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ISM Tier 4 Engine

See the following page for engine model numbers

SERVICE MANUAL

Part number 47632293

2nd edition English

September 2014

Replaces part number 47434944



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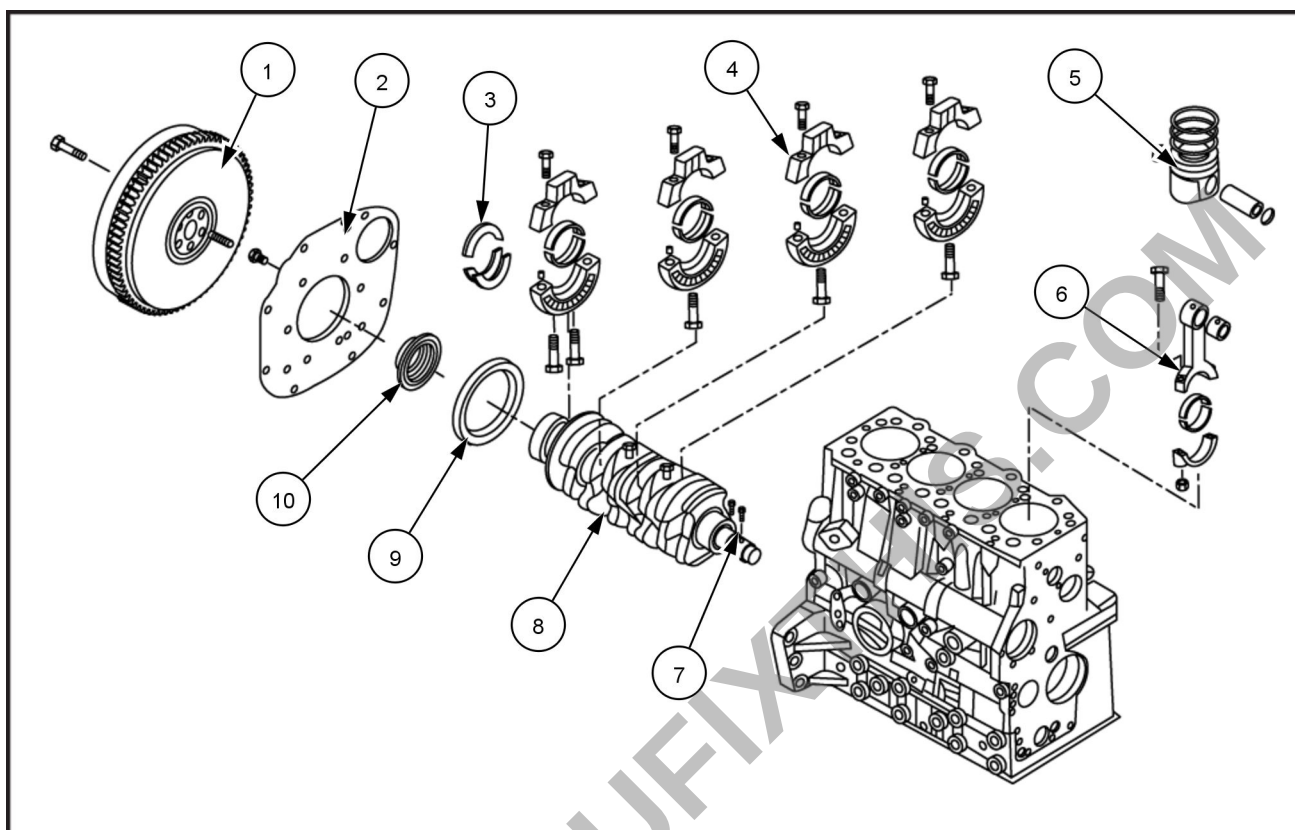
Torque - Minimum tightening torques for normal assembly

METRIC NON-FLANGED HARDWARE

NOM. SIZE	CLASS 8.8 BOLT and CLASS 8 NUT		CLASS 10.9 BOLT and CLASS 10 NUT		LOCKNUT CL.8 W/CL8.8 BOLT	LOCKNUT CL.10 W/CL10.9 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr		
M4	2.2 N·m (19 lb in)	2.9 N·m (26 lb in)	3.2 N·m (28 lb in)	4.2 N·m (37 lb in)	2 N·m (18 lb in)	2.9 N·m (26 lb in)
M5	4.5 N·m (40 lb in)	5.9 N·m (52 lb in)	6.4 N·m (57 lb in)	8.5 N·m (75 lb in)	4 N·m (36 lb in)	5.8 N·m (51 lb in)
M6	7.5 N·m (66 lb in)	10 N·m (89 lb in)	11 N·m (96 lb in)	15 N·m (128 lb in)	6.8 N·m (60 lb in)	10 N·m (89 lb in)
M8	18 N·m (163 lb in)	25 N·m (217 lb in)	26 N·m (234 lb in)	35 N·m (311 lb in)	17 N·m (151 lb in)	24 N·m (212 lb in)
M10	37 N·m (27 lb ft)	49 N·m (36 lb ft)	52 N·m (38 lb ft)	70 N·m (51 lb ft)	33 N·m (25 lb ft)	48 N·m (35 lb ft)
M12	64 N·m (47 lb ft)	85 N·m (63 lb ft)	91 N·m (67 lb ft)	121 N·m (90 lb ft)	58 N·m (43 lb ft)	83 N·m (61 lb ft)
M16	158 N·m (116 lb ft)	210 N·m (155 lb ft)	225 N·m (166 lb ft)	301 N·m (222 lb ft)	143 N·m (106 lb ft)	205 N·m (151 lb ft)
M20	319 N·m (235 lb ft)	425 N·m (313 lb ft)	440 N·m (325 lb ft)	587 N·m (433 lb ft)	290 N·m (214 lb ft)	400 N·m (295 lb ft)
M24	551 N·m (410 lb ft)	735 N·m (500 lb ft)	762 N·m (560 lb ft)	1016 N·m (750 lb ft)	501 N·m (370 lb ft)	693 N·m (510 lb ft)

NOTE: M4 through M8 hardware torque specifications are shown in pound-inches. M10 through M24 hardware torque specifications are shown in pound-feet.

