SERVICE MANUAL

F4CE9484 / F4CE9487A / F4CE9487N / F4CE9684 / F4DE9484 / F4DE9684B*J111 / F4DE9684M*J101 / F4DE9684M*J103 / F4DE9684 / F4DE9687 / F4GE9484C*J601 / F4GE9484 / F4GE9684 / F4HE0484G*J102 / F4HE0484G*J109 / F4HE9484C*J102 / F4HE9484C*J103 / F4HE9484 / F4HE9684 / F4HE9687G*J100 / F4HE9687

NEF Tier 3

Engine

Part number 47597675
1st edition English
October 2013

NEW HOLLAND CONSTRUCTION

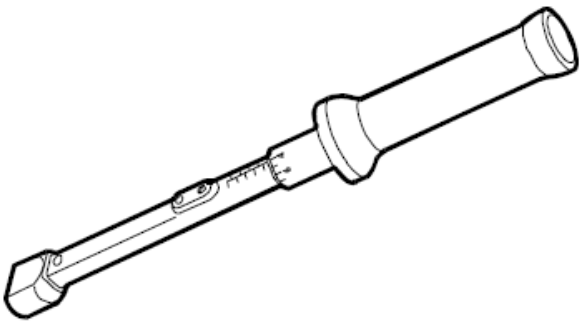
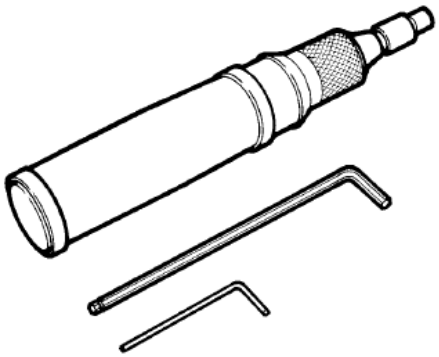
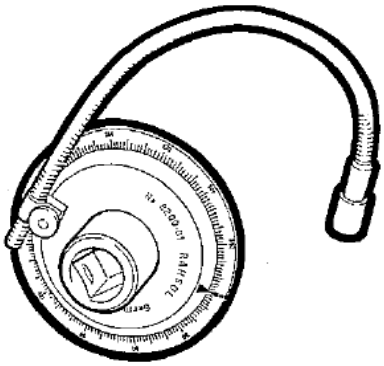
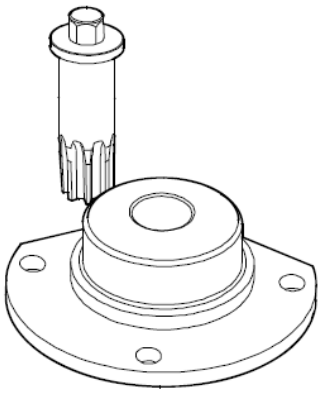
- Keep the engine clean from oil spills, diesel fuel and or chemical solvents.
- Use of solvents or detergents during maintenance may originate toxic vapors. Always keep working areas ventilated. Whenever necessary wear safety mask.
- Do not leave rags impregnated with flammable substances close to the engine.
- Upon engine start after maintenance, undertake proper preventing actions to stop air suction in case of a runaway speed rate.
- Do not utilize fast screw tightening tools.
- Never disconnect batteries when the engine is running.
- Disconnect batteries before any intervention on the electrical system.
- Disconnect batteries from system before applying a load to them with the battery loader.
- After every intervention, verify that battery clamp polarity is correct and that the clamps are tight and safe from accidental short circuit and oxidation.
- Do not disconnect and connect electrical connections in presence of electrical feed.
- Before proceeding with pipelines disassembly (pneumatic, hydraulic, fuel pipes) verify presence of liquid or air under pressure. Take all necessary precautions bleeding and draining residual pressure or closing dump valves. Always wear adequate safety mask or goggles. Non fulfillment of these precautions may cause serious injury and poisoning.
- Avoid incorrect tightening or out of sequence. Danger: incorrect tightening may seriously damage engine's components, affecting engine's duration.
- Avoid priming from fuel tanks made out of copper alloys and/or with ducts not being provided with filters.
- Do not modify cable wires: their lengths shall not be changed.
- Do not connect to the engine electrical equipment unless specifically approved by Iveco.
- Do not modify fuel systems or hydraulic system unless Iveco specific approval has been released. Any unauthorized modification will compromise warranty assistance and furthermore may affect engine correct working and duration.

For engines equipped with electronic controller:

- Do not execute electric arc welding without having previously removed electronic controller.
- Remove electronic controller in case of any intervention requiring heating over **80 °C** (**176 °F**) temperature.
- Do not paint the components and the electronic connections.
- Do not vary or alter any data filed in the electronic controller driving the engine. Any manipulation or alteration of electronic components shall totally compromise engine assistance warranty and furthermore may affect engine correct working and duration.

Respect of the Environment

- Respect of the Environment shall be of primary importance: all necessary precautions to ensure personnel's safety and health shall be adopted.
- Be informed and inform personnel as well of the laws in force regulating use and exhaust of liquids and engine drain oil. Provide for adequate board indications and organic specific training courses to ensure that personnel is fully aware of such law prescriptions and of basic preventative safety measures.
- Collect drain oils in adequate specially provided containers with hermetic sealing ensuring that storage is made in specific, properly identified areas that shall be ventilated far from heat sources and not exposed to fire danger,
- Handle the batteries with care, storing them in ventilated environment and within anti-acid containers. Warning: Battery exhalation represent serious danger of intoxication and environment contamination.

Tool No.	Description	Image
N/A	Torque wrench	 TORQUEWRENCH 17
380000158	Torque screwdriver	 TORQUESCREWDRIV 18
380000304	Tool for angle tightening	 ANGLETIGHTENING 19
380000988	Flywheel rotation tool	 ROTATOR 20

SERVICE MANUAL

Engine

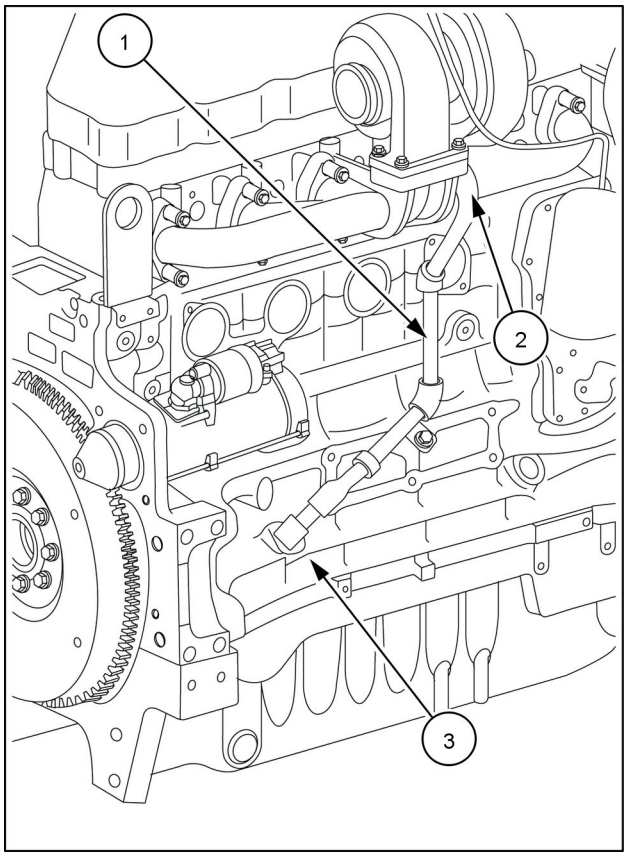
F4CE9484 , F4CE9487A , F4CE9487N , F4CE9684 , F4DE9484 , F4DE9684B*J111 , F4DE9684M*J101 , F4DE9684M*J103 , F4DE9684 , F4DE9687 , F4GE9484C*J601 , F4GE9484 , F4GE9684 , F4HE0484G*J102 , F4HE0484G*J109 , F4HE9484C*J102 , F4HE9484C*J103 , F4HE9484 , F4HE9684 , F4HE9687G*J100 , F4HE9687

