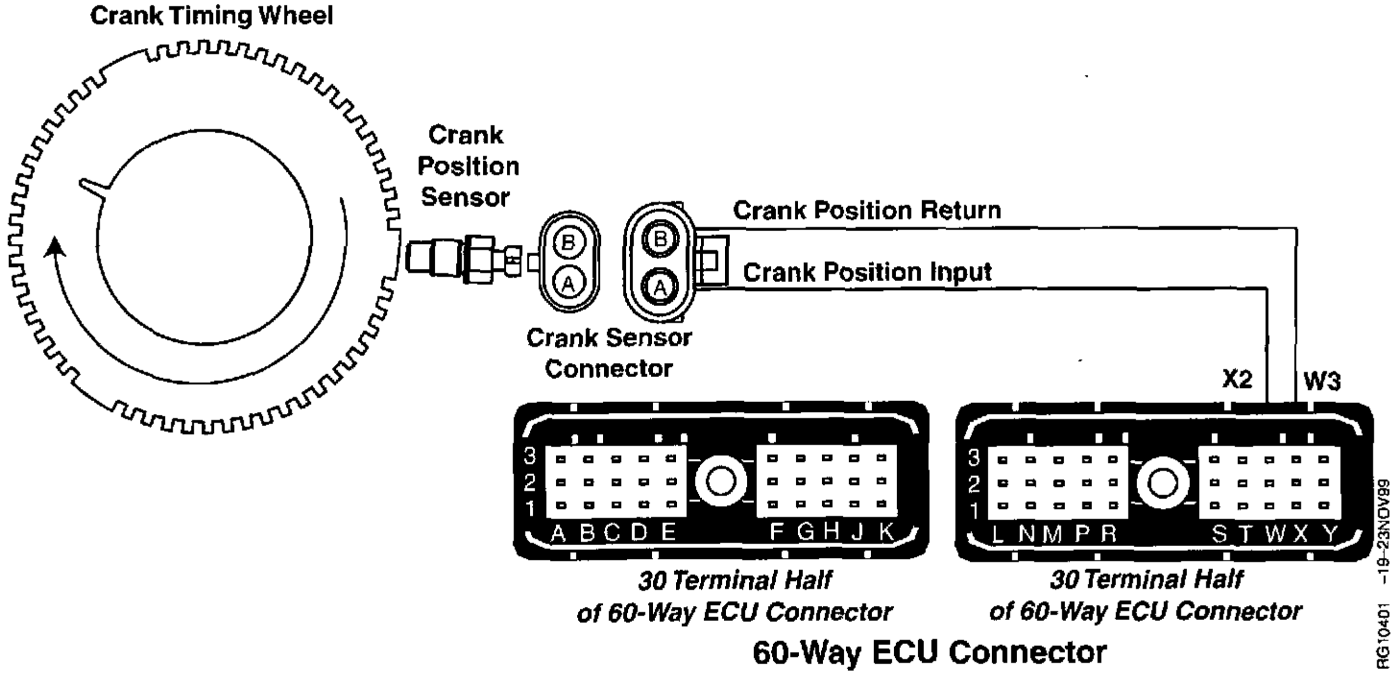
Fault found in a component

- Repair or replace component as needed

RG10458 -19-17NOV99

DPSG,RG40854,412 -19-12OCT99-1/1

DTC SPN 637 FMI 2 Crank Position Input Noise



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

Crank Position Sensor

- The crank position sensor is an inductive type pickup sensor that detects notches on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the cam position sensor input to determine piston position in relation to the firing order. Based on information from the crank and cam position sensors, the ECU calculates the cam position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC SPN 637 FMI 2 will set if:

- The ECU detects excessive noise (extra pulses) on the crank position input.

If DTC SPN 637 FMI 2 sets, the following will occur:

- If a cam position sensor trouble code accompanies DTC SPN 637 FMI 2, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the cam position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DTC SPN 637 FMI 2 Crank Position Input Noise - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the crank sensor connector looking for dirty, damaged, or poorly positioned terminals.

- Warm engine
- Ignition ON, engine OFF
- Make note of all DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor DTCs

SPN 637 FMI 2 reoccurs

- SPN 637 FMI 2 is most likely caused by radiated or conducted electrical "noise" from some part of the machine. This problem may be caused by loose electrical ground or power connections anywhere on the machine. Things to check:
  - All harness connectors
  - Alternator connections
  - Chassis ground connections, battery ground connection
  - Corrosion, dirt, or paint can cause intermittent and "noisy" connections
  - Check the wiring for intermittent open and short circuits; particularly the crank sensor wiring
  - Check wiring for proper pin location in the crank sensor and ECU connectors
- Other possible causes of SPN 637 FMI 2:
  - Electromagnetic interference (EMI) from an incorrectly installed 2-way radio
  - Interference from some radar source
  - Possible broken teeth on the crankshaft timing ring

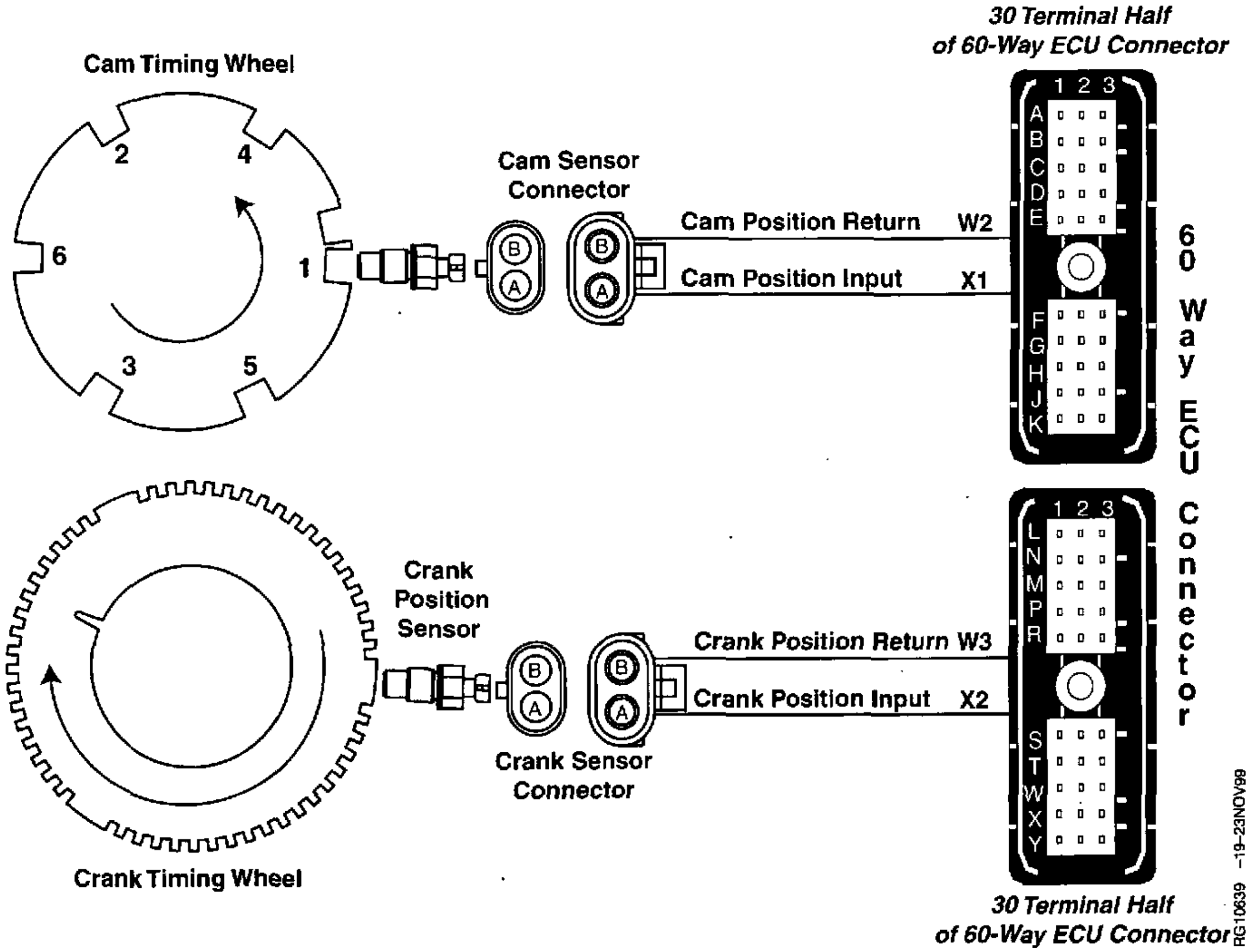
SPN 637 FMI 2 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10460 -19-17NOV99

DPSG,RG40854,410 -19-12OCT99-1/1

DTC SPN 637 FMI 7 Crank Position/Cam Position Out of Sync



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

Camshaft and Crankshaft Position Sensors

- The cam and crank position sensors are both inductive type pickup sensors that detect notches on the cam and crank timing wheels. The ECU uses the crank position input to determine engine speed and precise piston position in relation to TDC. Using the cam position input, the ECU is able to determine when a cylinder is at the end of the compression stroke. Based on this information, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly. A known relationship between the cam position sensor signal and the crank position sensor signal allows the ECU to recognize when one signal is not in sync with the other.

DTC SPN 637 FMI 7 will set if:

- The ECU detects that the cam and crank inputs are not in sync with each other.

If DTC SPN 637 FMI 7 sets, the following will occur:

- Depending on the cause of the trouble code, the engine may die, and then it may or may not restart.

Continued on next page

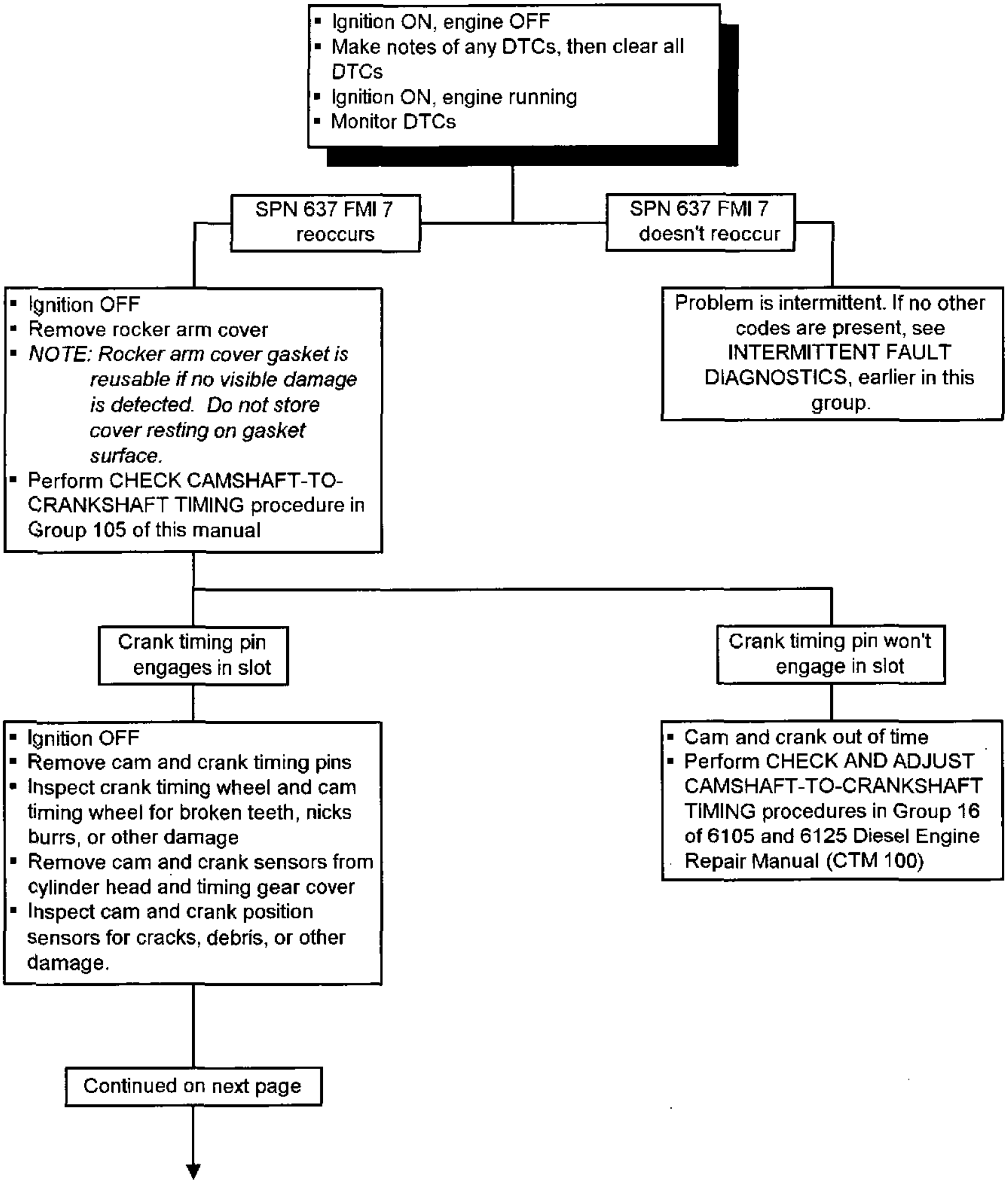
DPSG,RG40854,316 –19–26AUG99–1/2

- If the engine dies and won't restart, it is possible that disconnecting the crank position sensor will allow the engine to start.
- If the engine continues to run, it will develop low power.

DPSG,RG40854.316 –19–26AUG99–2/2

DTC SPN 637 FMI 7 Crank Position/Cam Position Out of Sync - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the cam and crank position sensors connectors looking for dirty, damaged, or poorly positioned terminals.



RG10481 –19–01FEB00

DPSG,RG40854,414 –19–12OCT99–1/1

DTC SPN 637 FMI 7 Crank Position/Cam Position Out of Sync - Continued

All components OK

- Ignition OFF
- Disconnect crank position sensor connector
- Using a multimeter, measure resistance between both terminal of the crank position sensor

Faulty component found

- Replace faulty component
- Retest

Measurement between 2500 and 3500 Ω

- Ignition OFF
- Disconnect cam position sensor connector
- Using a multimeter, measure resistance between both terminals of the cam position sensor

Measurement below 2500 Ω or above 3500 Ω

- Faulty crankshaft position sensor

Measurement between 2500 and 3500 Ω

- Ignition OFF
- Disconnect crank position sensor connector
- Disconnect 60-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal A of the crank position sensor harness connector and terminal X2 in the harness end of the 60-way ECU connector

    and
  - Terminal B of the crank position sensor harness connector and terminal W3 in the harness end of the 60-way ECU connector

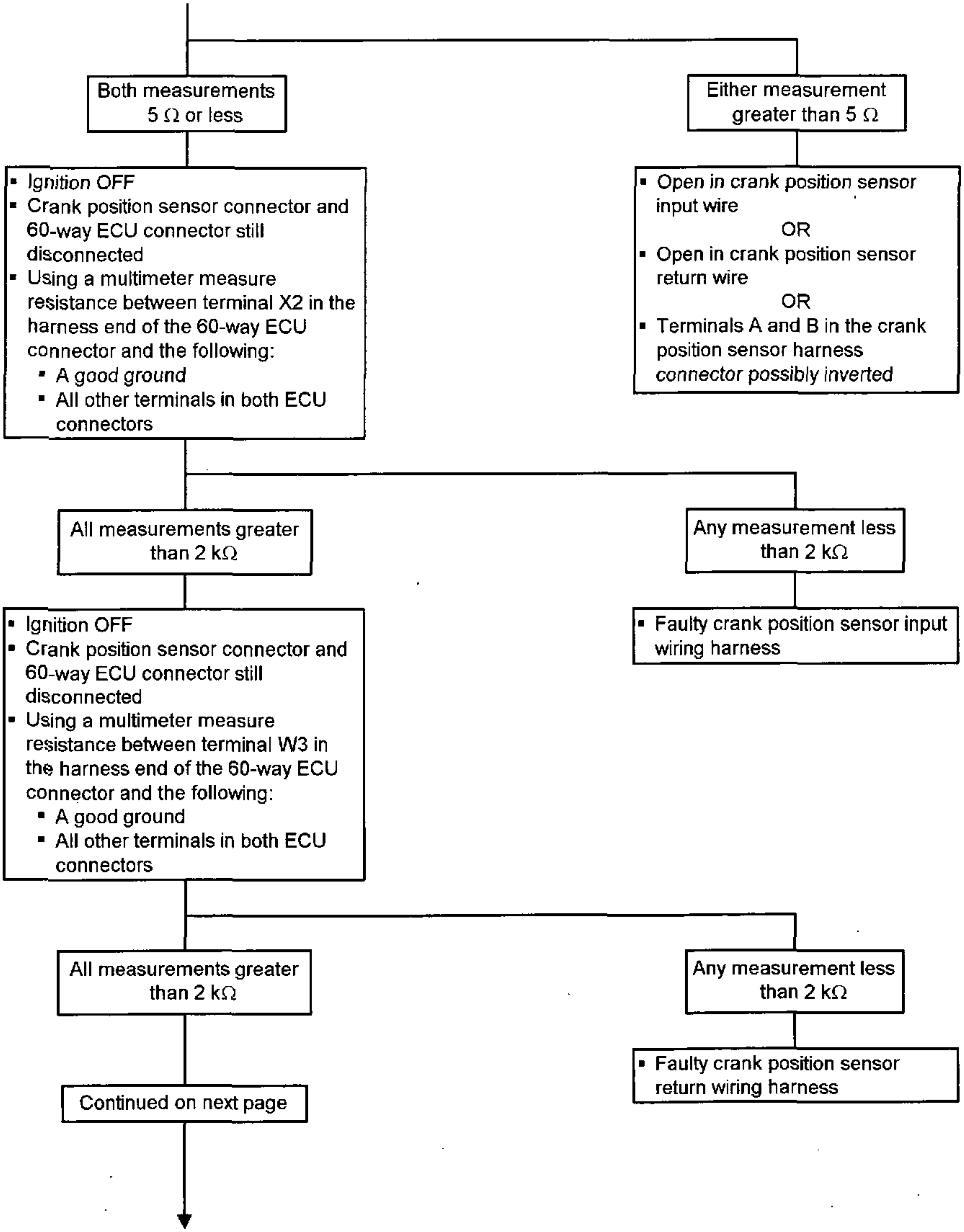
Measurement below 2500 Ω or above 3500 Ω

- Faulty camshaft position sensor

Continued on next page

RG10462 –19–17NOV99

DTC SPN 637 FMI 7 Crank Position/Cam Position Out of Sync - Continued



RG10463 –19–17NOV99

DPSG,RG40854,416 –19–12OCT99–1/1

DTC SPN 637 FMI 7 Crank Position/Cam Position Out of Sync - Continued

- Ignition OFF
- Disconnect cam position sensor connector
- Disconnect 60-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal A of the cam position sensor harness connector and terminal X1 in the harness end of the 60-way ECU connector

    and
  - Terminal B of the cam position sensor harness connector and terminal W2 in the harness end of the 60-way ECU connector

Both measurements 5 Ω or less

- Ignition OFF
- Cam position sensor connector and 60-way ECU connector still disconnected
- Using a multimeter measure resistance between terminal X1 in the harness end of the 60-way ECU connector and the following:
  - A good ground
  - All other terminals in both ECU connectors

All measurements greater than 2 kΩ

Continued on next page

Any measurement less than 2 kΩ

- Faulty cam position sensor input wiring harness

Either measurement greater than 5 Ω

- Open in cam position sensor input wire

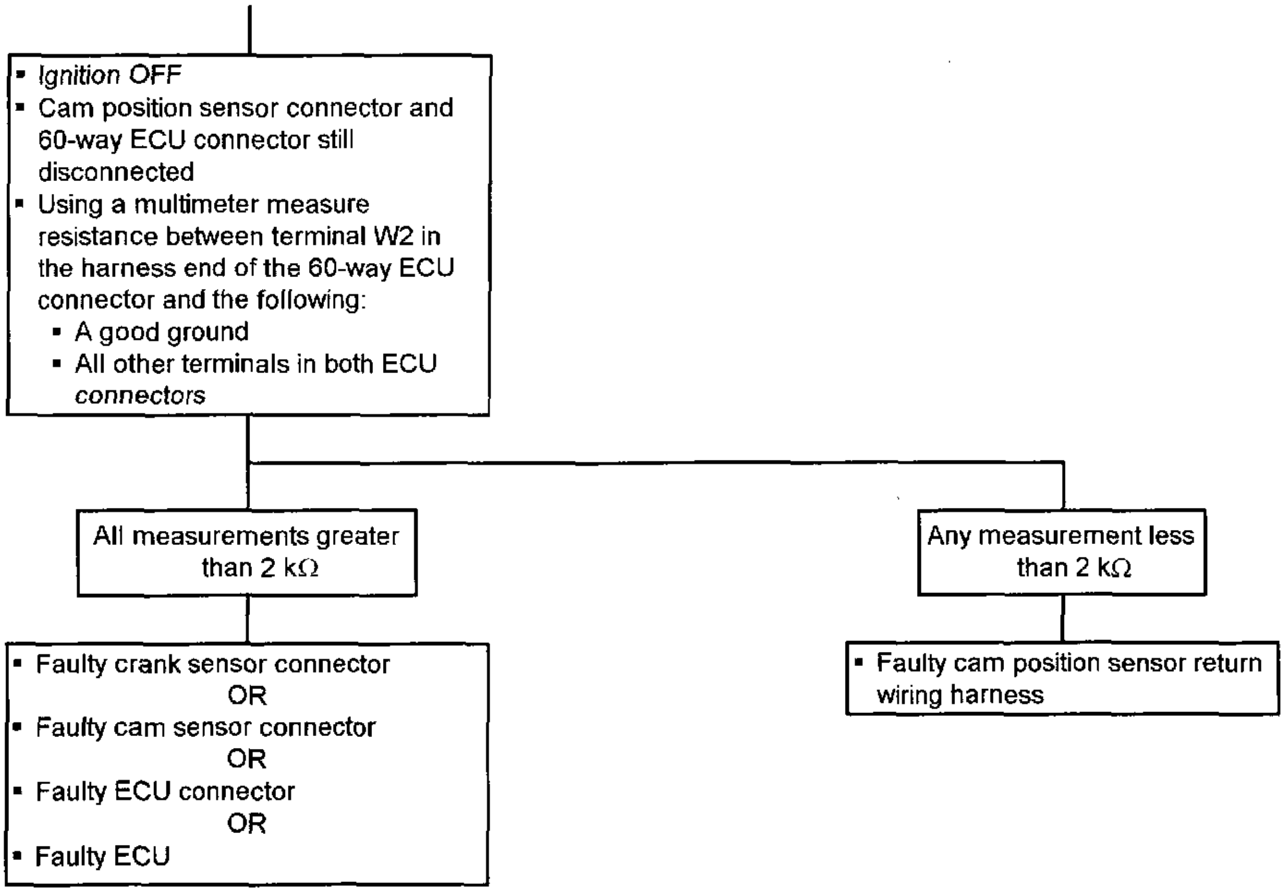
  OR
- Open in cam position sensor return wire

