POWERTECH® 4.5L & 6.8L Diesel Engines

Level 11 Electronic Fuel System With Denso HPCR

TECHNICAL MANUAL

POWERTECH® 4.5 L & 6.8 L Diesel Engines—Level 11 Electronic Fuel System with Denso HPCR

CTM220 14MAY03 (ENGLISH)

For complete service information also see:

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

John Deere Power Systems

LITHO IN U.S.A.

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A John Deere ILLUSTRUCTION® Manual

Handle Fluids Safely—Avoid Fires

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

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

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

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



TS227 –UN–23AUG88

DX,FLAME –19–29SEP98–1/1

Handle Starting Fluid Safely

Starting fluid is highly flammable.

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

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

Do not incinerate or puncture a starting fluid container.



TS1356 –UN–18MAR92

DX,FIRE3 –19–16APR92–1/1

Service Cooling System Safely

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

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



TS281 –UN–23AUG88

DX,RCAP –19–04JUN90–1/1

Engine Application Charts

JOHN DEERE AGRICULTURAL EQUIPMENT

Machine Model	Engine Model
Waterloo - Tractors	
7220 Tractor	PE6068HRW61
7320 Tractor	PE6068HRW61
7420 Tractor	PE6068HRW62
7520 Tractor	PE6068HRW62
7720 Tractor	
7820 Tractor	PE6068HRW54
	PE6068HRW56
Mannheim - Tractors	
6120	
6220	
6420 Tractor Premium (NA/RII)	CD4045HL473
64XX Tractor Premium (RII) IVT, 40K/50K	CD4045HL474
6520 Tractor Premium (NA/RII)	CD6068HL470
6520L Tractor Premium (NA)	CD4045HL475
6620 Tractor Premium (NA/RII)	CD6068HL471
6820 Tractor Premium (RII)	CD6068HL472
6920 Tractor Premium (RII)	CD6068HL473
69XX Tractor Premium (RII) IVT, 40K/50K	CD6068HL474
Moline - Combines	
9550LP Combine	T06068HH054
9550HP Combine	T06068HH055
9965 Amadas Peanut Combine	PE6068HH057
Zweibrucken - Combines	
9560/9560HM Combine	CD6068HZ070

JOHN DEERE CONSTRUCTION AND FORESTRY EQUIPMENT

Machine Model	Engine Model
Davenport	
624 Loader	PE6068HDW57
670 Motor Grader	PE6068HDW61
672 Motor Grader	PE6068HDW61

JOHN DEERE OEM (OUTSIDE EQUIPMENT MANUFACTURERS)

PE4045HF475
CD4045HF475
PE6068HF475
CD6068HF475

RG40854,0000009 –19–11APR03–1/1

Remove and Install Pre-Filter/Water Bowl Base

NOTE: For Combine and 6020 Tractors, refer to Vehicle manual for pre-filter information.

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

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

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

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

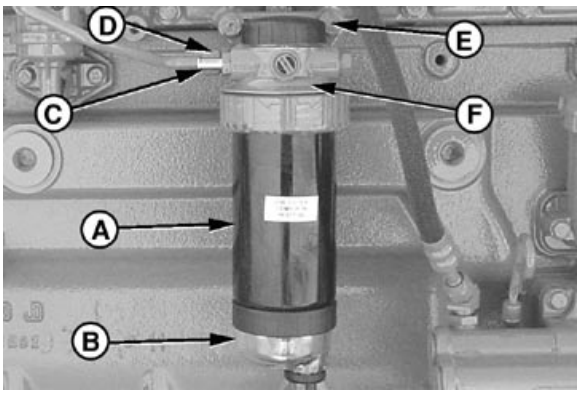
NOTE: Mounting bracket does not need to be removed.

7. Replace parts as necessary.

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

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

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



RG12451A –UN–14JUN02

Pre-filter (OEM engines)

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

Continued on next page

RG40854,000010A –19–22MAY02–1/2

Install Flow Dampers

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

Specification

Flow Damper—Torque ..... 176 N•m (130 lb-ft)