Engine - Exploded view



NHIL13ENG0023AA 1

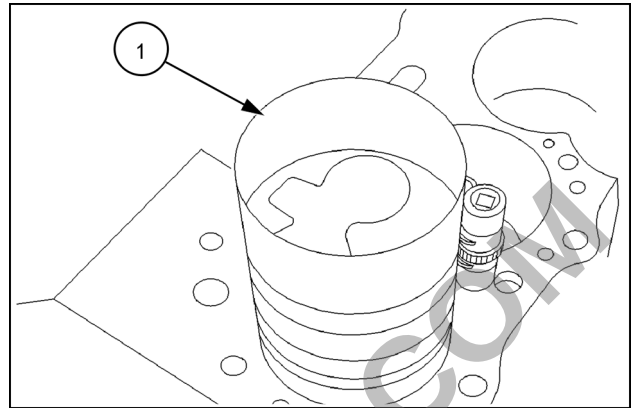
- | | |
|---------------------------------|--------------------|
| (1) Flywheel assembly | (6) Connecting rod |
| (2) Rear plate | (7) Key |
| (3) Thrust washer | (8) Crankshaft |
| (4) Bearing holders / bearings | (9) Gear; Balancer |
| (5) Piston / Rings / Piston pin | (10) Rear oil seal |

The cylinder block assembly contains the pistons, connecting rods, crankshaft, timing gears, and engine oil pump. The crankshaft is supported on five main bearings. The front bearing is positioned in a bore in front of the block. The other bearings are split liners located in holders bolted to the block. The camshaft is supported on four cam bearings located in the block.

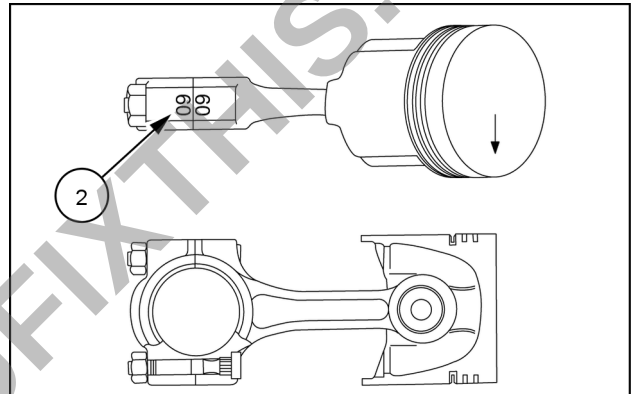
Connecting rod and piston - Install

1. Coat the bearing faces, pistons, and piston rings with clean engine oil. Slide the piston rings to permit a sufficient amount of oil to be applied in the grooves.
2. Set the piston ring gaps **120°** apart from each other. Do not position these gaps toward the piston pin or the right angle of the pin.
3. Using a piston ring compressor (**1**) insert the pistons in the cylinders with the arrow in the piston pointing toward the front of the engine.

NOTE: Install the pistons from the front to the rear in order.



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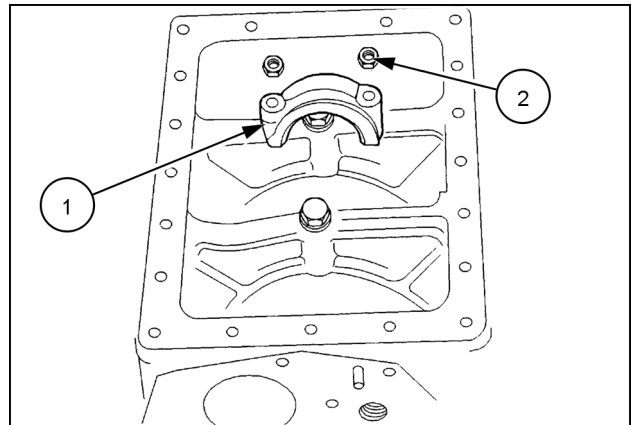


NHIL13ENG0047AA 2

4. Install the connecting rod caps (**1**) making sure the rod and cap matching marks (**2**), Figure 2 align. Tighten the connecting rod nuts (**2**) to **49 - 54 N·m (36 - 40 lb ft)**.

NOTE: After installation, ensure the crankshaft moves freely. Ensure the axial play of **0.1 - 0.3 mm (0.004 - 0.012 in)** is provided between the connecting rod and crank pin.

NOTICE: Replace the connecting rod if axial play of the connecting rod on the crank pin is more than **0.7 mm (0.0276 in)**.



76075710A 3

Engine - Troubleshooting

N843LT-F-27	
N843T-F-24	
N844L-F-30	
N844L-F-34	
N844L-F-36SL	
N844LT-F-45SL	

Problem	Possible Cause	Correction
Engine does not start	Defective key switch or loose connection.	Check for disconnected connectors, or broken wiring. Check the key switch contact points.
	Insufficient charging or completely discharged battery.	Charge the battery.
	No fuel.	Check the fuel level. Fill to proper level if needed.
	Air mixed in the fuel system.	See Injection pump - Bleed (10.218) to bleed the fuel system.
	Improper fuel supply. Injection system malfunction.	See Fuel injection system - Overview (10.218) for an overview of the injection system.
	Clogged fuel filter.	Replace the fuel filter.
	Defective glow plug.	See Cold start aid - Test (55.202) to test the glow plug.
	Improper viscosity of lubricating oil.	Check the oil. Change if needed.
	Clogged air cleaner.	Clean the air cleaner.
	Defective engine stop solenoid.	Check the switch. Check the wiring. Repair or replace as needed.
	No engine compression.	See Engine - Compression test (10.001) to perform the engine compression test.
	Electrical fault.	Check for fault codes using the diagnostic service tool.
Irregular engine speed	Air mixed in the fuel system.	See Injection pump - Bleed (10.218) to bleed the fuel system.
	Uneven fuel injection.	There may be trouble with the injection pump. See Injection pump - Dynamic description (10.218) for injection pump information.
	Clogged fuel filter.	Replace the fuel filter.
	Trouble with the governor.	See Governor - Dynamic description (10.220) for governor information.
	Electrical fault.	Check for fault codes using the diagnostic service tool.
Engine stops during operation	No fuel.	Check the fuel level. Fill to proper level if needed.
	Clogged fuel filter.	Replace the fuel filter.
	Air mixed in the fuel system.	See Injection pump - Bleed (10.218) to bleed the fuel system.
	Electrical fault.	Check for fault codes using the diagnostic service tool.
Engine overheat	Insufficient cooling water.	Replenish the cooling water. Check and repair water leaking points.
	Loosened or slipping fan belt.	Clean oil dust, etc. and retighten.
	Failure of fan belt.	Replace the belt.
	Clogged radiator.	Clean the radiator.
	Clogged radiator fin.	Clean the radiator fins.
	Cooling water passage clogged with dust, etc.	Clean out and wash parts.
	Improper function of thermostat.	Check and replace.
	Insufficient lubricating oil.	Check and replace oil if needed.
	Overloading the engine.	Decrease the load.