  OR
- Terminals A and B in the cam position sensor harness connector possibly inverted

RG10464 –19–17NOV99

DPSG,RG40854,417 –19–12OCT99–1/1

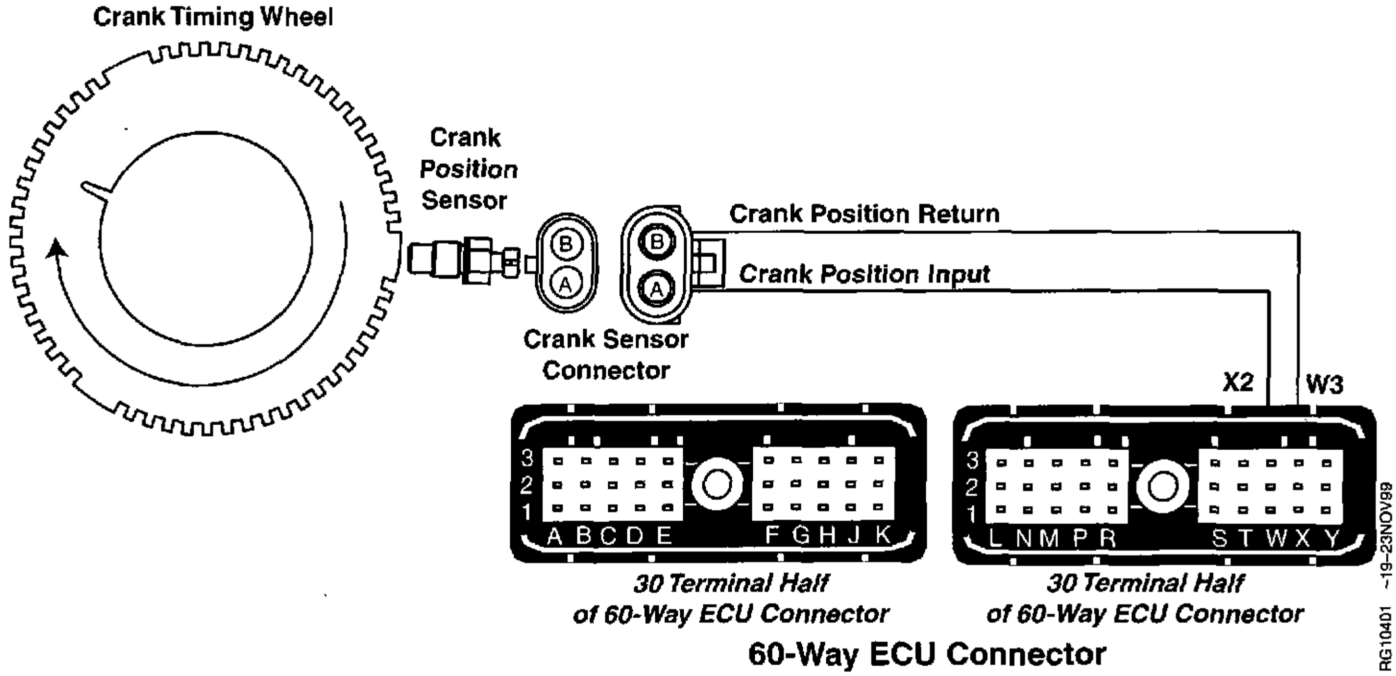
DTC SPN 637 FMI 7 Crank Position/Cam Position Out of Sync - Continued



RG10465 –19–17NOV99

DPSG,RG40854,418 –19–12OCT99–1/1

DTC SPN 637 FMI 8 Crank Position Input Missing



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

Crank Position Sensor

- The crank position sensor is an inductive type pickup sensor that detects notches on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the cam position sensor input to determine piston position in relation to the firing order. Based on information from the crank and cam position sensors, the ECU calculates the cam position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC SPN 637 FMI 8 will set if:

- The ECU does not detect the crank position input.

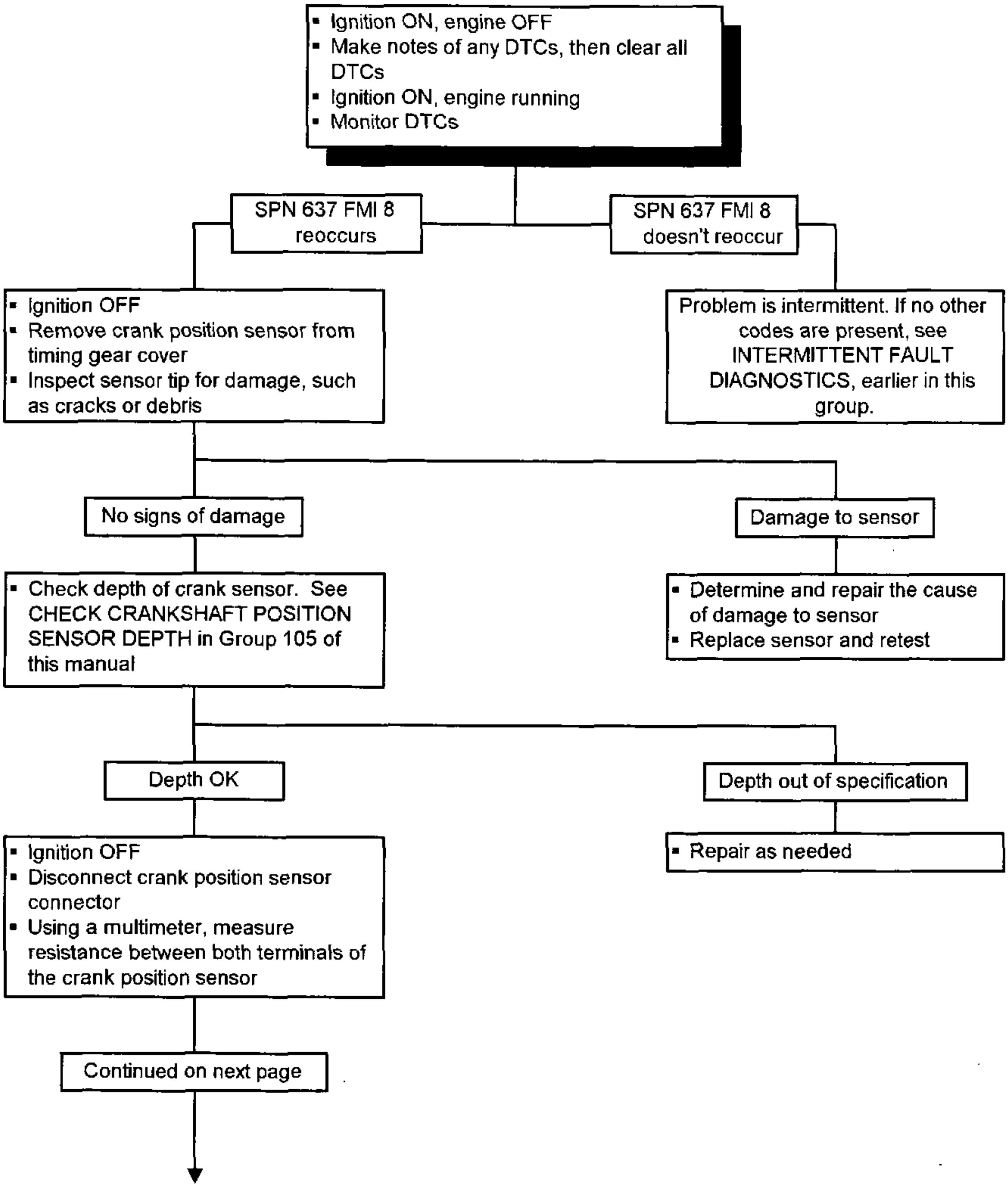
If DTC SPN 637 FMI 8 sets, the following will occur:

- If a cam position sensor trouble code accompanies DTC SPN 637 FMI 8, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the cam position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,221 -19-30JUN99-1/1

DTC SPN 637 FMI 8 Crank Position Input Missing - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the crank position sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10466 –19–22DEC99

DPSG,RG40854,420 –19–12OCT99–1/1

DTC SPN 637 FMI 8 Crank Position Input Missing - Continued

Measurement between 2500 and 3500 Ω

- Ignition OFF
- Disconnect crank position sensor connector
- Disconnect 60-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal A of the crank position sensor harness connector and terminal X2 in the harness end of the 60-way ECU connector

    and
  - Terminal B of the crank position sensor harness connector and *terminal* W3 *in the harness end of* the 60-way ECU connector

Measurement below 2500 Ω or above 3500 Ω

- Faulty crank position sensor

Both measurements 5 Ω or less

- Ignition OFF
- Crank position sensor connector and 60-way ECU connector still disconnected
- Using a multimeter measure resistance between terminal X2 in the harness end of the 60-way ECU connector and the following:
  - A good ground
  - All other terminals in both ECU connectors

Either measurement greater than 5 Ω

- Open in crank position sensor input wire

  OR
- Open in crank position sensor return wire

  OR
- Terminals A and B in the crank position sensor harness connector possibly inverted

All measurements greater than 2 kΩ

Continued on next page

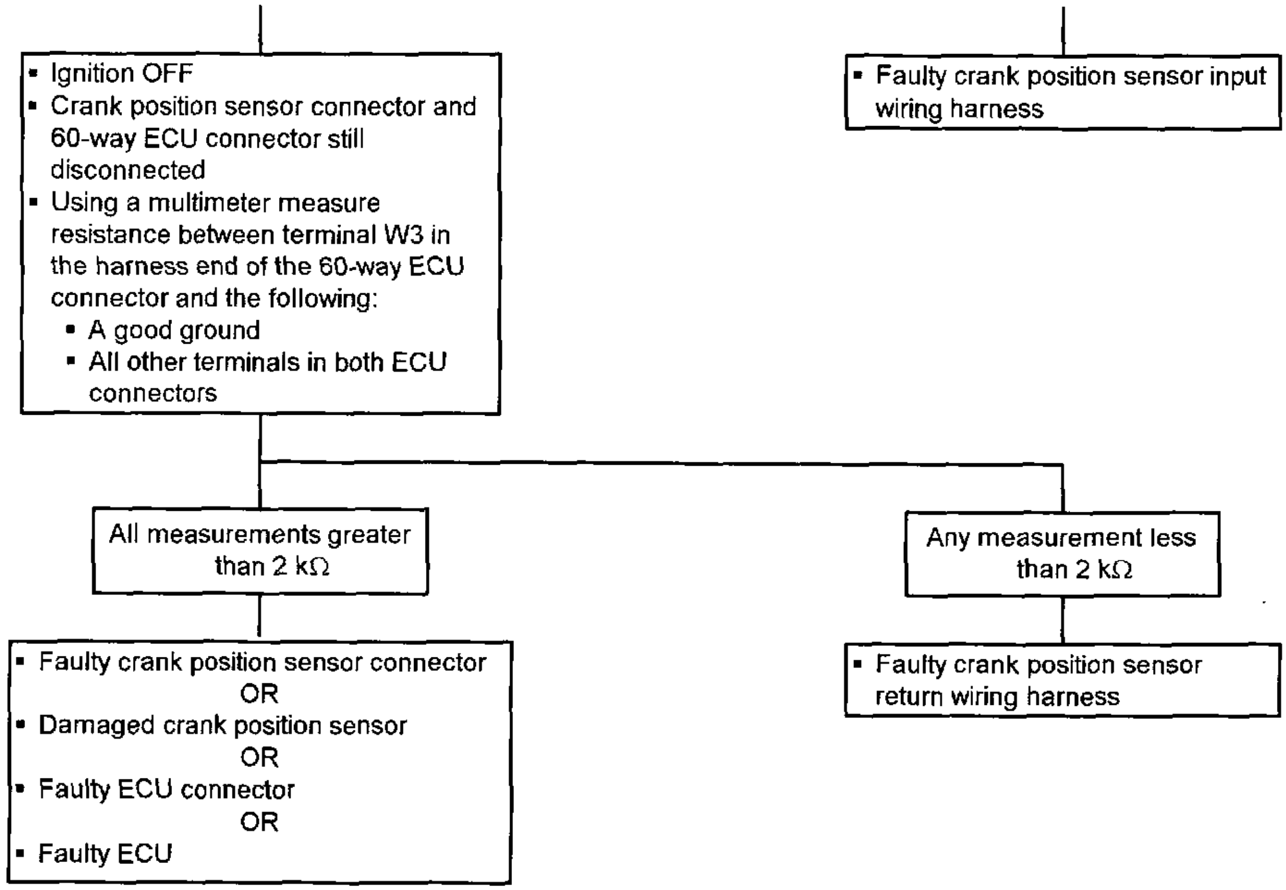
Any measurement less than 2 kΩ

Continued on next page

RG10467 -19-17NOV99

DPSG,RG40854,421 -19-12OCT99-1/1

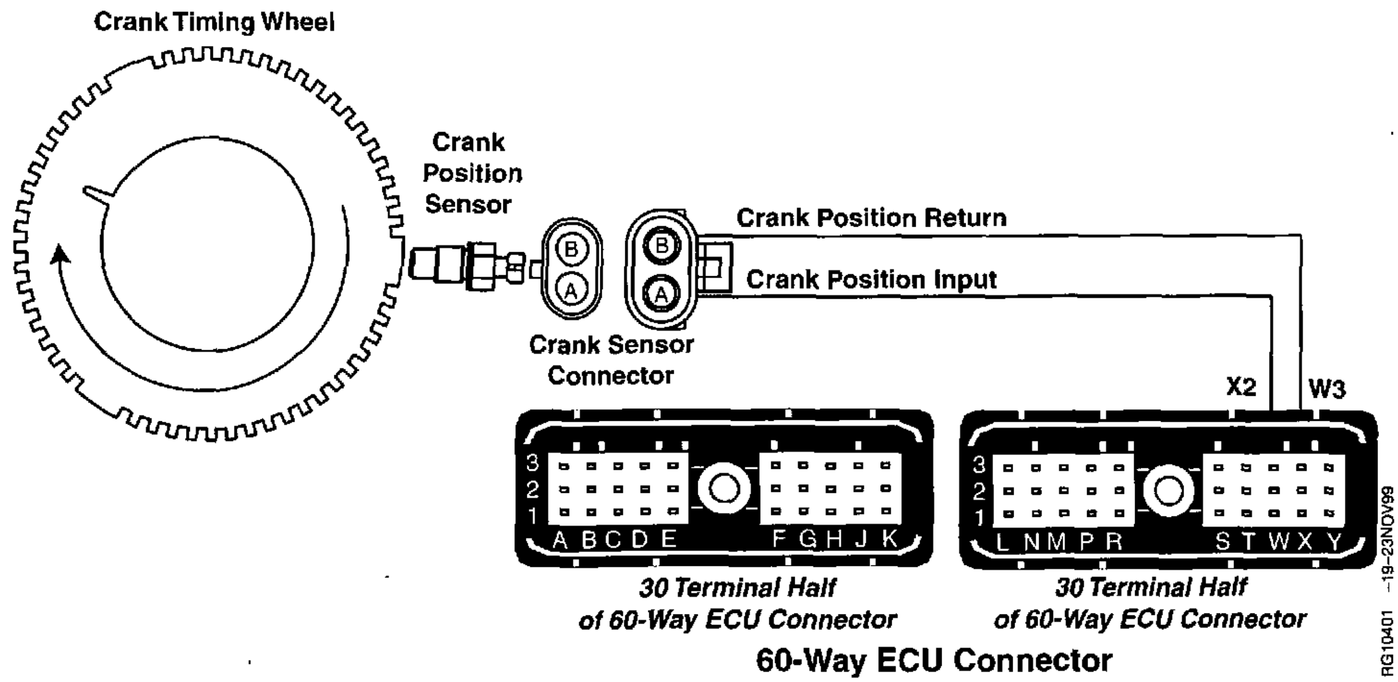
DTC SPN 637 FMI 8 Crank Position Input Missing - Continued



RG10630 –19–17NOV99

DPSG,RG40854,472 –19–24NOV99–1/1

DTC SPN 637 FMI 10 Crank Position Input Pattern Error



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

Crank Position Sensor

- The crank position sensor is an inductive type pickup sensor that detects notches on the crank timing wheel. The ECU uses the crank position input to determine engine speed and precision piston position in relation to TDC. The ECU monitors the cam position sensor input to determine piston position in relation to the firing order. Based on information from the crank and cam position sensors, the ECU calculates the cam position sensors, the ECU calculates the correct start of injection and amount of fuel to inject, then commands the EUIs accordingly.

DTC SPN 637 FMI 10 will set if:

- The ECU detects an improper pattern on the crank position input.

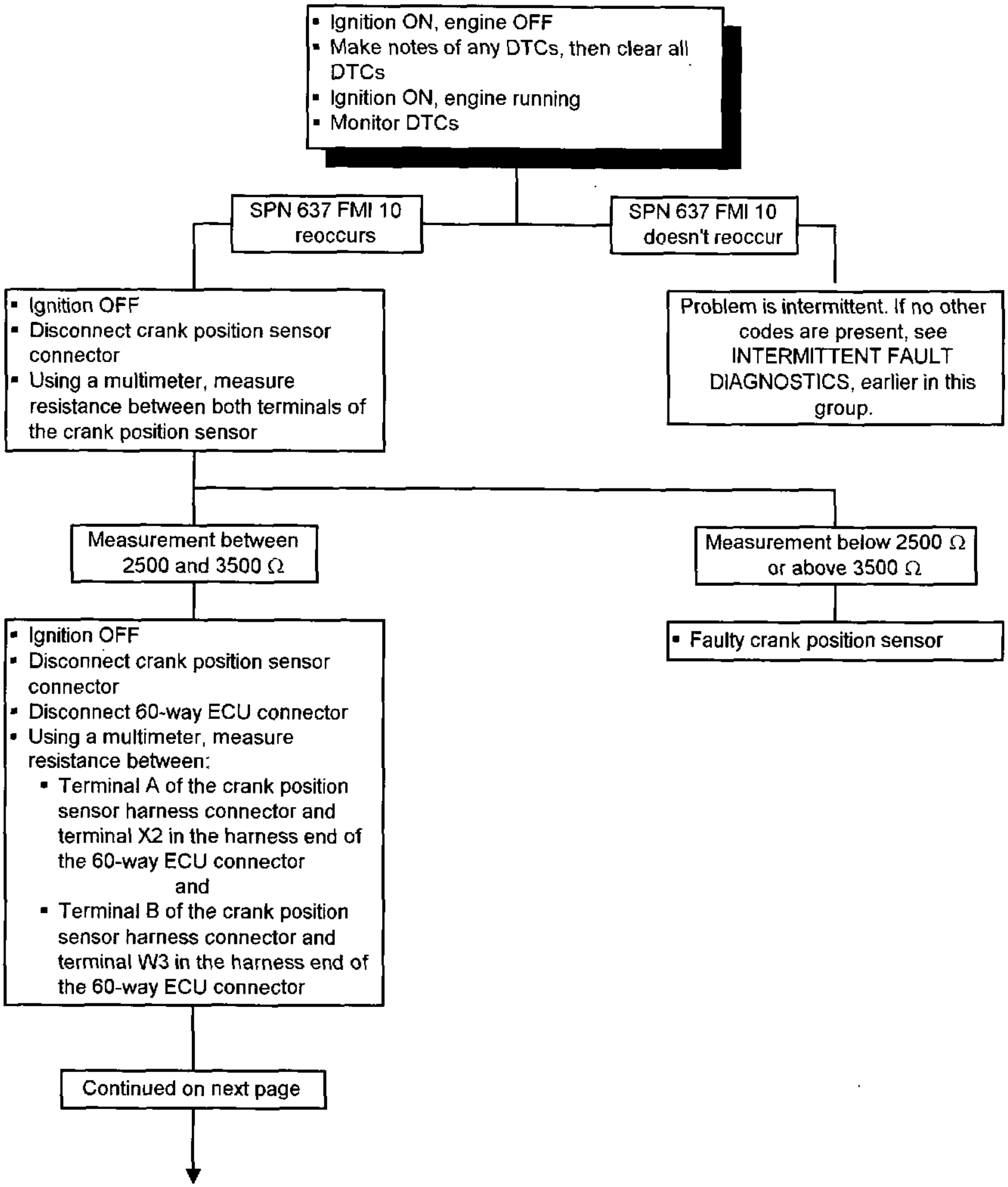
If DTC SPN 637 FMI 10 sets, the following will occur:

- If a cam position sensor trouble code accompanies DTC SPN 637 FMI 10, the engine will die and won't restart until at least one of the two codes is repaired.
- ECU will use only the cam position sensor input to determine piston position.
- The moment that the trouble codes sets, the engine may hesitate or die, but it will re-start.
- Prolonged cranking time may be required to start the engine.

DPSG,RG40854,222 -19-30JUN99-1/1

DTC SPN 637 FMI 10 Crank Position Input Pattern Error - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 60-way ECU connector and the crank position sensor connector looking for dirty, damaged, or poorly positioned terminals.



