Electronic Fuel Injection Systems

COMPONENT TECHNICAL MANUAL

Electronic Fuel Injection Systems

CTM68 28NOV01 (ENGLISH)

John Deere Power Systems
LITHO IN U.S.A.

Introduction

Foreword

This manual is written for an experienced technician. Essential tools required in performing certain service work are identified in this manual and are recommended for use. Information is organized in groups for the various components requiring service instruction.

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

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

Use this component technical manual in conjunction with the machine technical manual. See the machine technical manual for information on component removal and installation, and gaining access to the components.

This component technical manual (CTM) contains the latest procedures necessary to diagnose electronic fuel injection problems along with recommended adjustments and repairs. Some machines may have vehicle specific diagnostics that may be different from what is covered in this CTM, refer to the specific machine Operation and Test manual for this diagnostic information

Component Technical Manuals are concise service guides for specific components. Component technical manuals are written as stand-alone manuals covering multiple machine applications.

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.

RG,CTM68,IFC –19–03MAR94–1/1

John Deere Dealers

IMPORTANT: Please copy this page and route through your service department.

This CTM is one of three component technical manuals that makeup the complete revision of CTM11, Engine Accessories.

The three component technical manuals that replace CTM11 are:

- CTM67—This manual covers the 300, 400, 500 and 700 Series OEM engine accessories
- CTM68—This manual covers the electronically controlled fuel injection systems
- CTM77—This manual covers alternators and starting motors

Information that pertains to both Robert Bosch and Nippondenso electronic fuel injection systems is covered in the following groups:

- Group 00—Safety
- Group 02—General Information
- Group 05—Fuel Injection System Components
- Group 10—Basic System and Diagnostic Features

Information which is unique to each system is covered in Groups 15—45. For example, Group 15 contains information on Robert Bosch Fuel System Connectors. Group 20 contains the same type of information for Nippondenso connectors.

All connectors which were previously named 'J' connectors are now referred to as 'X' connectors. For instance, J1—Engine Controller Connector is now called X1—Engine Controller Connector.

RG,CTM68,DLR –19–04MAR94–1/1

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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.

Electronic Fuel Injection Systems

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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

DX,FLAME –19–04JUN90–1/1

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

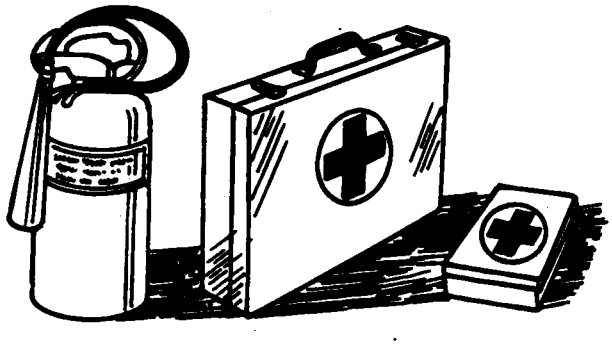
DX,SPARKS –19–03MAR93–1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 –UN–23AUG88

DX,FIRE2 –19–03MAR93–1/1

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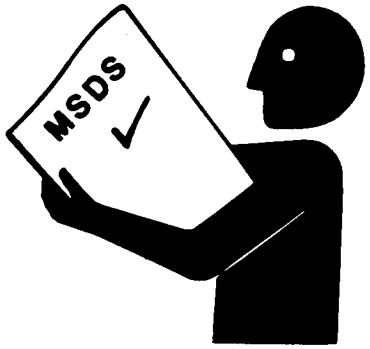
Handle Chemical Products Safely



TS1132 –UN–26NOV90

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

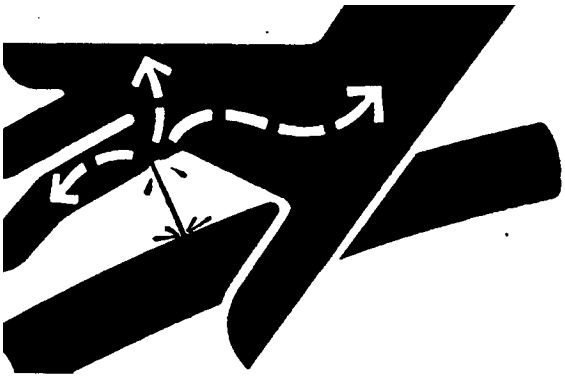
A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

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

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

DX,MSDS,NA –19–03MAR93–1/1

Avoid High-Pressure Fluids



X9811 –UN–23AUG88

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

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

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

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

DX,FLUID –19–03MAR93–1/1

Prevent Machine Runaway

Avoid possible injury or death from machinery runaway.

Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.

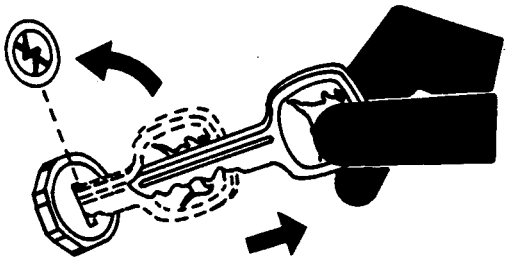
TS177 –UN–11JAN89

DX,BYPAS1 –19–03MAR93–1/1

Park Machine Safely

Before working on the machine:

- Lower all equipment to the ground.
- Stop the engine and remove the key.
- Disconnect the battery ground strap.
- Hang a "DO NOT OPERATE" tag in operator station.



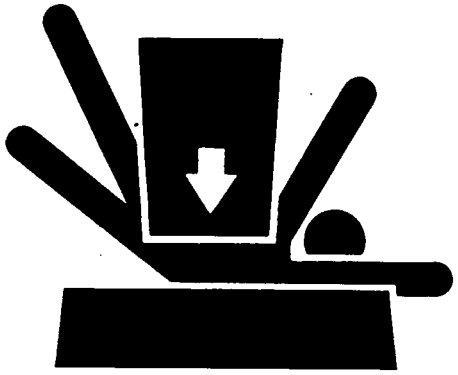
TS230 –UN–24MAY89

DX,PARK –19–04JUN90–1/1

Support Machine Properly

Always lower the attachment or implement to the ground before you work on the machine. If you must work on a lifted machine or attachment, securely support the machine or attachment.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



TS229 –UN–23AUG88

DX,LOWER –19–04JUN90–1/1

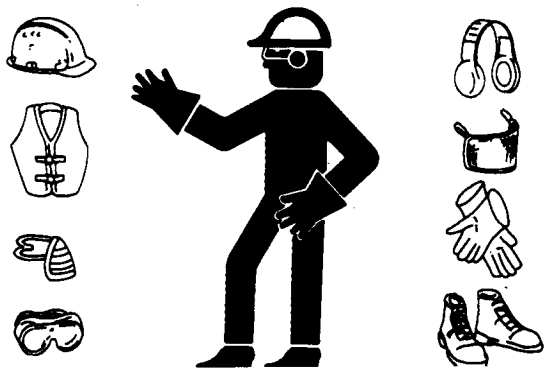
Wear Protective Clothing

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

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

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

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



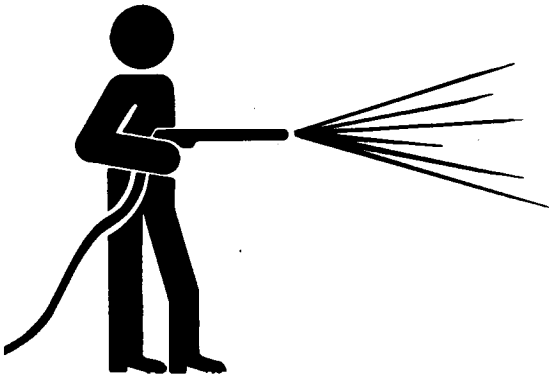
TS206 –UN–23AUG88

DX,WEAR –19–10SEP90–1/1

Work in Clean Area

Before starting a job:

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



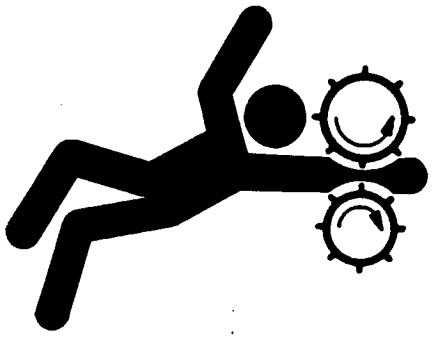
T6642EJ –UN–18OCT88

DX,CLEAN –19–04JUN90–1/1

Service Machines Safely

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

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



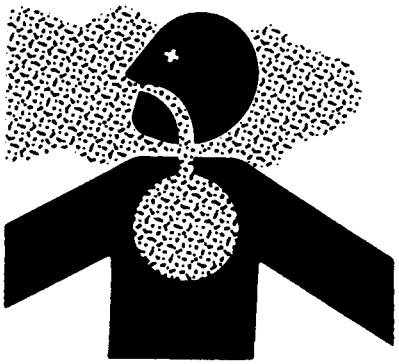
TS228 –UN–23AUG88

DX,LOOSE –19–04JUN90–1/1

Work in Ventilated Area

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

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

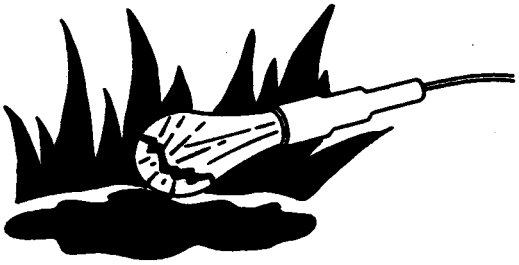


TS220 –UN–23AUG88

DX,AIR –19–04JUN90–1/1

Illuminate Work Area Safely

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

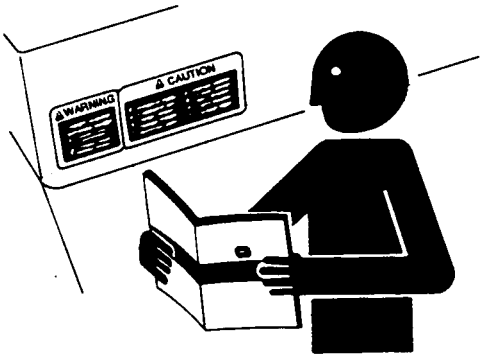


TS223 –UN–23AUG88

DX,LIGHT –19–04JUN90–1/1

Replace Safety Signs

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



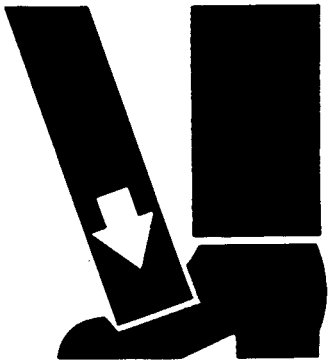
TS201 –UN–23AUG88

DX,SIGNS1 –19–04JUN90–1/1

Use Proper Lifting Equipment

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

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



TS226 –UN–23AUG88

DX,LIFT –19–04JUN90–1/1

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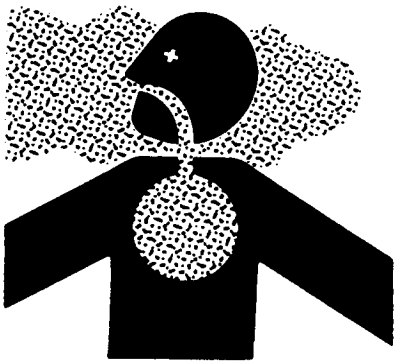
Remove Paint Before Welding or Heating



TS220 –UN–23AUG88

Avoid potentially toxic fumes and dust.

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

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.

DX,PAINT –19–03MAR93–1/1

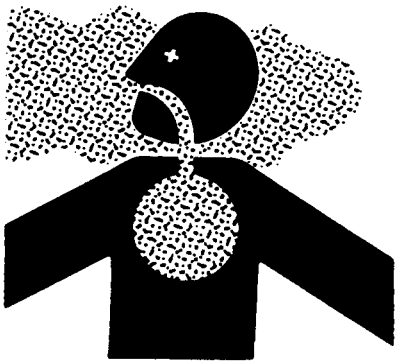
Avoid Heating Near Pressurized Fluid Lines

TS953 –UN–15MAY90

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.

DX,TORCH –19–03MAR93–1/1

Avoid Harmful Asbestos Dust



TS220 –UN–23AUG88

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos.

Keep bystanders away from the area.

DX,DUST –19–15MAR91–1/1

Practice Safe Maintenance

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

TS218 –UN–23AUG88

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.

DX,SERV –19–03MAR93–1/1

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Use Proper Tools

TS779 –UN–08NOV89

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

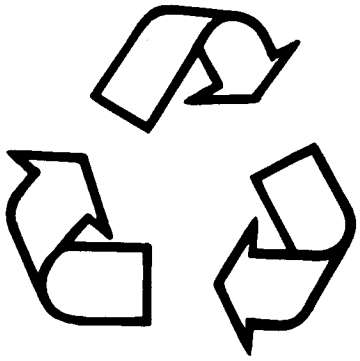
Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.

DX,REPAIR –19–04JUN90–1/1

Dispose of Waste Properly



TS1133 –UN–26NOV90

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

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

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

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

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

DX,DRAIN –19–03MAR93–1/1

Live With Safety

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

TS231 –19–07OCT88

DX,LIVE –19–25SEP92–1/1

About This Manual

This manual is provided for diesel engines using either the Robert Bosch or Nippondenso electronically-controlled fuel injection system.

The information in this manual contains necessary instructions to diagnose the electrical portion of the fuel injection system. Use the information in this manual in conjunction with the engine technical manual and/or machine technical manual.

See the engine technical manual for:

- Removal of engine components
- Disassembly
- Inspection
- Testing
- Assembly

See the machine Operations and Tests technical manual for:

- Theory of operation as it pertains to that machine.
- Diagnostic and testing procedures for that portion of the system which may be unique to that machine. (Such as machine digital code readout devices.)

IMPORTANT: Not under any circumstances, should the Engine Controller be opened.

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

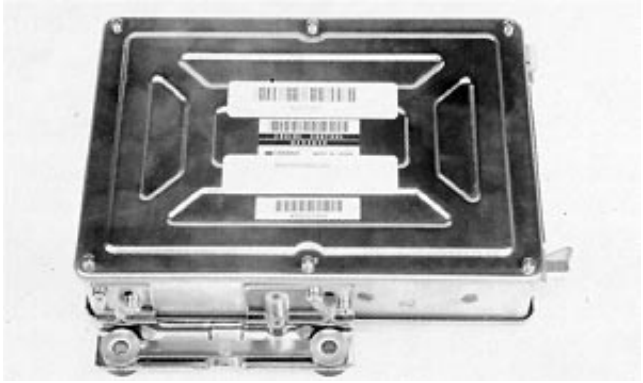
IMPORTANT: If an Engine Controller is not programmed identically with the original (failed) Engine Controller, misleading diagnostic messages, poor performance, or engine damage can occur.

The Engine Controller is not serviced through the John Deere parts system. If Engine Controller is determined to be defective, it is to be replaced as a unit directly from the factory.

S55,2000,MM –19–03MAR94–1/1

Engine Controller Serial Number Plate

Located on the top of the Engine Controller.



RG5414 –UN–09JAN90

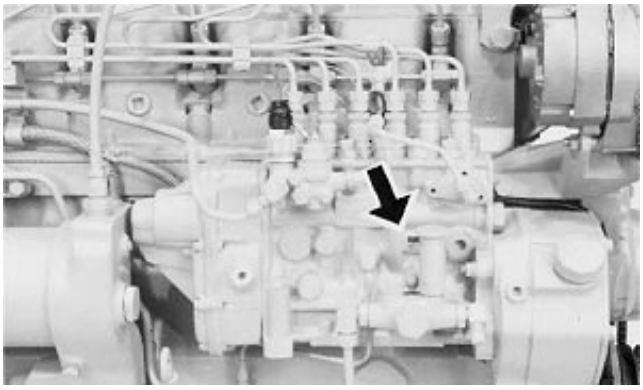
Nippondenso Shown (Bosch is Similar)

S55,2000,B –19–02MAR94–1/1

02
2

Injection Pump Serial Number Plate

Located on the right-hand side of the injection pump.



Robert Bosch Shown (Nippondenso is Similar)

S55,2000,C –19–02MAR94–1/1

Glossary of Terms

Term	Description
ADS	Association of Diesel Specialists. Used throughout the manual to mean authorized repair facilities for injection systems.
A/D Converter	Analog-to-Digital Converter. An integrated circuit within the Engine Controller which converts an analog voltage to an 8-bit binary number (1's and 0's) so the micro-computer can understand it.
Actuator Solenoid	The solenoid in the actuator housing on the back of injection pump which moves the control rack as commanded by the Engine Controller. (See Group 05-Fuel Injection System Components for further description.)
Actuator Control Rack	(See Actuator Solenoid.)
Analog	Signal which has a continuous range of possible voltages. Usually represents a continuously variable physical value such as rack position, fuel temperature or throttle lever position.
Auxiliary Speed Sensor	Engine speed sensor located on engine timing gear cover. Serves as back-up to primary engine speed sensor. (See Group 05-Fuel Injection System Components for further description.)
Diagnostic Code	A number which represents a problem detected by Engine Controller. Diagnostic codes are transmitted for use by on-board displays or a diagnostic reader so the operator or technician is aware there is a problem and in what part of the fuel injection system the problem can be found. (See Group 10-Basic System and Diagnostic Features for details.)
Diagnostic Reader	Any electronic module which is able to read the Diagnostic Codes Output signal, and possibly other diagnostic signals, and display diagnostic information to the operator or technician. (See USE OF A DIAGNOSTIC READER in Group 02 and USING THE ELECTRONIC GOVERNOR TESTER in Group 10 for details.)
Digital	A signal which consists of only two-volt levels -- usually 0 volts and +5 volts. Examples of digital signals are: Diagnostic Codes Output, PWM Throttle Input, Auxiliary Speed Output, and Fuel Flow/Throttle Output. On/Off type signals are also considered to be digital.
ECU	Electronic Control Unit. General term for any electronic controller. (When used in Group 25 and 35-Diagnostic Procedures, ECU refers to the Engine Controller.)
Electronic Governor	The computer program within the Engine Controller which determines the commanded fuel delivery based on throttle command, engine speed and fuel temperature. Replaces the function of a mechanical governor. The entire electronic fuel injection control system is sometimes referred to as the electronic governor.
Electronic Module	Any enclosure containing electric components designed to operate in a specified manner.
Engine Controller	The electronic module which controls fuel delivery, diagnostic outputs, back-up operation and communications with other electronic modules. (See Group 05-Fuel Injection System Components for further description of the Engine Controller and Group 10-Basic System and Diagnostic Features for a description of the operation of the Engine Controller.)
Power-OFF	The act of turning power OFF to the electronic fuel injection system.
Power-ON	The act of turning power ON to the electronic fuel injection system.
Primary Speed Sensor	Engine speed sensor located inside the actuator housing on the back of injection pump. (See Group 05-Fuel Injection System Components for further description.)
PTC Heater	On Nippondenso pumps, the PTC (positive temperature coefficient) heater is used for extreme low temperature environments below -30°C (-22°F). It takes 10 minutes to heat up the governor area at -40°C (-40°F). This heater is offered as an option on Nippondenso pumps.
PWM	Pulse-Width-Modulated. A digital electronic signal (not analog) which consists of a pulse generated at a fixed frequency. The information transmitted by the signal is contained in the width of the pulse. The width of the pulse is changed (modulated) to indicate a corresponding change in the information being transmitted, such as throttle command. (The Fuel Flow/Throttle Output and the PWM Throttle Input described in Group 10-Basic System and Diagnostic Features are examples of pulse-width-modulated signals.)
TVP Module	Transient Voltage Protection Module. A device which protects the Engine Controller electronics against high energy voltage transients such as alternator load dumps. (See Group 05-Fuel Injection System Components for further description.)

S55,OMOE,W –19–03MAR94–1/1

System Power Requirements

- Nominal System Voltage: 12V
- Operating Supply Voltage Range: 9—16V
- Supply Voltage Range During Starting: 6—16V
- Maximum Allowable Supply Voltage: 26.5V up to 5 min. duration below 212°C (100°F)
- Required current (including actuator solenoid and fuel shut-off solenoid): 17A maximum, 7A nominal

S55,2000,DO –19–02MAR94–1/1

Engine Controller Environmental Restrictions

- Operating Temperature Range -40 to +65°C (-40°F to +150°F)
- Storage Temperature Range -50 to +100°C (-58°F to +212°F)
- Operating Vibration Range -30m/sec^2 max. from 0—2500 Hz

S55,2000,CP –19–12SEP94–1/1

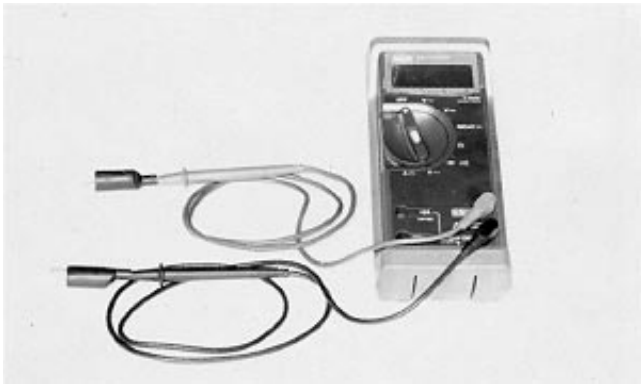
Electrical Concepts

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

S55,2000,E –19–02MAR94–1/1

Using a 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 in Groups 25 and 35.

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.

S55,2000,F –19–02MAR94–2/2

Use of a Diagnostic Reader

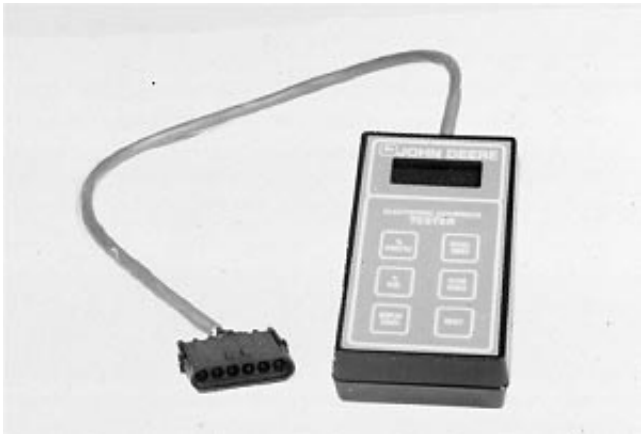
A diagnostic reader is an electronic module which is able to read the diagnostic output signal and display the diagnostic codes to the operator as a number or series of numbers. A reader may also be able to display throttle command and fuel delivery as percentages of full range.

A diagnostic reader may be a digital tachometer which is part of a vehicle's instrumentation package, or it may be a reader like the John Deere Electronic Governor Tester (JT05829).

NOTE: The logic used to display diagnostic codes also varies between applications. Some vehicles may display the codes immediately, and some may just store the codes for recall later. Also, some John Deere vehicles will display the letter 'E' next to the diagnostic code to indicate an engine related message. The JT05829 Diagnostic Reader does not use the 'E'.

If a vehicle's digital tachometer is to be used as a diagnostic reader, check your vehicle operator's manual for the description of tachometer's display features.

The illustration shows the John Deere Electronic Governor Tester (JT05829). For instructions on the use of this reader, see Group 10—Basic System and Diagnostic Features.



RG5351 –UN–09JAN90

S55,2000,O –19–02MAR94–1/1

Major System Components

The electronic fuel injection system consists of the following major components:

- Engine Controller
- Injection Pump/Actuator Assembly which includes
  - Injection Pump
  - Actuator Solenoid
  - Rack Position Sensor
  - Primary Speed Sensor
  - Fuel Shut-off Solenoid
  - Fuel Temperature Sensor
- Auxiliary Speed Sensor
- Transient Voltage Protection Module

These components are described and illustrated in the modules that follow.

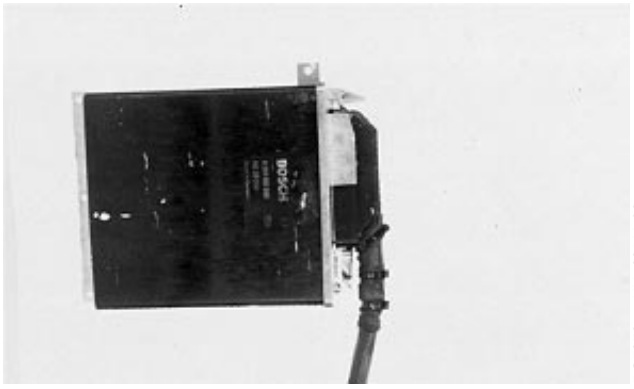
S55,2000,H –19–02MAR94–1/1

Engine Controller

The Engine Controller is a self-contained module with mounting brackets which contains electronic circuitry and a computer program which performs governor and diagnostic functions. The controller is remotely located from the engine in a protected environment and connects to the engine application through the wiring harness.

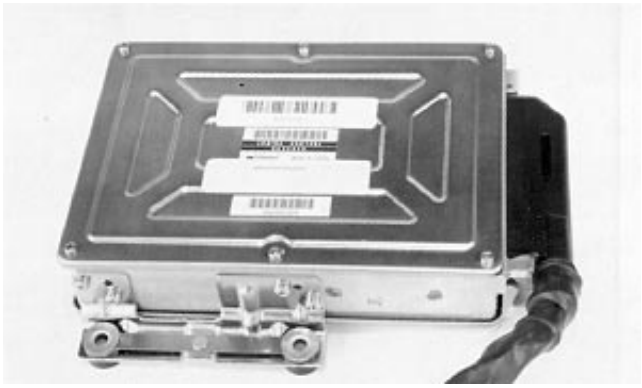
The Engine Controller controls the fuel delivery as a function of engine speed and throttle command. The controller also controls the fuel limiting for torque curves and the governing for speed control. Aneroids are eliminated and for most applications the controller can control fuel delivery to limit smoke without using additional sensors. For more stringent requirements, manifold air density can be monitored by the controller to limit smoke.

The illustration shows a typical controller mounting installation.



RG5350 –UN–09JAN90

Robert Bosch



RG5416 –UN–09JAN90

Nippondenso

S55,2000,K –19–02MAR94–1/1

05
2

Robert Bosch Injection Pump/Actuator Assembly

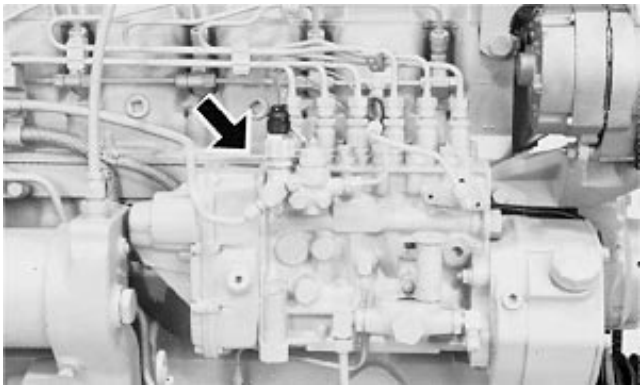
The injection pump/actuator assembly consists of the following:

- Injection Pump
- Actuator Solenoid
- Rack Position Sensor
- Primary Speed Sensor
- Fuel Shut-off Solenoid
- Fuel Temperature Sensor

S55,2000,LA1 –19–02MAR94–1/5

Injection Pump

The electronically controlled in-line injection system uses the same basic hydraulic pumping mechanism used in mechanically governed in-line pumps. The mechanical governor mechanism is replaced with the actuator assembly which includes the Actuator Solenoid to move the control rack, Rack Position Sensor, Primary Speed Sensor, and a toothed speed wheel. The throttle lever mechanism used on mechanical pumps is removed and its function is implemented by a throttle position sensor input to the Engine Controller. Fuel is transferred from vehicle or engine fuel tanks with a fuel supply pump. The injection pump fuel inlet connection is located at the rear of the pump on the fuel inlet assembly, which includes the Fuel Shut-off Solenoid and the Fuel Temperature Sensor.



RG5369 –UN–09JAN90

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S55,2000,LA1 –19–02MAR94–2/5

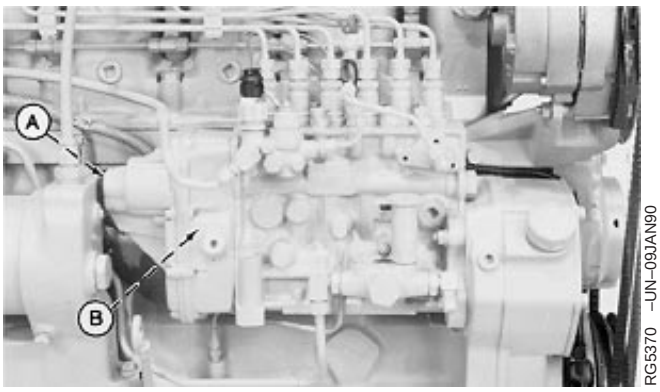
Actuator Solenoid (A)

The control rack is spring loaded to the fuel shut-off position “zero rack”. As increasing current is supplied to the Actuator Solenoid from the controller, the rack is driven toward full rack position. The Engine Controller has the capability to control the current to the solenoid in order to position the solenoid and control rack anywhere between zero rack and full rack.

Rack Position Sensor (B)

The Rack Position Sensor within the actuator housing supplies rack position information to the controller so that a specific rack position can be controlled. The sensor provides a voltage to the controller indicating the position of the rack and is used to control rack position for all operating conditions. If this critical sensor were to fail, the controller would be forced to shut down the engine due to loss of control.

The Rack Position Sensor can only be serviced by an authorized shop because of the recalibration which is required when actuator housing is removed from the pump.



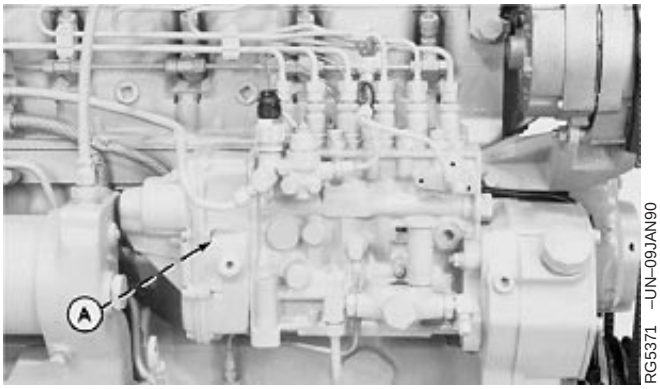
RG5370 –UN–09JAN90

S55,2000,LA1 –19–02MAR94–3/5

Primary Speed Sensor

The Primary Speed Sensor (A) is also located within the actuator housing. It is a magnetic pickup which generates voltage pulses to the controller as the teeth on the speed wheel pass by the tip of the sensor. If this sensor were to fail completely, the controller would use the signal coming from the Auxiliary Speed Sensor to get engine speed information.

Because the Primary Speed Sensor is located inside the actuator housing, it can only be serviced by an authorized repair shop.



RG5371 –UN–09JAN90

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S55,2000,LA1 –19–02MAR94–4/5

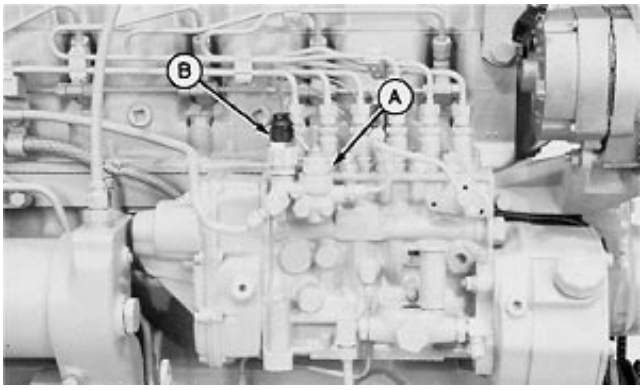
Fuel Shut-Off Solenoid (A)

The Fuel Shut-off Solenoid will shut off fuel to the injection pump when the key switch is turned off or when the Engine Controller detects a rack position error above a preset engine speed.

Fuel Temperature Sensor

The Fuel Temperature Sensor is located at the fuel inlet to the pump. It is used to determine the optimum fuel delivery for starting, and depending on the application, is used to maintain constant power over a predetermined temperature range. If this sensor were to fail, a low temperature would be assumed by the Engine Controller. In warm weather this might result in a slight drop in maximum torque and smokier starts.

The Fuel Temperature Sensor has its own 2-pin connector and is a serviceable parts. (No recalibration is required when this sensor is replaced.)



RG5372 –UN–09JAN90

S55,2000,LA1 –19–02MAR94–5/5

Nippondenso Injection Pump/Actuator Assembly

The injection pump/actuator assembly consists of the following:

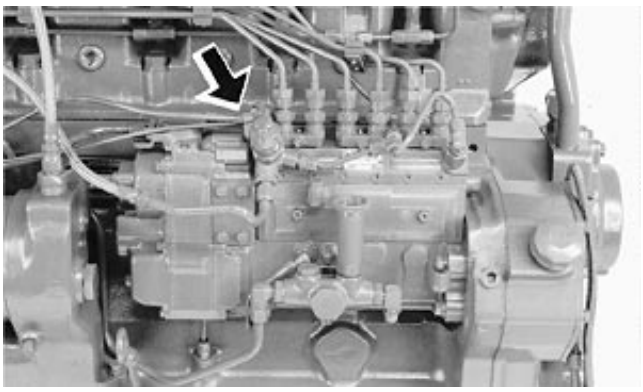
- Injection Pump
- Actuator Solenoid
- Rack Position Sensor
- Primary Speed Sensor
- Fuel Shut-off Solenoid
- Fuel Temperature Sensor

Continued on next page

S55,2000,L –19–02MAR94–1/5

Injection Pump

The electronically controlled in-line injection system uses the same basic hydraulic pumping mechanism used in mechanically governed in-line pumps. The mechanical governor mechanism is replaced with the actuator assembly which includes the Actuator Solenoid to move the control rack, Rack Position Sensor, Primary Speed Sensor, and a toothed speed wheel. The throttle lever mechanism used on mechanical pumps is removed and its function is implemented by a throttle position sensor input to the Engine Controller. Fuel is transferred from vehicle or engine fuel tanks with a fuel supply pump. The injection pump fuel inlet connection is located at the rear of the pump on the fuel inlet assembly, which includes the Fuel Shut-off Solenoid and the Fuel Temperature Sensor.



RG5427 –UN–09JAN90

S55,2000,L –19–02MAR94–2/5

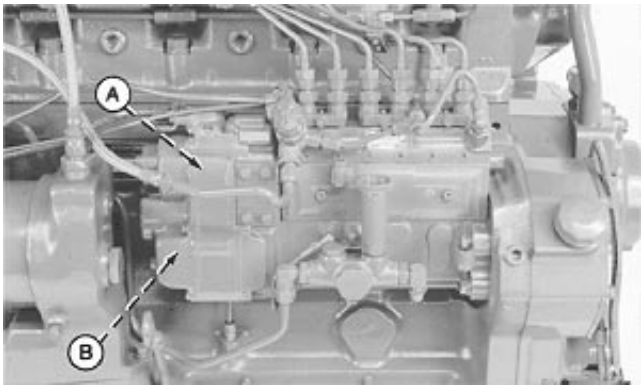
Actuator Solenoid (A)

The control rack is spring loaded to the fuel shut-off position “zero rack”. As increasing current is supplied to the Actuator Solenoid from the controller, the rack is driven toward full rack position. The Engine Controller has the capability to control the current to the solenoid in order to position the solenoid and control rack anywhere between zero rack and full rack.

Rack Position Sensor (B)

The Rack Position Sensor within the actuator housing supplies rack position information to the controller so that a specific rack position can be controlled. The sensor includes an electronic module mounted in the actuator housing which provides a voltage to the controller indicating the position of the rack and is used to control rack position for all operating conditions. If this critical sensor were to fail, the controller would be forced to shut down the engine due to loss of control.

The Rack Position Sensor can only be serviced by an authorized shop because of the recalibration which is required if the actuator housing is removed from the pump.



RG5428 –UN–09JAN90

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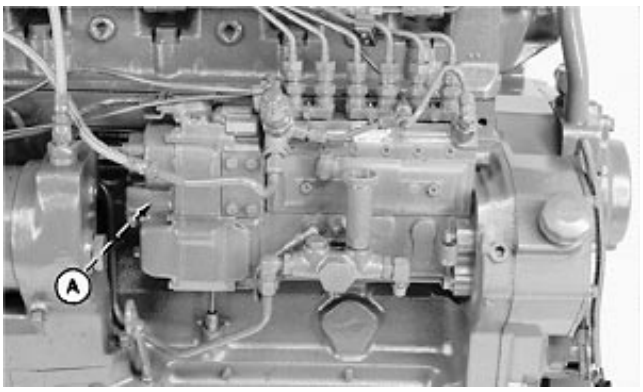
S55,2000,L –19–02MAR94–3/5

Primary Speed Sensor

The Primary Speed Sensor (A) is also located within the actuator housing. It is a magnetic pickup which generates voltage pulses to the controller as the teeth on the speed wheel pass by the tip of the sensor. If this sensor were to fail completely, the controller would use the signal coming from the Auxiliary Speed Sensor to get engine speed information.

Because the Primary Speed Sensor is located inside the actuator housing, it can only be serviced by an authorized repair shop.



RG5429 –UN–09JAN90

S55,2000,L –19–02MAR94–4/5

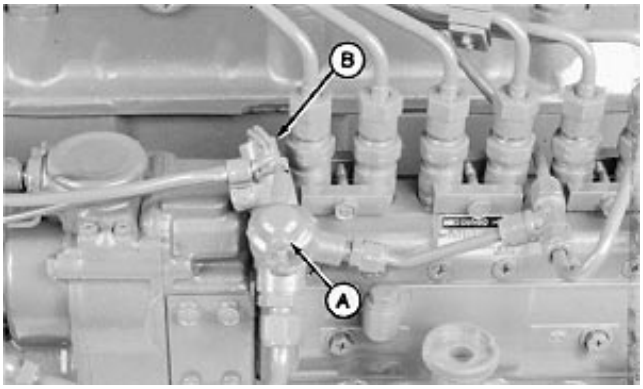
Fuel Shut-Off Solenoid (A)

The Fuel Shut-off Solenoid will shut off fuel to the injection pump when the key switch is turned off or when the Engine Controller detects a rack position error.

Fuel Temperature Sensor (B)

The Fuel Temperature Sensor is located at the fuel inlet to the pump. It is used to determine the optimum fuel delivery for starting, and depending on the application, is used to maintain constant power over a predetermined temperature range. If this sensor were to fail, a low temperature would be assumed by the Engine Controller. In warm weather this might result in a slight drop in maximum torque and smokier starts.

The Fuel Temperature Sensor has its own 2-pin connector and is a serviceable part. (No recalibration is required when this sensor is replaced.)



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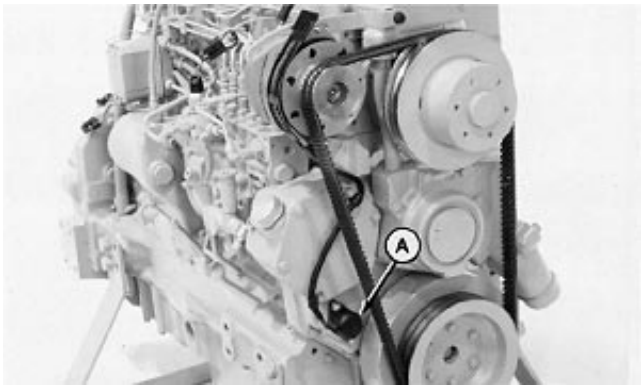
Auxiliary Speed Sensor

This engine speed sensor (magnetic pickup) (A) serves as a back-up speed sensor in the event of complete failure of the Primary Speed Sensor.



RG5373 –UN–09JAN90

Robert Bosch Shown; Nippondenso Similar

S55,2000,AE –19–02MAR94–1/1

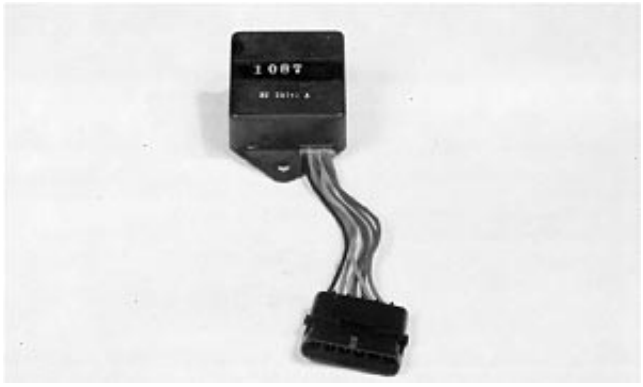
Transient Voltage Protection Module (TVP)

The main function of the Transient Voltage Protection (TVP) Module is to limit high energy voltage transients (from the charging system) to a maximum of 40 volts to protect the electronic circuitry in the Engine Controller.

The TVP module provides a relay, a circuit breaker, and a transient voltage suppressor in an environmentally tested package. The module is normally used with the Engine Controller in applications which would not otherwise provide this type of function (such as OEM engines).

The relay contacts provide battery power to the Engine Controller through the 20 amp circuit breaker. The relay should be energized when the system is in the Run or Start modes.

Refer to the foldout schematic in Group 45—Wiring, which shows the circuitry of the TVP module and how it connects to the rest of the system.



RG5374 –UN–09JAN90

S55,2000,M –19–02MAR94–1/1

How the Electronically-Controlled Fuel Injection System Works

Description

The Engine Controller has capability to diagnose many fault conditions that exist either in the signals which interface with the controller or within the controller itself. If a problem occurs that can be diagnosed, the controller will switch to a safe mode of operation and output an indication of the problem.

The Engine Controller has two outputs which are used to indicate problems. One is a driver for a Fault Lamp, and the other is a signal to a diagnostic code reader. Diagnostic code messages will help isolate the problem and allow quicker repair.

Some fault conditions will not result in an indication from the built-in diagnostic provisions of the Engine Controller. Therefore, diagnostic procedures are given for the two conditions: diagnostic codes present; and diagnostic codes not present.

If the controller indicates a fault condition, it will also store the diagnostic code within its own memory.

Stored codes can be recalled later by using a service tool or an on-board code reader (such as a vehicle tachometer). Other modules in this group will describe code storage and how to recall and display stored codes. To recall and clear stored codes without using the Electronic Governor Tester, refer to USING THE DIAGNOSTIC READER CONNECTOR (X4) in Group 15 (Robert Bosch) or Group 20 (Nippondenso).

On some John Deere equipment with electronic governors, the diagnostic codes can be displayed on the vehicle tachometer. See the vehicle operator's manual for details on using this capability.

All electronic governor systems should have a connector (X4) in place to allow connection of the Electronic Governor Tester (JT05829). This service tools is a diagnostic reader which provides a display of diagnostic codes, a display of throttle commands in terms of percent of full throttle and a display of fuel flow quantity in terms of percent of rated fuel quantity. It can also recall and display stored codes, and it can clear the stored codes.

Operation

Refer to the foldout system schematic in Group 45—Wiring, for the interconnecting wiring between fuel injection system components. The following paragraphs describe the basic operation of the electronically controlled fuel injection system.

1. When the key switch is turned to the "ON" position, the Engine Controller receives power and the fuel shutoff solenoid is powered (opening the valve).

2. When the key switch is turned to the "START" position, the controller powers the Actuator Solenoid moving the rack to starting fuel positions based on fuel temperature and engine speed. This starting mode is triggered either by a controller input which senses the key switch "START" position or by an engine speed greater than 60 rpm. Starting fuel quantity is not affected by throttle position.

3. Once the engine has started, fuel delivery is controlled by the Engine Controller based on various inputs (primarily throttle and engine speed).

4. The Engine Controller controls rack position by adjusting the current level to the Actuator Solenoid until the rack position signal from the injection pump matches the commanded signal. When no fuel is desired, the controller turns off current to the Actuator Solenoid. If a problem occurs where the controller cannot control rack position, the Fuel Shut-off Solenoid is turned off in addition to the Actuator Solenoid being turned off.

Self-Diagnosis and Back Up Features

NOTE: If the operator is able to keep the engine running during a fault condition, no damage to the engine should result. The problem should be fixed at the earliest convenience.

The Engine Controller self-diagnoses as many system faults as is practical. This includes determining if any of the sensor input voltages are too high or too low if the engine speed signals are valid, and if the control rack is responding properly.

The controller also monitors its own operation for problems. In most cases, the controller will output a diagnostic code to indicate the specific problem which has been detected. The controller can also flash a Fault Lamp. See FAULT LAMP OPERATION later in this group.

The controller will automatically switch to another mode of operation as a back-up whenever possible or will shut down the engine if control cannot be guaranteed. In some cases, little or no degradation in performance is noticed. For example, the engine will continue to operate normally using the auxiliary speed sensor in the even of a primary speed sensor failure.

S55,2000,AJ –19–02MAR94–1/1

Fault Lamp Operation

The Fault Lamp gives the diagnostic status of the system. The Fault Lamp is an optional diagnostic provision that should be used in systems which do not have on-board display of diagnostic codes.

A Fault Lamp, if used, must be connected to battery voltage on one side and to the correct Engine Controller pin on the other side. The Fault Lamp output can control a bulb. (similar to type 194). The Fault Lamp has three output conditions. These conditions and their meanings are listed below:

Condition	Meaning
Steady Off	Normal Operation - no problems detected
Flashing once per second	Problem has been detected. JT05829 Diagnostic Tester or vehicle tachometer is required to read and display the codes
Steady On	In Governor Mode the steady on light is present at power-on until the presence of either a Start Signal or starting engine speed. This is a lamp test function. If the lamp remains on even after a start is attempted it is indicating an Engine Controller failure.

IMPORTANT: Applications which do not have digital readouts which read and display diagnostic codes must use the Fault Lamp. The use of at least one of these message displays is required.

S55,2000,AM –19–02MAR94–1/1

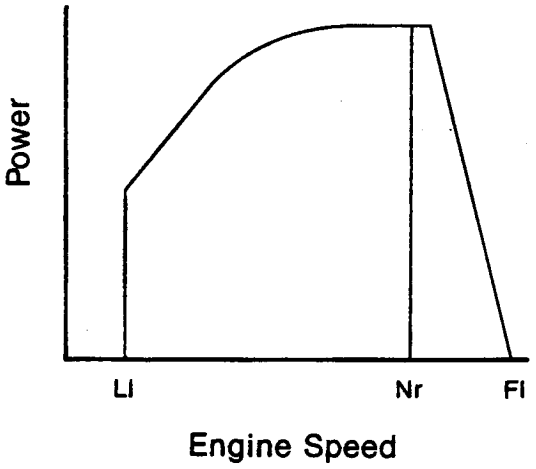
10
4

Governor Modes

The governor mode is selected at the factory. The Engine Controller can provide either all-speed governing or min-max governing. When using all-speed governing, the controller controls the engine speed based on the throttle command and the selected speed regulation (droop). When using the min-max governor, the controller provides the same minimum (slow idle) and maximum (fast idle) speed governing as with the all-speed governor. However, in between the minimum and maximum speeds, the throttle and engine speed inputs are used by the controller to select a fuel quantity. Thus, the throttle commands fuel quantity rather than engine speed in the min-max governor mode.

The percent of droop can be programmed at the factory to provide three switch selectable combinations of droop, rated speed, and fast idle, including zero percent (isochronous). The engine application determines what droops will be programmed into the controller and whether or not they will be switch selectable. If no input signal is present, the normal droop/fast idle combination is selected (refer to the foldout schematic in Group 45—Wiring, for the Speed Regulation Select input). The Engine Controller provides isochronous governing at the slow idle speed regardless of the speed regulation selected for governing over the rest of the operating range.

The slow idle, fast idle, and breakaway speeds are programmed into the Engine Controller at the factory. These values are precisely repeatable and system to system variations are eliminated.



RG5361 –19–15MAR89

LI—Low (slow) Idle
NR—Normal Rated
FI—Fast Idle

S55,2000,AG –19–02MAR94–1/1

Starting Control

The Engine Controller uses engine speed and initial fuel temperature to control rack position during starting. This permits use of excess fuel and retarding for cold temperatures but less fuel and no retard for hot starts. Thus, cold starting is improved and black smoke can be greatly reduced on hot starts.

The throttle input is ignored by the controller until the starting routine is completed. A factory programmed feature allows an increased slow-idle speed for a preset time after a cold start.

S55,2000,AI –19–02MAR94–1/1

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Maximum Fuel Quantity Control

The Engine Controller limits the maximum fuel delivery as a function of engine speed. This function is set at the factory to obtain the proper fuel limit curve (power curve) shape, which is highly repeatable.

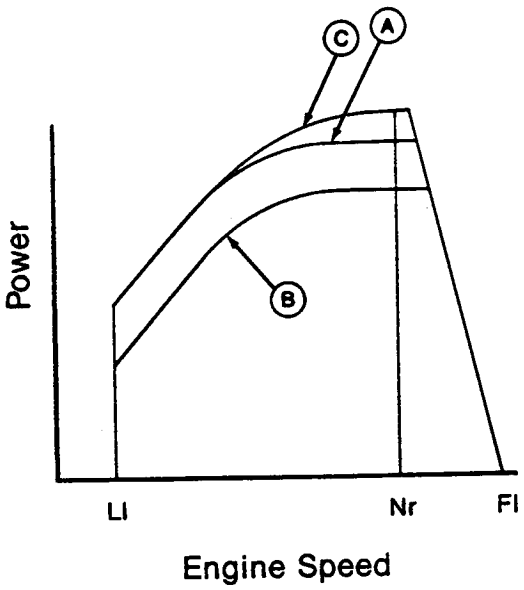
An optional feature allows the power curve to be switched to any one of three factory programmed power curves (refer to the foldout schematic in Group 45—Wiring, for the Fuel Limit Select input). Switching between power curves can be done while the engine is running. The three curves may be identical, thus disabling the input.

The normal power curve (A) is selected if no input signal is present.

A derated power curve (B) is usually selectable by shorting the input signal to ground. A temperature switch is one method used to select the derated power curve.

The third curve (C) is typically used for a “Power Boost” mode since operation using this curve can be limited by timers within the Engine Controller. Power Boost mode is selected by connecting the input to ground through a 2000 ohm resistor (refer to the foldout schematic). If the Power Boost timers are enabled, the controller will limit Power Boost operation to the amount of time in the “ON” timer. If the “ON” time is reached, the controller will automatically switch back to the normal power curve. The “OFF” time must then be reached before the controller will allow selection of the Power Boost mode again. The switch must be switched off and back on to re-select the Power Boost mode.

Use of the optional power curves is dependent on engine application.



RG5360 –19–15MAR89

A—Normal Power Curve
B—Derated Power Curve
C—Power Boost
LI—Low (slow) Idle
NR—Normal Rated
FI—Fast Idle

S55,2000,AF –19–03MAR94–1/1

Smoke Control

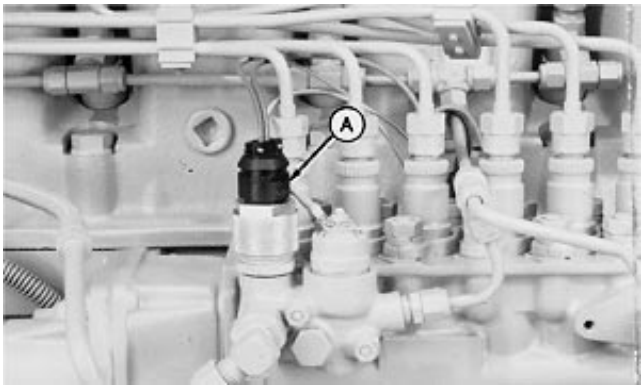
Smoke control is based on mathematical equations which use known engine characteristics. The Engine Controller implements smoke control based on the instantaneous values and the rates of change of throttle, load and speed. This “math model” smoke control is used for most applications since it provides good smoke control without requiring intake manifold sensors.

S55,2000,AH –19–02MAR94–1/1

Fuel Temperature Compensation

The Engine Controller monitors the injection pump inlet fuel temperature with the fuel temperature sensor (A) located at the fuel shutoff valve manifold. The controller can provide nearly constant fuel delivery by compensating for changes in fuel density over any desired temperature range.

The fuel temperature compensation characteristic is dependent on engine application and is programmed at the factory.



RG5375 –UN–09JAN90

S55,2000,DP –19–02MAR94–1/1

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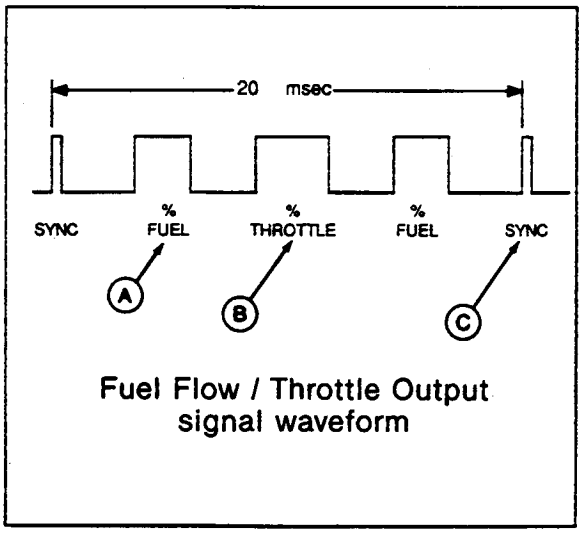
Fuel Flow/Throttle Output Signal

The Engine Controller sends a pulse-width-modulated signal which indicates the percentage of full load/rated speed fuel delivery (A) and percentage of full throttle (B). This signal is primarily intended for use by a transmission controller, but is also useful for monitoring performance if the engine application has compatible electronics.

The illustration shows the waveform of the signal. “Pulse-width-modulated” means that the frequency of the signal remains the same, and the width of the pulse is changed to indicate a change in value. The width of the synchronizing pulse (C) remains constant and indicates the beginning of the signal. The signal is repeated every 20 milliseconds.

The JT05829 Electronic Governor Tester is capable of reading this signal and displaying “percent fuel” and “percent throttle”. It is also capable of reading and displaying diagnostic codes.



Fuel Flow / Throttle Output signal waveform

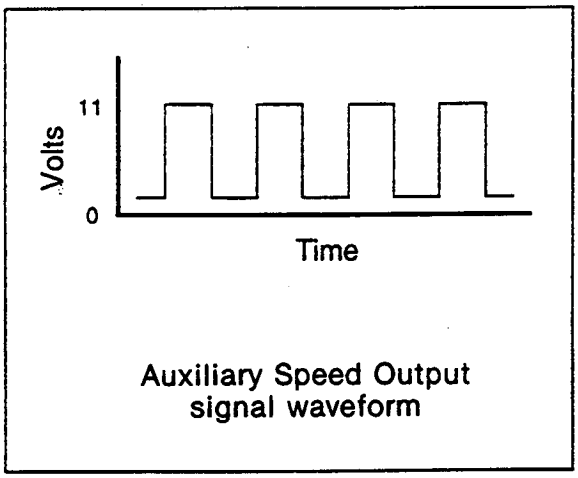
RG5376 –19–15MAR89

S55,2000,DQ –19–02MAR94–1/1

Auxiliary Speed Output Signal

The Engine Controller receives the Auxiliary Speed Input from the sensor and then transmits the Auxiliary Speed Output signal for use by other electronic modules such as tachometers and other controllers. The Engine Controller and only the Engine Controller receives the signal from the auxiliary speed sensor at the front of the engine.

The illustration shows the waveform of the Auxiliary Speed Output signal. The signal is the same frequency as the auxiliary speed sensor.



Auxiliary Speed Output signal waveform

RG5377 –19–15MAR89

S55,2000,AK –19–03MAR94–1/1

Understanding the Throttle Options

There are three throttle options available for use with the electronically controlled fuel injection system. The selection of a throttle option is dependent on the application and is programmed into the Engine Controller at the factory. (Refer to the foldout system schematic in Group 45—Wiring, for the throttle input circuits.) These options are:

- An analog throttle (continuously variable voltage input) which is normally implemented using a potentiometer.
- A 3-state throttle which uses a simple switching arrangement to select one of three fixed engine speeds.
- A Pulse-Width-Modulated (PWM) Throttle which can be used alone or with an analog throttle.

Analog Throttle

The analog throttle is commonly used with either all-speed or min-max governing. The Engine Controller converts the potentiometer voltage signal into a percent of full throttle command and controls engine speed or fuel quantity accordingly.

3-State Throttle

The 3-state throttle is only used with all-speed governing and when a maximum of three fixed speeds are desired. Typical applications are generator sets where one or two fixed speeds are desired, and combines which use two fixed speeds.

Continued on next page

S55,OMOE,J –19–03MAR94–1/2

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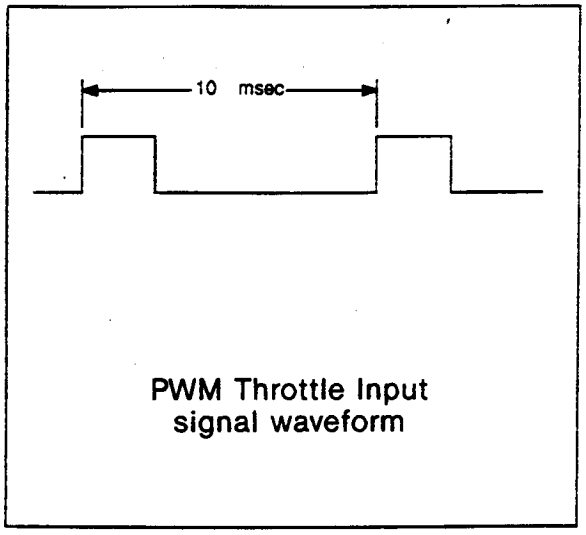
Pulse-Width-Modulated Throttle

The Pulse-Width-Modulated (PWM) Throttle is a signal received from another electronic module (usually a transmission controller) which uses a pulse width to indicate the desired percent of full throttle. The PWM Throttle Input has priority over the analog throttle. This means that if the Engine Controller starts receiving a PWM throttle signal, the controller will stop using the analog throttle and will start using the PWM throttle to determine the throttle command. If the PWM throttle signal is turned off or is disconnected, the Engine Controller will start using the analog throttle again.

The illustration shows the PWM Throttle signal waveform. “Pulse-width-modulated” means that the frequency of the signal remains the same, and the width of the pulse is changed to indicated a change in value. This signal is repeated every 10 milliseconds.



PWM Throttle Input signal waveform

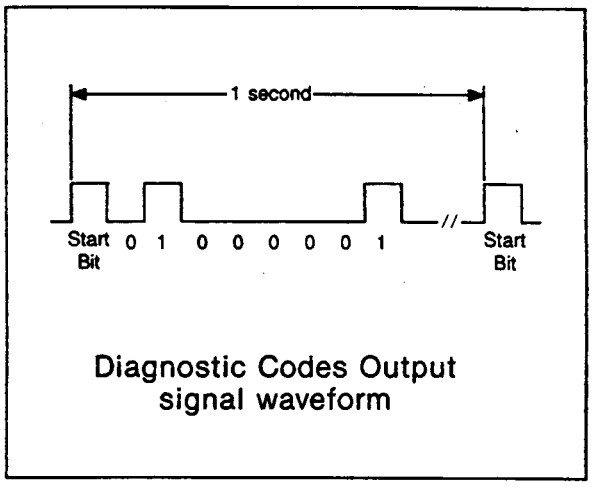
RG5378 –19–15MAR89

S55,OMOE,J –19–03MAR94–2/2

Diagnostic Codes Operation

Normal Operation

When the Engine Controller is in the Governor Mode (which is normal engine operating mode), the Diagnostic Codes Output signal transmits data which can be read by a compatible diagnostic reader, such as the JT05829 Electronic Governor Tester. The signal (see illustration) consists of a stream of high and low pulses which represent code numbers from 0—255, only some of which are valid for each application. Each code represents a specific fault condition which could be caused by one or more problems. Refer to the Listing of Diagnostic Codes later in this group.



Diagnostic Codes Output signal waveform

RG5388 –19–15MAR89

If only one diagnostic condition is present, its code is transmitted once per second, and the reader will display it continuously. If multiple conditions are present, the codes are transmitted one after another, one per second, until all have been transmitted after which the sequence is continuously repeated. The order in which codes are transmitted has no meaning.

A diagnostic code is transmitted as long as the fault condition exists. If an intermittent condition is present, the code may be present, only briefly, and for only a short time.