Parts name	Tightening torque	Remarks
Nozzle and holder	59 - 69 N·m (44 - 51 lb ft)	
Injection pipe complete	23 - 36 N·m (17 - 27 lb ft)	
Glow plug (engine and afterburner)	15 - 20 N·m (11 - 15 lb ft)	
Relief valve assembly	59 - 69 N·m (44 - 51 lb ft)	
Oil pressure switch	14.7 - 19.6 N·m (10.8 - 14.5 lb ft)	
Engine stop solenoid	14.7 - 24.5 N·m (10.8 - 18.1 lb ft)	
Sensor ; Water and induction temperature	14.7 - 19.6 N·m (10.8 - 14.5 lb ft)	
Sensor ; Speed	5.6 - 8.4 N·m (4.1 - 6.2 lb ft)	
Sensor ; Exhaust temperature	25 - 35 N·m (18.4 - 25.8 lb ft)	Apply an "Anti seize compound" to the threads of the sensor.

Engine - General specification

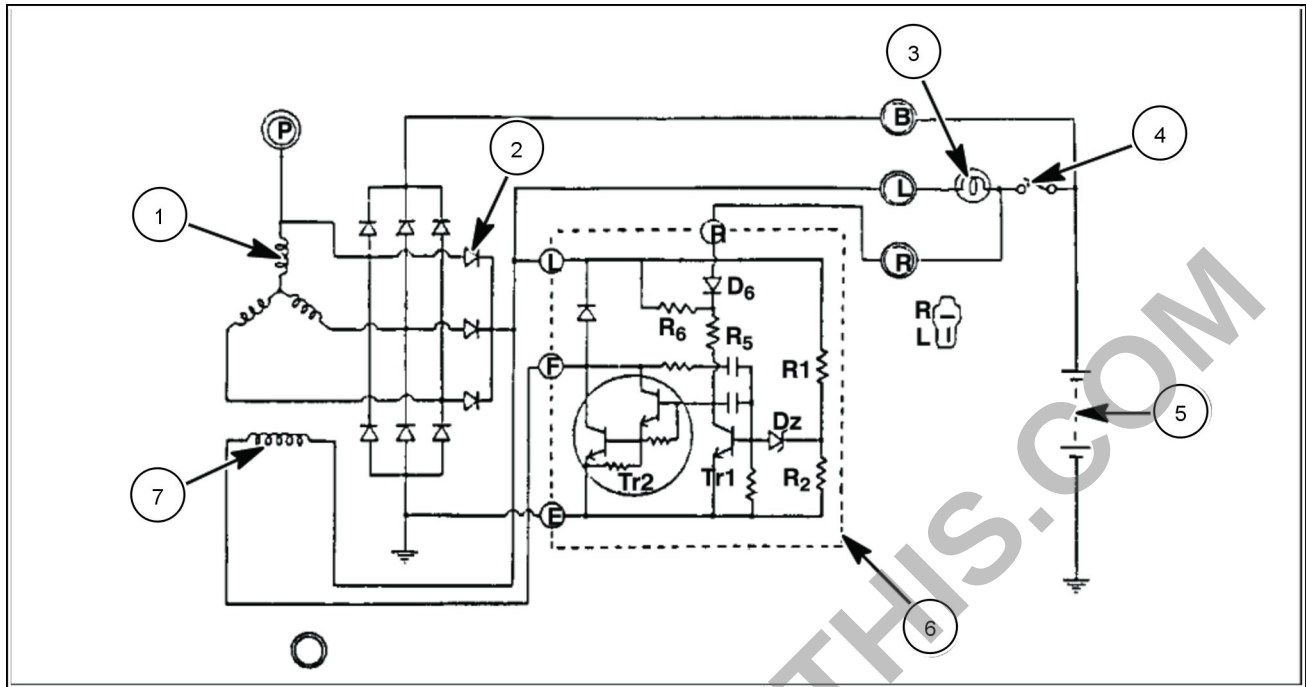
N4LDI-TA-45SL	
N4LDI-TA-50SL	

Engine model	N4LDI - TA - 50SL	N4LDI - TA - 45SL
Number of cylinders	4	
Combustion system	Direct Injection (DI)	
Bore x Stroke	84 mm x 100 mm (3.31 in x 3.94 in)	
Displacement	2216 cm ³ (135.2 in ³)	
Compression ratio	18:1	
Engine speeds (RPM)		
High idle	2825 RPM +/- 25 (No load)	
Rated	2800 RPM (Full load)	
Low idle	1200 RPM +/- 50	
Engine horsepower @ 2800 RPM	50 kW (68 Hp)	45 kW (61 Hp)
Peak torque @ 1800 RPM	208 N·m (153 lb ft)	183 N·m (135 lb ft)
Firing order	1-3-4-2	
Cylinder arrangement	In-Line Vertical	
Valve arrangement	Overhead	
Aspiration	Turbocharged with waste gate	
Emissions control	External Exhaust Gas Recirculation (EGR)	
Fuel injection system	Common rail system HP-CRS	
Lubrication method	Pressure feed by gerotor pump	
Oil capacity with filter included	7.1 L (7.5 US qt)	
Oil filtration	Replaceable full flow spin on cartridge	
Water pump style	Centrifugal	
Water pump flow @ rated RPM	55.5 L/min (14.7 US gpm)	
Coolant volume (engine only)	4.2 l (4.4 US qt)	
Engine dry weight	206 kg (454.2 lb)	
Air cleaner	Dry type	

Engine - General specification

N843LT-F-27	
N843T-F-24	
N844L-F-30	
N844L-F-34	
N844L-F-36SL	
N844LT-F-45SL	

Engine model	N844L - F - 36SL	N844LT - F - 45SL
Number of cylinders	4	
Combustion system	Swirl chamber	
Bore x Stroke	84 mm x 100 mm (3.31 in x 3.94 in)	



T1530CHARGCIRA 2

Charging circuit

The charging circuit and internal connections are shown. The charging system consists of an IC voltage regulator (6) (enclosed with dotted lines), a battery (5) and connecting wires. Because of the use of IC, the voltage regulator is very compact and is built into the alternator.