Clearance Data	
Thrust Bearing	**37.28 - 37.38 mm** (**1.468 - 1.472 in**)
Crankshaft End Play	**0.095 - 0.265 mm** (**0.004 - 0.010 in**)
Cylinder Head and Components	
Valve Guide Bore	**7.042 - 7.062 mm** (**0.277 - 0.278 in**)
Intake Valves	
Stem diameter	**6.970 - 6.990 mm** (**0.274 - 0.275 in**)
Face angle	**59.75 - 60.25 °**
Exhaust Valves	
Stem diameter	**6.970 - 6.990 mm** (**0.274 - 0.275 in**)
Face angle	**44.75 - 44.25 °**
Valve Stem and Guide Clearance	**0.052 - 0.092 mm** (**0.002 - 0.004 in**)
Valve Seat Bore	
Intake	**34.837 - 34.863 mm** (**1.372 - 1.373 in**)
Exhaust	**34.837 - 34.863 mm** (**1.372 - 1.373 in**)
Valve seat Outside Diameter:	
Intake	**34.917 - 34.931 mm** (**1.375 - 1.375 in**)
Exhaust	**34.917 - 34.931 mm** (**1.375 - 1.375 in**)
Valve Seat Angle	
Intake	**60 °**
Exhaust	**45 °**
Valve Sink	
Intake	**0.59 - 1.11 mm** (**0.023 - 0.044 in**)
Exhaust	**0.96 - 1.48 mm** (**0.038 - 0.058 in**)
Interference Between Valve Seat and Cylinder Head	
Intake	**0.054 - 0.094 mm** (**0.002 - 0.004 in**)
Exhaust	**0.054 - 0.094 mm** (**0.002 - 0.004 in**)
Valve Spring Height	
Free	**47.75 mm** (**1.880 in**)
Under a load equal to: **330.8 - 348.8 N** (**74.4 - 78.4 lb**)	**35.33 mm** (**1.391 in**)
Under a load equal to: **702 - 780 N** (**157.8 - 175.4 lb**)	**25.2 mm** (**0.992 in**)
Camshaft Bore	
No.1 (flywheel side)	**59.222 - 59.248 mm** (**2.332 - 2.333 in**)
No. 2,3,4,5 / 2,3,4,5,6,7	**54.089 - 54.139 mm** (**2.129 - 2.131 in**)
Camshaft Journals	
1-5 / 1-7	**53.995 - 54.045 mm** (**2.126 - 2.128 in**)
Bushing inside diameter	**54.083 - 54.147 mm** (**2.129 - 2.132 in**)
Bushing and Journal Clearance	**0.038 - 0.162 mm** (**0.001 - 0.006 in**)
Cam Lift	
Intake	**7.582 mm** (**0.299 in**)
Exhaust	**6.045 mm** (**0.238 in**)
Tappet Bore	**16.000 - 16.030 mm** (**0.630 - 0.631 in**)
Tappet outside diameter	
Top	**15.924 - 15.954 mm** (**0.627 - 0.628 in**)
Middle	**15.960 - 15.975 mm** (**0.628 - 0.629 in**)
Bottom	**15.924 - 15.954 mm** (**0.627 - 0.628 in**)
Tappets and Bore Clearance	**0.025 - 0.070 mm** (**0.001 - 0.003 in**)
Rocker shaft	**21.965 - 21.977 mm** (**0.865 - 0.865 in**)
Rockers	**22.001 - 22.027 mm** (**0.866 - 0.867 in**)
Rockers and Shaft Clearance	**0.024 - 0.162 mm** (**0.001 - 0.006 in**)
(*) Valid for engines: F4HE9684P, F4HE9684A, F4HE9687P, F4HE9687A	

Engine Type	4 cylinder	6 cylinder
Compression ratio	17.5 : 1	
Bore	**104 mm** (**4.1 in**)	
Stroke	**132 mm** (**5.2 in**)	
Displacement	**4485 cm³**	**6728 cm³**
Turbocharger type	Intercooled Holset HX25W	Intercooled Holset HX35W
Lubrication		
Oil Pressure (warm engine)		
Idling	**0.8 bar** (**11.6 psi**)	
Peak RPM	**3.5 bar** (**50.8 psi**)	
Cooling		
Water Pump	Belt Driven	
Thermostat opening temperature	**79 - 83 °C** (**174.2 - 181.4 °F**)	
Capacity		
Oil Pan	-	**16 l** (**16.9 US qt**)
Oil Filter	-	**1 l** (**1.1 US qt**)

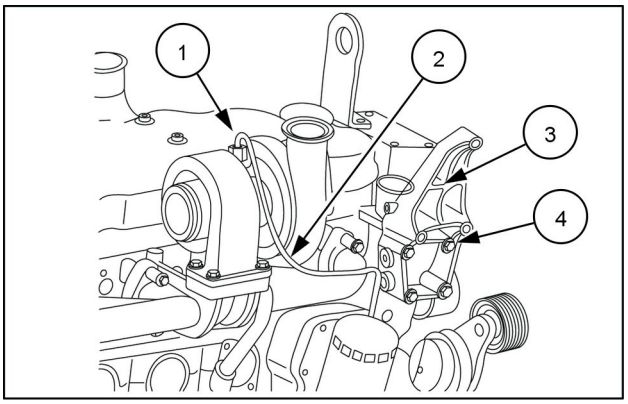
Clearance Data	
Cylinder Block and Crankshaft Components	
Cylinder Barrels	**104.000 - 104.024 mm** (**4.094 - 4.095 in**)
Oversize	**0.4 mm** (**0.016 in**)
Pistons	**103.714 - 103.732 mm** (**4.083 - 4.084 in**) / **103.759 - 103.777 mm** (**4.085 - 4.086 in**) **(*)**
Skirt Height	**55.9 mm** (**2.201 in**) / **49.5 mm** (**1.949 in**) **(*)**
Pin housing	**38.010 - 38.016 mm** (**1.496 - 1.497 in**)
Piston (oversize)	**0.4 mm** (**0.016 in**)
Protrusion	**0.28 - 0.52 mm** (**0.011 - 0.020 in**)
Pin	**37.994 - 38.000 mm** (**1.496 - 1.496 in**)
Piston Pin - Pin Housing	**0.01 - 0.022 mm** (**0.0004 - 0.001 in**)
Piston ring landings	
Combustion	**2.705 - 2.735 mm** (**0.106 - 0.108 in**)
Intermediate	**2.440 - 2.460 mm** (**0.096 - 0.097 in**) / **2.420 - 2.440 mm** (**0.095 - 0.096 in**) **(*)**
Oil Control	**4.030 - 4.050 mm** (**0.159 - 0.159 in**)
Piston Rings	
Combustion	**2.560 - 2.605 mm** (**0.101 - 0.103 in**)
Intermediate	**2.350 - 2.380 mm** (**0.093 - 0.094 in**)
Oil Control	**3.970 - 3.990 mm** (**0.156 - 0.157 in**)
Piston Ring and Ring Landing Clearance	
Combustion	**0.100 - 0.175 mm** (**0.004 - 0.007 in**)
Intermediate	**0.060 - 0.110 mm** (**0.002 - 0.004 in**) / **0.040 - 0.090 mm** (**0.002 - 0.004 in**) **(*)**
Oil Control	**0.040 - 0.080 mm** (**0.002 - 0.003 in**)
Piston Ring End Gap	
Combustion	**0.30 - 0.40 mm** (**0.012 - 0.016 in**)
Intermediate	**0.60 - 0.80 mm** (**0.024 - 0.031 in**)
Oil Control	**0.30 - 0.55 mm** (**0.012 - 0.022 in**)
Connecting Rod	
Small end housing	**40.987 - 41.013 mm** (**1.614 - 1.615 in**)
Big end housing	**72.987 - 73.013 mm** (**2.874 - 2.875 in**)
Small end bushing Inside Diameter	**38.019 - 38.033 mm** (**1.497 - 1.497 in**)
Big end bearing shell thickness	**1.955 - 1.968 mm** (**0.077 - 0.077 in**)
Piston Pin and Bushing Clearance	**0.019 - 0.039 mm** (**0.001 - 0.002 in**)

10. Remove the oil return line **(1)** from the turbocharger outlet **(2)** and at the return fitting at the engine block **(3)**.



NHIL13ENG0301BA 3

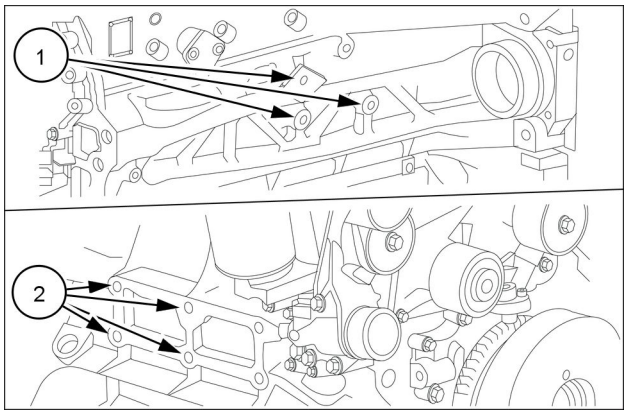
11. Remove the turbocharger oil feed line **(2)** from the turbocharger **(1)** inlet.
12. Remove the retaining bolts **(4)** and remove the support **(3)**.
13. Remove the thermostat body including the seal.



NHIL13ENG0302AA 4

14. In order to hoist the engine onto a rotary engine stand, use the provided holes **(1)** and **(2)** on both sides of the engine block to install brackets **380000661**.
15. Drain the engine oil by removing the drain plug from the bottom of the engine oil pan.

NOTE: *Collect and dispose of the engine oil according to enforced regulations.*



NHIL13ENG0303FA 5

Engine - Service instruction Maintenance Procedures

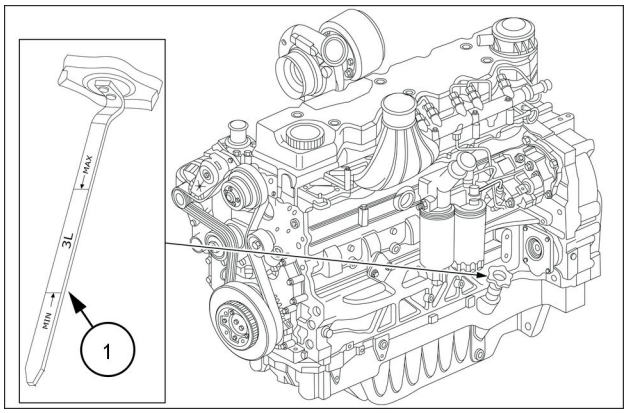
F4DE9484, F4DE9684, F4DE9687, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

CHECKS AND INSPECTIONS

Engine oil level check

The check can be made using the engine oil dipstick **(1)** located on the right hand side of the EDC.