Stored Codes Operation

IMPORTANT: Record stored codes before disconnecting the battery. Shortly after the battery is disconnected, stored codes will be erased.

The Engine Controller has the capability to save the diagnostic codes that have occurred. The codes are saved even when the ignition is turned off. This feature allows a service person to check to see if a diagnostic code has occurred in the past even through it is not presently occurring. This is helpful for intermittent failure conditions.

Stored code operation is governed by the following rules:

Continued on next page

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During Governor Mode operation, those codes which have been selected for stored code operation and which have occurred on a regular basis at some point in time are stored for recall.

Stored codes are transmitted on the Diagnostic Code Output line when the Transmit Stored Codes Input is shorted to ground. Display of stored codes replaces the normal function of the Diagnostic Code Output line, but the codes are displayed using the same format.

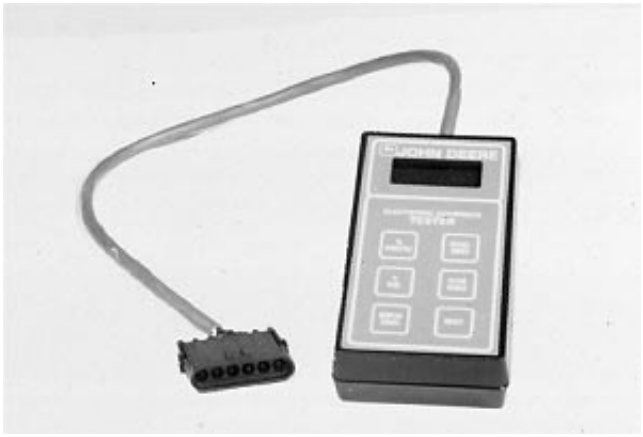
While the Transmit Stored Codes Input is grounded, no new diagnostic codes are stored.

Stored codes can be cleared by shorting the Clear Stored Codes Input to ground while the Transmit Stored Codes Input is also grounded. (These Inputs should be grounded for a minimum of 1 second to clear stored codes.)

When service work has been done which has repaired a problem for which a diagnostic code was stored or which has caused diagnostic codes to be stored, the clearing feature should be used to eliminate these stored codes. The clearing procedure will vary depending on which type of diagnostic tester is being used.

S55,2000,AN –19–02MAR94–2/2

Using the Electronic Governor Tester—JT05829



RG5351 –UN–09JAN90

The Electronic Governor Tester is a diagnostic reader which provides a display of diagnostic codes, throttle position, or commanded fuel quantity. The throttle position is given as a percentage of full throttle. The range of the “percent throttle” display is from 0—100%. The fuel quantity is given as a percentage of rated fuel delivery. The range of the ’percent fuel’ display is from 0—159%.

The Electronic Governor Tester can be used by connecting it to the Diagnostic Reader Connector (X4). Connector X4 can be found by examining the governor system harness and locating a capped 6-way WEATHER PACK™ tower connector. The reader is powered through this connector, so the key switch must be ON to obtain a display. The reader should power up displaying all display segments (8’s) so a visual check of the display can be made by the user. After two seconds in the display check, the reader begins displaying diagnostic codes.

Operating instructions are as follows:

Diagnostic codes are obtained by pressing the DISPLAY CODES switch

Throttle command is obtained by pressing the % THROTTLE switch

Fuel quantity is obtained by pressing the % FUEL switch

Recalling stored diagnostic codes is done be pressing DISPLAY CODES as above and then holding the RECALL CODES switch for as long as display of stored codes is desired. (The RECALL CODES switch must be pressed continuously while stored code display is desired.)

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S55,2000,AX –19–02MAR94–1/4

Clearing stored diagnostic codes is done by simultaneously pressing on both the RECALL CODES and CLEAR CODES switches for at least one second. (Verification that stored codes have been cleared can be accomplished by being in the diagnostic code display mode when clearing is performed. Pressing the RECALL CODES switch first will display stored codes. By continuing to press the RECALL CODES switch and then pressing the CLEAR CODES switch the reader will display a continuous “0” when all codes have been cleared.)

If proper operation is obtained after the reader has been connected with power on, press the RESET switch. The reader should begin operation in the diagnostic code display mode

NOTE: A horizontal bar appears to the left of the displayed value while one of the % THROTTLE, % FUEL, or DISPLAY CODES select switches is pressed to show that the switch has been pressed hard enough to select the desired display mode.

Checking the Analog Throttle with the Electronic Governor Tester

The % Throttle display will indicate the percent of full throttle where 0% = Slow idle and 100% = Fast Idle. This is also true for vehicles with two analog throttles. The displayed percentage is based on commanded engine speed and is not just an indication of the sensor output voltage.

For example, on a vehicle with only one throttle sensor: if the sensor voltage is higher than the normal operating range, the Engine Controller will command Slow Idle and the % Throttle display will read 0% even though the output of the sensor is near +5 volts. As the throttle lever on this vehicle is increased from Slow to Fast Idle, the engine speed will continue to increase as the display approaches 100%. At this point the controller is commanding Fast Idle speed. If the throttle lever is pushed further toward the Fast Idle stop, and the speed drops to Slow Idle and the % Throttle display reads 0, this probably means that the throttle sensor is out of adjustment.

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On vehicles with both hand throttle and foot throttle, if the voltage from either of the throttle sensors goes too high or too low, the Engine Controller will ignore that sensor and immediately start using the other sensor as the only throttle command input.

Another indication that the throttle sensor is out of adjustment would be if the Fast Idle speed is too slow, or if the Slow Idle speed is too fast. If the throttle is at the Slow Idle stop and the % Throttle display reads greater than 0%, the sensor probably needs to be adjusted. Also, if the throttle is at the Fast Idle stop and the % Throttle display reads less than 100%, the sensor probably needs to be adjusted.

A quick check can be made to see if the throttle sensor adjustment is bad.

1. Connect the Electronic Governor Tester to service connector X4, then turn the ignition on without starting the engine.
2. Press the % Throttle switch on the Tester.
3. Move the throttle lever (one at a time if two throttles are installed) to the Slow Idle and then to the Fast Idle positions making sure that the display reads 0 % at Slow Idle and 100% at Fast Idle.

If the display continues to read greater than 0% at the Slow Idle position, or less than 100% at the Fast Idle position, then the throttle adjustment procedure in the machine technical manual should be followed. Also, if the display reads 0% at the Fast Idle position but jumps up to 100% when the throttle is pulled back a little, then the sensor needs to be readjusted.

Refer to Group 30—Robert Bosch Component Repairs and Adjustments or Group 40—Nippondenso Component Repairs and Adjustments for important notes concerning analog throttle adjustments.

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Checking the 3-State Throttle with the Electronic Governor Tester

NOTE: Some machines use the 3-State Throttle Input instead of the Analog Throttle Input. Depending on the application, only one or two speeds may be selected.

For machines using the 3-State Throttle Input, the % Throttle display will indicate percent of full throttle command (based on commanded engine speed) regardless of the actual signal voltage at the Engine Controller input. If Slow Idle speed is selected, the display should read 0%. If Fast Idle speed is selected, the display should read 100%. If a third mid-range speed is selected, the display will read somewhere between 0 and 100% based on the actual programmed value for that speed.

For example, say that Speed 1 is 1000 rpm (Slow Idle) and Speed 2 is 2000 rpm (Fast Idle). If Speed 3 is programmed for 1500, the display should read 50% when Speed 3 is selected. If Speed 3 is programmed for 1600 rpm, the display should read 60% when Speed 3 is selected. If Speed 1 and Speed 3 are both programmed for 1000 rpm, the display should read 0% for both Speed 1 and Speed 3.

As with machines with analog throttles, these checks with the Electronic Governor Tester can be made without the engine running.

Using the % Fuel Display

The % Fuel display indicates percent of full load, rated speed fuel delivery. This display gives an approximation of percent engine torque.

The range of the displayed value is from 0%—159%, where 100% equals rated fuel delivery (or rated torque) regardless of engine speed.

S55,2000,AX –19–02MAR94–4/4

Listing of Diagnostic Codes

Following is a listing of the diagnostic codes that can occur in an electronic governor system. Not all of these codes will be present in all engine applications.

IMPORTANT: If any engine diagnostic codes are stored within the Engine Controller, transmitted by the Engine Controller, or stored within an on-board code reader that are not in the following list, report these codes to the factory for further instruction.

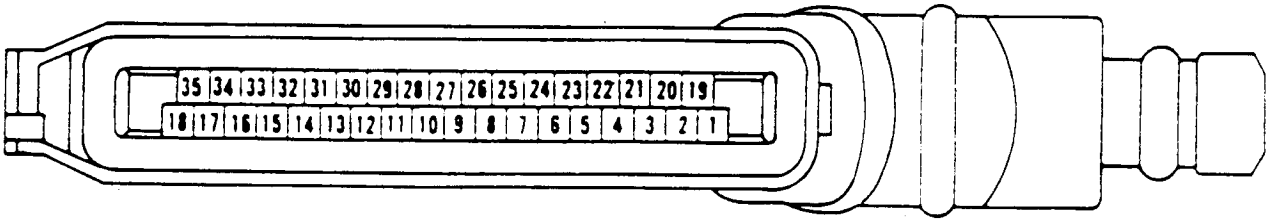
NOTE: When diagnosing the cause for poor engine performance, perform normal checks of the engine as described in the troubleshooting section of the operator's manual before considering the electronic governor system as the source of the problem.

NOTE: Codes 71—74 occur when the Electronic Governor Tester is unable to read the Diagnostic Codes Output signal or the Fuel Flow/Throttle signal from the Engine Controller. These codes are generated by the tester.

Code	Definition
0	No fault condition detected.
11	Analog Throttle Input voltage too high (primary or hand throttle).
12	Analog Throttle Input voltage too low (primary or hand throttle).
13	Analog Throttle Input voltage too high (secondary or foot throttle).
14	Analog Throttle Input voltage too low (secondary or foot throttle).
28	Engine Controller failure
29	Sensor excitation voltage too high or too low
32	Actuator circuit fault (rack position remains at a low value though the controller has been commanding a higher position for more than 3 seconds). X12 connector loose, while starting engine
33	Actuator Solenoid Output shorted high
34	Rack position error (rack voltage commanded by the controller does not match the actual rack voltage measured by the controller). X12 connector loose, engine running.
35	Rack Position Voltage too high.
36	Rack Position Voltage too low.
37	Fuel Temperature Input voltage too high.
38	Fuel Temperature Input voltage too low.
39	Primary Speed Input error
41	Start Signal missing (engine speed has been present without the Start Signal having occurred).
42	Engine overspeed.
43	PWM Throttle Input erratic, too short or too long.
44	Auxiliary Speed Input error.
47	Derated torque curve selected.
51	Electrical noise on Analog Throttle input
54	Electrical noise on Rack Position Voltage input
55	Electrical noise on Fuel Temperature input
56	Electrical noise on Fuel Limit Select input
57	Electrical noise on Speed Regulation Select input
58	Electrical noise on 3-State Throttle input
59	Electrical noise on +5V sensor excitation
71	Diagnostic Codes Output Signal Stuck High
72	Diagnostic Codes Output Signal Stuck Low
73	Full Flow Throttle Output Signal Stuck High
74	Fuel Flow Throttle Output Signal Stuck Low

S55,2000,HJ –19–02MAR94–1/1

Engine Controller Connector (X1)



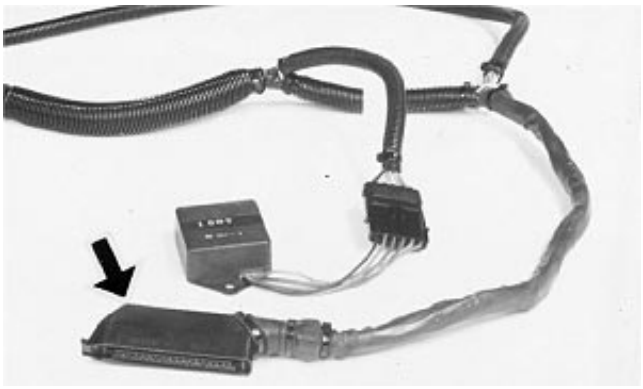
RG5368 –UN–19JAN89

The Engine Controller is connected to the rest of the system through only one connector. The connector is rectangular with 35 pins total; one row of 18 pins and one row of 17 pins. The pin numbers are not labeled on the connector. Therefore, the connector figure must be used during troubleshooting to identify pin numbers.

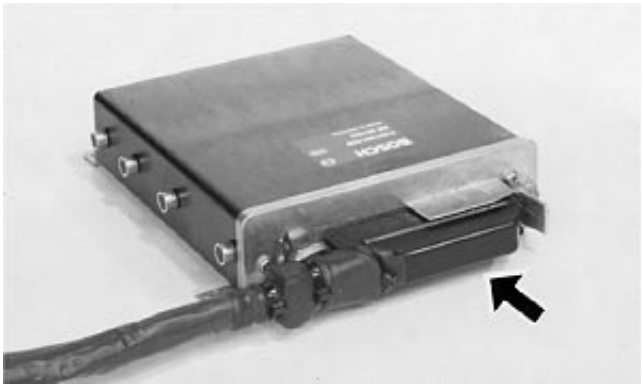
The connector is disconnected by releasing the spring latch beneath the wire exit end of the connector and pivoting the wire end of the connector away from the controller. This will allow the tip of the other end of the connector to be released from under the locking lip of the controller housing. Mating the connector is done by reversing these steps. The tip of the connector is inserted beneath the locking lip of the controller housing. Then the connector is pivoted toward the controller until the spring latch locks the wire end of the connector in place.

IMPORTANT: Care should be used during diagnostic procedures to avoid damaging the pins of the Engine Controller Connector. Probes should not be poked into the pins or damage will result. Probes should only be touched against the pins to make measurements. If damage occurs to the connector pins, refer to Group 30, Robert Bosch Component Repairs and Adjustments.

A listing of each connector pin, the signal on that pin, and a description of the signal is provided on the following pages.



RG5380 –UN–09JAN90



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Pin	Functional Description
1	+ 12 Volt Input—This pin provides power to the Engine Controller and is common with Pin 2.
2	+ 12 Volt Input—See Pin 1.
3	Actuator Solenoid Output—Current-sinking output which drives the solenoid coil of the injection pump rack actuator. Pin 3 is common with Pin 21.
4	Fuel Shut-off Solenoid Output—Current-sourcing output which turns on the fuel shut-off valve. During certain fault conditions this output turns off the fuel shut-off valve to force zero fuel delivery.
5	This pin is common with Pin 35 but is not used for any present application.
6	Rack Position Sensor Common—One of three pins which connect to the rack position sensor. This pin connects to the common connection between the sensing coil and the temperature compensation coil.
7	Fuel Flow/Throttle Output—Output signal which contains fuel flow quantity and throttle position information to be used by other electronic devices in the system. The throttle position valve represents the throttle input value received on Pin 13 whether or not a PWM Throttle Input is present at Pin 27.
8	Rack Position Voltage Output—D.C. output voltage which is proportional to pump rack position. This signal is available as a diagnostic line only. It is not used by the governor system. The relationship is as follows (after the rack voltage is corrected as described later in this group): Rack Voltage (volts) = 0.5 + Rack Position (mm) X 0.2
9	Auxiliary Speed Input—Input which receives an A.C. signal whose frequency is proportional to engine speed. In the event of a primary engine speed sensor failure, the Engine Controller will use this signal to govern the engine.
10	Rack Position Sensor Excitation—One of three pins which connect to the rack position sensor. This pin provides an A.C. output signal which is used as a reference signal for the position sensor.
11	No connection.
12	No connection.
13	Throttle Input—0 to 5 volt D.C. analog input which is used by both the analog and 3-state throttles to input throttle position.
14	Diagnostic Codes Output—Signal which sends diagnostic codes to a service tool or on-board code reader.
15	Fault Lamp Output—Output which drives a fault lamp during failure conditions.
16	This signal must be open circuit (less than 0.5 volts measured) to allow the system to operate normally.
17	Analog Throttle + 5 volt—Supply for the analog throttle sensor. Should always be 4.8—5.2 volts.
18	Clear Stored Codes Input—This input is used to clear the stored diagnostic codes from memory when shorted to ground if Pin 30 is also shorted to ground.
19	Power Ground Input—This pin supplies ground connection to the Engine Controller. It is common with Pins 20 and 35. Only Pins 19 and 20 should be used as high current connections.
20	Power Ground Input—See Pin 19.
21	Actuator Solenoid Output—See Pin 3. Pin 21 is common with Pin 3.
22	Fuel Limit Select Input—3-state input which selects between three optional torque curves. Selection is made by connecting input to ground, by connecting input to ground through a 2000 ohm resistor, or by leaving input open
23	Speed Regulation Select Input—3-state input which selects between three end speed regulation curves. Selection is similar to that of Pin 22.
24	Fuel Temperature Input—Analog input which is connected to a Robert Bosch resistive sensor that is pump mounted. The input has a pull-up resistor (1000 ohms) to +5 volts.
25	3-State Throttle Excitation—Output which supplies +5 volts through a 2000 ohm resistor for 3-state throttle applications. If the 3-State Throttle is used, Pins 25 and 13 are connected together.
26	This signal must be open circuit (+5V measured) to allow the system to operate normally.
27	Pulse-Width-Modulated (PWM) Throttle Input—This input is an optional throttle command which takes precedence over the Throttle Input at Pin 13 (whether analog or 3-state) for governor control when it is present.
28	Optional Analog Throttle +5V—Supply for a second analog throttle (if used). Should always be 4.8—5.2 volts.
29	Rack Position Sensor Signal—One of three pins which connect to the rack position sensor. This pin is the output signal of the sensor.
30	Transmit Stored Codes Input—When shorted to ground, this input causes stored diagnostic codes to be transmitted via the Diagnostic Codes Output (Pin 14) rather than the current diagnostic codes. When this input and Pin 18 are simultaneously selected, the stored diagnostic codes are cleared.
31	Primary Speed Input—This input receives the signal from the Robert Bosch pump-mounted sensor which monitors engine speed. The sensor provides 6 pulses per engine revolution.

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Pin	Functional Description
32	Auxiliary Speed Output—This output provides a buffered output of the Auxiliary Speed Input. It supplies one pulse for each pulse received on the Auxiliary Speed Input. The signal is made available for other devices which require an engine speed signal.
33	Start Signal Input—A high voltage (greater than about 3 volts) on this input causes the Engine Controller to enter the start sequence if other conditions allow.
34	Optional Analog Throttle Input—This signal is a 0—5 volt D.C. analog input for use if the engine application is equipped with a second analog throttle.
35	Sensor Common—This pin is used to provide a reference voltage for analog sensors (engine speed, fuel temperature, throttle sensors, and 3-state inputs) and for analog voltage measurements.

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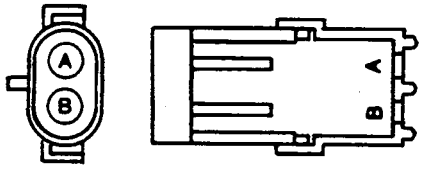
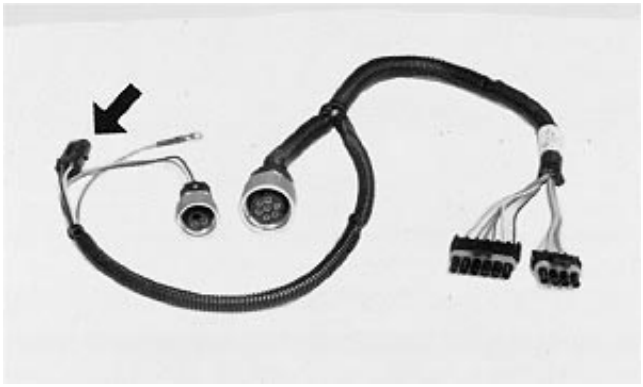
Auxiliary Speed/Sensor Connector (X2)

This harness connector is a 2-way WEATHER PACK™ shroud connector. The pin description is given below.

Pin	Function
A	Signal
B	Sensor Common



RG5381 –UN–14DEC88



RG5383 –UN–09JAN90

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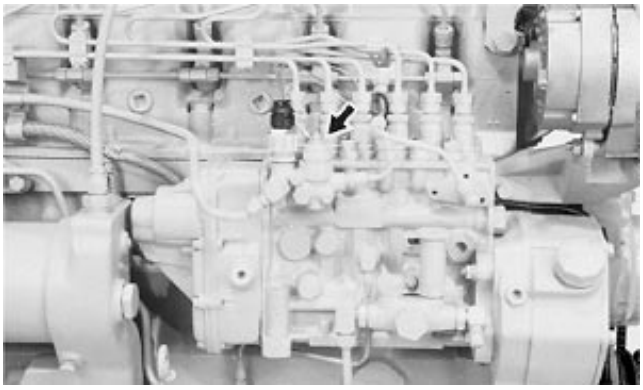
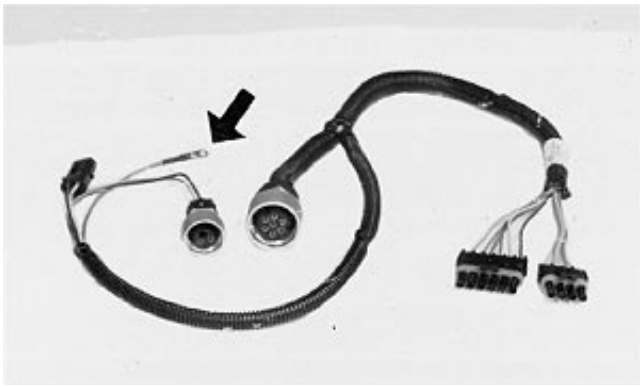
S55,2000,W –19–02MAR94–1/1

Fuel Shut-Off Solenoid Connector (X11)

Made with a 5 mm (0.20 in.) eyelet on the threaded stud of the solenoid. The solenoid is internally grounded to the fuel inlet assembly housing.



RG5382 –UN–09JAN90



RG5392 –UN–09JAN90

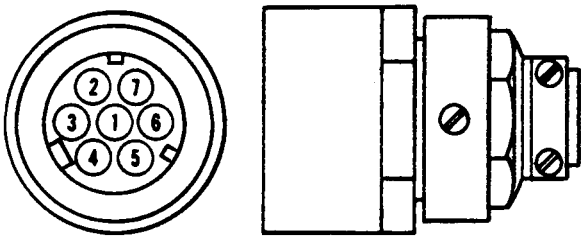
S55,2000,X –19–02MAR94–1/1

Actuator Connector (X12)

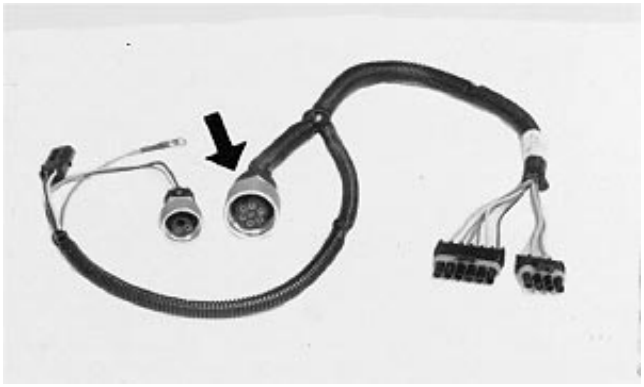
A 7-way circular connector with a threaded coupling ring which mates the connector halves. The actuator half of the connector is molded plastic while the cable end coupling ring is aluminum.

IMPORTANT: Because of the location of this connector, accessibility is difficult. On 6076 Engines, remove the oil filter and oil filter housing when working with the X12 connector. On 6101 Engines, remove fuel filter and full flow oil filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. Also, because of the combination of the aluminum coupling ring and the plastic mating thread, cross-threading of the connector can damage the actuator half. Therefore, care should be used when mating this connector to avoid damaging the threads.

A special crowsfoot wrench (JDG646) is required to adequately tighten the coupling ring. Mating torque range is 10—20 N•m (7—14 lb-ft). When the coupling ring engages the sealing O-ring, a false indication of a fully mated connector can be given. Tightening to the prescribed torque will avoid this problem. When the connector is disconnected, be careful to avoid losing the O-ring located in the cable end connector.



RG5384 –UN–14DEC88



RG5385 –UN–09JAN90

RG5408 –UN–09JAN90

S55,2000,Y –19–02MAR94–1/1

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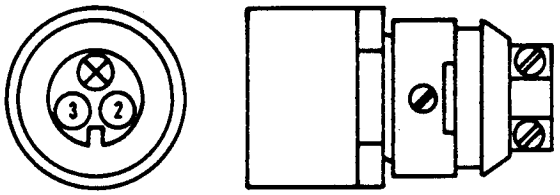
6

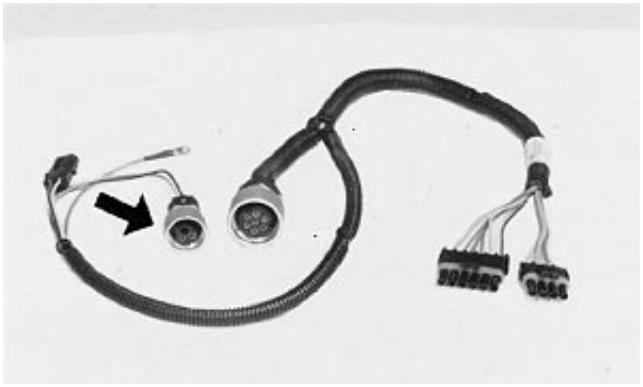
Fuel Temperature Sensor Connector (X13)

A 3-way (only two positions are used) circular connector with a threaded coupling ring which mates the connector halves. The sensor half of the connector is molded plastic while the cable end coupling ring is aluminum. Mating torque range is 7—17 N•m (5—11 lb-ft).

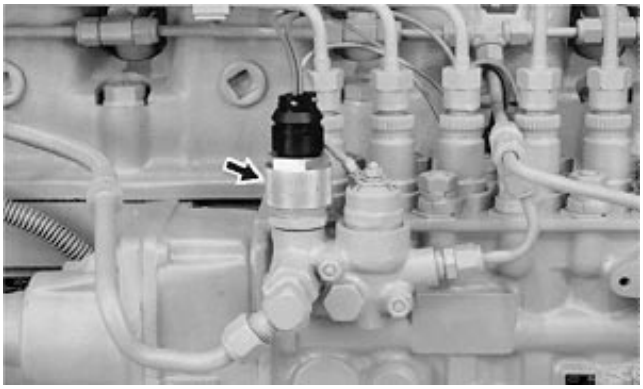
IMPORTANT: Be careful to tighten the coupling ring to this torque range to verify that the ring is fully engaged. When the connector is disconnected, avoid losing the O-ring located in the cable end connector.



RG5386 –UN–14DEC88



RG5387 –UN–09JAN90



RG5409 –UN–09JAN90

S55,2000,Z –19–02MAR94–1/1

In-Line Connectors (X7, X8, X9, X10)

These connectors are used to connect the Engine Wiring Harness to the Application Wiring Harness. Refer to Group 45—Wiring.

S55,2000,GL –19–02MAR94–1/1

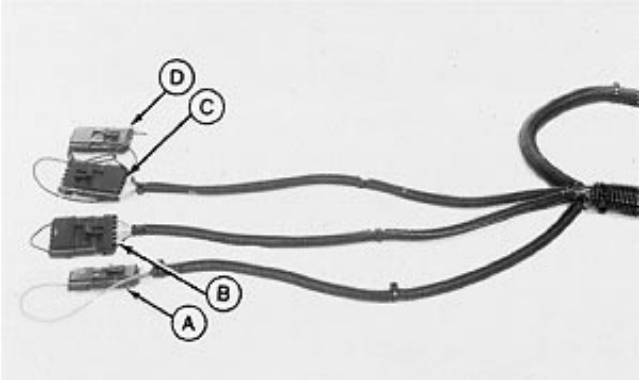
Service Connectors (X3, X4, X5, X6)

IMPORTANT: These connectors are used during service and troubleshooting procedures and should be capped when not in use to provide environmental protection. Engine performance and/or operation can be affected if these connectors are not kept capped.

X3 (A) is the Diagnostic Voltages Connector. It provides access to important system voltages which can be read with a digital multimeter. The following section describes how to interpret these voltages.

X4 (B) is the Diagnostic Reader Connector. It is used to connect to a diagnostic reader such as the Electronic Governor Tester. When a reader is not connected, this connector can be used to check the +12V system supply voltage and to access the “Transmit” and “Clear” signals when using an on-board code reader. See USING THE DIAGNOSTIC READER CONNECTOR (X4) later in this group for more details.

X5 (C) and X6 (D) are connectors which would be used by service personnel with factory authorization to service the Engine Controller. X5 provides the only connection to the Engine Controller for certain service equipment.



RG5353 –UN–09JAN90

A—Diagnostic Voltages Connector (X3)
B—Diagnostic Reader Connector (X4)
C—Service Connector (X5)
D—Service Connector (X6)

S55,2000,Q –19–03MAR94–1/1

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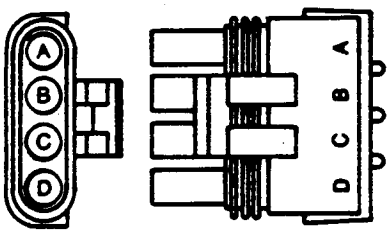
8

Using the Diagnostic Voltages Connector (X3)

X3 is a WEATHER PACK™ 4-way tower connector. The voltages present at X3 provide useful diagnostic information on the electronic governor system. The information presented in the sections below will give the service person an understanding of what these voltages represent so that quick checks of the electronic governor system can be made.



RG5389 –UN–14DEC88

Socket	Description
A	Analog Throttle +5V
B	Throttle Input Voltage
C	Rack Position Voltage
D	Sensor Common

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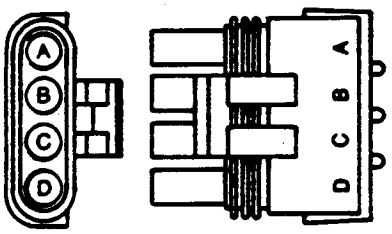
S55,2000,R –19–02MAR94–1/5

X3 Socket A—Analog Throttle +5V

This signal is the source voltage from the Engine Controller for the analog throttle. The throttle output signal (as measured at X3 Socket B) is directly proportional to this signal. The Analog Throttle +5V can be used to check on the health of the Engine Controller internal power supply system. The absence of +5V indicates a failure within the Engine Controller or a problem in the wiring harness or throttle sensor. The nominal voltage at Socket A should be 4.8—5.2 volts. If the voltage is outside this range, the Engine Controller may be defective or there may be a short circuit in the wiring harness.



RG5389 –UN–14DEC88

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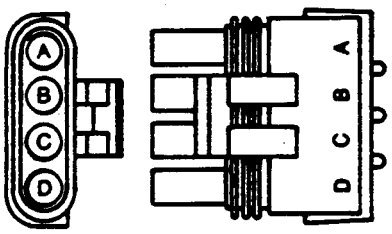
S55,2000,R –19–02MAR94–2/5

X3 Socket B—Throttle Input Voltage



RG5389 –UN–14DEC88

This signal is the input to the Engine Controller from the throttle sensor. It is proportional to throttle position and Analog Throttle +5V supply. This signal can be used to check throttle sensor adjustment and performance of the throttle sensor.

As the throttle is moved from slow idle to high idle, the Throttle Input Voltage should vary from low voltage to a high voltage. If the throttle is moved slowly through its range and the Throttle Input Voltage at Socket B changes erratically rather than smoothly, the throttle sensor may be defective.

The Analog Throttle +5V signal is also used to correct the readings for Throttle Input Voltage (Socket B) and Rack Position Voltage (Socket C). This is required because both of these voltages are proportional to the Analog Throttle +5V signal. Therefore, the voltages read at Sockets B and C must be corrected for the difference of the voltage measured at Socket A from +5V. This is done by multiplying the measured voltage by a correction factor as follows:

$$\text{Corrected Valve} = \frac{\text{(Voltage at Socket B X 5)}}{\text{(Voltage at Socket A)}}$$

The corrected values should be used when evaluating throttle voltage and rack position voltage.

If the throttle position sensor adjustment is questionable, refer to Group 30—Robert Bosch Component Repairs and Adjustments, for important notes on throttle adjustment.

Continued on next page

S55,2000,R –19–02MAR94–3/5

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X3 Socket C—Rack Position Voltage

This signal is proportional to the injection pump rack position and can, therefore, be used to determine if the governor control system is actually moving the rack to the proper range for a given operating condition. The relationship between the Rack Position Voltage (when corrected as shown in previous module) and rack position is as follows:

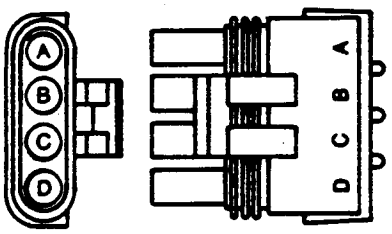
Rack Voltage = 0.5 + [Rack Position (mm) X 0.2]

OR

$$\text{Rack Position} = \frac{\text{Rack Voltage} - 0.5}{0.2}$$

The following table indicates what Rack Position Voltages (when corrected as shown in previous module) should be present for certain operating conditions:

Operating Condition	Rack Position Voltage
Key on, engine stopped	0.4—0.6
Cranking, fuel temperature less than 50°F (10°C)	3.5—4.5
Cranking, fuel temperature greater than 50°F (10°C)	2.4—4.5
Full load at rated speed	2.3—2.9
Engine idling	1.0—1.5

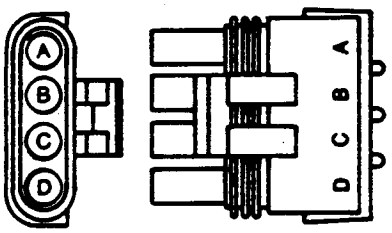


RG5389 –UN–14DEC88

S55,2000,R –19–02MAR94–4/5

X3 Socket D—Sensor Common

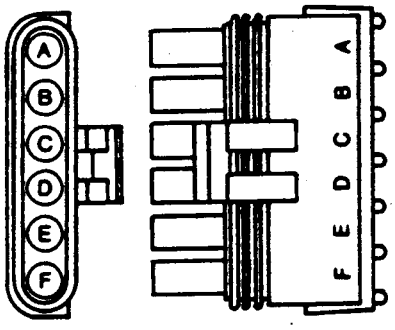
Socket D is used as a reference point for the voltages present at Sockets A, B, and C. In other words, the voltmeter “common” or “ground” input should be connected to Socket D when measuring these voltages.



RG5389 –UN–14DEC88

S55,2000,R –19–02MAR94–5/5

Using the Diagnostic Reader Connector (X4)



RG5390 –UN–14DEC88

The Diagnostic Reader Connector (X4) is used to connect to Electronic Governor Tester during service work. However, when the Electronic Governor Tester is disconnected, this connector can be used to measure the governor system +12V supply voltage. Also, when an on-board code reader is being used rather than the electronic governor tester, this connector can be used to recall stored diagnostic codes from the Engine Controller and clear stored diagnostic codes from the Engine Controller.

Socket	Function
A	+12V input
B	Transmit stored codes input
C	Clear stored codes input
D	Diagnostic Codes output
E	Fuel flow/throttle output
F	Power ground

Checking the governor system supply voltage can be done by measuring the voltage from X4 socket A (+) to X4 socket F (-). This provides a test to see if the supply voltage is reaching the governor harness and that the voltage level is adequate to allow system function (greater than 9 volts).

CAUTION: DO NOT short X4 socket A to X4 socket F. This will short battery voltage to ground which will probably blow a circuit breaker or fuse. Sparks may be produced as a result of the short circuit.

When an on-board code reader (such as tachometer with code reading capability) is present, shorting X4 socket B to X4 socket F causes stored diagnostic codes from the Engine Controller to be transmitted to the code reader. Shorting X4 socket C to X4 socket F while X4 socket B is also shorted to X4 socket F clears the stored codes from the Engine Controller.

Shorting X4 socket B to X4 socket F will allow stored codes to read out on tachometer. To clear stored codes, short X4 socket B and X4 socket F with X4 socket C for a couple of seconds.

Continued on next page

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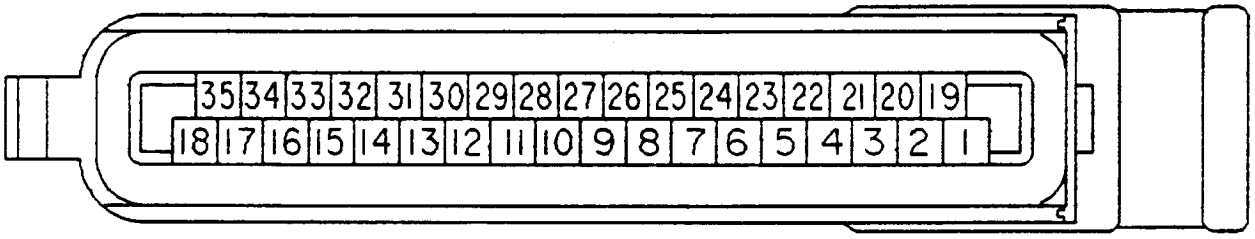
See stored codes operation in Group 10. Stored codes can give help for intermittent problems in which a malfunction has occurred in the past but is not present when diagnostic tests are being performed.

S55,2000,S –19–03MAR94–2/2

Engine Controller Connector (X1)



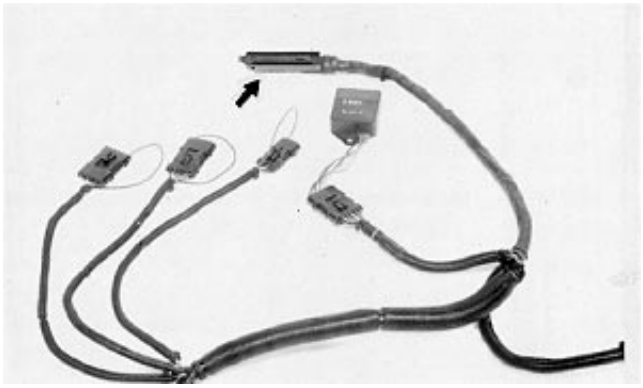
RG5401 –UN–13JAN89

The Engine Controller is connected to the rest of the system through only one connector. The connector is rectangular with 35 pins total; one row of 18 pins and one row of 17 pins. The pin numbers are not labeled on the connector. Therefore, the connector figure must be used during troubleshooting to identify pin numbers.

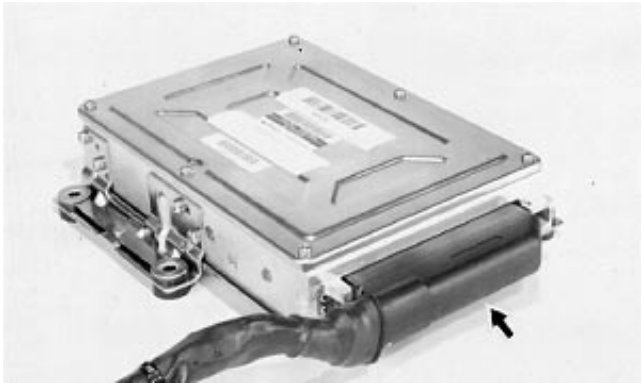
The connector is disconnected by releasing the spring latch beneath the wire exit end of the connector and pivoting the wire end of the connector away from the controller. This will allow the tip of the other end of the connector to be released from under the locking pin of the controller housing. Mating the connector is done by reversing these steps. The tip of the connector is inserted beneath the locking pin of the controller housing. Then the connector is pivoted toward the controller until the spring latch locks the wire end of the connector in place.

IMPORTANT: Care should be used during diagnostic procedures to avoid damaging the pins of the Engine Controller Connector. Probes should not be poked into the pins or damage will result. Probes should only be touched against the pins to make measurements. If damage occurs to the connector pins, refer to Group 40—Nippondenso Component Repairs and Adjustments.

A listing of each connector pin, the signal on that pin, and a description of the signal is provided on the following pages.



RG5417 –UN–09JAN90



RG5418 –UN–09JAN90

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Pin	Functional Description
1	+ 12 Volt Input—This pin provides power to the ECU and is common with Pin 34.
2	Analog Throttle +5V - +5 volt supply for the analog throttle sensor.
3	Manifold Air Pressure +5V—This pin supplies volts for the MAP sensor (if used).
4	Manifold Air Pressure Input—D.C. analog input which receives the signal from the MAP sensor (if used).
5	Manifold Air Temperature Input—During Governor Mode it is an analog input which is connected to a resistive temperature sensor (if used).
6	Analog Throttle Input—0 to 5 volt D.C. analog input which is used by the analog throttle to input throttle position.
7	Start Signal Input—A high voltage (greater than about 3 volts) on this input causes the ECU to enter the start sequence if other conditions allow.
8	This signal must be open circuit or less than 0.5 volts to allow the system to operate normally.
9	Rack Position Sensor Common—One of three pins which connect to the rack position sensor. This pin provides for return current and ground reference for the Rack Position Sensor.
10	Primary Engine Speed—This input receives the signal on the 'minus' lead from the pump-mounted engine speed sensor.
11	Auxiliary Speed Input—Input which receives an A.C. signal whose frequency is proportional to engine speed. In the event of a primary engine speed sensor failure, the Engine Controller will use this signal to govern the engine.
12	This input should be left open circuit for normal operation.
13	Fault Lamp Input—Output which drives a fault lamp during failure conditions. The output flashes at a one flash per second rate when on.
14	Clear Stored Codes Input—Used to clear the stored diagnostic codes from Engine Controller memory when shorted to ground when pin 16 is also active.
15	Fuel Shut-Off Solenoid Output—Current-sourcing output which turns on the fuel shut-off valve. During certain fault conditions this output turns off the fuel shut-off valve to force zero fuel delivery.
16	Transmit Stored Codes Input—When shorted to ground, this input causes stored diagnostic codes to be transmitted via the Diagnostic Codes Output (Pin 31) rather than the current diagnostic codes. When this input and Pin 14 are simultaneously selected, the stored diagnostic codes are cleared.
17	Actuator Solenoid Output—Current-sinking output which drives the solenoid coil of the injection pump rack actuator. Pin 17 is common with Pin 18.
18	Actuator Solenoid Output—See Pin 17.
19	Code Storage + 12V Input—Provides +12V continuous power for code storage memory. Must remain at +12V even when key switch is off.
20	Signal Ground—This pin is used to provide a ground reference for the electronic signals within the controller.
21	Rack Position Sensor +5V—The +5v supply for the Rack Position Sensor.
22	Sensor Common—This pin is used to provide a reference voltage for analog sensors (fuel temperature, throttle sensors, and 3-state inputs) and for analog voltage measurements.
23	Fuel Temperature Input—Analog input which is connected to a Nippondenso resistive sensor that is pump mounted. The input has a pull-up resistor (5000 ohms) to +5 volts.
24	Fuel Limit Select Input—3-state input which selects between three optional torque curves. Selection is made by connecting input to ground, by connecting input to ground through a 2000 ohms resistor, or by leaving input open.
25	Speed Regulation Select Input—3-state input which selects between three end speed regulation curves. Selection is similar to that of Pin 24.
26	3-State Throttle Input— +5 volts is supplied through a 2000 ohm resistor on this pin for 3-state throttle applications. Selection is similar to that of Pin 24.
27	Rack Position Voltage—D.C. voltage from the Rack Position Sensor which is proportional to pump rack position. The relationship is as follows: RACK VOLTAGE (volts) = 3.00 volts + [RACK POSITION (mm) x -0.1]
28	Primary Speed Input +—This input receives the signal on the 'plus' lead from the Nippondenso pump-mounted sensor which monitors engine speed. The sensor provides 6 pulses per engine revolution.
29	Auxiliary Speed Output—This output provides a buffered output of the Auxiliary Speed Input. It supplies one pulse for each pulse received on the Auxiliary Input. The signal is made available for other devices which require an engine speed signal.
30	Pulse-Width-Modulated (PWM) Throttle Input—This input is an auxiliary throttle command which takes precedence over the Analog Throttle Input for governor control when it is present.
31	Diagnostic Codes Input—Signal which sends diagnostic codes to a service tool or on-board code reader.

Continued on next page

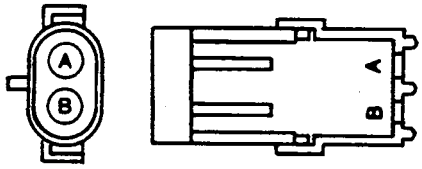
Pin	Functional Description
32	Fuel Flow/Throttle Output—Output control signal which contains percent of rated fuel flow and throttle position information to be used by other electronic devices in the system. The throttle position value represents the Analog Throttle Input value received on Pin 6 (and Pin 4 if machine has dual analog throttles) whether or not a PWM Throttle Input is present at Pin 30.
33	Power Ground Input—This pin supplies a high current ground connection to the Engine Controller. It is common with Pin 35. Only Pins 33 and 35 should be used as high current connections.
34	+12 Volt Input—See Pin 1.
35	Power Ground Input—See Pin 33.

S55,2000,HA –19–02MAR94–3/3

Auxiliary Speed Sensor Connector (X2)

This harness connector is a 2-way WEATHER PACK™ shroud connector. The pin description is given below.

Pin	Function
A	Signal
B	Signal Ground



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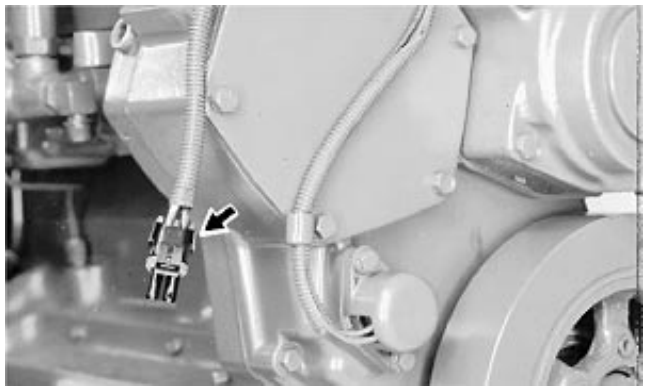

RG5434 –UN–09JAN90

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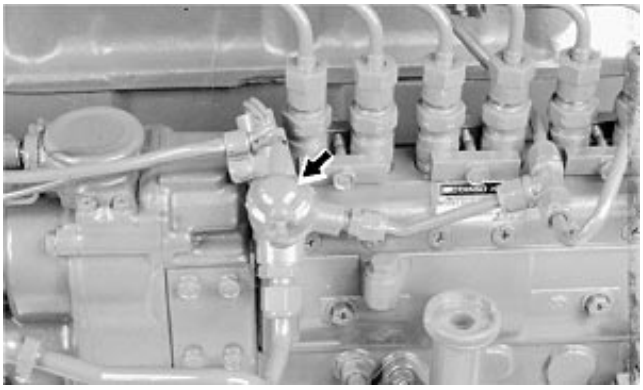
S55,2000,HE –19–02MAR94–1/1

Fuel Shut-Off Solenoid Connector (X10)

This harness connector is a 1-way WEATHER PACK™ tower connector. It connects to a 1-way shroud near the rear of the pump/actuator assembly. The connection at the solenoid is made with a 5 mm (0.20 in.) eyelet on the threaded stud of the solenoid. The solenoid is internally grounded to the fuel inlet assembly housing.



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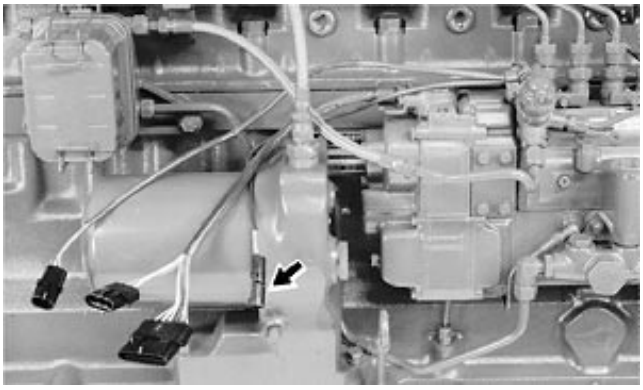

RG5436 –UN–09JAN90

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S55,2000,HF –19–02MAR94–1/1

Actuator Connectors (X7, X9)

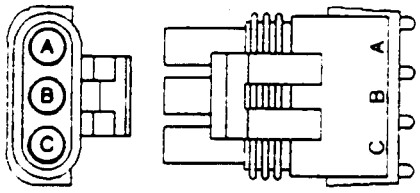
X7 and X9 are harness connectors which are located near the rear of the pump/actuator assembly. The connectors which mate with X7 and X9 lead into the top rear of the actuator.

X7 is a 3-way WEATHER PACK™ tower with the following pin description:

Pin	Function
A	Not Used
B	Actuator drive from controller
C	+12V Power

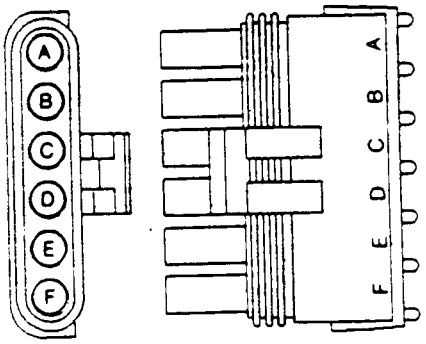
X9 is a 6-way WEATHER PACK™ tower which has signals for the Primary Speed Sensor and the Rack Position Sensor.

Pin	Function
A	Primary Speed Input (-)
B	Primary Speed Input (=)
C	Rack Position Sensor Common
D	Rack Position Voltage
E	Not Used
F	Rack Position Sensor +5V



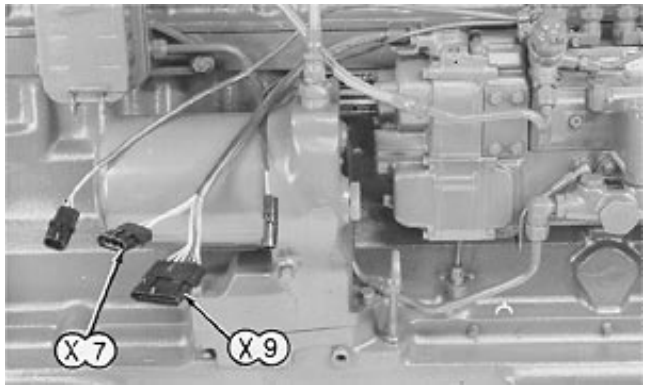
RG5437 –UN–13JAN89

(X7 Connector)



RG5438 –UN–13JAN89

(X9 Connector)



RG5439 –UN–09JAN90

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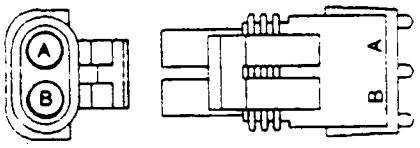
S55,2000,HG –19–02MAR94–1/1

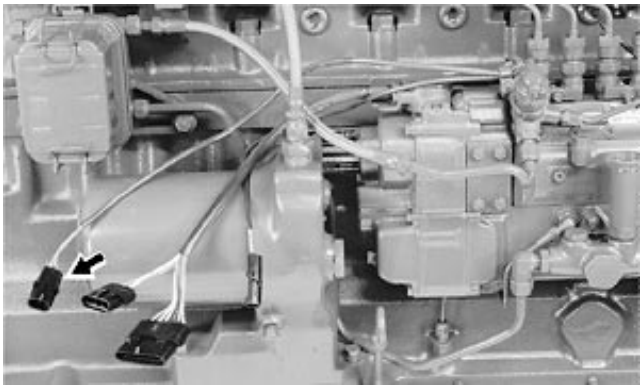
Fuel Temperature Sensor Connector (X8)

This harness connector is a 2-way WEATHER PACK™ tower connector. The pin description is given below.

Pin	Function
A	Sensor Common
B	Signal



RG5440 –UN–13JAN89



RG5441 –UN–09JAN90

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S55,2000,HH –19–02MAR94–1/1

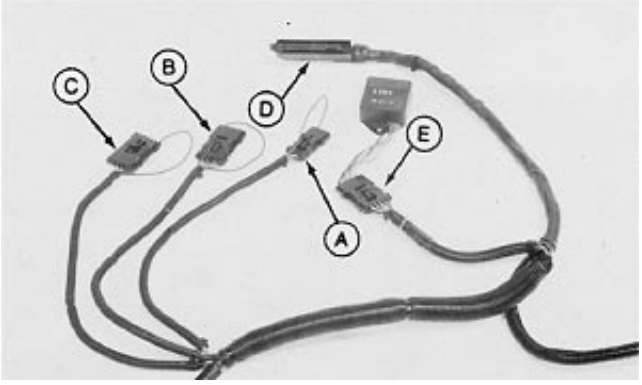
Service Connectors (X3, X4, X5)

IMPORTANT: These connectors are used during service and troubleshooting procedures and should be capped when not in use to provide environmental protection. Engine performance and/or operation can be affected, if these connectors are not kept capped.

X3 (A) is the Diagnostic Voltages Connector. It provides access to important system voltages which can be read with a digital multimeter. The following section describes how to interpret these voltages.

X4 (B) is the Diagnostic Reader Connector. It is used to connect to a diagnostic reader such as the Electronic Governor Tester. When a reader is not connected, this connector can be used to check the + 12V system supply voltage and to access the “Transmit” and “Clear” signals when using an on-board code reader. See USING THE DIAGNOSTIC READER CONNECTOR (X4) later in this group for more details.

X5 (C) is a connector which would be used by service personnel with factory authorization to service the Engine Controller. X5 provides the only connection to the Engine Controller for certain service equipment.



RG5443 –UN–09JAN90

A—Diagnostic Voltages Connector (X3)
B—Diagnostic Reader Connector (X4)
C—Service Connector (X5)
D—Engine Controller Connector (X1)
E—TVP Module Connector

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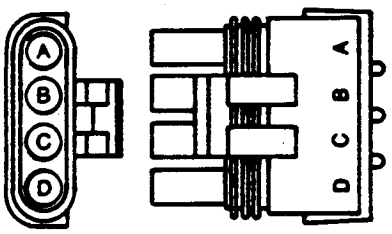
Using the Diagnostic Voltages Connector (X3)

X3 is a WEATHER PACK™ 4-way tower connector. The voltages present at X3 provide useful diagnostic information on the electronic governor system. The information presented in the sections below will give the service person an understanding of what these voltages represent so that quick checks of the electronic governor system can be made.



RG5389 –UN–14DEC88

Socket	Description
A	Analog Throttle +5V
B	Throttle Input Voltage
C	Rack Position Voltage
D	Sensor Common

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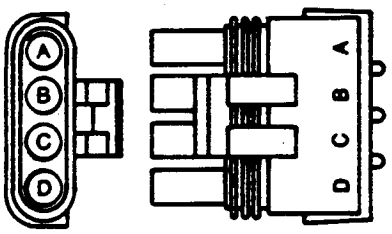
X3 Socket (A)—Analog Throttle +5V

This signal is the source voltage from the Engine Controller for the analog throttle and Rack Position Sensor. The throttle output signal (as measured at X3 Socket B) is directly proportional to this signal. The Analog Throttle +5V can be used to check on the health of the Engine Controller internal power supply system. The absence of +5V indicates a failure within the Engine Controller or a problem in the wiring harness or throttle sensor. The nominal voltage at Socket A should be 4.8—5.2 volts. If the voltage is outside this range, the Engine Controller may be defective or there may be a short circuit in the wiring harness.



RG5389 –UN–14DEC88

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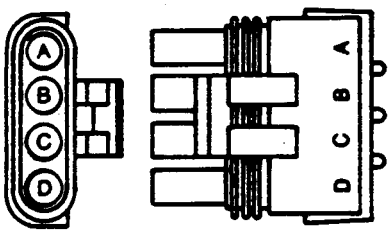
X3 Socket B—Throttle Input Voltage



RG5389 –UN–14DEC88

This signal is the input to the Engine Controller from the throttle sensor. It is proportional to throttle position and Analog Throttle +5V supply. This signal can be used to check throttle sensor adjustment and performance of the throttle sensor.

As the throttle is moved from slow idle to high idle, the Throttle Input Voltage should vary from low voltage to a high voltage. If the throttle is moved slowly through its range and the Throttle Input Voltage at Socket B changes erratically rather than smoothly, the throttle sensor may be defective.

The Analog Throttle +5V signal is also used to correct the readings for Throttle Input Voltage (Socket B) and Rack Position Voltage (Socket C). This is required because both of these voltages are proportional to the Analog Throttle +5V signal. Therefore, the voltages read at Sockets B and C must be corrected for the difference of the voltage measured at Socket A from +5V. This is done by multiplying the measured voltage by a correction factor as follows:

$$\text{Corrected Valve} = \frac{\text{(Voltage at Socket B X 5)}}{\text{(Voltage at Socket A)}}$$

The corrected values should be used when evaluating throttle voltage and rack position voltage.

If the throttle position sensor adjustment is questionable, refer to Group 40—Nippondenso Component Repairs and Adjustments, for important notes on throttle adjustment.

Continued on next page

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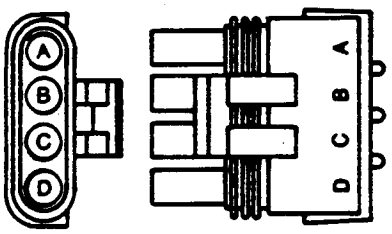
X3 Socket C—Rack Position Voltage

This signal is proportional to the injection pump rack position and can be used to determine if the governor control system is actually moving the rack to the proper range for a given operating condition. The relationship between the Rack Position Voltage and rack position is as follows:



RG5389 –UN–14DEC88

Rack Voltage = 3.00 volts + [Rack Position (mm) X - 0.1]

OR

Rack Position (mm) = 10 x [3.00 volts - Rack Voltage]

The following table indicates what Rack Position Voltages should be present for certain operating conditions:

Operating Conditions	Rack Position Voltage
Key on, engine stopped	2.7—2.9
Cranking, fuel temperature less than 77°F (25°C)	1.0—1.5
Cranking, fuel temperature greater than 77°F (25°C)	1.0—2.0
Full load at rated speed	1.4—2.0
Engine idling	2.1—2.6

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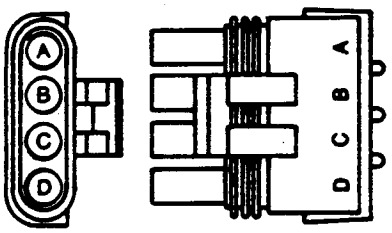
X3 Socket D—Sensor Common

Socket D is used as a reference point for the voltages present at Sockets A, B, and C. In other words, the voltmeter “common” or “ground” input should be connected to Socket D when measuring these voltages.



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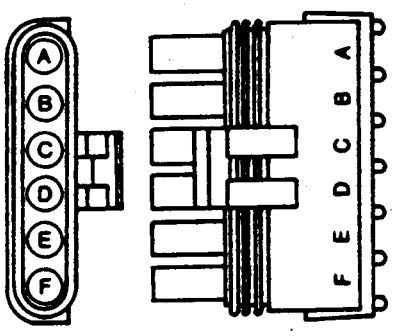
Using the Diagnostic Reader Connector (X4)



RG5390 –UN–14DEC88

The Diagnostic Reader Connector (X4) is used to connect to Electronic Governor Tester during service work. However, when the Electronic Governor Tester is disconnected, this connector can be used to measure the governor system +12V supply voltage. Also, when an on-board code reader is being used rather than the electronic governor tester, this connector can be used to recall stored diagnostic codes from the Engine Controller and clear stored diagnostic codes from the Engine Controller.

Socket	Function
A	+12V input
B	Transmit stored codes input
C	Clear stored codes input
D	Diagnostic Codes output
E	Fuel flow/throttle output
F	Signal Ground

Checking the governor system supply voltage can be done by measuring the voltage from X4 socket A (+) to X4 socket F (-). This provides a test to see if the supply voltage is reaching the governor harness and that the voltage level is adequate to allow system function (greater than 9 volts).

CAUTION: DO NOT short X4 socket A to X4 socket F. This will short battery voltage to ground which will probably blow a circuit breaker or fuse. Sparks may be produced as a result of the short circuit.

When an on-board code reader (such as a tachometer with code reading capability) is present, shorting X4 socket B to X4 socket F causes stored diagnostic codes from the Engine Controller to be transmitted to the code reader. Shorting X4 socket C to X4 socket F while X4 socket B is also shorted to X4 socket F clears the stored codes from the Engine Controller. See Stored Codes Operation earlier in this group. Stored codes can give help for intermittent problems in which a malfunction has occurred in the past but is not present when diagnostic tests are being performed.