The IC voltage regulator (6) limits the field current to flow directly from the diode trio (2) to the field coil (7) without passing through the external circuit. Consequently, there are no voltage drops caused by the key switch or the external wiring as with conventional vibrating-contact regulators mounted separately from the alternator. To aid in initial voltage buildup when the engine is started the field current is supplied through the indicator lamp (3) from the battery (5).

Since the frequency pulse output of 1/10 the alternator speed develops on the 'P' terminal, this terminal is used for speed detection.

Principle of IC regulator

The basic function of the IC voltage regulator is to make the terminal voltage constant by detecting the generated voltage and increasing/decreasing the field current.

As indicated, the regulator consists of two basic sections: a voltage control device and an output device to handle the field current. The voltage control device includes the voltage divider network, R1 and R2, a zener diode, Dz, for voltage reference, and a single amplifying transistor, Tr1. The output device is a darlington-type amplifier which is called power transistor, Tr2. The power transistor, Tr2, is placed in series with the alternator field coil and ground.

The signal amplifying transistor, Tr1, senses the generated voltage and turns the power transistor, Tr2, on and off many times per second most of the time the engine is in operation.

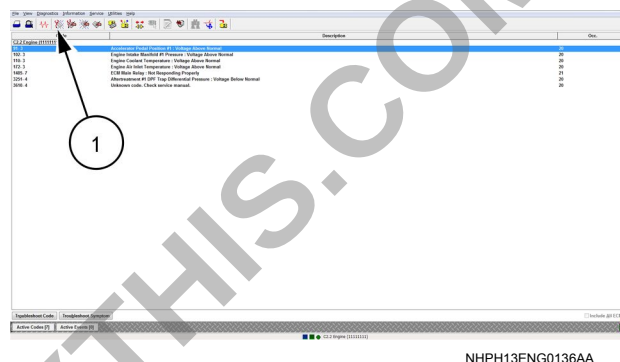
Electrical system Computer support tools - View - Diagnostic codes

N843LT-F-27	
N843T-F-24	
N844L-F-30	
N844L-F-34	
N844L-F-36SL	
N844LT-F-45SL	

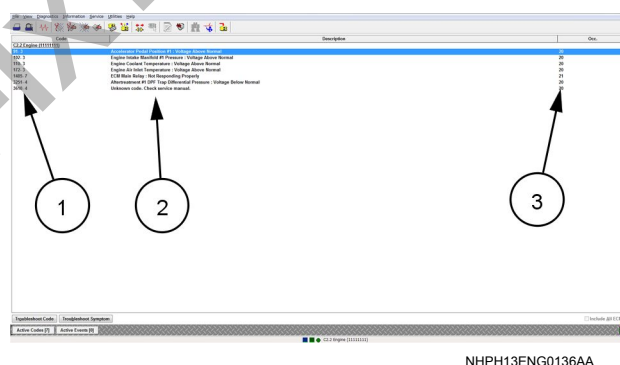
These codes are electrically based faults.

Active diagnostic trouble codes

1. Click the "Active Diagnostic Codes" icon (1).

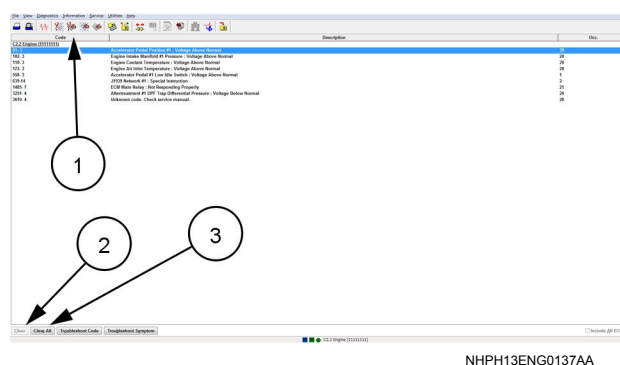


2. In this window, you can view the active codes in the Engine Control Unit (ECU) sorted by:
 - Code number (1).
 - Description (2).
 - Number of occurrences (3).