NOTICE: *The check must be executed when the engine is off and possibly cool.*
Remove the dipstick from the tube and check that the level is within the etched markings of minimum and maximum level.
If it is difficult to make the evaluation, clean the dipstick using a clean cloth with no contamination and put it back in it's tube Remove it again and check the level.
In case the level results are close to the marking indicating minimum level, add the correct engine oil through the upper engine oil cap or lateral cap of the engine.

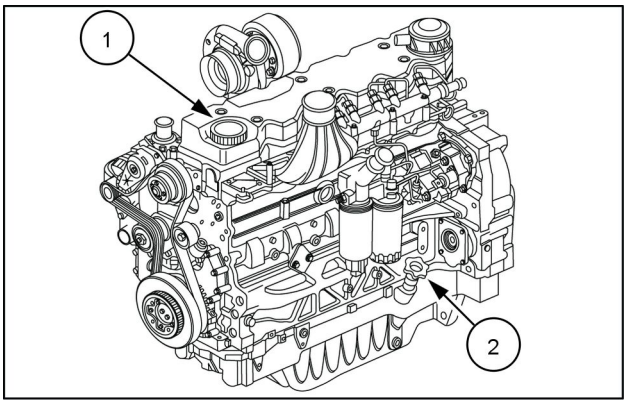


NHIL13ENG0314FA 1

⚠ WARNING

Chemical hazard!
When handling fuel, lubricants, and other service chemicals, follow the manufacturer's instructions. Wear Personal Protective Equipment (PPE) as instructed. Do not smoke or use open flame. Collect fluids in proper containers. Obey all local and environmental regulations when disposing of chemicals.
Failure to comply could result in death or serious injury.

W0371A



NHIL13ENG0265AA 2

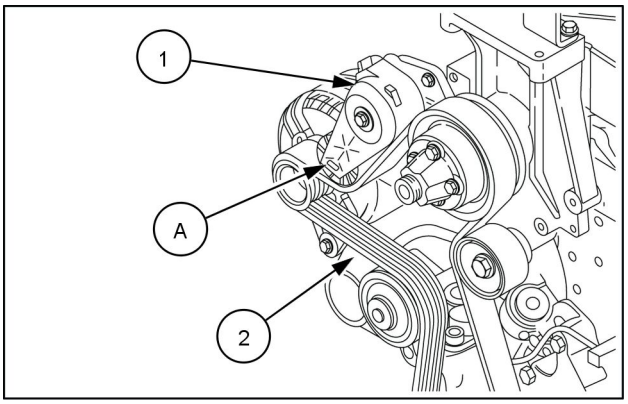
Add oil through the upper engine oil cap **(1)** or through the lateral oil cap **(2)**. During filling operation, the engine oil caps must be removed as well as the engine oil dipstick in order to make the oil flow easier.

Alternator belt replacement

⚠ WARNING

Rotating parts!
The engine is running. Keep clear of rotating fans and belts.
Failure to comply could result in death or serious injury.

W0275A



NHIL13ENG0271AA 4

Due to several applications the belt run can change very much.
For applications with automatic belt tensioner, the procedure is the following:
By means of square wrench of proper of proper size, act on point **(A)**, indicated in the figure, of the automatic belt tensioner **(1)** and release the pressure.
Remove the control belt **(2)** from the driven and intermediate pulleys.
Replace the worn belt with a new one.
Place the belt on the pulleys and guide rollers.
Place the automatic tightener in order to key the belt in the functioning position.
Check proper position in the races of the pulleys.

Engine - 10

Pan and covers - 102

F4CE9484 , F4CE9487A , F4CE9487N , F4CE9684 , F4DE9484 , F4DE9684B*J111 , F4DE9684M*J101 , F4DE9684M*J103 , F4DE9684 , F4DE9687 , F4GE9484C*J601 , F4GE9484 , F4GE9684 , F4HE0484G*J102 , F4HE0484G*J109 , F4HE9484C*J102 , F4HE9484C*J103 , F4HE9484 , F4HE9684 , F4HE9687G*J100 , F4HE9687

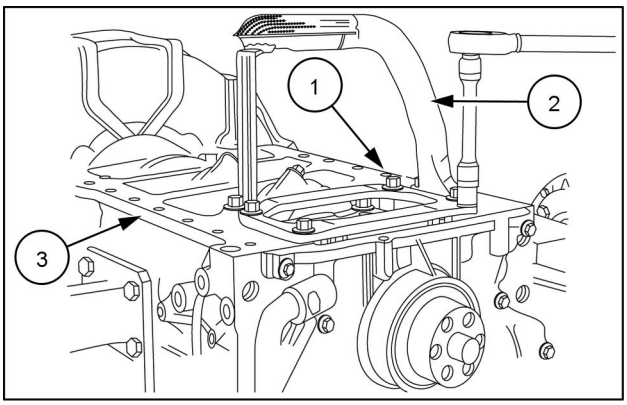
Engine oil pan - Install

F4GE9484, F4GE9484C*J601, F4GE9684

Prior operation:
Engine oil pan - Remove (10.102)

Oil pick up tube A

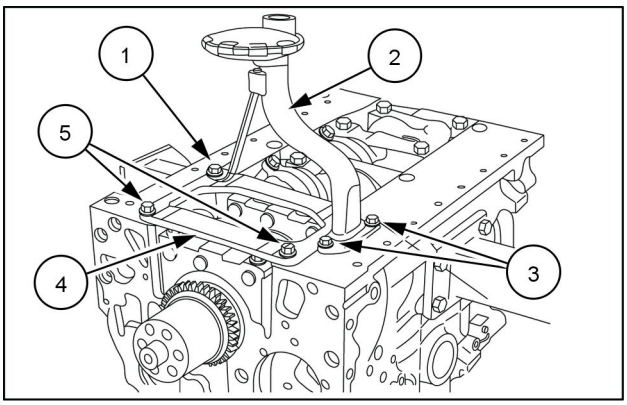
1. Install the stiffening plate **(3)** and the oil pick up tube **(2)**.
2. Torque bolts **(1)** to **20 - 28 N·m** (**15 - 21 lb ft**).



NHIL13ENG0284AA 1

Oil pick up tube B

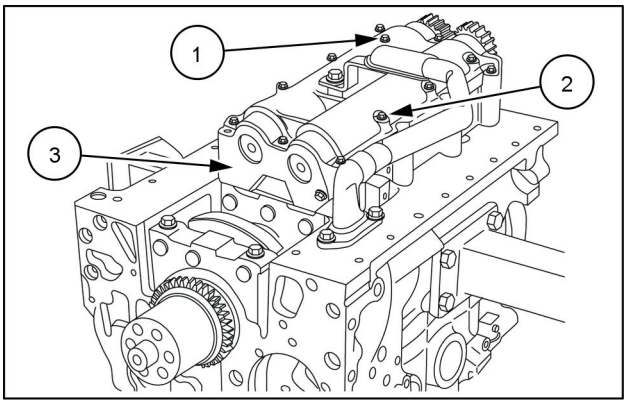
1. Install the stiffening plate **(4)**.
2. Install the oil pick up tube **(2)**.
3. Torque the bolts **(1)**, **(3)**, and **(5)** to **20 - 28 N·m** (**15 - 21 lb ft**).



NHIL13ENG0276AA 2

Version with dynamic balancer

1. Install the dynamic balancer **(3)** on the engine block.
2. Torque the bolts **(2)** to **20 - 28 N·m** (**15 - 21 lb ft**).
3. Remove the lock pin **(1)**.
4. Refer to **Balancer - Install (10.110)** for proper timing procedures.



NHIL13ENG0279AA 3

Engine block cover Rear - Cleaning

F4CE9484, F4CE9487N, F4CE9487A, F4DE9484, F4CE9684, F4DE9684, F4DE9687, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

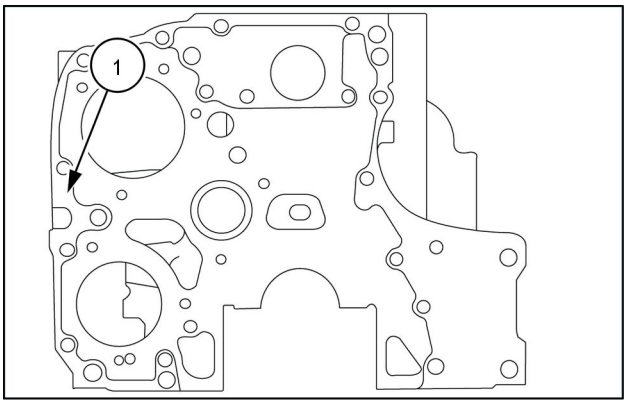
Prior operation:
Engine block cover Rear - Remove (10.102)

1. Clean the rear cover and it's mating surface on the timing gear cover.

NOTE: *A perfect seal is only obtained by completely cleaning the surface to seal. Any imperfection should be corrected as soon as possible. Avoid using excess sealant. Excessive sealant could squeeze out the sides and cause blockage of lubrication passages.*

2. Apply a thin bead of **LOCTITE® 518 GASKET ELIMINATOR®**, a few millimeters thick, to the sealing surface **(1)** of the cover.