RG10468 –19–17NOV99

DPSG,RG40854,422 –19–12OCT99–1/1

115
154

DTC SPN 637 FMI 10 Crank Position Input Pattern Error - Continued

Both measurements 5 Ω or less

- Ignition OFF
- Crank position sensor connector and 60-way ECU *connector still* disconnected
- Using a multimeter measure resistance between terminal X2 in the harness end of the 60-way ECU connector and the following:
  - A good ground
  - All other terminals in both ECU connectors

Either measurement greater than 5 Ω

- Open in crank position sensor input wire

OR

- Open in crank position sensor return wire

OR

- Terminals A and B in the crank position sensor harness connector possibly inverted

All measurements greater than 2 kΩ

- Ignition OFF
- Crank position sensor connector and 60-way ECU connector still disconnected
- *Using a multimeter measure* resistance between terminal W3 in the harness end of the 60-way ECU connector and the following:
  - A good ground
  - All other terminals in both ECU connectors

Any measurement less than 2 kΩ

- Faulty crank position sensor input wiring harness

All measurements greater than 2 kΩ

Continued on next page

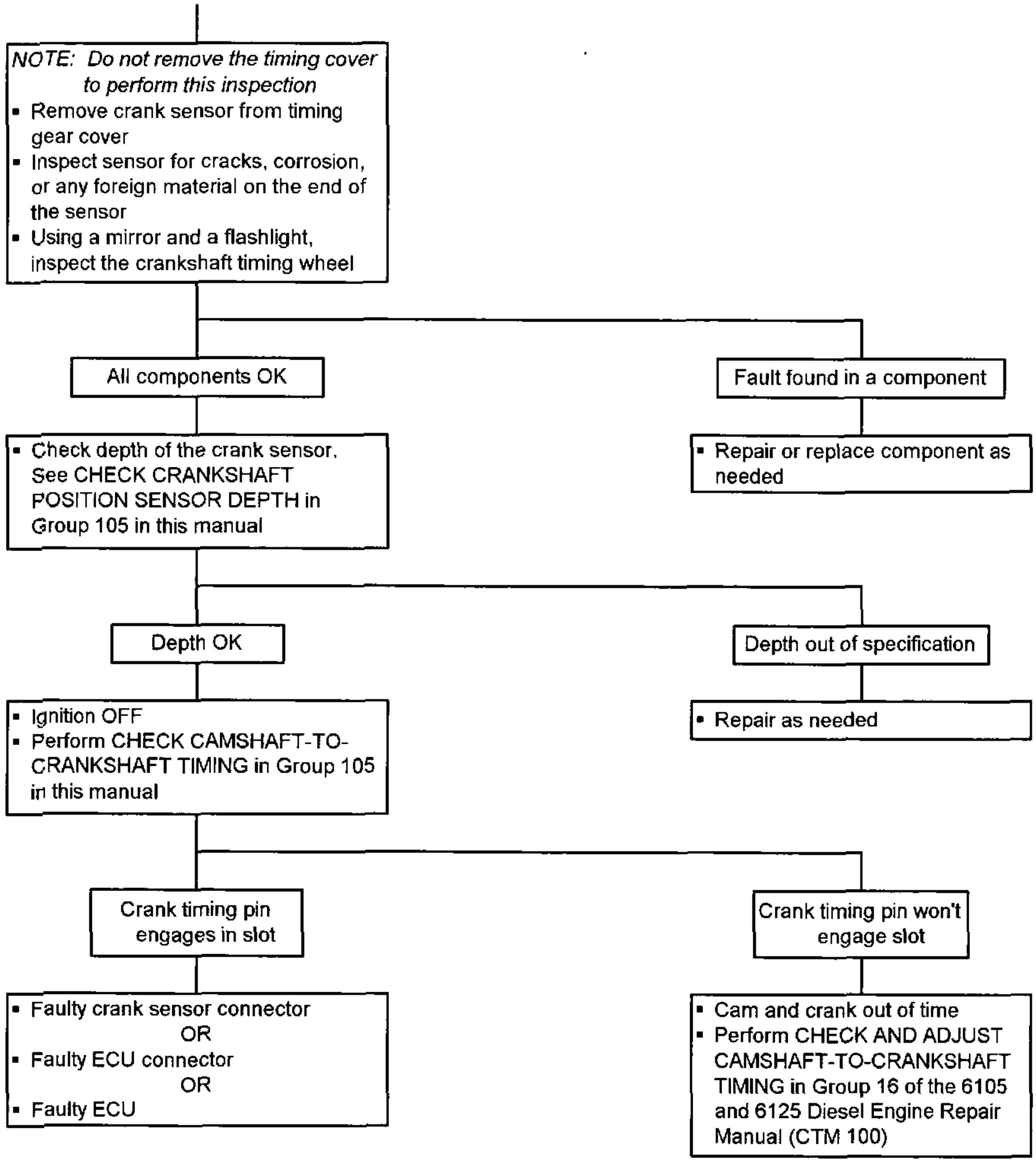
Any measurement less than 2 kΩ

- Faulty crank position sensor return wiring harness

RG10469 –19–17NOV99

DPSG,RG40854,423 –19–12OCT99–1/1

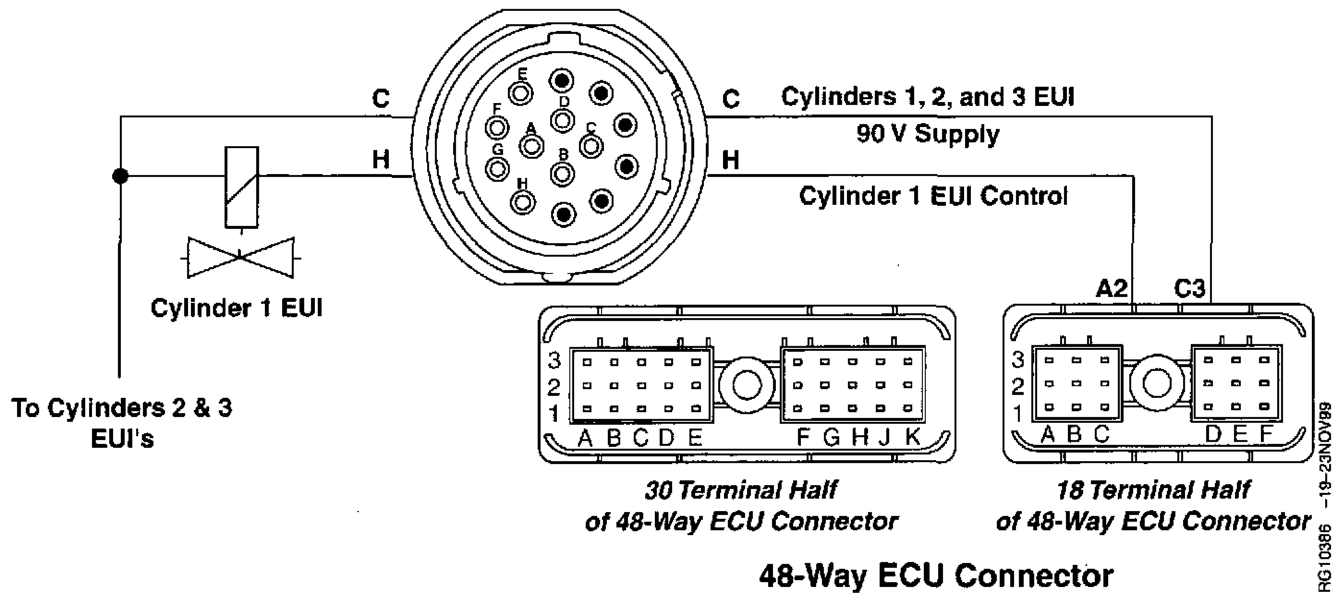
DTC SPN 637 FMI 10 Crank Position Input Pattern Error - Continued



RG10470 –19–22DEC99

DPSG,RG40854,424 –19–12OCT99–1/1

DTC SPN 651 FMI 5 Cylinder #1 EUI Circuit Open



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 651 FMI 5 will set if:

- The ECU detects an open in the Cylinder #1 EUI circuit.

If DTC SPN 651 FMI 5 sets, the following will occur:

- Cylinder #1 EUI will not fire.

DPSG,RG40854,223 -19-30JUN99-1/1

DTC SPN 651 FMI 5 Cylinder #1 EUI Circuit Open - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the back of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor DTCs

SPN 651 FMI 5 reoccurs

- Ignition OFF

CAUTION: Possible strong electric shock hazard if engine is cranking or running

- Disconnect EUI wiring harness connector at rear of cylinder head
- Disconnect 18-terminal half of 48-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal H in the harness end of the EUI wiring harness connector and terminal A2 in the harness end of the ECU connector
  - Terminal C in the harness end of the EUI wiring harness connector and terminal C3 in the harness end of the ECU connector

Both measurements 5 Ω or less

Continued on next page

Measurement between H to A2 greater than 5 Ω

- Open in wire between terminal H and A2

Measurement between C to C3 greater than 5 Ω

- Open in wire between terminal C and C3

SPN 651 FMI 5 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10471 -19-06JAN00

DPSG,RG40854,425 -19-12OCT99-1/1

DTC SPN 651 FMI 5 Cylinder #1 EUI Circuit Open - Continued

- Remove rocker arm cover
- Disconnect electrical connections to cylinder 1 EUI and a known good EUI
- Using a multimeter measure resistance between:
  - The two terminals on cylinder 1 EUI
  - The two terminals on the known good EUI
- Compare the measurements between the two EUIs

NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typically EUI resistance should be 1.0-1.8 Ω

Difference between measurements 0.2 Ω or less

- Ignition OFF
- Cylinder 1 EUI wires disconnected from EUI
- Disconnect EUI wiring harness connector from rear of cylinder head
- Using a multimeter, measure resistance between:
  - One of the cylinder 1 EUI harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head (either C or H, the EUI's are not polarity sensitive)
  - The other cylinder 1 EUI harness eyelet and the other corresponding terminal at the connector on the rear of the cylinder head

Both measurements 2.0 Ω or less

- Faulty ECU connection

OR

- Faulty EUI wiring harness connection

OR

- Faulty ECU

Either measurements greater than 2.0 Ω

- Faulty EUI harness in head

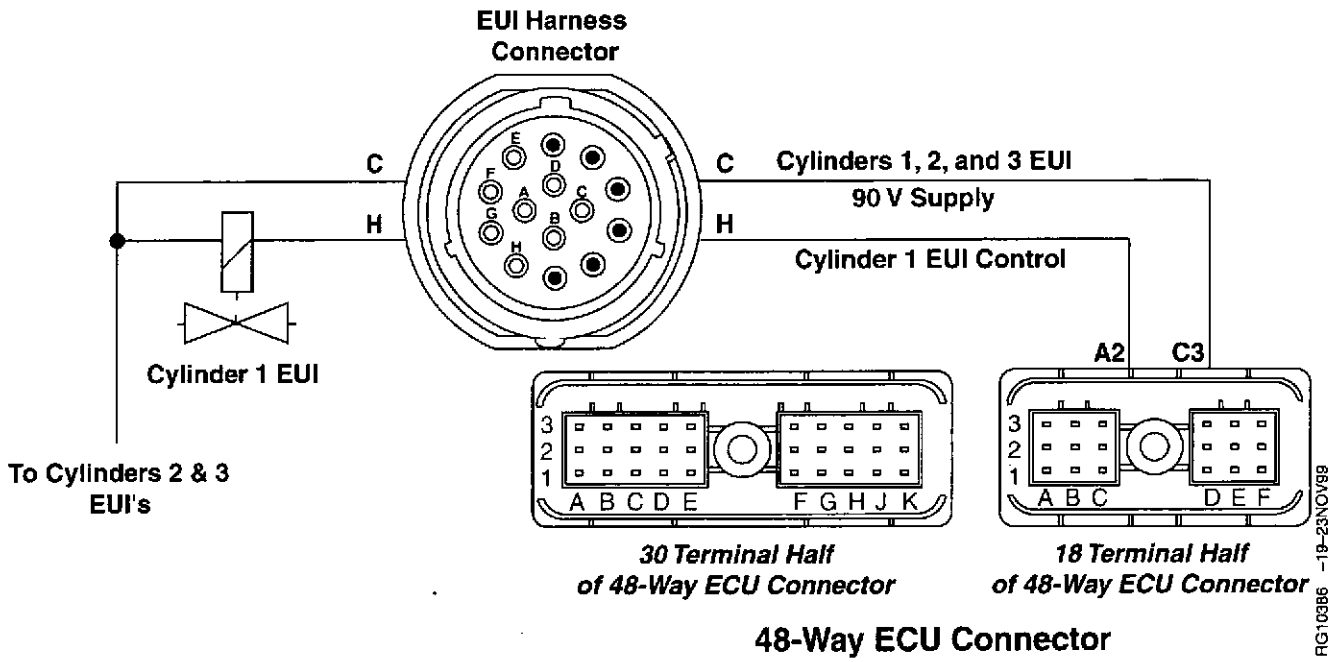
Difference between measurements greater than 0.2 Ω

- Faulty cylinder 1 EUI

RG10472 -19-17NOV99

DPSG,RG40854,426 -19-12OCT99-1/1

DTC SPN 651 FMI 6 Cylinder #1 EUI Circuit Shorted



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 651 FMI 6 will set if:

- The ECU detects a short in the Cylinder #1 EUI circuit.

If DTC SPN 651 FMI 6 sets, the following will occur:

- Cylinder #1 EUI will not fire.

DPSG,RG40854,224 –19–30JUN99–1/1

DTC SPN 651 FMI 6 Cylinder #1 EUI Circuit Shorted - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the rear of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor active DTCs

SPN 651 FMI 6 reoccurs

- Ignition OFF

CAUTION: Possible strong electric shock hazard if engine is cranking or running

- Disconnect 18-terminal half of 48-way ECU connector
- Disconnect EUI wiring harness connector at rear of cylinder head
- Using a multimeter, measure resistance between terminal H in the harness end of the EUI wiring connector and the following:
  - Terminal C in the harness end of the EUI wiring connector
  - Terminal F in the harness end of the EUI wiring connector

Both measurements greater than 20 kΩ

Continued on next page

Either measurement less than 20 kΩ

- Short in ECU wiring harness

SPN 651 FMI 6 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10473 –19–17NOV99

DTC SPN 651 FMI 6 Cylinder #1 EUI Circuit Shorted - Continued

- Remove rocker arm cover
- Disconnect electrical connections to cylinder 1 EUI and a known good EUI
- Using a multimeter measure resistance between:
  - The two terminals on cylinder 1 EUI
  - The two terminals on the known good EUI
- Compare the measurements between the two EUIs

NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typical EUI resistance should be 1.0-1.8 Ω

Difference between measurements 0.2 Ω or less

- Ignition OFF
- Keep cylinder 1 EUI wires disconnected from EUI
- Keep EUI wiring harness connector at rear of cylinder head disconnected
- Using a multimeter, measure resistance between:
  - Both of the cylinder 1 EUI harness eyelet's

Greater than 20 kΩ

- Faulty ECU connection

OR

- Faulty EUI wiring harness connection

OR

- Faulty ECU

Less than 20 kΩ

- Faulty EUI wiring harness

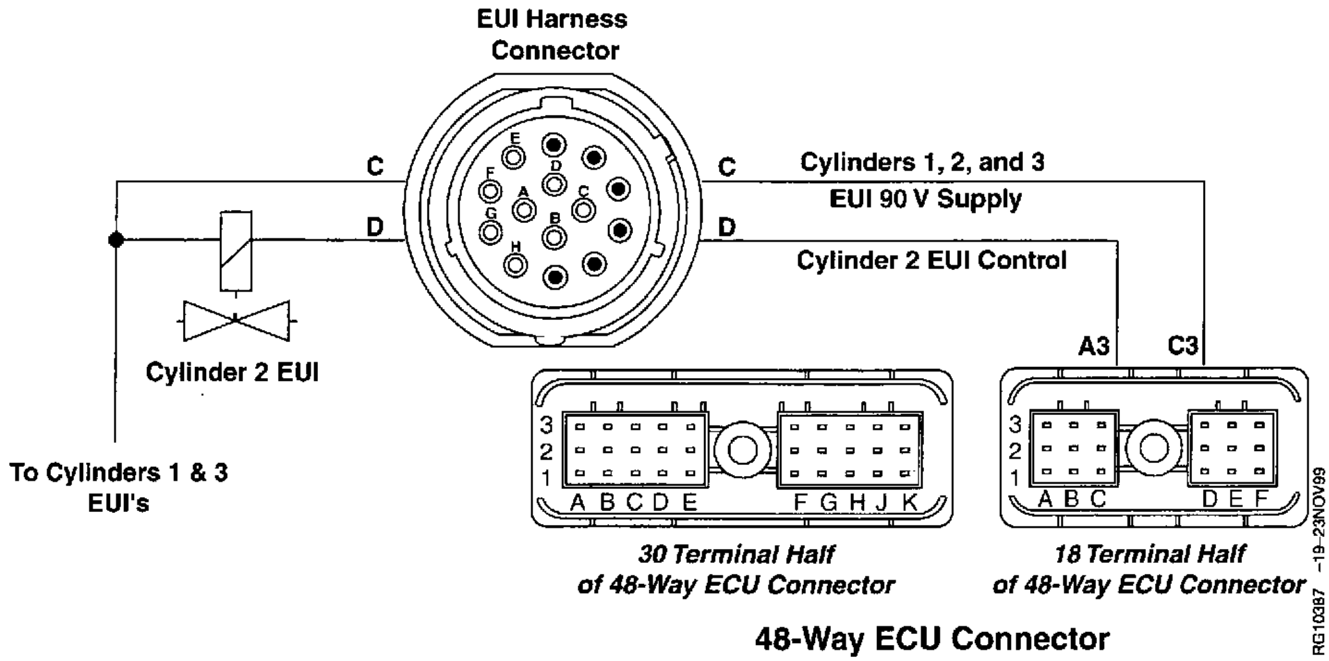
Difference between measurements greater than 0.2 Ω

- Faulty cylinder 1 EUI

RG10474 –19–17NOV99

DPSG,RG40854,428 –19–12OCT99–1/1

DTC SPN 652 FMI 5 Cylinder #2 EUI Circuit Open



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 652 FMI 5 will set if:

- The ECU detects an open in the Cylinder #2 EUI circuit.

If DTC SPN 652 FMI 5 sets, the following will occur:

- Cylinder #2 EUI will not fire.

DPSG,RG40854,225 –19–30JUN99–1/1

DTC SPN 652 FMI 5 Cylinder #2 EUI Circuit Open - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the back of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor DTCs

SPN 652 FMI 5 reoccurs

- Ignition OFF

  CAUTION: Possible strong electric shock hazard if engine is cranking or running
- Disconnect EUI wiring harness connector at rear of cylinder head
- Disconnect 18-terminal half of 48-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal D in the harness end of the EUI wiring harness connector and terminal A3 in the harness end of the ECU connector
  - Terminal C in the harness end of the EUI wiring harness connector and terminal C3 in the harness end of the ECU connector

Both measurements 5 Ω or less

Continued on next page

Measurement between D to A3 greater than 5 Ω

- Open in wire between terminal D and A3

Measurement between C to C3 greater than 5 Ω

- Open in wire between terminal C and C3

SPN 652 FMI 5 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10475 –19–07JAN00

DTC SPN 652 FMI 5 Cylinder #2 EUI Circuit Open - Continued

- Remove rocker arm cover
- Disconnect electrical connections to cylinder 2 EUI and a known good EUI
- Using a multimeter measure resistance between:
  - The two terminals on cylinder 2 EUI
  - The two terminals on the known good EUI
- Compare the measurements between the two EUIs

NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typically EUI resistance should be 1.0-1.8 Ω

Difference between measurements 0.2 Ω or less

- Ignition OFF
- Cylinder 2 EUI wires disconnected from EUI
- Disconnect EUI wiring harness connector from rear of cylinder head
- Using a multimeter, measure resistance between:
  - One of the cylinder 2 EUI harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head (either C or D, the EUI's are not polarity sensitive)
  - The other cylinder 2 EUI harness eyelet and the other corresponding terminal at the connector on the rear of the cylinder head

Both measurements 2.0 Ω or less

- Faulty ECU connection

OR

- Faulty EUI wiring harness connection

OR

- Faulty ECU

Either measurements greater than 2.0 Ω

- Faulty EUI harness in head

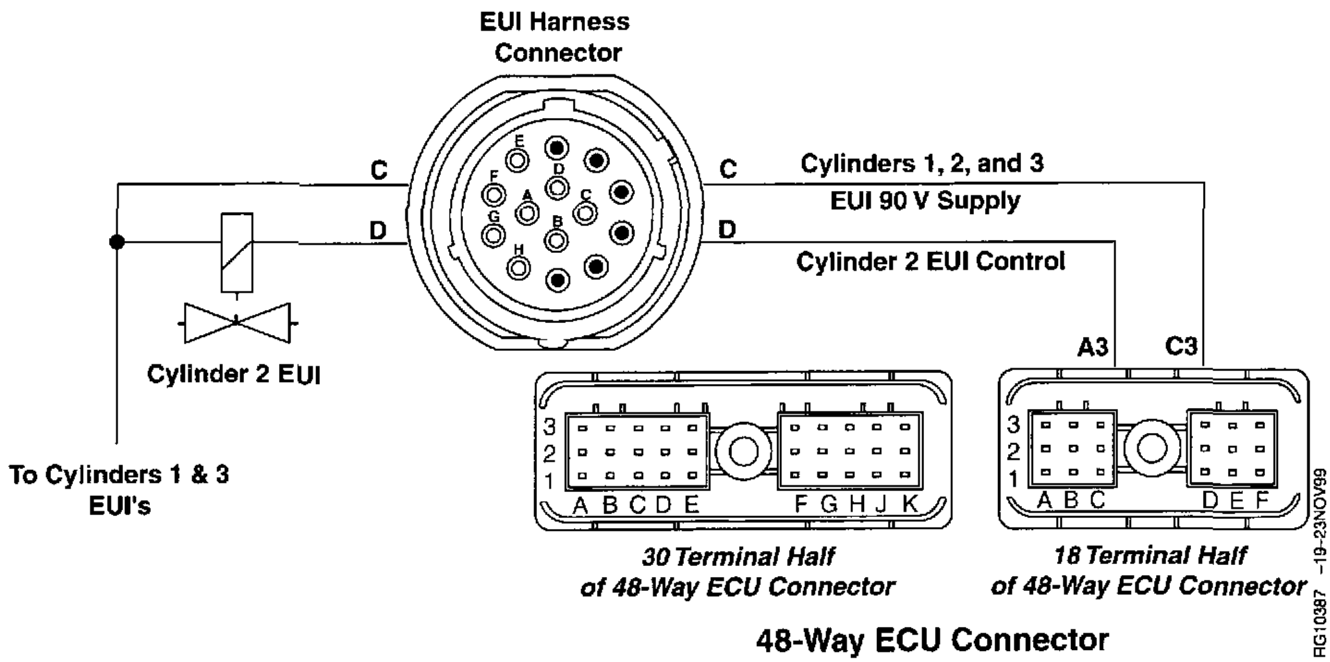
Difference between measurements greater than 0.2 Ω

- Faulty cylinder 2 EUI

RG10476 –19–17NOV99

DPSG,RG40854,430 –19–12OCT99–1/1

DTC SPN 652 FMI 6 Cylinder #2 EUI Circuit Shorted



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 652 FMI 6 will set if:

- The ECU detects a short in the Cylinder #2 EUI circuit.

If DTC SPN 652 FMI 6 sets, the following will occur:

- Cylinder #2 EUI will not fire.