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How to Start Troubleshooting a Problem

Before troubleshooting of the fuel injection system is begun (especially if no diagnostic codes are present), verify that a problem does not exist in the basic electrical system or in the fuel supply system. The troubleshooting section of your operator's manual will help in finding problems in areas other than the electronic fuel injection system. The areas covered in your operator's manual or machine technical manual include the following:

- Charging system (condition of the battery and battery cables).
- Power distribution system
  - – Fuses or circuit breakers
  - – Key switch and any relays between battery and fuel injection system
  - – Starter solenoid wiring connection
- Fuel source
  - – Fuel in tank
  - – Fuel lines and filters

IMPORTANT: If the problem is in one of the above areas, the diagnostic procedures for the fuel injection system will probably not help to find it.

In a later section, you will be directed to one of two diagnostic procedures. The Symptom-Only Procedures are used when there are only symptoms of a problem and no diagnostic codes are being displayed by the Electronic Governor Tester or the on-board code reader. The Diagnostic-Codes-Present Procedures will be used if one or more diagnostic codes are present (are being displayed).

If the above checks have been made and a problem with the fuel injection system is still suspected, become familiar with the next two modules, Troubleshooting Tools Needed and Troubleshooting Suggestions, and then proceed to Initial Operational Checks to begin troubleshooting.

IMPORTANT: Always begin diagnosis of a fuel injection system problem at Initial Operational Checks.

NOTE: Keep service connectors capped when not in use.

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Troubleshooting Tools Needed

Digital Multimeter—(JT05791 or equivalent) Refer to USING A DIGITAL MULTIMETER in Group 02—General Information.

Diagnostic Reader—(John Deere Electronic Governor Tester JT05829 or on-board diagnostic code read-out device). Refer to USE OF A DIAGNOSTIC READER in Group 02—General Information.

Jumper Wires—(Terminated with WEATHER PACK™ terminals) Refer to USING THE DIAGNOSTIC READER CONNECTOR (X4) in Group 15—Robert Bosch Fuel System Connectors.

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Troubleshooting Suggestions

Checking Wiring and Connectors

When diagnosing electrical system problems, take special note of the condition of wiring and connectors since a high percentage of problems originate here. Check first 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. Considerable time may be saved if the harnesses and connectors are inspected first.

Use good judgment if component replacement is thought to be required.

NOTE: The Engine Controller is the component LEAST likely to fail.

Running Engine at Different Speeds

Run the throttle control(s) at slow-to-medium rate between the slow idle and the fast idle stops with the engine running. If engine speed “catches” or “drops”, this may indicate a problem with throttle adjustment, throttle sensor operation, or the wiring between the Engine Controller and the throttle sensor(s). Using this method of changing engine speed, you may be able to identify problems which only occur at certain speeds or throttle settings. For machines with 3-State Throttle, switch between speed selections to see if problem is speed dependent.

Looking for Intermittent Problems

An intermittent code may mean that something is going outside of its normal operating range, but then returning to normal. This may be caused by a marginal adjustment (on a throttle sensor, for example) or by a poor connection. Check the condition of the wiring and connectors as described in the first paragraph. If codes 11, 12, 13 or 14 are intermittent and the wiring appears to be OK, then the throttle sensor(s) may need to be adjusted. See Group 30—Robert Bosch Component Repairs and Adjustments.

An intermittent code may also mean that something is beginning to fail. Some failures are related to vibration. Because of the cost of replacing the pump, the condition of the wiring and connectors should be checked first.

Continued on next page S55,2000,EEA1 –19–02MAR94–1/3

IMPORTANT: On 6076 Engines, remove filter and oil filter housing when working with the X12 connector. On 6101 Engines, remove fuel filter and full flow oil filter. Refer to CTM6 and CTM42 (6076 Engines), or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. Because of the location of X12, accessibility to this connector is difficult. A special crowsfoot wrench (JDG646) is required for removal and replacement. When replacing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to thread damage. Also, make sure that the connecting ring is completely engaged by tightening ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

If code 32, 34, 35, 36, 39 or 42 are intermittent, check the wiring and connectors leading to pump connector X12. This includes X7, X8, X9, X10 and X12. Visually inspect the mating X12 with the pump connector, or check the torque on the X12 connecting ring before removing the connector to inspect the contacts. If X12 is loose, it is likely that one or more of these codes will be intermittent. If X12 is found to be loose, disconnect it completely and inspect the contacts for damage, dirt, and burning (blackening). If the contacts show signs of burning (much darker color than other contacts), especially high current contacts 2 and 7, then the engine harness or the pump, or both, should be replaced. If not replaced, the engine will eventually fail to start or run.

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CAUTION: Avoid possible injury. Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

For those engine in machines, NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.

Wear tight fitting clothing. Keep clear of moving parts and hot surfaces while making adjustments.

TS177 –UN–11JAN89

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Initial Operational Checks

IMPORTANT: Do not ignore stored codes. They represent problems that occurred at some time in the past or problems are still occurring.

1. **Stored codes should be read and recorded for reference when service on an engine first begins. Shortly after the battery is disconnected, stored codes will be erased.**
2. **Clear the stored codes once they have been recorded. This may eliminate old codes for problems which are now occurring.**
3. **Currently active codes should be investigated as directed by the procedures starting on this page. Work on one code at a time if more than one code is active.**
4. **Clear stored codes again after each repair has been verified.**
5. **To help make sure that all problems have been found and worked on, operate the engine at all engine speeds and all throttle settings to see if any symptoms or codes remain.**
6. **If there are any stored codes after Step 5, there is still a problem which needs to be fixed. If so, proceed to Diagnostic-Codes-Present Procedures. The engine should not be returned to normal operation with stored codes.**

NOTE: The abbreviation ECU (for electronic control unit) is used in the diagnostic procedures as a "shorthand" way to indicate the Engine Controller.

When instructions are given to read diagnostic codes, use either the Electronic Governor Tester (JT05829) or an on-board code reader. See USE OF A DIAGNOSTIC READER in Group 02—General Information.

If instructions are given to read diagnostic codes (diagnostic codes stored in the Engine Controller) refer to USING THE ELECTRONIC GOVERNOR TESTER in Group 10—Basic System and Diagnostic Features, if that service tool is used. Refer to USING THE DIAGNOSTIC READER CONNECTOR (X4) in Group 15—Robert Bosch Fuel System Connectors, if an on-board code reader is used. These two sections explain how to cause stored codes to be displayed on the diagnostic reader being used. If using on-board digital tachometer to read stored codes, refer to machine TM.

NOTE: Remember to keep service connectors capped when not in use.

Step/Sequence	Result	Next
A-1 Stored Codes Check		
With ignition on but engine not running, check for codes stored in Engine Controller memory.	Stored codes present	Go to A-2
No stored codes	Go to A-3	
A-2 Clear Stored Codes		
MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes.	Stored codes present	Go to A-3
No stored codes	Operation complete	
A-3 Diagnostic Codes Check.		
With the ignition on but the engine not running, check the diagnostic codes.	No diagnostic codes	Go to A-4
Codes present ..... (Other than 71 or 72.)	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.	

Continued on next page

A-4 Engine Start Check.

Attempt to start engine. (If engine does not start, be sure to crank continuously for at least 4 seconds.)	Engine starts and runs ..... (No diagnostic codes present.)	Go to A-5
Codes present	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.	
Engine does not start and ..... no codes present.	Go to A-11	

IMPORTANT: Do not operate the starter for more that 30 seconds at a time. To do so may over-heat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again.

Step/Sequence	Result	Next
A-5 Run Engine Check.		
With engine running, move throttle through its entire range noting diagnostic codes and engine performance.	No codes present and engine ..... runs satisfactorily.	No problems evident, Go to A-10
Codes present	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.	
Engine not running ..... satisfactorily but no codes present.	Go to A-11	
A-10 Stored Codes Check. (Engine runs OK.)		
With ignition on but engine not running, check for codes stored in Engine Controller memory. Refer to tester or machine technical manual. Use Electronic Governor Tester or refer to USING THE DIAGNOSTIC READER CONNECTOR (X4) in Group 15—Robert Bosch Fuel System Connectors, if an on-board reader is used.	No stored codes	Refer to Troubleshooting Suggestions at beginning of this Group. Return to normal operation if all suggestions have been tried and still no improper operation can be found.
Stored codes present	Go to A-12.	
A-11 Stored Codes Check. (Engine does NOT run OK, or does NOT start.)		
With the ignition on but engine not running, check for codes stored in Engine Controller memory. Use Electronic Governor Tester or refer to USING THE DIAGNOSTIC READER CONNECTOR (X4) in Group 15—Robert Bosch Fuel System Connectors, if an on-board reader is used.	No stored codes ..... Problem probably NOT in controller, harness, or rack actuator.	Go to Symptom-Only Procedures, which follow Initial Operational Checks.
Stored codes present	Go to A-12.	
A-12 Clear Stored Codes.		
MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes. One of the codes may indicate the problem area. Restart engine and attempt to make problem appear. (If engine does NOT start, crank for at least 4 seconds.) Now look for codes which have just been stored.	No stored code ..... Problem possibly NOT in controller, harness, or rack actuator.	Go to Symptom-Only Procedures, which follow Initial Operational Checks.
Stored codes present	Go to section for corresponding code in Diagnostic-Codes-Present Procedures after referring to Troubleshooting Suggestions in operator's manual, if present.	

Continued on next page

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A-20 Connector Check.

Turn ignition to “OFF” position. Disconnect connector X1 at ECU and uncap or disconnect connector X4. Inspect terminals of these connectors for damage, corrosion, and poorly positioned pins or sockets.	OK	Go to A-21
Problem found	Repair and go to A-1	

A-21 Harness Short Circuit Check.

With ignition off, measure resistance between pin No. 14 of the X1 connector and all other pins of the X1 connectors.	All greater than 5 ohms	Go to A-22
Any less than 5 ohms ..... (Short circuit exists in harness between pin No. 14 of X1 connector and another circuit.)	Repair and go to A-1	

A-22 Harness Open Circuit Check.

Measure resistance between pin 14 of the X1 Connector and X4 socket D.	Less than 5 ohms	Go to A-23
Greater than 5 ohms ..... (Open circuit exists between pin No. 14 of X1 Connector and X4 socket D.)	Repair and go to A-1	

A-23 ECU Power Check.

Turn ignition to “ON”. Measure voltage between X1 terminal 1 (+) and X1 terminal 19 (-).	Greater than 9 volts ..... (Equal to battery voltage.)	Go to A-24
Less than 9 volts ..... (Problem exists in harness or in electrical system.)	Repair and go to A-1	

A-24 ECU Check.

Turn ignition to “OFF”. Reconnect connector X1 and Electronic Governor Tester (if necessary to read codes). Turn ignition to “ON” and check diagnostic codes.	Code 71 or 72 ..... (No communication from ECU.)	Replace ECU and go to A-1
Codes other than 71 or 72	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.	
No diagnostic codes	Go to A-2	

A-30 (+) 12V check for diagnostic reader. (This only applies for the Electronic Governor Tester JT05829 and not for on-board display of diagnostic codes.)

With ignition off, disconnect Electronic Governor Tester from Connector X4. Turn ignition to “ON”. Measure voltage from X4 socket A (+) to X4 socket F (-)	Less than 1 volt	Go to A-31
Between 1 and 9 volts ..... Problem in basic electrical system—battery and supply circuit.)	Repair and go to A-1	
Greater than 9 volts ..... (code reader is bad.)	Replace Electronic Governor Tester and go to A-1.	

A-31 Ground Circuit Check.

With ignition on, measure voltage from X4 socket A (+) to chassis ground.	Greater than 9 volts ..... (Open circuit between X4 socket F and chassis ground.)	Repair and go to A-1
Less than 1 volt ..... (+12 volts is not being supplied to X4 socket A. Look for open circuit or problem in +12 V circuit to the electronic governor system causing fuse or circuit breaker to open.)	Repair and go to A-1	

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Symptom-Only Procedures

This section is used for procedures where a problem exists without being identified by a diagnostic code. Use this section only after Initial Operational Checks have been performed. If a diagnostic code is present during these procedures, go first to the appropriate section of the Diagnostic-Code-Present Procedures to diagnose the problem.

Refer to the Troubleshooting section of the Operator's Manual if the engine problem is not covered by one of these symptoms, or if the procedures for these symptoms do not fix the problem.

Step/Sequence	Result	Next
Determine complaint/symptom.		
Operate engine to verify reported symptom.	Engine will not start or starts and dies	Go to B1
Fast idle speed too low	Go to B2	
Slow idle speed too high	Go to B3	
SYMPTOM B1—Engine Will Not Start, Or Starts and Dies		
B1-1 ECU Power Check		
Disconnect X1 connector. With ignition on, check system voltage by measuring from X1 pin 1 (+) to X1 pin 20 (-).	Voltage should be same as battery	Go to B1-2
B1-2 Starting rack position check.		
Determine if control rack is moving when engine is cranking by measuring Rack Position Voltage (from X3 socket C (+) to X3 socket D (-) during cranking. Crank engine for at least 4 seconds. (See USING THE DIAGNOSTIC VOLTAGES CONNECTOR (Rack Position Voltage) in Group 15—Robert Bosch Fuel System Connectors.	Voltage less than 1V ..... No codes present (activator solenoid is not moving).	Go to B1-3
Voltage is between 1V and 2V ..... Actuator Solenoid is not moving the control rack far enough.	Go to B1-4	
Voltage greater than 2V ..... Control rack movement is sufficient to provide starting fuel.	Go to B1-10	
	Code present	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.

Continued on next page

IMPORTANT: Do not operate the starter for more than 30 seconds at a time. To do so may over-heat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again.

Step/Sequence	Result	Next
B1-3 Stored Codes Check for no rack movement.		
With the ignition on but the engine not running or cranking, check for stored codes in ECU memory.	No stored codes	Replace ECU and Go to B1-90
Stored codes present	MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes and go to section for corresponding code (32, 34, 35 or 36) in Diagnostic-Codes- Present Procedures.	
B1-4 Stored Codes Check for insufficient rack movement.		
With the ignition on but the engine not running or cranking, check for stored codes in ECU memory. Look for code 32, 34, 35, or 36.	No stored codes	Go to B1-5
Stored codes present	MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes and go to section for corresponding code (32, 34, 35 or 36) in Diagnostic-Codes-Present Procedures.	

CAUTION: During the B1-5 Actuator Solenoid Check test, be careful to keep the jumper leads isolated so the battery +12V is not shorted to ground. Also, if the rack actuator is functioning correctly, about 20 amperes of current will be conducted during the check and a spark will occur when the circuit is broken. This condition should not be continued beyond a few seconds, as overheating of the Actuator Solenoid will occur.

Step/Sequence	Result	Next
B1-5 Actuator Solenoid Check.		
Locate and uncap connector X3. With ignition on, monitor voltage from X3 socket C (+) to X3 socket D (-) (Rack Position Voltage). Locate X8 (4-way connector on engine harness). Connect jumper wire from X8 socket A to +12V battery voltage and X8 socket B to ground. While the above connection is made, monitor Rack Position Voltage again.	Measured voltage changes from 0.5 ± 0.1V to a value greater than 4V when +12V is applied to the Actuator Solenoid	Go to B1-6
Measured voltage does NOT change as described above ..... (Rack is stuck or solenoid is defective.)	Replace pump and Go to B1-90	

Continued on next page

B1-6 ECU Check.		
With ignition off, reconnect all connectors. Attempt to start engine. If engine does not start be sure to crank continuously for at least 4 seconds. Monitor diagnostic codes.	Engine does not start and no codes are present	If connectors, wiring and battery have been checked, then replace ECU and Go to B1-90
Engine starts and no codes are present ..... (Problem no longer present.)	Go to B1-90	
Code present	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.	
B1-10 Pump Fuel Flow Check.		
Disconnect hydraulic line from pump return to bleed line 'T'. With ignition on but engine not running, operate hand primer looking for fuel from pump return.	Fuel flows out pump return line ..... (Shut-off valve is opening and fuel is getting through pump.)	Starting problem is NOT in electronic fuel injection system. Refer to troubleshooting section of engine operator's manual.
No fuel out pump return line ..... (Shut-off valve is probably closed.) There is a rubber overflow valve which may stick shut on older style pumps. This air lock stops fuel flow. Newer pumps have a steel ball.	Go to B1-11	
B1-11 Shut-Off Solenoid Power Check.		
Check electrical connection at shut-off solenoid threaded stud.	OK	Go to B1-12
Loose connection	Repair and go to B1-90	
B1-12 Shut-Off Solenoid Power Check.		
With ignition still on, measure voltage from shut-off solenoid threaded stud (+) to fuel inlet housing (-).	Less than 10 volts	Go to B1-13
	Same as battery voltage ..... (Should be greater than 10 volts.)	Go to B1-14
B1-13 Electrical System Check.		
Turn ignition off. Check connections at battery, check battery charge, check for damaged wiring. Check for open circuit between X1 pin 4 and shut-off solenoid terminal.	Problem found	Repair and go to B1-90
Electrical system and wiring harness OK	Replace ECU and go to B1-90	
B1-14 Shut-Off Solenoid Continuity Check.		
Disconnect wire from shut-off solenoid terminal. Measure resistance between terminal and pump housing.	7—15 ohms (OK)	Go to B1-15
Less than 7 or greater than 15 ohms ..... (short or open circuit)	Replace fuel shut-off solenoid and go to B1-90	
B1-15 Bleed Orifice Check.		
Disconnect hydraulic line from fuel inlet housing to bleed line "T". (Line from fuel inlet housing is small bleed orifice between fuel filter and fuel shut-off valve.) With ignition on but engine not running, operate hand primer looking for fuel from bleed orifice.	Fuel leaks out bleed orifice ..... (If bleed orifice is not restricted, then fuel shut-off valve is probably stuck shut.)	Replace fuel shut-off valve reconnect all lines, and Go to B1-90
No fuel out bleed orifice or pump return line .... (Bleed orifice clogged or no fuel	Go to B1-16	

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B1-16 Fuel Inlet Check.		
With ignition on, loosen fuel inlet line fitting at fuel inlet assembly at pump. (Fuel may spray if pressurized.)	Fuel is pressurized and leaks out of loose fitting	Go to B1-17
Fuel is NOT pressurized. No significant leak from loose fitting ..... (Fuel is NOT getting to pump.)	Refer to troubleshooting section of engine operator's manual and check remainder of fuel system	

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

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

Step/Sequence	Result	Next
B1-17 Pump Return Fuel Check.		
With ignition still on, wait several seconds until pressure is relieved and leak slows to drip. Now tighten fuel inlet line fitting and operate hand primer checking pump return fuel flow.	Fuel flows out pump return line ..... (Bleed orifice is clogged.)	Remove fuel inlet assembly, clean out bleed orifice, reinstall fuel inlet assembly, and go to B1-90 OR Replace fuel inlet assembly and Go to B1-90
No fuel out bleed orifice pump return line ..... (Bleed orifice is clogged and shut-off valve is stuck closed.)	Replace fuel inlet assembly and Go to B1-90	
B1-90 Verify Repairs.		
With ignition off, reconnect all connectors and hydraulic lines. Attempt to start engine noting diagnostic codes (if engine does not start, be sure to crank continuously for at least 4 seconds).	Engine starts and no diagnostic codes are present	Repairs are complete. Clear stored codes.
Codes are present	Go to section for corresponding code in Diagnostic-Codes-Present Procedure.	
Engine does not start and no diagnostic codes are present	Refer to troubleshooting section of engine operator's manual, or repeat Procedure B1 to verify repair.	

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IMPORTANT: When throttle input voltage measurements are required, the measured voltage must be corrected by the value of the Analog Throttle +5V voltage when comparing with specified voltage ranges. Refer to Analog Throttle Adjustments in Group 30 for how to measure and "correct" a throttle input voltage. (This applies to the Three-State Throttle and each Analog Throttle that is used.)

Step/Sequence	Result	Next
SYMPTOM B2-Fast Idle Speed Too Low		
B2-1 Three-State Throttle Check.		
Determine if engine application uses Three-State Throttle. (Generator sets use Three-State Throttle.)	Three-State Throttle is used	Go to B2-4
Three-State Throttle NOT used	Go to B2-2	
B2-2 Check Stored Codes.		
With ignition on, check stored codes for codes 11, 12, 13 or 14. MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes.	One or more of these stored codes is present. ..... (Possible throttle adjustment or throttle sensor problem.)	Refer to machine technical manual for throttle sensor adjustment or replacement instructions.
None of these stored codes are present ..... Go to B2-4 if PWM Throttle Input is NOT used.	Go to B2-3 if PWM Throttle Input is used in this engine application.	
B2-3 PWM Throttle Check.		
Disconnect PWM Throttle Input between ECU and electronics module which is sending the signal. Start engine and check fast idle speed first with primary throttle, then with secondary throttle (if equipped).	Fast idle speed OK ..... (Throttle sensors are probably OK.)	If problem exists only when PWM throttle is connected, refer to machine technical manual for PWM Throttle diagnostic procedures.
Fast idle speed still too slow ..... (PWM Throttle Input probably OK. Reconnect PWM Throttle Input at end of procedure.)	Go to B2-4	

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B2-4 Analog Throttle Check with Electronic Governor Tester.

Stop engine. Connect Electronic Governor Tester to connector X4. Start engine with no load. Select "% Throttle" mode on tester. Make sure engine speed control is for fast idle. (If dual analog throttles are used, check one throttle at a time.)	Electronic Governor Tester not available for use	Go to B2-6
Tester reads 100% and idle speed is near normal fast idle speed	Normal operation.	
Tester reads 100% and idle speed is too slow ..... (Fuel injection system is functioning correctly, but parasitic loads may be unusually high.)	Go to B2-7	
Fast idle speed is too slow and tester reads LESS than 100% ..... (Throttle input voltage(s) probably not correct for fast idle.)	Check machine technical manual for throttle sensor wiring, adjustment, or replacement.	

B2-5 3-State Throttle

Stop engine. Connect Electronic Governor Tester to connector X4. Start engine with no load. Select "% Throttle" mode on tester. Make sure engine speed control is for high idle. Refer to machine technical manual for correct throttle percentages for each selectable speed.	Electronic Governor Tester not available for use	Go to B2-6
Tester reads correct throttle percentage and idle speed is near normal fast idle speed	Normal operation.	
Tester reads correct throttle percentage and idle speed is too slow ..... (Fuel injection system is functioning correctly, parasitic loads may be unusually high.)	Go to B2-7	
Fast idle speed is too slow and Tester reads an incorrect value ..... (Throttle input voltage(s) probable not correct for fast idle.)	Check machine technical manual for throttle wiring.	

B2-6 Throttle Check Without Electronic Governor Tester.

With ignition on but engine not running, make sure engine speed control is set for fast idle. (For vehicles with dual analog throttles, check one throttle at a time.) Check corrected throttle input voltages (see Group 30—Robert Bosch Component Repairs and Adjustments, for throttle measurement instructions). Refer to machine technical manual for proper fast idle voltages.	Voltage is correct for fast idle ..... (Fuel injection system is functioning correctly, but parasitic loads may be unusually high.)	Go to B2-7
Voltage is too high or too low for fast idle	Refer to machine technical manual for sensor/adjustment/replacement instructions or throttle wiring description.	

B2-7 Speed Regulation Select Input Check.

Determine if Speed Regulation Select input is used for this engine application.	It is used (or not sure if it is used)	Refer to machine technical manual for details and troubleshooting the Speed Regulation Select input.
Not used	Throttle adjustment OK. Look elsewhere for problem.	

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IMPORTANT: When throttle input voltage measurements are required, the measured voltage must be corrected by the value of the Analog Throttle +5V voltage when comparing with specified voltage ranges. Refer to Analog Throttle Adjustments in Group 30 for how to measure and "correct" a throttle input voltage. (This applies to the Three-State Throttle and each Analog Throttle that is used.)

Step/Sequence	Result	Next
SYMPTOM B3-Slow Idle Speed Too Fast		
B3-1 3-State Throttle Check.		
Determine if engine application uses Three-State Throttle. (Generator sets use Three-State Throttle.)	Three-State Throttle is used	Go to B3-4
Three-State Throttle NOT used	Go to B3-2	
B3-2 Check Stored Codes.		
With ignition on, check stored codes 11, 12, 13 or 14. MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes.	One or more of these stored codes is present. (Possible throttle adjustment or throttle sensor problem.)	Refer to machine technical manual for throttle sensor adjustment replacement instructions.
None of these stored codes are present	Go to B3-3 if PWM Throttle Input is used in this engine application. Go to B3-4 if PWM Throttle Input is NOT used.	
B3-3 PWM Throttle Check.		
Disconnect PWM Throttle Input between ECU and electronics module which is sending the signal. Start engine and check idle speed with throttle(s) set to slow idle.	Fast idle speed OK ..... (Throttle sensors are probably OK.)	If problem exists only when PWM throttle is connected, refer to machine technical manual for PWM Throttle diagnostic procedures.
Slow idle speed still too fast	Go to B3-4	
(PWM Throttle Input probably OK. Reconnect PWM Throttle Input at end of procedure.)		
B3-4 Throttle Check with Electronic Governor Tester.		
Stop engine. Connect Electronic Governor Tester to connector X4. Start engine with no load. Select '% Throttle' mode on tester. Make sure engine speed control is for slow idle. (If dual analog throttles are used, make sure both are set for slow idle.)	Electronic Governor Tester not available for use	Go to B3-5
Tester reads 0% and idle speed is near normal slow idle speed	Normal operation. (Problem is no longer present.)	
Slow idle speed is too fast and tester reads GREATER than 0% ..... (Throttle input voltage(s) probably not correct for slow idle.)	Check machine technical manual for throttle sensor, adjustment, or replacement.	

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B3-5 Throttle Check Without Electronic Governor Tester.

With ignition on but engine not running, make sure engine speed control is for slow idle. (For vehicles with dual analog throttles, make sure both are set for slow idle.) Check corrected throttle input voltage (see Group 40—Nippondenso Component Repairs and Adjustments). Refer to machine technical manual for proper slow idle voltages.	Corrected throttle voltage is proper for slow idle	Go to B3-6
Voltage is too high or too low for slow idle	Refer to machine technical manual for sensor adjustment or replacement instructions.	

B3-6 Slow Idle Speed Check.

Start engine and check slow idle speed.	Slow idle speed is correct	Normal operation. (Problem is no longer present.)
	Slow idle speed too fast	Go to B3-7.

B3-7 Rack Position Check.

Stop engine. Turn ignition on. Check rack position voltage by measuring from X3 socket C (+) to X3 socket D (-).	Above 2.6 volt ..... (Rack not sticking.)	Replace Engine Controller and recheck slow idle speed.
Below 2.6 volt ..... (Rack sticking above slow idle)	Replace pump/actuator assembly and recheck slow idle speed.	

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Diagnostic-Codes-Present Procedures

The diagnostic procedures below are intended to be used when diagnostic codes are present at the time the procedure is started (with the exception of Code 34). They will not necessarily result in the correct diagnosis if the diagnostic code is not present when the procedure is begun. Note that Codes 34, 39, 42, and 44 can only occur when the engine is running.

CAUTION: The diagnostic procedures sometime require that tests be performed with the ignition on or while cranking the engine or with the engine running. Proper precautions should be taken prior to performing any of these steps.

When instructed to 'turn ignition on', simply apply supply voltage to the governor system - do not start or attempt to start the engine.

IMPORTANT: If any engine diagnostic codes are stored within the Engine Controller, transmitted by the Engine Controller, or stored within an on-board code reader that are not in the following list, report these codes to the factory for further instruction. Record stored codes before disconnecting the battery. Shortly after the battery is disconnected, stored codes will be erased.

A quick reference directory of the diagnostic codes is shown below; a more detailed diagnostic code description follows.

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NOTE: If the operator is able to keep the engine running during a fault condition, no damage to the engine should result. Therefore, in certain fault conditions, the operator can keep working until it is more convenient for him to get the problem fixed.

Code	Code Description/Symptom/Action	Page
11	Primary Analog Throttle Input too high	25-25
12	Primary Analog Throttle Input too low	25-28
13	Secondary Analog Throttle Input too high	25-30
14	Secondary Analog Throttle Input too low	25-33
	Symptom: Partial or total loss of throttle control. If vehicle has two throttles (hand and foot), control will revert to throttle that is still working. If vehicle has only one throttle (or if both throttles have failed), engine will run at slow idle while fault is occurring. Engine speed will probably be erratic if fault is intermittent.	
	Action: Operator should be able to find part of the throttle range that works and continue to operate if necessary. If the fault is due to misadjustment, continuing to operate will not harm engine.	
32	Actuator Solenoid Circuit Fault	25-35
	Symptom: Engine will stall if fault occurs while running. Engine will be prevented from starting.	
	Action: Operator can visually check the harness connectors to make sure they all look properly connected. If problem still exists, see dealer.	
34	Rack Position Error	25-41
	Symptom: Engine may perform erratically or it may just shut down. Engine should restart, but will likely exhibit the same symptoms as before.	
	Action: Refer to Code 34 later in this group.	
35 and 36	Rack Position Voltage out of range	25-45
	Symptom: Erratic engine speed and stalled engine.	
	Action: Refer to code 35 or 36 later in this group. If problem still exists, see dealer.	
37 and 38	Fuel Temperature Input Voltage out of range	25-53
	Symptom: Power change; hard or smoky starting. Performance loss may only be slight.	
	Action: This fault will not harm the engine. Continue to operate if necessary; repair when convenient.	
39	Primary Speed Input Error	25-61
	Symptom: Momentary erratic speed.	
	Action: This fault will not harm the engine. Continue to operate if necessary. Repair when convenient.	
41	Start Signal Missing	25-67
	Symptom: Engine may hiccup (start to die, then recover) due to momentary power loss to electronic governor.	
	Action: If above symptom occurs, operator can check connectors to see if they are mated properly. Otherwise, see dealer.	
42	Engine Overspeed	25-70
	Symptom: Momentary overspeed.	
	Action: None required if no other symptom.	
43[a]	PWM Throttle Input erratic, too short or too long	25-71
	Symptom: Automatic shift feature not functioning for machines equipped with Deere PST, Solenoid Shifted Transmission, and Automatic Power Train feature.	
	Action: Check to see if connectors are mated properly, otherwise see the dealer.	
44	Auxiliary Speed Input Error	25-74
	Symptom: Engine performance may be erratic.	
	Action: This code will not harm the engine. Continue to operate if necessary. Repair when convenient.	
47	De-rated Torque Curve Selected	25-77
71	Diagnostic Codes Output Signal stuck high	25-78
72	Diagnostic Codes Output Signal stuck low	25-80
73	Fuel Flow/Throttle Output Signal stuck high	25-81
74	Fuel Flow/Throttle Output Signal stuck low	25-83

[a]This fault does not impair the normal operation of the electronic governor.

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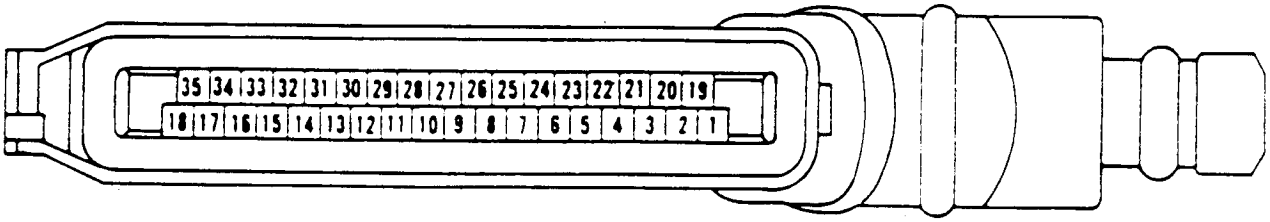
Code 11—Primary Analog Throttle Input Too High



X1 Connector

NOTE: Code 11 occurs when the ECU reads a voltage at the Throttle Input (Connector X1 pin 13) which is higher than the normal operating range of the throttle sensor.

IMPORTANT: When throttle input voltage measurements are required, the measured voltage must be corrected by the value of the Analog Throttle +5V voltage when comparing with specified voltage ranges. Refer to Analog Throttle Adjustments—Group 30, for how to measure and "correct" a throttle input voltage.

Step/Sequence	Result	Next
C11-1 Sensor Adjustment Check.		
With ignition on, slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Code 11 always present	Go to C11-2
Code 11 only present at upper portion of throttle lever travel	Refer to machine technical manual and adjust throttle sensor.	
C11-2 Throttle Linkage Check.		
Check throttle linkage and verify that throttle sensor does move through its range of travel as the throttle lever is moved from slow to fast idle.	Linkage OK	Go to C11-3
Problem found	Adjust throttle linkage and go to C11-90	
C11-3 Throttle Sensor Connector Check.		
Disconnect throttle sensor connector.	OK	Go to C11-4
Inspect terminals on both connector halves for damage, corrosion, and poorly positioned pins or sockets.	Problem found	Repair and go to C11-90
C11-4 +5 Volt Short Check.		
With ignition on and sensor still disconnected, measure voltage between harness throttle connector terminals C (+) and A (-).	Greater than 4 volts	Go to C11-5
Less than 4 volts	Go to C11-20	
C11-5 Sensor Open Diagnostic Check.		
With ignition on and sensor still disconnected, check diagnostic codes.	Code 12	Go to C11-6
Code 11	Go to C11-20	

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IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C11-6 Common Open Circuit Check.		
Turn ignition to 'OFF.' Disconnect connector X1 at ECU. Install a shorting jumper between throttle sensor harness connector terminals A and B. Measure resistance between X1 harness connector pins 13 and 35.	Less than 5 ohms	Replace sensor and go to C11-90
Greater than 5 ohms (Open circuit exists in harness between X1 connector pin 35 and throttle connector pin A.)	Repair and go to C11-90	
C11-20 ECU Connector Check.		
Turn ignition 'OFF'. Disconnect connector X1 at ECU. Inspect terminals of both connector halves for damage, dust, corrosion, and poorly positioned terminals.	OK	Go to C11-21
Problem found	Repair and go to C11-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C11-21 Harness Short Circuit Check.		
Turn ignition to 'OFF'. Measure resistance between X1 harness connector terminal 13 and all other X1 terminals.	All greater than 5 ohms	Go to C11-22
Any less than 5 ohms ..... (Short circuit exists in harness between X1 connector pin 13 and another circuit.)	Repair and go to C11-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C11-22 Harness External Short Check.		
With ECU and throttle sensor disconnected, turn ignition to 'ON'.	Less than 1 volt	Go to C11-23
Measure voltage from X1 connector pin 13 (+) to X1 connector pin 19 (-).	Greater than 1 volt ..... Short circuit exists in harness between X1 connector pin 13 and some voltage source.)	Repair and go to 11-90
C11-23 ECU Check.		
Reconnect connector X1 to ECU but leave throttle sensor disconnected. Turn ignition to 'ON'. Check diagnostic codes.	Code 11	Replace ECU and go to C11-90
Code 12 with or without ..... additional codes (Problem is no longer present.)	Diagnostics are complete. Go to C11-90 to see if problem will reoccur.	

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C11-90 Verify Repairs.

With ignition off, reconnect all connectors. Turn ignition to 'ON'. Slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Neither Code 11 nor Code 12 present	Go to C11-91
Code 11 always present	Review this section to find problem.	
Code 12 always present	Go to Code 12 procedure to find problem.	
Code 11 or Code 12 present ..... during a portion of the throttle lever travel.	Refer to machine technical manual for sensor adjustment instructions.	

C11-91 Verify Repairs.

Start engine. Verify that movement of throttle through its entire range gives engine speed range of slow to fast idle. Note diagnostic codes.	Throttle operation OK and ..... no diagnostic codes present.	Repairs are complete. Clear stored codes.
Throttle operation OK but ..... diagnostic codes present.	Go to appropriate section to continue service.	
No diagnostic codes but ..... low idle and/or high idle speeds cannot be obtained.	Refer to machine technical manual for sensor adjustment instructions.	
Throttle does not control ..... engine speed properly.	Review this section to find problem.	

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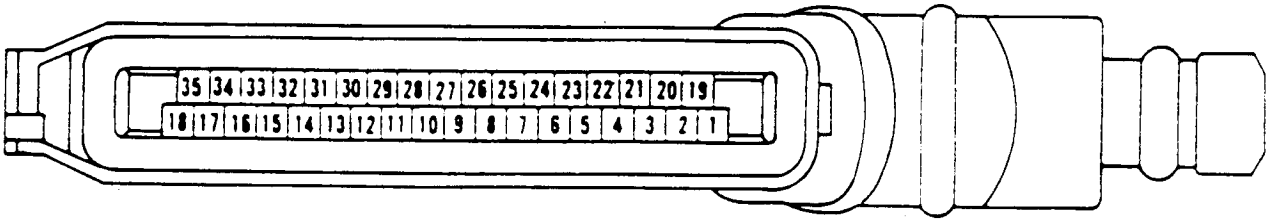
Code 12—Primary Analog Throttle Input Too Low



RG5368 –UN–19JAN89

X1 Connector

NOTE: Code 12 occurs when the ECU reads a voltage at the analog throttle input (Connector X1 pin 13) which is higher than the normal operating range of the throttle sensor.

IMPORTANT: When throttle input voltage measurements are required, the measured voltage must be corrected by the value of the Analog Throttle +5V voltage when comparing with specified voltage ranges. Refer to ANALOG THROTTLE ADJUSTMENTS—Group 30, for how to measure and 'correct' a throttle input voltage. (This applies to the Three-State Throttle and each analog Throttle that is used.)

Step/Sequence	Result	Next
C12-1 Sensor Adjustment Check.		
With ignition on, slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Code 12 always present	Go to C12-2
Code 12 only present at lower portion of throttle lever travel	Refer to machine technical manual for sensor adjustment instructions.	
C12-2 Throttle Linkage Check.		
Check throttle linkage and verify that throttle sensor does move through its range of travel as the throttle lever is moved from slow to fast idle.	Linkage OK	Go to C12-3
Problem found	Repair and go to C11-90	
C12-3 Throttle Sensor Connector Check.		
Disconnect throttle sensor connector. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned pins and sockets.	OK	Go to C12-4
Problem found	Repair and go to C11-90	
C12-4 Sensor Check. (A is ground, B is signal, and C is +5 volts.)		
When throttle connector disconnected, install a shorting jumper between throttle sensor harness connector terminals B and C. Check diagnostic codes.	Code 12	Go to C12-5
Code 11	Replace sensor and go to C11-90	
C12-5 ECU Connector Check.		
Turn ignition to 'OFF'. Disconnect connector X1 at ECU. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C12-6
Problem found	Repair and go to C11-90	

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IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C12-6 Harness Check. (This assumes connector configuration.)		
Shorting jumper should still be installed between throttle connector terminals B and C. Measure resistance between X1 harness connector, pins 13 and 17.	Less than 5 ohms	Go to C12-7
Greater than 5 ohms ..... (Open circuit exists in harness either in wire to X1 connector, pin 13 or in wire to X1 connector, pin 17.)	Repair and go to C11-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C12-7 Harness Check.		
Shorting jumper should still be installed between throttle connector terminals B and C. Measure resistance between X1 harness connector, pins 13 and all other X1 pins.	All greater than 5 ohms	Go to C12-8
Any less than 5 ohms ..... (Short circuit exists in harness between X1 connector, pin 13 or 17 and another circuit.)	Repair and go to C11-90	
C12-8 ECU Check.		
Reconnect connector X1 to ECU. With shorting jumper still installed between throttle connector terminals B and C, turn ignition to 'ON'. Check diagnostic codes.	Code 12	Replace ECU and go 10 C11-90
Code 11 with or without additional codes ..... (Problem is no longer present).	Go to C11-90 to see if Code 12 will reoccur.	

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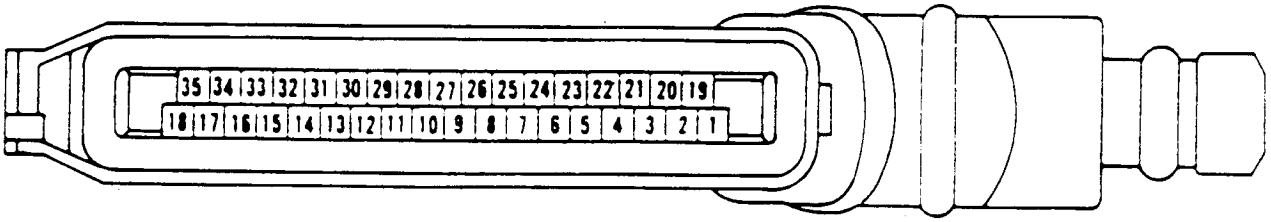
Code 13—Secondary Analog Throttle Input Too High



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X1 Connector

NOTE: Code 13 occurs when the ECU reads a voltage at the secondary analog throttle input (Connector X1 pin 34) which is higher than the normal operating range of the throttle sensor.

The +5V and signal for the secondary analog throttle may not be accessible at a service connector as is the primary throttle sensor. The engine application technical manual may have additional information for troubleshooting the secondary analog throttle input.

IMPORTANT: When throttle input voltage measurements are required, the measured voltage must be corrected by the value of the Analog Throttle +5V voltage when comparing with specified voltage ranges. Refer to ANALOG THROTTLE ADJUSTMENTS—Group 30, for how to measure and 'correct' a throttle input voltage. (This applies to the Three-State Throttle and each Analog Throttle that is used.)

Step/Sequence	Result	Next
C13-1 Sensor Adjustment Check.		
With ignition on, slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Code 13 always present	Go to C13-2
Code 13 only present at upper portion of throttle lever travel	Refer to machine technical manual for sensor adjustment instructions.	
C13-2 Throttle Linkage Check.		
Check throttle linkage and verify that throttle sensor does move through its range of travel as the throttle lever is moved from slow to fast idle.	Linkage OK	Go to C13-3
Problem found	Repair and go to C13-90	
C13-3 Throttle Sensor Connector Check.		
Disconnect throttle sensor connector. Inspect terminals on both connector halves for damage, corrosion, and poorly positioned pins or sockets.	OK	Go to C13-4
Problem found	Repair and go to C13-90	
C13-4 +5 Volt Short Check.		
With ignition on and sensor still disconnected, measure voltage between harness throttle connector terminals C (+) and A (-).	Greater than 4 volts	Go to C13-5
Less than 4 volts ...	Go to C13-20	
C13-5 Sensor Open Diagnostic Check.		
With ignition on and sensor still disconnected, check diagnostic codes.	Code 14	Go to C13-6
Code 13	Go to C13-23	

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IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C13-6 Common Open Circuit Check.		
Turn ignition to 'OFF'. Disconnect connector X1 at ECU. Install a shorting jumper between throttle sensor harness connector terminals A and B. Measure resistance between X1 harness connector pins 34 and 35.	Less than 5 ohms	Replace sensor and go to C13-90
	Greater than 5 ohms ..... (Open circuit exists in harness between X1 connector pin 35 and throttle connector pin A.)	Repair and go to C13-90
C13-20 ECU Connector Check.		
Turn ignition to 'OFF'. Disconnect connector X1 at ECU. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C13-21
	Problem found	Repair and go to C13-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C13-21 Harness Short Circuit Check.		
Turn ignition to 'OFF'.	All greater than 5 ohms	Go to C13-22
Measure resistance between X1 harness connector terminal 34 and all other X1 terminals.	Any less than 5 ohms ..... (Short circuit exists in harness between X1 Connector pin 34 and another circuit.)	Repair and go to C13-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C13-22 Harness External Short Circuit.		
With ECU and throttle sensor disconnected, turn ignition to 'ON'.	Less than 1 volt	Go to C13-23
Measure voltage from X1 connector pin 34 (+) to X1 connector pin 19 (-).	Greater than 1 volt ..... (Short circuit exists in harness between X1 connector pin 34 and some voltage source.)	Repair and go to C13-90
C13-23 ECU Check.		
Reconnect connector X1 to ECU but leave throttle sensor disconnected. Turn ignition to 'ON'. Check diagnostic codes.	Code 13	Replace ECU and go to C13-90
	Code 14 with or without ..... additional codes. (Problem is no longer present.)	Diagnostics are complete. Go to C13-90 to see if problem will reoccur.

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C13-90 Verify Repairs.

With ignition off, reconnect all connectors. Turn ignition to 'ON'. Slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Neither Code 13 nor Code 14 present	Go to C13-91
Code 13 always present	Review this section to find problem.	
Code 14 always present	Go to Code 14 procedure to find problem.	
Code 13 or Code 14 present ..... during a portion of the throttle lever travel.	Refer to machine technical manual for sensor adjustment instructions.	

C13-91 Verify Repairs.

Start engine. Verify that movement of throttle through its entire range gives engine speed range of slow to fast idle. Note diagnostic codes.	Throttle operation OK and ..... no diagnostic codes present.	Repairs are complete. Clear stored codes.
Throttle operation OK but ..... diagnostic codes present.	Go to appropriate section to continue service.	
No diagnostic codes but ..... slow idle and/or fast idle speeds cannot be obtained.	Refer to machine technical manual for sensor adjustment instructions.	
Throttle does not control ..... engine speed properly.	Review this section to find problem.	

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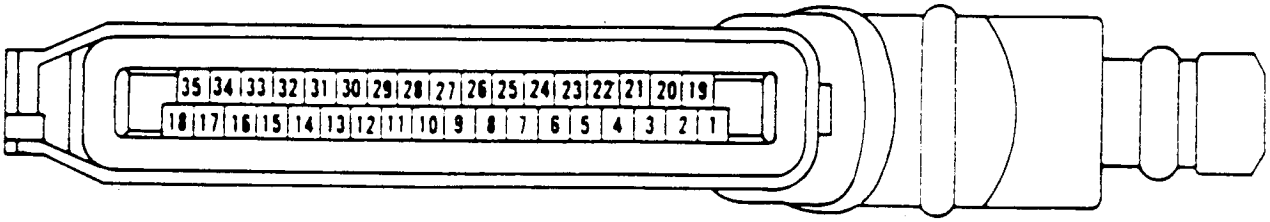
Code 14—Secondary Analog Throttle Input Too Low



X1 Connector

NOTE: Code 14 occurs when the ECU reads a voltage at the secondary analog throttle input (Connector X1 pin 34) which is lower than the normal operating range of the throttle sensor.

The +5V and signal for the secondary analog throttle may not be accessible at a service connector as is the primary throttle sensor. The machine technical manual may have additional information for troubleshooting the secondary analog throttle input.

IMPORTANT: When throttle input voltage measurements are required, the measured voltage must be corrected by the value of the Analog Throttle +5V voltage when comparing with specified voltage ranges. Refer to ANALOG THROTTLE ADJUSTMENTS—Group 30, for how to measure and 'correct' a throttle input voltage. (This applies to the Three-State Throttle and each Analog Throttle that is used.)

Step/Sequence	Result	Next
C14-1 Sensor Adjustment Check.		
With ignition on, slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Code 14 always present	Go to C14-2
Code 14 only present at lower portion of throttle lever travel	Refer to machine technical manual for sensor adjustment instructions.	
C14-2 Throttle Linkage Check.		
Check throttle linkage and verify that throttle sensor does move through its range of travel as the throttle lever is moved from slow to fast idle.	Linkage OK	Go to C14-3
Problem found	Repair and go to C13-90	
C14-3 Throttle Sensor Connector Check.		
Disconnect throttle sensor connector. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned pins and sockets.	OK	Go to C14-4
Problem found	Repair and go to C13-90	
C14-4 Sensor Check (This assumes connector configuration.)		
With throttle disconnected, install a shorting jumper between connector terminals B and C. Check diagnostic codes.	Code 14	Go to C14-5
Code 13	Replace sensor and go to C13-90	

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C14-5 ECU Connector Check.

Turn ignition to 'OFF'. Disconnect connector X1 at ECU. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C14-6
Problem found	Repair and go to C13-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C14-6 Harness Check (This assumes connector configuration).		
Shorting jumper should still be installed between throttle connector terminals B and C. Measure resistance between X1 harness connector, pins 34 and 28.	Less than 5 ohms	Go to C14-7
Greater than 5 ohms ..... (Open circuit exists in harness either in wire X1 connector, pin 34 or in wire to X1 connector, pin 28).	Repair and go to C13-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C14-7 Harness Check.		
Shorting jumper should still be installed between throttle connector terminals B and C. Measure resistance between X1 harness connector, pins 34 and all other X1 pins.	All greater than 5 ohms	Go to C14-8
Any less than 5 ohms ..... (Short circuit exists in harness between X1 connector, pin 34 or 28 and another circuit.)	Repair and go to C13-90	
C14-8 ECU Check.		
Reconnect connector X1 to ECU. With shorting jumper still installed between throttle terminals B and C, turn ignition to 'ON'. Check diagnostic codes.	Code 14	Replace ECU and go to C13-90
Code 13 with or without additional codes ..... (Problem is no longer present.)	Go to C13-90 to see if Code 14 will reoccur.	

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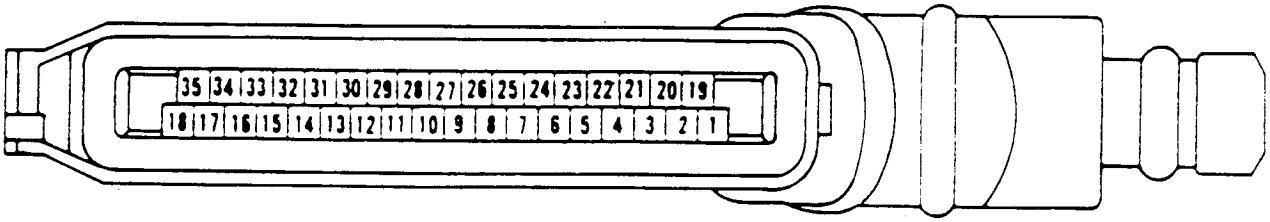
Code 32—Actuator Solenoid Circuit Fault



X1 Connector

NOTE: Code 32 occurs when the ECU has been attempting to drive the rack to a position greater than the zero fuel point for several seconds during which time the rack position has remained less than the zero fuel point. Once Code 32 is present, it will continue to be displayed until either the rack does move beyond the zero fuel point or the ECU goes through a power off and power on sequence.

The resistance of the actuator solenoid is nominally 0.7 ohms. Because of this low value, the multimeter used to measure resistance must have good low resistance measurement capabilities (in the range of 0—2 ohms).

IMPORTANT: Because of the location of X12, accessibility to this connector is difficult. On 6076 Engines remove the oil filter and oil filter housing when working with the X12 connector. On 6101 Engines, remove fuel filter and full flow oil filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. A special crowsfoot wrench (JDG646) is required for removal and replacement. When replacing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to damage. Also, make sure that connecting ring is completely engaged by tightening ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

Step/Sequence	Result	Next
C32-1 Actuator Connector Check.		
Turn ignition off. Disconnect connectors X7/X8. Inspect terminals of both connectors for damage, corrosion and poorly positioned pins and sockets.	OK	Go to C32-2
Problem found	Repair and go to C32-90	
C32-2 Actuator Solenoid Circuit Check.		
Measure resistance between X8 sockets A and B.	Between 0.5 and 1.5 ohms	Go to C32-3
Less than 0.5 ohms ..... (Short circuit in actuator circuit.)	Go to C32-2	
Greater than 1.5 ohms ..... (Open circuit in actuator circuit.)	Go to C32-30	

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C32-3 ECU Connector Check.

With ignition off, disconnect connector X1 at ECU. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C32-4
	Problem found	Repair and go to C32-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C32-4 Harness Open Circuit Check.		
Connectors X1 and X7 should be disconnected and ignition should be off. Measure resistance between X1 terminals 3 and 21.	Less than 5 ohms	Go to C32-5
	Greater than 5 ohms ..... (Open circuit exists in harness between measured points.)	Repair and go to C32-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C32-5 ECU Harness Open Circuit Check.		
Connectors X1 and X7 should be disconnected and ignition should be off . Measure resistance between X1 terminal 3 and X7 pin B.	Less than 5 ohms	Go to C32-6
	Greater than 5 ohms ..... (Open circuit exits in harness between measured points.)	Repair and go to C32-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C32-6 ECU Harness Short Circuit Check.		
With ignition off and connectors X1, X7 and X9 disconnected, measure resistance between X1 terminal 3 and all other X1 terminals except terminal 21.	All greater than 5 ohms	Go to C32-7
	Any less than 5 ohms ..... (Short circuit exists in harness between measured points.)	Repair and go to C32-90

Continued on next page

C32-7 Actuator +12V Check.

Reconnect X1 to ECU. Turn ignition on. Measure voltage from X7 pin A (+) to chassis ground (-).	Greater than 11 volts	Go to C32-8
Between 9 and 11 volts ..... (Battery voltage is low.)	Recharge batteries and go to C32-90	
Less than 9 volts ..... (Problem with +12V supply in harness.)	Repair and go to C32-90	

CAUTION: During the following test, be careful to keep the jumper leads isolated so that the battery +12V is not shorted to ground. Also, if the rack actuator is functioning correctly, about 20 amperes of current will be conducted during this check and a spark will occur when the circuit is broken. This condition should not be continued beyond a few seconds, as overheating of the actuator solenoid will occur.

Step/Sequence	Result	Next
C32-8 Rack Movement Check		
Reconnect X9 connector. Locate and uncap connector X3. With ignition on, monitor voltage from X3 socket C (+) to X3 socket D (-). Connect jumper wire from X8 socket B to chassis ground. Connect a second jumper wire from X8 socket A to +12V battery voltage. While the above connection is made, monitor voltage from X3 socket C (+) to X3 socket D (-) again.	Measured voltage changes from a value if 0.5 ± 0.1 V to a value greater than 4 V when +12V is applied to actuator solenoid	Go to C32-9
Measured voltage does not change as described above ..... (Rack is stuck or solenoid is defective.)	Replace pump and go To C32-90	
C32-9 ECU Check.		
With ignition at 'OFF', remove jumpers and reconnect all connectors. Attempt to start the engine. If engine does not start, be sure to crank continuously for at least 4 seconds. Monitor diagnostic codes.	Engine does not start and Code 32 still present	Replace ECU and go to C32-9
Engine does not start but no codes present .	Go to Initial Operational Checks earlier in this group.	
Engine starts and Code 32 no longer present ..... (Problem no longer present.)	Go to C32-90	
Code other than 32	Go to appropriate section to continue service	
C32-20 Actuator Connector Check.		
Disconnect connector X12 from injection pump (see note at beginning of Code 32 information). Inspect terminals of connector X12 for damage, corrosion and poorly positioned terminals.	OK	Go to C32-21
Problem found	Repair and go to C32-90	

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C32-21 Engine Harness Short Circuit Check.		
Measure resistance between X8 sockets A and B and inspect harness for potential short circuit locations.	Greater than 5 ohms and no problem areas seen	Go to C32-33
Less than 5 ohms or possible short circuit location seen	Repair and go to C32-90	

IMPORTANT: Because of the location of X12, accessibility to this connector is difficult. On 6076 Engines remove the oil filter and oil filter housing when working with the X12 connector. On 6101 Engines, remove fuel filter and full flow oil filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. A special crowsfoot wrench (JDG646) is required for removal and replacement. When replacing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to damage. Also, make sure that connecting ring is completely engaged by tightening ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

Step/Sequence	Result	Next
C32-30 Actuator Connector Check.		
Disconnect connector X12 from injection pump.	OK	Go to C32-31
Problem found ..... Inspect terminals of connector X12 for damage, corrosion and poorly positioned terminals.	Repair and go to C32-90	
C32-31 Engine Harness Open Circuit Check.		
Measure resistance between X8 socket A and X12 socket 7.	Less than 5 ohms	Go to C32-32
Greater than 5 ohms ..... (Open circuit exists between measured points.)	Repair and go to C32-90	
C32-32 Engine Harness Open Circuit Check.		
Measure resistance between X8 socket B and X12 socket 2.	Less than 5 ohms	Go to C32-33
Greater than 5 ohms ..... (Open circuit exists between measured points.)	Repair and go to C32-90	
C32-33 Actuator Solenoid Check.		
Measure resistance between actuator connector pins 2 and 7 on pump. See ACTUATOR CONNECTOR (X12) in Group 15—Robert Bosch Fuel System Connectors.	Less than 0.5 ohms or greater than 1.5 ohms	Replace pump and go to C32-90
Between 0.5 and 1.5 ohms (Problem not found.)	Go to C32-90 to see if problem will reoccur.	

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C32-90 Verify Repairs.

With ignition off, reconnect all connectors. Attempt to start engine noting diagnostic codes (if engine does not start, be sure to crank continuously for at least 4 seconds).	Engine starts and no diagnostic codes are present	Repairs are complete. Clear stored codes.
Engine does not start and Code 32 is still present.	Review this section to find problem.	
Codes other than Code 32	Go to appropriate section to continue service.	
Engine does not start but no diagnostic codes present	Go to Initial Operational Checks earlier in this group.	

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Code 34—Rack Position Error

NOTE: Code 34 occurs when the actual rack position of the injection pump differs from the rack position as commanded by the ECU while the engine speed is greater than a predetermined value. When the ECU detects this condition, it attempts to shut off fuel by turning off drive to the actuator solenoid and to the fuel shut-off solenoid. Therefore, Code 34 will normally only occur for a short period of time until the fuel shut-off condition brings the engine speed below the predetermined threshold value. Code 34 cannot occur when the engine is stopped. If Code 34 is occurring, irregular engine operation should be present.

If Codes 32, 35, or 36 are occurring with Code 34, go to the procedures for servicing those problems first.

Because of the limited circumstances in which Code 34 can occur, it is difficult to diagnose this problem. The procedure below is to be followed when Code 34 has been occurring during engine operation without other diagnostic codes being present. This may have been detected by seeing the code during engine operation or by using the stored codes feature after an engine malfunction to display codes that have occurred. Correction of this problem can only be accomplished by trail-and-error substitution of parts (except for the condition of the actuator solenoid output shorted to ground).

IMPORTANT: Because of the location of X12, accessibility to this connector is difficult. On 6076 Engines, remove the oil filter and oil filter housing when working with the X12 connector. On 6101 Engines, remove fuel filter and full flow oil filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. A special crowsfoot wrench (JDG646) may be required for removal and replacement of connector. When replacing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to thread damage. Also, make sure that connecting ring is completely engaged by torquing ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

Step/Sequence	Result	Next
C34-1 Diagnostic Code Check.		
With ignition on but engine not running, check diagnostic codes.	No diagnostic codes	Go to C34-2
Codes other than 34	Go to appropriate sections and complete other service before doing Code 34 service.	
C34-2 Engine Start Check.		
Attempt to start engine.	Engine starts and runs	Go to C34-3
Engine starts but runs up to over- speed	Turn off ignition and go to C34-20	

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C34-3 Engine Run Check.

Set engine speed at fast idle speed.	Code 34 only	Go to C34-4
Check diagnostic codes.	No codes present but previous engine operation has resulted in irregular operation with Code 34 occurring	Go to C34-4
Codes other than 34	Go to appropriate sections and complete other service first.	

C34-4 Injection Pump Replacement.

At this point the problem could be either in the actuator/injection pump combination or in the ECU. It is more likely for the problem to be located in the actuator or pump.

If the pump is replaced, run engine and check diagnostic codes (engine should be run at varying loads at full throttle).	Code 34 still present ..... (Pump was probably good.)	Go to C34-5
No diagnostic codes	Repairs are complete. Clear stored codes.	
Codes other than 34	Go to appropriate sections to continue service.	

C34-5 ECU Replacement.

If the ECU is replaced, run engine and check diagnostic codes (engine should be run at varying loads at full throttle).	No diagnostic codes	Repairs are complete
Code 34 still present	Review this section to find problem.	
Codes other than 34	Go to appropriate sections to continue service.	

C34-20 Connector Check

With ignition off, disconnect connectors X7 and X8. Inspect connectors for damage, corrosion, and poorly positioned terminals looking especially for short circuit possibilities.	OK	Go to C34-21
Problem found	Repair and go to C34-90	

C34-21 Engine Circuit Short Circuit Check

Measure resistance between X8 socket B and pump housing.	Greater than 5 ohms	Go to C34-22
Less than 5 ohms ..... (Resistance less than 5 ohms indicates presence of short.)	Repair and go to C34-30	

C34-22 ECU Harness Circuit Check.