NOTE: *After applying the sealant, the cover should be assembled within 10 to 20 minutes.*



NHIL13ENG0327AA 1

Next operation:
Engine block cover Rear - Install (10.102)

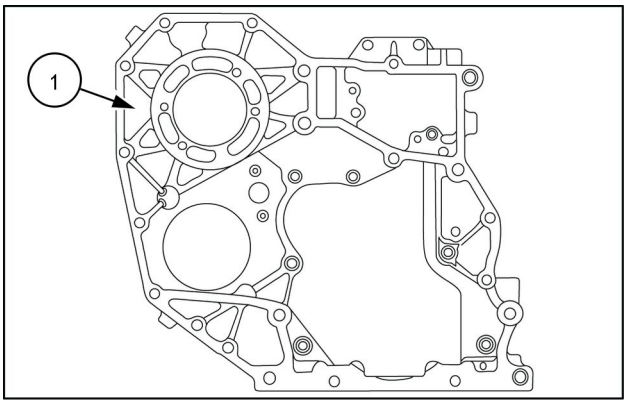
Timing gear housing - Install

F4CE9484, F4CE9487N, F4CE9487A, F4DE9484, F4CE9684, F4DE9684, F4DE9687, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

Prior operation:
Timing gear housing - Cleaning (10.102)

NOTE: *Before any assembly operation, be sure that the hole and bolt threads have no wear or dirt.*

1. Install the housing **(1)** onto the engine block.
2. Install the retaining bolts in the same position found upon removal and torque the bolts to **20 - 28 N·m** (**15 - 21 lb ft**).

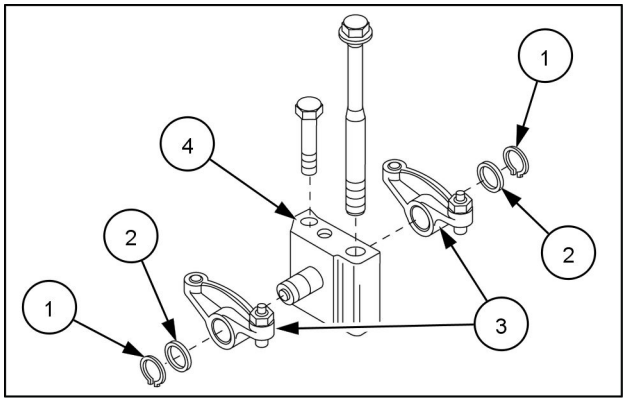


NHIL13ENG0336AA 1

Rocker arm - Check

F4CE9484, F4GE9484, F4CE9487N, F4CE9487A, F4GE9484C*J601, F4CE9684, F4GE9684

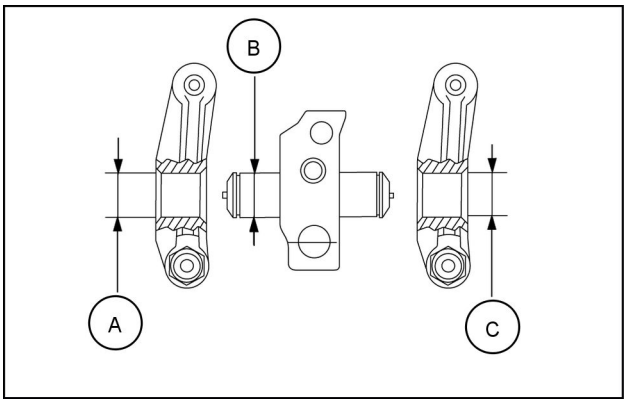
Prior operation:
Rocker arm - Remove (10.106)



NHIL13ENG0344AA 1

(1) Elastic ring - (2) Spacer - (3) Rocker arms - (4) Support.

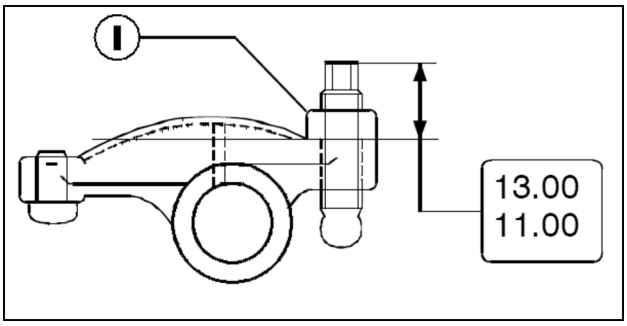
1. Carry out the assembly of the rocker arms after checking the components.



NHIL13ENG0345AA 2

A	B	C
19.000 - 19.026 mm (**0.748 - 0.749 in**)	**18.975 - 18.963 mm** (**0.747 - 0.747 in**)	**19.000 - 19.026 mm** (**0.748 - 0.749 in**)

2. Check the coupling surfaces of the bearings and shaft for excessive wear or damages. Replace if necessary.
3. Torque the threaded nut **(1)** to **4 - 6 N·m** (**35 - 53 lb in**).



ROCKERCOMPCG3 3

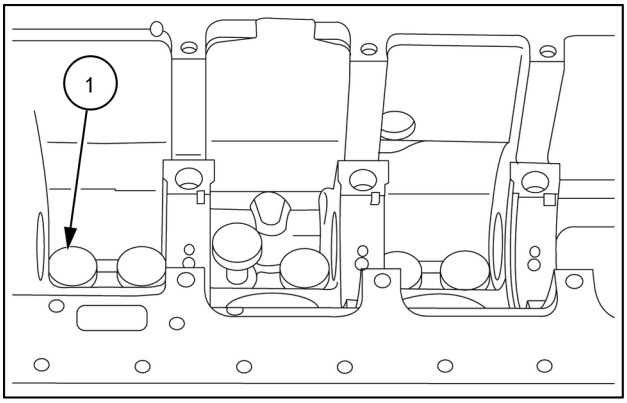
Next operation:
Rocker arm - Install (10.106)

Camshaft Tappets - Remove

F4CE9484, F4GE9484, F4CE9487N, F4CE9487A, F4GE9484C*J601, F4HE0484G*J109, F4HE0484G*J102, F4HE9484C*J102, F4HE9484C*J103, F4CE9684, F4GE9684, F4HE9687, F4HE9687G*J100, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

Prior operation:
Camshaft - Remove (10.106)

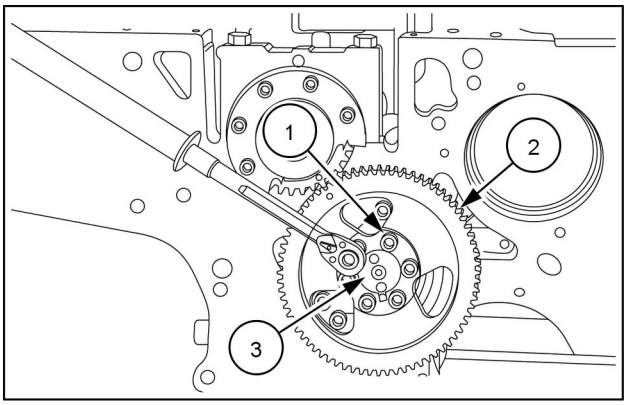
1. Remove the tappets **(1)** from the engine block.



NHIL13ENG0359AA 1

Next operation:
Camshaft Tappets - Measure (10.106)

5. Torque the bolts **(1)** that secure the gear **(2)** to camshaft **(3)** to **32 - 40 N·m** (**24 - 30 lb ft**).



NHIL13ENG0372AA 4

Next operation:
Engine block cover Rear - Cleaning (10.102)

Valves

Valve guide

Valve seat

Cylinder head - Check

F4DE9484, F4HE9484, F4HE0484G*J109, F4HE0484G*J102, F4HE9484C*J102, F4HE9484C*J103, F4DE9684, F4DE9687, F4HE9684, F4HE9687, F4HE9687G*J100, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

Prior operation:
Cylinder head - Remove (10.101)

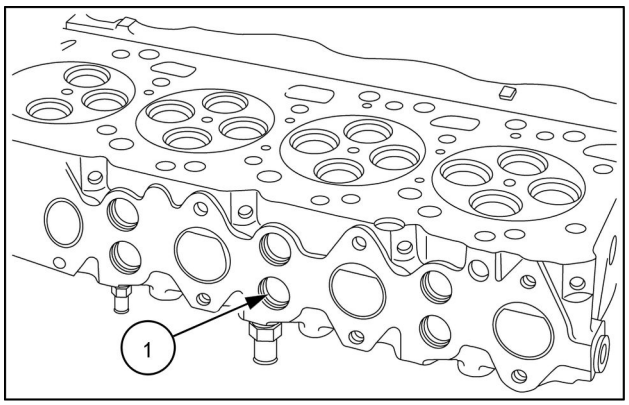
Checking cylinder head wet seal

This check should be performed using the proper tools.

1. Use a pump to fill with water heated to approximately **90 °C** (**194.0 °F**) and **2 - 3 bar** (**29.0 - 43.5 psi**) of pressure.
2. Replace the core plugs **(1)** if any leakage is found. Use the proper punch for their removal and installation.