DPSG,RG40854,226 –19–30JUN99–1/1

DTC SPN 652 FMI 6 Cylinder #2 EUI Circuit Shorted - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the rear of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor active DTCs

SPN 652 FMI 6 reoccurs

- Ignition OFF

CAUTION: Possible strong electric shock hazard if engine is cranking or running

- Disconnect 18-terminal half of 48-way ECU connector
- Disconnect EUI wiring harness connector at rear of cylinder head
- Using a multimeter, measure resistance between terminal D in the harness end of the EUI wiring connector and the following:
  - Terminal C in the harness end of the EUI wiring connector
  - Terminal F in the harness end of the EUI wiring connector

Both measurements greater than 20 kΩ

Continued on next page

Either measurement less than 20 kΩ

- Short in ECU wiring harness

SPN 652 FMI 6 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10477 –19–17NOV99

DTC SPN 652 FMI 6 Cylinder #2 EUI Circuit Shorted - Continued

- Remove rocker arm cover
- Disconnect electrical connections to cylinder 2 EUI and a known good EUI
- Using a multimeter measure resistance between:
  - The two terminals on cylinder 2 EUI
  - The two terminals on the known good EUI
- Compare the measurements between the two EUIs

NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typical EUI resistance should be 1.0-1.8 Ω

Difference between measurements 0.2 Ω or less

- Ignition OFF
- Keep cylinder 2 EUI wires disconnected from EUI
- Keep EUI wiring harness connector at rear of cylinder head disconnected
- Using a multimeter, measure resistance between:
  - Both of the cylinder 2 EUI harness eyelet's

Greater than 20 kΩ

- Faulty ECU connection

OR

- Faulty EUI wiring harness connection

OR

- Faulty ECU

Less than 20 kΩ

- Faulty EUI wiring harness

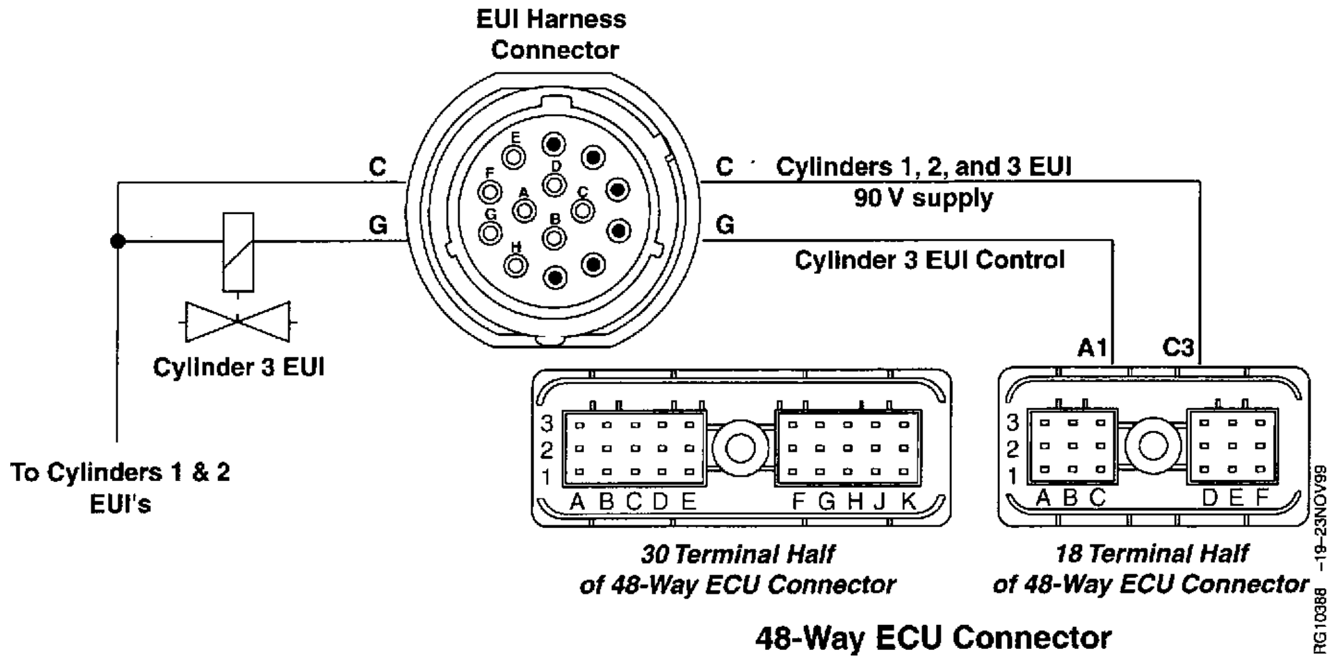
Difference between measurements greater than 0.2 Ω

- Faulty cylinder 2 EUI

RG10541 –19–17NOV99

DPSG,RG40854,432 –19–12OCT99–1/1

DTC SPN 653 FMI 5 Cylinder #3 EUI Circuit Open



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 653 FMI 5 will set if:

- The ECU detects an open in the Cylinder #3 EUI circuit.

If DTC SPN 653 FMI 5 sets, the following will occur:

- Cylinder #3 EUI will not fire.

DPSG,RG40854,227 -19-30JUN99-1/1

DTC SPN 653 FMI 5 Cylinder #3 EUI Circuit Open - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the back of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor DTCs

SPN 653 FMI 5 reoccurs

- Ignition OFF

CAUTION: Possible strong electric shock hazard if engine is cranking or running

- Disconnect EUI wiring harness connector at rear of cylinder head
- Disconnect 18-terminal half of 48-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal G in the harness end of the EUI wiring harness connector and terminal A1 in the harness end of the ECU connector
  - Terminal C in the harness end of the EUI wiring harness connector and terminal C3 in the harness end of the ECU connector

Both measurements 5 Ω or less

Continued on next page

Measurement between G to A1 greater than 5 Ω

- Open in wire between terminal G and A1

Measurement between C to C3 greater than 5 Ω

- Open in wire between terminal C and C3

SPN 653 FMI 5 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10478 –19–07JAN00

DPSG,RG40854,433 –19–12OCT99–1/1

DTC SPN 653 FMI 5 Cylinder #3 EUI Circuit Open - Continued

- Remove rocker arm cover
- Disconnect electrical connections to cylinder 3 EUI and a known good EUI
- Using a multimeter measure resistance between:
  - The two terminals on cylinder 3 EUI
  - The two terminals on the known good EUI
- Compare the measurements between the two EUIs

NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typically EUI resistance should be 1.0-1.8 Ω

Difference between measurements 0.2 Ω or less

- *Ignition OFF*
- Cylinder 3 EUI wires disconnected from EUI
- Disconnect EUI wiring harness connector from rear of cylinder head
- Using a multimeter, measure resistance between:
  - One of the cylinder 3 EUI harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head (either C or G, the EUI's are not polarity sensitive)
  - The other cylinder 3 EUI harness eyelet and the other corresponding terminal at the connector on the rear of the cylinder head

Both measurements 2.0 Ω or less

- Faulty ECU connection

OR

- Faulty EUI wiring harness connection

OR

- Faulty ECU

Either measurements greater than 2.0 Ω

- Faulty EUI harness in head

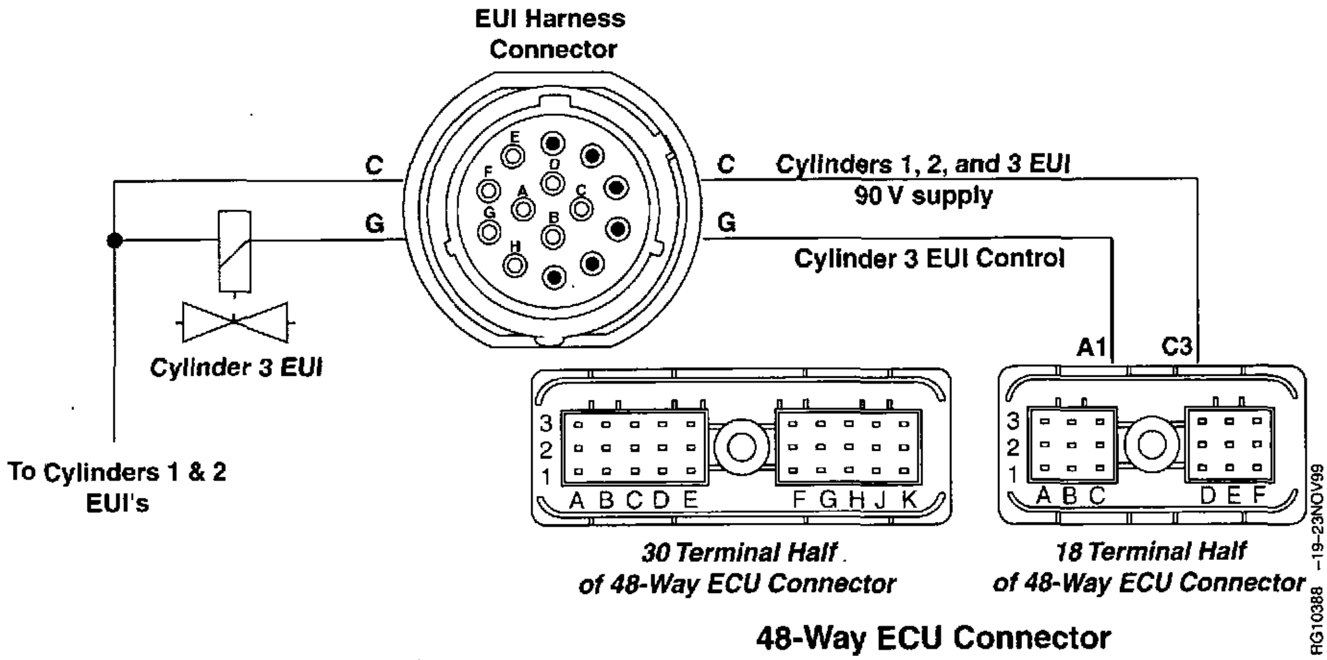
Difference between measurements greater than 0.2 Ω

- *Faulty cylinder 3 EUI*

RG10479 –19–17NOV99

DPSG,RG40854,434 –19–12OCT99–1/1

DTC SPN 653 FMI 6 Cylinder #3 EUI Circuit Shorted



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 653 FMI 6 will set if:

- The ECU detects a short in the Cylinder #3 EUI circuit.

If DTC SPN 653 FMI 6 sets, the following will occur:

- Cylinder #3 EUI will not fire.

DPSG,RG40854,228 –19–30JUN99–1/1

DTC SPN 653 FMI 6 Cylinder #3 EUI Circuit Shorted - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the rear of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor active DTCs

SPN 653 FMI 6 reoccurs

- Ignition OFF

CAUTION: Possible strong electric shock hazard if engine is cranking or running

- Disconnect 18-terminal half of 48-way ECU connector
- Disconnect EUI wiring harness connector at rear of cylinder head
- Using a multimeter, measure resistance between terminal G in the harness end of the EUI wiring connector and the following:
  - Terminal C in the harness end of the EUI wiring connector
  - Terminal F in the harness end of the EUI wiring connector

Both measurements greater than 20 kΩ

Continued on next page

Either measurement less than 20 kΩ

- Short in ECU wiring harness

SPN 653 FMI 6 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10480 -19-17NOV99

DPSG,RG40854,435 -19-12OCT99-1/1

DTC SPN 653 FMI 6 Cylinder #3 EUI Circuit Shorted - Continued

- Remove rocker arm cover
- Disconnect electrical connections to cylinder 3 EUI and a known good EUI
- Using a multimeter measure resistance between:
  - The two terminals on cylinder 3 EUI
  - The two terminals on the known good EUI
- Compare the measurements between the two EUIs

NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typical EUI resistance should be 1.0-1.8 Ω

Difference between measurements 0.2 Ω or less

- Ignition OFF
- Keep cylinder 3 EUI wires disconnected from EUI
- Keep EUI wiring harness connector at rear of cylinder head disconnected
- Using a multimeter, measure resistance between:
  - Both of the cylinder 3 EUI harness eyelet's

Greater than 20 kΩ

- Faulty ECU connection

OR

- Faulty EUI wiring harness connection

OR

- Faulty ECU

Less than 20 kΩ

- Faulty EUI wiring harness

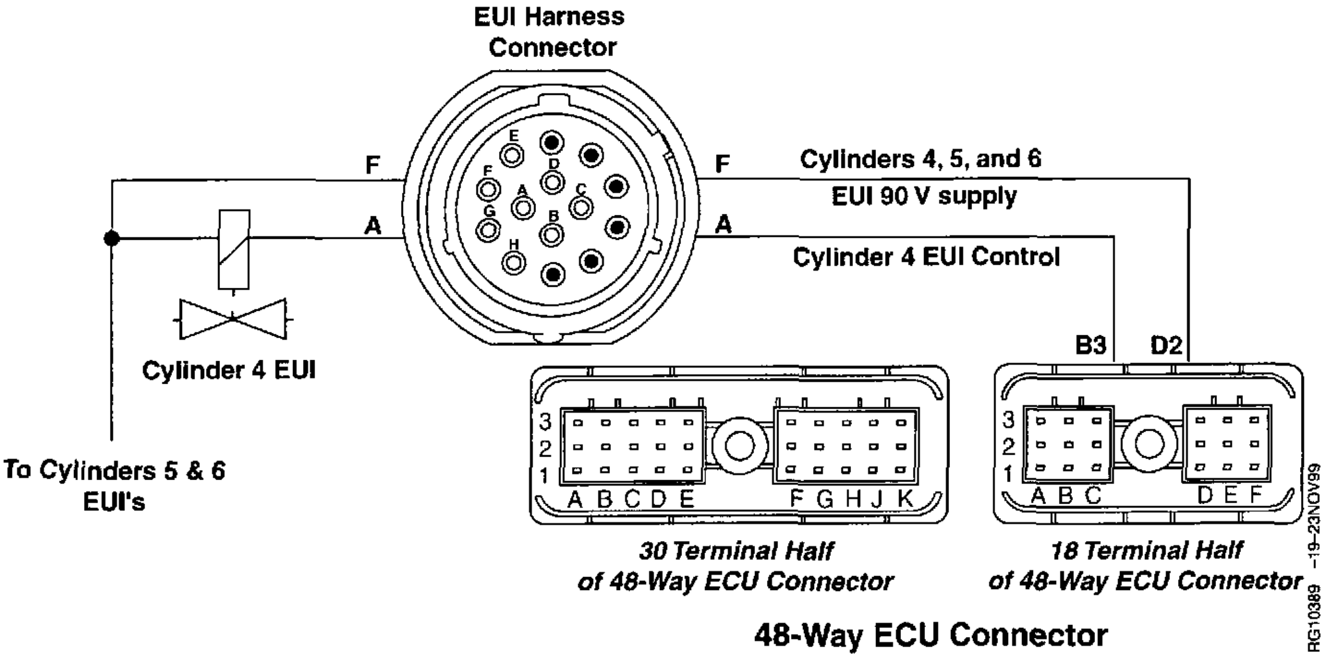
Difference between measurements greater than 0.2 Ω

- Faulty cylinder 3 EUI

RG10481 -19-17NOV99

DPSG,RG40854,436 -19-12OCT99-1/1

DTC SPN 654 FMI 5 Cylinder #4 EUI Circuit Open



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 654 FMI 5 will set if:

- The ECU detects an open in the Cylinder #4 EUI circuit.

If DTC SPN 654 FMI 5 sets, the following will occur:

- Cylinder #4 EUI will not fire.

DPSG,RG40854,229 -19-30JUN99-1/1

DTC SPN 654 FMI 5 Cylinder #4 EUI Circuit Open - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the back of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor DTCs

SPN 654 FMI 5 reoccurs

- Ignition OFF

CAUTION: Possible strong electric shock hazard if the engine is cranking or running

- Disconnect EUI wiring harness connector at rear of cylinder head
- Disconnect 18-terminal half of 48-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal A in the harness end of the EUI wiring harness connector and terminal B3 in the harness end of the ECU connector
  - Terminal F in the harness end of the EUI wiring harness connector and terminal D2 in the harness end of the ECU connector

Both measurements 5 Ω or less

Continued on next page

Measurement between A to B3 greater than 5 Ω

- Open in wire between terminal A and B3

Measurement between F to D2 greater than 5 Ω

- Open in wire between terminal F and D2

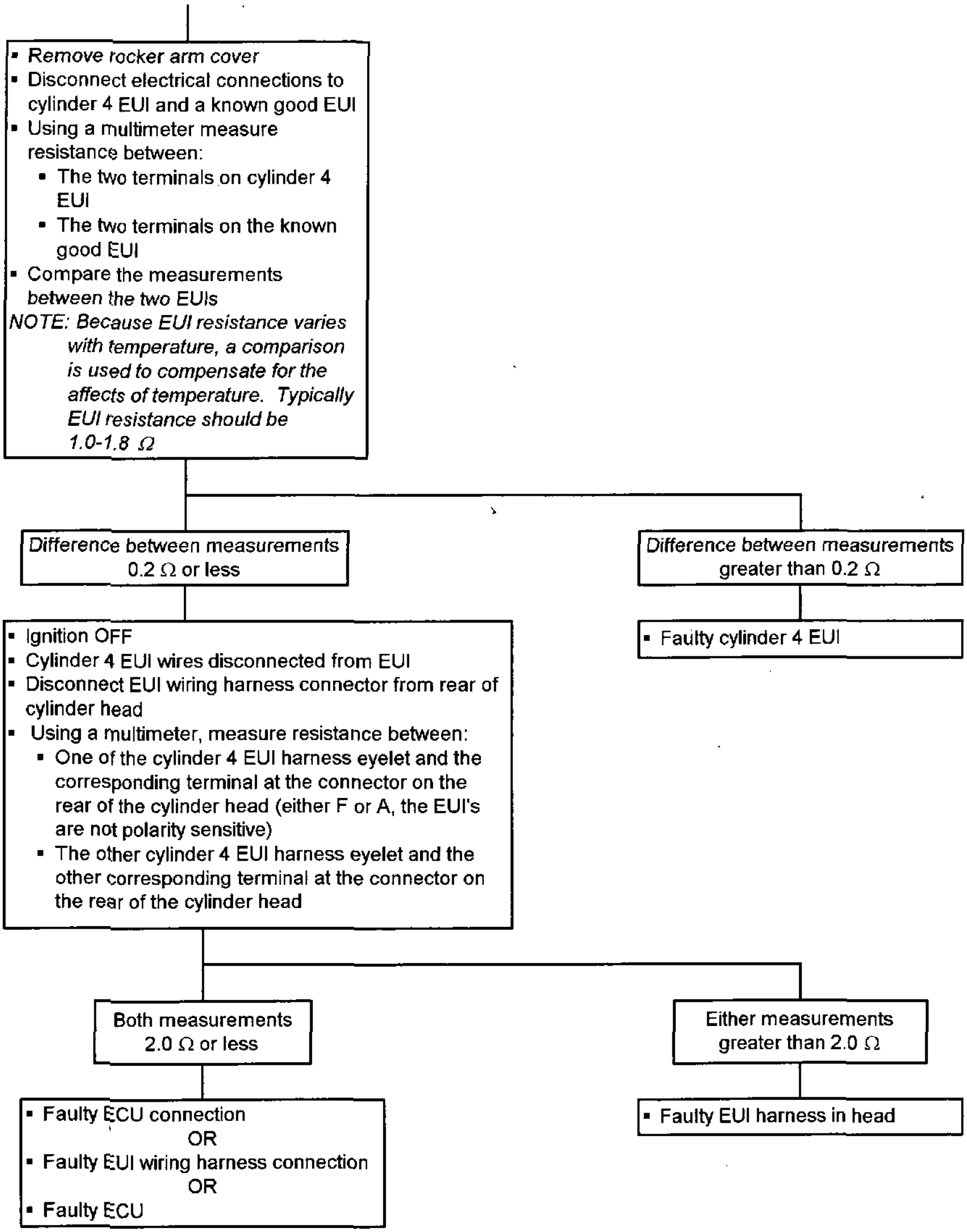
SPN 654 FMI 5 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10482 –19–07JAN00

DPSG,RG40854,437 –19–12OCT99–1/1

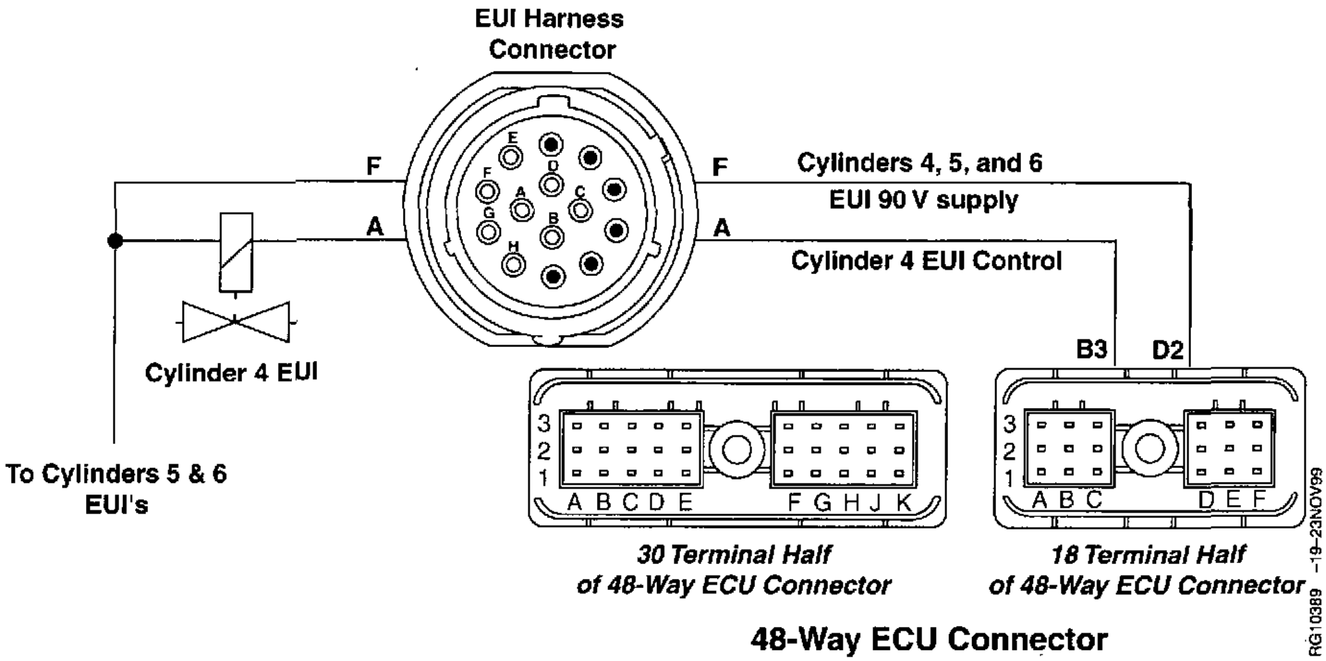
DTC SPN 654 FMI 5 Cylinder #4 EUI Circuit Open - Continued



RG10463 –19–17NOV99

DPSG,RG40854,438 –19–12OCT99–1/1

DTC SPN 654 FMI 6 Cylinder #4 EUI Circuit Shorted



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 654 FMI 6 will set if:

- The ECU detects a short in the Cylinder #4 EUI circuit.

If DTC SPN 654 FMI 6 sets, the following will occur:

- Cylinder #4 EUI will not fire.