Disconnect connector X1 at the ECU. Measure resistance between X7 pin B and chassis ground and inspect harness for potential short circuit locations.	Greater than 5 ohms and no problem areas seen	Go to C34-23
Less than 5 ohms or possible short circuit location seen ..... (Resistance less than 5 ohms indicates presence of short.)	Repair and go to C34-90	

C34-23 ECU Check.

Replace ECU, reconnect all harnesses, and test system by attempting to run the engine.	Engine starts and runs	Go to C34-90
Engine still does not run normally	Review this section to find problem.	

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IMPORTANT: Because of the location of X12, accessibility to this connector is difficult. On 6076 Engines, remove the oil filter and oil filter housing when working with the X12 connector. On 6101 Engines, remove fuel filter and full flow oil filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. A special crowsfoot wrench (JDG646) may be required for removal and replacement of connector. When replacing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to thread damage. Also, make sure that connecting ring is completely engaged by torquing ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

Step/Sequence	Result	Next
C34-30 Pump Connector Check.		
Disconnect X12 from pump. Inspect connectors for damage, corrosion, and poorly positioned terminals looking especially for short circuit possibilities.	OK	Go to C34-31
Problem found	Repair and go to C34-90	
C34-31 Engine Harness Short Circuit Check.		
Measure resistance between X8 socket B and chassis ground and inspect engine harness for potential short circuit locations.	Greater than 5 ohms and no problem areas seen	Go to C34-32
Less than 5 ohms or possible short circuit location seen	Repair and go to C34-90	
C34-32 Actuator Solenoid Check.		
Measure resistance between actuator connector pin 2 and pump housing.	Greater than 5 ohms	Problem was not found. Review this section to find problem. Look especially for harness shorts that may have been removed by moving the harnesses.
Less than 5 ohms	Replace pump and go to C34-90.	
C34-90 Verify Repairs.		
With ignition off, reconnect all connectors. Start engine and run at speeds from slow to fast idle at varying loads. Check diagnostic codes.	Engine runs OK and no diagnostic codes present	Repairs are complete. Clear stored codes.
Code 34 still occurs	Review this section to find problem.	
Codes other than 34	Go to appropriate section to continue	

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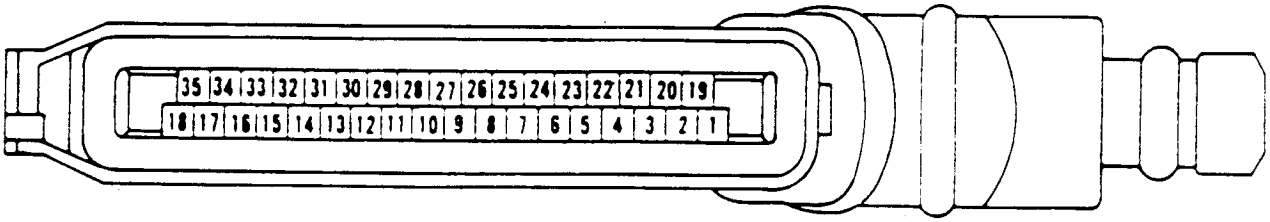
Code 35—Rack Position Voltage Too High



X1 Connector

NOTE: Code 35 occurs when the Rack Position Voltage (an internal voltage in the ECU) is higher than the normal operating range. A buffered output of this voltage is available at Connector X3 socket C.

The primary failure mode of the rack position sensor and its associated lead wires within the injection pump is a broken wire or connection. If a fracture of a wire or connection occurs, it is common for the circuit to have intermittent connection depending on temperature and vibration. This means that diagnosis may be difficult since an open circuit that has caused a malfunction may no longer be present when the diagnosis actually takes place. Therefore, if diagnosis is unsuccessful, it may be helpful to try running the engine to allow it to warm up or to try other means to duplicate the conditions which were present during the malfunction. It is also suggested that resistance checks be made as soon as possible after engine shutdown, if a diagnostic code had been present during engine operation.

IMPORTANT: Because of the location of X12, accessibility to this connector is difficult. On 6076 Engines, remove the oil filter and oil filter housing when working with the X12 connector. On 6101 Engines, remove fuel filter and full flow oil filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. A special crowsfoot wrench (JDG646) is required for removal and replacement of connector. When replacing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to thread damage. Also, make sure the connecting ring is completely engaged by tightening ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

Step/Sequence	Result	Next
C35-1 Connector Check.		
Turn ignition off. Disconnect connectors X9 and X10. Inspect connectors for damage, corrosion, and poorly positioned terminals.	OK	Go to C35-2
Problem found	Repair and go to C35-90	

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C35-2 Engine Circuit Check.		
Measure resistance between X10 sockets A and B.	Between 14 and 26 ohms	Go to C35-3
Less than 14 ohms ..... (Short circuit exists.)	Go to C35-20	
Greater than 26 ohms ..... (Open circuit exists.)	Go to C35-30	
C35-3 Engine Circuit Check.		
Measure resistance between X10 sockets B and C.	Between 14 and 26 ohms	Go to C35-4
Less than 14 ohms ..... (Short circuit exists.)	Go to C35-20	
Greater than 26 ohms ..... (Open circuit exists.)	Go to C35-30	
C35-4 Engine Circuit Check.		
Disconnect connector X8. Measure resistances between X10 socket B and the following points: a) X10 sockets D, E, F b) X8 sockets A—D c) Chassis ground	All greater than 2000 ohms	Go to C35-5
Any less than 2000 ohms ..... (Short circuit exists in engine circuit.)	Go to C35-20	
C35-5 Connector Check.		
Disconnect connector X1 at ECU. Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C35-6
Problem found	Repair and go to C35-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C35-6 ECU Harness Check.		
X1 and X9 should be disconnected. Install a jumper between X9 pins A and B. Measure resistance between X1 pins 6 and 10.	Less than 5 ohms	Go to C35-7
Greater than 5 ohms ..... (Open circuit exists in harness between X1 pin 10 and X9 pin A or between X1 pin 6 and X9 pin B.)	Repair and go to C35-90	

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IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C35-7 ECU Harness Check.		
X1 and X9 should be disconnected. Install a jumper between X9 pins B and C. Measure resistance between X1 pins 6 and 29.	Less than 5 ohms	Go to C35-8
Greater than 5 ohms ..... (Open circuit exists in harness between X1 pin 29 and X9 pin C or between X1 pin 6 and X9 pin B.)	Repair and go to C35-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C35-8 ECU Harness Check.		
X1 and X9 should be disconnected and without jumpers. Measure resistance between X1 pin 6 and all other X1 pins.	All greater than 2000 ohms	Go to C35-9
Any less than 2000 ohms ..... (Short circuit exists in harness between X1 pin 6 and another circuit.)	Repair and go to C35-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C35-9 ECU Harness Check.		
X1 and X9 should be disconnected and without jumpers. Measure resistance between X1 pin 10 and all other X1 pins.	All greater than 2000 ohms	Go to C35-10
Any less than 2000 ohms ..... (Short circuit exists in harness between X1 pin 10 and another circuit.)	Repair and go to C35-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C35-10 ECU Harness Check.		
X1 and X9 should be disconnected and without jumpers. Measure resistance between X1 pin 29 and all other X1 pins.	All greater than 2000 ohms	Go to C35-11
Any less than 2000 ohms ..... (Short circuit exists in harness between X1 pin 29 and another circuit.)	Repair and go to C35-90	

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C35-11 ECU Check.

Reconnect all connectors, turn ignition on (engine start not required). Check diagnostic codes.	Code 35 still present	Go to C35-12
Code 35 no longer present ..... (Problem is no longer present, but cause was not found. Allow engine to run for several minutes to see if Code 35 reappears.)	Go to C35-90	

C35-12 ECU Check.

At this point the problem could be one of the following:
1) Intermittent sensor in pump.
2) Intermittent wiring problem.
3) Failed ECU. Therefore, if ECU replacement does not permanently correct the problem, consider one of the other two possibilities.

Turn ignition to 'OFF'. Replace ECU. Turn ignition to 'ON' and check diagnostic codes.	Code 35 no longer present	Go to C35-90
Code 35 still present ..... (ECU was probably not bad.)	Diagnostics are complete. Review this section to find problem looking especially for intermittents.	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C35-20 Engine Harness Short Circuit Check.		
Disconnect connector X12 and connectors X8 and X10 if not already disconnected. Measure resistance between X10 socket A and the following: points: a) all other X10 sockets b) X8 sockets A - D c) chassis ground	All greater than 2000 ohms	Go to C35-21
Any less than 2000 ohms ..... (Short circuit exists in harness.)	Repair and go to C35-90	
C35-21 Engine Harness Short Circuit Check.		
Connectors X8, X10, and X12 should still be disconnected. Measure resistance between X10 socket B and the following points: a) all other X10 sockets b) X8 sockets A - D c) chassis ground	All greater than 2000 ohms	Go to C35-22
Any less than 2000 ohms ..... (Short circuit exists in harness.)	Repair and go to C35-90	
C35-22 Engine Harness Short Circuit Check.		
Connectors X8, X10, and X12 should still be disconnected. Measure resistance between X10 socket C and the following points: a) all other X10 sockets b) X8 sockets A - D c) chassis ground	All greater than 2000 ohms	Go to C35-40
Any less than 2000 ohms ..... (Short circuit exists in harness.)	Repair and go to C35-90	

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IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C35-30 Engine Harness Open Circuit Check.		
Disconnect connector X12 (X10 should still be disconnected.) Measure resistance between X10 socket A and X12 socket 1.	Less than 5 ohms	Go to C35-31
Greater than 5 ohms ..... (Harness is open circuit.)	Repair and go to C35-90	
C35-31 Engine Harness Open Circuit Check.		
Connectors X10 and X12 are still disconnected. Measure resistance between X10 socket and X12 socket 6.	Less than 5 ohms	Go to C35-32
Greater than 5 ohms ..... (Harness is open circuit.)	Repair and go to C35-90	
C35-32 Engine Harness Open Circuit Check.		
Connectors X10 and X12 are still disconnected. Measure resistance between X10 socket and X12 socket 5.	Less than 5 ohms	Go to C35-40
Greater than 5 ohms ..... (Harness is open circuit.)	Repair and go to C35-90	
C35-40 Sensor Check.		
Measure resistance between actuator connector pins 1 and 6.	Between 14 and 26 ohms	Go to C35-41
Less than 14 ohms or greater than 26 ohms	Replace pump and go to C35-90	
C35-41 Sensor Check.		
Measure resistance between actuator connector pins 5 and 6.	Between 14 and 26 ohms	Go to C35-42
Less than 14 ohms or greater than 26 ohms	Replace pump and go to C35-90	
C35-42 Sensor Short Circuit Check.		
Measure resistance between actuator connector pin 6 and the following points: a) actuator connector pins 2, 3, 4, 7 b) actuator housing	All greater than 2000 ohms ..... (Problem as seen in C35-2, C35-3, or C35-4 is no longer present.)	Go to C35-90 to see if problem still exists.
Any less than 2000 ohms ..... (Short circuit in actuator.)	Replace pump and go to C35-90	
C35-90 Verify Repairs.		
With ignition off, reconnect all connectors. Start engine and check diagnostic codes.	No diagnostic codes	Repairs are complete. Clear stored codes.
Code 35 still present	Review this section to find problem.	
Codes other than Code 35	Go to appropriate section to continue service.	

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Code 36—Rack Position Voltage Too Low

NOTE: Code 36 occurs when the rack position voltage (an internal voltage in the ECU) is lower than the normal operating range. A buffered output of this voltage is available at connector X3 socket C.

Code 36 will not result from any harness or connector problem. It can only result from a failed ECU or an incorrectly calibrated rack position sensor in the actuator. Diagnosis can only be accomplished by substitution of a good ECU or pump in the system to identify which of the two parts is bad.

IMPORTANT: Because of the location of X12, accessibility to this connector is difficult. On 6076 Engines, remove the oil filter and oil filter housing when working with the X12 connector. On 6101 Engines, remove fuel filter and full flow oil filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. A special crowsfoot wrench (JDG646) is required for removal and replacement of the connector. When replacing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to thread damage. Also, make sure that the connecting ring is completely engaged by tightening ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

Step/Sequence	Result	Next
C36-1 Rack Position Voltage Check.		
With ignition on and engine off, measure voltage from X3 socket C (+) to X3 socket D (-).		
Less than 0.5 volt	Go to C36-2	
Greater than 0.5 volt	Replace ECU and go to C36-90	
C36-2 ECU/Pump Check.		
Turn ignition to 'OFF'. Substitute either an ECU or a pump in the system. (This can be done by swapping connectors without removing the existing part until a final determination is made.) Turn ignition to 'ON' and check diagnostic codes.		
Code 36 still present	(Swapped part did not correct problem. Part that was disconnected is OK.)	Go to C36-3
Code 36 no longer present	Complete installation to repair part and go to C36-90	
C36-3 ECU/Pump Check.		
Turn ignition to 'OFF'. Put substituted part back on Replace remaining part. Turn ignition on and check diagnostic codes.		
Code 36 no longer present		Go to C36-90
Code 36 still present	Review this section to find problem.	
C36-90 Verify Repairs.		
With ignition off, complete any necessary installation and connect all connectors. Start engine and check diagnostic codes.		
No diagnostic codes		Repairs are complete Clear stored codes.
Code 36 still present	Review this section to find problem.	
Codes other than 36	Go to appropriate section to continue service.	

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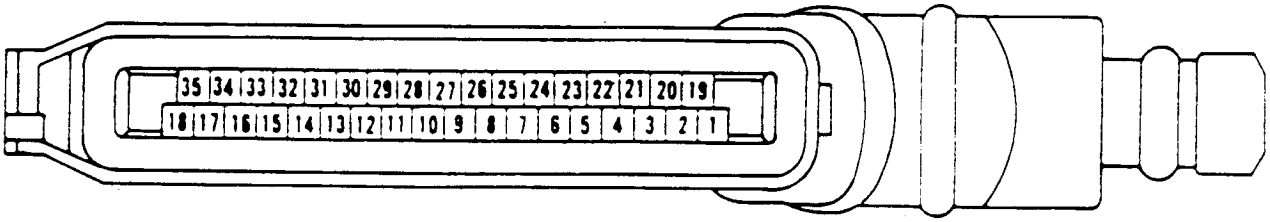
Code 37—Fuel Temperature Input Too High



X1 Connector

NOTE: Code 37 occurs when the ECU reads a voltage at the fuel temperature input (Connector X1 pin 24) which is higher than the normal operating range of the fuel temperature circuit. The sensor is a resistive device which has decreasing resistance with increasing temperature. This gives decreasing voltage at X1 pin 24 with increasing temperature.

Step/Sequence	Result	Next
C37-1 Sensor Check		
Disconnect connector X13.	Between 10,000 and 50,000 ohms	Go to C37-2
Measure resistance between the two sensor pins.	Less than 10,000 ohms	Go to C37-3
Greater than 50,000 ohms ..... (Sensor is open circuit.)	Replace sensor and go to C37-90	
C37-2 Sensor Check.		
A sensor resistance of between 10,000 and 50,000 ohms is only valid for temperature lower than -10°C (14°F). Refer to the temperature vs. resistance table and check to see if the sensor resistance corresponds to the sensor temperature.	Sensor resistance OK	Go to C37-3
Sensor resistance much higher than it should be for the current sensor temperature	Replace sensor and go to C37-90	

Temperature Sensor Characteristic

Temp. °C (°F)	Resistance (OHMS)
-20 (-4)	15300
0 (32)	5840
20 (68)	2500
40 (104)	1180
60 (140)	600
80 (176)	327
100 (212)	188

C37-3 Connector Check.		
Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C37-4
Problem found	Repair and go to C37-90	
C37-4 Voltage Check.		
Turn ignition to 'ON'. Measure voltage from X13 socket 3 (+) to X13 socket 2 (-).	Less than 5.5 volts	Go to C37-5
Greater than 5.5 volts	Go to C37-20	

Continued on next page

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C37-5 Diagnostic Check.		
Install shorting jumper between X13 sockets 2 and 3. With ignition	Code 37	Go to C37-6
	Code 38	Go to C37-20
C37-6 Connector Check.		
Turn ignition to 'OFF'. Disconnect ECU connector X1 Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C37-7
	Problem found	Repair and go to C37-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C37-7 Harness Check.		
Shorting jumper should still be installed between X13 sockets 2 and 3.	Less than 5 ohms	Go to C37-8
Measure resistance between X1 pins 24 and 35.	Greater than 5 ohms ..... (Open circuit exists in harness either in wire to X1 pin 24 or in wire to X1 pin 35.)	Go to C37-30
C37-8 ECU Check.		
Reconnect ECU connector X1 Install shorting jumper between X13 sockets 2 and 3 if not already present. Turn ignition to 'ON'. Check diagnostic codes.	Code 37	Replace ECU and go to C37-90
	Code 38 ..... (Problem is no longer present.)	Go to C37-90
C37-20 Connector Check.		
Turn ignition to 'OFF'. Disconnect ECU connector X1 Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C37-21
	Problem found	Repair and go to C37-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C37-21 Harness Check.		
Connectors X1 and X13 should still be disconnected. Remove shorting jumper between X13 sockets 2 and 3. Measure resistances between X1 harness connector pin 24 and all other X1 pins.	All greater than 5 ohms	Go to C37-22
	Any less than 5 ohms ..... (Short circuit exists in harness between X1 pin 24 and another circuit.)	Go to C37-40

Continued on next page

C37-22 External Short Check.		
Inspect the engine harness routing and look for any location where a possible short with another harness or device could be present.	OK	Go to C37-8
Problem found	Repair and go to C37-90	
C37-30 Connector Check.		
Disconnect connectors X9 and X10. Inspect both connectors for damage, corrosion, and poorly positioned terminals.	OK	Go to C37-31
Problem found	Repair and go to C37-90	
C37-31 Engine Harness Check.		
Shorting jumper should still be installed between X13 sockets 2 and 3. Measure resistance between X10 sockets D and F.	Less than 5 ohms	Go to C37-32
Greater than 5 ohms ..... (Open circuit exists between connectors X10 and X13 either in wire to X10 socket D or in wire to X10 socket F.)	Repair and go to C37-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C37-32 ECU Harness Check.		
Install shorting jumper between X9 pins D and F. Measure resistance between X1 pins 24 and 35.	Less than 5 ohms ..... (Problem is no longer present)	Go to C37-90 to see if problem still exists.
Greater than 5 ohms ..... (Open circuit exists between connectors X1 and X9 either in wire to X1 pin 24 or in wire to X1 pin 35.)	Repair and go to C37-90	
C37-40 Connector Check.		
Disconnect connectors X9 and X10. Inspect both connectors and their lead wires for damage, corrosion, and poorly positioned terminals.	OK	Go to C37-41
Problem found	Repair and go to C37-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C37-41 Harness Check Without Engine Harness.		
Measure resistance between X1 harness connector pin 24 and all other X1 pins. (Check to see if short found in Step C37-21 is still present.)	All greater than 5 ohms ..... (Problem not present without engine harness connected.)	Go to C37-42
Any less than 5 ohms ..... (Short circuit exists in ECU harness between X1 pin 24 and another circuit.)	Repair ECU harness and go to C37-90	

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C37-42 Engine Harness Check.

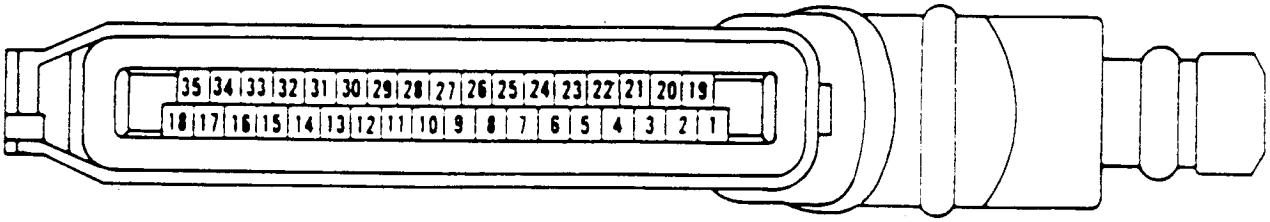
Inspect engine harness looking for short circuits between X10 socket D and another circuit.	OK ..... (Problem is no longer present or was not found.)	Go to C37-90
Problem found	Repair and go to C37-90	

C37-90 Verify Repairs.

With ignition off, reconnect all connectors. Turn ignition to 'ON'. Check diagnostic codes.	Code 37	Review this section to find problem
Codes other than Code 37	Go to appropriate section to continue service.	
No codes present	Repairs are complete. Clear stored codes.	

S55,2000,BV –19–02MAR94–4/4

Code 38—Fuel Temperature Input Too Low



X1 Connector

NOTE: Code 38 occurs when the ECU reads a voltage at the fuel temperature input (connector X1 pin 24) which is lower than the normal operating range of the fuel temperature circuit.

The sensor is a resistive device which has decreasing resistance with increasing temperature. This gives decreasing voltage at X1 pin 24 with increasing temperature.

Step/Sequence	Result	Next
C38-1 Sensor Check.		
Disconnect connector X13.	Greater than 50 ohms and in agreement with the table of resistance versus temperature values	Go to C38-2
Measure resistance between the two temperature sensor pins.	Greater than 50 ohms but much less than what the table of resistance versus temperature indicates	Replace sensor and go to C38-90
Less than 50 ohms	Replace sensor and go to C38-90	

Temperature Sensor Characteristic

Temp. °C (°F)	Resistance (OHMS)
-20 (-4)	15300
0 (32)	5840
20 (68)	2500
40 (104)	1180
60 (140)	600
80 (176)	327
100 (212)	188

C38-2 Sensor Connector Check.		
Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C38-3
Problem found	Repair and go to C38-90	
C38-3 Diagnostic Check.		
With sensor still disconnected, turn ignition to 'ON'. Check diagnostic codes.	Code 38	Go to C38-4
Code 37 ..... (Problem is no longer present.)	Go to C38-90 to see if problem will reoccur.	
C38-4 Connector Check.		
Disconnect connectors X9 and X10. Inspect both connectors and their lead wires for damage, corrosion and poorly positioned terminals.	OK	Go to C38-5
Problem found	Repair and go to C38-90	

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C38-5 Diagnostic Check Without Engine Harness.		
Connectors X9 and X10 should be disconnected.	Code 38	Go to C38-6
With ignition on, check diagnostic codes.	Code 37 ..... (Short exists in engine harness between X10 socket D and another circuit in the harness or between X10 socket D and something external to the harness.)	Repair and go to C38-90
C38-6 ECU Connector Check.		
Turn ignition off. Disconnect connector X1 Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C38-7
Problem found	Repair and go to C38-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C38-7 Harness Check.		
Measure resistance between X1 harness connector pin 24 and all other X1 pins.	All greater than 5 ohms	Go to C38-8
Any less than 5 ohms ..... (Short circuit exists in ECU harness between X1 pin 24 and another circuit.)	Repair and go to C38-90	
C38-8 External Short Check.		
Inspect the ECU harness routing and look for any location where a possible short with another harness or device could be present.	OK	Go to C38-9
Problem found	Repair and go to C38-90	
C38-9 ECU Check.		
Reconnect ECU connector X1. Engine harness (X9/X10) should still be disconnected Turn ignition to 'ON'. Check diagnostic codes.	Code 38	Replace ECU and go to C38-90
Code 37 ..... (Problem is no longer present).	Go to C38-90	
C38-90 Verify Repairs.		
With ignition off, reconnect all connectors. Turn ignition to 'ON'. Check diagnostic codes.	Code 38	Review this section to find problem.
Codes other than Code 38	Go to appropriate section to continue service.	
No codes present	Repairs are complete. Clear stored codes.	

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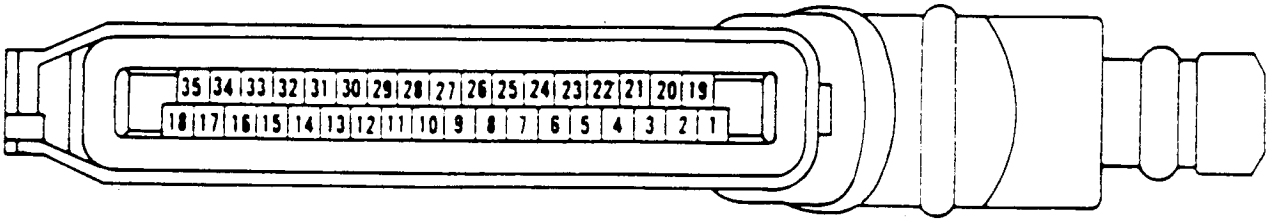
Code 39—Primary Speed Input Error



X1 Connector

NOTE: Code 39 occurs when the signal from the primary speed sensor (located within the actuator) either stops or becomes erratic while the auxiliary speed continues to be valid. Code 39 cannot occur while engine speed is zero.

An intermittent connection may be affected by temperature and vibration. This means that diagnosis may be difficult since an open circuit that has caused a malfunction may no longer be present when the diagnosis actually takes place. Therefore, if diagnosis is unsuccessful, it may be helpful to try running the engine to allow it to warm up or to try other means to duplicate the conditions which were present during the malfunction. It is also suggested that resistance checks be made as soon as possible after engine shutdown, if a diagnostic code had been present during engine operation.

IMPORTANT: Because of the location of X12, accessibility to this connector is difficult. On 6076 Engines, remove the oil filter and oil filter housing when working with X12 connector. On 6101 Engines, remove fuel filter and full flow filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. A special crowsfoot wrench (JDG646) is required for removal and replacement. When replacing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to thread damage. Also, make sure that connecting ring is completely engaged by tightening ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

Step/Sequence	Result	Next
C39-1 Connector Check.		
Turn ignition off. Disconnect X9 and X10. Inspect terminals of both connectors for damage, corrosion and poorly positioned pins or sockets.	OK	Go to C39-2
Problem found	Repair and go to C39-90	

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C39-2 Engine Harness Check.

Measure resistance between X10 sockets E and F. (See note on previous page.)	Between 600 and 1500 ohms	Go to C39-3
	Less than 600 ohms ..... (Short circuit exists in harness or sensor.)	Go to C39-20
	Greater than 1500 ohms ..... (Open circuit exists in harness or sensor.)	Go to C39-30

C39-3 Engine Harness Check.

Measure resistance between X10 socket E and all other X10 sockets and between X10 Socket E and chassis ground	All greater than 600 ohms ..... (Sockets A, B, C should be open circuit. Socket D and F should have resistance greater than 600 ohms.) Socket E to chassis ground should be open circuit.	Go to C39-4
	Any less than 600 ohms ..... (Short circuit exists in harness between X10 socket E and another circuit.)	Repair and go to C39-90

C39-4 Connector Check.

Disconnect connector X1 at ECU. Inspect terminals at both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C39-5
	Problem found	Repair and go to C39-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C39-5 ECU Harness Check.		
With connectors X1, X9 and X10 still disconnected, install a jumper between X9 pins E and F. Measure resistance between X1 harness connector pins 31 and 35.	Less than 5 ohms	Go to C39-6
	Greater than 5 ohms ..... (Open circuit exists in harness between X1 and 31 and X9 pin E or between X1 pin 35 and X9 pin F.)	Repair and go to C39-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C39-6 ECU Harness Check.		
Remove jumper from X9 pins E and F Measure resistance between X1 harness connector terminal 31 and all other X1 pins.	All greater than 5 ohms	Go to C39-7
	Any less than 5 ohms ..... (Short circuit exists in harness between X1 pin 31 and another circuit.)	Repair and go to C39-90

Continued on next page

C39-7 ECU Check.		
Reconnect all connectors. Start engine and check diagnostic codes.	Code 39 still present	Go to C39-8
Code 39 no longer present ..... (Problem is no longer present but cause was not found. Allow engine to run for several minutes to see if Code 39 reappears.)	Go to C39-90	
C39-8 ECU Check.		
At this point the problem could be one of the following: 1) Intermittent sensor in pump. 2) Intermittent wiring problem. 3) Failed Engine Controller. Therefore, if Engine Controller replacement does not permanently correct the problem, consider one of the other two possibilities.		
Stop engine and turn ignition to 'OFF'. Replace ECU. Start engine and check diagnostic codes.	Code 39 no longer present	Go to C39-90
Code 39 still present ..... (ECU was probably not bad.)	Diagnostics are complete. Review this section to find problem looking especially for intermittent problems.	

IMPORTANT: Because of the location of X12, accessibility to this connector is difficult. On 6076 Engines, remove the oil filter and oil filter housing when working with X12 connector. On 6101 Engines, remove fuel filter and full flow filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. A special crowsfoot wrench (JDG646) is required for removal and replacement. When replacing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to thread damage. Also, make sure that connecting ring is completely engaged by tightening ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

Step/Sequence	Result	Next
C39-20 Actuator Connector Check.		
Disconnect connector X12 from injection pump. Inspect terminals of connector X12 for damage, corrosion, and poorly positioned terminals.	OK	Go to C39-21
Problem found	Repair and go to C39-90	
C39-21 Engine Harness Check.		
Connectors X10 and X12 should be disconnected. Measure resistance between X10 socket E and all other X10 sockets.	All greater than 5 ohms	Go to C39-22
Any less than 5 ohms ..... (Short circuit exists in harness.)	Repair and go to C39-90	
C39-22 Sensor Check.		
Measure resistance between pump connector pins 3 and 4.	Between 600 and 1500 ohms ..... (Problem not found)	Diagnostics are complete. GO to C39-90 to see if problem still exists.
Less than 600 ohms	Replace pump and go to C39-90	
Greater than 1500 ohms	Replace pump and go to C39-90	

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IMPORTANT: Because of the location of X12, accessibility to this connector is difficult. On 6076 Engines, remove the oil filter and oil filter housing when working with X12 connector. On 6101 Engines, remove fuel filter and full flow filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. A special crowsfoot wrench (JDG646) is required for removal and replacement. When replacing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to thread damage. Also, make sure that connecting ring is completely engaged by tightening ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

Step/Sequence	Result	Next
C39-30 Actuator Connector Check		
Disconnect connector X12 from injection pump. Inspect terminals of connector X12 for damage, corrosion and poorly positioned terminals.	OK	Go to C39-31
Problem found	Repair and go to C39-90	
C39-31 Engine Harness Check.		
Connectors X10 and X12 are still disconnected.	Less than 5 ohms	Go to C39-32
Measure resistance between X10 socket E and X12 socket 3.	Greater than 5 ohms ..... (Open circuit exists in harness between X10 socket E and X12 socket 3.)	Repair and go to C39-90
C39-32 Engine Harness Check.		
Connectors X10 and X12 are still disconnected. Measure resistance between X10 socket F and X12 socket 4.	Less than 5 ohms	Go to C39-33
Greater than 5 ohms ..... (Open circuit exists in harness between X10 socket F and X12 socket 4.)	Repair and go to C39-90	
C39-33 Sensor Check.		
Measure resistance between actuator connector pins 3 and 4.	Between 600 and 1500 ohms	Diagnostics are complete. Go to C39-90 to see if problem still exists.
Greater than 1500 ohms or less than 600 ohms	Replace pump and go to C39-90	
C39-90 Verify Repairs.		
With ignition off, reconnect all connectors. Start engine and run through entire speed range from slow idle to fast idle and check for diagnostic codes.	No diagnostic codes present	Repairs are complete. Clear stored codes.
Code 39 still present	Review this section to find problem.	
Codes other than Code 39	Go to appropriate section to continue service.	

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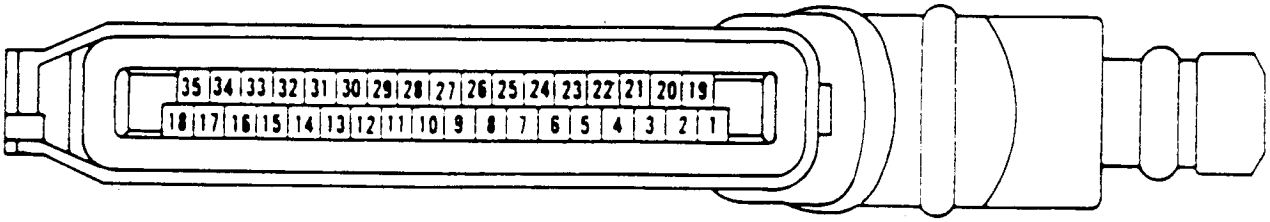
Code 41—Start Signal Missing



X1 Connector

NOTE: Code 41 occurs when the engine speed has increased above slow idle speed without a 'Start Signal' having been present at Connector X1 pin 33. A Start Signal is recognized when the voltage at X1 pin 33 is greater than about 3 volts. This input is typically connected to the starter relay circuit such that battery voltage is present when the ignition switch is in the START position. When this input is active and engine speed is less than minimum idle speed, the ECU commands the injection pump rack to starting fuel position. Code 41 is cleared when a Start Signal occurs or after a power-off and power-on sequence.

The engine can be started and will run normally without the Start Signal available. However, during adverse starting conditions, the Start Signal may provide an advantage for starting because the rack is positioned for start slightly in advance of engine cranking.

CAUTION: Instruction is given to crank the engine during test steps C41-2 and C41-4. Although the engine will not start because of the disconnected governor system connectors, be aware that the engine will be cranking and use appropriate safeguards.

Step/Sequence	Result	Next
C41-1 ECU Connector Check.		
With ignition off, disconnect connector X1 at ECU. Inspect pin 33 of X1 for damage, corrosion, and poor positioning.	OK	Go to C41-2
Problem found	Repair and go to C41-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C41-2 Start Signal Voltage Check. (See note on previous page.)		
Ignition should still be at 'OFF'. and X1 disconnected. Turn ignition switch to 'START' position while monitoring voltage from X1 pin 33 (+) to chassis ground.	Equal to battery voltage	Go to C41-3
(Engine will crank but not start with ECU disconnected.) Note the voltage when in the 'START' position.	Less than 3 volts ..... (Start Signal is not present in the harness to the ECU.)	Repair and go to C41-90

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C41-3 Diagnostic Code Check.

With ignition off, reconnect connector X1 at ECU. Disconnect connectors X7/X8. Turn ignition on but do not go to the 'START' position. Check diagnostic codes.	Code 41 not present	Go to C41-4
Code 41 present	Go to C41-20	

C41-4 Diagnostic Code Check During Start. (See Note on previous page.)

With connectors X7/X8 still disconnected, put ignition switch in 'START' position for at least 2 seconds. (Engine will not start with X7 and X8 disconnected.) Check diagnostic codes. Ignore code 32	Code 41 present ..... (Operation may continue without significant loss of starting performance above -29°C (-17°F)	Replace ECU if starting performance is affected and to go C41-90
Code 41 not present	Go to C41-5	

C41-5 Check For Intermittent Power to Controller

Reconnect connectors X7 and X8. With ignition ON, check stored codes for code 41. MAKE WRITTEN NOTE OF ALL STORED CODES then clear stored codes. Operate engine at various speeds in order to generate Code 41. Listen for 'missing'. Then check stored codes again.	Code 41 present ..... (supply voltage to ECU may be intermittent.)	Look for poor power or ground connections between battery and ECU.
Code 41 not present ..... (Problem is no longer occurring.)	Go to C41-90	

C41-20 Code 41-With-No-Engine-Speed Evaluation.

If Code 41 occurs at power-on before an engine speed is present, there are three possible causes. The Transmit Stored Codes Input (ECU pin 30) is shorted to ground in the harness or in the diagnostic reader causing a previously stored code to be displayed, or a false engine speed signal is present at one of the two speed inputs (ECU pins 9 and 31), or the ECU is defective. Proceed as follows:

1) Verify that stored diagnostic codes are not being transmitted (by checking to see that X4 socket B is greater than 3 volts).

2) Inspect the governor harness for potential problems such as open circuits, short circuits or interference with other devices.

3) If the above points do not uncover a problem, replace the ECU and test to see if the problem is corrected by performing Step C41-90.

C41-90 Verify Repairs.

With ignition off, reconnect all connectors. Start engine and check diagnostic codes.	No diagnostic codes	Repairs are complete. Clear stored codes.
Code 41 still present	Review this section to find problem.	
Codes other than Code 41	Go to appropriate section to continue service.	

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Code 42—Engine Overspeed

Code 42 does not necessarily mean there is a hardware problem present. Code 42 occurs when the engine speed is greater than a pre-programmed value in the Engine Controller memory. This can be caused by rapid downshifting, or coasting downhill while towing an implement, wagon, etc. However, if Code 42 has occurred, potentially damaging high engine speeds may have been present.

When Code 42 is present, the controller commands zero rack position for the injection pump. When engine speed drops below the pre-programmed value for overspeed, the controller stops sending Code 42.

If Code 42 occurs, it is possible that a problem does exist in the governor system. For example, if the rack actuator cannot obtain zero rack position during an engine overspeed condition, Code 34 will be sent and the Fuel Shut-off Solenoid output will be turned off until the engine speed drops to a much lower speed. In this case, engine overspeed may have been caused by the uncontrollable rack position indicated by Code 34. Therefore, check stored codes for an indication of the cause of the engine overspeed, especially Codes 32, 34, 35 or 36.

If Code 42 occurs or is stored and the engine is dying or 'missing' instead of overspeeding, it may be the result of a loose connection leading to connector X12, or an intermittent failure within the actuator housing. See Troubleshooting Suggestions at the beginning of this group under Checking Wiring and Connectors, and Looking for Intermittent Problems. Code 39 or 44 may also be stored as a result.

S55,2000,CH –19–02MAR94–1/1

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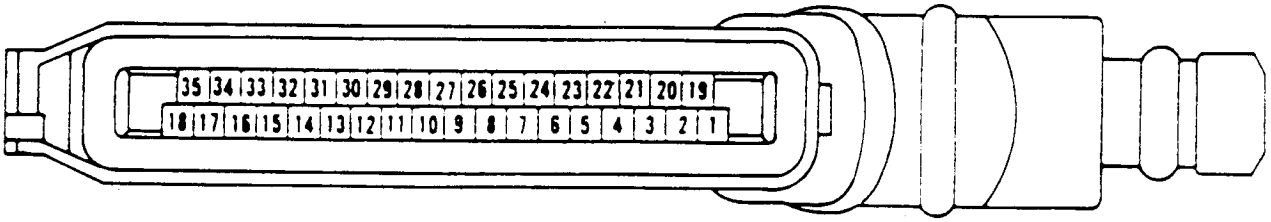
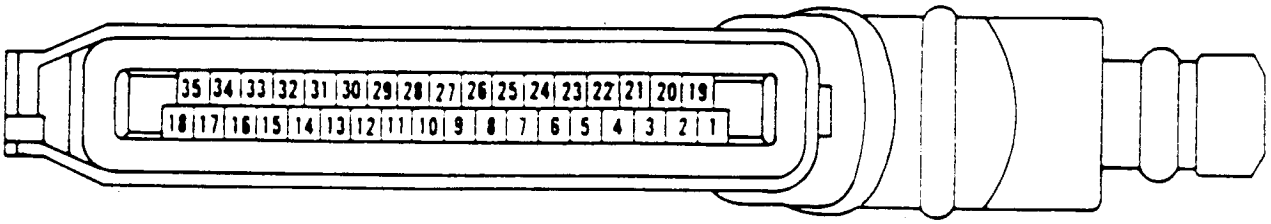
Code 43—PWM (Throttle Input Erratic, Too Short or Too Long)



X1 Connector



X1 Connector

NOTE: Code 43 can only occur in a system which includes a PWM throttle command to the governor system from another control system. When this input is present, it is used to provide the throttle command for governor operation instead of the analog or 3-state throttle inputs. Code 43 is generated when the PWM throttle had been present but is now missing or when the pulse width is out-of-range. If the PWM throttle has not been present since the ECU was powered on, no diagnostic code occurs.

The PWM throttle input originates from another system and can be connected to the governor system in various ways depending on the application. The service technician should refer to machine technical manual for details of the PWM throttle harness connections. However, the following procedure is given in general terms to assist in diagnosing this problem.

Step/Sequence	Result	Next
C43-1 Signal Source Check.		
Check the signal source system if possible to verify that it is functioning properly.	System OK	Go to C43-2
Problem found	Repair other system then go to C43-90 of this procedure.	
C43-2 ECU Connector Check.		
With ignition off, disconnect connector X1 at ECU. Inspect terminal 27 of X1 for damage, corrosion, and poor positioning.	OK	Go to C43-3
Problem found	Repair and go to C43-90	

Continued on next page

C43-3 Signal Source Connector Check.		
Obtain wiring information on this application and determine the source of the PWM throttle signal. Locate this source and inspect the connector for damage, corrosion, and poor contact positioning.	OK	Go to C43-4
Problem found	Repair and go to C43-90	
C43-4 Harness Open Circuit Check.		
Check for open circuit between X1 pin 27 and signal source connector by measuring resistance of this wire.	Resistance less than 5 ohms	Go to C43-5
Resistance greater than 5 ohms ..... (Open circuit is present.)	Repair and go to C43-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C43-5 Harness Short Circuit Check.		
Check for short circuit between X1 pin 27 and another circuit by measuring resistance between X1 pin 27 and the following points: 1) All other X1 pins 2) All other pins of signal source connector	Resistance in all checks greater than 5 ohms	Go to C43-6
Any one resistance measurement less than 5 ohms ..... (Short circuit exists.)	Repair and go to C43-90	
C43-6 ECU Check.		
Reconnect all connectors. Start engine, operate system, and monitor diagnostic codes.	Code 43 still present	Go to C43-7
Code 43 no longer present ..... (Problem is no longer present.)	Go to C43-90	
C43-7 Controller Replacement		
At this point the problem could be either of the following: 1) Failure in signal source system, or 2) Failed governor ECU. Therefore, if ECU replacement does not correct the problem, investigate the signal source system for problems.		
With ignition off, replace the ECU. With all connectors reconnected, start engine, operate system, and monitor diagnostic codes.	Code 43 no longer presents	Go to C43-90
Code 43 still present (ECU was probably not bad.)	Diagnostics are complete. Review this section to find problem and/or check signal source system.	
C43-90 Verify Repairs.		
With ignition off, reconnect all connectors. Start engine, operate system, and monitor diagnostic codes.	No diagnostic codes	Repairs are complete. Clear stored codes.
Code 43 still present	Review this section to find problem.	
Codes other than Code 35	Go to appropriate section to continue service.	

S55,2000,ES –19–02MAR94–2/2

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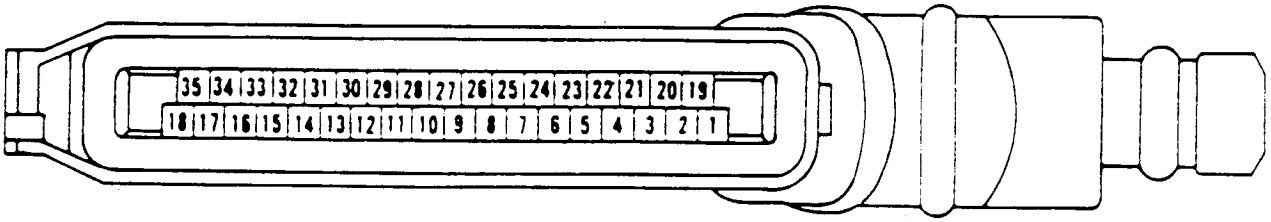
Code 44—Auxiliary Speed Input Error



X1 Connector

NOTE: Code 44 occurs when the signal from the auxiliary speed sensor stops or becomes erratic while the primary speed continues to be valid. Code 44 cannot occur while engine speed is zero.

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C44-1 Sensor Installation Check.		
Inspect sensor installation and verify that sensor is fully inserted into mounting hole and inserted into properly secured.	OK	Go to C44-2
Problem found	Adjust and go to C44-90	
C44-2 Connector Check.		
Turn ignition to 'OFF'. Disconnect connector X2 at speed sensor. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned pins and sockets.	OK	Go to C44-3
Problem found	Repair and go to C44-90	
C44-3 Sensor Check.		
Measure resistance between sensor connector terminals. (Results assume a John Deere RE12180 sensor.)	Between 300 and 700 ohms	Go to C44-4
Less than 300 or greater than 700 ohms	Replace sensor and go to C44-90	
C44-4 Connector Check.		
Disconnect connectors X7-X10 Inspect terminals of these connectors for damage, corrosion, and poorly positioned pins and sockets.	OK	Go to C44-5
Problem found	Repair and go to C44-90	
C44-5 Engine Harness Check.		
Connectors X2 and X7-X10 should still be disconnected. Measure resistance between X8 socket D and all other X8 and X10 sockets.	All greater than 5 ohms	Go to C44-6
Any less than 5 ohms ..... (Short circuit exists in harness.)	Repair and go to C44-90	

Continued on next page

C44-6 Engine Harness Check.		
Measure resistance between X2 pin A and X8 socket D.	Less than 5 ohms	Go to C44-7
Greater than 5 ohms ..... (Open circuit exists between measured points.)	Repair and go to C44-90	
C44-7 Engine Harness Check.		
Measure resistance between X2 pin B and X10 socket F.	Less than 5 ohms	Go to C44-8
Greater than 5 ohms ..... (Open circuit exists between measured points.)	Repair and go to C44-90	
C44-8 Connector Check.		
Disconnect connector X1 at ECU Inspect terminals at both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C44-9
Problem found	Repair and go to C44-90	

Step/Sequence	**Result**	**Next**
C44-9 ECU Harness Check.		
With connectors X1 and X7-X10 disconnected, install a jumper between X7 pin D and X9 pin F. Measure resistance between X1 harness connector pin 9 and pin 35.	Less than 5 ohms	Go to C44-10
Greater than 5 ohms ..... (Open circuit exists in harness between X1 pin 9 and X7 pin D or X1 pin 35 and X9 pin F.)	Repair and go to C44-90	
C44-10 ECU Harness Check.		
Remove jumper from X7 and X9. Measure resistance between X1 harness connector pin 9 and all other X1 pins.	All greater than 5 ohms	Go to C44-11
Any less than 5 ohms ..... (Short circuit exists in harness between X1 pin 9 and another circuit.)	Repair and go to C44-90	
C44-11 ECU Check.		
Reconnect all connectors. Start engine and check diagnostic codes.	Code 44 still present	Go to C44-12
Code 44 no longer present ..... (Problem is no longer present but cause was not found.) Allow engine to run for several minutes to see if Code 44 reappears.	Go to C44-90	
C44-12 ECU Check		
At this point the problem could be one of the following: 1) Intermittent speed sensor 2) Intermittent wiring problem or 3) Sensor installed incorrectly or 4) Failed Engine Controller. Therefore, if Engine Controller replacement does not permanently correct the problem, consider one of the other possibilities.		
Stop engine and turn ignition to 'OFF'. Replace ECU. Start engine and check diagnostic codes.	Code 44 no longer present	Go to C44-90
Code 44 still present ..... (ECU was probably not bad.)	Diagnostics are complete. Review this section to find problem looking especially for intermittent problems.	

Continued on next page

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C44-90 Verify Repairs.

With ignition off, reconnect all connectors. Start engine and check diagnostic codes.	No diagnostic codes	Repairs are complete. Clear stored codes.
Code 44 still present	Review this section to find problem.	
Codes other than Code 44	Go to appropriate section to continue service.	

S55,2000,CI –19–02MAR94–3/3

Code 47—Derated Torque Curve Selected

Code 47 occurs when the Fuel Limit Select input is pulled to ground to limit the output torque of the engine.

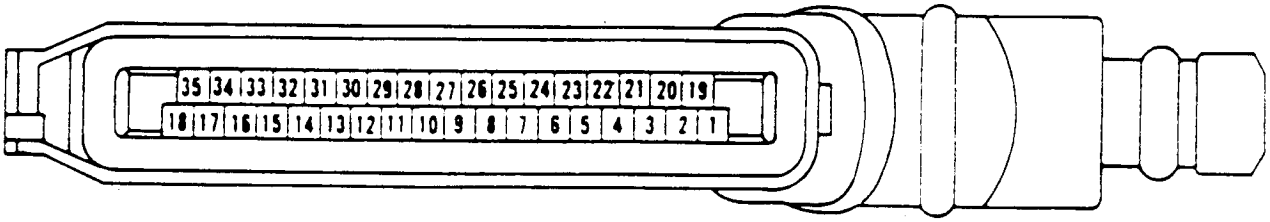
In certain applications, this feature is used to protect the engine.

Code 47 does not usually indicate a problem with the electronic fuel injection system. A possible use of this feature is to limit maximum fuel delivery to a lower level when there is an air flow restriction, which might result in the engine overheating.

If this code is observed, refer to the machine technical manual to determine how this feature is activated and how to correct the problem.

S55,2000,EU –19–02MAR94–1/1

Code 71—Diagnostic Codes Output Stuck High



X1 Connector

NOTE: Code 71 or 72 occur when the Electronic Governor Tester (JT05829) is unable to read the Diagnostic Codes Output signal from the Engine Controller. If Code 71 or 72 are displayed by an on-board code reader, refer to the machine technical manual.

Ignore codes greater than 100 that are displayed during troubleshooting.

If the Diagnostic Codes input to the Electronic Governor Tester is open circuit or shorted to a voltage greater than 2.5 volts. The tester should display code 71. If the input is shorted to ground or shorted to a voltage less than 2.5 volts anywhere in the harness, the tester should display code 72.

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C71-1 Connector Check.		
Turn ignition to 'OFF' position. Disconnect connector X1 at ECU and uncap or disconnect connector X4. Inspect terminals of these connectors for damage, corrosion, and poorly positioned pins or sockets.	Connector terminals look OK	Go to C71-2
Problem found	Repair and go to C71-90	
C71-2 Harness Short Circuit Check.		
With ignition off, measure resistance between X1 pin 14 and all other pins of the X1 connector.	All greater than 5 ohms ..... (No short circuits found.)	Go to C71-3
Any less than 5 ohms ..... (Short circuit exists in harness between X1 pin 14 and another circuit.)	Repair and go to C71-90	
C71-3 Harness Open Circuit Check.		
Measure resistance between X1 pin 14 and X4 socket D.	Less than 5 ohms ..... (No open circuit in harness.)	Go to C71-4
Greater than 5 ohms ..... (Open circuit exists between X1 pin 14 and X4 socket D.)	Repair and go to C71-90	
C71-4 ECU Power Check.		
Turn ignition to 'ON'. Measure voltage between X1 pin 1 (+) and X1 pin 19 (-).	Greater than 9 volts ..... (Equal to battery voltage.)	Go to C71-5
Less than 9 volts ..... (Problem exists in harness or in electrical system.)	Repair and go to C71-90	

Continued on next page

C71-5 ECU Check.		
Turn ignition to 'OFF'. Reconnect connector X1 to ECU and Electronic Governor Tester to connector X4. Turn ignition to 'ON' and check diagnostic codes. If using an internal tachometer display, refer to the machine technical manual.	Code 71 or 72 ..... (Tester cannot read signal from ECU.)	Replace ECU or Electronic Governor Tester and go to C71-90
Code 0 ..... (Code display is operational and no problems are being indicated.)	Replace cap on connector X4. Resume normal operation.	
Codes other than 71 or 72 ..... (Code display is operational.)	Go to section for corresponding code to troubleshoot indicated problem.	
C71-90 Verify Repairs.		
With ignition off, connect Electronic Governor Tester to service connector X4. Make sure connector X1 is connected properly to ECU. Turn ignition to 'ON'. If using an internal tachometer display, refer to the machine technical manual.	Code 71 or 72 ..... (Problem still exists.)	Review this section to find problem.
Code 0 ..... (Code display is operational.)	Repairs are complete. Replace cap on connector X4.	
Codes other than 0, 71, or 72 ..... (Code display is now operational, but code indicates a problem.)	Repairs on the diagnostic display are complete. Go to section for corresponding code to troubleshoot indicated problem.	

S55,2000,FE –19–02MAR94–2/2

Code 72—Diagnostic Codes Output Stuck Low

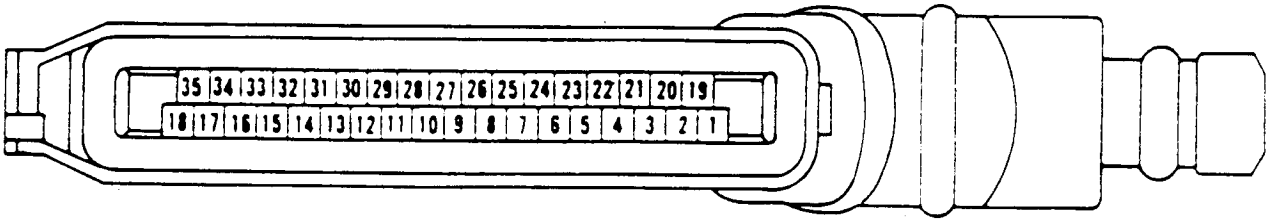
Code 71 or 72 occur when the Electronic Governor Tester is unable to read the Diagnostic Codes Output signal from the Engine Controller.

Use the diagnostic procedure for Code 71 when either Code 71 or Code 72 occur.

If code 71 or 72 are displayed by an on-board code reader, refer to the machine technical manual.

S55,2000,FF –19–02MAR94–1/1

Code 73—Fuel Flow/Throttle Output Stuck High



X1 Connector

NOTE: Code 73 or 74 occur when the electronic governor tester is unable to read the fuel flow/throttle output signal from the Engine Controller.

If the fuel flow/throttle input to the electronic governor tester is open circuit or shorted to a voltage greater than 2.5 volts, the tester should display code 73. If the input is shorted to ground or shorted to a voltage less than 2.5 volts anywhere in the harness, the tester should display code 74.

When checking to see if the electronic governor tester is reading the fuel flow/throttle output signal properly, the % fuel display should read '0' with the ignition on but, the engine not running. The % throttle display should respond to the throttle whether the engine is running or not.

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C73-1 Connector Check.		
Turn ignition to 'OFF' position. Disconnect connector X1 at ECU and uncap or disconnect connector X4. Inspect terminals or these connectors for damage, corrosion, and poorly positioned pins or sockets.	Connector terminals look OK	Go to C73-2
Problem found	Repair and go to C73-90	
C73-2 Harness Short Circuit Check.		
With ignition at 'OFF', measure resistance between X1 pin 7 and all other pins of the X1 connector.	All greater than 5 ohms ..... (No short circuits found.)	Go to C73-3
Any less than 5 ohms ..... (Short circuit exists in harness between X1 pin 7 and another circuit.)	Repair and go to C73-90	
C73-3 Harness Open Circuit Check.		
Measure resistance between X1 pin 7 and X4 socket E.	Less than 5 ohms ..... No open circuit in harness.)	Go to C73-4
Greater than 5 ohms ..... (Open circuit exists between X1 pin 7 and X4 socket E.)	Repair and go to C73-90	

Continued on next page

C73-4 ECU Power Check.

Turn ignition to 'ON'. Measure voltage between X1 pin 1 (+) and X1 pin 19 (-).
- Greater than 9 volts ..... (Equal to battery voltage.) → Go to C73-5
- Less than 9 volts ..... (Problem exists in harness or in electrical system.) → Repair and go to C73-90

C73-5 ECU Check.

Turn ignition to 'OFF'. Reconnect connector X1 to ECU and Electronic Governor Tester to connector X4. Turn ignition to 'ON' and check % Fuel and % Throttle displays.
- Code 73 or 74 ..... (Tester cannot read signal from ECU.) → Replace ECU or Electronic Governor Tester and go to C73-90
- Displays are functional ..... → Replace cap on connector X4. Resume normal operation.

C73-90 Verify Repairs.

With ignition off, connect Electronic Governor Tester to service connector X4. Make sure connector X1 is connected properly to ECU. Turn ignition to 'ON'. Check % Fuel and % Throttle displays.
- Code 73 or 74 ..... (Problem still exists.) → Review this section to find problem.
- Displays are functional ..... → Repairs are complete. Replace cap on connector X4.

S55,2000,FG –19–02MAR94–2/2

Code 74—Fuel Flow/Throttle Output Stuck Low

Code 73 or 74 occur when the Electronic Governor Tester is unable to read the Fuel Flow/Throttle Output signal from the Engine Controller.

Use the diagnostic procedure for Code 73 when either Code 73 or Code 74 occur

S55,2000,FH –19–02MAR94–1/1

Analog Throttle Adjustments

The electronic fuel injection system is capable of connecting to one or two analog throttle sensors. The throttle configuration, the throttle adjustment mechanism, and the actual sensor used will vary depending on application. Therefore, refer to the machine technical manual for the correct adjustment procedure.

If the analog throttle sensor is not properly adjusted, the following problems are possible:

- Diagnostic Code 11 or 13 is generated and engine drops to slow idle when throttle is at or near fast idle. Throttle input voltage is too high.
- Diagnostic Code 12 or 14 is generated when throttle is at or near slow idle position. Throttle input voltage is too low.
- The slow idle engine speed is too fast.
- The fast idle engine speed is too slow.

Continued on next page

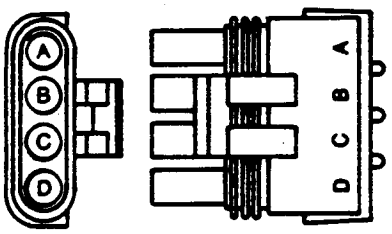
S55,2000,CK –19–02MAR94–1/2

Use the Diagnostic Voltages Connector (X3) to access the throttle voltage signals for the primary analog throttle during throttle adjustment. Use a digital multimeter for these measurements. Refer to Group 02—General Information, USING A DIGITAL MULTIMETER. Measurements are made as follows:

Analog Throttle +5V (nominally 5 volts):
X3 socket A (+) to X3 socket D (-)
Throttle Input Voltage:
X3 socket B (+) to X3 socket D (-)

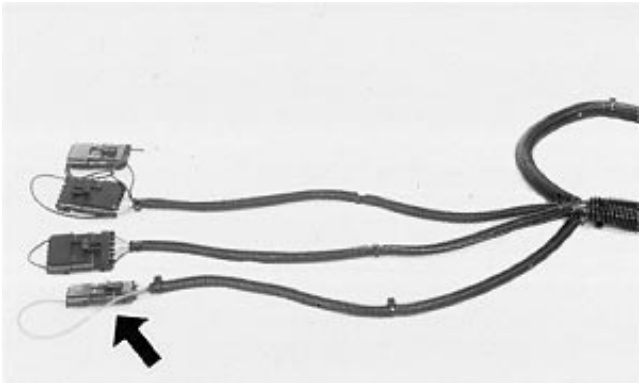
During adjustment, the signals from analog throttle sensors must be corrected for the variation of the Analog Throttle +5V supply voltage from exactly +5.000 volts. The calculation to do this requires a multiplication and a division:

$$\text{Corrected throttle input voltage} = \frac{5 \times \text{socket B voltage}}{\text{socket A voltage}}$$



RG5389 –UN–14DEC88

Diagnostic Voltage Connector (X3)



RG5396 –UN–09JAN90

Diagnostic Voltage Connector (X3)

RW11274 –UN–12DEC88

Digital Multimeter

S55,2000,CK –19–02MAR94–2/2

Fuel Injection System Components

Part Name	Action To Be Taken
Injection Pump	Repairable by ADS shop only. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), for removal and installation of injection pump. Protect connectors from debris while injection pump is removed. If debris enters connectors, it may be necessary to use compressed air to clean connectors.
Fuel Shut-off Solenoid Housing	Can be replaced with injection pump on engine.
Fuel Shut-off Solenoid	Can be replaced with injection pump on engine.
Actuator Solenoid	Repairable by ADS shop only.
Gear, oil line, overflow valve, transfer pump, miscellaneous hardware items	Replace with service parts as required. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 35, Fuel System for repair procedures for these parts.
Engine Controller	IMPORTANT: DO NOT OPEN ENGINE CONTROLLER. Not repairable; replace Engine Controller. If an Engine Controller is not programmed identically with the original (failed) Engine Controller, misleading diagnostic messages, poor performance, or engine damage can occur.
TVP Module	Not repairable; replace with new TVP Module. The connector on the TVP wiring harness is repairable.
Connectors	
X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, and X11	Repairable.
X12 and X13	Not repairable. Replace with new Engine Wiring Harness.
Sensors	
Primary Engine Speed Sensor	Repairable by ADS shop only.
Fuel Temperature Sensor	Repairable.
Rack Position Sensor	Repairable by ADS shop only.
Auxiliary Speed Sensor	Repairable.
Wiring Harness	
Engine Wiring Harness (short)	Connectors X2, X8, X10, and X11 are repairable. Connectors X12 and X13 are not repairable.
Application Wiring Harness (long)	All connectors are repairable. (X1, X3, X4, X6, X7, X9, and TVP connector)

S55,2000,FU –19–02MAR94–1/1

Essential Tools

NOTE: Order tools from your SERVICE-GARD™ Catalog. Some tools may be available from a local supplier.