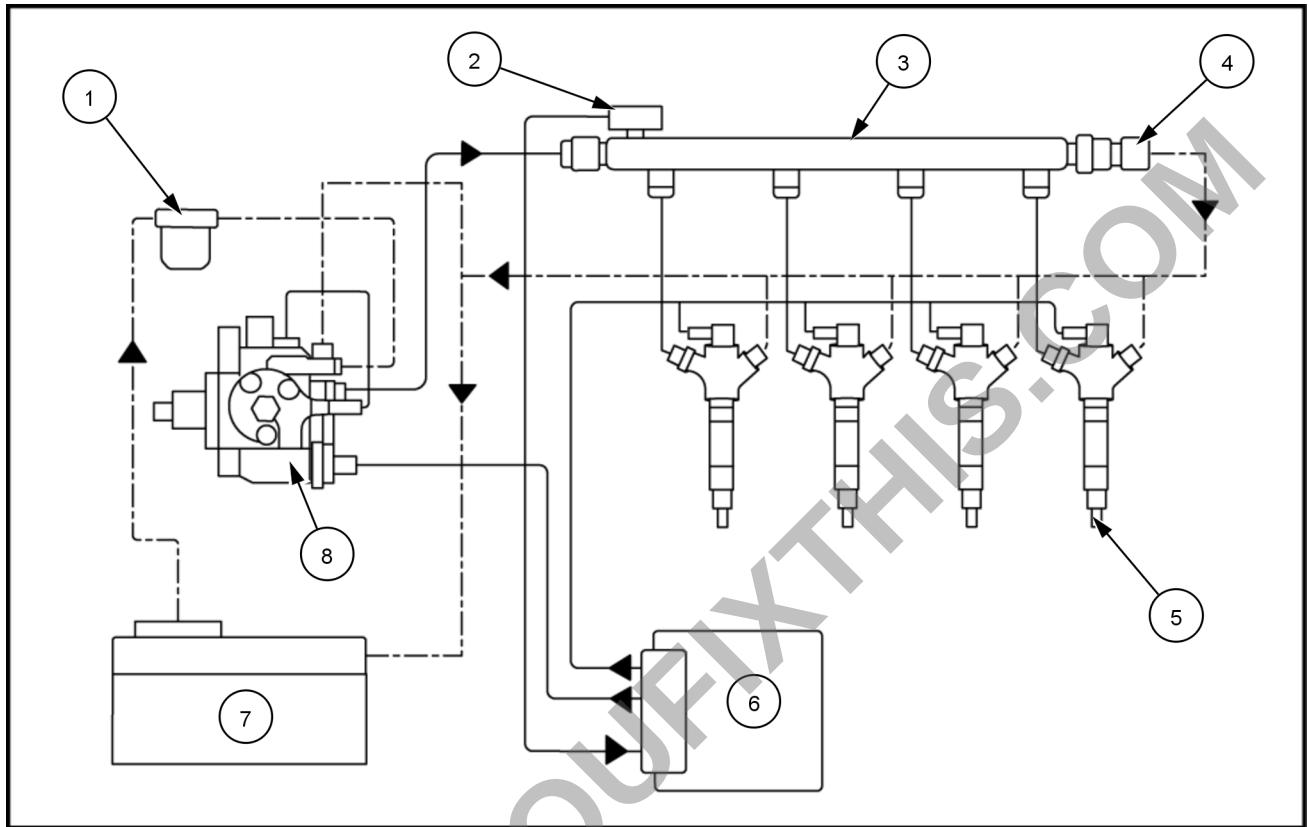
Logged diagnostic trouble codes

1. Click the "Logged Diagnostic Codes" icon (1).
2. This window displays diagnostic codes that are no longer active but have been stored in the ECU memory.
3. Click the "Clear" button (2) to clear the highlighted code.
4. Click the "Clear All" button (3) to clear the entire list of logged codes.



Fuel injection system - Overview

N4LDI-TA-45SL
N4LDI-TA-50SL



NHIL13ENG0025AA 1

- | | |
|----------------------|-----------------------|
| (1) Fuel filter | (5) Injector assembly |
| (2) Pressure sensor | (6) ECU |
| (3) Common rail | (7) Fuel tank |
| (4) Pressure limiter | (8) HP pump |

Common rail system:

- The High Pressure (HP) pump (8) pressurizes the fuel and conveys it through the fuel injection pipe.
- The fuel accumulates in the common rail (3).
- The Engine Control Unit (ECU) (6) controls the fuel quantity, timing and spray frequency electronically according to engine speed and load.
- Pressurized fuel in the common rail (3) conveys through the high pressure pipe into the fuel injectors (5) and sprays into the combustion chamber.

NOTE: The ECU decides the start and end time in which the injector operates.

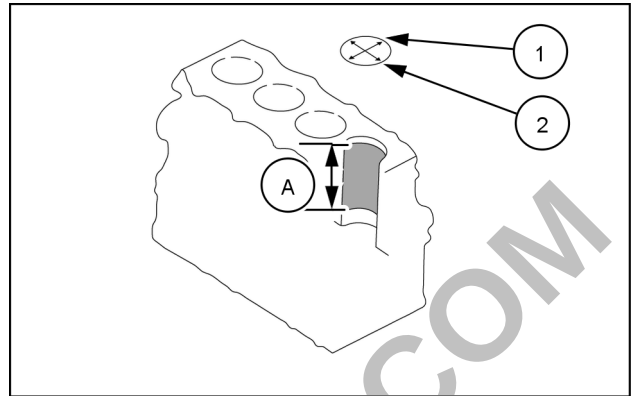
- The sensor (2) will determine and control the engine speed.

[55.014] Engine intake and exhaust system.....	55.7
[55.989] Exhaust Gas Recirculation (EGR) electrical system	55.8
[55.012] Engine cooling system	55.9
[55.013] Engine oil system	55.10
[55.640] Electronic modules	55.11

PREVIEW - YOUFIXTHIS.COM

Crankcase - Inspect

1. Inspect the cylinder block top face for cracks, damage, and warping. Replace the cylinder block if warp is greater than **0.12 mm (0.005 in)**.
2. Visually inspect the cylinder bore. There should be no scoring, rust, or corrosion.
3. Use a telescoping gauge to measure the cylinder bore at the top, center and bottom of the piston ring contact area (**A**) parallel to the crankshaft axis (**2**).
4. Repeat Step 3 perpendicular to the crankshaft axis (**1**).
5. If any of the measurements taken exceed **84.2 mm (3.315 in)** replace the engine block.



NHIL13ENG0004AA 1

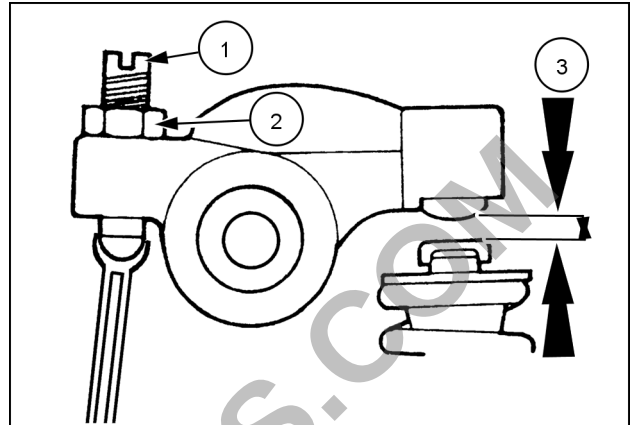
Rocker arm - Clearance

NOTICE: Adjust the valve clearance only while the engine is cold.

1. Rotate the crankshaft clockwise and bring each piston to Top Dead Center (TDC) on the compression stroke (both valves closed).

NOTE: This will ensure the tappet is in its lowest position before making the adjustment.

2. Loosen the nut (2) and adjust the clearance of both the intake and exhaust valves to **0.2 mm (0.008 in) (3)** with the adjusting screw (1).
3. Hold the adjusting screw from turning and torque nut to **12 - 16 N·m (9 - 12 lb ft)**.