DPSG,RG40854,230 -19-30JUN99-1/1

DTC SPN 654 FMI 6 Cylinder #4 EUI Circuit Shorted - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the rear of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor active DTCs

SPN 654 FMI 6 reoccurs

- Ignition OFF

  CAUTION: Possible strong electric shock hazard if engine is cranking or running
- Disconnect 18-terminal half of 48-way ECU connector
- Disconnect EUI wiring harness connector at rear of cylinder head
- *Using a multimeter, measure resistance between* terminal A in the harness end of the EUI wiring connector and the following:
  - Terminal C in the harness end of the EUI wiring connector
  - Terminal F in the harness end of the EUI wiring connector

Both measurements greater than 20 kΩ

Continued on next page

Either measurement less than 20 kΩ

- Short in ECU wiring harness

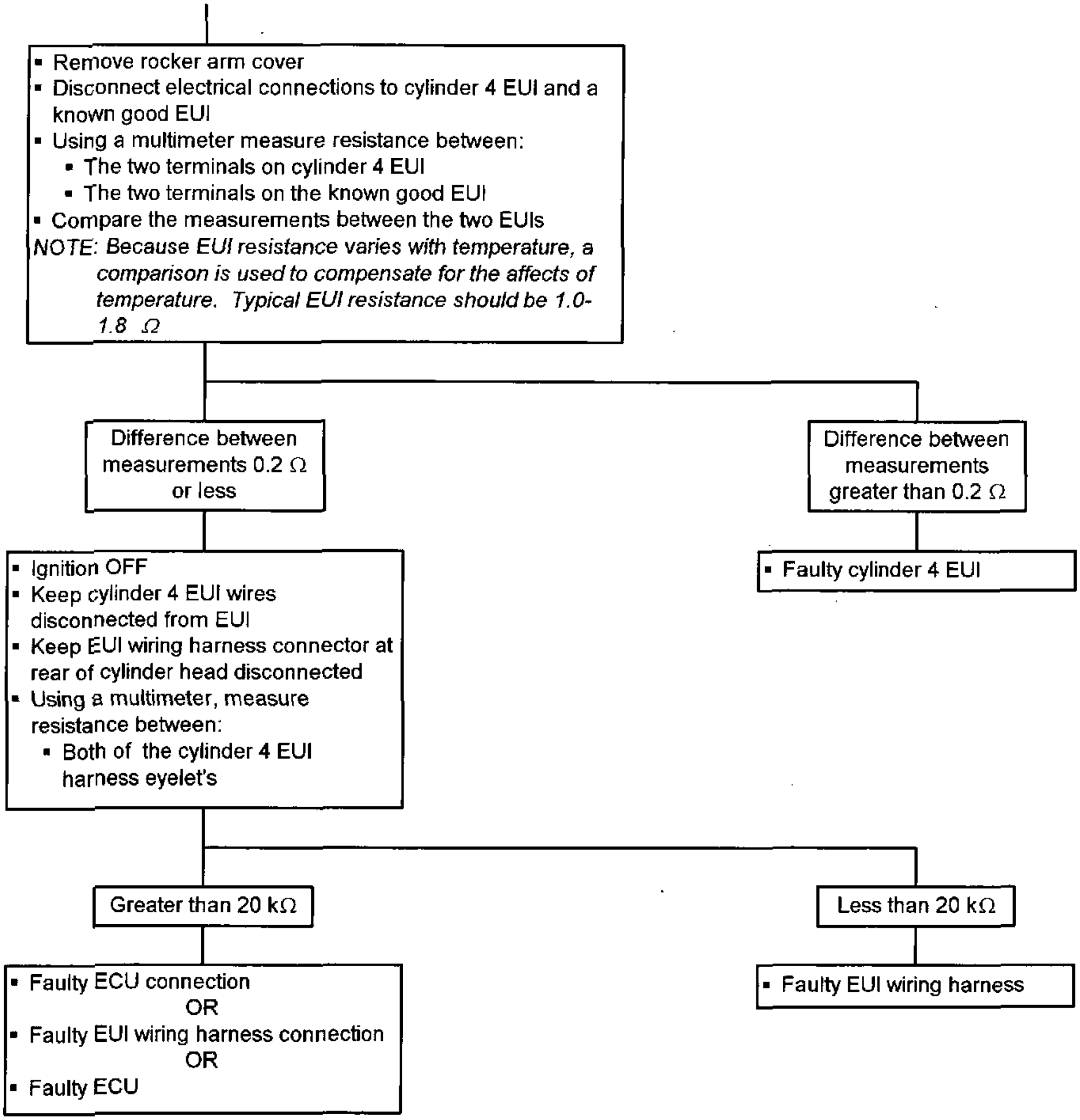
SPN 654 FMI 6 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10484 –19–17NOV99

DPSG,RG40854,439 –19–12OCT99–1/1

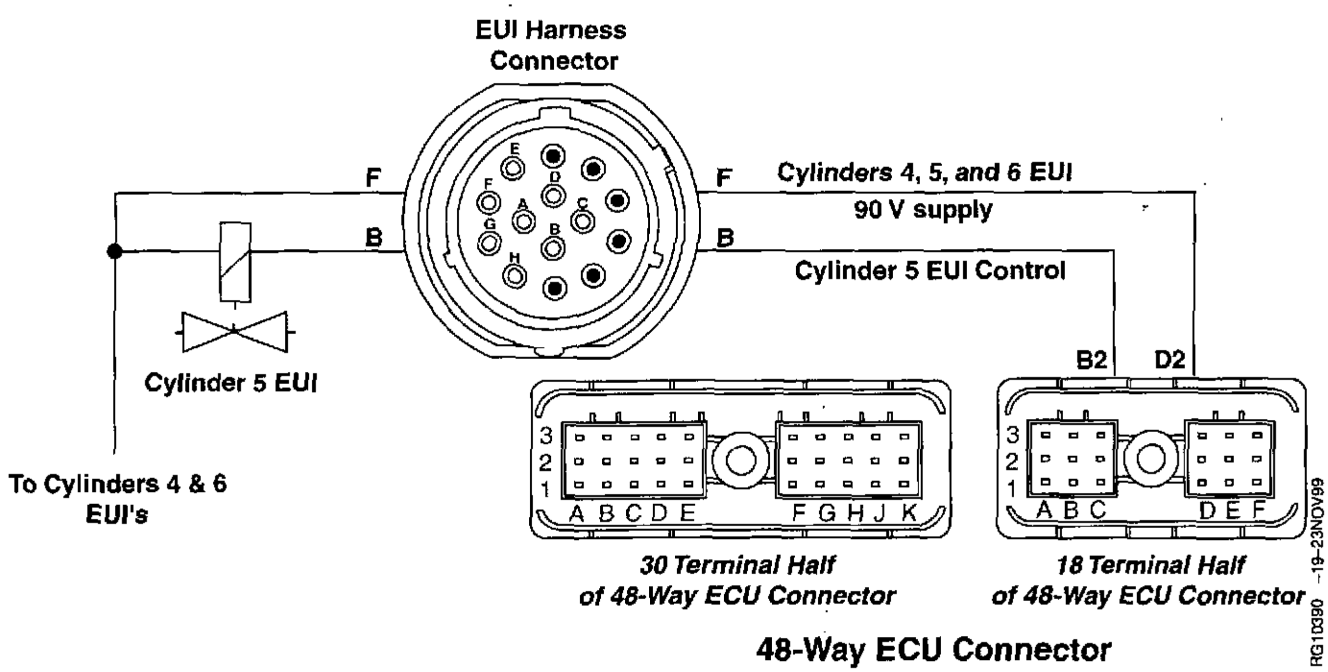
DTC SPN 654 FMI 6 Cylinder #4 EUI Circuit Shorted - Continued



RG10485 –19–17NOV99

DPSG,RG40854,440 –19–12OCT99–1/1

DTC SPN 655 FMI 5 Cylinder #5 EUI Circuit Open



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 655 FMI 5 will set if:

- The ECU detects an open in the Cylinder #5 EUI circuit.

If DTC SPN 655 FMI 5 sets, the following will *occur:*

- Cylinder #5 EUI will not fire.

DPSG,RG40854,231 -19-30JUN99-1/1

DTC SPN 655 FMI 5 Cylinder #5 EUI Circuit Open - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the back of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor DTCs

SPN 655 FMI 5 reoccurs

- Ignition OFF

CAUTION: Possible strong electric shock hazard if engine is cranking or running

- Disconnect EUI wiring harness connector at rear of cylinder head
- Disconnect 18-terminal half of 48-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal B in the harness end of the EUI wiring harness connector and terminal B2 in the harness end of the ECU connector
  - Terminal F in the harness end of the EUI wiring harness connector and terminal D2 in the harness end of the ECU connector

Both measurements 5.0 Ω or less

Continued on next page

Measurement between B to B2 greater than 5 Ω

- Open in wire between terminal B and B2

Measurement between F to D2 greater than 5 Ω

- Open in wire between terminal F and D2

SPN 655 FMI 5 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10486 –19–07JAN00

DPSG,RG40854,441 –19–12OCT99–1/1

DTC SPN 655 FMI 5 Cylinder #5 EUI Circuit Open - Continued

- Remove rocker arm cover
- *Disconnect electrical connections to cylinder 5 EUI and a known good EUI*
- Using a multimeter measure resistance between:
  - The two terminals on cylinder 5 EUI
  - The two terminals on the known good EUI
- Compare the measurements between the two EUIs

NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typically EUI resistance should be 1.0-1.8 Ω

Difference between measurements 0.2 Ω or less

- Ignition OFF
- Cylinder 5 EUI wires disconnected from EUI
- Disconnect EUI wiring harness connector from rear of cylinder head
- Using a multimeter, measure resistance between:
  - One of the cylinder 5 EUI harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head (either F or B, the EUI's are not polarity sensitive)
  - *The other cylinder 5 EUI harness eyelet and the* other corresponding terminal at the connector on *the rear of the cylinder head*

Both measurements 2.0 Ω or less

- Faulty ECU connection

OR

- Faulty EUI wiring harness connection

OR

- Faulty ECU

Either measurements greater than 2.0 Ω

- Faulty EUI harness in head

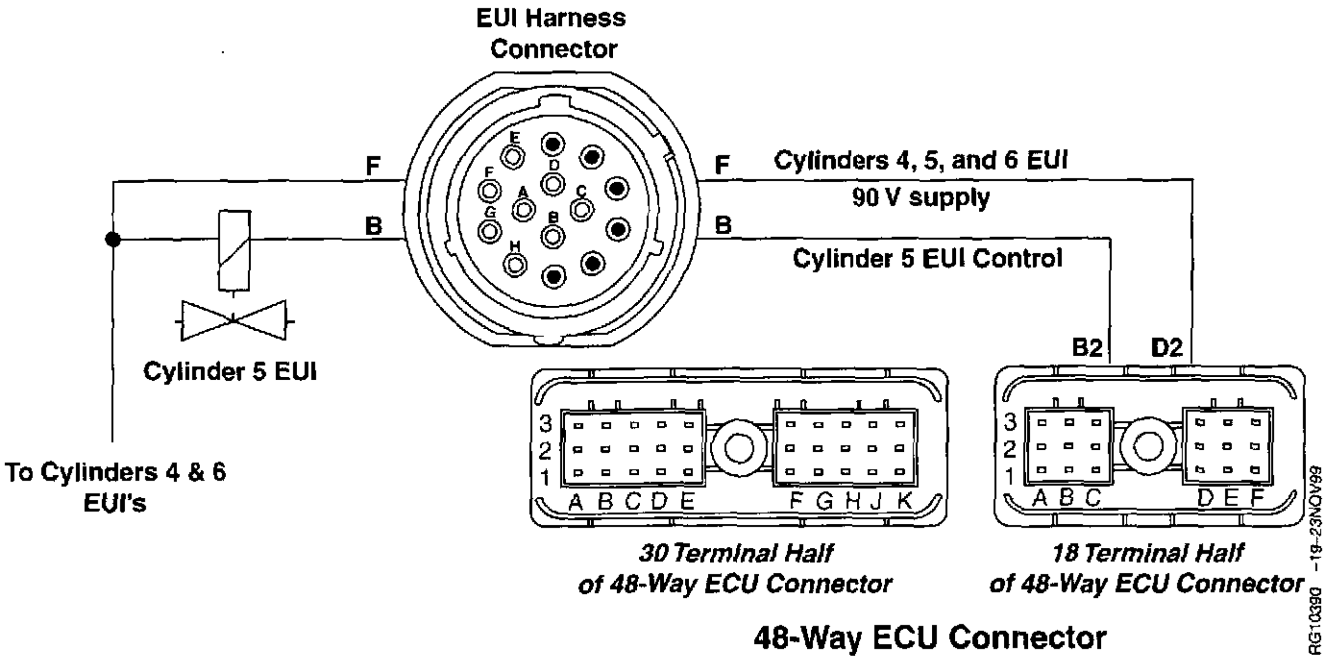
Difference between measurements greater than 0.2 Ω

- Faulty cylinder 5 EUI

RG10487 –19–17NOV99

DPSG,RG40854,442 –19–12OCT99–1/1

DTC SPN 655 FMI 6 Cylinder #5 EUI Circuit Shorted



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 655 FMI 6 will set if:

- The ECU detects an open in the Cylinder #5 EUI circuit.

If DTC SPN 655 FMI 6 sets, the following will occur:

- Cylinder #5 EUI will not fire.

DPSG,RG40854,232 –19–30JUN99–1/1

DTC SPN 655 FMI 6 Cylinder #5 EUI Circuit Shorted - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the rear of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor active DTCs

SPN 655 FMI 6 reoccurs

- Ignition OFF

CAUTION: Possible strong electric shock hazard if engine is cranking or running

- Disconnect 18-terminal half of 48-way ECU connector
- Disconnect EUI wiring harness connector at rear of cylinder head
- Using a multimeter, measure resistance between terminal B in the harness end of the EUI wiring connector and the following:
  - Terminal C in the harness end of the EUI wiring connector
  - Terminal F in the harness end of the EUI wiring connector

Both measurements greater than 20 kΩ

Continued on next page

Either measurement less than 20 kΩ

- Short in ECU wiring harness

SPN 655 FMI 6 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10488 –19–17NOV99

DTC SPN 655 FMI 6 Cylinder #5 EUI Circuit Shorted - Continued

- Remove rocker arm cover
- Disconnect electrical connections to cylinder 5 EUI and a known good EUI
- Using a multimeter measure resistance between:
  - The two terminals on cylinder 5 EUI
  - The two terminals on the known good EUI
- Compare the measurements between the two EUIs

NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typical EUI resistance should be 1.0-1.8 Ω

Difference between measurements 0.2 Ω or less

- Ignition OFF
- Keep cylinder 5 EUI wires disconnected from EUI
- Keep EUI wiring harness connector at rear of cylinder head disconnected
- Using a multimeter, measure resistance between:
  - Both of the cylinder 5 EUI harness eyelet's

Greater than 20 kΩ

- Faulty ECU connection

OR

- Faulty EUI wiring harness connection

OR

- Faulty ECU

Less than 20 kΩ

- Faulty EUI wiring harness

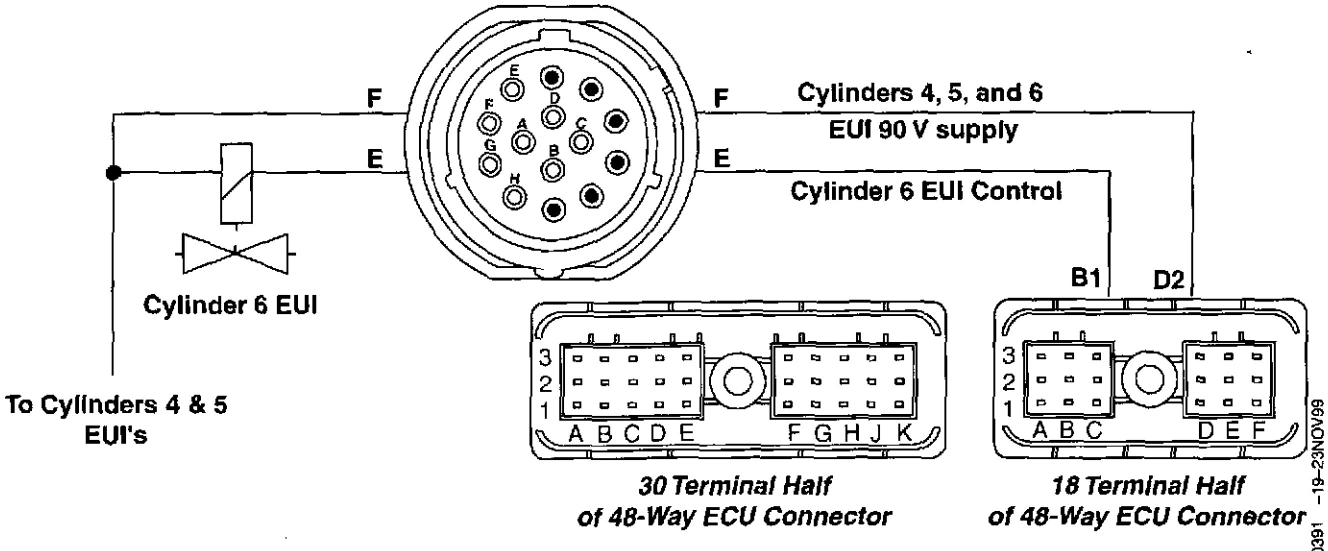
Difference between measurements greater than 0.2 Ω

- Faulty cylinder 5 EUI

RG10489 -19-17NOV99

DPSG,RG40854,444 -19-12OCT99-1/1

DTC SPN 656 FMI 5 Cylinder #6 EUI Circuit Open



48-Way ECU Connector

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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 656 FMI 5 will set if:

- The ECU detects an open in the Cylinder #6 EUI circuit.

If DTC SPN 656 FMI 5 sets, the following will occur:

- Cylinder #6 EUI will not fire.

DPSG,RG40854,233 –19–30JUN99–1/1

DTC SPN 656 FMI 5 Cylinder #6 EUI Circuit Open - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the back of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, or SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor DTCs

SPN 656 FMI 5 reoccurs

- Ignition OFF

CAUTION: Possible strong electric shock hazard if engine is cranking or running

- Disconnect EUI wiring harness connector at rear of cylinder head
- Disconnect 18-terminal half of 48-way ECU connector
- Using a multimeter, measure resistance between:
  - Terminal E in the harness end of the EUI wiring harness connector and terminal B1 in the harness end of the ECU connector
  - Terminal F in the harness end of the EUI wiring harness connector and terminal D2 in the harness end of the ECU connector

Both measurements 5 Ω or less

Continued on next page

Measurement between E to B1 greater than 5 Ω

- Open in wire between terminal E and B1

Measurement between F to D2 greater than 5 Ω

- Open in wire between terminal F and D2

SPN 656 FMI 5 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10490 –19–07JAN00

DPSG,RG40854,445 –19–12OCT99–1/1

DTC SPN 656 FMI 5 Cylinder #6 EUI Circuit Open - Continued

- Remove rocker arm cover
- Disconnect electrical connections to cylinder 6 EUI and a known good EUI
- Using a multimeter measure resistance between:
  - The two terminals on cylinder 6 EUI
  - The two terminals on the know good EUI
- Compare the measurements between the two EUIs

NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typically EUI resistance should be 1.0-1.8 Ω

Difference between measurements 0.2 Ω or less

- Ignition OFF
- Cylinder 6 EUI wires disconnected from EUI
- Disconnect EUI wiring harness connector from rear of cylinder head
- *Using a multimeter, measure resistance between:*
  - One of the cylinder 6 EUI harness eyelet and the corresponding terminal at the connector on the rear of the cylinder head (either F or E, the EUI's are not polarity sensitive)
  - The other cylinder 6 EUI harness eyelet and the other corresponding terminal at the connector on the rear of the cylinder head

Both measurements 2.0 Ω or less

- Faulty ECU connection

OR

- Faulty EUI wiring harness connection

OR

- Faulty ECU

Either measurements *greater than 2.0 Ω*

- Faulty EUI harness in head

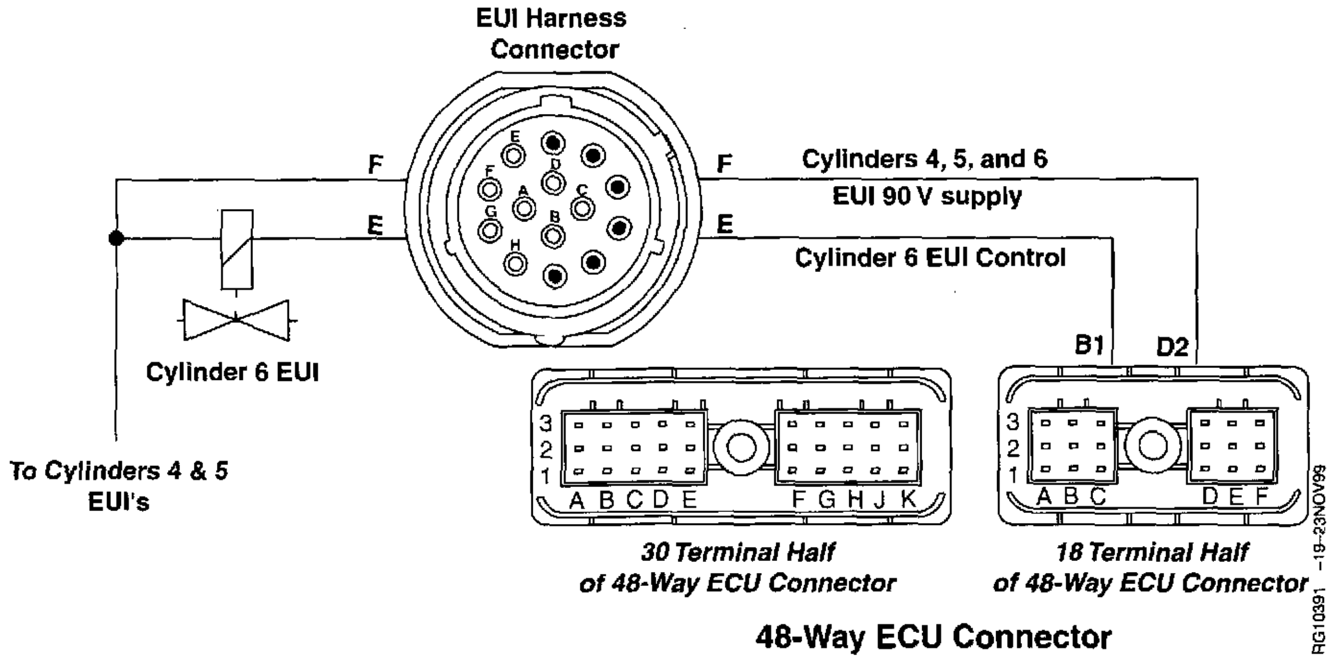
Difference between measurements greater than 0.2 Ω

- Faulty cylinder 6 EUI

RG10491 –19–17NOV99

DPSG,RG40854,446 –19–12OCT99–1/1

DTC SPN 656 FMI 6 Cylinder #6 EUI Circuit Shorted



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

EUI (Electronic Unit Injector)

- The fuel in 10.5 L and 12.5 L engines is delivered by 6 (one for each cylinder) electronic unit injectors (EUIs). The EUIs are mounted in they cylinder head, under the valve cover, so that they spray directly into the center of the cylinder bore. Each EUI is an injection pump and injector combined, operating at much higher pressures than standard in-line or rotary injection pumps. The ECU controls the start of injection and the amount of fuel injected by turning the solenoid in the EUI valve housing on and off which in turn opens and closes the EUI spill valve.
- Power is supplied to the EUIs for cylinders 1, 2, and 3 by a common wire, and to the EUIs for cylinders 4, 5, and 6 by a different common wire. The ECU energizes and deenergizes the solenoids of individual EUIs by closing and opening the individual EUI ground circuits.

DTC SPN 656 FMI 6 will set if:

- The ECU detects an open in the Cylinder #6 EUI circuit.

If DTC SPN 656 FMI 6 sets, the following will occur:

- Cylinder #6 EUI will not fire.

DPSG,RG40854,234 -19-30JUN99-1/1

DTC SPN 656 FMI 6 Cylinder #6 EUI Circuit Shorted - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of the 48-way ECU connector and the EUI harness connector (located at the rear of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.