NOTE: *Before refitting, smear the plug surfaces with water repellent sealant.*

3. Replace the cylinder head if leaks are found.

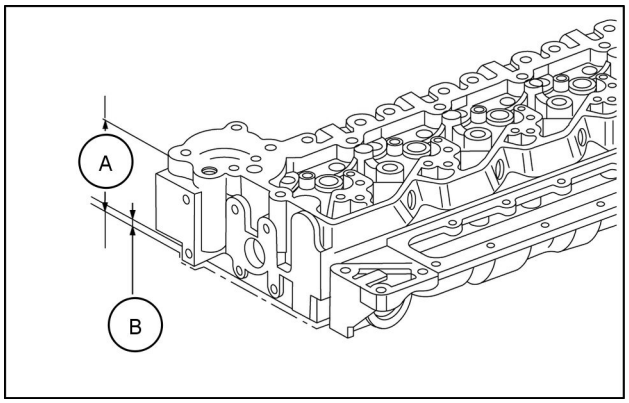


NHIL13ENG0395AA 1

Checking cylinder head supporting surface

1. Distortion found along the whole cylinder head should not exceed **0.20 mm** (**0.008 in**).
   If higher values are found, resurface the cylinder head according to values and indications shown in the following figure.
2. The rated thickness **(A)** for the cylinder head is **104.75 - 105.25 mm** (**4.124 - 4.144 in**). Maximum metal removal shall not exceed thickness **(B)** by **1 mm** (**0.039 in**).

NOTE: *After resurfacing, check valve sinking. Regrind the valve seats, if required, to obtain the specified value.*



NHIL13ENG0396AA 2

A	B
104.750 - 105.250 mm (**4.124 - 4.144 in**)	**1 mm**

Next operation:
Cylinder head - Install (10.101)

Cylinder head - Check

F4GE9484, F4GE9484C*J601, F4GE9684

Prior operation:
Cylinder head - Remove (10.101)

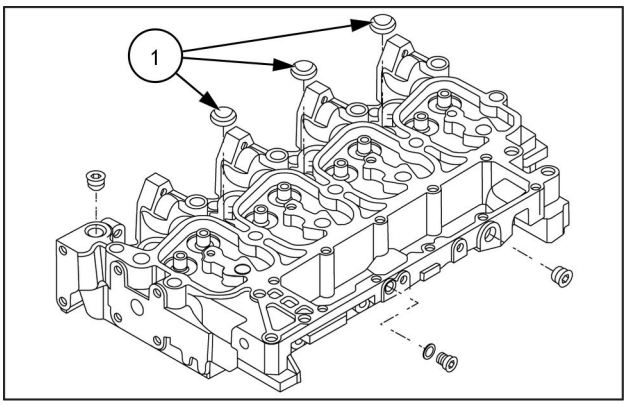
Checking cylinder head wet seal

This check should be performed using the proper tools.

1. Use a pump to fill with water heated to approximately **90 °C** (**194.0 °F**)and **2 - 3 bar** (**29.0 - 43.5 psi**) of pressure.
2. Replace the core plugs **(1)** if any leakage is found. Use the proper punch for their removal and installation.

NOTE: *Before refitting, smear the plug surfaces with water repellent sealant.*

3. Replace the cylinder head if leaks are found.

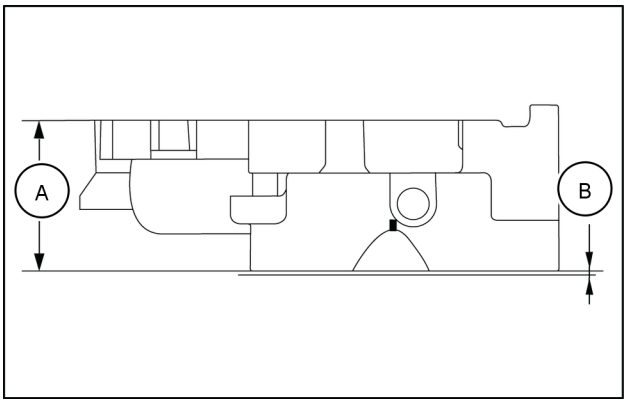


NHIL13ENG0416AA 1

Checking cylinder head supporting surface

4. Distortion found along the whole cylinder head should not exceed **0.20 mm** (**0.008 in**).
   If higher values are found, resurface the cylinder head according to values and indications shown in the following figure.
5. The rated thickness **(A)** for the cylinder head is **104.75 - 105.25 mm** (**4.124 - 4.144 in**). Maximum metal removal should not exceed thickness **(B)** by **1 mm** (**0.039 in**).

NOTE: *After resurfacing, check valve sinking. Regrind the valve seats, if required, to obtain the specified value.*



NHIL13ENG0419AA 2

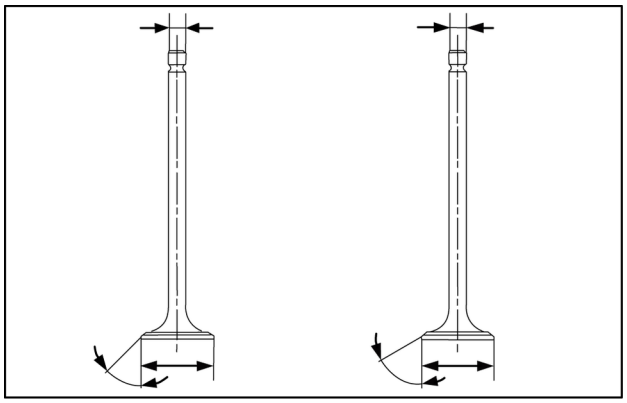
A	B
104.750 - 105.250 mm (**4.124 - 4.144 in**)	**1 mm**

Next operation:
Cylinder head - Install (10.101)

Valves - Measure

F4CE9484, F4GE9484, F4CE9487N, F4CE9487A, F4GE9484C*J601, F4CE9684, F4GE9684

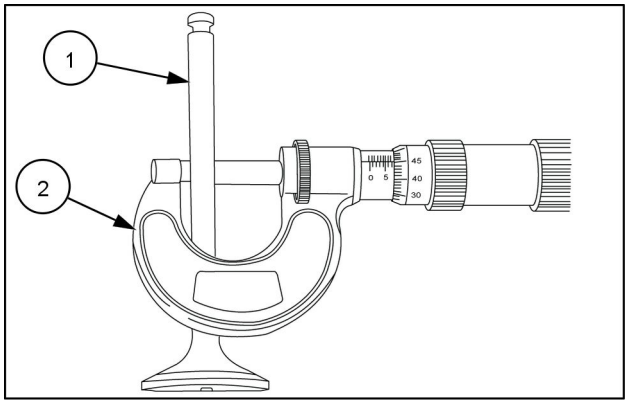
Prior operation:
Valves - Cleaning (10.101)



NHIL13ENG0437AA 1

INTAKE AND EXHAUST VALVE MAIN DATA

1. Check the valve stem **(1)** using a micrometer **(2)**. The valve stem diameter for intake and exhaust valves should be between **7.960 - 7.980 mm** (**0.313 - 0.314 in**).



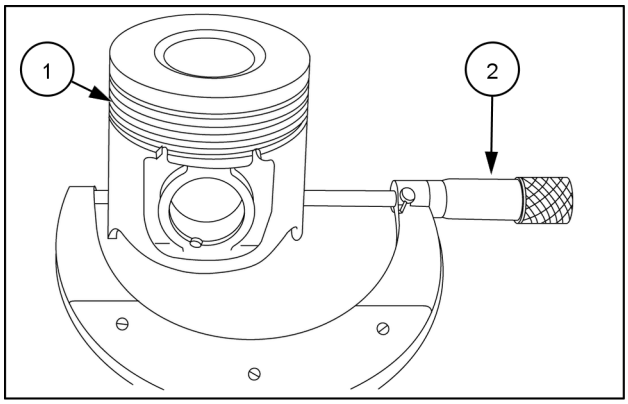
NHIL13ENG0438AA 2

Next operation:
Valves - Cleaning (10.101)

Piston - Measure

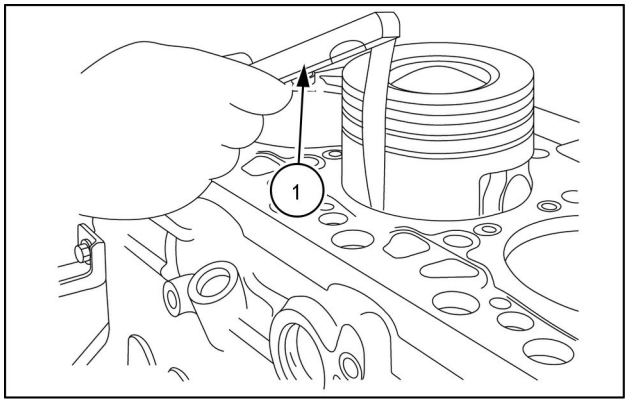
Prior operation:
Piston - Remove (10.105)

1. Using a micrometer **(2)**, measure the diameter of the piston **(1)** to determine the assembly clearance. The value should be between the following specifications:
   103.714 - 103.732 mm (**4.083 - 4.084 in**)
   103.759 - 103.777 mm (**4.085 - 4.086 in**)(*)
   (*) Valid for engines: F4HE9684P, F4HE9684A, F4HE9687P, F4HE9687A



NHIL13ENG0463AA 1

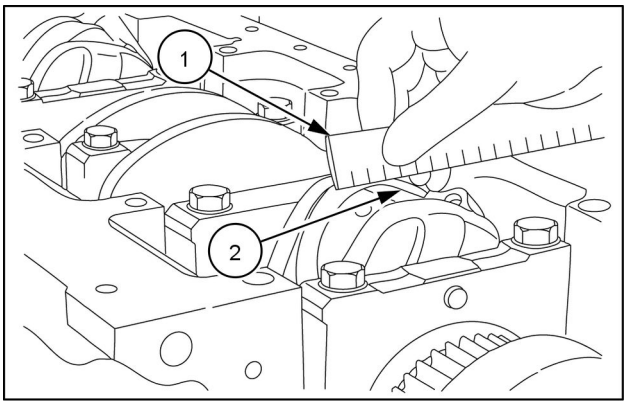
2. The clearance between the piston and the cylinder bore can be checked also with a feeler gauge **(1)** as shown in the figure.