SERVICE-GARD is a trademark of Deere and Company.

S55,2000,FV –19–02OCT98–1/9

Electrical Connector and Wire Service Kit. RE11154

Repair harnesses on John Deere electronic governor applications.

Continued on next page

S55,2000,FV –19–02OCT98–2/9

Electrical Repair Tool Kit. JDG155

Repair and installation of wires into electrical connectors.

S55,2000,FV –19–02OCT98–3/9

Electrical Repair Tool Kit includes:

JDG107 ..... Holding Plate
JDG139 ..... Contact Insertion Tool
JDG140 ..... Contact Extraction Tool
JDG141 ..... Contact Extraction Tool
JDG142 ..... Contact Extraction Tool
JDG143 ..... Contact Extraction Tool
JDG144 ..... Crimping Pliers
JDG145 ..... Electrician's Pliers
JDG146 ..... Carry Case

S55,2000,FV –19–02OCT98–4/9

WEATHER PACK™ Extraction Tool JDG364

Replace terminal contact in WEATHER PACK™ connector body.

WEATHER PACK is a trademark of Packard Electric.

S55,2000,FV –19–02OCT98–5/9

Wiring Tool R65594

Crimp WEATHER PACK™ terminals.

WEATHER PACK is a trademark of Packard Electric.

S55,2000,FV –19–02OCT98–6/9

Special Crowsfoot Wrench JDG646

Remove and install X12 Actuator connector.

Continued on next page

S55,2000,FV –19–02OCT98–7/9

Connection Removal Tool JDG671

Replace contact in X1 Engine Controller connector.

S55,2000,FV –19–02OCT98–8/9

Electrical Connection Extraction Tool. JDG776

Replace contact in X1 Engine Controller connector.

S55,2000,FV –19–02OCT98–9/9

Other Materials

Number	Name	Use
	Electrical Contact Cleaner Spray	Clean contacts on connectors.

S55,2000,KPA1 –19–02MAR94–1/1

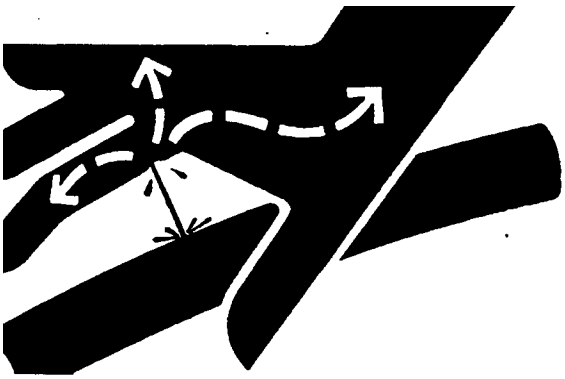
Relieve System Pressure

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

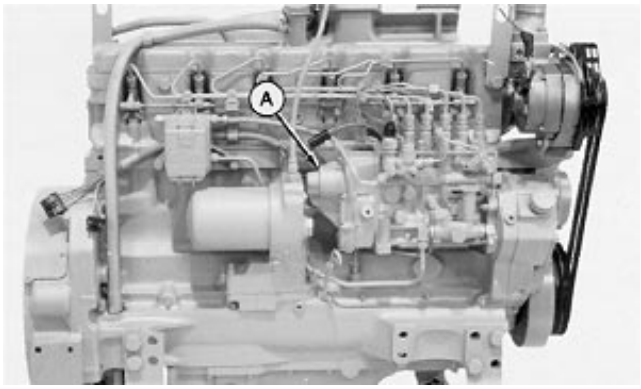
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical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

NOTE: For a complete description of the injection pump and the actuator assembly, refer to Group 05—Fuel Injection System Components.

The injection pump is repairable by an ADS shop only. The Actuator Solenoid (A) also is repairable by an ADS shop only. When the Actuator Solenoid is opened, the injection pump will require recalibration.



X9811 –UN–23AUG88



RG5399 –UN–09JAN90

S11,3010,OZA1 –19–02MAR94–1/1

Remove Fuel Shut-Off Solenoid Housing

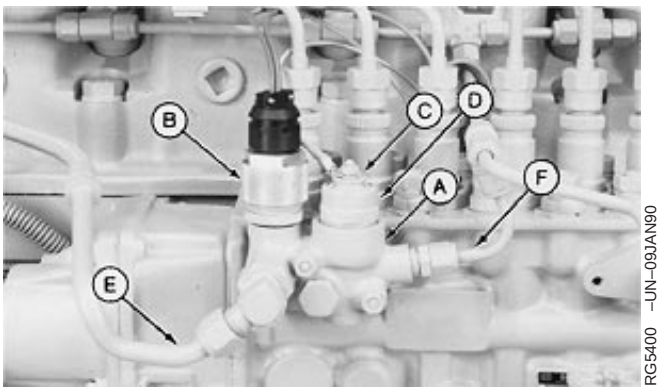
NOTE: The fuel shut-off solenoid housing (A) can be replaced with the injection pump installed on the engine.

IMPORTANT: When the X13 Connector is disconnected, be careful to avoid losing the O-ring located in the cable end connector.

1. Disconnect Fuel Temperature Sensor Connector (X13) (B) using an open end wrench.
2. Loosen nut and remove the Fuel Shut-off Solenoid Connector (X11) (C) and star washer.
3. Using an open end wrench, remove fuel shut-off solenoid (D) and O-ring.
4. Disconnect the fuel inlet line (E) and the fuel leak-off line (F). Cap all line openings so contaminants do not enter the fuel system.
5. Loosen three mounting nuts.
6. Pull fuel shut-off solenoid housing straight out from injection pump housing.

NOTE: Cover injection pump with cloth so debris does not enter any openings.

7. Inspect housing for cracks and wear. Replace housing as necessary.



RG5400 –UN–09JAN90

A—Fuel Shut-off Solenoid Housing
B—Fuel Temperature Sensor Connector (X13)
C—Fuel Shut-off Solenoid Connector (X11)
D—Fuel Shut-off Solenoid
E—Fuel Inlet Line
F—Fuel Leak-off Line

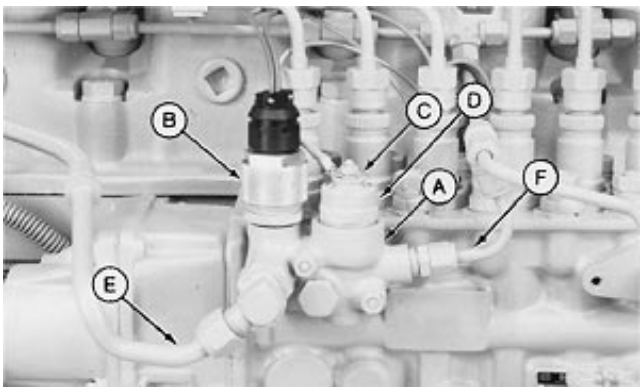
S55,2000,FX –19–02MAR94–1/1

Install Fuel Shut-Off Solenoid Housing

1. Install a new O-ring in housing bore next to mounting face.
2. Position fuel shut-off solenoid housing (A) over studs. Tighten mounting stud nuts 10 N•m (7 lb-ft).
3. Install fuel leak-off line (F) and fuel inlet line (E). Tighten all connections securely.
4. Reconnect the Fuel Temperature Connector (X13) (B) using an open end wrench. Tighten connector to 7—15 N•m (5—11 lb-ft).

IMPORTANT: Be careful to tighten the coupling to this torque range to verify that the ring is fully engaged. When the connector is disconnected, avoid losing the O-ring located in the cable end connector.

5. Using an open end wrench, install the fuel shut-off solenoid (D) with O-ring and tighten to 50 N•m (37 lb-ft).
6. Install the star washer and the Fuel Shut-off Solenoid Connector (X11) (C), and tighten nut securely.
7. Bleed the fuel system as described later in this group.



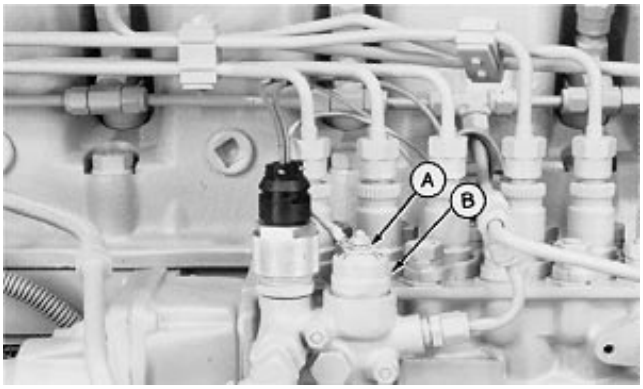
RG5400 –UN–09JAN90

A—Fuel Shut-off Solenoid Housing
B—Fuel Temperature Sensor Connector (X13)
C—Fuel Shut-off Solenoid Connector (X11)
D—Fuel Shut-off Solenoid
E—Fuel Inlet Line
F—Fuel Leak-off Line

S55,2000,GH –19–02MAR94–1/1

Remove and Replace Fuel Shut-Off Solenoid

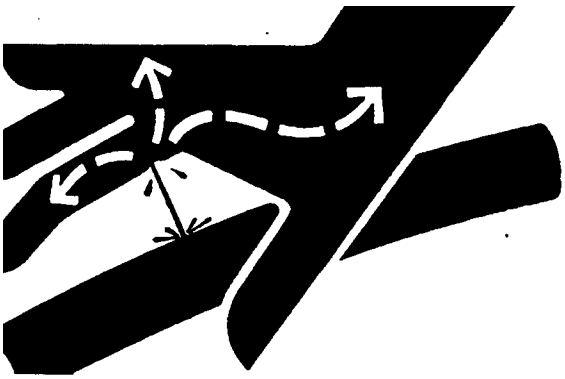
1. Loosen nut and remove the star washer and Fuel Shut-off Solenoid Connector (X11) (A).
2. Using an open end wrench, remove fuel shut-off solenoid (B) and O-ring.
3. Install new fuel shut-off solenoid with O-ring. Tighten solenoid to 50 N•m (37 lb-ft).
4. Install the Fuel Shut-off Solenoid Connector (X11) and star washer. Tighten nut securely.



RG5405 –UN–09JAN90

S55,2000,GI –19–02MAR94–1/1

Bleed the Fuel System



X9811 –UN–23AUG88

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

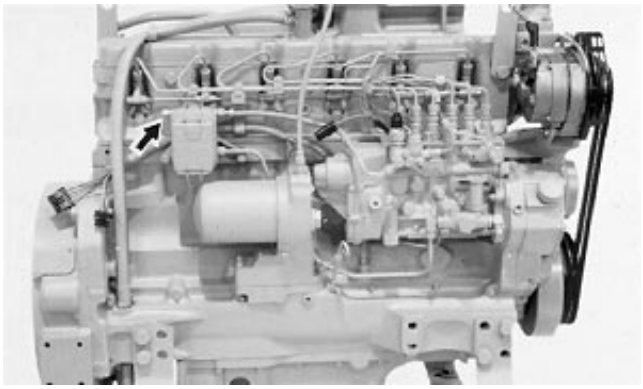
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical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

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.

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

S11,0408,ACA1 –19–02MAR94–1/3

1. Turn key switch to the 'ON' position.
2. Loosen bleed plug (arrow) on fuel filter base.



RG5406 –UN–09JAN90

Continued on next page

S11,0408,ACA1 –19–02MAR94–2/3

3. Unscrew hand primer (arrow) on fuel supply pump until it can be pulled by hand.

4. Operate the hand primer until a smooth flow of fuel, free of bubbles, comes out of the filter bleed plug hole.

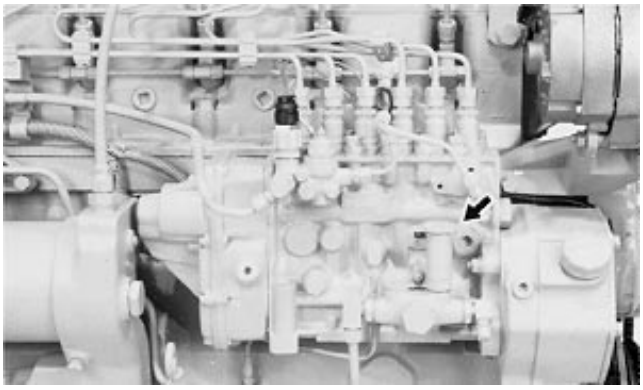
5. Gently stroke the hand primer down and close the bleed plug. Tighten plug securely. DO NOT overtighten. Continue operating hand primer until slight pressure is felt. The pressure indicates that fuel has filled the gallery in the injection pump.

IMPORTANT: Be sure hand primer is all the way down in barrel before tightening to prevent internal thread damage.

6. Lock hand primer in position.

NOTE: If the engine will not start, it may be necessary to loosen the fuel lines at the injection nozzles to bleed air from system. Put the hand throttle in slow idle position. Turn the engine with the starter until fuel without air flows from the loose fuel line connections. Tighten the connections.

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



RG5407 –UN–09JAN90

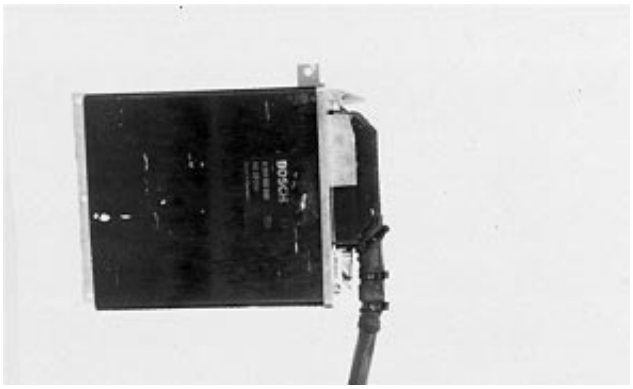
S11,0408,ACA1 –19–02MAR94–3/3

Engine Controller

IMPORTANT: DO NOT OPEN ENGINE CONTROLLER.

The Engine Controller is not repairable. If it is found to be defective, it is to be replaced as a unit.

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

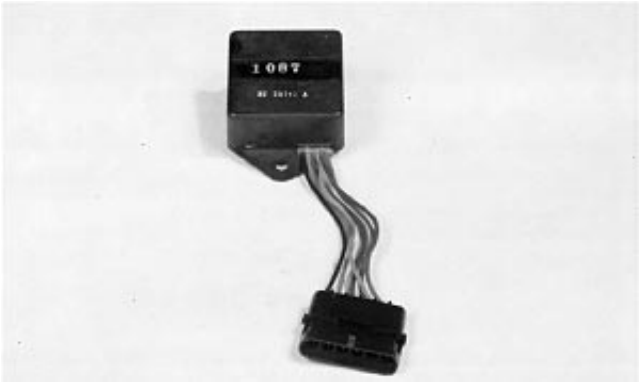


RG5350 –UN–09JAN90

S55,2000,GD –19–02MAR94–1/1

Transient Voltage Protection (TVP) Module

The TVP module is not repairable. If the TVP module is defective, the unit must be replaced. The connector on the TVP module wiring harness is repairable. Refer to REPLACE WEATHER PACK CONNECTOR later in this group.



RG5374 –UN–09JAN90

S55,2000,GEA1 –19–03MAR94–1/1

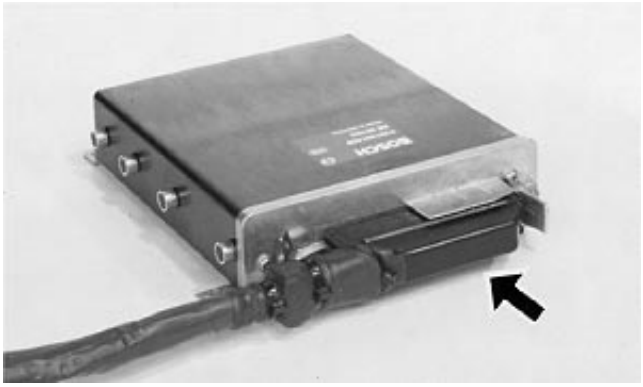
Connectors

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

NOTE: Refer to Group 45—Wiring for a diagram showing location of all connectors.

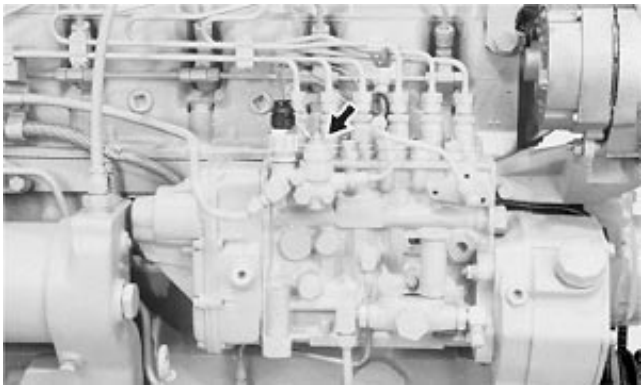
IMPORTANT: If for some reason the connectors are not connected, such as when the fuel injection pump is removed, it is important to protect the connectors from debris.

Engine Controller Connector (X1) is repairable. See Disassembling Engine Controller Connector (X1) later in this group. Connectors X2, X3, X4, X5, X6, X7, X8, X9 and X10 are WEATHER PACK™ Connectors and are also repairable. See REPLACE WEATHER PACK CONNECTOR later in this group. The Fuel Shut-off Solenoid Connector (X11) is repairable. (See REPLACE FUEL SHUT-OFF SOLENOID CONNECTOR (X11), later in this group.) The Actuator Connector (X12) and the Fuel Temperature Sensor Connector (X13) are not repairable.



RG5379 –UN–09JAN90

Engine Controller Connector (X1)



RG5382 –UN–09JAN90

Fuel Shut-off Solenoid Connector (X11)

RG5408 –UN–09JAN90

Actuator Connector (X12)

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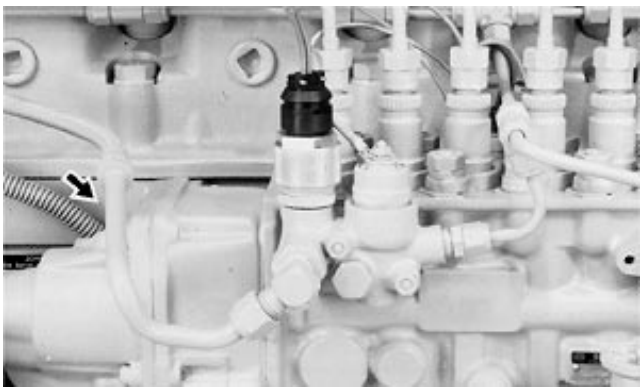
S55,2000,FY –19–07MAR94–1/2

IMPORTANT: Because of the location of connector X12, accessibility is difficult. On 6076 Engines, remove the oil filter and oil filter housing when working with the X12 connector. On 6101 Engines, remove fuel filter and full flow oil filter. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. Also, because of the combination of the aluminum coupling ring and the plastic mating thread, cross-threading of the connector can damage the actuator half. Therefore, care should be used when mating this connector to avoid damaging the threads.

A special crowsfoot wrench (JDG646) is required to adequately tighten the coupling ring. Mating torque range is 10—20 N•m (7—14 lb-ft). When the coupling ring engages the sealing O-ring, a false indication of a fully mated connector can be given. Tightening to the prescribed torque will avoid this problem. When the connector is unmated, be careful to avoid losing the O-ring located in the cable and connector.



Actuator Connector (X12)

Fuel Temperature Sensor Connector

The Fuel Temperature Sensor Connector (X13) is not repairable.

IMPORTANT: When reconnecting the X13 Connector, the mating torque range is 7—15 N•m (5—11 lb-ft). Be careful to tighten the coupling ring to this torque range to verify that the ring is fully engaged. When the connector is unmated, avoid losing the O-ring located in the cable end connector.

For a further description of these connectors, refer to Group 15—Robert Bosch Fuel System Connectors.

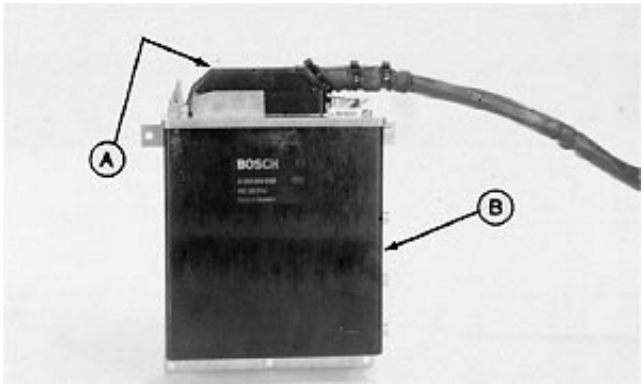
S55,2000,FY –19–07MAR94–2/2

Clean Engine Controller Connector (X1)

IMPORTANT: Disconnect the engine controller connector (A) from the Engine Controller (B) only when a known problem exists with the connector. Disconnecting the connector from the Engine Controller may allow dust to collect on the contacts.

1. With the Engine Controller connector connected to the Engine Controller, blow dust off of the connector using compressed air.

2. If a problem exists with the connector, disconnect the connector from the Engine Controller.

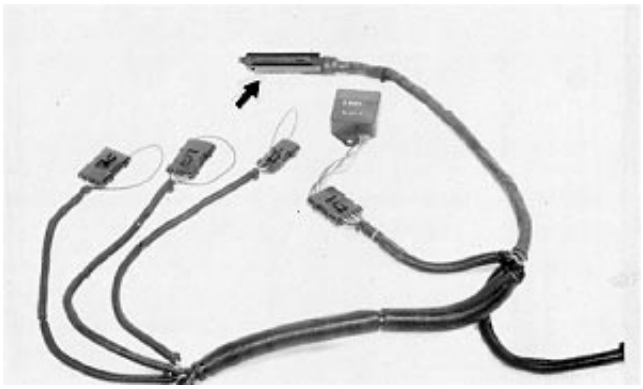


RG5498 –UN–09JAN90

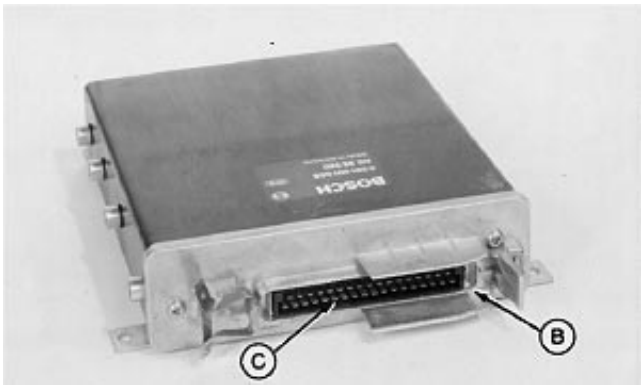
S55,2000,LZ –19–02MAR94–1/2

IMPORTANT: DO NOT under any circumstances, power wash engine controller (bold arrow) on wiring harness or connector (B) on engine connector. Doing so may cause a short circuit or controller malfunction.

3. Spray contacts (C) with electrical contact cleaner spray before installing connector on the Engine Controller.



RG5417 –UN–09JAN90



RG5499 –UN–09JAN90

S55,2000,LZ –19–02MAR94–2/2

30
14

Disassemble Engine Controller Connector (X1)

1. Cut off cable ties used to secure the wire boot.
2. Slide wire boot back from connector.

NOTE: A light lubricating oil applied to the boot may be helpful for sliding.

3. If a sealing sheath is present on the wires, it must be slit to allow access to connector wires. Try to minimize damage so that the wires can be sealed during reassembly.
4. Remove the wire clamp.

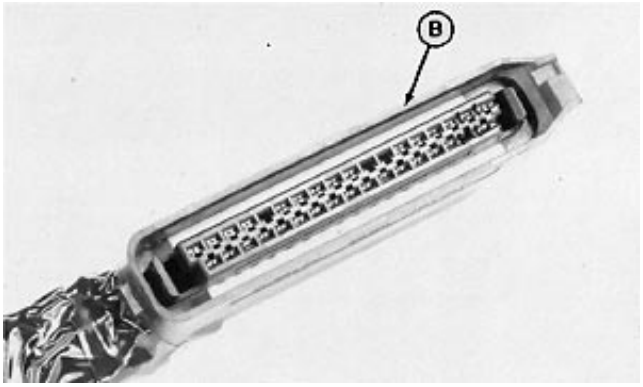
S55,2000,MC –19–02MAR94–1/5

5. Remove the locking screw (A).

RG5500 –UN–09JAN90

S55,2000,MC –19–02MAR94–2/5

6. Pull the gasket (shown removed) out of the connector shell (B).



RG5501 –UN–09JAN90

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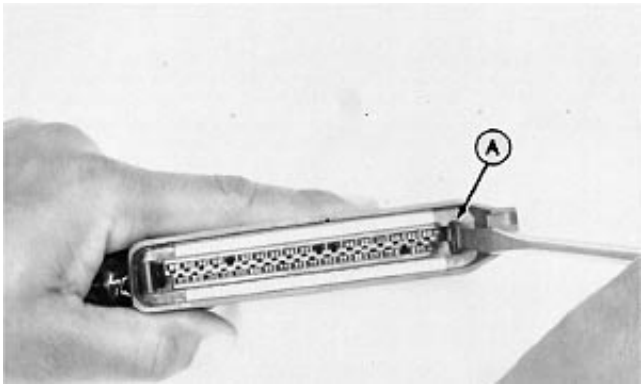
S55,2000,MC –19–02MAR94–3/5

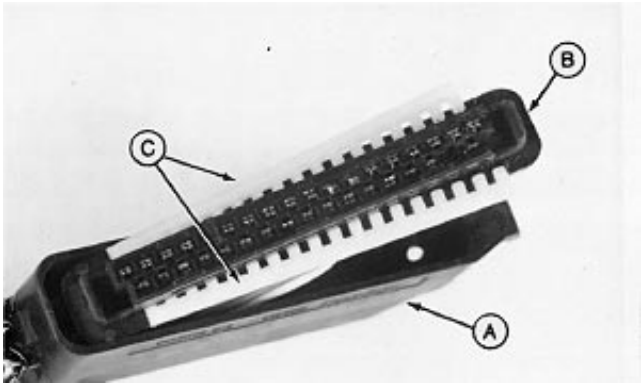
7. Remove the contact housing from the shell by pulling on the contact housing tab (A) on the locking screw end of the connector with a screwdriver or needle-nose pliers.



S55,2000,MC –19–02MAR94–4/5

8. Work the shell (A) back over the wires until the back side of the contact housing (B) is accessible.

9. Remove the contact retainer(s) on the side(s) that have to be serviced by prying with sharp object.



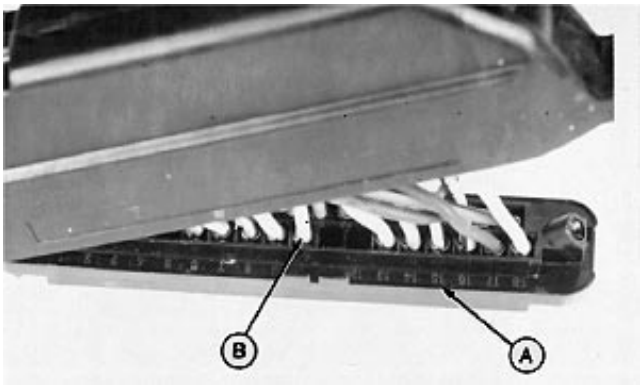
S55,2000,MC –19–02MAR94–5/5

Remove Contact from Contact Housing

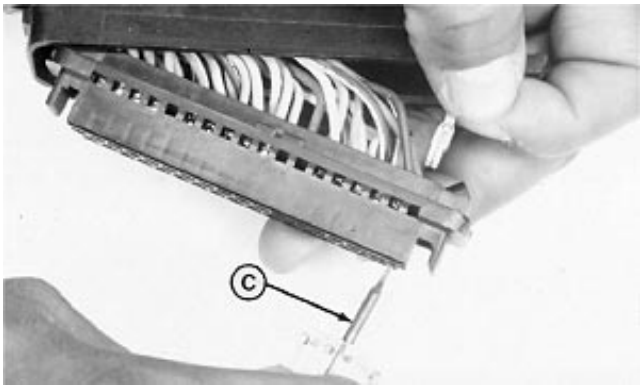
IMPORTANT: Note the position of the wire in the contact housing before removing any wires. The contact cavities are numbered (1-35) (A) on the rear of the contact housing. It is recommended that only one contact (B) at a time be replaced. It is easy to damage the contact during removal so use extreme care when inserting the tool. If visible damage is present, the contact should be replaced.

IMPORTANT: It is easy to damage the contact during removal, so use extreme care when inserting the tool.

Be sure the contact retainer has been removed before removing the contact. See DISASSEMBLE ENGINE CONTROLLER CONNECTOR (X1) earlier in this group.



RG5504 –UN–09JAN90



RG5505 –UN–09JAN90

1. If a contact must be replaced, use the JDG671 Contact Removal Tool (C), JDG776 Electrical Connector Extraction Tool, small screwdriver, or other similar pointed object.

2. Slide tool in the contact unlocking slot until it bottoms in the contact housing.

NOTE: These slots are accessed from the front side of the contact housing and are located toward the center of the housing from each contact cavity.

3. Push in on the wire while the removal tool is being inserted to ease in the removal of the contact.

4. If a contact must be replaced, cut off the old contact as near the contact as possible or there will not be sufficient wire length to reinstall it. See INSTALL NEW CONTACTS in the following module.

S55,2000,MG –19–07MAR94–1/1

Install New Contacts

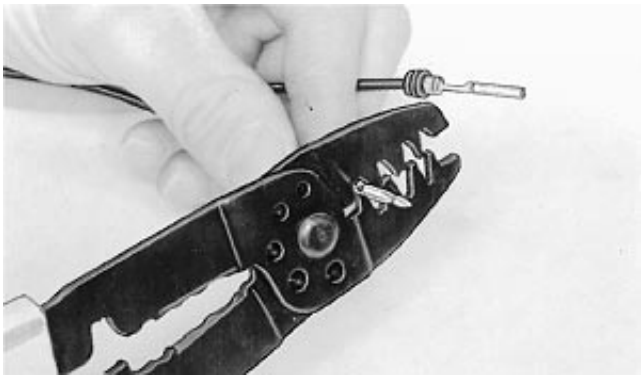
1. Strip insulation from wire to expose 3 mm (1.8 in.).

S55,2000,LH –19–07MAR94–1/2

2. Using JDG144 Crimping Pliers, crimp terminal on wire using Position 'D' for the wire crimp and Position 'G' for the insulation crimp.

NOTE: Locking tabs go to the middle of the connector.

3. Push the terminal into the contact housing making sure of the proper location.



TS0137 –UN–23AUG88

S55,2000,LH –19–07MAR94–2/2

Reassemble Engine Controller Connector (X1)

NOTE: If only the contacts have been serviced, begin with Step 6.

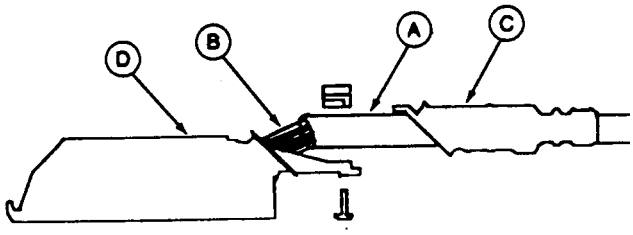
1. If a sealing sheath (A) is being added or replaced, insert the harness wires (B) through the sheath.

2. Insert the harness wires through the wire boot (C).

NOTE: A light lubricating oil may be helpful for sliding wires through the boot.

3. Insert the harness wires through the connector shell (D).

4. Crimp contacts on the wires.



RG5507 –UN–19JAN89

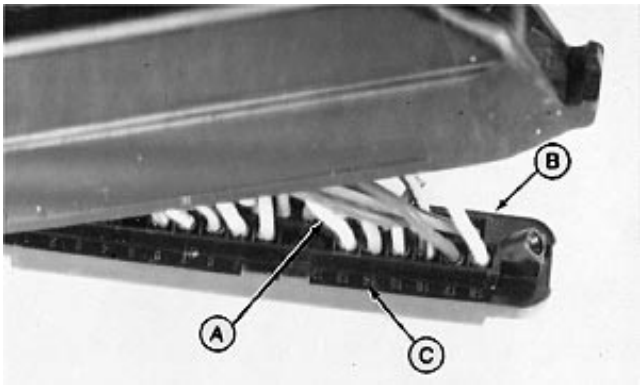
A—Sealing Sheath
B—Harness Wires
C—Wire Boot
D—Connector Shell

Continued on next page

S55,2000,MI –19–02MAR94–1/4

5. Insert contacts (A) into the contact housing (B) making sure of the proper position. Note that the contact cavities (C) are numbered. Make sure that the contacts lock into the housing by lightly pulling back on the wire after insertion.

NOTE: Locking tabs on the contacts go to the middle of the connector.



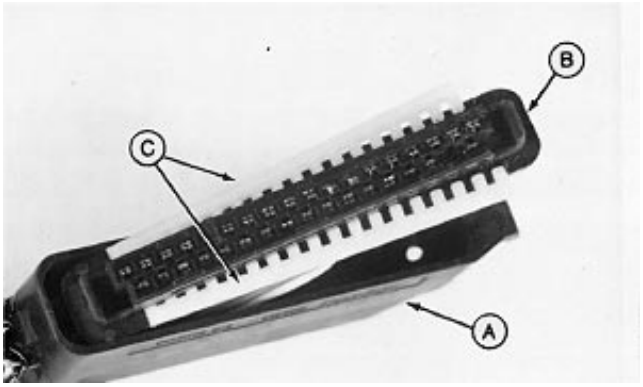
RG5506 –UN–09JAN90

S55,2000,MI –19–02MAR94–2/4

6. Install the two contact retainers (C) to lock the contacts in place.

7. Position the contact housing (B) into the shell (A) by simultaneously pulling excess wire back through the neck of the shell and pushing the contact housing into the shell.

NOTE: Be careful to get excess wire out of the shell cavity so that wires do not fold over and get pinched in the cavity. Also, make sure that the contact housing is properly locked into the shell.



RG5503 –UN–09JAN90

Continued on next page

S55,2000,MI –19–02MAR94–3/4

8. Install the locking screw (A) with sealing washer. This screw locks the contact housing in the shell. Tighten locking screw.

9. Install the gasket in the cavity between the contact housing and the shell. Make sure the concave-shaped side of the gasket faces into the shell. A small amount of lubricating oil on the gasket may make positioning of the gasket easier.

10. Align and smooth the wires that exit the shell and install the wire clamp with cap screws. Tighten cap screws securely.

11. If a sealing sheath is used, position it so that it butts against the cable clamp. If a sheath was slit to disassemble the connector, use electrical tape to repair the sheath.

12. Lightly lubricate and slide the wire boot into position over the wire clamp area and onto the shell.

13. Install the cable tie which holds the wire boot into place on the connector shell. The cable tie must be oriented with the latching mechanism on the side of the shell. A rectangular area is molded into the wire boot to designate the proper positioning from the cable tie latch.

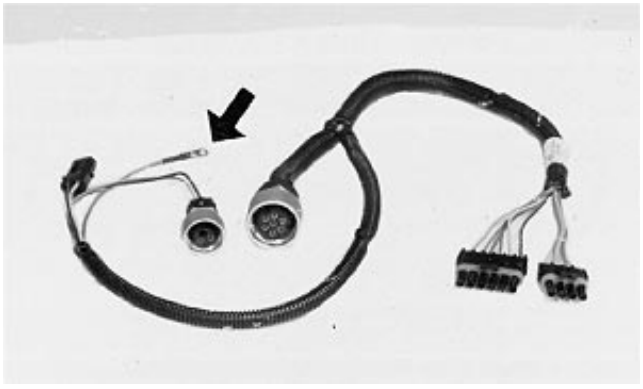
14. Install a cable tie around the tail of the wire boot to seal the boot to the wire sheath.

RG5500 –UN–09JAN90

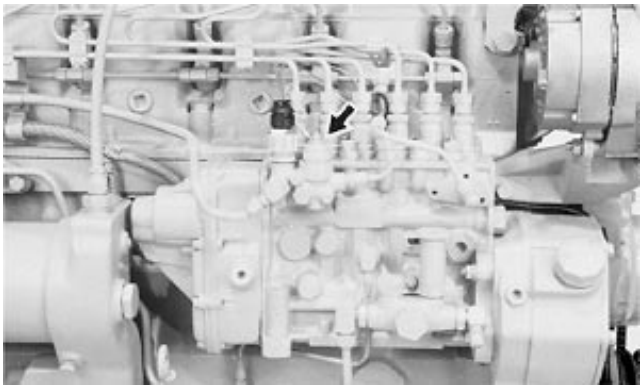
S55,2000,MI –19–02MAR94–4/4

Replace Fuel Shut-Off Solenoid Connector (X11)

1. Remove nut and star washer. Disconnect wire from fuel shut-off solenoid.
2. Cut eyelet terminal from wire and strip back insulation.
3. Using JDG145 Electrician's Plier, crimp on new eyelet terminal.
4. Reconnect wire on fuel shut-off solenoid. Replace star washer and tighten nut securely.



RG5392 –UN–09JAN90



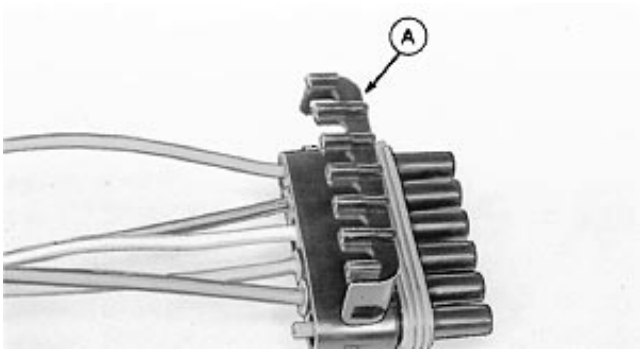
RG5382 –UN–09JAN90

S55,2000,FZ –19–02MAR94–1/1

Replace WEATHER PACK™ Connector

IMPORTANT: Identify wire color locations or circuit code numbers (imprinted on the wire) with connector terminal letters.

1. Open connector body (A).



TS0127 –UN–23AUG88

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S55,2000,LN1 –19–02MAR94–1/4

2. Insert JDG364 Extraction Tool over terminal contact in connector body.

TS0128 –UN–23AUG88

Continued on next page

S55,2000,LN1 –19–02MAR94–2/4

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

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

TS0129 –UN–23AUG88

S55,2000,LN1 –19–02MAR94–3/4

IMPORTANT: Carefully spread contact lances to assure good seating on connector body.

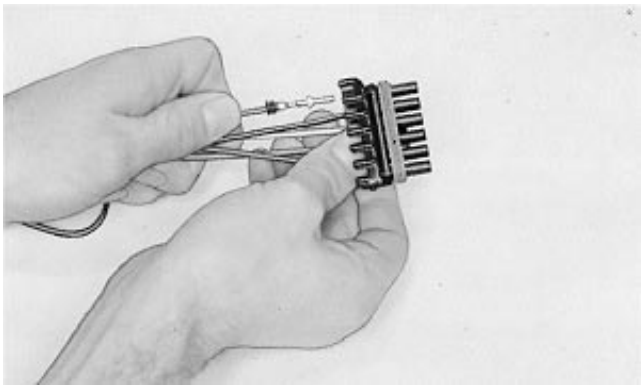
NOTE: Connector bodies are 'keyed' for proper contact mating. Be sure contacts are in proper alignment.

4. Push contact into new connector body until fully seated.

5. Pull on wire slightly to be certain contact is locked in place.

6. Transfer remaining wires to correct terminal in new connector.

7. Close connector body.



TS0130 –UN–23AUG88

S55,2000,LN1 –19–02MAR94–4/4

Install WEATHER PACK™ Contact

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

- *Green - 18 to 20 gauge wire*
- *Gray - 14 to 16 gauge wire*
- *Blue - 10 to 12 gauge wire*

1. Slip correct size cable seal on wire.

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

TS0136 –UN–23AUG88

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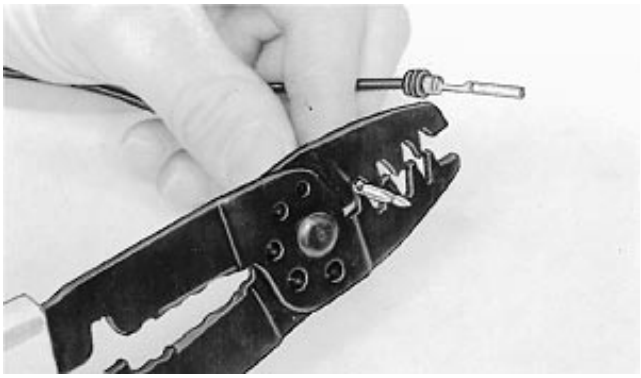
DX,ECONN,AA –19–04JUN90–1/4

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

- *#15 for 14 to 16 gauge wire*
- *#19 for 18 to 20 gauge wire*

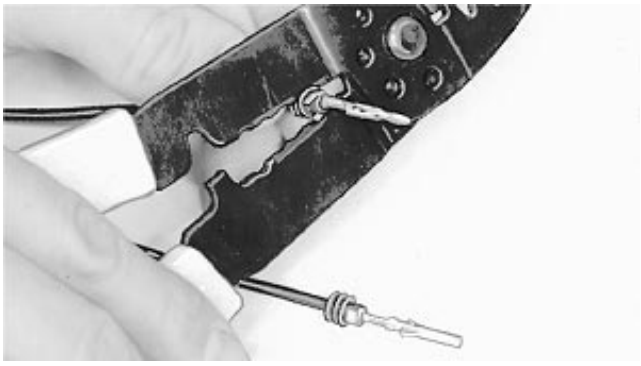
3. Place proper size contact on wire and use JDG144 Crimping Pliers to crimp contact in place with a 'W' type crimp.



TS0137 –UN–23AUG88

DX,ECONN,AA –19–04JUN90–2/4

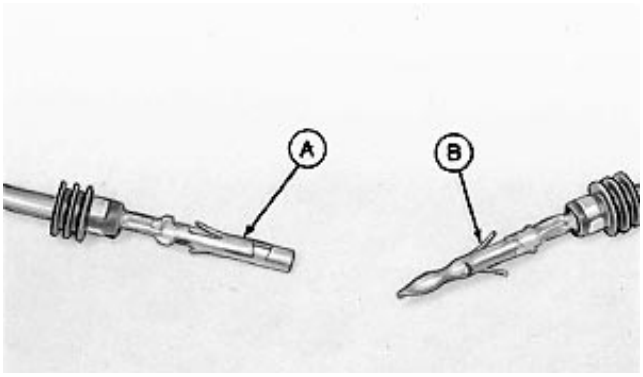
4. Use JDG144 Crimping Pliers to secure cable seal to contact as shown.



TS0138 –UN–23AUG88

DX,ECONN,AA –19–04JUN90–3/4

IMPORTANT: Proper contact installation for 'sleeve' (A) and 'pin' (B) is shown.

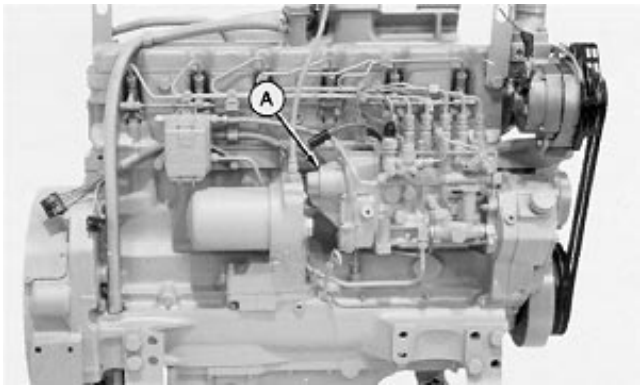


TS0139 –UN–02DEC88

DX,ECONN,AA –19–04JUN90–4/4

Sensors

The Primary Engine Speed Sensor and the Rack Position Sensor are located within the actuator housing (A) and are not repairable. If the actuator housing is removed, the injection pump will need to be recalibrated. For a description of these sensors, refer to Group 05—Fuel Injection System Components.



RG5399 –UN–09JAN90

S55,2000,GA –19–03MAR94–1/1

Replace Fuel Temperature Sensor

1. Disconnect the Fuel Temperature Sensor Connector (X13) (arrow) using an open end wrench. Be careful to avoid losing the O-ring located in the cable end of the connector.

2. Remove and replace sensor.

IMPORTANT: When reconnecting the X13 Connector, the mating torque range is 7—15 N•m (5—11 lb-ft). Be careful to tighten the coupling ring to this torque range to verify that the ring is fully engaged.

RG5409 –UN–09JAN90

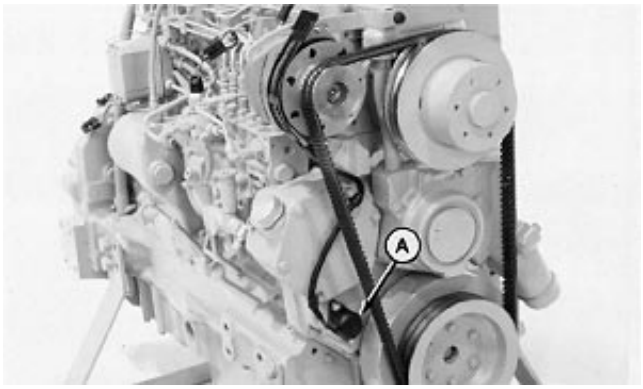
S55,2000,GB –19–03MAR94–1/1

Replace Auxiliary Speed Sensor

1. Remove auxiliary speed sensor cover (A).

2. Remove sensor from housing by pulling straight out. Replace sensor and the O-ring located on the sensor shaft.

3. Install auxiliary speed sensor cover and tighten cap screws securely.



RG5373 –UN–09JAN90

S55,2000,GC –19–02MAR94–1/1

How To Start Troubleshooting a Problem

Before troubleshooting of the fuel injection system is begun (especially if no diagnostic codes are present), verify that a problem does not exist in the basic electrical system or in the fuel supply system. The troubleshooting section of your operator's manual will help in finding problems in areas other than the electronic fuel injection system. The areas covered in your operator's manual or machine technical manual include the following:

- Charging system (condition of the battery and battery cables).
- Power distribution system
  - Fuses or circuit breakers
  - Key switch and any relays between battery and fuel injection system
  - Starter solenoid wiring connection
- Fuel source
  - Fuel in tank
  - Fuel lines and filters

IMPORTANT: If the problem is in one of the above areas, the diagnostic procedures for the fuel injection system will probably not help to find it.

In a later section, you will be directed to one of two diagnostic procedures. The Symptom-Only Procedures are used when there are only symptoms of a problem and no diagnostic codes are being displayed by the Electronic Governor Tester or the on-board code reader. The Diagnostic-Codes-Present Procedures will be used if one or more diagnostic codes are present (are being displayed).

If the above checks have been made and a problem with the fuel injection system is still suspected, become familiar with the next two modules, Troubleshooting Tools Needed and Troubleshooting Suggestions, and then proceed to Initial Operational Checks to begin troubleshooting.

IMPORTANT: Always begin diagnosis of a fuel injection system problem at Initial Operational Checks.

NOTE: Keep service connectors capped when not in use.

S55,2000,EC –19–02MAR94–1/1

Troubleshooting Tools Needed

Digital Multimeter—(JT05791 or equivalent) Refer to USING A DIGITAL MULTIMETER in Group 02, General Information.

Diagnostic Reader—(John Deere Electronic Governor Tester JT05829 or on-board diagnostic code read-out device) Refer to USE OF A DIAGNOSTIC READER in Group 02, General Information.

Jumper Wires—(Terminated with WEATHER PACK terminals) Refer to USING THE DIAGNOSTIC READER CONNECTOR (X4) in Group 20, Nippondenso Fuel System Connectors.

S55,2000,ED –19–02MAR94–1/1

Troubleshooting Suggestions

Checking Wiring and Connectors

When diagnosing electrical system problems, take special note of the condition of wiring and connectors since a high percentage of problems originate here. Check first 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. Considerable time may be saved if the harnesses and connectors are inspected first.

Use good judgment if component replacement is thought to be required.

NOTE: The Engine Controller is the component LEAST likely to fail.

Running Engine at Different Speeds

Run the throttle control(s) at slow-to-medium rate between the slow idle and the fast idle stops with the engine running. If engine speed 'catches' or 'drops', this may indicate a problem with throttle adjustment, throttle sensor operation, or the wiring between the Engine Controller and the throttle sensor(s). Using this method of changing engine speed, you may be able to identify problems which only occur at certain speeds or throttle settings. For machines with 3-State Throttle, switch between speed selections to see if problem is speed dependent.

Looking for Intermittent Problems

An intermittent code may mean that something is going outside of its normal operating range, but then returning to normal. This may be caused be a marginal adjustment (on a throttle sensor, for example) or by a poor connection. Check the condition of the wiring and connectors as described in the first paragraph. If codes 11, 12, 13 or 14 are intermittent and the wiring appears to be OK, then the throttle sensor(s) may need to be adjusted. See Group 40—Nippondenso Component Repairs and Adjustments.

An intermittent code may also mean that something is beginning to fail. Some failures are related to vibration. Because of the cost of replacing the pump, the condition of the wiring and connectors should be checked first.

If code 33, 34, 35, 36, 39 or 42 are intermittent, check the wiring and connectors leading to pump connector X7 and X9.

Continued on next page S55,2000,EE –19–02MAR94–1/2

CAUTION: Avoid possible injury. Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

For those engine in machines, NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.

Wear tight fitting clothing. Keep clear of moving parts and hot surfaces while making adjustments.

TS177 –UN–11JAN89

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Initial Operational Checks

IMPORTANT: Do not ignore stored codes. They represent problems that occurred at some time in the past or problems are still occurring.

1. **Stored codes should be read and recorded for reference when service on an engine first begins. Shortly after the battery is disconnected, stored codes will be erased.**
2. **Clear the stored codes once they have been recorded. This may eliminate old codes for problems which are now occurring.**
3. **Currently active codes should be investigated as directed by the procedures starting on this page. Work on one code at a time if more than one code is active.**
4. **Clear stored codes again after each repair has been verified.**
5. **To help make sure that all problems have been found and worked on, operate the engine at all engine speeds and all throttle settings to see if any symptoms or codes remain.**
6. **If there are any stored codes after Step 5, there is still a problem which needs to be fixed. If so, proceed to Diagnostic-Codes-Present Procedures. The engine should not be returned to normal operation with stored codes.**

NOTE: The abbreviation ECU (for electronic control unit) is used in the diagnostic procedures as a 'shorthand' way to indicate the Engine Controller.

When instructions are given to read diagnostic codes, use either the Electronic Governor Tester (JT05829) or an on-board code reader. See USE OF A DIAGNOSTIC READER in Group 02, General Information.

If instructions are given to read diagnostic codes (diagnostic codes stored in the Engine Controller) refer to USING THE ELECTRONIC GOVERNOR TESTER in Group 10—Basic System and Diagnostic Features, if that service tool is used. Refer to USING THE DIAGNOSTIC READER CONNECTOR (X4) in Group 20—Nippondenso Fuel System Connectors, if an on-board code reader is used. These two sections explain how to cause stored codes to be displayed on the diagnostic reader being used. If using on-board digital tachometer to read stored codes, refer to machine TM.

NOTE: Remember to keep service connectors capped when not in use.

Step/Sequence	Result	Next
A-1 Stored Codes Check		
With ignition on but engine not running, check for codes stored in Engine Controller memory.	Stored codes present	Go to A-2
No stored codes	Go to A-3	
A-2 Clear Stored Codes		
MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes.	Stored codes present	Go to A-3
No stored codes	Operation complete	

Continued on next page

A-3 Diagnostic Codes Check.		
With the ignition on but the engine not running, check the diagnostic codes.	No diagnostic codes	Go to A-4
Codes present ..... (Other than 71 or 72.)	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.	
A-4 Engine Start Check.		
Attempt to start engine. (If engine does not start, be sure to crank continuously for at least 4 seconds.)	Engine starts and runs ..... (No diagnostic codes present.)	Go to A-5
Codes present	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.	
	Engine does not start and ..... no codes present.	Go to A-11

IMPORTANT: Do not operate the starter for more that 30 seconds at a time. To do so may over-heat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again.

Step/Sequence	Result	Next
A-5 Run Engine Check.		
With engine running, move throttle through its entire range noting diagnostic codes and engine performance.	No codes present and engine ..... runs satisfactorily.	No problems evident, Go to A-10
Codes present	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.	
Engine not running ..... satisfactorily but no codes present.	Go to A-11	
A-10 Stored Codes Check. (Engine runs OK.)		
With ignition on but engine not running, check for codes stored in Engine Controller memory. Refer to tester or machine technical manual. Use Electronic Governor Tester or refer to USING THE DIAGNOSTIC READER CONNECTOR (X4) in Group 20, Nippondenso Fuel System Connectors, if an on-board reader is used.	No stored codes	Refer to Troubleshooting Suggestions at beginning of this group. Return to normal operation if all suggestions have been tried and still no improper operation can be found.
Stored codes present	Go to A-12	
A-11 Stored Codes Check. (Engine does NOT run OK, or does NOT start.)		
With the ignition on but engine not running, check for codes stored in Engine Controller memory. Use Electronic Governor Tester or refer to USING THE DIAGNOSTIC READER CONNECTOR (X4) in Group 20, Nippondenso Fuel System Connectors, if an on-board reader is used.	No stored codes ..... Problem probably NOT in controller, harness, or rack actuator.	Go to Symptom-Only Procedures, which follow Initial Operational Checks.
Stored codes present	Go to A-12.	

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A-12 Clear Stored Codes.

MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes. One of the codes may indicate the problem area. Restart engine and attempt to make problem appear. (If engine does NOT start, crank for at least 4 seconds.) Now look for codes which have just been stored.	No stored codes ..... Problem possibly NOT in controller, harness, or rack actuator.	Go to Symptom-Only Procedures, which follow Initial Operational Checks.
Stored codes present	Go to section for corresponding code in Diagnostic-Codes-Present Procedures after referring to Troubleshooting Suggestions in operator's manual, if present.	

A-20 Connector Check.

Turn ignition to 'OFF' position. Disconnect connector X1 at ECU and uncap or disconnect connector X4. Inspect terminals of these connectors for damage, corrosion, and poorly positioned pins or sockets.	OK	Go to A-21
Problem found	Repair and go to A-1	

A-21 Harness Short Circuit Check.

With ignition off, measure resistance between pin 31 of the X1 connector and all other pins of the X1 connectors.	All greater than 5 ohms	Go to A-22
Any less than 5 ohms ..... (Short circuit exists in harness between pin 14 of X1 connector and another circuit.)	Repair and go to A-1	

A-22 Harness Open Circuit Check.

Measure resistance between pin 31 of the X1 Connector and X4 socket D.	Less than 5 ohms	Go to A-23
Greater than 5 ohms ..... (Open circuit exists between pin 31 of X1 Connector and X4 socket D.)	Repair and go to A-1	

A-23 ECU Power Check.

Turn ignition to 'ON'. Measure voltage between X1 terminal 1 (+) and X1 terminal 35 (-).	Greater than 9 volts ..... (Equal to battery voltage.)	Go to A-24
Less than 9 volts ..... (Problem exists in harness or in electrical system.)	Repair and go to A-1	

A-24 ECU Check.

Turn ignition to 'OFF'. Reconnect connector X1 and Electronic Governor Tester (if necessary to read codes). Turn ignition to 'ON' and check diagnostic codes.	Code 71 or 72 ..... (No communication from ECU.)	Replace ECU and go to A-1
Codes other than 71 or 72	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.	
No diagnostic codes	Go to A-2	

Continued on next page

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A-30 (+) 12V check for diagnostic reader. (This only applies for the Electronic Governor Tester JT05829 and not for on-board display of diagnostic codes.)

With ignition off, disconnect Electronic Governor Tester from Connector X4. Turn ignition to 'ON'. Measure voltage from X4 socket A (+) to X4 socket F (-)	Less than 1 volt	Go to A-31
Between 1 and 9 volts ..... (Problem in basic electrical system—battery and supply circuit.)	Repair and go to A-1	
Greater than 9 volts ..... (code reader is bad.)	Replace Electronic Governor Tester and go to A-1.	

A-31 Ground Circuit Check.

With ignition on, measure voltage from X4 socket A (+) to chassis ground.	Greater than 9 volts ..... (Open circuit between X4 socket F and chassis ground.)	Repair and go to A-1
Less than 1 volt ..... (+12 volts is not being supplied to X4 socket A. Look for open circuit or problem in +12 V circuit to the governor harness, or shorted in electronic governor system causing fuse or circuit breaker to open.)	Repair and go to A-1	

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Symptom-Only Procedures

This section is used for procedures where a problem exists without being identified by a diagnostic code. Use this section only after Initial Operational Checks have been performed. If a diagnostic code is present during these procedures, go first to the appropriate section of the Diagnostic-Code-Present Procedures to diagnose the problem.

Refer to the Troubleshooting section of the Operator's Manual if the engine problem is not covered by one of these symptoms, or if the procedures for these symptoms do not fix the problem.

Step/Sequence	Result	Next
Determine complaint/symptom.		
Operate engine to verify reported symptom.	Engine will not start or starts and dies	Go to B1
	Fast idle speed too low	Go to B2
	Slow idle speed too high	Go to B3
SYMPTOM B1-Engine Will Not Start, Or Starts and Dies		
B1-1 ECU Power Check		
Disconnect connector X1. With ignition on, check system voltage by measuring from X1 pin 1 (+) to X1 pin 20 (-).	Voltage from ..... X1 pin 1 (+) to X1 pin 20 (-) should be the same as the battery voltage.	Go to B1-2
B1-2 Starting Rack Position Check.		
Determine if control rack is moving when engine is cranking by measuring Rack Position Voltage (from X3 socket C (+) to X3 socket D (-) during cranking. Crank engine for at least 4 seconds. (See USING THE DIAGNOSTIC VOLTAGES CONNECTOR (Rack Position Voltage)—Group 20, Nippondenso Fuel System Connectors.	Voltage greater than 2.6 ..... No codes present (activator solenoid is not moving).	Go to B1-3
	Voltage is between 2V and 2.6V ..... Actuator Solenoid is not moving the control rack far enough.	Go to B1-4
	Voltage greater than 2V ..... Control rack movement is sufficient to provide starting fuel.	Go to B1-10
	Code present	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.

Continued on next page

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IMPORTANT: Do not operate the starter for more than 30 seconds at a time. To do so may over-heat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again.

Step/Sequence	Result	Next
B1-3 Stored Codes Check For No Rack Movement.		
With the ignition on, but the engine not running or cranking, check for stored codes in ECU memory.	No stored codes	Replace ECU and Go to B1-90
Stored codes present	MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes and go to section for corresponding code (33, 34, 35, or 36) in Diagnostic-Codes-Present Procedures.	
B1-4 Stored Codes Check For Insufficient Rack Movement.		
With the ignition on but the engine not running or cranking, check for stored codes in ECU memory. Look for code 33, 34, 35, or 36.	No stored codes	Go to B1-5
Stored codes present	MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes and go to section for corresponding code (33, 34, 35 or 36) in Diagnostic-Codes-Present Procedures.	

Continued on next page

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CAUTION: During the B1-5 Actuator Solenoid Check test, be careful to keep the jumper leads isolated so the battery +12 V is not shorted to ground. Also, if the rack actuator is functioning correctly, about 20 amperes of current will be conducted during the check and a spark will occur when the circuit is broken. This condition should not be continued beyond a few seconds, as overheating of the Actuator Solenoid will occur.