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

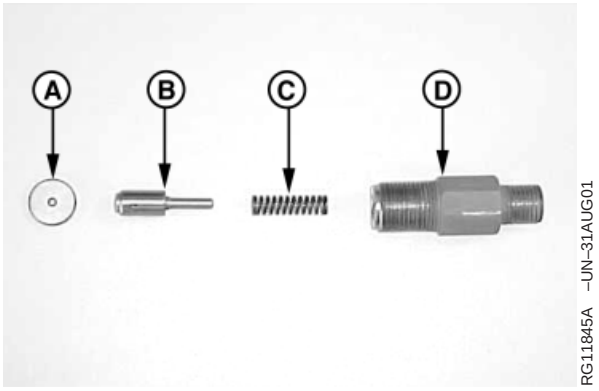
Specification

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

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

Specification

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

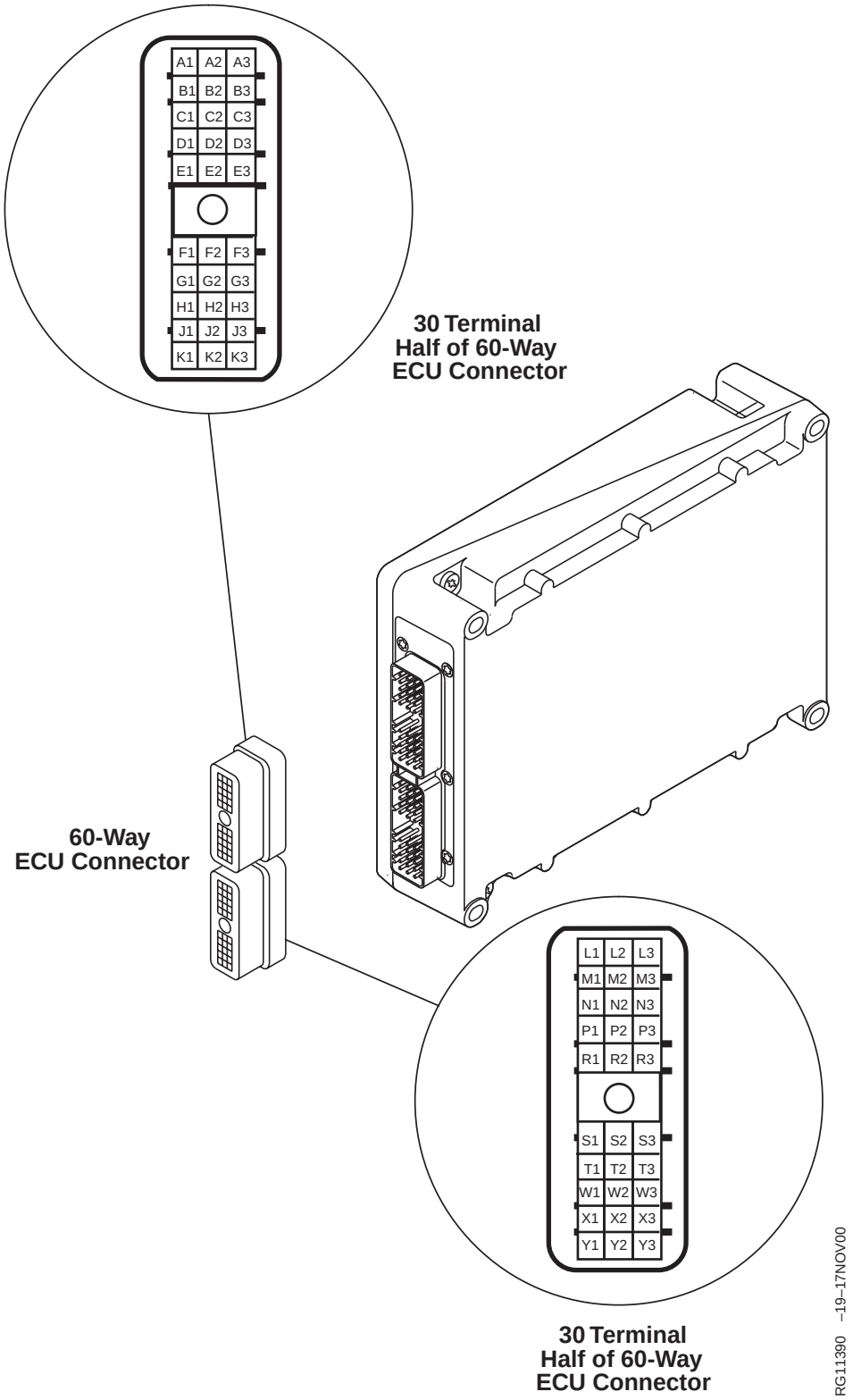


Flow Damper Exploded View

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

RG40854,0000112 –19–31MAY02–2/2

Engine Control Unit (ECU)