NHIL13ENG0464AA 2

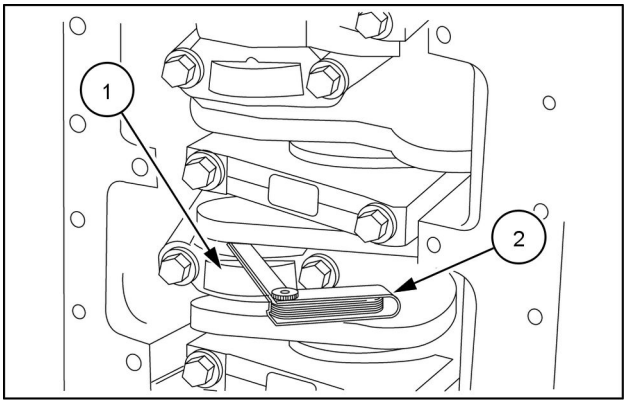
Next operation:
Connecting rod and piston - Assemble (10.105)

6. Remove the connecting rod cap and find the existing clearance by comparing the calibrated wire width **(2)** with the scale on the provided wire envelope **(1)**.
7. If a different clearance value is found, replace the connecting rod half bearings and repeat the check.
8. Once the specified clearance has been obtained, lubricate the connecting rod half bearings with engine oil and install them onto the connecting rod. Torque the bolts to **55 - 65 N·m** (**41 - 48 lb ft**). Attach the angular torque gauge **380001001** to the torque wrench and turn the bolts **60 °**.



NHIL13ENG0479AA 4

9. Check manually that the connecting rods **(1)** are sliding axially on the crank pins. Using a feeler gauge **(2)**, make sure that the connecting rod end float is between **0.10 - 0.33 mm** (**0.004 - 0.013 in**).



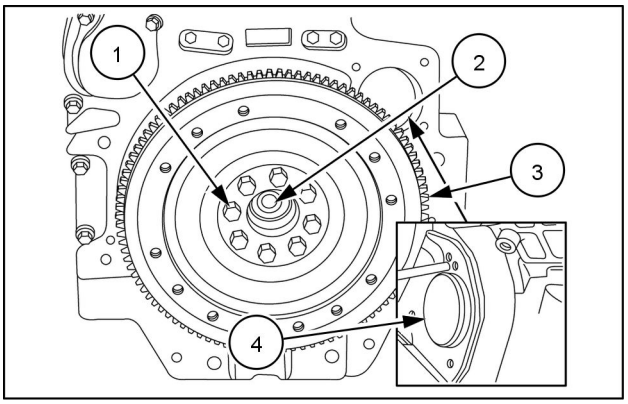
NHIL13ENG0480AA 5

Next operation:
Piston - Check (10.105)

Engine flywheel - Remove

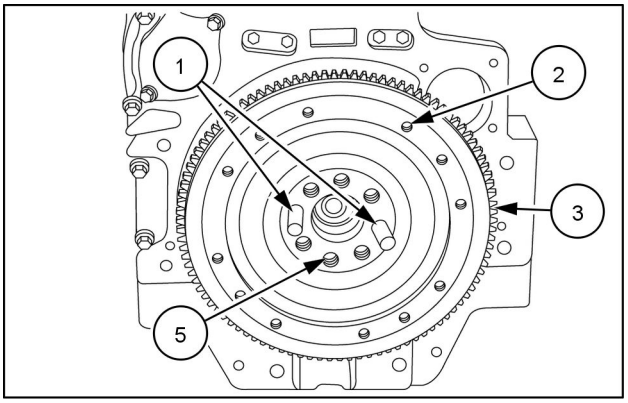
F4DE9484, F4DE9684, F4DE9687, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

1. Install the flywheel locking tool **380000988 (4)** into the flywheel housing to keep the flywheel **(3)** from rotating.
2. Remove two opposing flywheel bolts **(1)** and install two guide pins in place of the bolts.
3. Remove the remaining flywheel retaining bolts from the crankshaft **(2)** and remove the flywheel locking tool **(4)**.



NHIL13ENG0487AB 1

4. Install two bolts of medium length into flywheel holes **(2)** to sling the flywheel with a suitable hoist.
5. Using the two guide pins **(1)** previously installed into the flywheel mounting holes, **(5)** remove the engine flywheel **(3)** after slinging it with the hoist.



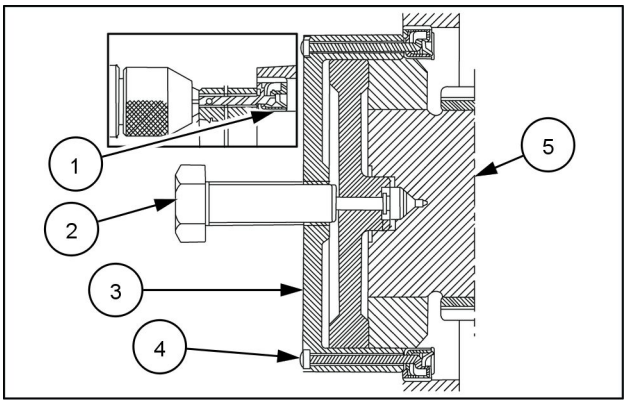
NHIL13ENG0488AA 2

Next operation:
Engine flywheel - Check (10.103)

Crankshaft oil seal Rear seal - Remove

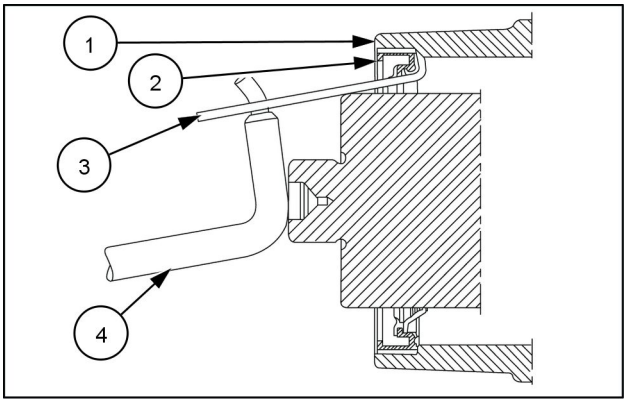
Prior operation:
Engine flywheel - Remove (10.103)

1. Remove the holding ring of the flywheel cover box using the tool **(3)** to operate on the driving shaft's back bar hold **(5)**.
2. Through the steering holes of the tool, perforate the inside holding ring with a straight way drill bit with a diameter of **3.5 mm** (**0.138 in**) for the depth of **5 mm** (**0.197 in**).
3. Install the tool **(3)** to the ring and tighten the six bolts **(4)** provided with the equipment.
4. Then proceed removing the ring **(1)** by tightening the bolt **(2)**.



NHIL13ENG0529AA 1

5. Using a specific tie rod **(3)** of the tool **380000669** and an ancillary lever **(4)**, remove the external holding ring **(2)** from the rear cover **(1)**.



NHIL13ENG0530AA 2

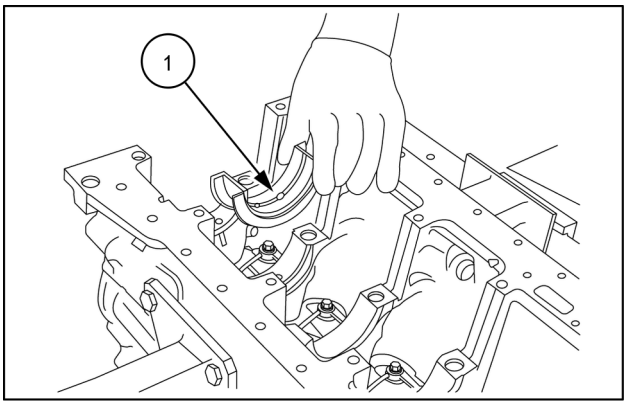
Next operation:
Engine flywheel - Remove (10.103)

Main bearings - Install

Prior operation:
Main bearings - Remove (10.103)

NOTE: *Reinstall the main bearings that have not been replaced, in the same position found at removal.*

Main bearings **(1)** are supplied spare with **0.250 - 0.500 mm** (**0.010 - 0.020 in**) undersize on the internal diameter.
Thoroughly clean the main bearings **(1)**, lubricate them with clean engine oil and install them into their housings.
The second last main half bearing **(1)** is fitted with shoulder half rings.