Step/Sequence	Result	Next
B1-5 Actuator Solenoid Check.		
Locate and uncap connector X3. With ignition on, monitor voltage from X3 socket C (+) to X3 socket D (-) (Rack Position Voltage). Locate X7 (3-way connector behind injection pump). At 3-way PUMP connector (which mates to X7), connect jumper wire from connector socket C to + 12V battery voltage and socket B to ground. While the above connection is made, monitor Rack Position Voltage again.	Measured voltage changes from 2.75—2.95V to a value less than 1.2V when + 12V is applied to the Actuator Solenoid	Go to B1-6
Measured voltage does NOT change as described above (Rack is stuck or solenoid is defective.)	Replace pump and Go to B1-90	
B1-6 ECU Check.		
With ignition off, reconnect all connectors. Attempt to start engine. If engine does not start be sure to crank continuously for at least 4 seconds. Monitor diagnostic codes.	Engine does not start and no codes are present	If connectors, wiring and battery have been checked, then replace ECU and Go to B1-90
Engine starts and no codes are present ..... (Problem no longer present.)	Go to B1-90	
Code present	Go to section for corresponding code in Diagnostic-Codes-Present Procedures.	
B1-10 Pump Fuel Flow Check.		
Disconnect hydraulic line from pump return to bleed line 'T'. With ignition on but engine not running, operate hand primer looking for fuel from pump return.	Fuel flows out pump return line ..... (Shut-off valve is opening and fuel is getting through pump.)	Starting problem is NOT in electronic fuel injection system. Refer to troubleshooting section of engine operator's manual.
No fuel out pump return line ..... (Shut-off valve is probably closed.)	Go to B1-11	
B1-11 Shut-Off Solenoid Power Check.		
Check electrical connection at shut-off solenoid threaded stud.	OK	Go to B1-12
Loose connection	Repair and go to B1-90	
B1-12 Shut-Off Solenoid Power Check.		
With ignition still on, measure voltage from shut-off solenoid threaded stud (+) to fuel inlet housing (-).	Less than 10 volts	Go to B1-13
Same as battery voltage .... (Should be greater than 10 volts.)	Go to B1-14	

Continued on next page

B1-13 Electrical System Check.		
Turn ignition off. Check connections at battery, check battery charge, check for damaged wiring. Check for open circuit between X1 pin 4 and shut-off solenoid terminal.	Problem found	Repair and go to B1-90
Electrical system and wiring ..... harness OK	Replace ECU and go to B1-90	
B1-14 Shut-Off Solenoid Continuity Check.		
Disconnect wire from shut-off solenoid terminal. Measure resistance between terminal and pump housing.	7—15 ohms (OK)	Go to B1-15
Less than 7 or greater than 15 ohms ..... (short or open circuit)	Replace fuel shut-off solenoid and go to B1-90	
B1-15 Bleed Orifice Check.		
Disconnect hydraulic line from fuel inlet housing to bleed line 'T'. (Line from fuel inlet housing is small bleed orifice between fuel filter and fuel shut-off valve.) With ignition on but engine not running, operate hand primer looking for fuel from bleed orifice.	Fuel leaks out bleed orifice ..... (If bleed orifice is not restricted, then fuel shut-off valve is probably stuck shut.)	Replace fuel shut-off valve reconnect all lines, and Go to B1-90
No fuel out bleed orifice or pump return line (Bleed orifice clogged or no fuel getting to pump.)	Go to B1-16	
B1-16 Fuel Inlet Check.		
With ignition on, loosen fuel inlet line fitting at fuel inlet assembly at pump. (Fuel may spray if pressurized.)	Fuel is pressurized and leaks out of loose fitting	Go to B1-17
Fuel is NOT pressurized. No significant leak from loose fitting ..... (Fuel is NOT getting to pump.)	Refer to troubleshooting section of engine operator's manual and check remainder of fuel system.	

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

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

Step/Sequence	Result	Next
B1-17 Pump Return Fuel Check.		
With ignition still on, wait several seconds until pressure is relieved and leak slows to drip. Now tighten fuel inlet line fitting and operate hand primer checking pump return fuel flow.	Fuel flows out pump return line ..... (Bleed orifice is clogged.)	Remove fuel inlet assembly, clean out bleed orifice, reinstall fuel inlet assembly, and go to B1-90 OR Replace fuel inlet assembly and Go to B1-90
No fuel out bleed orifice pump return line ..... (Bleed orifice is clogged and shut-off valve is stuck closed.)	Replace fuel inlet assembly and Go to B1-90	
B1-90 Verify Repairs.		
With ignition off, reconnect all connectors and hydraulic lines. Attempt to start engine noting diagnostic codes (if engine does not start, be sure to crank continuously for at least 4 seconds).	Engine starts and not diagnostic codes are present	Repairs are complete. Clear stored codes.
Codes are present	Go to section for corresponding code in Diagnostic-Codes-Present Procedure.	
Engine does not start and no diagnostic codes are present	Refer to troubleshooting section of engine operator's manual, or repeat Procedure B1 to verify repair.	
SYMPTOM B2-Fast Idle Speed Too Low		
B2-1 Three-State Throttle Check.		
Determine if engine application uses Three-State Throttle. (Generator sets use Three-State Throttle.)	Three-State Throttle is used	Go to B2-4
Three-State Throttle NOT used	Go to B2-2	

Continued on next page

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B2-2 Check Stored Codes.		
With ignition on, check stored codes 11, 12, 13 or 14. MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes.	One or more of these stored codes is present ..... (Possible throttle adjustment or throttle sensor problem.)	Refer to machine technical manual for throttle sensor adjustment or replacement instructions.
None of these stored codes are present	Go to B2-3 if PWM Throttle input is used in this engine application. Go to B2-4 if PWM Throttle Input is NOT used.	
B2-3 PWM Throttle Check.		
Disconnect PWM Throttle Input between ECU and electronics module which is sending the signal. Start engine and check fast idle speed first with primary throttle, then with secondary throttle (if equipped).	Fast idle speed OK ..... (Throttle sensors are probably OK.)	If problem exists only when PWM throttle is connected, refer to machine technical manual for PWM technical manual for PWM Throttle diagnostic procedures.
Fast idle speed still too low ..... (PWM Throttle Input probably OK. Reconnect PWM Throttle Input at end of procedure.)	Go to B2-4	
B2-4 Analog Throttle Check with Electronic Governor Tester.		
Stop engine. Connect Electronic Governor Tester to connector X4. Start engine with no load. Select '% Throttle' mode on tester. Make sure engine speed control is for fast idle. (If dual analog throttle at a time.)	Electronic Governor Tester not available for use	Go to B2-6
Tester reads 100% and idle speed is near normal fast idle speed	Normal operation.	
Tester reads 100% and idle speed is too slow ..... Fuel injection system is functioning correctly, but parasitic loads may be unusually high.)	Go to B2-7	
Fast idle speed is too slow and Tester reads LESS than 100% ..... (Throttle input voltage(s) probably not correct for fast idle.)	Check machine technical manual for throttle sensor wiring, adjustment, or replacement.	
B2-5 3-State Throttle		
Stop engine. Connect Electronic Governor Tester to connector X4. Start engine with no load. Select '% Throttle' mode on tester. Make sure engine speed control is for high idle. Refer to machine technical manual for correct throttle percentages for each selectable speed.	Electronic Governor Tester not available for use	Go to B2-6
Tester reads correct throttle percentage and idle speed is near normal fast idle speed	Normal operation.	
Tester reads correct throttle percentage and idle speed is too slow ..... (Fuel Injection system is functioning correctly, parasitic loads may be unusually high.)	Go to B2-7	
Fast idle speed is too slow and tester reads an incorrect value ..... (Throttle input voltage(s) probable not correct for fast idle.)	Check machine technical manual for throttle wiring.	

Continued on next page

B2-6 Throttle Check Without Electronic Governor Tester.

With ignition on but engine not running, make sure engine speed control is set for fast idle. (For vehicles with dual analog throttles, check one throttle at a time.) Check corrected throttle input voltages (see Group 40—Nippondenso Component Repairs and Adjustments). Refer to machine technical manual for proper fast idle voltages.	Voltage is correct for fast idle ..... (Fuel injection system is functioning correctly, but parasitic loads may be unusually high.)	Go to B2-7
Voltage is too high or too low for fast idle	Refer to machine technical manual for sensor/adjustment/replacement instructions or throttle wiring description.	

B2-7 Speed Regulation Select Input Check.

Determine if Speed Regulation Select input is used for this engine application.	It is used (or not sure if it is used)	Refer to machine technical manual for details and troubleshooting the Speed Regulation Select input.
Not used	Throttle adjustment OK. Look elsewhere for problem.	

SYMPTOM B3—Slow Idle Speed Too Fast B3-1 3-State Throttle Check.

Determine if engine application uses Three-State Throttle. (Generator sets use Three-State Throttle.)	Three-State Throttle is used	Go to B3-4
Three-State Throttle NOT used	Go to B3-2	

B3-2 Check Stored Codes.

With ignition on, check stored codes 11, 12, 13 or 14. MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes.	One or more of these stored codes is present. (Possible throttle adjustment or throttle sensor problem.)	Refer to machine technical manual for throttle sensor adjustment replacement instructions.
None of these stored codes are present	Go to B3-3 if PWM Throttle Input is used in this engine application. Go to B3-4 if PWM Throttle Input is NOT used.	

B3-3 PWM Throttle Check.

Disconnect PWM Throttle Input between ECU and electronics module which is sending the signal. Start engine and check idle speed with throttle(s) set to slow idle.	Fast idle speed OK ..... (Throttle sensors are probably OK.)	If problem exists only when PWM throttle is connected, refer to machine technical manual for PWM Throttle diagnostic procedures.
Slow idle speed still too fast ..... (PWM Throttle Input probably OK. Reconnect PWM Throttle Input at end of procedure.)	Go to B3-4	

B3-4 Throttle Check with Electronic Governor Tester.

Stop engine. Connect Electronic Governor Tester to connector X4. Start engine with no load. Select '% Throttle' mode on tester. Make sure engine speed control is for slow idle. (If dual analog throttles are used, make sure both are set for slow idle.)	Electronic Governor Tester not available for use	Go to B3-5
Tester reads 0% and idle speed is near normal slow idle speed	Normal operation. (Problem is no longer present.)	
Slow idle speed is too fast and tester reads GREATER than 0% ..... (Throttle input voltage(s) probably not correct for slow idle.)	Check machine technical manual for throttle sensor, adjustment, or replacement.	

Continued on next page

B3-5 Throttle Check Without Electronic Governor Tester.

With ignition on but engine not running, make sure engine speed control is for slow idle. (For vehicles with dual analog throttles, make sure both are set for slow idle.) Check corrected throttle input voltage (see Group 40—Nippondenso Component Repairs and Adjustments). Refer to machine technical manual for proper slow idle voltages.	Corrected throttle voltage is proper for slow idle	Go to B3-6
Voltage is too high or too low for slow idle ...	Refer to machine technical manual for sensor adjustment or replacement instructions.	

B3-6 Slow Idle Speed Check.

Start engine and check slow idle speed.	Slow idle speed is correct	Normal operation. (Problem is no longer present.)
Slow idle speed too fast	Go to B3-7.	

B3-7 Rack Position Check.

Stop engine. Turn ignition on. Check rack position voltage by measuring from X3 socket C (+) to X3 socket D (-).	Above 2.6 volt ..... (Rack not sticking.)	Replace Engine Controller and recheck slow idle speed.
Below 2.6 volt ..... (Rack sticking above slow idle)	Replace pump/actuator assembly and recheck slow idle speed.	

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Diagnostic-Codes-Present Procedures

The diagnostic procedures below are intended to be used when diagnostic codes are present at the time the procedure is started (with the exception of Code 34). They will not necessarily result in the correct diagnosis if the diagnostic code is not present when the procedure is begun. Note that Codes 34, 39, 42, and 44 can only occur when the engine is running.

CAUTION: The diagnostic procedures sometime require that tests be performed with the ignition on or while cranking the engine or with the engine running. Proper precautions should be taken prior to performing any of these steps.

When instructed to 'turn ignition on', simply apply supply voltage to the governor system - do not start or attempt to start the engine.

IMPORTANT: If any engine diagnostic codes are stored within the Engine Controller, transmitted by the Engine Controller, or stored within an on-board code reader that are not in the following list, report these codes to the factory for further instruction. Record stored codes before disconnecting the battery. Shortly after the battery is disconnected, stored codes will be erased.

A quick reference directory of the diagnostic codes is shown below; a more detailed diagnostic code description follows.

Continued on next page

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NOTE: If the operator is able to keep the engine running during a fault condition, no damage to the engine should result. Therefore, in certain fault conditions, the operator can keep working until it is more convenient for him to get the problem fixed.

Code	Code Description/Symptom/Action	Page
11	Primary Analog Throttle Input too high	35-24
12	Primary Analog Throttle Input too low	35-27
13	Secondary Analog Throttle Input too high	35-29
14	Secondary Analog Throttle Input too low	35-32
	Symptom: Partial or total loss of throttle control. If vehicle has two throttles (hand and foot), control will revert to throttle that is still working. If vehicle has only one throttle (or if both throttles have failed), engine will run at slow idle while fault is occurring. Engine speed will probably be erratic if fault is intermittent. Action: Operator should be able to find part of the throttle range that works and continue to operate range if necessary. If the fault is due to misadjustment, continuing to operate will not hard the engine.	
28	Engine Controller Failure	35-35
	Symptom: Engine only runs at slow idle. Action: The Engine Controller will have to be replaced.	
29	Sensor Excitation Voltage too high or too low	35-36
	Symptom: Stalled engine; may or may not restart. If engine does start, it will likely stall again. Performance when running may or may not be impaired. Action: This problem may be hard to troubleshoot. The only thing the operator can do is GENTLY wiggle the harness going to the pump and to the throttles in case there is a short in the harness.	
33	Actuator Solenoid Output shorted high	35-38
	Symptom: Engine will stall if fault occurs while running. Engine will be prevented from starting. Action: Operator can GENTLY wiggle the harness between the controller and the pump because the fault is most likely caused by a short circuit. If the problem still exists, refer to Code 33 later in this group.	
34	Rack Position Error	35-41
	Symptom: Engine may perform erratically or it may just shut down. Engine should restart, but will likely exhibit the same symptoms as before. Action: Refer to Code 34 later in this group.	
35, 36	Rack Position Voltage out of range	35-46
	Symptom: Erratic engine speed and stalled engine. Action: Refer to Code 35 or 36 later in this group.	
37, 38	Fuel Temperature Input Voltage out of range	35-51
	Symptom: Power change; hard or smoky starting. Performance loss may be only slight. Action: This fault will harm the engine. Continue to operate if necessary. Repair when convenient.	
39	Primary Speed Input Error	35-58
	Symptom: Momentary erratic speed. Action: This fault will not harm the engine. Continue to operate if necessary. Repair when convenient.	

Continued on next page

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NOTE: Engine operation may return to normal in a short time (minutes or hours) when the speed sensor fails completely.

Code	Code Description/Symptom/Action	Page
41	Start Signal Missing	35-61
	Symptom: Engine may hiccup (start to die, then recover) die to momentary power loss to electronic governor.	
	Action: If above symptom occurs, operator can check connectors to see if they are mated properly. Otherwise, see the dealer.	
42	Engine Overspeed	35-63
	Symptom: Momentary overspeed.	
	Action: No action is required if no other symptom is present.	
44	Auxiliary Speed Input Error	35-64
	Symptom: Engine performance may be erratic.	
	Action: This fault will not harm the engine. Continue to operate if necessary. Repair when convenient.	
47	Derated Torque Curve Selected	35-66
51	Electrical Noise on Analog Throttle Input	35-67
	Symptom: Erratic engine speed or operation at slow idle.	
	Action: Hard to troubleshoot. Refer to Code 51 later in this group.	
54	Electrical Noise on Rack Position Voltage Input	35-67
	Symptom: Engine stall. Engine may or may not restart. If fault persists, engine will stall again.	
	Action: Hard to troubleshoot. Refer to Code 54 later in this group.	
55	Electrical Noise on Fuel Temperature Input	35-68
	Symptom: Same as for code 38, but in this case we know that problem will both be with sensor. Engine will keep running and operator may continue to work if necessary.	
	Action: This fault will not harm the engine. Continue to operate if necessary. Repair when convenient.	
56	Electrical Noise on Fuel Limit Select Input	35-68
	Symptom: Possible erratic engine performance.	
	Action: This fault will not harm the engine. Continue to operate if necessary. Repair when convenient.	
57	Electrical Noise on Speed Regulation Select Input	35-69
	Symptom: Possible erratic engine performance.	
	Action: This fault will not harm the engine. Continue to operate if necessary. Repair when convenient.	
58	Electrical Noise on 3-State Throttle Input	35-69
	Symptom: Possible erratic engine performance.	
	Action: Check for loose connections on electrical equipment. Refer to code 58 later in this group.	
59	Electrical Noise on Sensor +5V Supply	35-70
	Symptom: Engine will die and will be prevented from starting. If this fault occurs, there will probably be other codes as a result.	
	Action: Refer to code 59 later in this group.	
71	Diagnostic Codes Output Signal stuck high	35-71
72	Diagnostic Codes Output Signal stuck low	35-73
73	Fuel Flow/Throttle Output Signal stuck high	35-74
74	Fuel Flow/Throttle Output Signal stuck low	35-76

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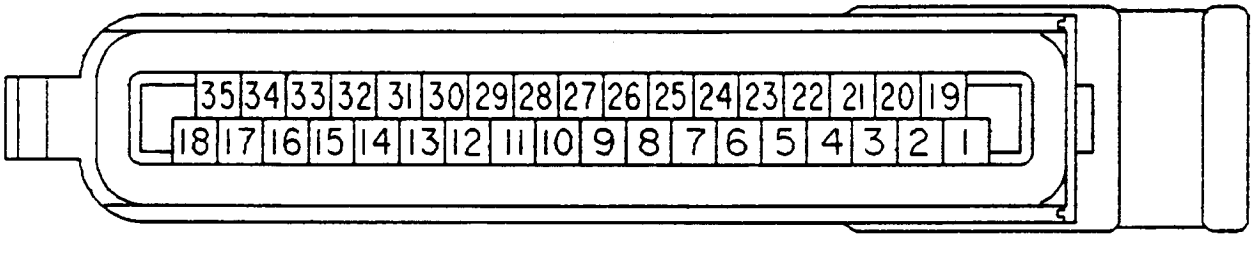
Code 11—Primary Analog Throttle Input Too High



X1 Connector

NOTE: Code 11 occurs when the ECU reads a voltage at the Throttle Input (Connector X1 Pin 6) which is higher than the normal operating range of the throttle sensor.

Step/Sequence	Result	Next
C11-1 Sensor Adjustment Check.		
With ignition on, slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Code 11 always present	Go to C11-2
Code 11 only present at upper portion of throttle lever travel	Refer to machine technical manual and adjust throttle sensor.	
C11-2 Throttle Linkage Check.		
Check throttle linkage and verify that throttle sensor does move through its range of travel as the throttle lever is moved from slow to fast idle.	Linkage OK	Go to C11-3
Problem found	Adjust throttle linkage and go to C11-90	
C11-3 Throttle Sensor Connector Check.		
Disconnect throttle sensor connector. Inspect terminals on both connector halves for damage, corrosion, and poorly positioned pins or sockets.	OK	Go to C11-4
Problem found	Repair and go to C11-90	
C11-4 +5 Volt Short Check		
With ignition on and sensor still disconnected, measure voltage between harness throttle connector terminals C (+) and a (-).	Greater than 4 volts ..... (Should be between 4.8V and 5.2V	Go to C11-5
Less than 4 volts	Go to C11-20	
C11-5 Sensor Open Diagnostic Check.		
With ignition on and sensor still disconnected, check diagnostic codes.	Code 12 ..... (Harness is ok)	Go to C11-6
Code 11 ..... (Short in harness or connector)	Go to C11-20	

Continued on next page

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C11-6 Common Open Circuit Check.		
Turn ignition to 'OFF'. Disconnect connector X1 at ECU. Install a shorting jumper between throttle sensor harness connector terminals A and B. Measure resistance between X1 harness connector pins 6 and 22.	All greater than 5 ohms	Replace sensor and go to C11-90.
Greater than 5 ohms ..... (Open circuit exists in harness between X1 connector pin 35 and throttle connector pin A.)	Repair and go to C11-90	
C11-20 ECU Connector Check.		
Turn ignition 'OFF'. Disconnect connector X1 at ECU. Inspect terminals of both connector halves for damage, dust corrosion, and poorly positioned terminals.	OK	Go to C11-21
Problem found	Repair and go to C11-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C11-21 Harness Short Circuit Check.		
Turn ignition of 'OFF'. Measure resistance between X1 harness connector terminal 6 and all other X1 terminals.	All greater than 5 ohms	Go to C11-22
Any less than 5 ohms ..... Short circuit exists in harness between X1 connector pin 6 and another circuit.)	Repair and go to C11-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C11-22 Harness External Short Check.		
With ECU and throttle sensor disconnected, turn ignition to 'ON'.	Less than 1 volt	Go to C11-23
Measure voltage from X1 connector pin 6 (+) to X1 connector pin 20 (-).	Greater than 1 volt ..... (Short circuit exists in harness between X1 connector pin 6 and some voltage source.)	Repair and go to C11-90
C11-23 ECU Check.		
Reconnect connector X1 to ECU but leave throttle sensor disconnected. Turn ignition to 'ON'. Check diagnostic codes.	Code 11	Replace ECU and go to C11-90.
Code 12 with or without ..... additional codes (Problem is no longer present.)	Diagnostics are complete. Go to C11-90 to see if problem will reoccur	

Continued on next page

C11-90 Verify Repairs.

With ignition off, reconnect all connectors. Turn ignition to 'ON'. Slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Neither Code 11 nor 12 present	Go to C11-91
Code 11 always present	Review this section to find problem.	
Code 12 always present	Go to Code 12 procedure to find problem.	
Code 11 or Code 12 present ..... during a portion of the throttle lever travel.	Refer to machine technical manual for sensor adjustment instructions.	

C11-91 Verify Repairs.

Start engine. Verify that movement of throttle through its entire range gives engine speed range of slow to fast idle. Note diagnostic codes.	Throttle operation OK and ..... no diagnostic codes present.	Repairs are complete. Clear stored codes.
Throttle operation OK but ..... diagnostic codes present.	Go to appropriate section to continue service.	
No diagnostic codes but ..... low idle and/or fast idle speeds cannot be obtained.	Refer to machine technical manual for sensor adjustment instructions.	
Throttle does not control ..... engine speed properly.	Review this section to find problem.	

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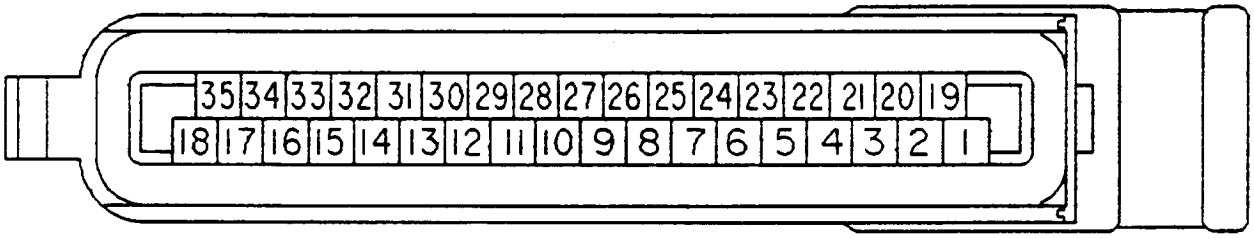
Code 12—Primary Analog Throttle Input Too Low



X1 Connector

NOTE: Code 12 occurs when the ECU reads a voltage at the primary analog throttle input (Connector X1 pin 6) which is lower than the normal operating range of the throttle sensor.

Step/Sequence	Result	Next
C12-1 Sensor Adjustment Check.		
With ignition on, slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Code 12 always present	Go to C12-2
Code 12 only present at lower portion of throttle lever travel	Refer to machine technical manual for sensor adjustment instructions.	
C12-2 Throttle Linkage Check.		
Check throttle linkage and verify that throttle sensor does move through its range of travel as the throttle lever is moved from slow to fast idle.	Linkage OK	Go to C12-3
Problem found	Repair and go to C11-90	
C12-3 Throttle Sensor Connector Check.		
Disconnect throttle sensor connector. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned pins and sockets.	OK	Go to C12-4
Problem found	Repair and go to C11-90	
C12-4 Sensor Check. (Assumes that A is ground, B is signal, and C is +5 volts.)		
When throttle connector disconnected, install a shorting jumper between throttle sensor harness connector terminals B and C. Check diagnostic codes.	Code 12	Go to C12-5
Code 11	Replace sensor and go to C11-90.	
C12-5 ECU Connector Check.		
Turn ignition to 'OFF'. Disconnect connector X1 at ECU. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C12-6
Problem found	Repair and go to C11-90	

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IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C12-6 Harness Check. (Assumes that A is ground, B is signal and C is +5 volts)		
Shorting jumper should still be installed between throttle connector terminals B and C.	Less than 5 ohms	Go to C12-7
Measure resistance between X1 harness connector, pins 6 and 2.	Greater than 5 ohms ..... (Open circuit exists in harness either in wire to X1 connector, pin 6 or in wire to X1 connector, pin 2.)	Repair and go to C11-90
C12-7 Harness Check.		
Shorting jumper should still be installed between throttle connector terminals B and C. Measure resistance between X1 harness connector, pins 6 and all other X1 pins.	All greater than 5 ohm	Go to C12-8
Any less than 5 ohms ..... (Short circuit exists in harness between X1 connector, pin 6 or 2 and another circuit).	Repair and go to C11-90	
C12-8 ECU Check.		
Reconnect connector X1 to ECU. With shorting jumper still installed between throttle connector terminals B and C, turn ignition to 'ON'. Check diagnostic codes.	Code 12	Replace ECU and go to C11-90
Code 11 with or without additional codes ..... (Problem is no longer present).	Go to C11-90 to see if Code 12 will reoccur.	

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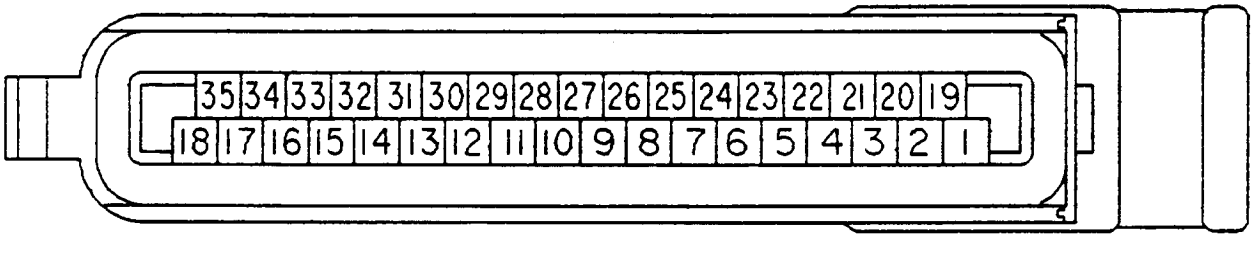
Code 13—Secondary Analog Throttle Input Too High



X1 Connector

NOTE: Code 13 occurs when the ECU reads a voltage at the secondary analog throttle input (Connector X1 pin 4) which is higher than the normal operating range of the throttle sensor.

The +5V and signal for the secondary analog may not be accessible at a service connector as is the primary throttle sensor. The machine technical manual may have additional information for troubleshooting the secondary analog throttle input.

Step/Sequence	Result	Next
C13-1 Sensor Adjustment Check.		
With ignition on, slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Code 13 always present	Go to C13-2
Code 13 only present at upper portion of throttle lever travel	Refer to machine technical manual for sensor adjustment instructions.	
C13-2 Throttle Linkage Check.		
Check throttle linkage and verify that throttle sensor does move through its range of travel as the throttle lever is moved from slow to fast idle.	Linkage OK	Go to C13-3
Problem found	Repair and go to C13-90	
C13-3 Throttle Sensor Connector Check.		
Disconnect throttle sensor connector. Inspect terminals on both connector halves for damage, corrosion, and poorly positioned pins or sockets.	OK	Go to C13-4
Problem found	Repair and go to C13-90	
C13-4 +5 Volt Short Check. (Assumes that A is ground, B is signal and C is +5 volts.)		
With ignition and sensor still disconnected, measure voltage between harness throttle connector terminals C (+) and A (-).	Greater than 4 volts ..... (Should be between 4.8V and 5.2V)	Go to C13-5
Less than 4 volts	Go to C13-20	
C13-5 Sensor Open Diagnostic Check.		
With ignition on and sensor still disconnected, check diagnostic codes.	Code 14 ..... (Harness is ok)	Go to C13-6
Code 13 ..... (Short in harness or connector)	Go to C13-23	

Continued on next page

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C13-6 Common Open Circuit Check. (Assume that A is ground, B is signal, and C is +5 volts.)		
Turn ignition to 'OFF'. Disconnect connector X1 at ECU. Install a shorting jumper between throttle sensor harness connector terminals A and B. Measure resistance between X1 harness connector pins 4 and 22.	Less than 5 ohms	Replace sensor and to C13-90
	Greater than 5 ohms ..... (Open circuit exists in harness between X1 connector pin 22 and throttle connector pin A.)	Repair and go to C13-90
C13-20 ECU Connector Check.		
Turn ignition to 'OFF'. Disconnect connector X1 at ECU. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C13-21
	Problem found	Repair and go to C13-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C13-21 Harness Short Circuit Check.		
Turn ignition to 'OFF'. Measure resistance between X1 harness connector terminal 4 and all other X1 terminals.	All greater than 5 ohms	Go to C13-22
	Any less than 5 ohms ..... (Short circuit exists in harness between X1 connector pin 4 and another circuit.)	Repair and go to C13-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C13-22 Harness External Short Check.		
With ECU and throttle sensor disconnected, turn ignition to 'ON'.	Less than 1 volt	Go to C13-23
Measure voltage from X1 connector pin 4 (+) to X1 connector pin 20 (-).	Greater than 1 volt ..... (Short circuit exists in harness between X1 connector pin 4 and some voltage source.)	Repair and go to C13-90
C13-23 ECU Check.		
Reconnect connector X1 to ECU but leave throttle sensor disconnected. Turn ignition to 'ON'. Check diagnostic codes.	Code 13	Replace ECU and go to C13-90
Code 14 with or without ..... additional codes. (Problem is no longer present.)	Diagnostics are complete. Go to C13-90 to see if problem will reoccur	

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C13-90 Verify Repairs.

With ignition off, reconnect all connectors. Turn ignition to 'ON'. Slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Neither Code 13 nor Code 14 present	Go to C13-91
Code 13 always present	Review this section to find problem.	
Code 14 always present	Go to Code 14 procedure to find problem.	
Code 13 or Code 14 present ..... during a portion of the throttle lever travel.	Refer to machine technical manual for sensor adjustment instructions.	

C13-91 Verify Repairs.

Start engine. Verify that movement of throttle through its entire range gives engine speed range of slow to fast idle. Note diagnostic codes.	Throttle operation OK and ..... no diagnostic codes present.	Repairs are complete. Clear stored codes.
Throttle operation OK but ..... diagnostic codes present.	Go to appropriate section to continue service	
No diagnostic codes but ..... slow idle and/or fast idle speeds cannot be obtained.	Refer to machine technical manual for sensor adjustment instructions.	
Throttle does not control ..... engine speed properly.	Review this section to find problem.	

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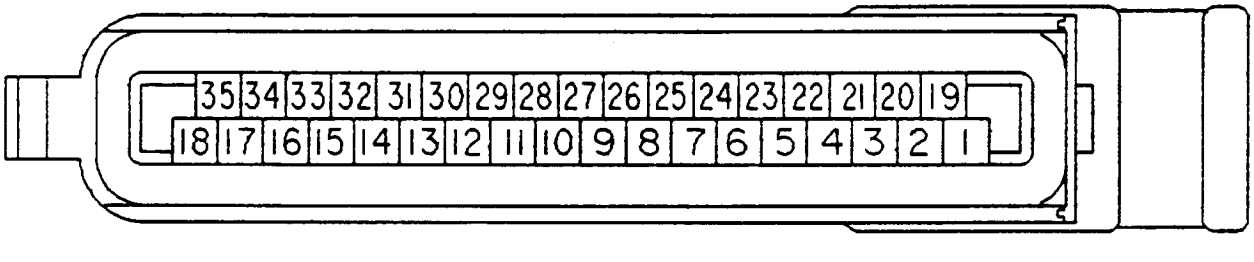
Code 14—Secondary Analog Throttle Input Too Low



X1 Connector

NOTE: Code 14 occurs when the ECU reads a voltage at the secondary analog throttle input (Connector X1 pin 4) which is lower than the normal operating range of the throttle sensor.

The +5V and signal for the secondary analog may not be accessible at a service connector as is the primary throttle sensor. The machine technical manual may have additional information for troubleshooting the secondary analog throttle input.

Step/Sequence	Result	Next
C14-1 Sensor Adjustment Check.		
With ignition on, slowly move throttle lever through its entire travel noting the status of the diagnostic codes.	Code 14 always present	Go to C14-2
Code 14 only present at lower portion of throttle lever travel	Refer to machine technical manual for sensor adjustment instructions.	
C14-2 Throttle Linkage Check.		
Check throttle linkage and verify that throttle sensor does move through its range of travel as the throttle lever is moved from slow to fast idle.	Linkage OK	Go to C14-3
Problem found	Repair and go to C13-90	
C14-3 Throttle Sensor Connector Check.		
Disconnect throttle sensor connector. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned pins and sockets.	OK	Go to C14-4
Problem found	Repair and go to C13-90	
C14-4 Sensor Check (Assumes A is ground, B is signal, and C is +5 volts.)		
With throttle disconnected, install a shorting jumper between throttle sensor harness connector terminals B and C. Check diagnostic codes.	Code 14	Go to C14-5
Code 13	Replace sensor and go to C13-90	
C14-5 ECU Connector Check.		
Turn ignition to 'OFF'. Disconnected connector X1 at ECU. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C14-6
Problem found	Repair and go to C13-90	

Continued on next page

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C14-6 Harness Check (Assumes A is ground, B is signal, and C is +5 volts.)		
Shorting jumper should still be installed between throttle connector terminals B and C.	Less than 5 ohms	Go to C14-7
Measure resistance between X1 harness connector, pins 4 and 3.	Greater than 5 ohms ..... (Open circuit exists in harness either in wire X1 connector, pin 4 or in wire to X1 connector, pin 3).	Repair and go to C13-90

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C14-7 Harness Check.		
Shorting jumper should still be installed between throttle connector terminals B and C. Measure resistance between X1 harness connector, pin 4 and all other X1 pins.	All greater than 5 ohms	Go to C14-8
Any less than 5 ohms ..... (Short circuit exists in harness between X1 connector, pin 4 or 3 and another circuit).	Repair and go to C13-90	
C14-8 ECU Check.		
Reconnect connector X1 to ECU. With shorting jumper still installed between throttle terminals B and C, turn ignition to 'ON'. Check diagnostic codes.	Code 14	Replace ECU and go C13-90
Code 13 with or without additional codes (Problem is no longer present.)	Go to C13-90 to see if Code 14 will reappear.	

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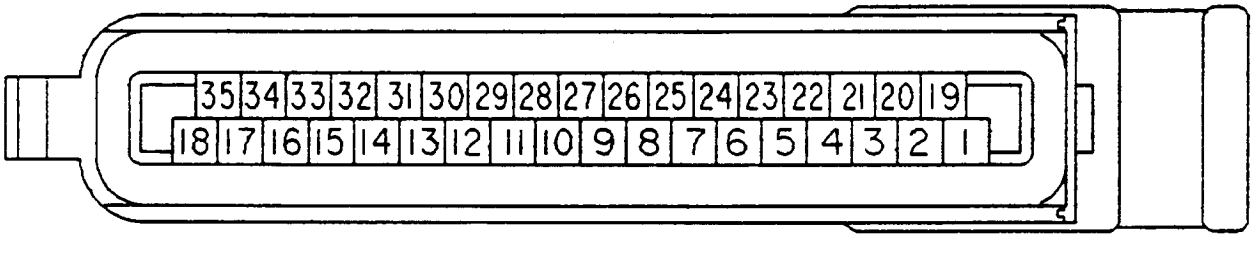
Code 28—Engine Controller Failure



X1 Connector

NOTE: Code 28 occurs when the circuitry in the Engine Controller used for measuring input voltages has failed. This failure may be temperature or vibration related, so system may begin to work normally after engine has been shut down for a while. Failure will probably reappear.

Engine should run at slow idle while this failure is occurring.

Step/Sequence	Result	Next
C28-1 ECU Sequence Check.		
Disconnect connector X1 at ECU and inspect terminals at both connector halves for damage, corrosion, and poorly positioned terminals.	Problem found	Repair connector(s) and go to C28-90.
OK	Replace ECU and go to C28-90.	
C28-90 Verify Repairs.		
Make sure connector X1 is connected to ECU. Turn ignition to 'ON'.	Code 28 still present	Replace ECU. Clear stored codes (if any) after new ECU has been installed.
Code 28 not present	Clear stored codes. Continue normal operation. If Code 28 recurs after connector has been checked or repaired, then ECU will have to be replaced.	

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Code 29—Sensor Excitation Voltage Too High or Too Low

NOTE: Code 29 will occur if there is a short circuit in the harness, or if there is a problem with a sensor which would cause excessive current demand on the sensor excitation voltage (+5V supply from ECU pins 2, 3 or 21).

The engine will die and not restart until key switch has been turned off first. Diagnostic Code 29 will be transmitted until the key switch is turned off. If the fault still exists, engine will not restart.

Step/Sequence	Result	Next
C29-1 Connector X3 Check.		
Inspect service connector X3 for dirt, shorted or damaged contacts, or loose wires at back of connector.	Connector OK	Go to C29-2.
Problem found	Repair and go to C29-90.	
C29-2 Analog Throttle Connector Checks.		
Inspect analog throttle connectors for dirt, shorted or damaged contacts, or loose wires at back of connectors.	Connector(s) OK	Go to C29-3.
Problem found	Repair and go to C29-90.	
C29-3 Analog Throttle Sensor Checks.		
With ignition off, disconnect analog throttle connectors one at a time. With sensor disconnected, turn ignition to 'ON' to see if Code 29 is still present.	Code 29 is still present with throttle sensors disconnected (Problem not with throttle sensors.)	Go to C29-4.
Code 29 no longer present	Replace throttle sensor which causes Code 29 to go away when disconnected. Then go to C29-90.	
C29-4 Pump Connector Check.		
Inspect both halves of 6-way pump connector (X9) for dirt, shorted or damaged contacts, or loose wires at back of connector.	Connector OK	Go to C29-5.
Problem found	Repair and go to C29-90.	
C29-5 Rack Position Sensor Check.		
With ignition off, disconnect X9 (6-way pump connector). Turn ignition to 'ON' to see if Code 29 is still present. (Ignore Code 36).	Code 29 is still present with X9 disconnected ..... (Problem is not with rack position sensor.) Replace pump/actuator assembly and go to C29-90.	Go to C29-6.
Code 29 no longer present (Problem probably in rack position sensor or sensor wiring.)		
C29-6 Harness Check.		
Reconnect X9 (6-way pump connector.) With ignition off, gently flex wiring harness bundle and separate harness from sheet metal while looking for cuts or abrasions on wires or harness cover. Turn ignition to 'ON' to see if Code 29 is still present.	Code 29 is still present	Go to C29-7.
Code 29 no longer present (Short circuit in harness, or short circuit to machine frame.) ..	Repair or replace wiring harness and go to C29-90.	

Continued on next page

C29-7 Engine Controller Connector Check.		
Turn off ignition. Disconnect Engine Controller connector (X1) and inspect both halves of connector for dirt, shorted or damaged contacts, or loose wires at back of harness connector.	Connector OK	Replace ECU and go to C29-90.
Problem found	Repair and go to C29-90.	
C29-90 Verify Repairs.		
With ignition off, reconnect all connectors. Turn ignition to 'ON' and note status of diagnostic codes.	No diagnostic codes	Go to C29-91.
Code 29 still present	Review this section to find problems.	
C29-91 Verify Repairs.		
Start engine, move throttle lever through entire range of travel both slowly and quickly.	Engine runs normally and no diagnostic codes	Repairs complete.
Engine does not start, or starts and dies with Code 29	Review this section to find problems.	
Other diagnostic codes present	Refer to appropriate section to continue service.	

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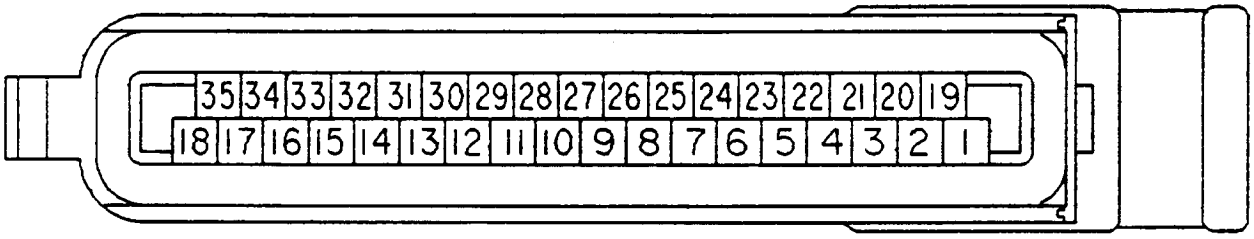
32

Code 33—Actuator Solenoid Output Shorted High



X1 Connector

NOTE: Code 33 will occur if there is a short circuit so that the Engine Controller detects battery voltage on the actuator solenoid drive output (ECU pins 17 and 18).

The engine will die and not restart until key switch has been turned off first. Code 33 will be transmitted until the key switch is turned off. If the fault still exists, engine will not restart.

Step/Sequence	Result	Next
C33-1 Pump Connector Check.		
Inspect both halves of 3-way pump connector (X7) for dirt, shorted or damaged contacts, or loose wires at back of connector.		
Problem found	Repair and go to C33-90.	
C33-2 Actuator Short Circuit Check.		
With ignition off, disconnect X7 (3-way pump connector). Turn to 'ON' to see if Code 33 is still present. If not, crank engine for 4 seconds (engine will not start.)		
Code 33 no longer present (Problem probably in actuator.)	Replace pump/actuator assembly and go to C33-90.	
C33-3 Harness Check.		
With ignition off, gently flex wiring harness bundle and separate harness from sheet metal while looking for cuts or abrasions on wires or harness cover. Turn ignition to 'ON' to see if Code 33 is still present.		
Code 33 no longer present (Short circuit in harness, or short circuit in machine frame.) ..	Repair or replace wiring harness and go to C33-90.	
C33-4 Engine Controller Connector Check.		
Turn off ignition. Disconnect Engine Controller Connector (X1) and inspect both halves of connector for dirt, shorted or damaged contacts, or loose wires at back of harness connector.		
Problem found	Repair and go to C33-90.	

Continued on next page

C33-5 Harness Check.		
Connector X7 (3-way pump connector) should still be disconnected. Turn on ignition and measure voltage between X1 pin 17 (+) or 18 (+) and X1 pin 35 (-).	Battery voltage ..... (Problem is in harness.)	Repair or replace wiring harness and go to C33-90.
Less than 1 volts	Replace Engine Controller and go to C33-90.	
C33-6 Actuator Solenoid Circuit Check.		
Measure resistance between X7 pins 'B' and 'C'.	Between 0.3 ohm and 0.7 ohm	Go to C33-90.
Greater than 0.7 ohm	Replace pump.	
Less than 0.7 ohm	Replace pump.	
C33-90 Verify Repairs.		
With ignition off, reconnect all connectors. Turn ignition to 'ON' and note status of diagnostic codes.	No diagnostic codes	Go to C33-91.
Code 33 still present	Review this section to find problems.	
C33-91 Verify Repairs.		
Start engine, move throttle lever through entire range of travel both slowly and quickly.	Engine runs normally and no diagnostic codes	Repairs complete.
Engine does not start, or starts and dies with Code 33	Review this section to find problems.	
Other diagnostic codes present	Refer to appropriate section to continue service.	

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34

Code 34—Rack Position Error

NOTE: Code 34 occurs when the actual rack position of the injection pump differs from the rack position as commanded by the Engine Controller. When the controller detects this condition, it attempts to shut off fuel by turning off drive to the actuator solenoid and, under certain conditions of speed of rack position, to the fuel shut-off solenoid. Code 34 cannot occur when the engine is stopped.

If the engine is running when the fault occurs, it will die and not restart until the key switch has been turned off first. If the fault still exists when the key switch is turned on, the engine will not start. Code 34 will be transmitted until the control rack returns to zero rack position. Therefore, there may be no code transmitted after the engine has died. Check stored codes for Code 34.

Step/Sequence	Result	Next
C34-1 Diagnostic Code Check.		
With ignition on but engine not running, check diagnostic codes.		
Codes other than 34	Go to appropriate sections and complete other service before doing Code 34 service.	
C34-2 Engine Start Check.		
Check stored codes. MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes. Attempt to start engine. Move throttle slowly and quickly through entire range of travel. Check diagnostic codes during operation.	Engine starts but runs up to over speed when dies with Code 34 present or stored ... (Problem could be stuck rack or short in harness.)	Leave ignition on (after engine has died) and go to C34-3.
Engine starts and runs. No codes present but previous engine operation has resulted in irregular operation with Code 34 observed or stored	Replace pump and go to C34-5.	
Engine does not start and Code 34 is present	Go to C34-10.	
Codes other than 34	Go to appropriate sections and complete other service first.	
C34-3 Rack Position Voltage Check.		
Measure rack position voltage at service connector X3 by measuring voltage from X3 socket C (+) to X3 socket D (-).	Less than 2.7 volts ..... (Rack may be stuck at a position greater than zero fuel.)	Go to C34-4.
Greater than 2.7 volts ..... (Rack position voltage is typically greater than 2.8 volts when the engine is shut down.)	Go to C34-20.	
C34-4 Stuck Rack Check.		
With ignition on, continue to monitor rack position voltage as in previous step. When monitoring voltage, disconnect X7 (3-way pump connector.)	Voltage stays less than 2.7 volts ..... (Rack is sticking.)	Replace injection pump and go to C34-5.
Voltage increases to greater than 2.7 volts (typically greater than 2.8 volts) ..... (Possible short in harness.)	Go to C34-20.	

Continued on next page

C34-5 Injection Pump Actuator Replacement.		
If the pump is replaced, first clear stored diagnostic codes. Run engine and check diagnostic (engine should be run at varying loads and throttle settings.)	Code 34 is still present ..... (Pump/actuator was probably good.)	Replace Engine Controller and go to C34-6.
No active or stored diagnostic codes	Repairs are complete. Make sure there are no stored codes.	
Codes other than 34	Go to appropriate sections to continue service.	
C34-6 Engine Controller Replacement.		
If the ECU is replaced, first clear the stored diagnostic codes. Run engine and check diagnostic codes (engine should be run at varying loads and throttle settings).	Code 34 is still present	Review this section to find problem.
No active or stored diagnostic codes	Repairs are complete. Make sure there are no stored codes.	
Codes other than 34	Go to appropriate sections to continue service.	
C34-10 X7 Connector Check.		
Turn key switch off. Find X7, the 3-way pump connector, near the rear of the injection pump. Disconnect X7 and inspect both connector halves for loose, poorly positioned, corroded, dirty or damaged contacts.	OK	Go to C34-11.
Problem found	Repair and go to C34-90.	
C34-11 Actuator Resistance Check.		
Use digital multimeter to measure the actuator coil resistance at the 3-way pump connector. Measure resistance between pins B and C.	Less than 1 ohm ..... (Typical resistance is 0.5—0.6 ohm.)	Go to C34-12.
Greater than 1 ohm ..... (Open circuit or too much resistance.)	Replace injection pump/actuator assembly and go to C34-90.	
C34-12 Actuator Power Supply Check.		
Turn ignition on and measure voltage between X7 socket C (+) and the injection pump housing (-) (vehicle ground).	Battery voltage	Go to C34-13.
Less than 10 volts ..... (Problem with electrical system or harness.)	Find cause of low voltage, repair and go to C34-90.	

Continued on next page

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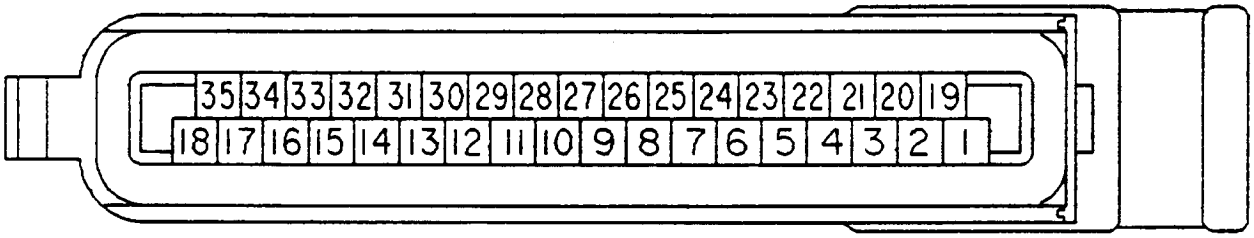

X1 Connector

Step/Sequence	Result	Next
C34-13 X1 Connector Check.		
Turn ignition off. Disconnect X1 and inspect for loose, poorly positioned, corroded, dirty or damaged contacts.	OK	Go to C34-14
Problem found	Repair and go to C34-90.	
C34-14 Harness Resistance Check.		
Measure resistance between socket B or 3-way pump connector X7 and pins 17 and 18 of controller connector X1.	Less than 5 ohms ..... (No open circuit in harness.)	Go to C34-15.
Greater than 5 ohms ..... (Bad connections or open in harness.)	Repair wiring and go to C34-90.	
C34-15 ECU Check.		
Reconnect X1 and X7 Attempt to start engine.	Engine still will not start	Replace Engine Controller and go to C34-90.
Engine starts	Go to C34-90.	
C34-20 Connector Check.		
With ignition off, disconnect connector X7 (3-way) from pump connector. Inspect both connector halves for damage, corrosion, and poorly positioned terminals looking especially for short circuit possibilities.	Connectors look OK	Go to C34-21.
Problem found	Repair and go to C34-90.	
C34-21 Pump Wiring Short Circuit Check.		
Measure resistance between pin B of 3-way pump connector and pump housing.	Greater than 5 ohms	Go to C34-22.
Less than 5 ohms ..... (Resistance less than 5 ohms indicates presence of short.)	Repair or replace pump/actuator assembly and go to C34-90.	
C34-22 ECU Harness Short Circuit Check.		
Disconnect connector X1 at Engine Controller. Measure resistance between X7 socket B and chassis ground and inspect harness for potential shorts to ground.	Greater than 5 ohms and no problem areas seen	Replace Engine Controller and go to C34-23.
Less than 5 ohms measures, or possible short circuit location seen ..... (Less than 5 ohms resistance indicates presence of short circuit.)	Repair and go to C34-90	
C34-23 ECU Check.		
Reconnect all harnesses, and test system by attempting to run engine.	Engine starts and runs	Go to C34-90
Engine still does not run normally	Check stored codes and go to appropriate section or review this section.	

Continued on next page

C34-90 Verify Repairs.

With ignition off, reconnect all connectors. Start engine and run at speeds from slow to fast idle at varying loads and throttle settings. Check diagnostic codes.	Engine runs OK and no diagnostic codes present	Repairs are complete. Clear stored codes.
Code 34 still occurs	Review this section to find problem.	
Code other than 34	Go to appropriate section to continue service.	

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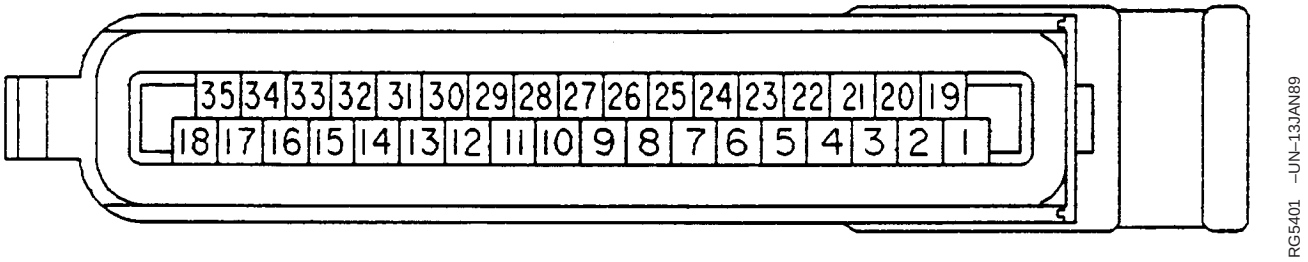
35
38

Code 35—Rack Position Voltage Too High



X1 Connector

NOTE: Code 35 occurs when the rack position voltage at ECU pin 27 is higher than the normal operating range (typically higher than 3.4 volts). This voltage is available for monitoring at service connector X3 socket C.

This fault condition is most likely caused by an open circuit in the wiring and connectors. If a connection becomes too loose or a wire is fractured, it is common for the circuit to have an intermittent connection depending on temperature and vibration. This means that diagnosis may be difficult since an open circuit that has caused a malfunction may no longer be present when the diagnosis actually takes place. Therefore, if diagnosis is unsuccessful, it may be helpful to try running the engine to allow it to warm up, or to try other means to duplicate the conditions which are present during the malfunction. It also suggested that resistance checks be made as soon as possible after engine shutdown, if a diagnostic code has been present during engine operation.

Refer also to Code 42—Engine Overspeed.

Step/Sequence	Result	Next
C35-1 6-Way Pump Connector Check.		
Turn ignition off. Disconnect X9 (6-way pump connector) and inspect both halves for damage, corrosion, and poorly positioned terminals.	Connectors OK	Go to C35-2.
Problem found	Repair and go to C35-90.	
C35-2 Engine Controller Connector Check.		
Disconnect X1 (35-pin ECU connector) and inspect both halves for damage, corrosion, and poorly positioned terminals.	Connectors OK	Go to C35-3.
Problem found	Repair and go to C35-90.	
C35-3 Machine Harness Check.		
With X1 and X9 still disconnected, measure the resistance between X1 pin 9 and X9 socket C. (X9 is at the 6-way pump connector.)	Less than 5 ohms ..... (No open circuit found.)	Go to C35-4.
Greater than 5 ohms ..... (Open circuit in connector or wire.)	Repair and open and go to C35-	
C35-4 Sensor +5V Supply Check.		
Install X1, 35-pin connector. Turn ignition on. Measure between X9 socket F (+) and X9 socket C (-). Note: Ignore Code 36.	Less than 5.5 volts ..... (Typical is 4.9—5.1 volts.)	Go to C35-5.
Greater than 5.5 volts ..... (Problem in wiring or bad Engine Controller.)	Go to C35-20.	

Continued on next page

C35-5 Signal Voltage Check.		
With ignition on, measure voltage between X9 socket D (+) and X9 socket C (-). Note: Ignore Code 36.	Less than 1 volt ..... (Typically close to 0 volt.)	Go to C35-6.
Greater than 1 volts ..... (Problem in wiring or bad Engine Controller.)	Go to C35-20.	
C35-6 Sensor Check.		
Turn ignition off. Reconnect X1 and X9. Turn ignition on and measure at X3 (4-way service connector) socket C (+) to X3 socket D (-).	2.75—2.95 volts	Go to C35-7.
Greater than 3.0 volts	Replace pump/actuator assembly and go to C35-90.	
C35-7 Engine Start Check.		
MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes. Attempt to start engine. Operate at various throttle settings.	Engine runs normally and no codes	No problems found, resume normal operation.
Engine does NOT run normally. Code 35 is present or stored	Replace pump/actuator assembly and go to C35-90.	
C35-20 Harness Check.		
Check for short circuits in wiring harness by visual check and by gently shifting the position of the harness. Check for damage where harness or wires might rest against sharp metal or hot surfaces. Disconnect X1 and X9. Measure resistance between X1 pin 27 and all other X1 pins. All resistances should be greater than 5 ohms.	Wiring OK	Replace Engine Controller and go to C35-90.
Problem found	Repair and go to C35-90.	
C35-90 Verify Repairs.		
With ignition off, reconnect all connectors. Start engine and check diagnostic codes. Operate engine at various throttle settings.	Engine runs normally, no diagnostic codes ...	Repairs are complete. Clear stored codes.
Code 35 still present	Review this section to find problem.	
Codes other than Code 35	Go to appropriate section to continue service.	

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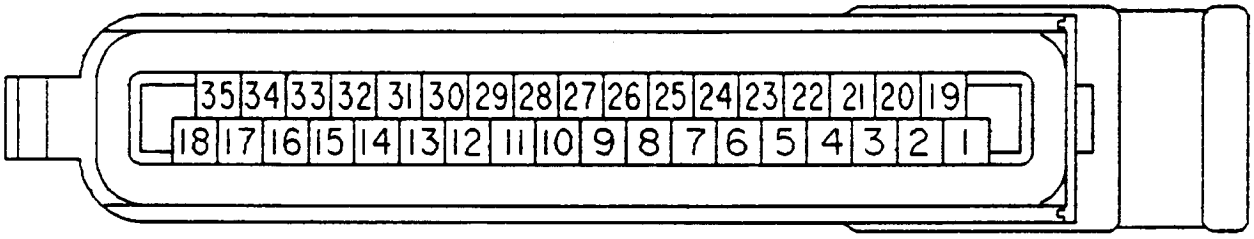
40

Code 36—Rack Position Voltage Too Low



X1 Connector

NOTE: Code 36 occurs when the rack position voltage at ECU pin 27 is lower than the normal operating range (typically lower than 0.6 volt). This voltage is available for monitoring at service connector X3 socket C.

This fault condition is most likely caused by an open or short circuit in the wiring and connectors. IF a connection becomes too loose or a wire is fractured, it is common for the circuit to have an intermittent connection depending on temperature and vibration. This means that diagnosis may be difficult since an open circuit that has caused a malfunction may no longer be present when the diagnosis actually takes place. Therefore, if diagnosis is unsuccessful, it may be helpful to try running the engine to allow it to warm up, or to try other means to duplicate the conditions which were present during the malfunction. It also suggested that resistance checks be made as soon as possible after engine shutdown, if a diagnostic code has been present during engine operation.

Refer also to Code 42—Engine Overspeed.

Step/Sequence	Result	Next
C36-1 6-Way Pump Connector Check.		
Turn ignition off. Disconnect X9 (6-way pump connector) and inspect both halves for damage, corrosion, and poorly positioned terminals.	Connectors OK	Go to C36-2.
Problem found	Repair and go to C36-90.	
C36-2 Engine Controller Connector Check.		
Disconnect X1 (35-pin ECU connector) and inspect both halves for damage, corrosion, and poorly positioned terminals.	Connectors OK	Go to C36-3.
Problem found	Repair and go to C36-90.	
C36-3 Machine Harness Check.		
With X1 and X9 still disconnected, measure the resistance between X1 pin 21 and X9 socket F. (X9 is at the 6-way pump connector.)	Less than 5 ohms ..... (No open circuit found.)	Go to C36-4.
Greater than 5 ohms ..... (Open circuit in connector or wire.)	Repair open circuit and go to C36-90.	
C36-4 Sensor +5V Supply Check.		
Reconnect connector X1. Turn ignition on. Measure voltage between X9 socket F (+) and X9 socket C (-).	Greater than 4.8 volts ..... (Typical is 4.9—5.1 volts.)	Go to C36-5.
Less than 4.8 volts ..... (Problem in wiring or bad Engine Controller.)	Go to C36-20.	

Continued on next page

C36-5 Sensor Check.		
Turn ignition off. Reconnect X1 and X9. Turn ignition on and measure voltage at X3 (4-way service connector) socket C (+) to X3 socket D (-).	2.75—2.95 volts	Go to C36-6.
Less than 1.0 volts	Replace pump/actuator assembly and go to C36-90.	
C36-6 Engine Start Check.		
MAKE WRITTEN NOTE OF ALL STORED CODES. Then clear stored codes. Attempt to start engine. Operate at various throttle settings.	Engine runs normally and no codes	No problem found, resume normal operation.
Engine does NOT run normally. Code 36 is present or stored	Replace pump/actuator assembly and go to C36-90.	
C36-20 Harness Check.		
Check for short circuits in wiring harness by visual check and by gently shifting the position of the harness. Check for damage where harness or wires might rest against sharp metal or hot surfaces. Disconnect X1 and X9. Measure resistance between X1 pin 27 and all other X1 pins. All resistances should be greater than 5 ohms.	Wiring OK	Replace Engine Controller and go to C36-90.
Problem found	Repair and go to C36-90.	
C36-90 Verify Repairs.		
With ignition off, reconnect all connectors. Start engine and check diagnostic codes. Operate engine at various throttle settings.	Engine runs normally, no diagnostic codes ...	Repairs are complete. Clear stored codes.
Code 36 still present	Review this section to find problem.	
Codes other than Code 36	Go to appropriate section to continue service.	