John Deere Level 11 ECU

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Section 04
Diagnostics

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Listing of Diagnostic Trouble Codes (DTCs) on ECU

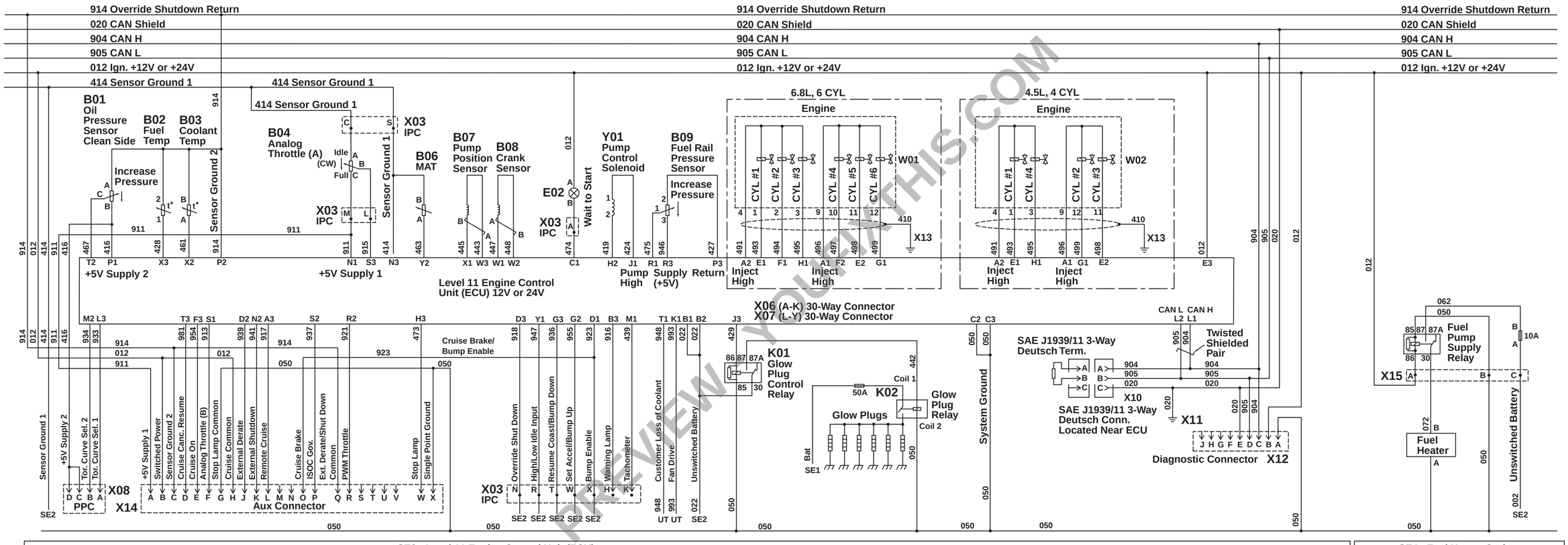
Ascending SPN/FMI Codes

SPN	FMI	Description
000028	03	Throttle Volts High
	04	Throttle Volts Low
000029	03	Throttle Volts High
	04	Throttle Volts Low
000084	31	Vehicle Speed Mismatch
000091	03	Throttle Volts High
	04	Throttle Volts Low
	09	Throttle Invalid
	14	Throttle Voltage Out of Range
000094	03	Fuel Rail Pressure Input Voltage High
	04	Fuel Rail Pressure Input Voltage Low
	10	Fuel Rail Pressure Loss Detected
	13	Fuel Rail Pressure Higher Than Expected
	17	Fuel Rail Pressure Not Developed
000097	00	Water in Fuel Continuously Detected
	03	Water in Fuel Signal Voltage High
	04	Water in Fuel Signal Voltage Low
	16	Water in Fuel Detected
000100	01	Engine Oil Pressure Extremely Low
	03	Engine Oil Pressure Input Voltage High
	04	Engine Oil Pressure Input Voltage Low
	18	Engine Oil Pressure Moderately Low
000105	00	Manifold Air Temperature Extremely High
	03	Manifold Air Temperature Input Voltage High
	04	Manifold Air Temperature Input Voltage Low
	16	Manifold Air Temperature Moderately High
000107	00	Air Filter Differential Pressure
000110	00	Engine Coolant Temperature Extremely High
	03	Engine Coolant Temperature Input Voltage High
	04	Engine Coolant Temperature Input Voltage Low
	15	Engine Coolant Temperature High Least Severe
	16	Engine Coolant Temperature Moderately High
000111	01	Engine Coolant Level Low
000158	17	ECU Power Down Error
000160	02	Wheel Speed Input Noise
000174	00	Fuel Temperature High Most Severe
	03	Fuel Temperature Input Voltage High
	04	Fuel Temperature Input Voltage Low
	16	Fuel Temperature High Moderately Severe
000189	00	Engine Speed Derate
000190	00	Engine Overspeed Extreme
	16	Engine Overspeed Moderate
000237	02	Vehicle Identification Number Invalid
	13	Vehicle Identification Option Code Invalid
	31	Vehicle Model Number Invalid
000611	03	Electronic Injector Wiring Shorted to Power Source
	04	Electronic Injector Wiring Shorted to Ground
000620	03	Sensor Supply 2 Voltage High
	04	Sensor Supply 2 Voltage Low