NHIL13ENG0546AA 1

NOTICE: *Do not try to adapt the bearings.*

NOTE: *Do not lubricate the connecting rod side housing side of the bearing. Only lubricate the internal side of the bearing which rides along the crankshaft pins.*

Next operation:
Engine oil pan - Install (10.102)

Index

Engine - 10

Balancer and damper - 110

Index

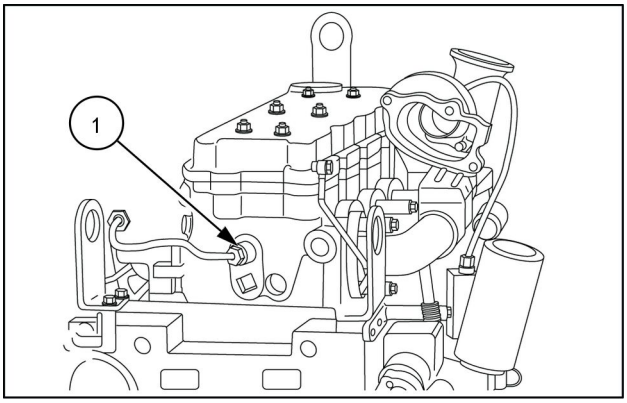
Engine - 10

Pump drives - 114

Fuel supply lines Low pressure - Disconnect

F4DE9484, F4HE9484, F4HE0484G*J109, F4HE0484G*J102, F4HE9484C*J102, F4HE9484C*J103, F4DE9684, F4DE9687, F4HE9684, F4HE9687, F4HE9687G*J100, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

1. Disconnect the fuel return pressure limiter **(1)**. Refer to **Common rail lines - Disconnect (10.218)**.



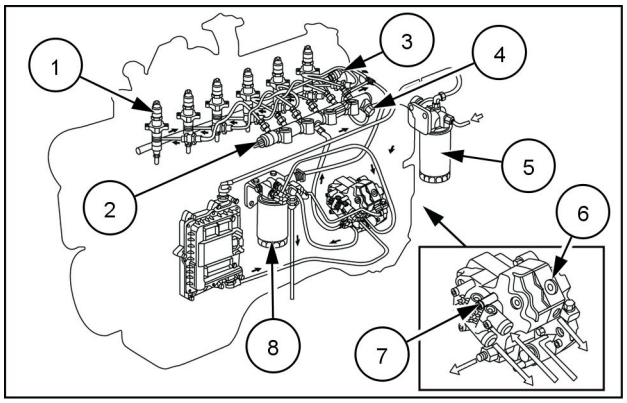
NHIL13ENG0490AA 1

Fuel heater - Overview

The ECU drives the filter heater at a fuel temperature less than or equal to **5 °C** (**41 °F**).

Fuel injection system - Dynamic description

F4HE9484, F4HE0484G*J109, F4HE0484G*J102, F4HE9484C*J102, F4HE9484C*J103, F4HE9684, F4HE9687, F4HE9687G*J100



NHIL13ENG0500AA 1

(1) Electro-injector
(2) Common rail
(3) Pressure limiting device for fuel return
(4) Common rail pressure relief valve
(5) Pre-filter mounted on the frame
(6) High-pressure pump
(7) Mechanical vane pump
(8) Fuel filter

The common rail system has a special pump that continuously keeps fuel at high pressure, independently from stroke and cylinder that has to receive the injection and accumulates fuel in a common duct for all injectors.

Therefore, fuel at the injection pressure computed by the ECU is always available at the injectors inlet.

The hydraulic system is implemented by a low pressure circuit and a high pressure circuit.

The high pressure circuit is composed of the following pipings:

- piping connecting high pressure pump outlet to rail
- pipings supplying injectors from rail

The low pressure circuit is composed of the following pipings:

- fuel suction piping from tank to pre-filter
- pipings supplying the mechanical supply pump through the control unit heat exchanger, manual priming pump and pre-filter
- pipings supplying the high pressure pump through the fuel filter

The fuel draining circuit from the rail, injectors and the high pressure pump cooling circuit complete the system.

High pressure pump - External view

F4DE9484, F4DE9684, F4DE9687, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

Introduction

Extremely high injection pressures are necessary in order to reduce particulate emissions. The common rail system makes it possible to inject fuel at pressures of up to **1450 - 1600 bar** (**21025 - 23200 psi**), while the injection precision obtained by electronic control of the system serves to optimize operation of the engine while limiting emissions and fuel consumption.

For engines more powerful than **152 kW** (**207 Hp**), the CRIN2 injectors have DLLA nozzles that work up to a pressure of **1600 bar** (**23200 psi**), for engines less powerful than **152 kW** (**207 Hp**), DSLA nozzles are fitted which work at pressures up to **1450 bar** (**21025 psi**).

Description of system

The injection system is composed of an electrical part and a hydraulic part.

Electrical system

The electronic control unit monitors engine control parameters by means of the various sensors on the engine.

Air pressure/temperature system

It is a component integrating a temperature sensor and a pressure sensor. Fitted on the intake manifold, it measures the maximum inlet air capacity to calculate precisely the fuel quantity to inject at every cycle. The outlet voltage is proportional to the pressure or temperature obtained by the sensor.

Engine oil temperature and pressure sensor

Same as the air pressure/temperature sensor, it is fitted on the engine oil filter base, in a horizontal position. It measures engine oil temperature and pressure.

Fuel pressure sensor

Assembled on a rail end, it measures the fuel pressure in the rail in order to determine the injection pressure. The injection pressure value is used to control the pressure and to determine the electric injection control length.

Coolant temperature sensor

It is a variable resistance sensor suitable to measure the coolant temperature to provide the control unit with an index of the engine thermal state.

Output shaft sensor

It is an inductive sensor placed on the engine rear left part. It generates signals obtained from magnetic flow lines that are closed through holes obtained on the keyed gear on the camshaft. The signal generated by this sensor is used by the ECU as injection phase signal. Though being equal to the flywheel sensor, it is NOT interchangeable since it has a different outside shape.

System functionality

The ECU self-diagnostic system checks signals coming from sensors by comparing them with threshold data.

FPT Code recognition

The EDC 7 control unit communicates with the Immobilizer control unit (if fitted) to obtain the startup consent.

Fuel injectors - Overview

F4DE9484, F4DE9684, F4DE9687, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

On NEF TIER III engines, BOSCH - CRIN2 electro-injectors with different injection tubes are used working on power developed by the engine.

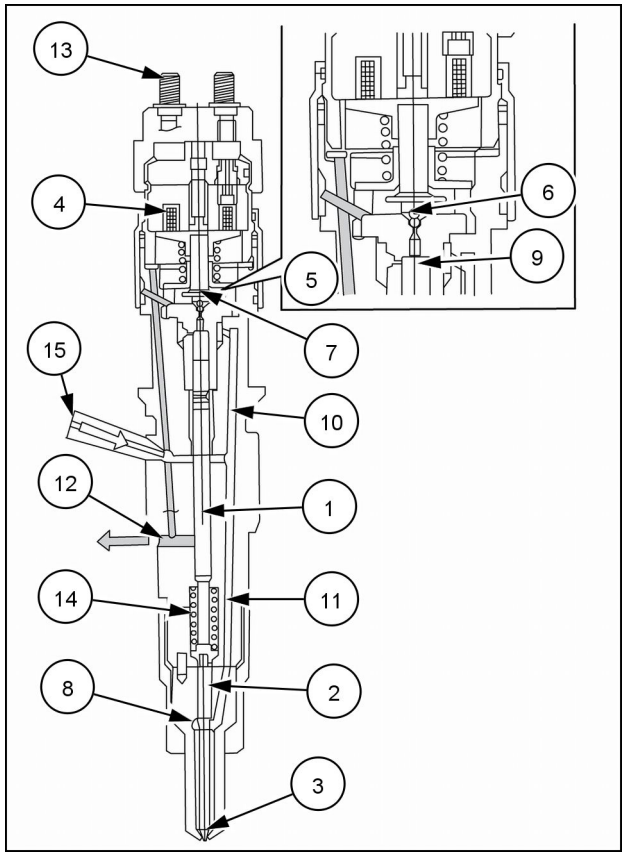
Jet	Power	Pressure
DLLA	Up to **152 kW** (**207 Hp**)	**250 - 1600 bar** (**3625 - 23200 psi**)
DSLA	**152 kW** (**207 Hp**) and above	**250 - 1450 bar** (**3625 - 21025 psi**)

The injector is similar as construction to the traditional ones, apart from the absence of the plunger return springs. The injector is composed of two parts:

- actuator - spray nozzle composed of a pressure rod, plunger, and nozzle.
- control solenoid valve composed of a coil, and pilot valve.

The solenoid valve controls spray nozzle plunger lift.