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Cylinder head - Assemble

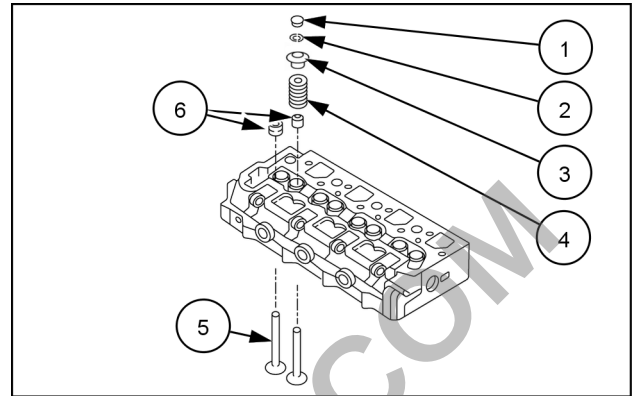
1. Insert each valve (5) in the guide (6) from which it was removed and lightly lap the valve to be sure of an even seat around the valve face. Remove the valve and remove all traces of lapping compound.

2. Install new intake valve seals on the valve guides using a suitable driver.

NOTE: Be sure to check the seals, the valve guide seals for the intake and exhaust are different sizes.

3. Use a spring compressor to assemble the valves (5), springs (4), spring cap (3), keepers (2).

4. Install the valve stem cap (1).



NHIL13ENG0058AC 1

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SERVICE

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(*) See content for specific models

Governor - Dynamic description

N843LT-F-27	
N843T-F-24	
N844L-F-30	
N844L-F-34	
N844L-F-36SL	
N844LT-F-45SL	

These engines have a mechanical governor in order to control engine speed. The governor is installed inside the timing cover.

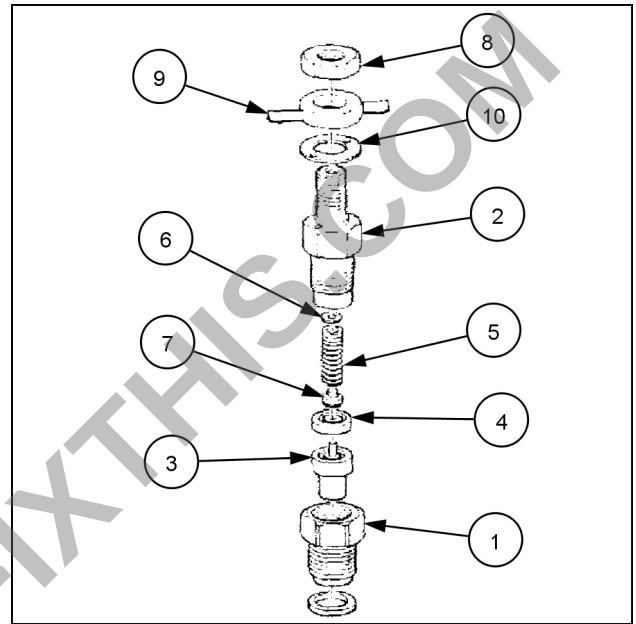
The flyweight assembly is installed onto the camshaft gear, its movement is transmitted to the control rack of the injection pump through the slider control lever link. The spring which controls the movement of the flyweight is connected to the tension lever.

PREVIEW - YOUFIXTHIS.COM

Fuel injectors - Disassemble

N843LT-F-27	
N843T-F-24	
N844L-F-30	
N844L-F-34	
N844L-F-36SL	
N844LT-F-45SL	

1. Loosen and remove the nozzle nut **(1)** from the injector body **(2)** being careful not to drop or damage the nozzle.
2. Remove the nozzle assembly **(3)**, spacer **(4)**, spring **(5)** and shim **(6)**.
3. Clean the nozzle body and the needle valve. Check the nozzle for any burn or score marks. Check the needle seat for evidence of fuel leakage or carbon deposits.
4. Correct fuel leakage at the seat using a polishing stick and polish the seat area.
5. Inspect the upper and lower contact surfaces of the nozzle holder for a clean contact surface area.
6. Check the contact area between the push rod and spring seat.



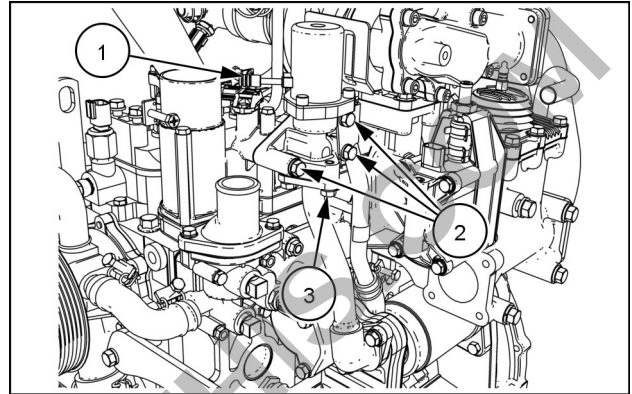
20097772 1

- (1) Nozzle nut
- (2) Injector body
- (3) Nozzle assembly
- (4) Spacer
- (5) Spring
- (6) Shims
- (7) Rod
- (8) Nut
- (9) Leak-off line
- (10) Washer