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OEM Engines - Electronic Control System Wiring Diagram

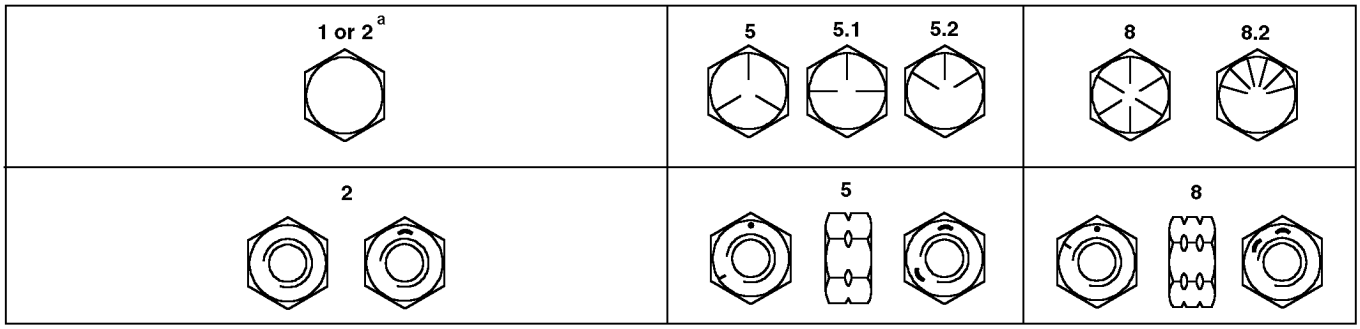
RG12338 –19–18JUL02



PREVIEW YOUFIXTHIS.COM

Download full manual at youfixthis.com

Unified Inch Bolt and Cap Screw Torque Values



TORQ1A –UN–27SEP99

Top, SAE Grade and Head Markings; Bottom, SAE Grade and Nut Markings

	Grade 1 (No Mark)		Grade 2[a] (No Mark)		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
Size	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**	**Lubricated[b] N•m(lb-ft)**	**Dry[c] N•m(lb-ft)**
1/4	3.8 (2.8)	4.7 (3.5)	6 (4.4)	7.5 (5.5)	9.5 (7)	12 (9)	13.5 (10)	17 (12.5)
5/16	7.7 (5.7)	9.8 (7.2)	12 (9)	15.5 (11.5)	19.5 (14.5)	25 (18.5)	28 (20.5)	35 (26)
3/8	13.5 (10)	17.5 (13)	22 (16)	27.5 (20)	35 (26)	44 (32.5)	49 (36)	63 (46)
7/16	22 (16)	28 (20.5)	35 (26)	44 (32.5)	56 (41)	70 (52)	80 (59)	100 (74)
1/2	34 (25)	42 (31)	53 (39)	67 (49)	85 (63)	110 (80)	120 (88)	155 (115)
9/16	48 (35.5)	60 (45)	76 (56)	95 (70)	125 (92)	155 (115)	175 (130)	220 (165)
5/8	67 (49)	85 (63)	105 (77)	135 (100)	170 (125)	215 (160)	240 (175)	305 (225)
3/4	120 (88)	150 (110)	190 (140)	240 (175)	300 (220)	380 (280)	425 (315)	540 (400)
7/8	190 (140)	240 (175)	190 (140)	240 (175)	490 (360)	615 (455)	690 (510)	870 (640)
1	285 (210)	360 (265)	285 (210)	360 (265)	730 (540)	920 (680)	1030 (760)	1300 (960)
1-1/8	400 (300)	510 (375)	400 (300)	510 (375)	910 (670)	1150 (850)	1450 (1075)	1850 (1350)
1-1/4	570 (420)	725 (535)	570 (420)	725 (535)	1280 (945)	1630 (1200)	2050 (1500)	2600 (1920)
1-3/8	750 (550)	950 (700)	750 (550)	950 (700)	1700 (1250)	2140 (1580)	2700 (2000)	3400 (2500)
1-1/2	990 (730)	1250 (930)	990 (730)	1250 (930)	2250 (1650)	2850 (2100)	3600 (2650)	4550 (3350)