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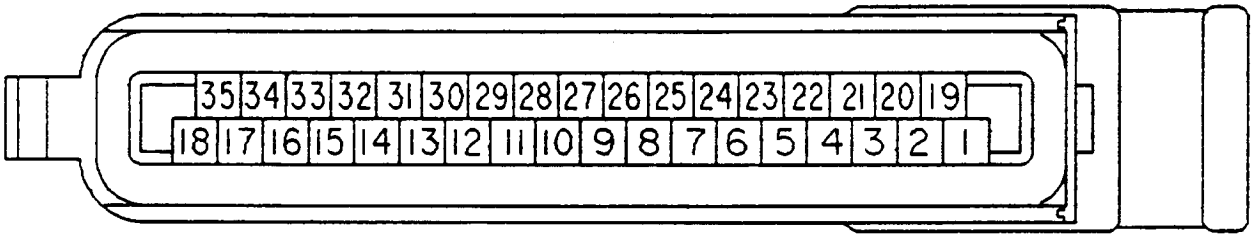
42

Code 37—Fuel Temperature Input Too High



X1 Connector

NOTE: Code 37 occurs when the Engine Controller reads a voltage at the fuel temperature input (connector X1 pin 23) which is higher than the normal operating range of the fuel temperature circuit. The sensor is a resistive device which has decreasing resistance with increasing temperature. This gives decreasing voltage at X1 pin 23 with increasing temperature.

Step/Sequence	Result	Next
C37-1 Sensor Check.		
Disconnect connector X8. Measure resistance between the two pins of the 2-way pump connector.	Between 10,000 and 50,000 ohms	Go to C37-2
Less than 10,000 ohms	Go to C37-3	
Greater than 50,000 ohms ..... (Sensor is open circuit.)	Replace sensor and go to C37-90	
C37-2 Sensor Check.		
A sensor resistance of between 10,000 and 50,000 ohms is only valid for temperature lower than -10°C (14°F). Refer to the temperature vs. resistance table and check to see of the sensor resistance corresponds to the sensor temperature.	Sensor resistance OK	Go to C37-3
Sensor resistance much higher than it should be for the current sensor temperature	Replace sensor and go to C37-90	

Temperature Sensor Characteristic

Temp. °C (°F)	Resistance (OHMS)
-20 (-4)	15300
0 (32)	5840
20 (68)	2500
40 (104)	1180
60 (140)	600
80 (176)	327
100 (212)	188

C37-3 Connector Check.		
Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C37-4
Problem found	Repair and go to C37-90	
C37-4 Voltage Check.		
Turn ignition to 'ON'. Measure voltage from X8 socket B (+) to X8 socket A (-).	Less than 5.5 volts	Go to C37-5
Greater than 5.5 volts	Go to C37-20	

Continued on next page

C37-5 Diagnostic Check.

Install shorting jumper between X8 sockets A and B. With ignition on, check diagnostic codes.	Code 37 ..... (Probable open circuit.)	Go to C37-6
Code 38	Go to C37-20	

C37-6 Connector Check.

Turn ignition to 'OFF'. Disconnect ECU connector X1. Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C37-7
Problem found	Repair and go to C37-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

C37-7 Harness Check.

Shorting jumper should still be installed between X8 sockets A and B.	Less than 5 ohms	Go to C37-8
Measure resistance between X1 pins 23 and 22.	Greater than 5 ohms ..... (Open circuit exists in harness either in wire to X1 pin 23 or in wire to X1 pin 22.)	Repair harness and go to C37-90.

C37-8 ECU Check.

Reconnect ECU connector X1. Install shorting jumper between X8 sockets A and B if not already present. Turn ignition to 'ON'. Check diagnostic codes.	Code 37	Replace ECU and go to C37-90
Code 38 ..... (Problem is no longer present.)	Go to C37-90	

C37-20 Connector Check.

Turn ignition to 'OFF'. Disconnect ECU connector X1 Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C37-21
Problem found	Repair and go to C37-90	

C37-21 Harness Check.

Connectors X1 and X8 should still be disconnected. Remove shorting jumper between X8 sockets A and B. Measure resistance between X1 harness connector pin 23 and all other X1 pins.	All greater than 5 ohms	Go to C37-22
Any less than 5 ohms ..... (Short circuit exists in harness between X1 pin 23 and another circuit.)	Repair harness and go to C37-90.	

C37-22 External Short Check.

Inspect the governor harness routing and look for any location where a possible short with another harness or device could be present.	OK	Go to C37-8
Problem found	Repair and go to C37-90	

Continued on next page

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C37-90 Verify Repairs.

With ignition off, reconnect all connectors. Turn ignition to 'ON'. Check diagnostic codes.	Code 37	Review this section to find problem.
Codes other than Code 37	Go to appropriate section to continue service.	
No codes present	Repairs are complete. Clear stored codes.	

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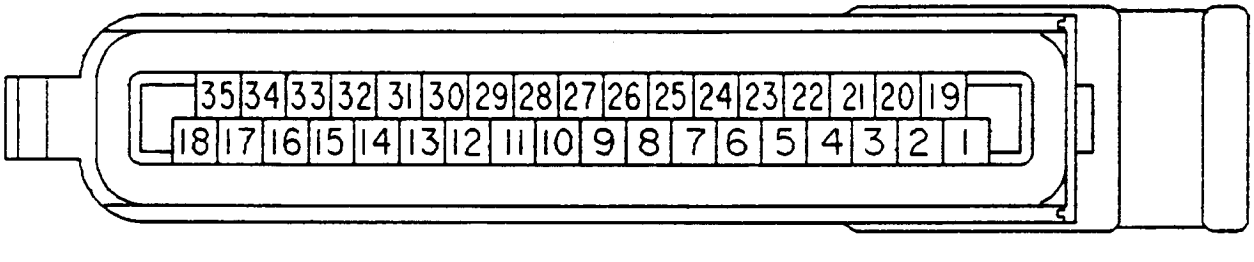
Code 38—Fuel Temperature Input Too Low



X1 Connector

NOTE: Code 38 occurs when the Engine Controller reads a voltage at the fuel temperature input (connector X1 pin 23) which is lower than the normal operating range of the fuel temperature circuit. The sensor is a resistive device which has decreasing resistance with increasing temperature. This gives decreasing voltage at X1 pin 23 with increasing temperature.

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C38-1 Sensor Check.		
Disconnect connector X8.	Greater than 50 ohms and in agreement with the table of resistance versus temperature values	Go to C38-2
Measure resistance between the two pins of the 2-way pump connector.	Greater than 50 ohms but much less than what the table of resistance versus temperature indicates	Replace sensor and go to C38-90
Less than 50 ohms	Replace sensor and go to C38-90	

Temperature Sensor Characteristic

Temp. °C (°F)	Resistance (OHMS)
-20 (-4)	15300
0 (32)	5840
20 (68)	2500
40 (104)	1180
60 (140)	600
80 (176)	327
100 (212)	188

C38-2 Sensor Connector Check.		
Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C38-3
Problem found	Repair and go to C38-90	
C38-3 Diagnostic Check.		
With sensor still disconnected, Turn ignition to 'ON'. Check diagnostic codes.	Code 38	Go to C38-6
Code 37 ..... (Problem is no longer present.)	Go to C38-90 to see if problem will reoccur.	
C38-6 ECU Connector Check.		
Turn ignition off. Disconnect connector X1 Inspect both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C38-7
Problem found	Repair and go to C38-90	

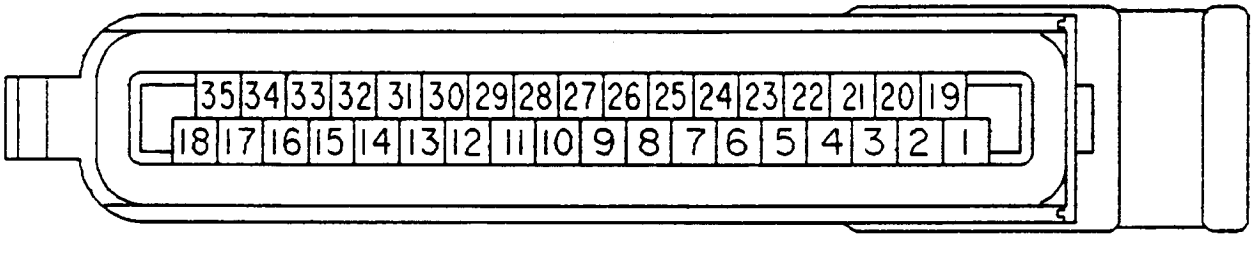
Continued on next page

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C38-7 Harness Check.		
Measure resistance between X1 harness connector pin 23 and all other X1 pins.	All greater than 5 ohms	Go to C38-8
Any less than 5 ohms ..... (Short circuit exists in harness between X1 pin 23 and another circuit.)	Repair and go to C38-90	
C38-8 External Short Check.		
Inspect the Engine Controller harness routing and look for any location where a possible short with another harness or device could be present.	OK	Go to C38-9
Problem found	Repair and go to C38-90	
C38-9 ECU Check.		
Reconnect ECU connector X1. X8 should still be disconnected Turn ignition to 'ON'. Check diagnostic codes.	Code 38	Replace ECU and go to C38-90.
Code 37 ..... (Problem is no longer present).	Go to C38-90.	
C38-90 Verify Repairs.		
With ignition off, reconnect all connectors. Turn ignition to 'ON'. Check diagnostic codes.	Code 38	Review this section to find problem
Codes other than Code 38	Go to appropriate section to continue service.	
No codes present	Repairs are complete. Clear stored codes.	

S55,2000,JH –19–03MAR94–2/2

Code 39—Primary Speed Input Error



X1 Connector

NOTE: Code 39 occurs when the signal from the primary speed sensor (located within the actuator) either stops or becomes erratic while the auxiliary speed continues to be valid. Code 39 cannot occur while engine speed is zero.

An intermittent connection may be affected by temperature any vibration. This means that diagnosis may be difficult since an open circuit that has caused a malfunction may no longer be present when the diagnosis actually takes place. Therefore, if diagnosis is unsuccessful, it may be helpful to try running the engine to allow it to warm up or to try other means to duplicate the conditions which were present during the malfunction. It is also suggested that resistance checks be made as soon as possible after engine shutdown, if a diagnostic code has been present during engine operation.

Refer also to Code 42—Engine Overspeed.

Step/Sequence	Result	Next
C39-1 Connector Check.		
Turn ignition off. Disconnect connector X9. Inspect terminals of both connectors for damage, corrosion and poorly positioned pins or sockets.	OK	Go to C39-2.
Problem found	Repair and go to C39-90.	
C39-2 Sensor Check.		
Measure resistance between 6-way pump connector pins A and B. (See note above.)	Between 90 and 1000 ohms	Go to C39-3.
Less than 90 ohms or greater than 1000 ohms	If wiring problem cannot be found external to actuator, replace actuator/pump assembly and to C39-90.	
C39-3 Engine Harness Check.		
Measure resistance between 6-way pump connector socket B and all other sockets, and between socket A and B and chassis ground.	All greater than 90 ohms ..... (All sockets should be open circuit with other sockets and chassis ground.)	Go to C39-4.
Any less than 90 ohms ..... (Short circuit exists in actuator assembly wiring.)	If wiring problem cannot be found external to actuator, replace pump/actuator assembly and go to C39-90.	
C39-4 Connector Check.		
Disconnect connector X1 at ECU. Inspect terminals at both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C39-5.
Problem found	Repair and go to C39-90.	

Continued on next page

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

C39-5 ECU Harness Check.

With connectors X1 and X9 still disconnected, install a jumper between X9 sockets A and B. Measure resistance between X1 harness connector pins 10 and 28, and 35.	Less than 5 ohms	Go to C39-6
Greater than 5 ohms ..... (Open circuit exists in harness between X1 pin 10 and X9 socket A or between X1 pin 28 and X9 socket B.)	Repair harness and go to C39-90.	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

C39-6 ECU Harness Check.

Remove jumper from X9.	All greater than 5 ohms	Go to C39-7.
Measure resistance between X1 pin 10 and all other X1 pins, and between X1 pin 28 and all other X1 pins.	Any less than 5 ohms ..... (Short circuit exists in harness between speed sensor circuit and another circuit.)	Repair harness and go to C39-90

C39-7 ECU Check.

Reconnect all connectors. Start engine and check diagnostic codes.	Code 39 still present	Go to C39-8
Code 39 no longer present ..... (Problem is no longer present but cause was not found. Allow engine to run for several minutes to see if Code 39 reappears.)	Go to C39-90	

C39-8 ECU Check.

At this point the problem could be one of the following:
1) Intermittent sensor in pump
2) Intermittent wiring problem or
3) Failed Engine Controller.

Therefore, if Engine Controller replacement does not permanently correct the problem, consider one of the other two possibilities.

Stop engine and turn ignition to 'OFF'. Replace ECU. Start engine and check diagnostic codes.	Code 39 no longer present	Go to C39-90
Code 39 still present ..... (ECU was probably not bad.)	Diagnostics are complete. Review this section to find problem looking especially for intermittent problems.	

C39-90 Verify Repairs.

With ignition off, reconnect all connectors. Start engine and run through entire speed range from slow idle to fast idle and check for diagnostic codes.	No diagnostic codes present	Repairs are complete. Cleared stored codes.
Code 39 still present	Review this section to find problem.	
Codes other than Code 39	Go to appropriate section to continue service.	

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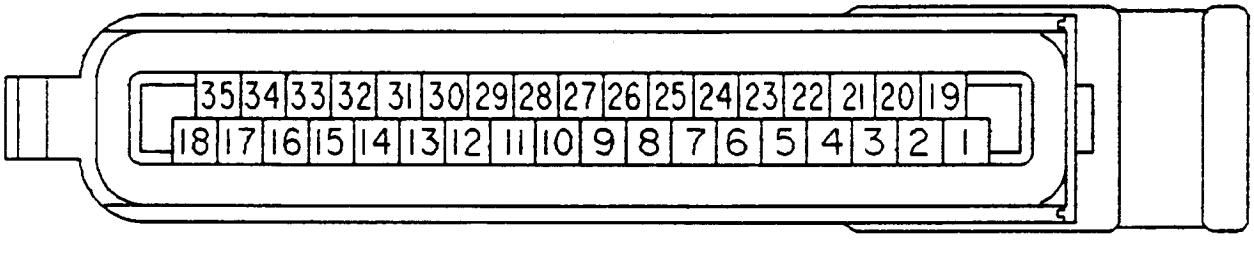
Code 41—Start Signal Missing



X1 Connector

NOTE: Code 41 occurs when the engine speed has increased above slow idle speed without a 'Start Signal' having been present at Connector X1 pin 7. A Start Signal is recognized when the voltage at X1 pin 7 is greater than about 3 volts. This input is typically connected to the starter relay circuit such that battery voltage is present when the ignition switch is in the 'START' position. When this input is active and engine speed is less than minimum idle speed, the ECU commands the injection pump rack to starting fuel position. Code 41 is cleared when a Start Signal occurs or after a power-off and power-on sequence.

The engine can be started and will run normally without the Start Signal available. However, during adverse starting conditions, the Start Signal may provide an advantage for starting because the rack is positioned for start slightly in advance of engine cranking.

CAUTION: Instruction is given to crank the engine during test steps C41-2 and C41-4. Although the engine will not start because of the disconnected governor system connectors, be aware that the engine will be cranking and use appropriate safeguards.

Step/Sequence	Result	Next
C41-1 ECU Connector Check.		
With ignition off, disconnect connector X1 at ECU. Inspect pin 7 of X1 for damage, corrosion, and poor positioning.	OK	Go to C41-2
Problem found	Repair and go to C41-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

C41-2 Start Signal Voltage Check. (See Note.)		
Ignition should still be at 'OFF'. and X1 disconnected. Turn ignition switch to 'START' position while monitoring voltage from X1 pin 7 (+) to chassis ground.	Equal to battery voltage	Go to C41-3
Less than 3 volts ..... (Start signal is not present in the harness to the ECU.) (Engine will crank but not start with ECU disconnected.) Note the voltage when in the 'START' position.	Repair harness or machine wiring and go to C41-90.	

Continued on next page

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C41-3 Diagnostic Code Check.

With ignition off, reconnect connector X1 at ECU. Disconnect connector at X7. Turn ignition on but do not go to the 'START' position. Check diagnostic codes.	Code 41 not present	Go to C41-4
Code 41 present	Go to C41-20	

C41-4 Diagnostic Code Check During Start. (See note on previous page.)

With connector X7 still disconnected, put ignition switch in START position for at least 2 seconds. (Engine will not start with X7 disconnected.) Check diagnostic codes. Ignore Code 34	Code 41 present ..... Operation may continue without significant loss of starting performance above -29°C (-17°F)	Replace ECU if starting performance is affected and go to C41-90
Code 41 not present	Go to C41-5	

C41-5 Check For Intermittent Power to Controller

Reconnect connector X7. With ignition ON, check stored codes for code 41. MAKE WRITTEN NOTE OF ALL STORED CODES then clear stored codes. Operate engine at various speeds in order to generate Code 41. Listen for 'missing'. Then check stored codes again.	Code 41 present ..... (supply voltage to ECU may be intermittent.)	Look for poor power or ground connections between battery and ECU.
Code 41 not present ..... (Problem is no longer occurring.)	Go to C41-90	

Code 41-20 Code 41-With-No-Engine-Speed Evaluation.

If Code 41 occurs at power-on before an engine speed is present, there are three possible causes. The Transmit Stored Codes Input (ECU pin 16) is shorted to ground in the harness or in the diagnostic reader causing a previously stored code to be displayed, or a false engine speed signal is present at one of the two speed inputs (ECU pins 9 and 31), or the ECU is defective. Proceed as follows:

1) Verify that stored diagnostic codes are not being transmitted (by checking to see that X4 socket B is greater than 3 volts).

2) Inspect the governor harness for potential problems such as open circuits, short circuits or interference with other devices.

3) If the above points do not uncover a problem, replace the ECU and test to see if the problem is corrected by performing Step C41-90.

C41-90 Verify Repairs.

With ignition off, reconnect all connectors. Start engine and check diagnostic codes.	No diagnostic codes	Repairs are complete. Clear stored codes.
Code 41 still present	Review this section to find problem.	
Codes other than Code 41	Go to appropriate section to continue service.	

S55,2000,JN –19–02MAR94–2/2

Code 42—Engine Overspeed

Code 42 does not necessarily mean there is a hardware problem present. Code 42 occurs when the engine speed is greater than a pre-programmed value in the Engine Controller memory. This can be caused by rapid downshifting, or coasting downhill while towing an implement, wagon, etc. However, if Code 42 has occurred, potentially damaging high engine speeds may have been present.

When Code 42 is present, the controller commands zero rack position for the injection pump. When engine speed drops below the pre-programmed value for overspeed, the controller stops sending Code 42.

If code 42 occurs, it is possible that a problem does exist in the governor system. For example, if the rack actuator cannot obtain zero rack position during an engine overspeed condition, Code 34 will be sent and the Fuel Shut-Off Solenoid output will be turned off until the engine speed drops to a much lower speed.

In this case, engine overspeed may have been caused by the uncontrollable rack position indicated by Code 34. Therefore, check stored codes for an indication of the cause of the engine overspeed, especially Codes 34, 35 or 36.

If Code 42 occurs or is stored and the engine is dying or 'missing' instead of overspeeding, it may be the result of a loose connection leading to connector X9, or an intermittent failure within the actuator housing. See Troubleshooting Suggestions at the beginning of this group for Checking Wiring and Connectors, and Looking for Intermittent Problems. Code 39 or 44 may also be stored as a result.

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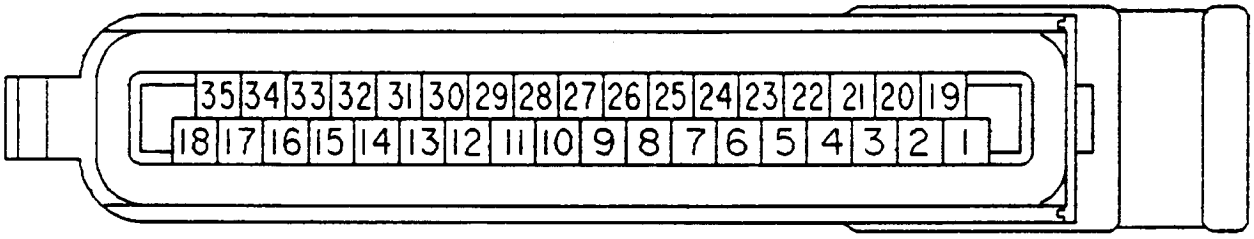
Code 44—Auxiliary Speed Input Error



X1 Connector

NOTE: Code 44 occurs when the signal from the auxiliary speed sensor stops or becomes erratic while the primary speed continues to be valid. Code 44 cannot occur while engine speed is zero. Refer also to Code 42—Engine Overspeed.

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C44-1 Sensor Installation Check.		
Inspect sensor installation and verify that sensor is fully inserted into mounting hole and properly secured.	OK	Go to C44-2
Problem found	Correct and go to C44-90	
C44-2 Connector Check.		
Turn ignition to 'OFF'. Disconnect connector X2 at speed sensor. Inspect terminals of both connector halves for damage, corrosion, and poorly positioned pins and sockets.	OK	Go to C44-3
Problem found	Repair and go to C44-90	
C44-3 Sensor Check.		
Measure resistance between sensor connector terminals. (Results assume a John Deere RE12180 sensor.)	Between 300 and 700 ohms	Go to C44-8
Less than 300 or greater than 700 ohms	Replace sensor and go to C44-90	
C44-8 Connector Check.		
Disconnect connectors X1 at ECU. Inspect terminals at both connector halves for damage, corrosion, and poorly positioned terminals.	OK	Go to C44-9
Problem found	Repair and go to C44-90.	

Continued on next page

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

C44-9 ECU Harness Check.

With connectors X1 and X2 disconnected, install a jumper between X2 pins A and B. Measure resistance between X1 harness connector pin 11 and pin 20.	Less than 5 ohms	Go to C44-10
Greater than 5 ohms ..... (Open circuit exists in harness between X1 pin 11 and X2 pin A or X1 pin 20 and X2 pin B.)	Repair and go to C44-90	

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

C44-10 Short Circuit Check.

Remove jumper from X2. Measure resistance between X1 harness connector pin 11 and all other X1 pins.	All greater than 5 ohms	Go to C44-11.
Any less than 5 ohms ..... (Short circuit exists in harness between X1 pin 11 and another circuit.)	Repair and go to C44-90.	

C44-11 ECU Check.

Reconnect all connectors. Start engine and check diagnostic codes.	Code 44 still present	Go to C44-12.
Code 44 no longer present ..... (Problem is no longer present but cause was not found.) Allow engine to run for several minutes to see if Code 44 reappears.	Go to C44-90.	

C44-12 ECU Check

At this point the problem could be one of the following:
1) Intermittent speed sensor
2) Intermittent wiring problem or
3) Sensor installed incorrectly or 4) Failed Engine Controller.
Therefore, if Engine Controller replacement does not permanently correct the problem, consider one of the other possibilities.

Stop engine and turn ignition to 'OFF'. Replace ECU. Start engine and check diagnostic codes.	Code 44 no longer present	Go to C44-90.
Code 44 still present ..... (ECU was probably not bad.)	Diagnostics are complete. Review this section to find problem looking especially for intermittent problems.	

C44-90 Verify Repairs.

With ignition off, reconnect all connectors. Start engine and check diagnostic codes.	No diagnostic codes	Repairs are complete. Clear stored codes.
Code 44 still present	Review this section to find problem.	
Codes other than Code 44	Go to appropriate section to continue service.	

S55,2000,JQ –19–02MAR94–2/2

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Code 47—Derated Torque Curve Selected

Code 47 occurs when the Fuel Limit Select input is pulled to ground to limit the output torque of the engine. In certain applications, this feature is used to protect the engine.

Code 47 does not usually indicate a problem with the electronic fuel injection system. A possible use of this feature is to limit maximum fuel delivery to a lower level when there is an air flow restriction, which might result in the engine overheating.

If this code is observed, refer to the machine technical manual to determine how this feature is activated and how to correct the problem.

S55,2000,EU –19–02MAR94–1/1

Code 51—Electrical Noise on Analog Throttle Input

Code 51 occurs when the Engine Controller detects a negative voltage on the analog throttle input. A negative voltage would typically be caused by radiated or conducted electrical noise from some part of the machine when the throttle signal is close to zero volts.

Erratic engine performance may be observed, especially at slow idle. Code 11, 12, 13 or 14 may also be present, or stored.

This problem may be caused by loose electrical grounds or power connections anywhere on the machine. Check all electrical connectors and wire connections. Check alternator connections, ground connections at engine block or near battery, power and ground at load center, etc. Corrosion, dirt or paint can cause intermittent and noisy connections. Remove, clean, and replace connection if unsure. Also check for opens or shorts in the wiring harness.

S55,2000,JT –19–02MAR94–1/1

Code 54—Electrical Noise on Rack Position Voltage Input

Code 54 occurs when the Engine Controller detects a negative voltage on the rack voltage input. A negative voltage would typically be caused by radiated or conducted electrical noise from some part of the machine when the rack position voltage is close to zero volts (during starting, for example).

Erratic engine performance should be observed, or the engine may die. Engine may or may not restart. Code 34, 35 or 36 may also be present, or stored.

This problem may be caused by loose electrical grounds or power connections anywhere on the machine. Check all electrical connectors and wire connections. Check alternator connections, ground connections at engine block or near battery, power and ground at load center, etc. Corrosion, dirt, or paint can cause intermittent and noisy connections. Remove, clean, and replace connection if unsure. Also check for opens or shorts in the wiring harness.

S55,2000,JU –19–02MAR94–1/1

Code 55—Electrical Noise on Fuel Temperature Input

Code 55 occurs when the Engine Controller detects a negative voltage on the fuel temperature input. A negative voltage typically be caused by radiated or conducted electrical noise from some part of the machine when the fuel temperature signal is close to zero volts (when the fuel temperature is high, for example).

Erratic engine performance may be observed. This problem cannot be caused by the fuel temperature sensor. Code 38 may also be present, or stored.

This problem may be caused by loose electrical grounds or power connections anywhere on the machine. Check all electrical connectors and wire connections. Check alternator connections, ground connections at engine block or near battery, power and ground at load center, etc. Corrosion, dirt or paint can cause intermittent and noisy connections. Remove, clean, and replace connection if unsure. Also check for opens or shorts in the wiring harness.

S55,2000,JV –19–02MAR94–1/1

Code 56—Electrical Noise on Fuel Limit Select Input

Code 56 occurs when the Engine Controller detects a negative voltage on the fuel limit select input. A negative voltage would typically be caused by radiated or conducted electrical noise from some part of the machine when the fuel limit select input is grounded to select torque curve 2.

Erratic engine performance will probably NOT be observed. This problem will not cause any other diagnostic codes to be present or stored. If condition is severe, intermittent reduction of power may occur during operation at high loads.

This problem may be caused by loose electrical grounds or power connections anywhere on the machine. Check all electrical connectors and wire connections. Check alternator connections, ground connections at engine block or near battery, power and ground at load center, etc. Corrosion, dirt or paint can cause intermittent and noisy connections. Remove, clean, and replace connection if unsure. Also check for opens or shorts in the wiring harness.

S55,2000,JW –19–02MAR94–1/1

Code 57—Electrical Noise on Speed Regulation Select Input

Code 57 occurs when the Engine Controller detects a negative voltage on the speed regulation select input. A negative voltage would typically be caused by radiated or conducted electrical noise from some part of the machine when the speed regulation select input is grounded to select droop 2.

Erratic engine performance should be observed because of intermittent changes in rated speed and/or droop.

This problem may be caused by loose electrical grounds or power connections anywhere on the machine. Check all electrical connectors and wire connections. Check alternator connections, ground connections at engine block or near battery, power and ground at load center, etc. Corrosion, dirt, or paint can cause intermittent and noisy connections. Remove, clean, and replace connection if unsure. Also check for opens or shorts in the wiring harness.

S55,2000,JX –19–02MAR94–1/1

Code 58—Electrical Noise on 3-State Throttle Input

Code 58 occurs when the Engine Controller detects a negative voltage on the 3-State Throttle input. A negative voltage would typically be caused by radiated or conducted electrical noise from some part of the machine when the 3-state speed select input is grounded to select speed 2.

Erratic engine performance will probably NOT be observed. This problem will not cause any other diagnostic codes to be present or stored. If condition is severe, intermittent speed changes may occur when Speed 3 is selected.

This problem may be caused by loose electrical grounds or power connections anywhere on the machine. Check all electrical connectors and wire connections. Check alternator connections, ground connections at engine block or near battery, power and ground at load center, etc. Corrosion, dirt or paint can cause intermittent and noisy connections. Remove, clean, and replace connection if unsure. Also check for opens or shorts in the wiring harness.

S55,2000,JY –19–02MAR94–1/1

Code 59—Electrical Noise on Sensor +5V Supply

Code 59 occurs when the Engine Controller detects a negative voltage on the +5V sensor excitation. A negative voltage would typically be caused by radiated or conducted electrical noise from some part of the machine.

Erratic engine performance may be observed; engine may die. Code 29 may also be present, or stored.

This problem may be caused by loose electrical grounds or power connections anywhere on the machine. Check all electrical connectors and wire connections. Check alternator connections, ground connections at engine block or near battery, power and ground at load center, etc. Corrosion, dirt or paint can cause intermittent and noisy connections. Remove, clean, and replace connection if unsure. Also check for opens or shorts in the wiring harness.

S55,2000,JZ –19–02MAR94–1/1

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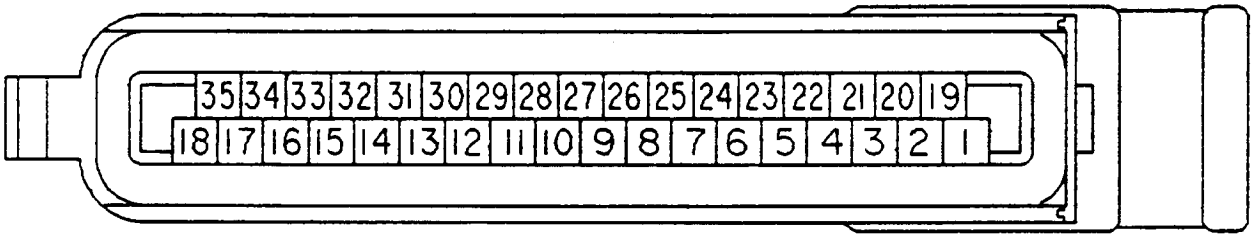
Code 71—Diagnostic Codes Output Stuck High



X1 Connector

NOTE: Code 71 or 72 occur when the Electronic Governor Tester (JT05829) is unable to read the Diagnostic Codes Output signal from the Engine Controller. If Code 71 or 72 are displayed by an on-board code reader, refer to the machine technical manual.

Ignore codes greater than 100 that are displayed during troubleshooting.

If the Diagnostic Codes input to the Electronic Governor Tester is open circuit or shorted to a voltage greater than 2.5 volts, the tester should display code 71. If the input is shorted to ground or shorted to a voltage less than 2.5 volts anywhere in the harness the tester should display code 72.

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C71-1 Connector Check.		
Turn ignition to 'OFF' position. Disconnect connector X1 at ECU and uncap or disconnect connector X4. Inspect terminals of these connectors for damage, corrosion, and poorly positioned pins or sockets.	Connector terminals look OK	Go to 71-2
Problem found	Repair and go to C71-90	
C71-2 Harness Short Circuit Check.		
With ignition off, measure resistance between X1 pin 31 and all other pins of the X1 connector.	All greater than 5 ohms ..... (No short circuits found.)	Go to C71-3
Any less than 5 ohms ..... (Short circuit exists in harness between X1 pin 31 and another circuit.)	Repair and go to C71-90	
C71-3 Harness Open Circuit Check.		
Measure resistance between X1 pin 31 and X4 socket D.	Less than 5 ohms ..... (No open circuit in harness.)	Go to C71-4
Greater than 5 ohms ..... (Open circuit exists between X1 pin 31 and X4 socket D.)	Repair and go to C71-90	
C71-4 ECU Power Check.		
Turn ignition to 'ON'. Measure voltage between X1 pin 1 (+) and X1 pin 20 (-).	Greater than 9 volts ..... (Equal to battery voltage.)	Go to C71-5
Less than 9 volts ..... (Problem exists in harness or in electrical system.)	Repair and go to C71-90	

Continued on next page

C71-5 ECU Check.		
Turn ignition to 'OFF'. Reconnect connector X1 to ECU and Electronic Governor Tester to connector X4. Turn ignition to on and check diagnostic codes. If using an internal tachometer display, refer to the machine technical manual.	Code 71 or 72 ..... (Tester cannot read signal from ECU.)	Replace ECU or Electronic Governor Tester and go to C71-90
Code 0 ..... (Code display is operational and no problems are being indicated.)	Replace cap on connector X4. Resume normal operation.	
Codes other than 71 or 72 ..... (Code display is operational.)	Go to section for corresponding code to troubleshoot indicated problem.	
C71-90 Verify Repairs.		
With ignition off, connect Electronic Governor Tester to service connector X4. Make sure connector X1 is connected properly to ECU. Turn ignition on. If using an internal tachometer display, refer to the machine technical manual.	Code 71 or 72 ..... (Problem still exists.)	Review this section to find problem.
Code 0 ..... (Code display is operational.)	Repairs are complete. Replace cap on connector X4.	
Codes other than 0, 71, or 72 ..... (Code display is now operational, but code indicates a problem.)	Repairs on the diagnostic display are complete. Go to section for corresponding code to troubleshoot indicated problem.	

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Code 72—Diagnostic Codes Output Stuck Low

Code 71 or 72 occur when the Electronic Governor Tester is unable to read the Diagnostic Codes Output signal from the Engine Controller.

Use the diagnostic procedure for Code 71 when either Code 71 or Code 72 occur.

If code 71 or 72 are displayed by an on-board code reader, refer to the machine technical manual.

S55,2000,FF –19–02MAR94–1/1

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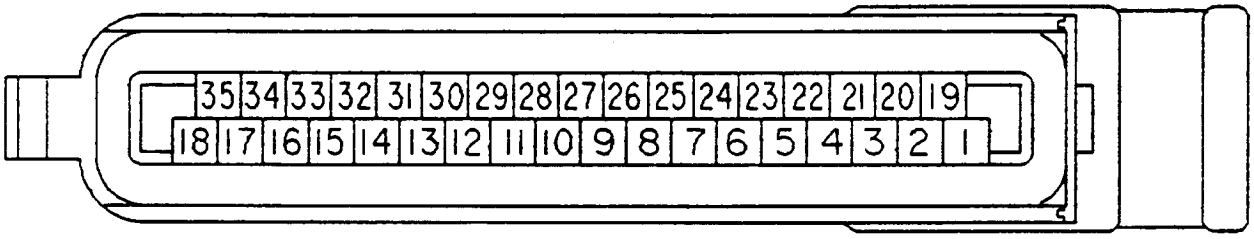
Code 73—Fuel Flow/Throttle Output Stuck High



X1 Connector

NOTE: Code 73 or 74 occur when the Electronic Governor Tester is unable to read the Fuel Flow/Throttle Output signal from the Engine Controller.

If the Fuel Flow/Throttle input to Electronic Governor Tester is open circuit or shorted to a voltage greater than 2.5 volts, the tester should display code 73. If the input is shorted to ground or shorted to a voltage less than 2.5 volts anywhere in the harness, the tester should display code 74.

When checking to see if the Electronic Governor Tester is reading the Fuel Flow/Throttle Output signal properly, the % Fuel display should read '0' with the ignition 'ON' but the engine not running. The % Throttle display should respond to the throttle whether the engine is running or not.

IMPORTANT: TOUCH harness connector pins with probe. Forcing probes into pins could damage them.

Step/Sequence	Result	Next
C73-1 Connector Check.		
Turn ignition to 'OFF' position. Disconnect connector X1 at ECU and uncap or disconnect connector X4. Inspect terminals of these connectors for damage, corrosion, and poorly positioned pins or sockets.	Connector terminals look OK	Go to C73-2
Problem found	Repair and go to C73-90	
C73-2 Harness Short Circuit Check.		
With ignition off, measure resistance between X1 pin 32 and all other pins of the X1 connector.	All greater than 5 ohms ..... (No short circuits found.)	Go to C73-3
Any less than 5 ohms ..... (Short circuit exists in harness between X1 pin 32 and another circuit.)	Repair and go to C73-90	
C73-3 Harness Open Circuit Check.		
Measure resistance between X1 pin 32 and X4 socket E.	Less than 5 ohms ..... (No open circuit in harness.)	Go to C73-4
Greater than 5 ohms ..... (Open circuit exists between X1 pin 32 and X4 socket E.)	Repair and go to C73-90	

Continued on next page

C73-4 ECU Power Check.		
Turn ignition to 'ON'. Measure voltage between X1 pin 1 (+) and X1 pin 20 (-).	Greater than 9 volts ..... (Equal to battery voltage.)	Go to C73-5
Less than 9 volts ..... (Problem exists in harness or in electrical system.)	Repair and go to C73-90	
C73-5 ECU Check.		
Turn ignition to 'OFF'. Reconnect connector X1 to ECU and Electronic Governor Tester to connector X4. Turn ignition to 'ON' and check % Fuel and % Throttle displays.	Code 73 or 74 ..... (Tester cannot read signal from ECU.)	Replace ECU or Electronic Governor Tester and go to C73-90
Displays are functional	Replace cap on connector X4. Resume normal operation.	
C73-90 Verify Repairs.		
With ignition off, connect Electronic Governor Tester to service connector X4. Make sure connector X1 is connected properly to ECU. Turn ignition on. Check % Fuel and % Throttle displays.	Code 73 or 74 ..... (Problem still exists.)	Review this section to find problem.
Displays are functional	Repairs are complete. Replace cap on connector X4.	

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Code 74—Fuel Flow/Throttle Output Stuck Low

Code 73 or 74 occur when the Electronic Governor Tester is unable to read the Fuel Flow/Throttle Output signal from the Engine Controller.

Use the diagnostic procedure for Code 73 when either Code 73 or Code 74 occur.

S55,2000,FH –19–02MAR94–1/1

Analog Throttle Adjustments

The electronic fuel injection system is capable of connecting to one or two analog throttle sensors. The throttle configuration, the throttle adjustment mechanism, and the actual sensor used will vary depending on application. Therefore, refer to the machine technical manual for the correct adjustment procedure. If the analog throttle sensor is not properly adjusted, the following problems are possible:

- Diagnostic Code 11 or 13 is generated and engine drops to slow idle when throttle is at or near fast idle. Throttle input voltage is too high.
- Diagnostic Code 12 or 14 is generated when throttle is at or near slow idle position. Throttle input voltage is too low.
- The slow idle engine speed is too fast.
- The fast idle engine speed is too slow.

Continued on next page

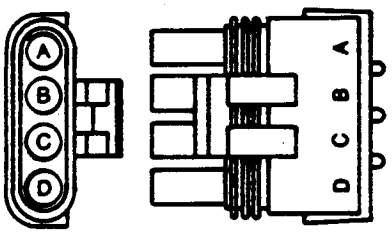
S55,2000,CKA1 –19–02MAR94–1/2

Use the Diagnostic Voltages Connector (X3) to access the throttle voltage signals for the primary analog throttle during throttle adjustment. Use a digital multimeter for these measurements. Refer to Group 02—General Information. Measurements are made as follows:

Analog Throttle +5V (nominally 5 volts):
X3 socket A (+) to X3 socket D (-)
Throttle Input Voltage:
X3 socket B (+) to X3 socket D (-)

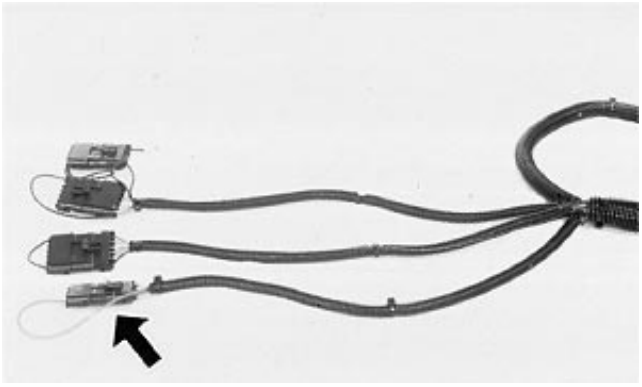
During adjustment, the signals from analog throttle sensors must be corrected for the variation of the Analog Throttle +5V supply voltage from exactly +5.000 volts. The calculation to do this requires a multiplication and a division:

$$\text{Corrected throttle input voltage} = \frac{5 \times \text{socket B voltage}}{\text{socket A voltage}}$$



RG5389 –UN–14DEC88

Diagnostic Voltage Connector (X3)



RG5396 –UN–09JAN90

Diagnostic Voltage Connector (X3)

RW11274 –UN–12DEC88

Digital Multimeter

S55,2000,CKA1 –19–02MAR94–2/2

Fuel Injection System Components

Part Name	Action To Be Taken
Injection Pump	Repairable by ADS shop only. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines) Group 35, Fuel System for removal and installation of injection pump. Protect wiring harness connectors from debris while injection pump is removed. If debris enters connectors, it may be necessary to use compressed air to clean connectors.
Actuator Solenoid	Repairable by ADS shop only.
Fuel Shut-Off Solenoid	Can be replaced with injection pump on engine.
Fuel Shut-Off Solenoid Housing	Can be replaced with injection pump on engine.
Gear, oil line, overflow valve, transfer pump, miscellaneous hardware items	Replace with service parts as required. Refer to CTM6 and CTM42 (6076 Engines) or CTM20 and CTM61 (6101 Engines), Group 35, Fuel System for repair procedures for these parts.
Engine Controller	IMPORTANT: DO NOT OPEN ENGINE CONTROLLER. Not repairable; replace Engine Controller. If an Engine Controller is not programmed identically with the original (failed) Engine Controller, misleading diagnostic messages, poor performance, or engine damage can occur.
TVP Module	Not repairable; replace with new TVP Module. The connector on the TVP wiring harness is repairable.
Connectors	
X1, X2, X3, X4, X5, X7, X8, X9, X10	Repairable.
Sensors	
Rack Position Sensor	Repairable by ADS shop only.
Primary Speed Sensor	Repairable by ADS shop only.
Fuel Temperature Sensor	Repairable.
Auxiliary Speed Sensor	Repairable.
PTC Heater (if equipped)	Not repairable; replace with new PTC Heater; order from ADS shop.
Wiring Harness	
Application Wiring Harness	All connectors are repairable. (X1, X2, X3, X4, X5, X7, X8, X9, X10 and TVP connector).

S55,2000,KI –19–03MAR94–1/1

Essential Tools

NOTE: Order tools from your SERVICE-GARD™ Catalog. Some tools may be available from a local supplier.

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S55,2000,FV –19–05OCT98–1/8

Electrical Connector and Wire Service Kit. RE11154

Repair harnesses on John Deere electronic governor applications.

Continued on next page

S55,2000,FV –19–05OCT98–2/8

Electrical Repair Tool Kit. JDG155

Repair and installation of wires into electrical connectors.

S55,2000,FV –19–05OCT98–3/8

Electrical Repair Tool Kit includes:

JDG107 ..... Holding Plate
JDG139 ..... Contact Insertion Tool
JDG140 ..... Contact Extraction Tool
JDG141 ..... Contact Extraction Tool
JDG142 ..... Contact Extraction Tool
JDG143 ..... Contact Extraction Tool
JDG144 ..... Crimping Pliers
JDG145 ..... Electrician's Pliers
JDG146 ..... Carry Case

S55,2000,FV –19–05OCT98–4/8

WEATHER PACK™ Extraction Tool JDG364

Replace terminal contact in WEATHER PACK™ connector body.

WEATHER PACK is a trademark of Packard Electric.

S55,2000,FV –19–05OCT98–5/8

Wiring Tool R65594

Crimp WEATHER PACK™ terminals.

WEATHER PACK is a trademark of Packard Electric.

S55,2000,FV –19–05OCT98–6/8

Connection Removal Tool JDG671

Replace contact in X1 Engine Controller connector.

Continued on next page

S55,2000,FV –19–05OCT98–7/8

Electrical Connection Extraction Tool. JDG776

Replace contact in X1 Engine Controller connector.

S55,2000,FV –19–05OCT98–8/8

Other Materials

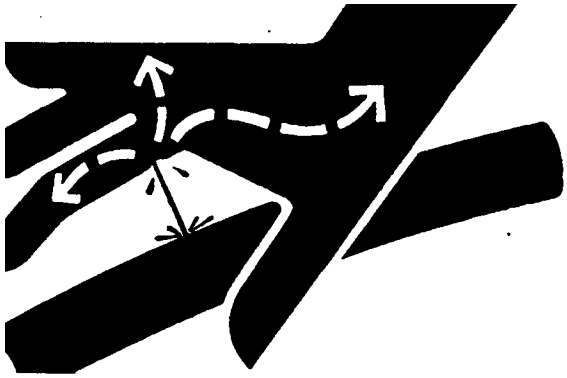
Number	Name	Use
	Electrical Contact Cleaner Spray	Clean contacts on connectors.

S55,2000,KP –19–02MAR94–1/1

Relieve System Pressure

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

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



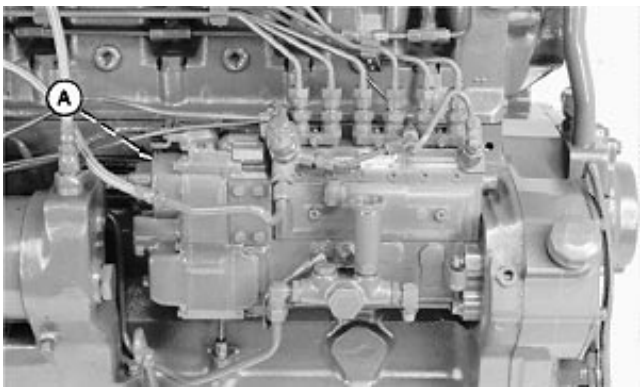
X9811 –UN–23AUG88

S11,3010,OZ –19–02MAR94–1/1

Injection Pump/Actuator Assembly

NOTE: For a complete description of the injection pump and the actuator assembly, refer to Group 05—Fuel Injection System Components.

The injection pump is repairable by an ADS shop only. The Actuator Solenoid (A) also is repairable by an ADS shop only. When the Actuator Solenoid is opened, the injection pump will require recalibration.



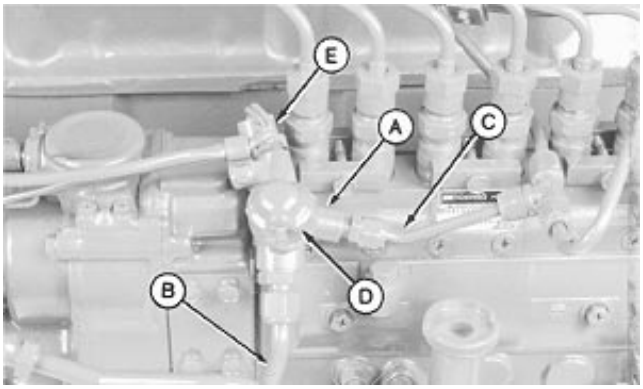
RG5496 –UN–09JAN90

S55,2000,KL –19–03MAR94–1/1

Remove Fuel Shut-Off Solenoid Housing

NOTE: The fuel shut-off solenoid housing (A) can be replaced with the injection pump installed on the engine.

1. Disconnect the 1-way WEATHER PACK™ fuel shut-off connector and the 2-way WEATHER PACK™ fuel temperature sensor connector from the application wiring harness.
2. Disconnect the fuel inlet line (B) and the fuel outlet line (C).
3. Lift rubber cap off the fuel shut-off solenoid (D) and remove the fuel shut-off solenoid. (See REPLACE FUEL SHUT-OFF SOLENOID, later in this group.)
4. Remove the fuel temperature sensor (E). (See REPLACE FUEL TEMPERATURE SENSOR, later in this group.)



RG5445 –UN–09JAN90

A—Fuel Shut-Off Solenoid Housing
B—Fuel Inlet Line
C—Fuel Outlet Line
D—Fuel Shut-Off Solenoid
E—Fuel Temperature Sensor

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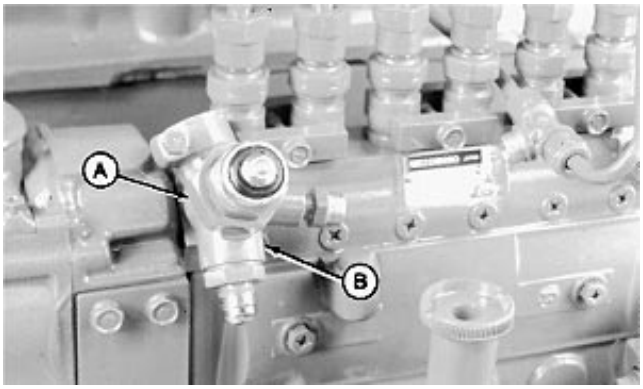
S55,2000,KM –19–02MAR94–1/3

IMPORTANT: Do not lose the pin that locks the housing into position with the injection pump.

5. Using a 30 mm wrench, loosen nut (A) and remove fuel shut-off solenoid housing (B).

NOTE: Cover injection pump with cloth so debris does not enter any openings.



RG5446 –UN–09JAN90

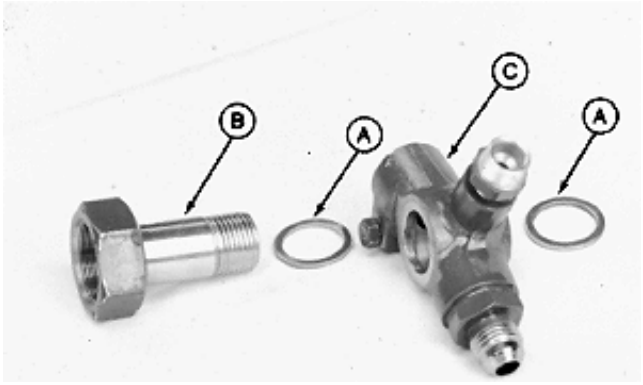
Continued on next page

S55,2000,KM –19–02MAR94–2/3

6. Remove copper washers (A) from both sides of cap screw (B).

NOTE: It may be necessary to press the cap screw with copper washer from the fuel shut-off housing (C).

7. Inspect housing for cracks and wear. Replace housing as necessary.



RG5447 –UN–09JAN90

S55,2000,KM –19–02MAR94–3/3

Install Fuel Shut-Off Solenoid Housing

1. Install index pin in injection pump housing (A).

2. With copper washer (B) placed on both sides of cap screw (C), position fuel shut-off solenoid housing (D) on pin and start cap screw in thread of injection pump.

3. Using a 30 mm wrench, tighten cap screw securely.

NOTE: Fuel shut-off solenoid housing and cap screw should bottom on both sides of copper washer.

4. Install fuel shut-off solenoid assembly. (See REPLACE FUEL SHUT-OFF SOLENOID, later in this group.)

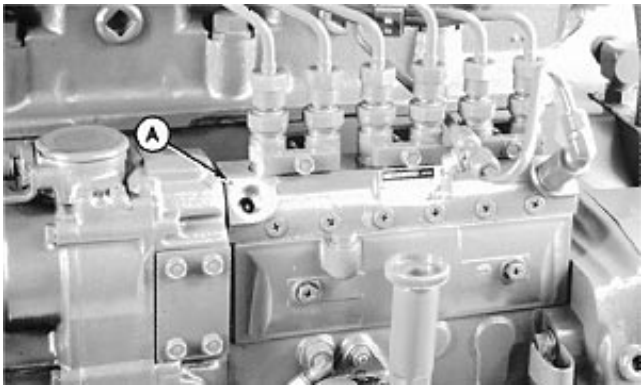
NOTE: Be sure O-ring is in position on top of the fuel shut-off solenoid housing.

5. Install fuel temperature sensor. (See REPLACE FUEL TEMPERATURE SENSOR, later in this group.)

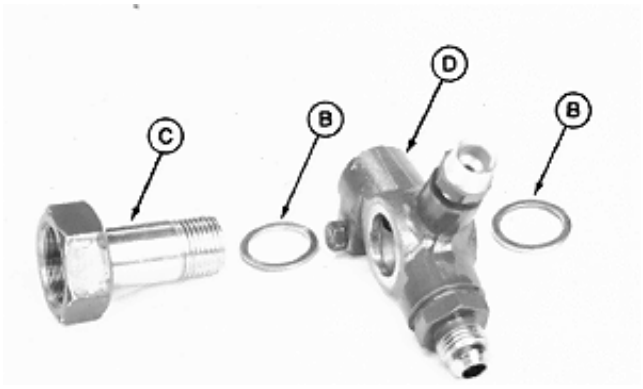
6. Connect fuel inlet line (E) and fuel outlet line (F).

7. Bleed the fuel system as described later in this group.

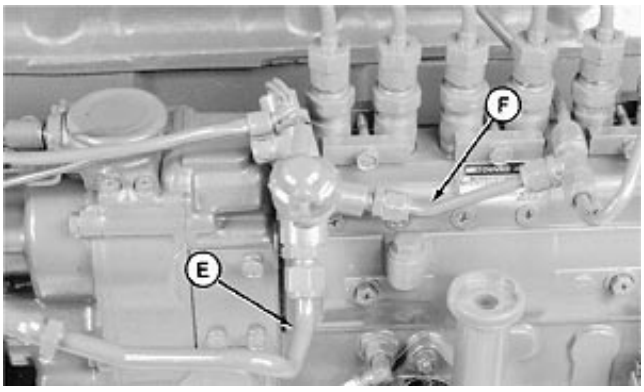
A—Injection Pump Housing
B—Copper Washer(s)
C—Cap Screw
D—Fuel Shut-Off Solenoid Housing
E—Fuel Inlet Line
F—Fuel Outlet Line



RG5448 –UN–09JAN90



RG5449 –UN–09JAN90



RG5510 –UN–09JAN90

S55,2000,KQ –19–02MAR94–1/1

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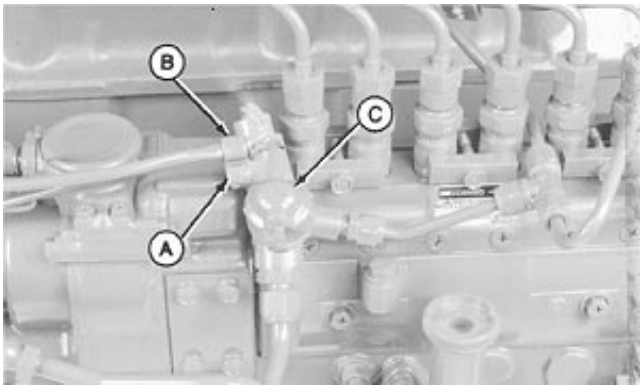
Replace Fuel Shut-Off Solenoid

1. Disconnect the 1-way WEATHER PACK™ fuel shut-off connector from the application wiring harness.
2. Using an 8 mm wrench, loosen the hex head screw (A) and remove clip (B).
3. Lift off the rubber cap (C) on the fuel shut-off solenoid.
4. Loosen hex head screw and remove fuel shut-off wiring connector using an 8 mm wrench.



RG5450 –UN–09JAN90

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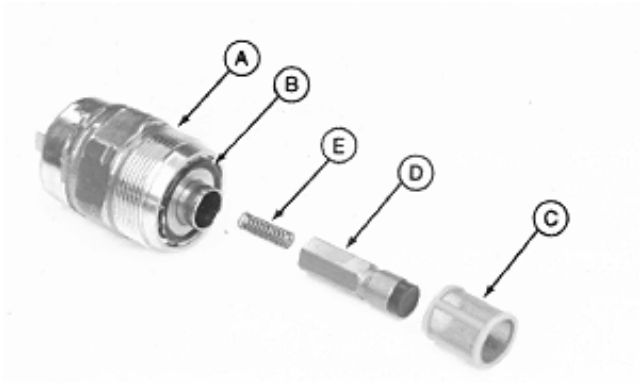
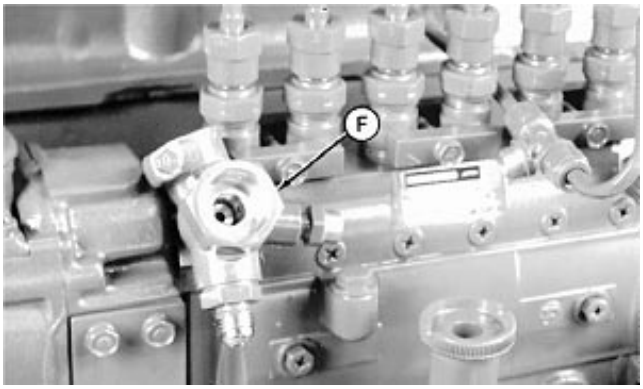
S55,2000,KR –19–02MAR94–1/3

5. Remove fuel shut-off solenoid (A) with O-ring (B), filter (C), plunger (D), and spring (E) using a 24 mm wrench.
6. Replace fuel shut-off solenoid and O-ring. Install solenoid in housing (F). Tighten securely.
7. Put fuel shut-off connector wire and hex head cap screw on fuel shut-off solenoid. Using an 8 mm wrench, tighten cap screw securely.

A—Fuel Shut-Off Solenoid
B—O-Ring
C—Filter
D—Plunger
E—Spring
F—Fuel Shut-Off Solenoid Housing



RG5452 –UN–09JAN90



RG5453 –UN–09JAN90

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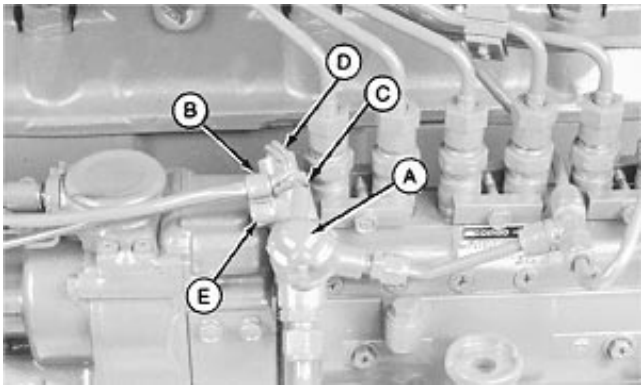
S55,2000,KR –19–02MAR94–2/3

8. Install rubber cap (A) over fuel shut-off solenoid.

9. Put clip (B) around fuel shut-off wire (C) and fuel temperature wire (D). Using an 8 mm wrench. tighten hex head screw (E) securely.

10. Connect the 1-way WEATHER PACK™ fuel shut-off connector to the application wiring harness.

A—Rubber Cap
B—Clip
C—Fuel Shut-off Wire
D—Fuel Temperature Wire
E—Hex Head Screw



RG5455 –UN–09JAN90

WEATHER PACK is a trademark of Packard Electric.

S55,2000,KR –19–02MAR94–3/3

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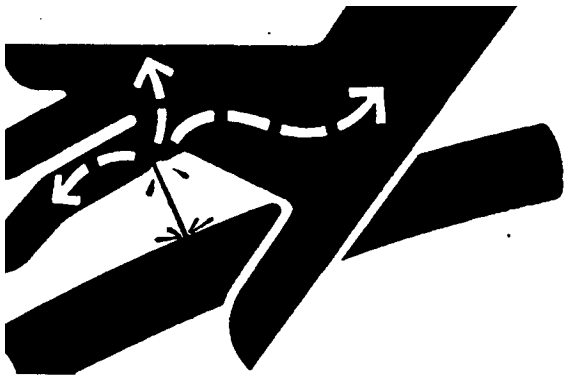
10

Bleed Fuel System



X9811 –UN–23AUG88

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

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

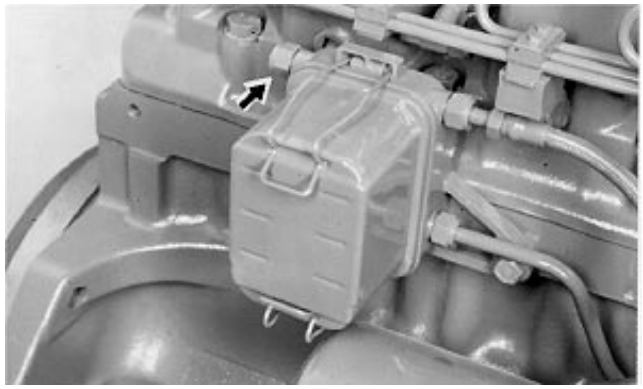
Whenever the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system.