Exhaust Gas Recirculation (EGR) valve - Remove

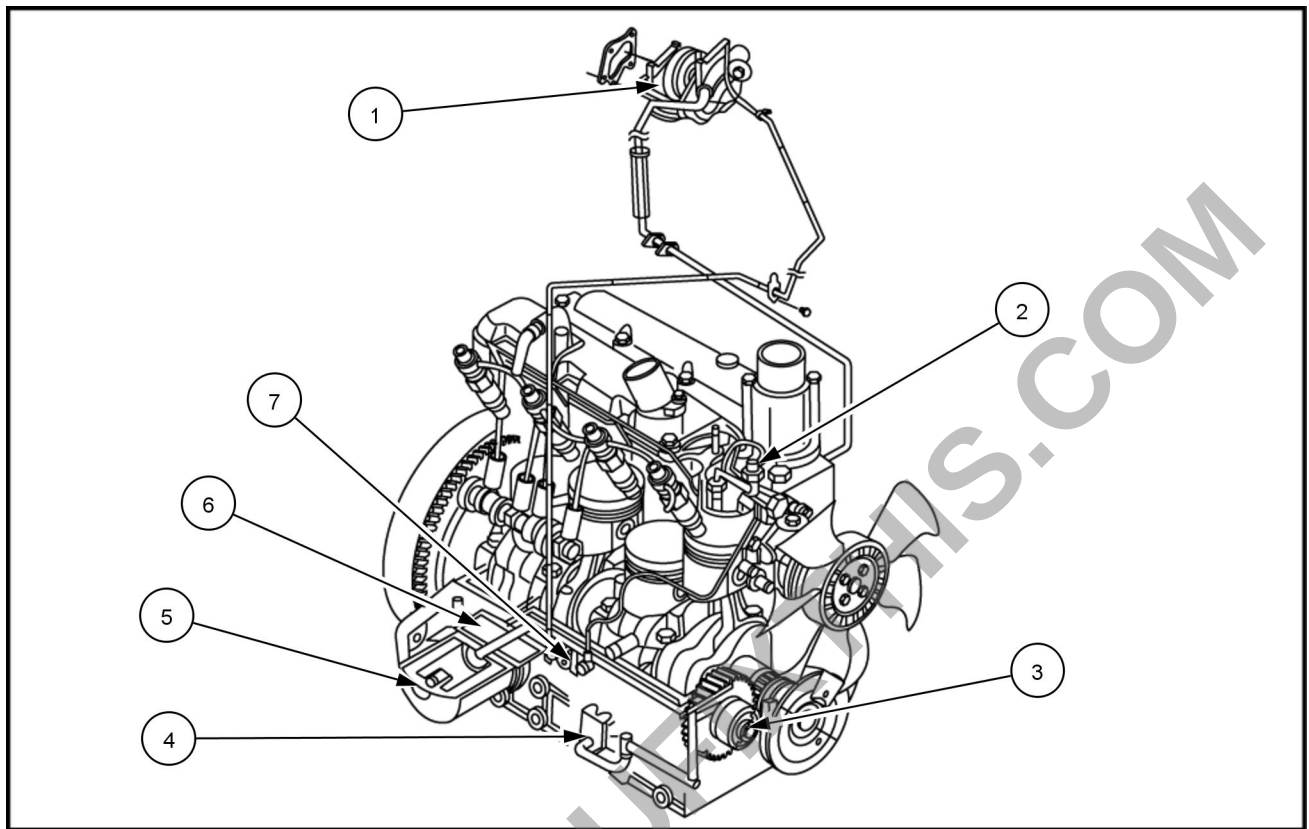
N843LT-F-27	
N843T-F-24	
N844L-F-30	
N844L-F-34	
N844L-F-36SL	
N844LT-F-45SL	

1. Disconnect the electrical connector **(1)**.
2. Remove the three bolts **(3)** connecting the pipe to the EGR valve body.
3. Remove the three retaining bolts **(2)** from the intake manifold and remove the EGR valve.



NHIL13ENG0214AA 1

Engine lubrication system - Overview

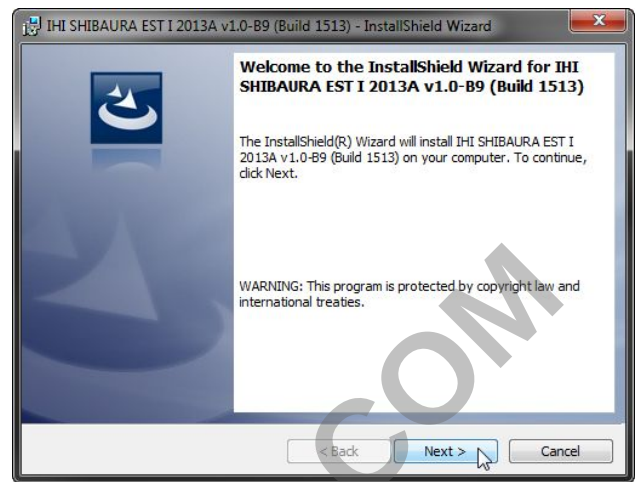


NHIL13ENG0042AA 1

- (1) Turbocharger
- (2) Oil pressure switch
- (3) Oil pump
- (4) Suction filter

- (5) Oil filter
- (6) Oil cooler
- (7) Oil pressure relief valve

6. Click on the "Next" button.



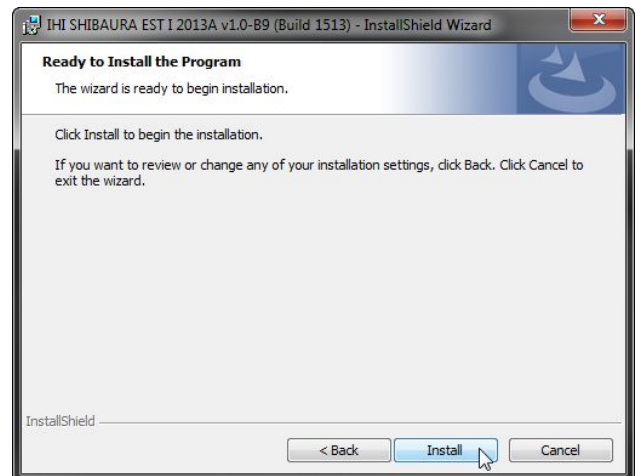
NHPH13ENG0206AA 5

7. Select the "I accept the terms in the license agreement" and then click the "Next" button.



NHPH13ENG0207AA 6

8. Click on the "Install" button.



NHPH13ENG0208AA 7

7. This screen will be displayed when the rewriting is correctly completed.



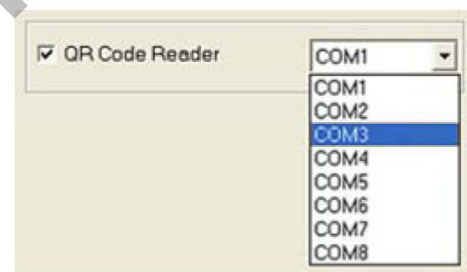
RAPH13SPT0105AA 4

	Read compensation data for all cylinders from Engine Control Unit (ECU).
	Register compensation data for all cylinders in ECU.
	Read compensation data from external file and change display. (No registering)
	Write displayed compensation data in external file.

Scan Compensation Data by using Quick Response (QR) code

1. Compensation data can be scanned directly from QR code printed on injector by connecting QR code scanner with PC Com port.