[a] Grade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

[b] "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

[c] "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

RG40854,000015B –19–22JUL02–1/1

Electronic Fuel System Repair and Adjustment Specifications

Item	Measurement	Specification
Pre-filter Inlet and Outlet Lines	Torque	9 N•m (6.6 lb-ft)
Pre-filter Mounting Bracket-to-Cylinder Head Cap Screws	Torque	73 N•m (53.8 lb-ft)
Pre-filter Fuel Filter Base-to-Bracket Cap Screws	Torque	50 N•m (36.9 lb-ft)
Final Fuel Filter Inlet and Outlet Lines	Torque	9 N•m (6.6 lb-ft)
Final Fuel Filter Outlet Line	Torque	9 N•m (6.6 lb-ft)
Air Bleed Valve Fitting (Combine engines)	Torque	20 N•m (14.8 lb-ft)
Final Fuel Filter Base-to-Bracket	Torque	50 N•m (36.9 lb-ft)
Final Fuel Filter Bracket to Cylinder Head	Torque	73 N•m (53.4 lb-ft)
Fuel Transfer Pump Cap Screws (OEM engines only)	Torque	30 N•m (22 lb-ft)
High Pressure Fuel Pump to Adapter Plate	Torque	40 N•m (29.5 lb-ft)
High Pressure Fuel Pump Gear Nut	Torque	68 N•m (50.1 lb-ft)
High Pressure Fuel Pump Adapter Plate to Front Cover	Torque	40 N•m (29.5 lb-ft)
High Pressure Fuel Lines - Injection Pump Fitting	Torque	27 N•m (19.9 lb-ft)
High Pressure Fuel Lines - High Pressure Common Rail Fitting	Torque	27 N•m (19.9 lb-ft)
High Pressure Fuel Pump Leak-off Line Fitting	Torque	6 N•m (4.4 lb-ft)
High Pressure Fuel Pump Inlet Filter Plug	Torque	18 N•m (13.3 lb-ft)

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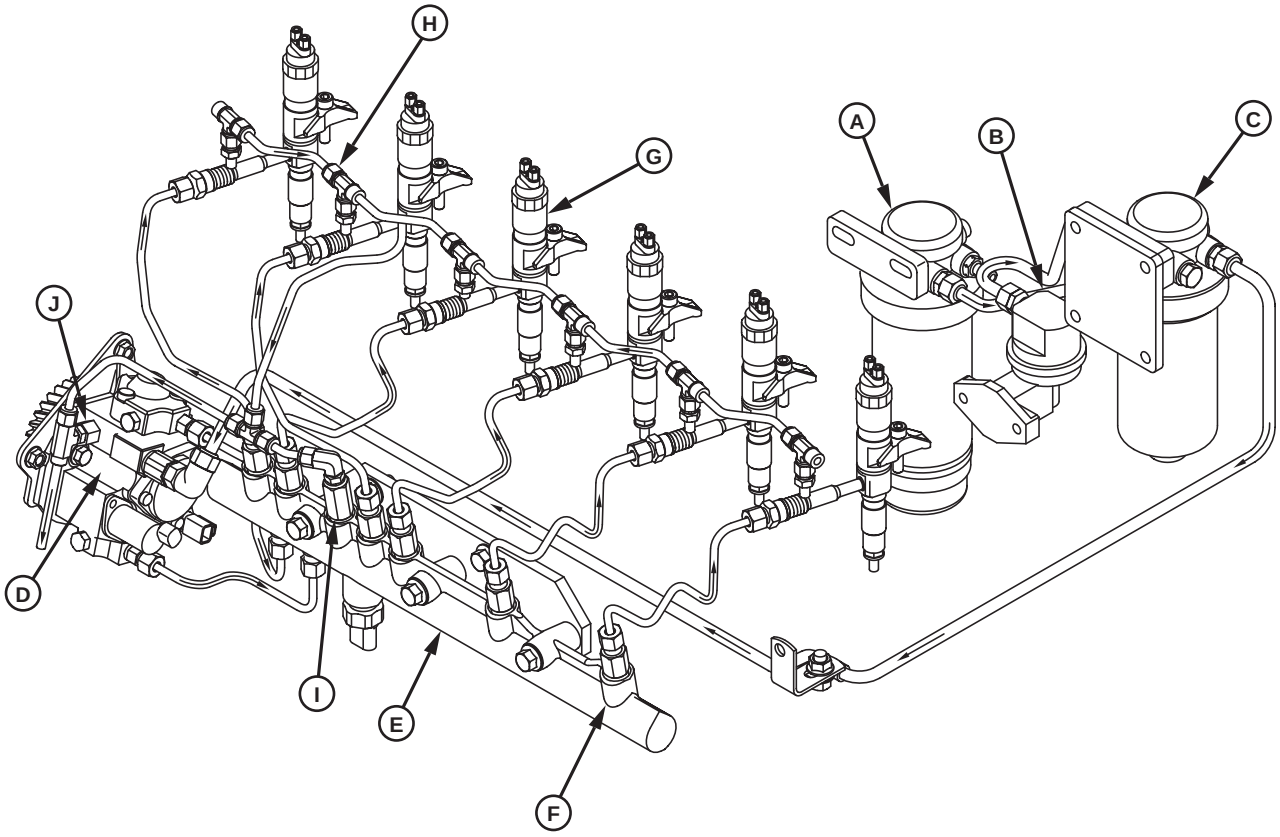
Fuel System Diagnostic Specifications