- **If DTCs SPN 611 FMI 3, SPN 611 FMI 4, OR SPN 627 FMI 1 are active, repair those DTCs first**

- Ignition ON, engine OFF
- Make note of any DTCs, then clear all DTCs
- Ignition ON, engine running
- Monitor active DTCs

SPN 656 FMI 6 reoccurs

- Ignition OFF

  CAUTION: Possible strong electric shock hazard if engine is cranking or running
- Disconnect 18-terminal half of 48-way ECU connector
- Disconnect EUI wiring harness connector at rear of cylinder head
- Using a multimeter, measure resistance between terminal E in the harness end of the EUI wiring connector and the following:
  - Terminal C in the harness end of the EUI wiring connector
  - Terminal F in the harness end of the EUI wiring connector

Both measurements greater than 20 kΩ

Continued on next page

Either measurement less than 20 kΩ

- Short in ECU wiring harness

SPN 656 FMI 6 doesn't reoccur

Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS, earlier in this group.

RG10492 –19–17NOV99

DPSG,RG40854,447 –19–12OCT99–1/1

DTC SPN 656 FMI 6 Cylinder #6 EUI Circuit Shorted - Continued

- Remove rocker arm cover
- Disconnect electrical connections to cylinder 6 EUI and a known good EUI
- Using a multimeter measure resistance between:
  - The two terminals on cylinder 6 EUI
  - The two terminals on the known good EUI
- Compare the measurements between the two EUIs

NOTE: Because EUI resistance varies with temperature, a comparison is used to compensate for the affects of temperature. Typical EUI resistance should be 1.0-1.8 Ω

Difference between measurements 0.2 Ω or less

- Ignition OFF
- Keep cylinder 6 EUI wires disconnected from EUI
- Keep EUI wiring harness connector at rear of cylinder head disconnected
- Using a multimeter, measure resistance between:
  - Both of the cylinder 6 EUI harness eyelet's

Greater than 20 kΩ

- Faulty ECU connection

OR

- Faulty EUI wiring harness connection

OR

- Faulty ECU

Less than 20 kΩ

- Faulty EUI wiring harness

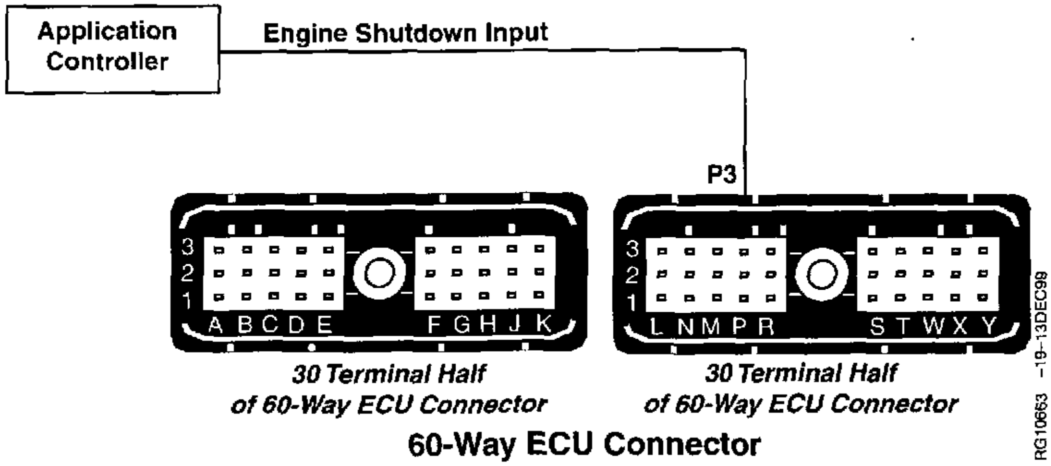
Difference between measurements greater than 0.2 Ω

- Faulty cylinder 6 EUI

RG10483 -19-17NOV99

DPSG,RG40854,448 -19-12OCT99-1/1

DTC SPN 970 FMI 2 Auxiliary Engine Shutdown Switch Signal Invalid



60-Way ECU Connector

NOTE: Wiring diagram shows Tractor engine applications only.

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

DTC SPN 970 FMI 2 will set if:

- The ECU reads an input voltage from the application's controller to be less than 0.5 volts or greater than 2.5 volts.

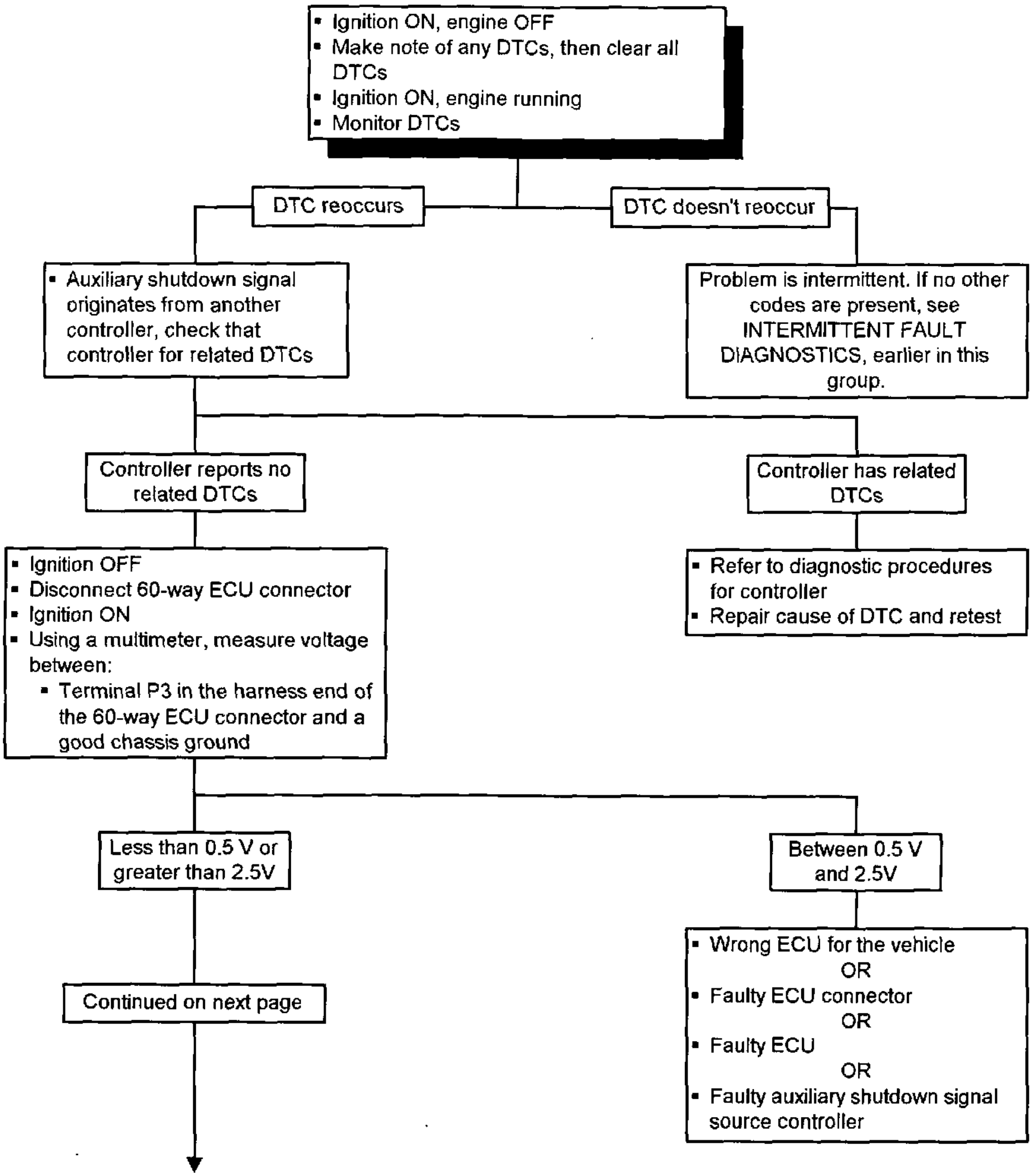
If DTC SPN 970 FMI 2 sets, the following will occur:

- The ECU will shut the engine down.

DPSG,RG40854,317 –19–26AUG99–1/1

DTC SPN 970 FMI 2 Auxiliary Engine Shutdown Switch Signal Invalid - Continued

Note: Before using this diagnostic procedure, perform a preliminary inspection of 60-way ECU connector looking for dirty, damaged, or poorly positioned terminals.



RG10539 –19–06JAN00

DPSG,RG40854,449 –19–12OCT99–1/1

DTC SPN 970 FMI 2 Auxiliary Engine Shutdown Switch Signal Invalid - Continued

- Ignition OFF
- 60-way ECU connector still disconnected
- Obtain wiring information for this application and determine the source of the auxiliary shutdown signal
- Disconnect the connector that outputs the shutdown signal
- Using a multimeter, measure the resistance between:
  - Terminal P3 of the 60-way ECU connector and the originating shutdown signal terminal

5 Ω or less

- Ignition OFF
- 60-way ECU connector and the originating connector still disconnected
- Using a multimeter measure resistance between terminal P3 in the harness end of the 60-way ECU connector and:
  - All other terminals in that connector
  - A good chassis ground

All measurements greater than 2 kΩ

- Faulty signal source controller wiring

OR

- Faulty auxiliary shutdown controller connector

OR

- Faulty auxiliary shutdown signal source controller

Any measurement less than 2 kΩ

- Short in auxiliary shutdown signal circuit

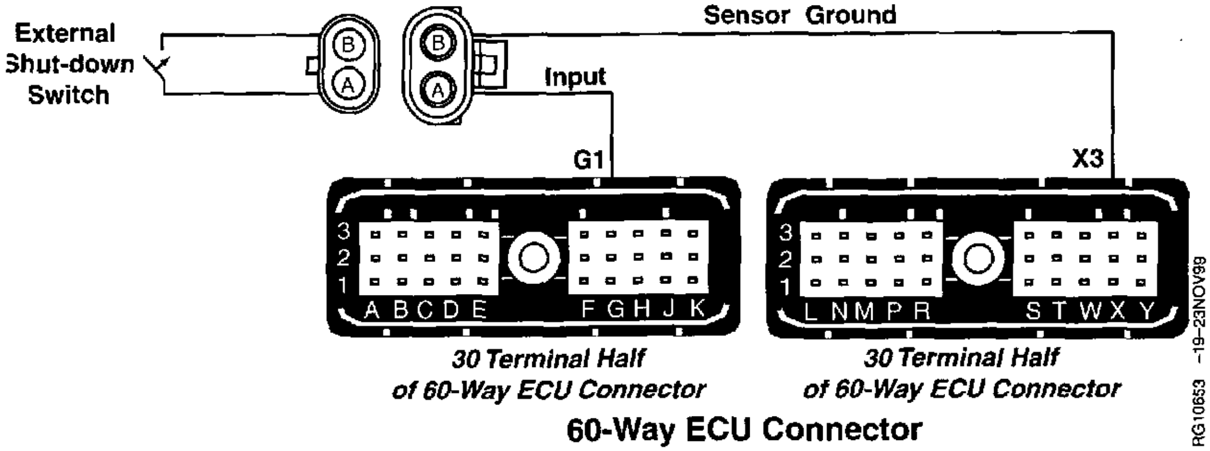
Greater than 5 Ω

- Open in auxiliary shutdown signal circuit

RG10540 -19-14DEC99

DPSG,RG40854,450 -19-12OCT99-1/1

DTC SPN 970 FMI 31 Auxiliary Engine Shutdown Switch Active



NOTE: Wiring diagram shows OEM engine applications. For wiring information non-OEM engines, refer to machine manual.

Auxiliary Engine Shutdown Switch

- On OEM applications, the engine shutdown switch is a normally open switch. When the property being measured exceeds a certain value, the switch will close. When the switch is closed, the voltage is grounded, which will cause the ECU to shutdown the engine.

DTC SPN 970 FMI 31 will set if:

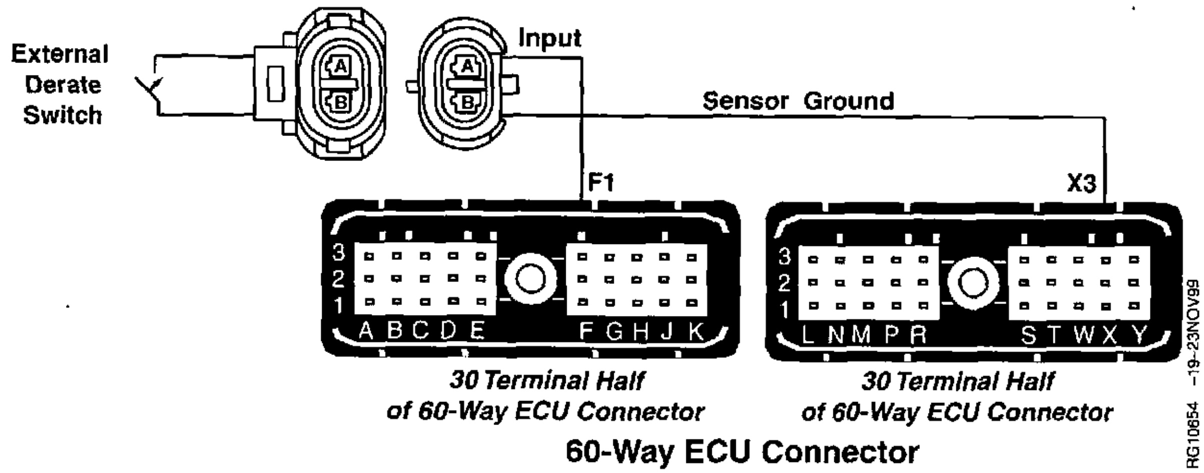
- The ECU does not read an input voltage.

If DTC SPN 970 FMI 31 sets, the following will occur:

- The ECU will shut the engine down.

DPSG,RG40854,318 –19–26AUG99–1/1

DTC SPN 971 FMI 31 External Fuel Derate Switch Active



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

External Fuel Derate Switch

On OEM applications, the external derate switch is a normally open switch. When the property being measured exceeds a certain value, the switch will close. When the switch is closed, the voltage is grounded, which will cause the ECU to derate the engine.

DTC SPN 971 FMI 31 will set if:

- The ECU does not read an input voltage.

If DTC SPN 971 FMI 31 sets, the following will occur:

- The ECU will derate the engine. The amount of derate is dependent on the application.

DPSG,RG40854,319 -19-26AUG99-1/1

DTC SPN 1109 FMI 31 Engine Shutdown Warning

Engine Shutdown Warning:

This code informs the operator that the ECU will shut the engine down because it has detected a condition such as low fuel pressure, water in fuel, low oil pressure, high engine coolant temperature, ECU error or low coolant level. If the ECU is programmed with engine protection with shutdown, the ECU has shut the engine down within 30 seconds. Prior to shutdown, the engine will be derated.

DTC SPN 1109 FMI 31 will set if:

- The ECU senses a coolant temperature of 115 °C (239 °F) (DTC SPN 110 FMI 1 will also be present).

NOTE: Temperature value shown applies to OEM engine applications. Other applications may have the same or a similar temperature value. Refer to the machine manual for high coolant temperature value.

- The ECU senses an oil pressure below the shutdown value set point in the ECU (DTC SPN 100 FMI 1 will also be present).
- The ECU detects water in fuel above a quantity for an extended period of time by the ECU (DTC SPN 97 FMI 0 will also be present).
- The ECU detects a fuel pressure below the shutdown value set point in the ECU (DTC SPN 94 FMI 1 will also be present).
- The ECU detects a loss of coolant that is above the shutdown set point in the ECU (DTC SPN 111 FMI 1 will also be present).
- The ECU detects an ECU error (DTC SPN 629 12 or 13 will also be present).

If DTC SPN 1109 FMI 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 1110 FMI 31 sets:

- Check for other stored or active trouble codes that indicate the reason for why the ECU is shutting the engine down.

DPSG,RG40854,487 –19–25JAN00–1/1

DTC SPN 1110 FMI 31 Engine Shutdown

Engine Shutdown:

This code informs the operator that the ECU shut the engine down because it has detected a condition such as low fuel pressure, water in fuel, low oil pressure, high engine coolant temperature, ECU error or low coolant level. If the ECU is programmed with engine protection with shutdown, the ECU has shut the engine down.

DTC SPN 1110 FMI 31 will set if:

- The ECU senses a coolant temperature of 115 °C (239 °F) (DTC SPN 110 FMI 1 will also be present).

NOTE: Temperature value shown applies to OEM engine applications. Other applications may have the same or a similar temperature value. Refer to the machine manual for high coolant temperature value.

- The ECU senses an oil pressure below the shutdown value set point in the ECU (DTC SPN 100 FMI 1 will also be present).
- The ECU detects water in fuel above a quantity for an extended period of time by the ECU (DTC 97 FMI 0 will also be present).
- The ECU detects a fuel pressure below the shutdown value set point in the ECU (DTC SPN 94 FMI 1 will also be present).
- The ECU detects a loss of coolant that is above the shutdown set point in the ECU (DTC SPN 111 FMI 1 will also be present).
- The ECU detects an ECU error (DTC SPN 629 12 or 13 will also be present).

If DTC SPN 1110 FMI 31 sets, the following will occur:

- The ECU will have shut the engine down.

If DTC 1110 FMI 31 sets:

- Check for other stored or active trouble codes that indicate the reason for the ECU shutting the engine down.

DPSG,RG40854,488 –19–25JAN00–1/1

DTC SPN 1569 FMI 31 Fuel Derate

Fuel Derate

The fuel derate trouble code is information to the operator that the ECU has detected a condition such as low fuel pressure, high fuel pressure, water in fuel, low oil pressure, high manifold air temperature, high air filter restriction, high engine coolant temperature, or low coolant level, and is derating the engine by limiting the maximum amount of fuel available to the engine.

DTC SPN 1569 FMI 31 will set if:

- The ECU senses a coolant temperature of 105 °C (221 °F) (DTC SPN 110 FMI 1 or 16 will also be present).

NOTE: Temperature value shown applies to OEM engine applications. Other applications may have the same or a similar temperature value. Refer to the machine manual for high coolant temperature value.

- The ECU senses an oil pressure below the warning value set point in the ECU (DTC SPN 100 FMI 1 or 18 will also be present).
- The ECU senses a manifold air temperature above 90 °C (194 °F) (DTC SPN 105 FMI 16 will also be present).

NOTE: Temperature value shown applies to OEM engine applications. Other applications may have the same or a similar temperature value. Refer to the machine manual for high coolant temperature value.

- The ECU detects water in fuel above a quantity known by the ECU.
- The ECU detects a fuel pressure below the warning value set point in the ECU (DTC SPN 94 FMI 1 or 18 will also be present).
- The ECU detects a fuel pressure above the warning value set point in the ECU (DTC SPN 94 FMI 16 will also be present).
- The ECU detects a loss of coolant that is above the shutdown set point in the ECU (DTC SPN 111 FMI 1 will also be present).
- The ECU detects a restriction in the air filter that is above the warning set point set in the ECU (DTC SPN 107 FMI 31 will also be present).
- The ECU detects an ECU error (DTC SPN 629 12 or 13 will also be present).

If DTC SPN 1569 FMI 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 1569 FMI 31 sets:

- Check for other stored or active trouble codes that indicate the reason for the fuel derate.

DPSG,RG40854,320 –19–26AUG99–1/1

Group 105
Engine Diagnostics and Testing Procedures Specifications

ITEM	SPECIFICATION
Oil Pressure:	
Minimum No Load at Idle	100 kPa (1.0 bar) (15 psi)
Maximum Full Load at Rated Speed	450 kPa (4.5 bar) (65 psi)
Thermostats (2 Used):	
Initial Opening (Range)	80–84°C (175–182°F)
Full Open (Nominal)	94°C (202°F)
Fuel Supply Pressure on a Dual Rail Fuel System	
Normal (Idle)	410–480 kPa (4.1–4.8 bar) (60–70 psi)
Cranking (Minimum 200 rpm)	70–170 kPa (0.7–1.7 bar) (10–25 psi)
Fuel Supply Pressure on a Single Rail Fuel System	
Normal (Idle)	410-555 kPa (4.1—5.5 bar) (60—80 psi)
Cranking (Minimum 200 rpm)	135—175 kPa (1.35—1.75 bar) (20—25 psi)
Rated Speed	480—620 kPa (4.8—6.2 bar) (70—90 psi)
Fuel System O-ring-Face-Seal Fittings on Dual Rail Fuel Sytem:	
Final Filter-to-Fuel Manifold	24 N•m (18 lb-ft)
Transfer Pump-to-Final Filter	24 N•m (18 lb-ft)

RG,RG34710,1609 –19–30SEP97–1/1

Intake Manifold Pressure (Turbocharger Boost) Specifications

Engine Model	Fuel System Option Codes	Power Rating @ Rated Speed Without Fan kW (hp)	Rated Speed (rpm)	Pressure Specification
OEM INDUSTRIAL APPLICATIONS				
6105AF	1601, 1603	224 (300)	2100	134—154kPa (1.3—1.5bar) (19—22 psi)
6105HF	1610, 1620	242 (325)	2100	128—148 kPa (1.3—1.5 bar) (19-21 psi)
6125AF	1601, 1611	261 (350)	2100	144—166 kPa (1.4—1.7 bar) (21-24 psi)
	1602, 1612	280 (375)	2100	159—183 kPa (1.6—1.8 bar) 23—27 psi)
	1603, 1613	298 (399)	2100	173—199 kPa (1.7—2.0 bar) 25—29 psi)
	1610, 1620	242 (325)	2100	134—154 kPa (1.3—1.5 bar) (19—22 psi)
6125HF	1601, 1611	317 (425)	2100	148—170 kPa (1.5—1.7 bar) (21—25 psi)
	1602, 1612	336 (450)	2100	162—186 kPa (1.6—1.9 bar) (23—27 psi)
	1603, 1613	354 (474)	2100	172—198 kPa (1.7—2.0 bar) (25—29 psi)
	1604, 1614	373 (500)	2100	182—210 kPa (1.8—2.1 bar) (26—30 psi)
OEM GENERATOR SET (STANDBY) APPLICATIONS				
6125AF	1604, 1614	288 (386)	1800	182—210 kPa (1.8—2.1 bar) (26—30 psi)
	1605, 1615	311 (417)	1800	201—231 kPa (2.0—2.3 bar) (29—33 psi)
	1606, 1616	339 (454)	1800	223—257 kPa (2.2—2.6 bar) (32—37 psi)
	1607, 1617	247 (331)	1500	136—156 kPa (1.4—1.6 bar) (20—23 psi)
	1608, 1618	262 (351)	1500	150—172 kPa (1.5—1.7 bar) (22—25 psi)
	1609, 1619	289 (387)	1500	171—197 kPa (1.7—2.0 bar) (25—29 psi)
6125HF	1605, 1615	423 (567)	1800	250—288 kPa (2.5—2.9 bar) (36—42 psi)
	1606, 1616	367 (492)	1800	210—242 kPa (2.1—2.4 bar) (30—35 psi)
	1607, 1617	313 (419)	1500	184—212 kPa (1.8—2.1 bar) (27—31 psi)
	1608, 1618	362 (485)	1500	215—247 kPa (2.1—2.5 bar) (31—36 psi)
OEM - MARINE APPLICATIONS				
6125AFM	1618F	240 (330)	2100	157—194 kPa (1.5—2.0 bar) (22—28)

Engine Model	Deere Model	Rated Speed (rpm)	Pressure Specification
JOHN DEERE VEHICLE APPLICATIONS			
6125ADW01	744H/MH (4-Wheel Drive Loader)	2000	93—107 kPa (0.9—1.1 bar) (14—16 psi)
6125ADW70	Hitachi LX230-3 (4-WD Loader)	2000	93—107 kPa (0.9—1.1 bar) (14—16 psi)
6105HRW01	9200 (4-Wheel Drive Tractor)	2100	124—142 kPa (1.2—1.5 bar) (18—21 psi)
6125HRW01	9300 (4-Wheel Drive Tractor)	2100	113—130 kPa (1.1—1.3 bar) (16—19 psi)
6125HRW02	9400 (4-Wheel Drive Tractor)	2100	144—166 kPa (1.4—1.7 bar) (21—24 psi)
6125HRW03	9300 (LTV)	2100	113—130 kPa (1.1—1.3 bar) (16—19 psi)
6125HRW04	9400 (LTV)	2100	144—166 kPa (1.4—1.7 bar) (21—24 psi)
6125HZ001	6850 (Forage Harvester)	2100	149—172 kPa (1.5—1.7 bar) (22-25 psi)
6125HZ002	6750 (Forage Harvester)	2100	115—132 kPa (1.1—1.3 bar) (17—19 psi)
6125AT801	CH2500 Sugar Cane Harvester	2100	143—167 kPa (1.4—1.7 bar) (20—24 psi)

RG,RG34710,1610 –19–30SEP97–1/1

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Group 115
Electronic Control System Diagnostics Specifications

Refer to illustrations on following pages for electronic control system component locations.