2. Select COM port and check QR Code Scanner.

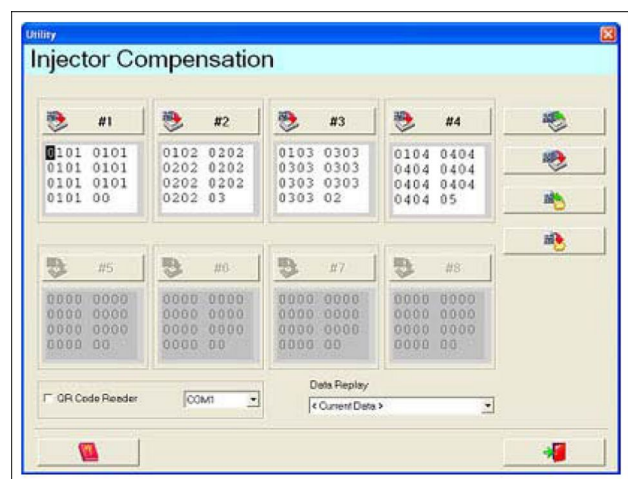


RAPH13SPT0106AA 5

3. Click data area of corresponding cylinder to register. Following example is clicking data area of cylinder number 1.

4. Scan data by using QR code scanner.

5. Register compensation data by clicking button.



RAPH13SPT0095BA 6

Communication requirement for QR code scanner

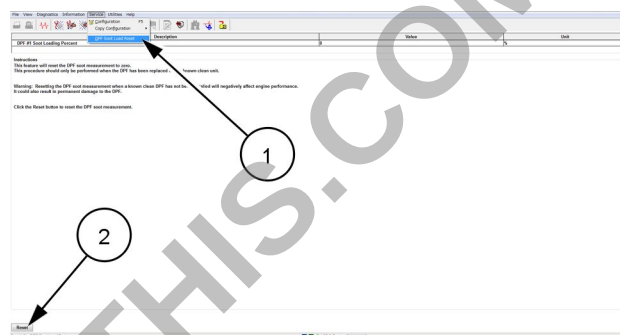
Procedure	[Normal Mode]
Character length	[8 bit]
Parity check	[No]
Transmission rate	[38400 bps]

Electrical system Computer support tools - Configure - Diesel Particulate Filter (DPF) soot load reset

N843LT-F-27	
N843T-F-24	
N844L-F-30	
N844L-F-34	
N844L-F-36SL	
N844LT-F-45SL	

Use this feature when the Diesel Particulate Filter (DPF) is cleaned or replaced.

1. Select the "Service" menu, then click "DPF Soot Load Reset" (1).
2. Click the "Reset" button (2).



NHPH13ENG0156AA 1

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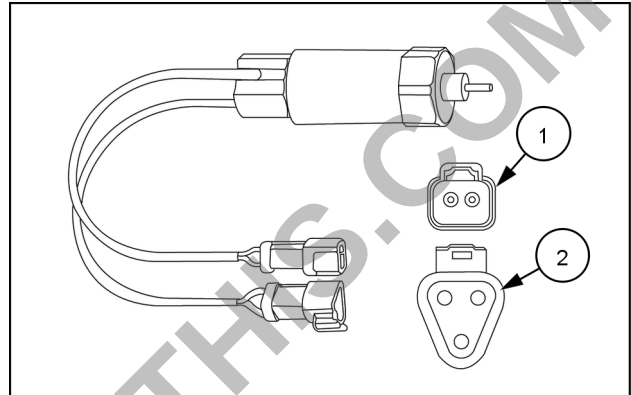
Fuel shutoff solenoid - Inspect – Linear solenoid and rack position sensor

N843LT-F-27	
N843T-F-24	
N844L-F-30	
N844L-F-34	
N844L-F-36SL	
N844LT-F-45SL	

The linear solenoid is a device controlled by the Engine Control Unit (ECU), a variety of plunger positions may determine the engine speed. The plunger position also assists with engine start up or shut down.

1. Remove the linear solenoid.
 - Check the body of the solenoid for damage.
 - Check for damage to the wiring harness and connector.

If there is visible damage, repair or replace as needed.



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2. Disconnect the linear solenoid connection (1).
3. Test the solenoid from pin 1 to pin 2.

Temperature (Degrees)	Resistance (ohms)
20 °C (68 °F)	3.7 - 4.1 Ω

If the resistance is incorrect, replace the solenoid. See **Electrical system Computer support tools - Overview — Engine configuration parameters (55.000)** to calibrate the new component.

4. Test the position sensor.
 - Leave the position sensor (2) connected to the wiring harness.
 - Place the key switch ON.
 - Press the plunger into the solenoid body.
 - Monitor the voltage output on the diagnostic screen.
 - The range should be between **1.0 - 4.0 V**.

If the range is incorrect, replace the sensor. See **Electrical system Computer support tools - Overview — Engine configuration parameters (55.000)** to calibrate the new component.

Fuel solenoid electrical wiring/connection specification:

Connector pin	Value
Pin 1	Ground
Pin 2	12.0 V

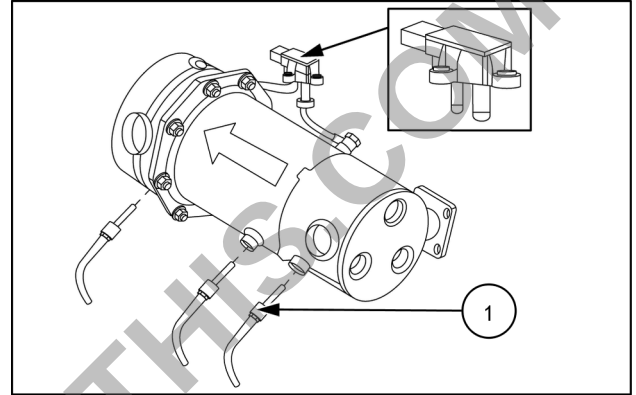
Rack position sensor electrical wiring/connection specification:

Connector pin	Value
Pin 1 (B)	5.0 V reference
Pin 2 (A)	Ground
Pin 3 (C)	Signal output 1.0 - 4.0 V

Exhaust Gas Recirculation (EGR) temperature sensors - Inspect - Diesel Oxidation Catalyst (DOC) Inlet temperature sensor

N843LT-F-27	
N843T-F-24	
N844L-F-30	
N844L-F-34	
N844L-F-36SL	
N844LT-F-45SL	

1. Use a multimeter to inspect the resistance of the sensor (1). If the resistance is not within range, replace the sensor.



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Temperature (Degrees)	Resistance (Ohms)
200 °C (392 °F)	4.0 kΩ +/- 15 %
650 °C (1202 °F)	164.8 Ω +/- 5 %

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N843LT-F-27, N843T-F-24, N844L-F-30, N844L-F-34, N844L-F-36SL,
N844LT-F-45SL Service Manual**



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