Item	Measurement	Specification
Minimum Fuel Transfer Pump Pressure	Cranking Running (Low Idle)	30 kPa (0.3 bar) (4.4 psi) 40 kPa (0.4 bar) (5.8 psi)
Minimum Fuel Rail Pressure	Cranking Running (Low Idle)	20 MPa (200 bar) (2900 psi) 35 MPa (350 bar) (5076 psi)

RG40854,0000140 –19–15JUL02–1/1

❻ **Compression and Misfire Test**	1. Using the DST or Service ADVISOR, perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 of this manual. 2. Make note of the results. 3. Using the DST or Service ADVISOR, perform the Misfire Test. For instructions, see ENGINE TEST INSTRUCTIONS - MISFIRE TEST in Section 04, Group 160 of this manual. 4. Make note of the results.	**All cylinders scored within 10% of each other on both tests:** GO TO ❼ **One or more cylinders scored 10% or more lower than the rest of the cylinders on the Compression Test and DIFFERENT cylinder(s) scored 10% or more lower on the Misfire Test:** GO TO ❽ **One or more cylinders scored 10% or more lower than the rest on the Compression Test and the SAME cylinder(s) scored 10% or more lower on the Misfire Test:** GO TO ❾ **All cylinders scored within 10% of each other on the Compression Rest and one or more cylinders scored 10% or more lower than other cylinders on the Misfire Test:** Replace the EI(s) of the cylinder(s) that tested low on the Misfire Test. – – –1/1
❼ **Fuel Supply System Test**	Check fuel supply system. See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group.	**No fuel supply system problems:** GO TO ❿ **Fuel supply system problem found:** Repair and retest. – – –1/1
❽ **Inconclusive Test Results**	These types of results indicate either the Misfire Test or Compression Test could not operate correctly. Further engine diagnostics should be performed to determine if the engine misfire is caused by a faulty EI or by a compression problem.	– – –1/1

Fuel System Operation



RG12290 –UN–22JUL02

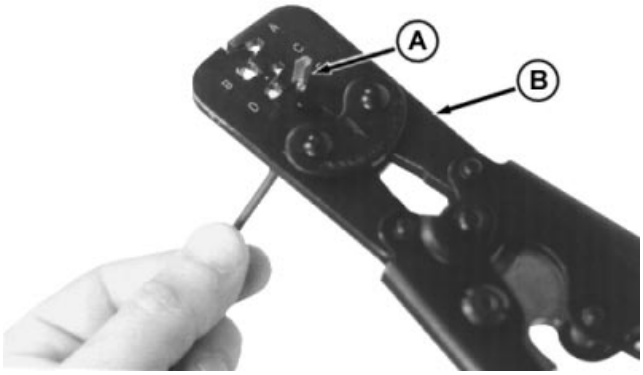
A—Pre-Filter
B—Fuel Transfer Pump
C—Final Filter
D—High Pressure Fuel Pump
E—High Pressure Common Rail (HPCR)
F—Flow Damper
G—Electronic Injector (EI)
H—Fuel Leak-off Line
I—Pressure Limiter
J—Overflow Orifice