A wiring diagram is provided later in this Group.

RG,RG34710,115 –19–30SEP97–1/1

Torque Curve Selection

John Deere Applications

NOTE: 6750/6850 Self-Propelled Forage Harvester applications only use torque curve #0.

Torque Curve Selection for 9200, 9300, 9400 Wheel Tractors			
Torque Curve	**PST**	**12 Speed MST**	**24 Speed MST**
0	When none of the below conditions are met	When none of the below conditions are met	When none of the below conditions are met
1	When in gear 3F	When in gear 3F	When in gears A3H or B1L
2	3-pt. hitch lowered OR Vehicle speed less than 0.5 mph and PTO engaged	3-pt. hitch lowered OR Vehicle speed less than 0.5 mph and PTO engaged	3-pt. hitch lowered OR Vehicle speed less than 0.5 mph and PTO engaged OR When in gears A1L, A1H, A2L, A2H, A3L, ARL, or ARH
3	When in gears 1F, 2F, 1R	Not Used	Not Used

Torque Curve Selection for 9300/9400 Track Tractors (LTVs)	
Torque Curve	**Conditions for Torque Curve**
0	When torque curve 1 and 2 conditions are not met
1	When in gears A3H or B1L
2	*When 3-pt. hitch lowered and PTO engaged* OR When in gears A1H, A2L, A2H, A3L, ARL, or ARH
3	Not Used
4	When torque curve 1 and 2 conditions not met AND steering boost is activated
5	When in gears A3H or B1L and steering boost activated.
6	When in gears A1L, A1H, A2L, A2H, A3L, ARL, or ARH AND steering boost activated
7	Not used

Torque Curve Selection for 744H/MH Loaders	
Torque Curve	**Conditions for Torque Curve**
0	Not a proper torque curve. Used when CAN is used.
1	744H when in Gears 2-4
2	744H/MH when in Gear 1
3	744MH when in Gears 2-4

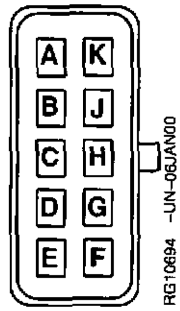
OEM and Marine Applications

Torque Curve Selection for Marine Applications		
Torque Curve	**Rated Speed**	**Jumper wire on Program Performance Connector:**
0	2100 rpm	No jumper wires installed
1	2000 rpm	Jumper wire installed between terminals C and H only
2	1900 rpm	Jumper wire installed between terminals B and J only
3	1800 rpm	Jumper wire installed between terminals A and K.

Continued on next page

RG,RG34710,1611 –19–30SEP97–1/2

Torque Curve Selection for OEM Applications		
Torque Curve	**Engine Speed**	**Jumper wire on Program Performance Connector:**
1	Intermittent	No jumper wires installed
2	Intermittent with minimum power bulge (Torque curve 1 times out and torque curve 2 is selected)	No jumper wires installed
3	Intermittent derated	Jumper wire installed between terminals B and J only
4	Continuous	Jumper wire installed between terminals A and K
5	Continuous with minimum power bulge (Torque curve 4 times out and torque curve 5 is selected)	Jumper wire installed between terminals A and K
6	Continuous derated	Jumper wire installed between terminals B and J only



Performance Program Connector

RG,RG34710,1611 –19–30SEP97–2/2

Governor Droop Mode Selection

NOTE: Desired Speed Governor and Max. Speed Governor are parameters that are listed in the DST. A number is located next to each of these parameters. Use the following tables to determine if the correct governor has been selected with respect to the conditions of the application.

John Deere Applications

Desired Speed Governor Selection for 9200, 9300, 9400 Wheel Tractors and 9300 and 9400 LTVs

Mode Selected	Conditions:
0	Normal droop
1	Field cruise with isochronous governor
4	Field cruise with crank error

Max. Speed Governor Selection 9200, 9300, 9400 Wheel Tractors and 9300 and 9400 LTVs

Mode Selected	Conditions:
9	Normal droop (at 2240 rpm, becomes isochronous)
10	PTO or hitch down operation.

Desired Speed Governor Selection for 744H/MH and LX 230 Loaders

Mode Selected	Conditions:
0	Normal droop

Max. Speed Governor Selection for 744H/MH and LX 230 Loaders

Mode Selected	Conditions:
9	Normal droop

Desired Speed Governor Selection for 6750 and 6850 Self-Propelled Forage Harvesters

Mode Selected	Conditions:
0	Droop for low speeds (mode 0 is selected until 1650 rpm when speed increases and below 1450 rpm when speed is decreases)
1	Droop for high speeds (mode 1 selected at 1650 rpm when speed increases and 1450 rpm *when speed decreases)*

Max. Speed Governor Selection for 6750 and 6850 Self-Propelled Forage Harvesters

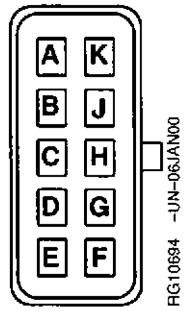
Mode Selected	Conditions:
9	Normal droop

Continued on next page

DPSG,RG40854,481 –19–10DEC99–1/2

OEM and Marine Applications

NOTE: In order for the isochronous governor to be selected, terminals E and F on the performance program connector must be connected by a jumper wire.



Performance Program Connector

Desired Speed Governor Selection for OEM Applications	
Mode Selected	**Conditions:**
0	Normal droop
2	Isochronous all speed
5	Cruise control

Max. Speed Governor Selection for OEM Applications	
Mode Selected	**Conditions:**
9	Drooped high speed governor
10	Isochronous governor at high idle

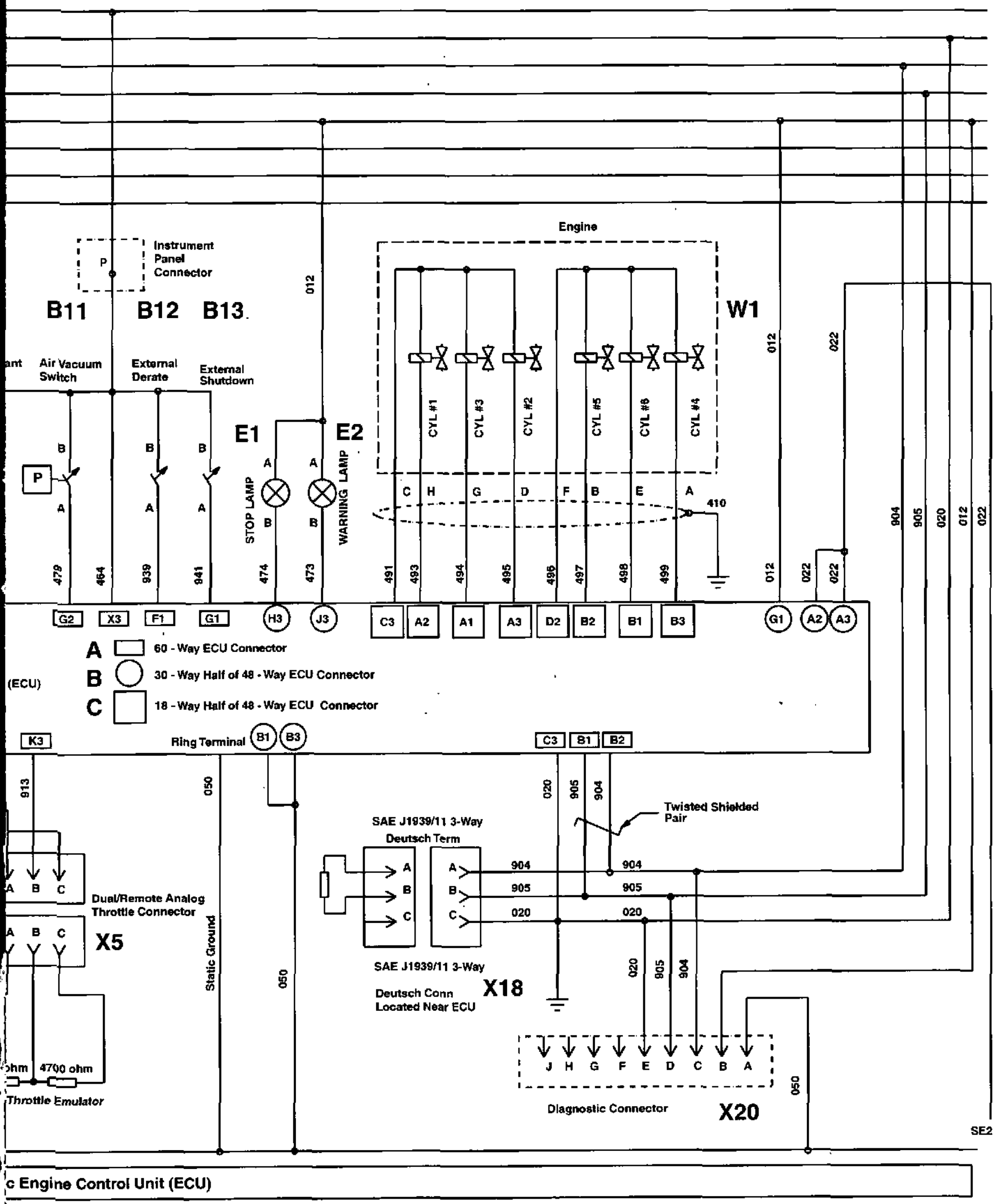
Desired Speed Governor Selection for Marine Applications	
Mode Selected	**Conditions:**
0	Torque curve 0 droop
1	Torque curve 1 droop
2	Torque curve 2 droop
3	Torque curve 3 droop
4	Torque curve 0 with isochronous governor
5	Torque curve 1 with isochronous governor
6	Torque curve 2 with isochronous goveror
7	Torque curve 3 with isochronous governor
10	Torque curve 0 with isochronous governor with crank error
11	Torque curve 1 with isochronous governor with crank error
12	Torque curve 2 with isochronous governor with crank error
13	Torque curve 3 with isochronous governor with crank error

Max. Speed Governor Selection for Marine Applications	
Mode Selected	**Conditions:**
9	Normal droop

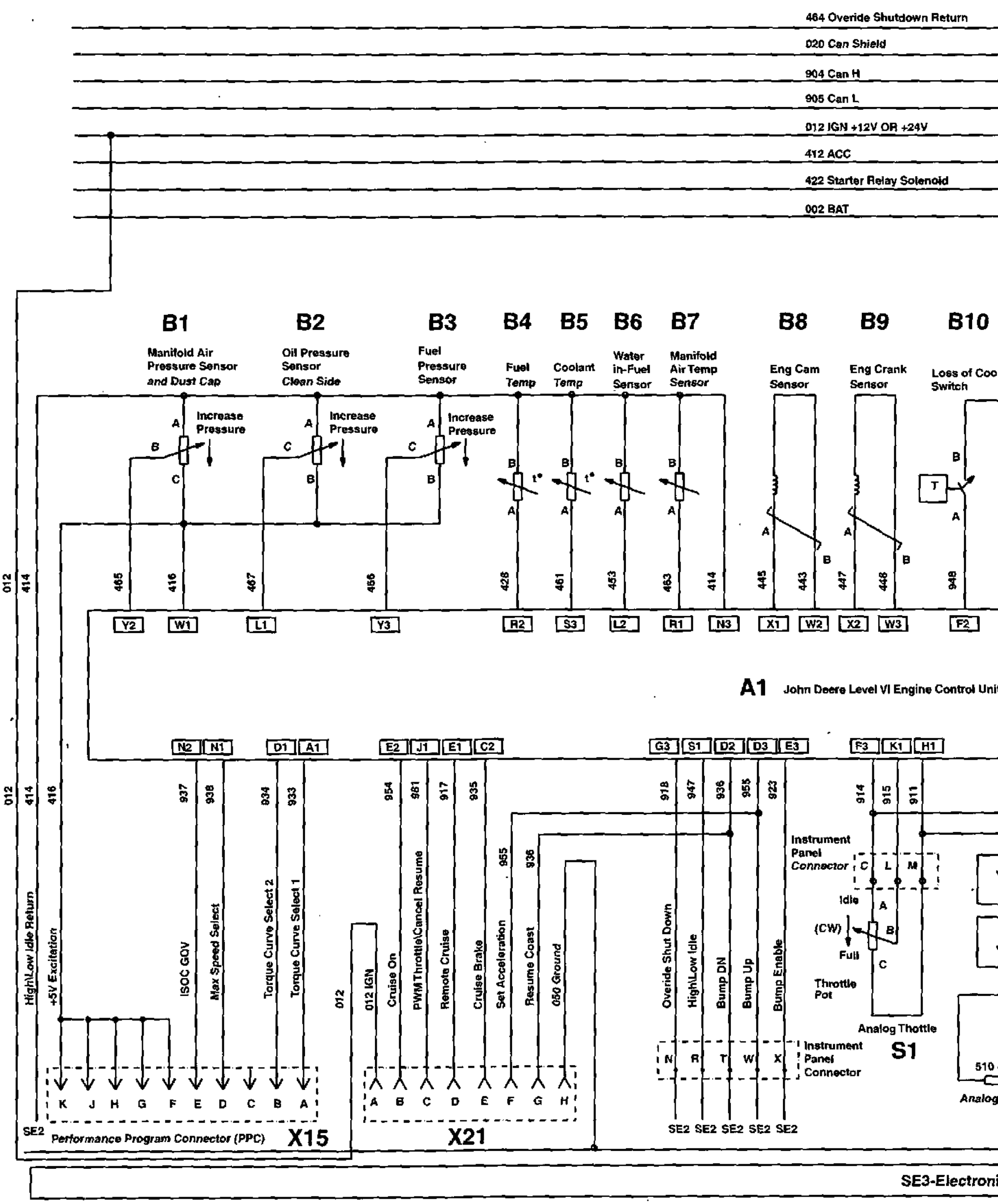
DPSG,RG40854,481 –19–10DEC99–2/2

6105 and 6125 OEM Application Electronic Control System Wiring Diagram

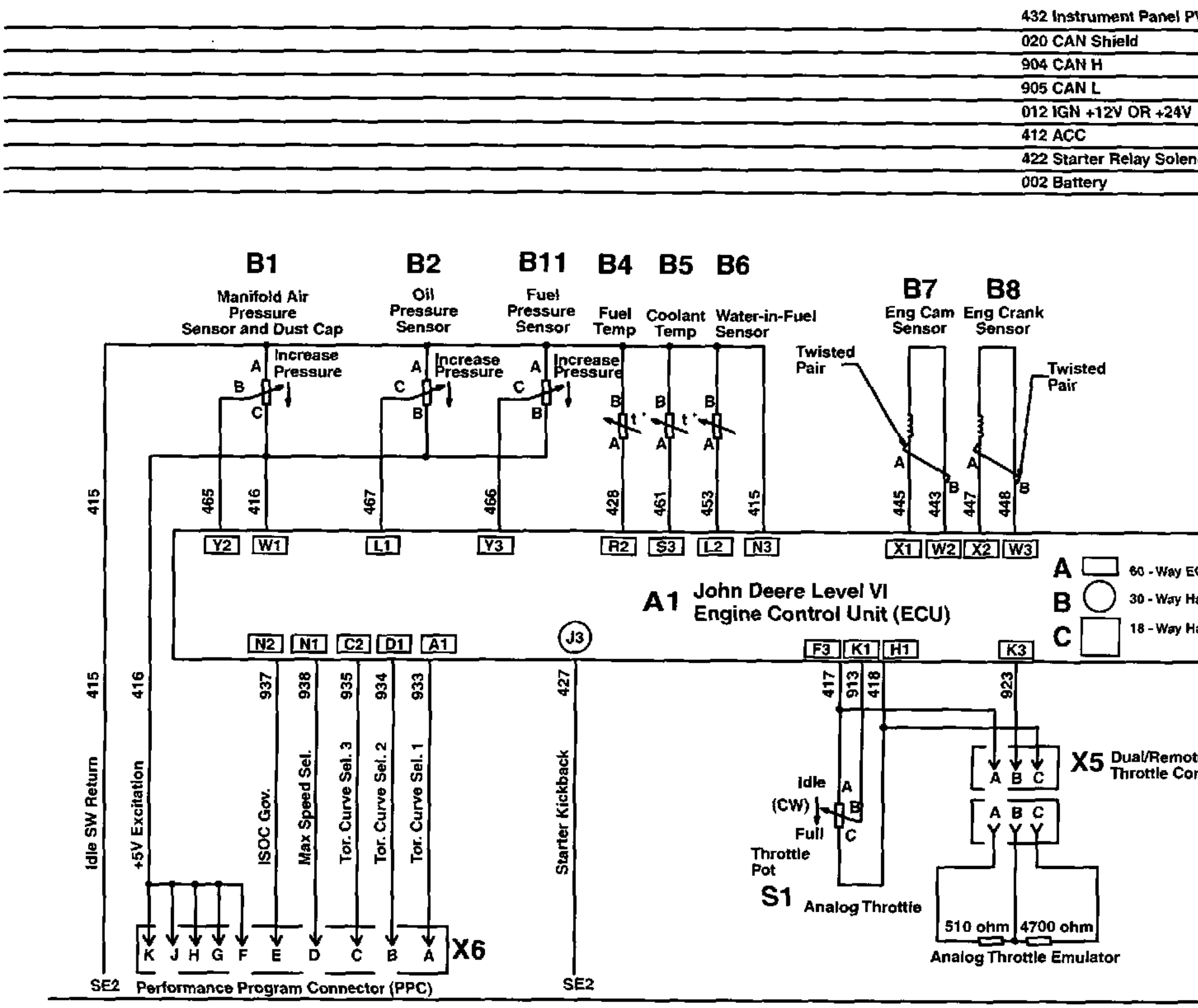
RG10668 –UN–06JAN00



DPSG,RG40854,478 –19–10DEC99–1/2



464 Overide Shutdown Return
020 Can Shield
904 Can H
905 Can L
012 IGN +12V OR +24V
412 ACC
422 Starter Relay Solenoid
002 BAT
B1
Manifold Air Pressure Sensor and Dust Cap
B2
Oil Pressure Sensor Clean Side
B3
Fuel Pressure Sensor
B4
Fuel Temp
B5
Coolant Temp
B6
Water in-Fuel Sensor
B7
Manifold Air Temp Sensor
B8
Eng Cam Sensor
B9
Eng Crank Sensor
B10
Loss of Cool Switch
Increase Pressure
A1
John Deere Level VI Engine Control Unit
High\Low Idle Return
+5V Excitation
ISOC GOV
Max Speed Select
Torque Curve Select 2
Torque Curve Select 1
012 IGN
Cruise On
PWM Throttle\Cancel Resume
Remote Cruise
Cruise Brake
Set Acceleration
Resume Coast
050 Ground
Overide Shut Down
High\Low Idle
Bump DN
Bump Up
Bump Enable
Instrument Panel Connector
Idle
(CW)
Full
Throttle Pot
Analog Thottle
S1
Instrument Panel Connector
SE2
Performance Program Connector (PPC)
X15
X21
SE3-Electroni



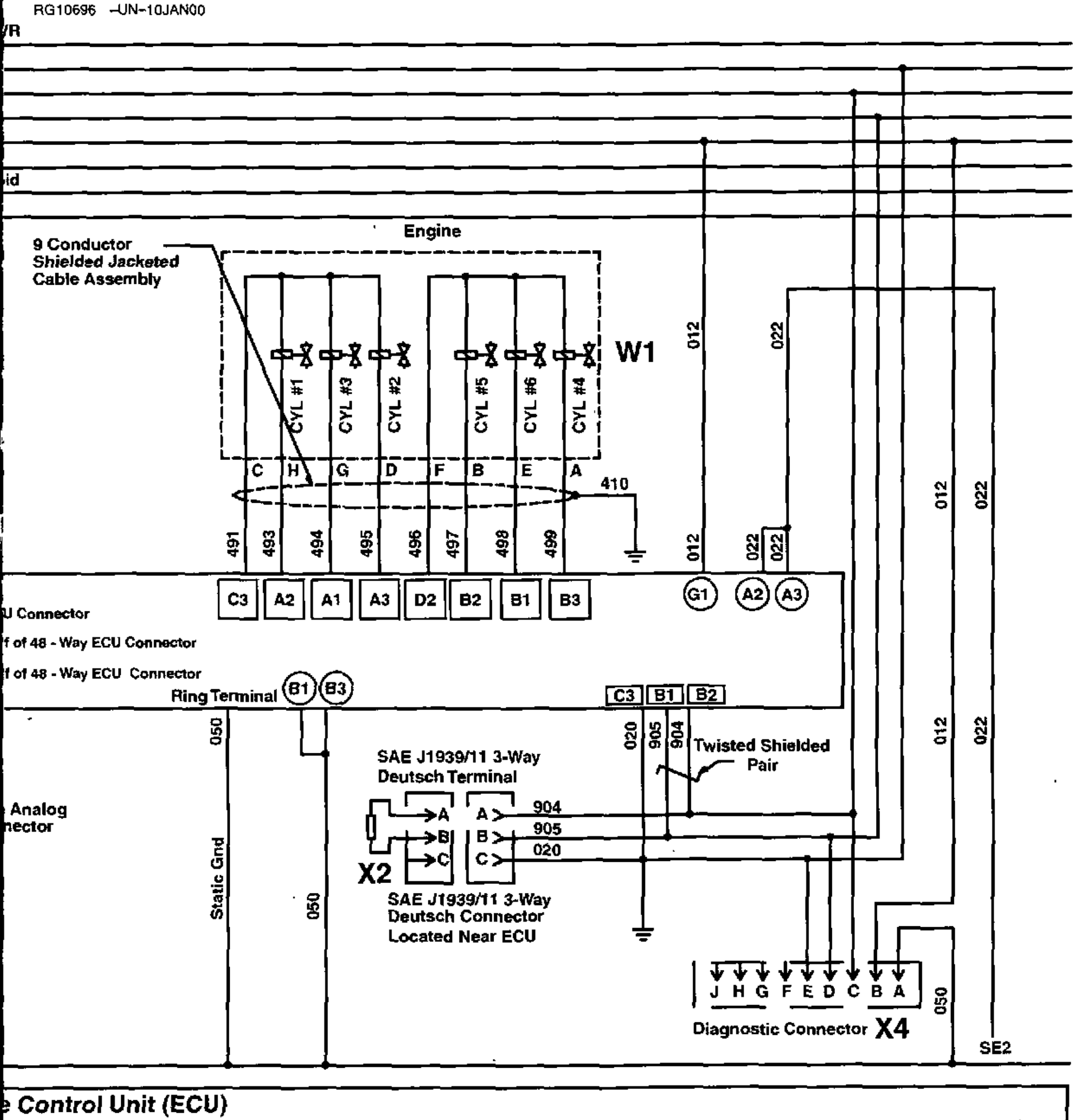
SE4-Electronic Engin

A—60-way ECU Connector
B—30-way half of 48-way ECU connector
C—18-way half of 48-way ECU connector
A1—John Deere Level 6 Engine Control Unit (ECU)
B1—Manifold Air Pressure Sensor
B2—Oil Pressure Sensor
B3—Fuel Pressure Sensor
B4—Fuel Temperature Sensor
B5—Engine Coolant Temperature Sensor
B6—Water in Fuel Sensor
B7—Manifold Air Temperature Sensor
B8—Engine Cam Sensor
B9—Engine Crank Sensor
B10—Loss of Coolant Switch
B11—Air Vacuum Switch
B12—External Derate Switch
B13—External Shutdown Switch
E1—Stop Lamp
E2—Warning Lamp
S1—Analog Throttle (A)
W1—Electronic Unit Injectors (6)
X5—Analog Throttle (B)
X15—Program Performance Connector
X18—CAN Terminator
X20—Diagnostic Connector
X21—Cruise Control Connector