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

1. Turn key switch to the 'ON' position.

S11,0408,AC –19–20JUL95–1/3

2. Loosen bleed plug (arrow) on fuel filter base.



RG5456 –UN–09JAN90

Continued on next page

S11,0408,AC –19–20JUL95–2/3

3. Unscrew hand primer (arrow) on fuel supply pump until it can be pulled by hand.

4. Operate the hand primer until a smooth flow of fuel, free of bubbles, comes out of the filter bleed plug hole.

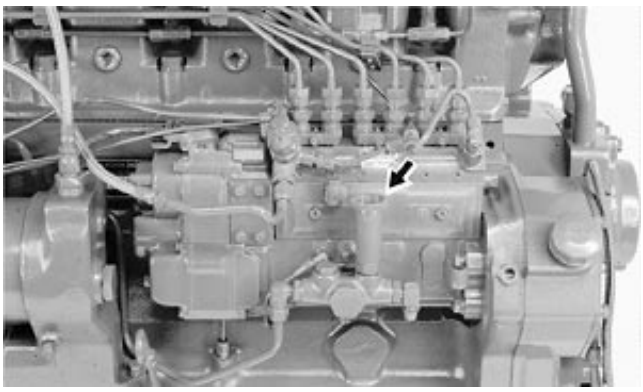
5. Gently stroke the hand primer down and close the bleed plug. Tighten plug securely. DO NOT overtighten. Continue operating hand primer until slight pressure is felt. The pressure indicates that fuel has filled the gallery in the injection pump.

IMPORTANT: Be sure hand primer is all the way down in barrel before tightening to prevent internal thread damage.

6. Lock hand primer in position.

NOTE: If the engine will not start, it may be necessary to loosen the fuel lines at the injection nozzles to bleed air from system. Put the hand throttle in slow idle position. Turn the engine with the starter until fuel without air flows from the loose fuel line connections. Tighten the connections.

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



RG5457 –UN–09JAN90

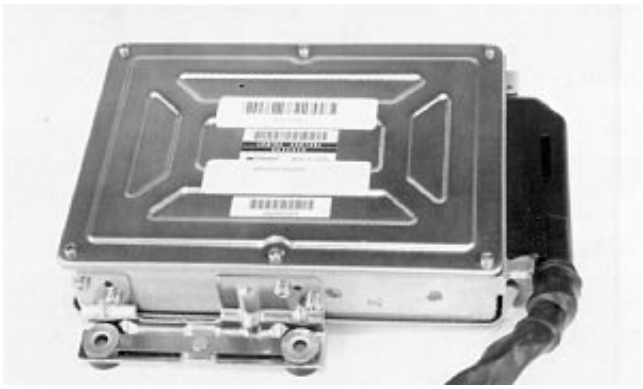
S11,0408,AC –19–20JUL95–3/3

Engine Controller

IMPORTANT: DO NOT OPEN ENGINE CONTROLLER.

The Engine Controller is not repairable. If it is found to be defective, it is to be replaced as a unit.

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

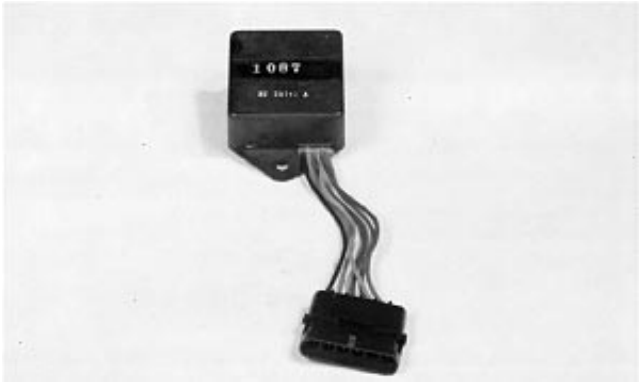


RG5416 –UN–09JAN90

S55,2000,KY –19–02MAR94–1/1

Transient Voltage Protection (TVP) Module

The TVP module is not repairable. If the TVP module is defective, the unit must be replaced. The connector on the TVP module wiring harness is repairable. Refer to REPLACE WEATHER PACK CONNECTOR, later in this group.



RG5374 –UN–09JAN90

S55,2000,GE –19–02MAR94–1/1

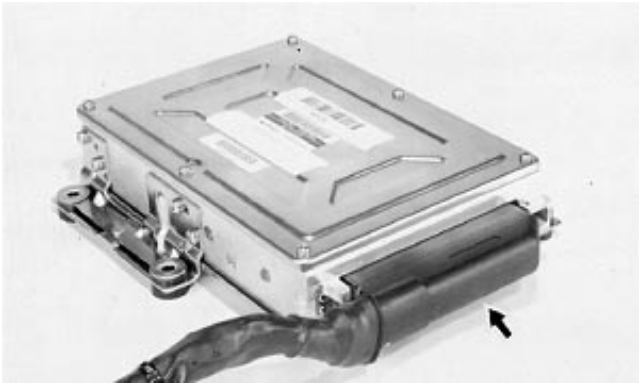
Connectors

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

IMPORTANT: If for some reason the connectors are not connected, such as when the fuel injection pump is removed, it is important to protect the connectors from debris.

NOTE: Refer to Group 45, Wiring for a diagram showing location of all connectors.

Engine Controller Connector (X1) (arrow) is repairable. (See DISASSEMBLE ENGINE CONTROLLER CONNECTOR (X1), later in this group. All other connectors are WEATHER PACK™ connectors and are also repairable. (See REPLACE WEATHER PACK CONNECTOR, later in this group.)



RG5418 –UN–09JAN90

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S55,2000,KZ –19–02MAR94–1/1

Clean Engine Controller Connector (X1)

IMPORTANT: Disconnect the engine controller connector (A) from the Engine Controller (B) only when a known problem exists with the connector. Disconnecting the connector from the Engine Controller may allow dust to collect on the contacts.

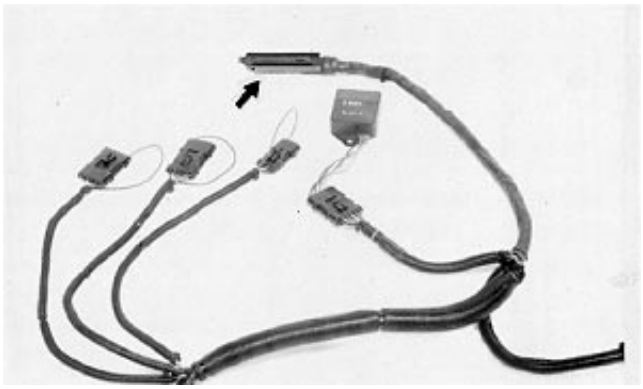
1. With the Engine Controller Connector connected to the Engine Controller, blow dust off of the connector using compressed air.

RG5459 –UN–09JAN90

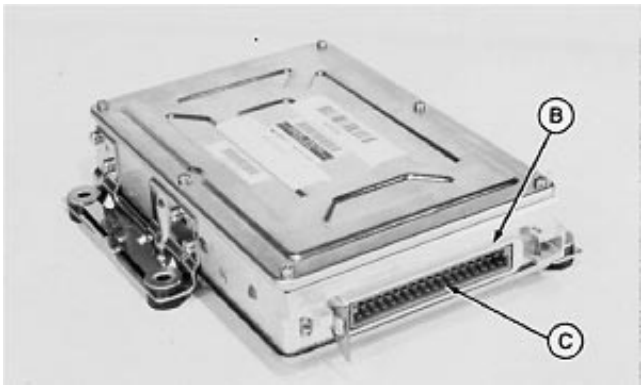
S55,2000,LA –19–02MAR94–1/2

2. If a problem exists with the connector, disconnect the connector from the Engine Controller and spray contacts (C) with electrical contact cleaner spray before installing connector on the Engine Controller.

IMPORTANT: DO NOT, under any circumstances, power wash engine controller connector (bold arrow) on wiring harness or connector (B) on engine controller. Doing so may cause a short circuit or controller malfunction.



RG5417 –UN–09JAN90



RG5460 –UN–09JAN90

S55,2000,LA –19–02MAR94–2/2

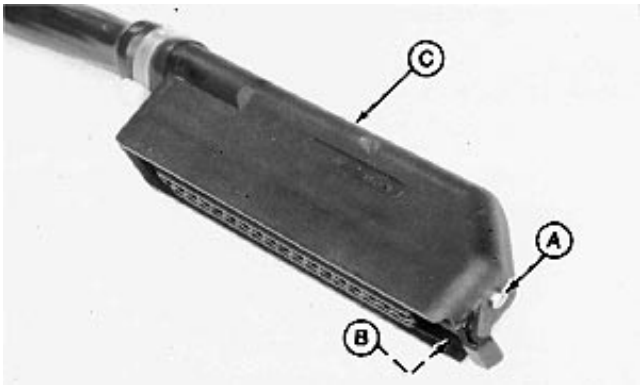
Disassemble Engine Controller Connector (X1)

1. Cut off cable tie (A) used to secure the wire sealing sheath.
2. Disconnect connector from Engine Controller.

RG5461 –UN–09JAN90

S55,2000,LC –19–02MAR94–1/3

3. Remove the locking screw (A) from the end of the connector.
4. Gently pry on front tab of contact housing (B).
5. Slide the connector shell (C) off the contact housing.



RG5462 –UN–09JAN90

S55,2000,LC –19–02MAR94–2/3

6. Remove the gasket (A) and the contact retainers (B) by prying with a sharp object.

RG5463 –UN–09JAN90

S55,2000,LC –19–02MAR94–3/3

Remove Contact From Housing

IMPORTANT: Make note of the wire positioning in the contact housing before removing any wires. The contact cavities are numbered (1-35) (A) on the rear of the contact housing. It is recommended that only one contact at a time be replaced. If visible damage is present, the contact should be replaced.

1. If a contact must be replaced, use the JDG671 Contact Removal Tool (B), JDG776 Electrical Connector Extractor, small screwdriver, or other similar pointed object.

IMPORTANT: It is easy to damage the contact during removal, so use extreme care when inserting the tool.

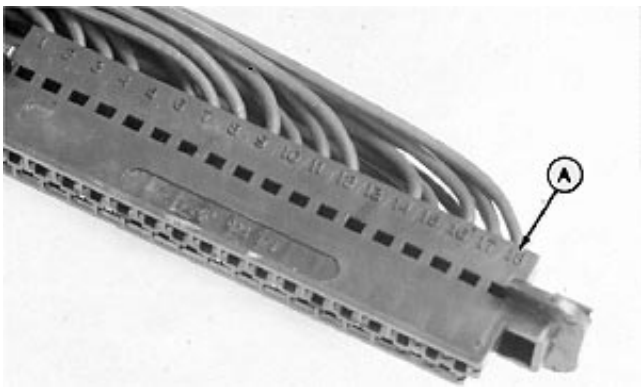
Be sure the contact retainer has been removed before removing the contact. (See DISASSEMBLE ENGINE CONTROLLER CONNECTOR (X1), earlier in this group.)

2. Slide tool in the contact unlocking slot until it bottoms in the housing.

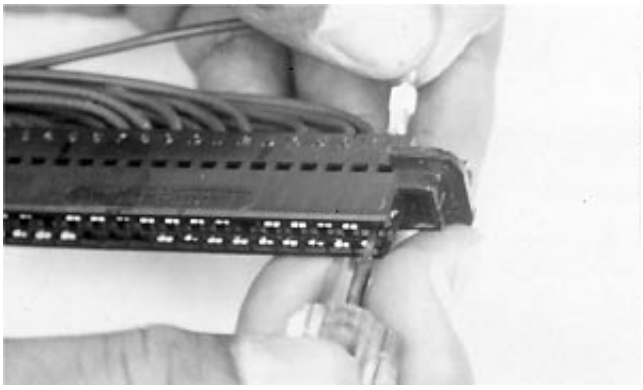
NOTE: These slots are accessed from the front side of the contact housing and are located toward the center of the housing from each contact cavity. Pushing in on the wire while the removal tool is being inserted will ease in the removal of the contact.

3. Keep the removal tool in place and pull wire out of the contact housing from the rear.

4. Cut off the old contact as near the contact as possible or there will not be sufficient wire length to reinstall it. (See INSTALL NEW CONTACTS in the following module.)



RG5464 –UN–09JAN90



RG5465 –UN–09JAN90

S55,2000,LF –19–02MAR94–1/1

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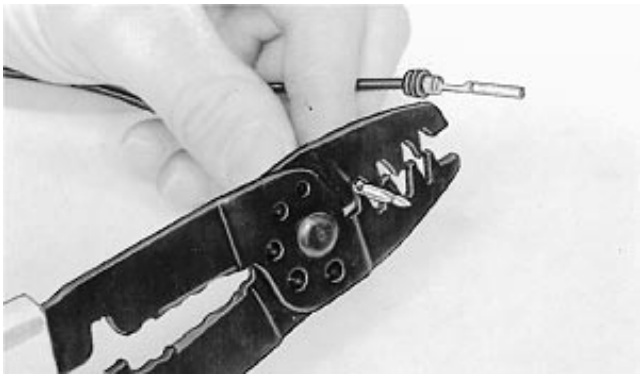
16

Install New Contacts

1. Strip insulation from wire to expose 3 mm (1.8 in.).
2. Using JDG144 Crimping Pliers, crimp terminal on wire using Position 'D' for the wire crimp and Position 'G' for the insulation crimp.

NOTE: Locking tabs go to the middle of the connector.

3. Push the terminal into the contact housing making sure of the proper location.

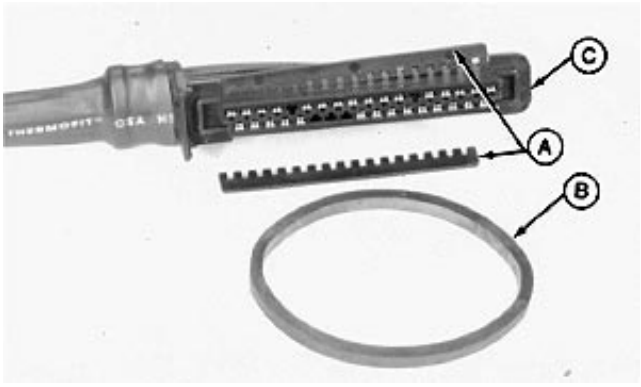


TS0137 –UN–23AUG88

S55,2000,LH –19–07MAR94–1/1

Reassemble Engine Controller Connector (X1)

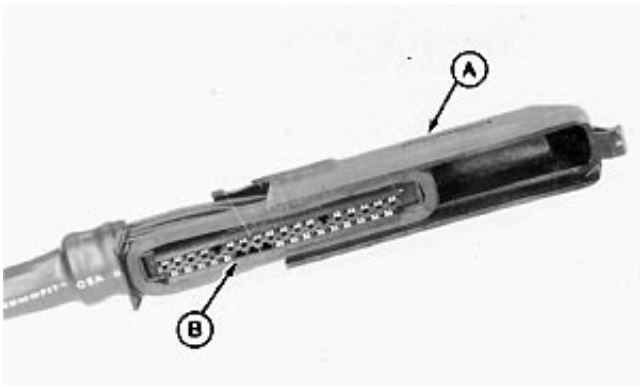
1. Install the two retainers (A) to lock the contacts in place.
2. Install the gasket (B) around the contact housing (C).



RG5467 –UN–09JAN90

S55,2000,LI –19–02MAR94–1/4

3. Slide the connector shell (A) back on the contact housing (B), as it was originally positioned.

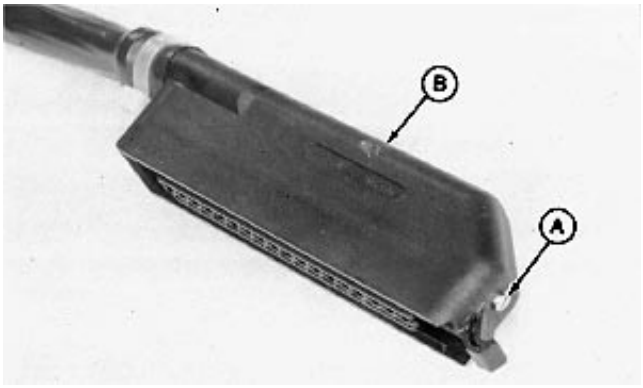


RG5468 –UN–09JAN90

Continued on next page

S55,2000,LI –19–02MAR94–2/4

4. Install and tighten the locking screw (A) on the connector shell (B).

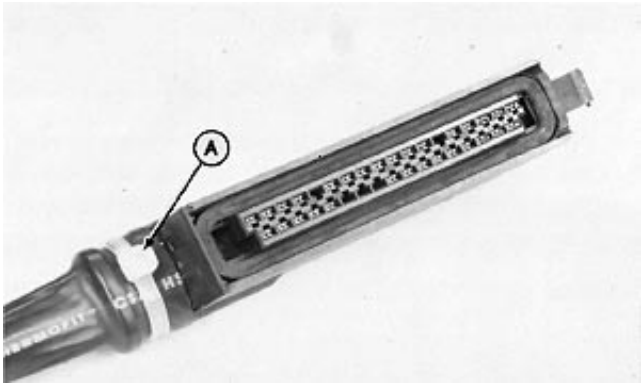


RG5469 –UN–09JAN90

S55,2000,LI –19–02MAR94–3/4

5. Install the cable tie (A) which holds the wire sealing sheath into place on the connector shell.

IMPORTANT: The locking mechanism on the cable tie should be oriented as shown in photo so that it does not interfere with the connector locking area.



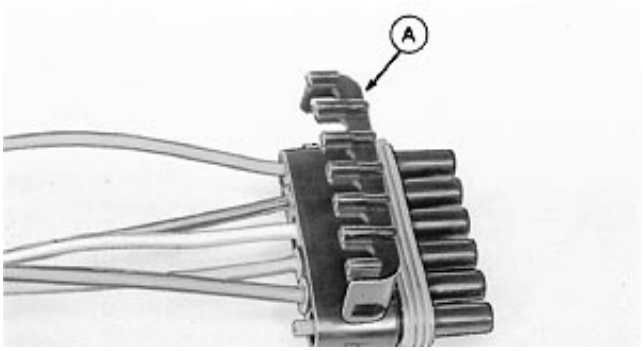
RG5471 –UN–09JAN90

S55,2000,LI –19–02MAR94–4/4

Replace WEATHER PACK™ Connector

IMPORTANT: Identify wire color locations or circuit code numbers (imprinted on the wire) with connector terminal letters.

1. Open connector body (A).



TS0127 –UN–23AUG88

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S55,2000,LN –19–07MAR94–1/4

2. Insert JDG364 Extraction Tool over terminal contact in connector body.

TS0128 –UN–23AUG88

Continued on next page

S55,2000,LN –19–07MAR94–2/4

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

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

TS0129 –UN–23AUG88

S55,2000,LN –19–07MAR94–3/4

IMPORTANT: Carefully spread contact lances to assure good seating on connector body.

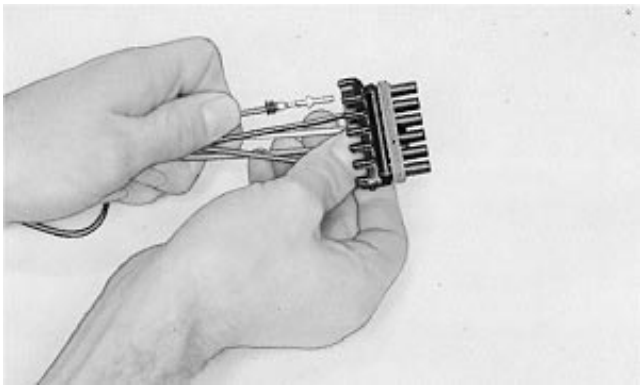
NOTE: Connector bodies are 'keyed' for proper contact mating. Be sure contacts are in proper alignment.

4. Push contact into new connector body until fully seated.

5. Pull on wire slightly to be certain contact is locked in place.

6. Transfer remaining wires to correct terminal in new connector.

7. Close connector body.



TS0130 –UN–23AUG88

S55,2000,LN –19–07MAR94–4/4

Install WEATHER PACK™ Contact

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

- *Green - 18 to 20 gauge wire*
- *Gray - 14 to 16 gauge wire*
- *Blue - 10 to 12 gauge wire*

1. Slip correct size cable seal on wire.

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

TS0136 –UN–23AUG88

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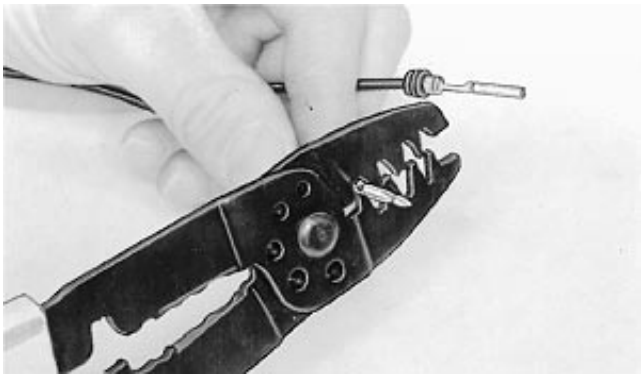
Continued on next page

DX,ECONN,AA –19–04JUN90–1/4

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

- *#15 for 14 to 16 gauge wire*
- *#19 for 18 to 20 gauge wire*

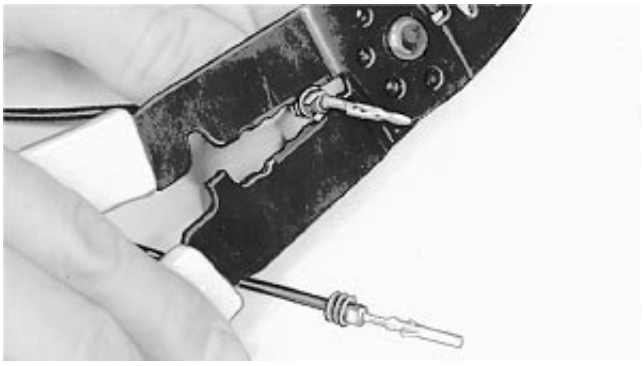
3. Place proper size contact on wire and use JDG144 Crimping Pliers to crimp contact in place with a 'W' type crimp.



TS0137 –UN–23AUG88

DX,ECONN,AA –19–04JUN90–2/4

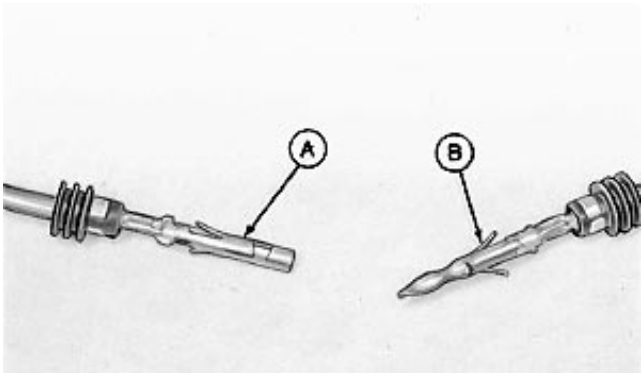
4. Use JDG144 Crimping Pliers to secure cable seal to contact as shown.



TS0138 –UN–23AUG88

DX,ECONN,AA –19–04JUN90–3/4

IMPORTANT: Proper contact installation for 'sleeve' (A) and 'pin' (B) is shown.

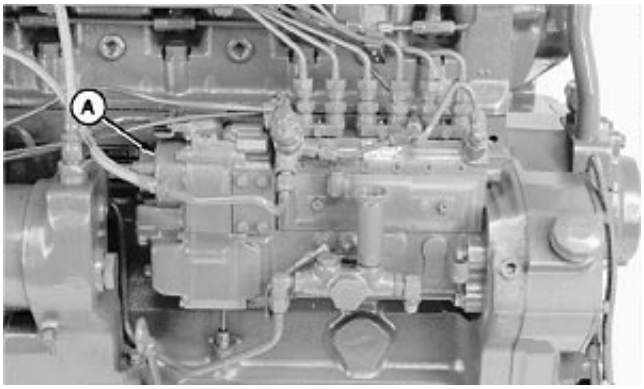


TS0139 –UN–02DEC88

DX,ECONN,AA –19–04JUN90–4/4

Sensors

The Primary Engine Speed Sensor and the Rack Position Sensor are located within the actuator housing (A) and are not repairable. If the actuator housing is removed, the injection pump will need to be recalibrated. For a description of these sensors, refer to Group 05—Fuel Injection System Components.

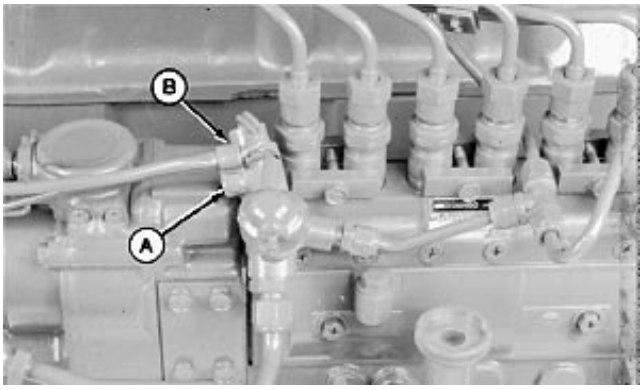


RG5444 –UN–09JAN90

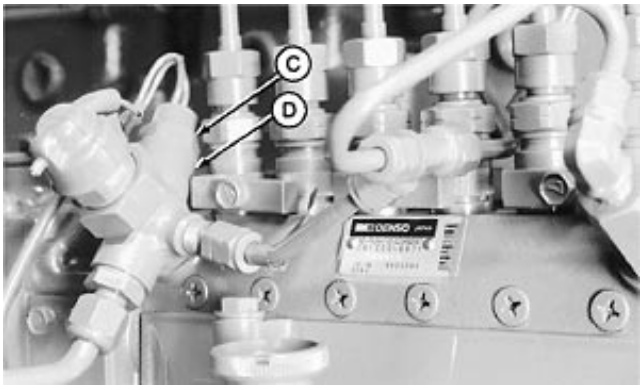
S55,2000,LO –19–03MAR94–1/1

Replace Fuel Temperature Sensor

1. Disconnect the 2-way WEATHER PACK™ fuel temperature sensor connector from the application wiring harness.
2. Using an 8 mm wrench, loosen the hex head screw (A) and remove clip (B).
3. Loosen fuel temperature sensor (C) from fuel shut-off solenoid housing (D) using a 22 mm wrench.
4. Replace O-ring in fuel shut-off solenoid housing.
5. Replace fuel temperature sensor and install on fuel shut-off solenoid housing. Tighten securely.
6. Place sensor wire within clamp. Tighten hex head screw securely to fuel shut-off solenoid housing.
7. Reconnect 2-way WEATHER PACK™ fuel temperature sensor connector to application wiring harness.



RG5472 –UN–09JAN90



RG5470 –UN–09JAN90

A—Hex Head Screw
B—Clip
C—Fuel Temperature Sensor
D—Fuel Shut-off Solenoid Housing

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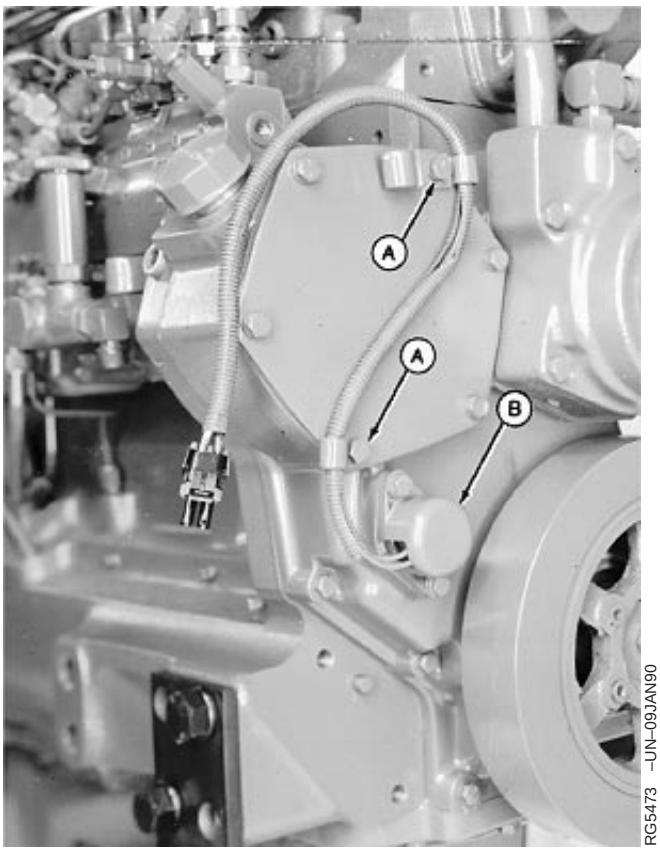
S55,2000,LP –19–02MAR94–1/1

Replace Auxiliary Speed Sensor

1. Disconnect the 2-way WEATHER PACK™ auxiliary speed connector from the application wiring harness.
2. Remove cap screws (A) from clamps holding auxiliary speed wire to front of injection pump drive gear cover.
3. Open clamp and remove wire.
4. Loosen cap screws and remove auxiliary speed sensor cover (B).
5. Disconnect and remove the auxiliary speed sensor with O-ring.
6. Replace auxiliary speed sensor and O-ring.
7. Install auxiliary speed sensor cover and tighten cap screws securely.
8. Connect dangling connector to mating connector on vehicle harness.



RG5473 –UN–09JAN90

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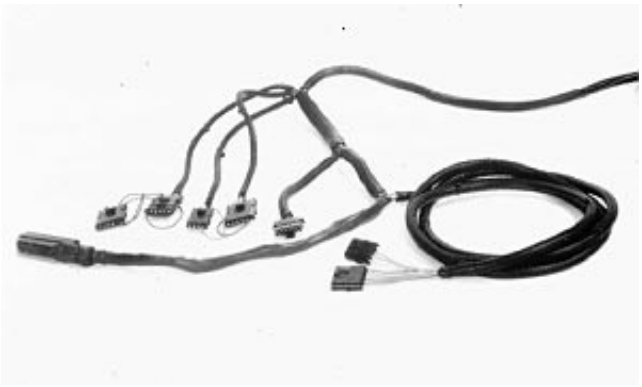
S55,2000,LQ –19–02MAR94–1/1

Robert Bosch—Wiring Harness

Engine Wiring Harness



Application Wiring Harness

The Engine Wiring Harness consists of Connectors X2, X8, X10, X11, X12, and X13. The Application Wiring Harness consists of X1, X3, X4, X5, X6, X7, and X9. To determine which connectors are repairable and how to repair them, refer to connectors in Group 30—Robert Bosch Component Repairs and Adjustments.

Depending on the application, various interconnections are made between the Engine Controller and the Actuator Solenoid, the Fuel Shut-off Solenoid, sensors, control switches, diagnostic devices, and other instrumentation or control systems. These connections are made using at least two wiring harnesses.

IMPORTANT: Because of the location of X12, (7-pin connector on back of injection pump), accessibility to this connector is difficult. On 6076 Engines, remove the oil filter and oil filter housing when working with the X12 connector. On 6101 Engines, remove fuel filter and full flow oil filter. Refer to CTM6 and CTM42 (6076) Engines or CTM20 and CTM61 (6101 Engines), Group 20 Lubrication System. A special crowsfoot wrench (JDG646) is required for removal and replacement. When re-installing connector X12, use care when beginning to thread the connecting ring because the pump connector half is plastic and subject to thread damage. Also, make sure that connecting ring is completely engaged by tightening ring to 10—20 N•m (7—15 lb-ft). If pump removal is required, it is suggested that connector X12 be disconnected and reconnected with the pump removed from the engine. DO NOT SEND ENGINE HARNESS TO ADS SHOP WITH PUMP.

A short Engine Wiring Harness connects signals from the Engine Controller to the injection pump components and the Auxiliary Speed Sensor. This Engine Wiring Harness will be the same for most machines.

IMPORTANT: Because of the importance of maintaining a good connection at connector X12, the engine harness should not be removed from the pump except when required by Diagnostic Procedures for troubleshooting or pump replacement.

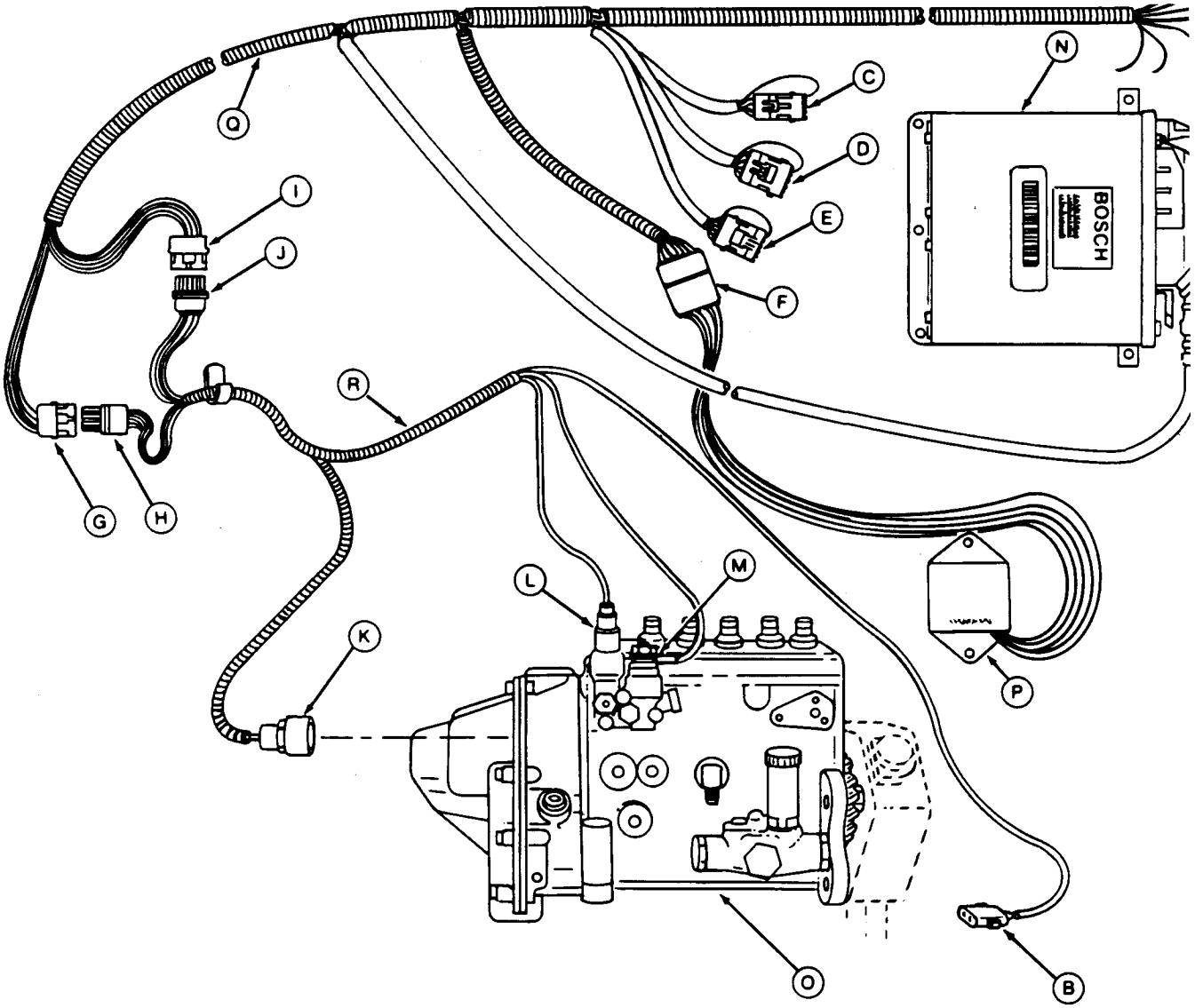
A longer Application Wiring Harness is required to carry power to the fuel injection system and signals between the controller and the devices which are part of the engine application. These signals include throttle input and diagnostic codes. This harness may be different for each engine application.

Continued on next page

These harnesses are shown in diagram form on the following page. The long application harness shown is for OEM engines where some wires are left unterminated for flexibility in installation.

S55,2000,CL –19–02MAR94–2/2

Robert Bosch Electronically-Controlled Fuel Injection System with Wiring Harnesses



RG5394 –UN–16MAR90

A—X1 Engine Controller Connector
B—X2 Auxiliary Speed Sensor Connector
C—X3 Diagnostic Voltages Connector
D—X4 Diagnostic Reader Connector
E—X5 Service Connector
F—TVP Connector
G—X7 In-Line Connector
H—X8 In-Line Connector
I—X9 In-Line Connector
J—X10 In-Line Connector
K—X12 Actuator Connector
L—X13 Fuel Temperature Sensor Connector
M—X11 Fuel Shut-off Solenoid Terminal
N—Engine Controller
O—Fuel Injection Pump
P—TVP Module
R—Engine Wiring Harness
Q—Application Wiring Harness
S—Unterminated Wires

NOTE: Connectors X2, X8, X10, X11, X12, and X13 are located on the Engine Wiring Harness (R) (short harness). Connectors X1, X3, X4, X5, X7, and X9, are located on the Application Wiring Harness (Q) (long harness). On some applications, X6 (not illustrated) is also located on the same pigtail as the X3, X4, and X5 connectors. X6 is a service connector only.

S55,2000,EV –19–07MAR94–1/1

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4

Robert Bosch—System Wiring Schematic

The system schematic for the Robert Bosch electronic governor is provided in the following foldout. The schematic includes power connections to the system, connections to the injection pump from the controller, service connectors, and signals which communicate with other systems on a machine.

All of the optional signals are shown on the schematic. The actual wiring depends on the engine application. For example, gen sets, combines and agricultural tractors all have service connectors but use different optional signals. Combines use the 2-state throttle, and tractors use the analog throttle. However, some tractors use just one analog throttle, some use both analog throttles, and some also receive a PWM throttle signal from another system. Refer to the machine technical manual for appropriate wiring information.

The engine wiring harness connects signals between X8 and X10 to the pump- mounted components plus the Auxiliary Speed Sensor.

For the throttle inputs, the switches, resistors and sensors used to generate those input signals are part of the machine and should be described in the machine technical manual. Similarly, the Fault Lamp, PWM throttle signal generator and instrumentation to read signals from the Engine Controller are also part of other machine systems.

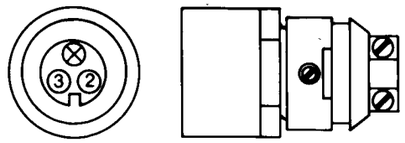
For transient voltage protection, OEM engine applications will use the RE30711 TVP Module. John Deere machines will include the required protection with the rest of the machine power distribution system.

Refer to the appropriate machine technical manual for details concerning the actual wiring and optional signals being used.

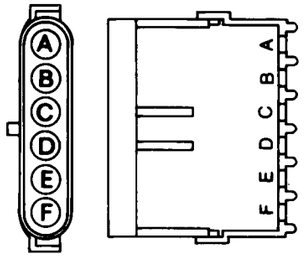
The following module provides a drawing of each connector. The foldout schematic follows the drawings of the individual connectors.

S55,2000,EW –19–02MAR94–1/1

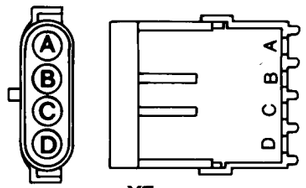
Robert Bosch Connectors



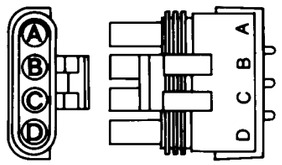
X13



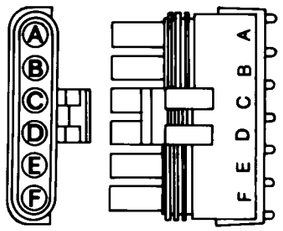
X5, X9



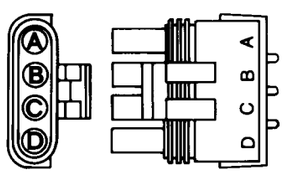
X7



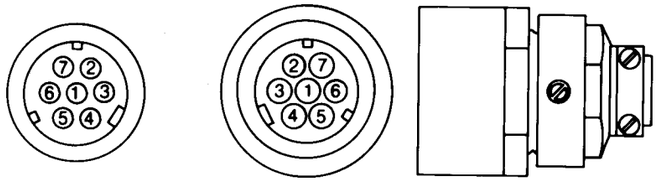
X8



X4, X10

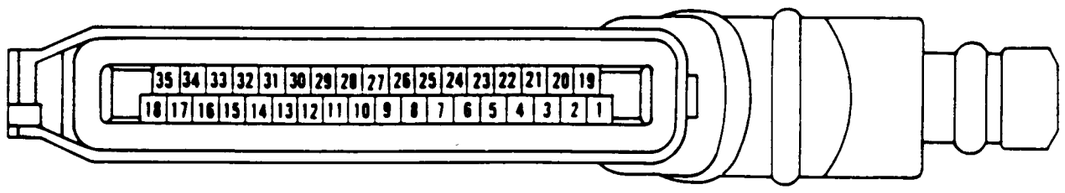


X3



X12

X1



RG6838 –UN–09MAR94

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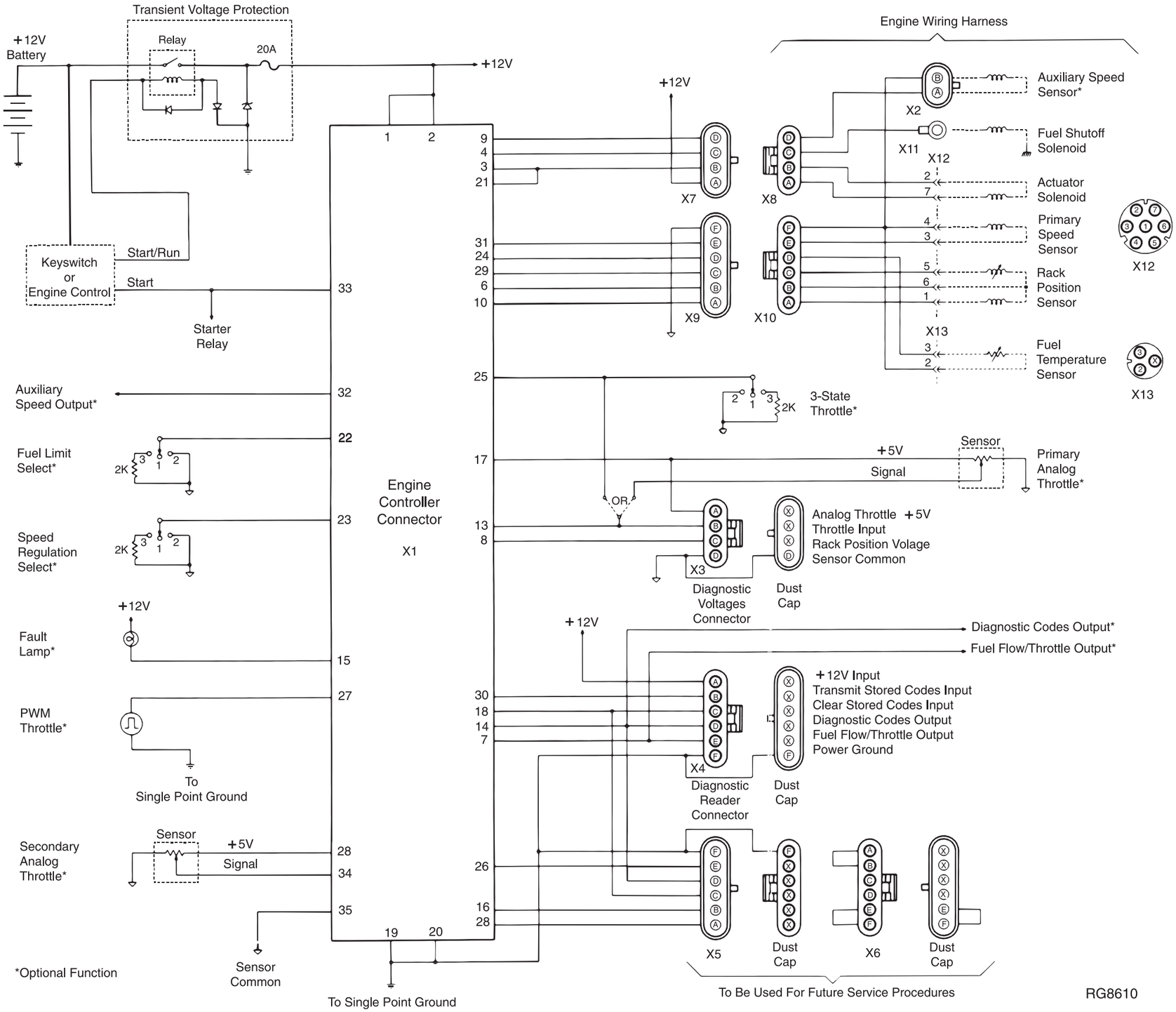
S55,2000,EX –19–14MAR94–1/2

RG8610 –UN–17DEC96

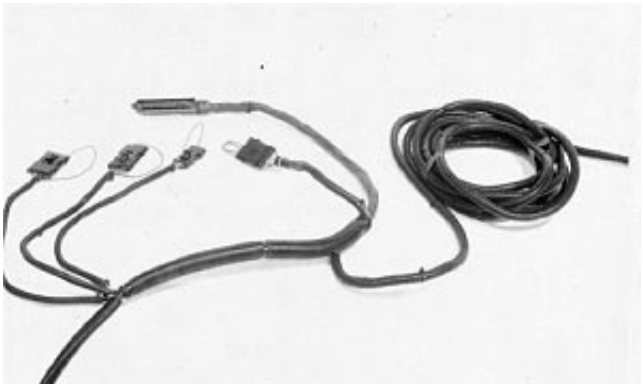


RG8610

Robert Bosch—System Wiring Schematic

S55,2000,EX –19–14MAR94–2/2

Nippondenso Wiring Harness


RG5474 –UN–09JAN90

Depending on the application, various interconnections are made between the Engine Controller and the Actuator Solenoid, the Fuel Shut-off Solenoid, sensors, control switches, diagnostic devices, and other instrumentation or control systems. These connections are made using the Application Wiring Harness.

The harness is required to carry power to the fuel injection system and signals between the controller and the devices which are part of the engine application. These signals include throttle input and diagnostic codes. This harness may be different for each engine application.

IMPORTANT: If for some reason the connector is not connected, such as when the fuel injection pump is removed, it is important to protect the connectors from debris.

The application harness is shown in diagram form on the following page. The harness shown is for OEM engines where some wires are left unterminated for flexibility in installation.

All connectors on the wiring harness are WEATHER PACK™ connectors and are repairable. See REPLACE WEATHER PACK CONNECTOR in Group 40, Nippondenso Component Repairs and Adjustments.

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S55,2000,LS –19–02MAR94–1/1

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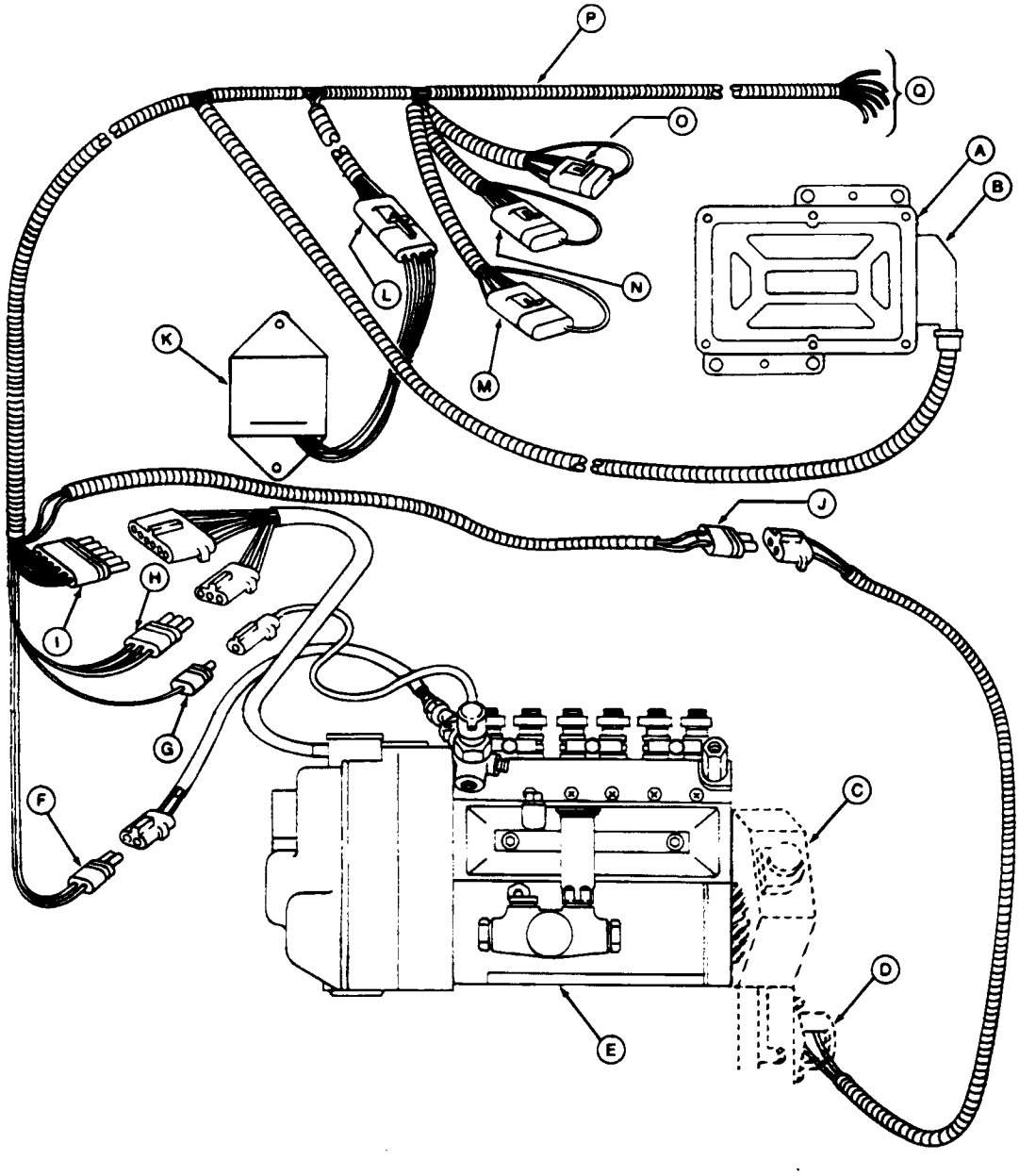
Nippondenso Electronically-Controlled Fuel Injection System with Wiring Harness



A—Engine Controller
B—X1 Engine Controller Connector
C—Injection Pump Gear Cover
D—Auxiliary Speed Sensor Cover
E—Fuel Injection Pump
F—X8 Fuel Temperature Sensor Connector
G—X10 Fuel Shut-off Solenoid Connector
H—X7 Actuator Connector
I—X9 Speed Sensor/Rack Sensor Connector
J—X2 Auxiliary Speed Sensor Connector
K—TVP Module
L—TVP Connector
M—X5 Service Connector
N—X4 Diagnostic Reader Connector
O—X3 Diagnostic Voltages Connector
P—Application Wiring Harness
Q—Unterminated Wires

NOTE: On some applications, X6 (not illustrated) is also located on the same pigtail as the X3, X4, and X5 connectors. X6 is a service connector only.

S55,2000,LT –19–07MAR94–1/1

Nippondenso System Wiring Schematic

The system schematic for the Nippondenso electronic governor is provided in the following foldout. The schematic includes power connections to the system, connections to the injection pump from the controller, service connectors, and signals which communicate with other systems on a machine.

All of the optional signals are shown on the schematic. The actual wiring depends on the engine application. For example, gen sets, combines and agricultural tractors all have service connectors but use different optional signals. Combines use the 3-State Throttle input, and tractors use the Analog Throttle input. However, some tractors use just one analog throttle, some use both analog throttles, and some also receive a PWM Throttle signal from another system. Refer to the machine technical manual for specific engine application wiring.

For the throttle inputs, the switches, resistors and sensors used to generate those input signals are part of the machine and should be described in the machine technical manual. Similarly, the Fault Lamp, PVM throttle signal generator and instrumentation to read signals from the Engine Controller are also part of other machine systems.

For transient voltage protection, OEM engine applications will use the RE30711 TVP Module. John Deere machines will include the required protection with the rest of the machine power distribution system.

Refer to the appropriate machine technical manual for details concerning the actual wiring and optional signals being used.

The following module provides a drawing of each connector. The foldout schematic follows the drawings of the individual connectors.

S55,2000,LU –19–02MAR94–1/1

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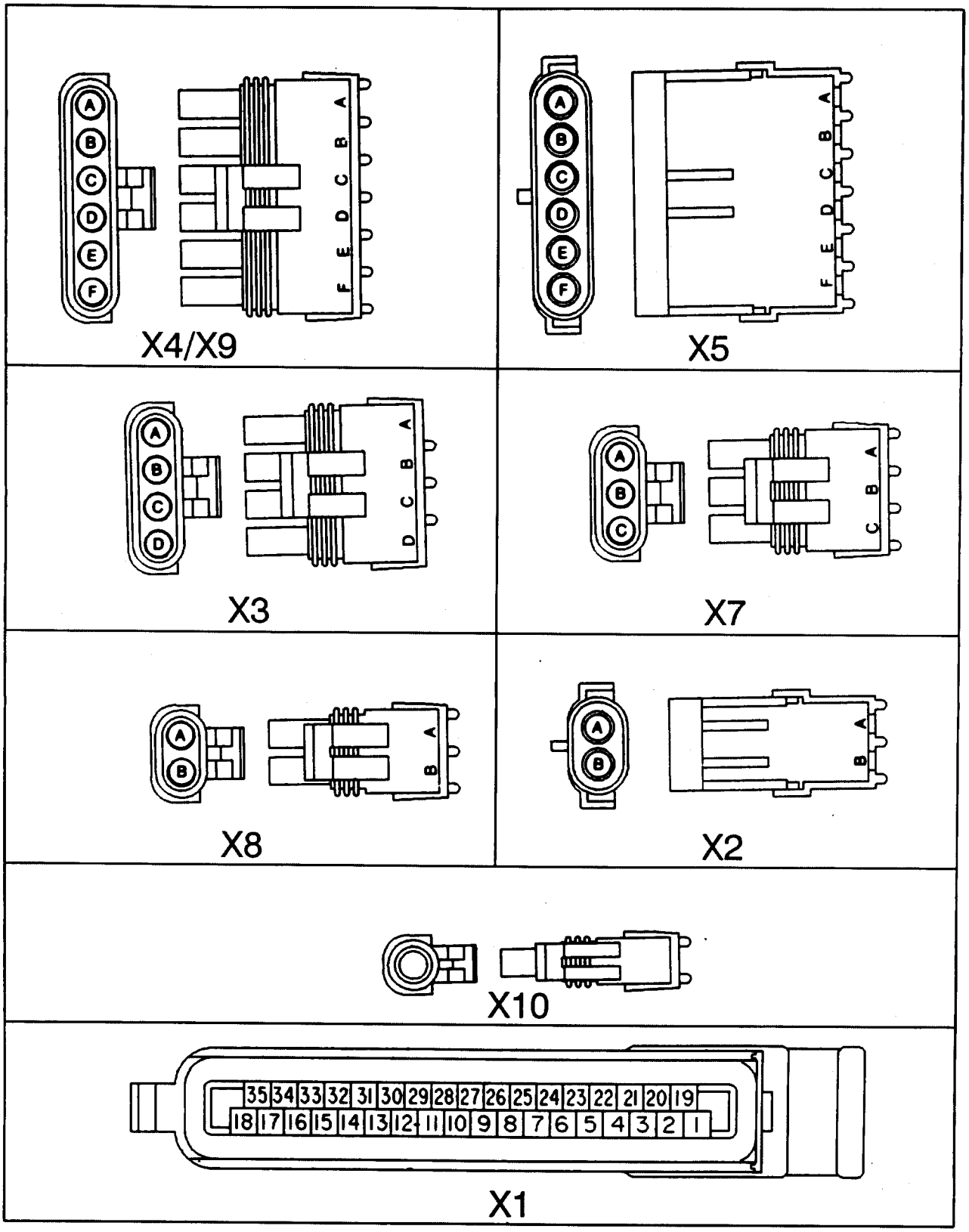
Nippondenso Connectors



RG6837 –UN–29JUN93

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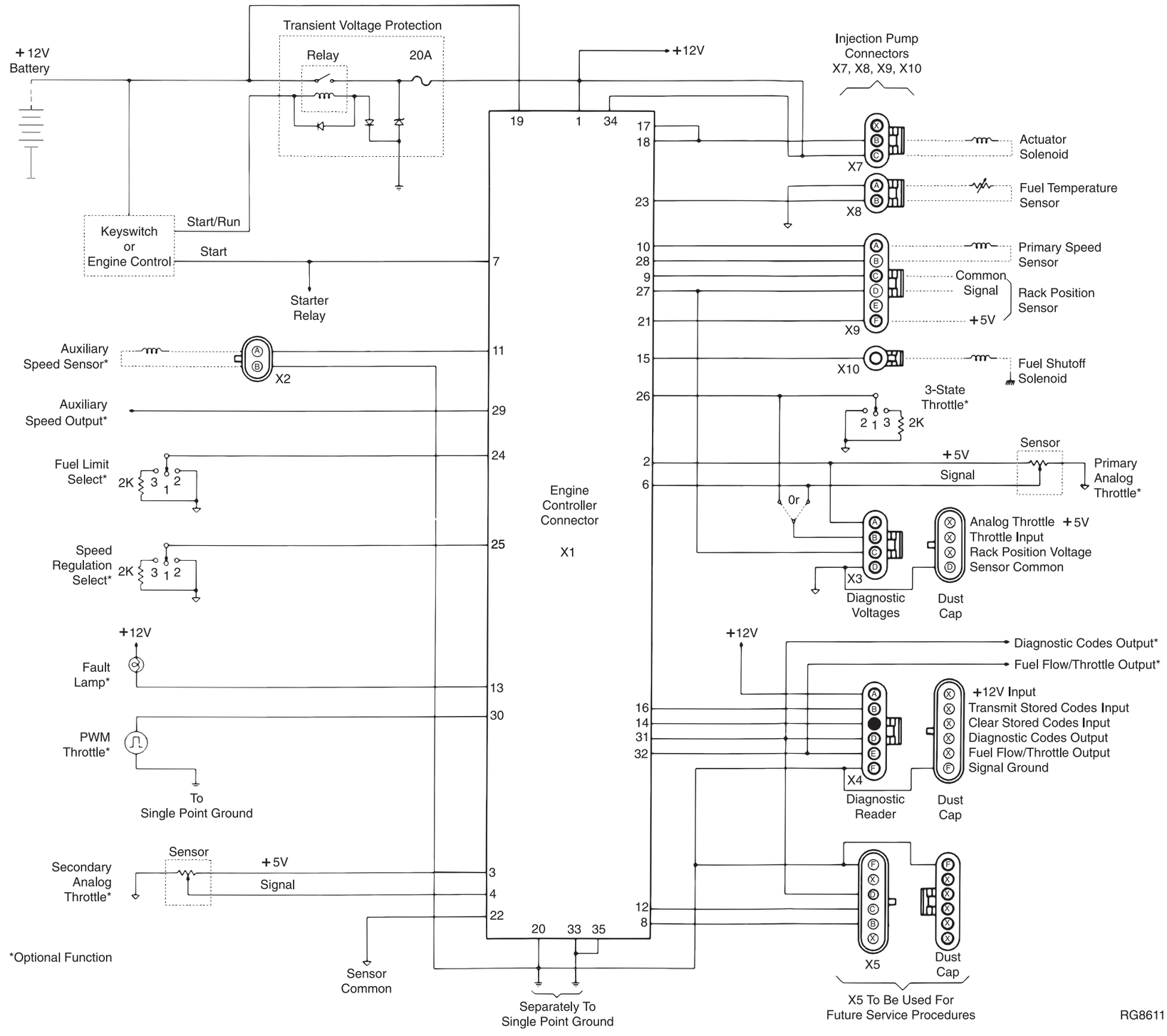
S55,2000,LV –19–02MAR94–1/2

RG8611 –19–17DEC96



Nippondenso—System Wiring Schematic

S55,2000,LV –19–02MAR94–2/2

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