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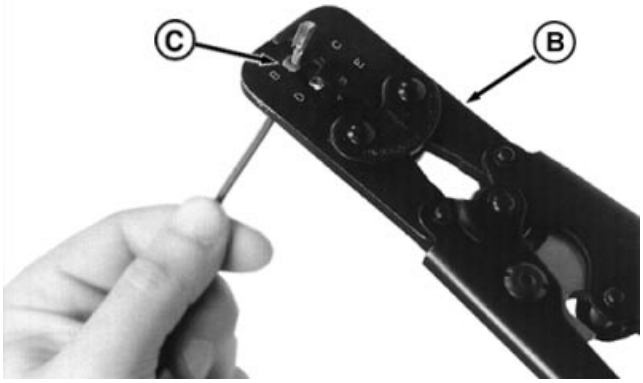
RG40854,0000122 –19–17JUN02–1/2

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

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



RW77139 –UN–07DEC98



RW77138A –UN–15MAR02



RW77140A –UN–15MAR02

RG40854,00000CC –19–20MAY02–3/3

❸ **Compression Test**	Perform the Compression Test. For instructions, see ENGINE TEST INSTRUCTIONS - COMPRESSION TEST in Section 04, Group 160 of this manual.	**All cylinders scored within 10% of each other:** GO TO ❹ **One or more cylinders scored 10% or more lower than other cylinders:** See E2 - ENGINE MISFIRE/RUNS IRREGULARLY DIAGNOSTIC PROCEDURE earlier in this Group. – – –1/1

❹ **Fuel Pressure Check**	1. Read fuel rail pressure (actual) when engine is idling using the DST or Service ADVISOR. 2. Check fuel supply pressure. See CHECK FUEL SUPPLY PRESSURE later in this Group.	**Both pressures within specification:** GO TO ❺ **Either pressure below specification:** See F1 - FUEL SUPPLY SYSTEM CHECK DIAGNOSTIC PROCEDURE later in this Group. – – –1/1

❺ **Valve Clearance Check**	Check valve lash. See CHECK AND ADJUST VALVE CLEARANCE in Section 02, Group 021 of the 4.5L & 6.8L Diesel Engine Base Engine Manual (CTM 104).	**Valve clearance on one or more valves out of specification:** GO TO ❻ **Valve clearance on all valves within specification:** Ensure there are no engine mechanical problems. If no other problems are found, see E3 - ENGINE DOES NOT DEVELOP FULL POWER DIAGNOSTIC PROCEDURE earlier in this Group. – – –1/1

Reprogramming Engine Control Unit (ECU)

John Deere Ag and Construction dealers are able to reprogram ECUs using SERVICE ADVISOR™. See REPROGRAMMING ENGINE CONTROL UNIT USING SERVICE ADVISOR later in this Group.

OEM Distributors are able to to reprogram ECUs using Diagnostic Scan Tool (DST). See REPROGRAMMING ENGINE CONTROL UNIT USING DST later in this Group.

SERVICE ADVISOR is a trademark of Deere & Company

RG41221,0000092 –19–04NOV02–1/1

000029.03 — Throttle Voltage High

Throttle voltage is above the specification.

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

Application	Diagnostic Procedure
OEM	See T3 - ANALOG THROTTLE (A) INPUT HIGH DIAGNOSTIC PROCEDURE later in this Group.
Tractors - 6020 Series	See T5 - ANALOG THROTTLE (B) INPUT HIGH DIAGNOSTIC PROCEDURE later in this Group.