DPSG,RG40854,478 –19–10DEC99–2/2

6105 and 6125 Marine Electronic Control System Wiring Diagram

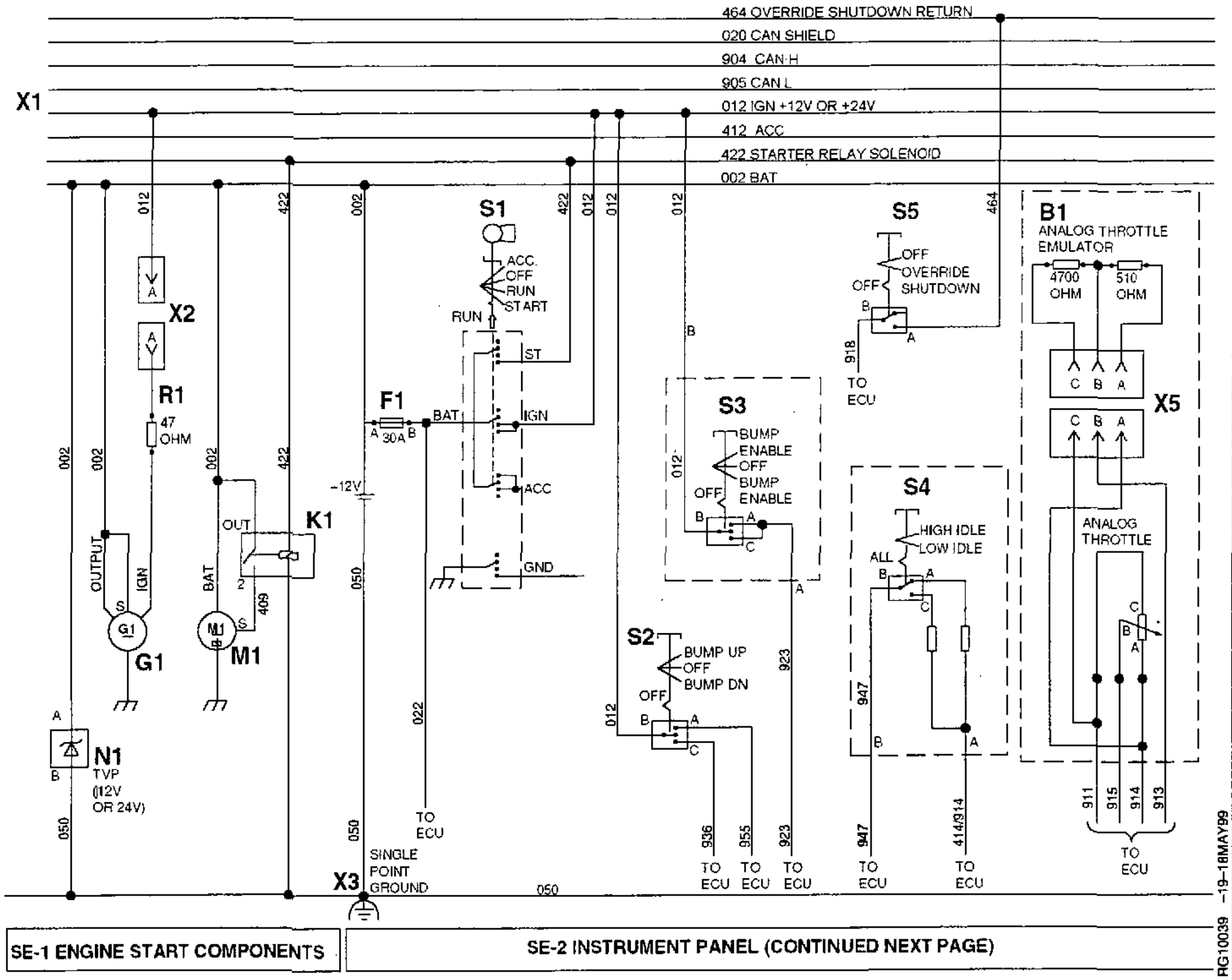
RG10696 –UN–10JAN00



A—60-way ECU Connector
B—30-way half of 48-way ECU connector
C—18-way half of 48-way ECU connector
A1—John Deere Level 6 Control Unit (ECU)
B1—Manifold Air Pressure Sensor
B2—Oil Pressure Sensor
B4—Fuel Temperature Sensor
B5—Engine Coolant Sensor
B6—Water in Fuel Sensor
B7—Engine Cam Sensor
B8—Engine Crank Sensor
B10—Fuel Vacuum Switch
B11—Fuel Pressure Sensor
S1—Analog Throttle (A)
W1—Electronic Unit Injectors (6)
X2—CAN Terminator
X4—Diagnostic Connector
X5—Analog Throttle (B)
X6—Performance Program Connector

DPSG,RG40854,485 –19–04JAN00–1/1

6105 and 6125 OEM Application Instrument Panel/Engine Start Components Electrical Wiring Diagram



B1—Analog Throttle or Emulator
E1—Back Light Regulator (24V) or Plug (12V)
F1—Fuse (30 Amp)
F2—Fuse (5 amp)
G1—Alternator
K1—Starter Relay
M1—Starter Motor
N1—Transient Voltage Protector

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

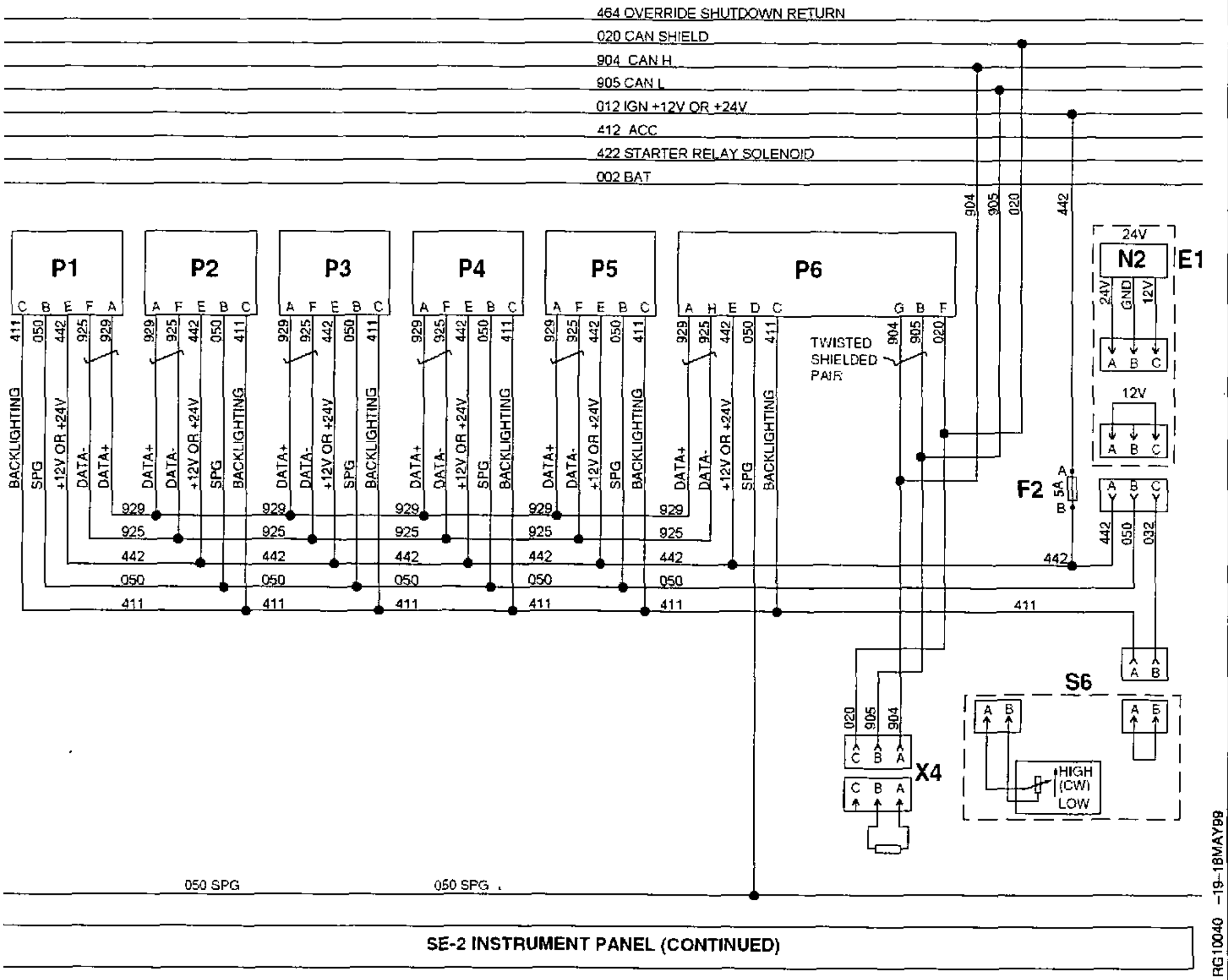
R1—Resistor
S1—Ignition Key Switch
S2—Speed Select Switch (Momentary)
S3—Bump Enable Switch (Momentary)
S4—High-Low Speed Switch
S5—Override Shutdown Switch (Momentary)
S6—Dimmer Control or Jumper Plug

X1—Vehicle Harness Connector
X2—Alternator Harness Connector
X3—Single Point Ground
X4—CAN Terminator
X5—Analog Throttle Connector

Continued on next page

DPSG,RG40854,479 —19—10DEC99—1/1

6105 and 6125 OEM Application Instrument Panel/Engine Start Components Electrical Wiring Diagram - Continued



B1—Analog Throttle or Emulator
E1—Back Light Regulator (24V) or Plug (12V)
F1—Fuse (30 Amp)
F2—Fuse (5 amp)
G1—Alternator
K1—Starter Relay
M1—Starter Motor
N1—Transient Voltage Protector
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
R1—Resistor
S1—Ignition Key Switch
S2—Speed Select Switch (Momentary)
S3—Bump Enable Switch (Momentary)
S4—High-Low Speed Switch
S5—Override Shutdown Switch (Momentary)
S6—Dimmer Control or Jumper Plug
X1—Vehicle Harness Connector
X2—Alternator Harness Connector
X3—Single Point Ground
X4—CAN Terminator
X5—Analog Throttle Connector

Continued on next page

DPSG,RG40854,480 -19-10DEC99-1/1

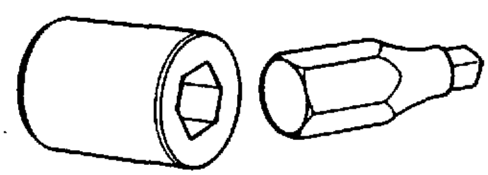
Group 105
Engine Diagnostics and Testing Procedure Tools

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or in the European Microfiche Tool Catalog (MTC) unless otherwise noted.

RG,RG34710,1605 –19–30SEP97–1/6

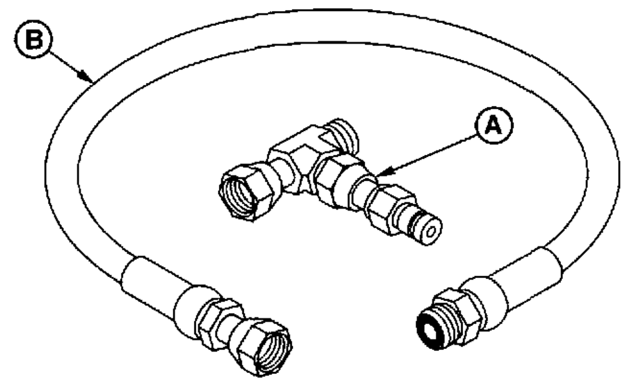
Oil Galley Plug Tool JDG782

Used to remove and install oil galley plug.



JDG782

RG,RG34710,1605 –19–30SEP97–2/6



JT03513

A—Fuel Pressure Test Fitting (JT03509)
B—Fuel Air Detection Line (JT03513-1)

Fuel Supply System Test Kit JT03513

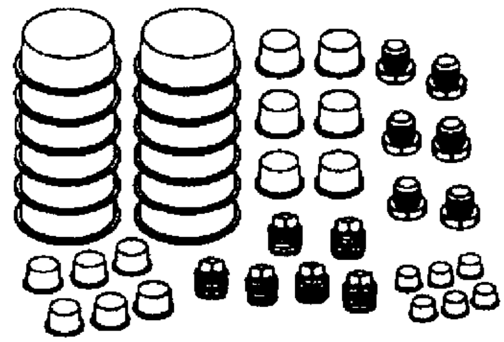
Fuel Pressure Test Fitting is used with JT05472 Universal Pressure Test Kit to measure fuel transfer pump pressure. Fuel Air Detection Line is used to determine if air is present in fuel system. JT03509 and JT03513-1 are included in this kit.

Continued on next page

RG,RG34710,1605 –19–30SEP97–3/6

Fuel System Cap Plug Kit JDG998

Used to protect the fuel system from dirt and debris when disconnecting fuel system components during fuel transfer pump pressure check.



RG8518 –UN–20MAY98

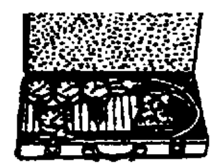
JDG998

RG,RG34710,1605 –19–30SEP97–4/6

RG5162 –UN–23AUG88

Universal Pressure Test Kit JT05412

Used for testing engine oil pressure, intake manifold pressure (turbo boost), and fuel transfer pump pressure.

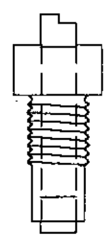


JT05412

RG,RG34710,1605 –19–30SEP97–5/6

Depth Checking Tool JDG1334

Used to check depth of crankshaft position sensor in timing gear cover.



RG10381 –UN–21OCT99

JDG1334

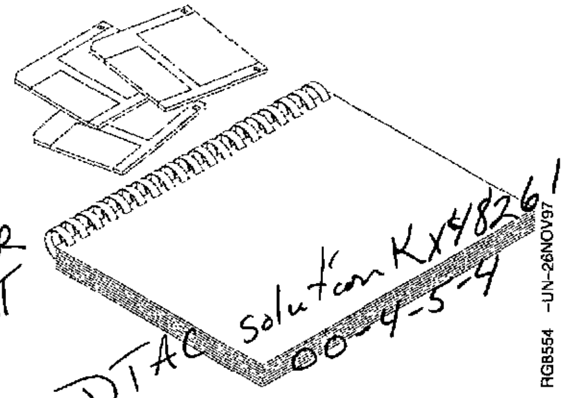
RG,RG34710,1605 –19–30SEP97–6/6

Group 115
Electronic Control System Diagnostic Tools

10.5/12.5 ECU Communication Software Kit JDIS122

Used with JDIS121 - 10.5/12.5 ECU Communication Hardware Kit. Together, the kits enable a Windows ('95 or '98) or NT compatible computer to read information from the Engine Control Unit (ECU). The computer must be at least a 486/66 with 8 MB of RAM and an IEEE 1284 compliant parallel port.

SeRvice AdvisoR
SeRvice ExpeRT
DST



JDIS122

RG,RG34710,111 -19-30SEP97-1/8

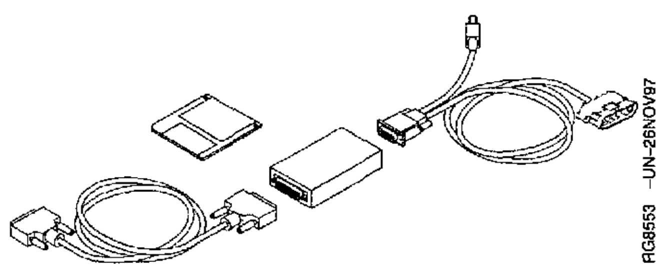
NOTE: *Available from John Deere Distribution Service Center (DSC).* **United States and Canadian Agricultural dealers DO NOT ORDER without first contacting your Branch or TAM.**

MPSD

RG,RG34710,111 -19-30SEP97-2/8

10.5/12.5 ECU Communication Hardware Kit . . . JDIS121

Used with JDIS122 - 10.5/12.5 ECU Communication Software Kit. Together, the kits enable a Windows ('95 or '98) or NT compatible computer to read information from the Engine Control Unit (ECU). The computer must be at least a 486/66 with 8 MB of RAM and an IEEE 1284 compliant parallel port.



JDIS121

RG,RG34710,111 -19-30SEP97-3/8

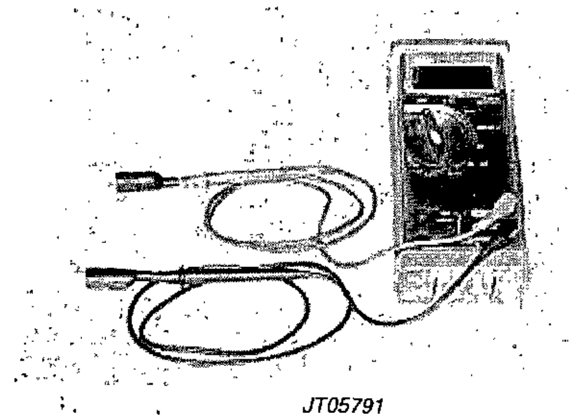
NOTE: *Available from John Deere Distribution Service Center (DSC).* **United States and Canadian Agricultural dealers DO NOT ORDER without first contacting your Branch or TAM.**

Continued on next page

RG,RG34710,111 -19-30SEP97-4/8

Digital Multimeter JT05791

Test electrical components for voltage, resistance, or current flow. It is especially good for measuring low voltage or high resistance circuits.



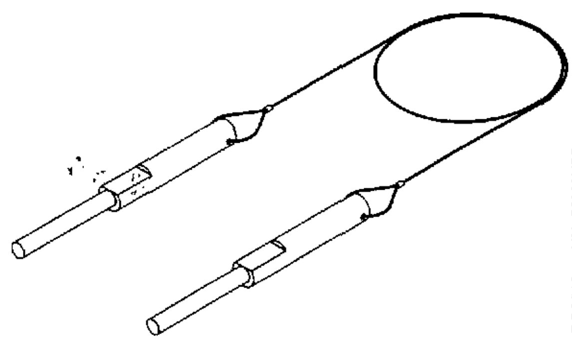
JT05791

RW11274 –UN–12DEC88

RG,RG34710,111 –19–30SEP97–5/8

Cam/Crankshaft Timing Lock Pins (2) JDG971

Used to verify cam/crank gear train is correctly timed. Use with JDG820.



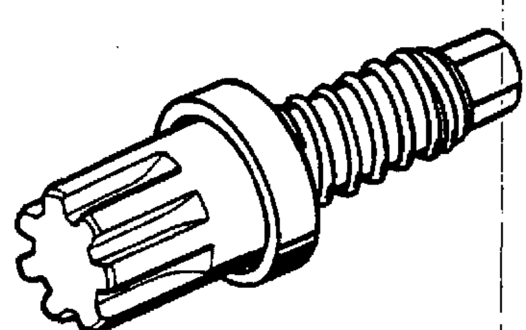
JDG971

RG8519 –UN–20MAY98

RG,RG34710,111 –19–30SEP97–6/8

Flywheel Turning Tool JDG820

Used to rotate flywheel on engine, with 129-tooth flywheel ring gear and a 29.9 mm (1.18 in.) I.D. flywheel housing guide bore diameter, to verify cam/crank gear train is correctly timed. JDE81-1 may be used also if JDG820 is not available. Use with JDG971 Timing Pins.



RG7056

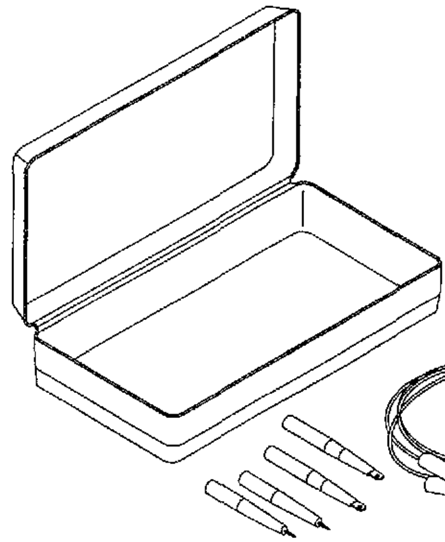
JDG820

RG7056 –UN–05DEC97

Continued on next page RG,RG34710,111 –19–30SEP97–7/8

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

RG,RG34710,111 -19-30SEP97-8/8

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Company Name ______________________ Address ______________________
City ______________________ State or Province & Postal Code ______________________
Sales Branch or Division ______________________

MANUAL OR CATALOG (error or suggestion)

Machine Name & Model Number ______________________ ☐ Microfiche
Manual Number (and issue date) ______________________ ☐ EPC (CD-ROM)
Parts Catalog Number (and date) ______________________ ☐ Printed Book
Description of error or suggestion: ______________________

SERVICE PRICING GUIDE OR FLAT RATE MANUAL

Machine Name & Model Number ______________________
SPG or FRM Number (and issue date) ______________________
Description of new job: ______________________

Restudy Existing Job: Job No. __________ Time Listed in Manual __________ Our Time __________
Reason: ______________________

REPORTCARD (Oct 94)

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