RG41221,00000C8 –19–22JAN03–1/1

000029.04 — Throttle Voltage Low

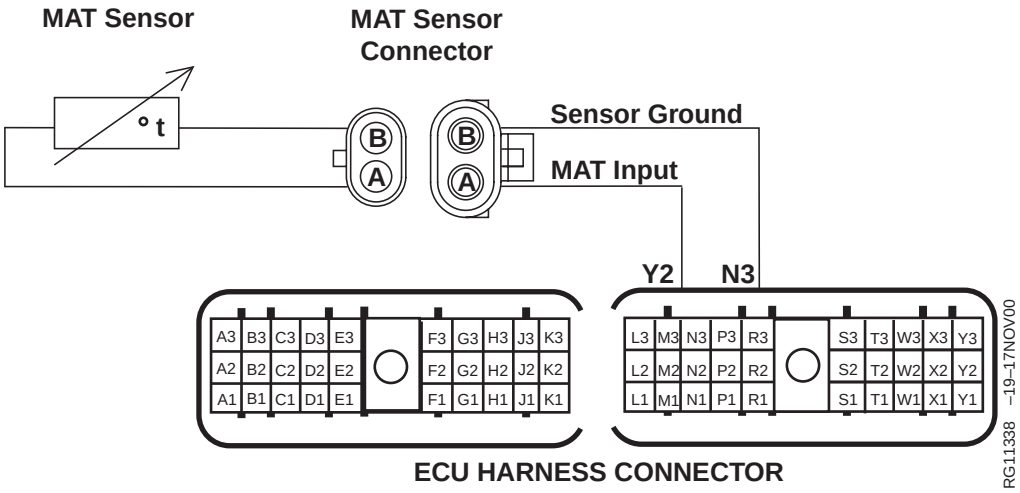
Throttle voltage is below the specification.

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

Application	Diagnostic Procedure
Tractors - 6020 Series	See T6 - ANALOG THROTTLE (B) INPUT LOW DIAGNOSTIC PROCEDURE later in this Group.

RG41221,00000C9 –19–22JAN03–1/1

000105.16 — Manifold Air Temperature Moderately High



04
160
,160

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

MAT (Manifold Air Temperature) Sensor

- The MAT sensor is a thermistor (temperature sensitive resistor) mounted in the intake manifold. The MAT sensor is used to measure the temperature of the intake air. The MAT sensor's variable resistance causes the input voltage to the ECU to vary. Higher intake air temperatures result in lower MAT input voltages to the ECU; lower temperatures result in higher voltages. For further MAT sensor information, see MEASURING TEMPERATURE in Section 03, Group 140.

DTC 000105.16 will set if:

- The ECU senses a manifold air temperature on OEM applications above 88°C (190°F). For manifold air temperature specifications on other applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 of this manual.

If DTC 000105.16 sets, the following will occur:

- Engine protection is enabled. See ENGINE PROTECTION in Section 03, Group 140 earlier in this manual.
  - – With Shutdown Feature: The derate feature will go into effect when the code is set and the engine will shut down after 30 seconds.
  - – With Derate Feature: On OEM applications, the engine derates 2% per minute until the engine is running at 80% of full power. For non-OEM applications, see APPLICATION SPECIFICATIONS in Section 06, Group 210 later in this manual.

RG40854,000002A –19–30APR02–1/1

000652.06 — Cylinder #2 EI Circuit Shorted

The ECU detects a short in the Cylinder #2 EI circuit.

RG40854,0000074 –19–01MAY02–1/1

000652.06 Cylinder #2 EI Circuit Shorted Diagnostic Procedure

04
160
,294

IMPORTANT: If DTCs 000611.03, 000611.04, OR 000627.01 are active, repair those DTCs first .

– – –1/1

❶ **Connection Check**	**IMPORTANT: Do not force probes into connector terminals or damage will result. Use JT07328 Connector Adapter Test Kit to make measurements in connectors. This will ensure that terminal damage does not occur.** *NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.* Perform a preliminary inspection of ECU connectors and the injector harness connector (located at the side of the cylinder head) looking for dirty, damaged, or poorly positioned terminals.	**No faulty connection(s):** GO TO ❷ **Faulty connection(s):** Repair faulty connection(s).

– – –1/1

❷ **Intermittent Fault Test**	*NOTE: For wiring and theory of operation information, see DTC 000652.06 CYLINDER #2 EI CIRCUIT SHORTED supporting information.* 1. Connect the DST or SERVICE ADVISOR™. For instructions on connecting to the DST or SERVICE ADVISOR™, see CONNECTING TO DIAGNOSTIC SCAN TOOL (DST) OR SERVICE ADVISOR earlier in this Group. 2. Ignition ON, engine OFF 3. Start the ECU diagnostic software 4. Make note of any DTCs, then clear all DTCs. 5. Ignition ON, engine running 6. Read DTCs using DST or SERVICE ADVISOR™.	**000652.06 reoccurs:** GO TO ❸ **000652.06 does not reoccur:** Problem is intermittent. If no other codes are present, see INTERMITTENT FAULT DIAGNOSTICS earlier in this Group.

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