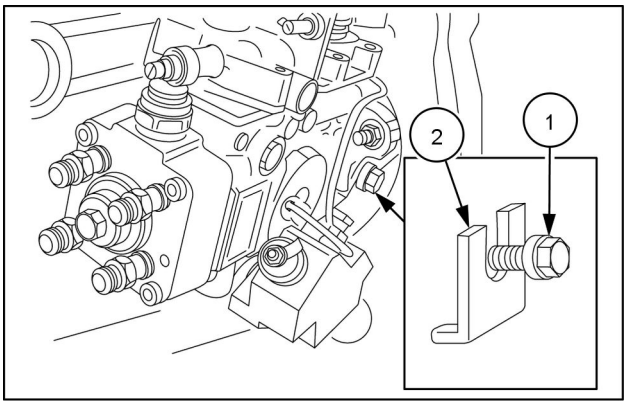
Injector in rest position



93095366 1

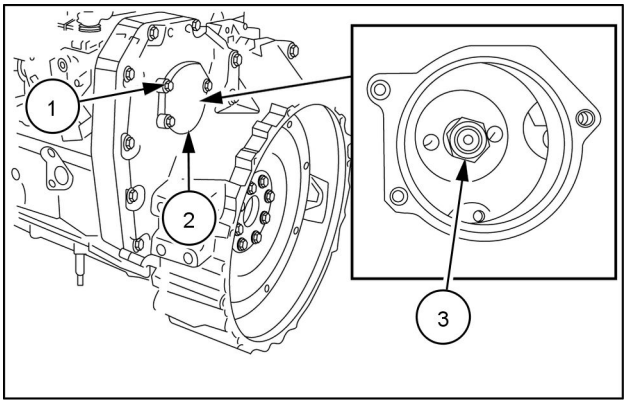
(1) Pressure Rod
(2) Plunger
(3) Nozzle
(4) Coil
(5) Pilot Valve
(6) Ball Shutter
(7) Control Area
(8) Pressure Chamber
(9) Control Volume
(10) Control Duct
(11) Supply Duct
(12) Control Fuel Outlet
(13) Electrical Connection
(14) Spring
(15) High Pressure Fuel Inlet

9. Loosen the side bolt **(1)** that is used to lock the pump shaft and remove the spacer **(2)**. The spacer must be kept. It is recommended to fix it to the pump with a wire or a clip.
10. Tighten the bolt **(1)** blocking rotation of the pump shaft.



NHIL13ENG0569AB 4

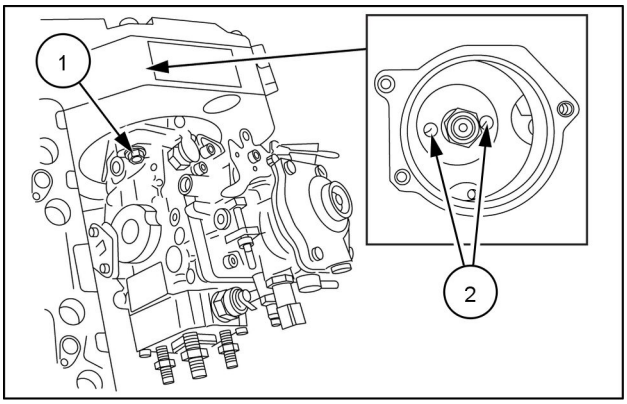
11. Remove the bolts **(1)** that retain the plate **(2)** covering the pump drive gear.
12. Remove the nut **(3)** securing the gear to the pump shaft and remove the relating washer.



NHIL13ENG0570AB 5

13. From the pump side, loosen the nuts **(1)** without removing them in order to move the pump backwards using the injection pump gear extractor.
14. Assemble the extractor throughout the two threaded ports **(2)** and withdraw the gear from the pump shaft.
15. Properly hold the pump and remove the nuts completely.
16. Remove the pump from its mounting studs, together with the gasket.

NOTE: *Hold the pump drive gear to avoid interference or crawling during timing gear rotation.*



NHIL13ENG0571AB 6

ATTENTION: *When the pump is to be installed, the engine must be at TDC of the compression phase on cylinder number one.*

Next operation:
Rotary injection pump - Assemble (10.218)

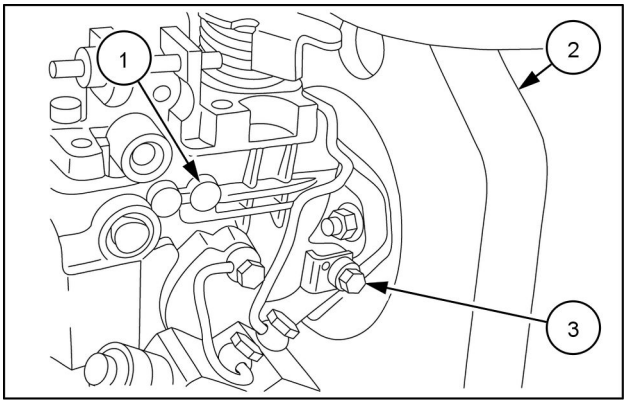
Rotary injection pump - Assemble

F4CE9484, F4CE9487N, F4CE9487A, F4CE9684

Prior operation:
Rotary injection pump - Disassemble (10.218)

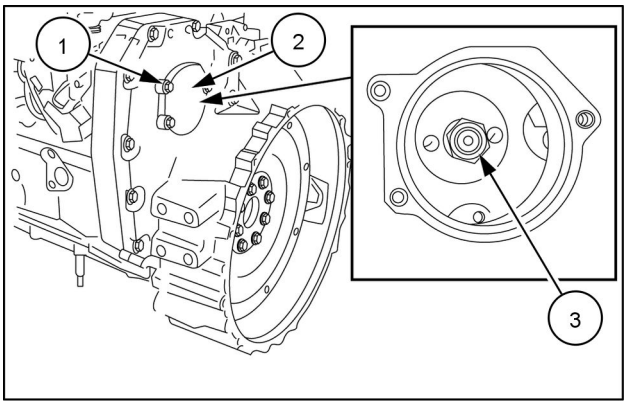
1. When installing the feed pump to the engine, it is necessary to ensure that the number one cylinder is at TDC of the compression stroke.
2. Install the pump unit **(1)**, preset, into the gearbox housing **(2)**.
3. Install the mounting nuts **(3)** and finger tighten them.

NOTE: *The gasket removed during disassembly should not be utilized again. Always use original spare parts.*



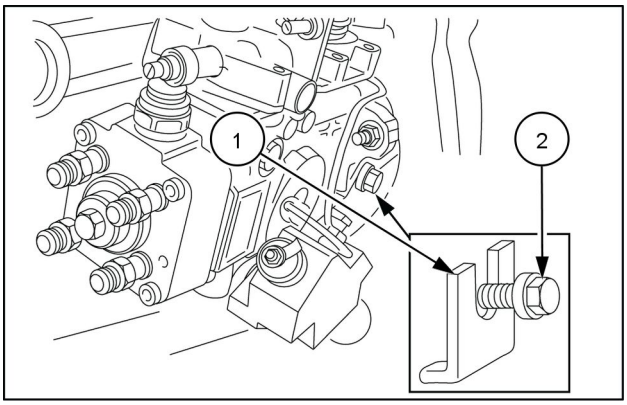
NHIL13ENG0584AA 1

4. On the timing side, install the washer and the retaining nut **(3)** on the pump shaft.
5. Torque the nut **(3)** to **90 - 95 Nm** (**66.4 - 70.1 lb ft**).
6. Install the plate **(2)** with new gasket and torque the bolts **(1)** to . **20 - 28 N·m** (**15 - 21 lb ft**).



NHIL13ENG0585AB 2

7. Loosen the bolt **(2)** that prevents pump shaft rotation and insert spacer **(2)**.
8. Tighten the bolt **(2)** so that it locks the spacer **(2)** in place. By doing this, the pump shaft will be able to rotate freely.
9. Remove the flywheel rotation locking tool **380000988** and install the starter.

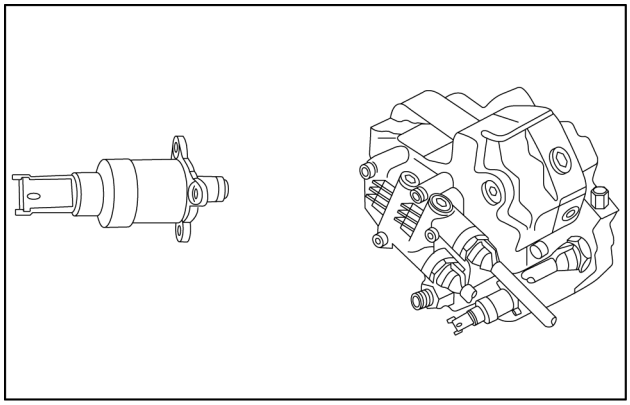


NHIL13ENG0586AB 3

Pressure regulating valve - Test

F4DE9484, F4HE9484, F4HE0484G*J109, F4HE0484G*J102, F4HE9484C*J102, F4HE9484C*J103, F4DE9684, F4DE9687, F4HE9684, F4HE9687, F4HE9687G*J100, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

1. If the high pressure flow regulator has an open circuit (the flow regulator is disconnected, the harness is broken, etc.) or a short circuit (resistance value is much lower than **3.2 Ω**):
   - The pump will be in maximum delivery mode and pressure in the rail will exceed **1700 bar** (**24650.0 psi**) for a very short amount of time.
   - The high pressure relief valve will open.
   - The ECU senses the over pressure condition and stores fault codes in the ECU memory.
   - The engine will derate.



NHIL13ENG0592AA 1

2. Check the resistance (on the ECU connector pins). The resistance specification is approximately **3.2 Ω**.
3. When in parameter mode on the Electronic Service Tool, the duty cycle reading indicates the position of the regulator.
4. If all of the system components have been checked, inspect for the following symptoms:
   The duty cycle tends to fluctuate irregularly and the engine idle speed is irregular.
   The engine stalls when idling and no fault is stored in the ECU.
   Starting is difficult (takes longer than 4 seconds).
5. If any of these symptoms are present, replace the high pressure flow regulator.

Fuel injectors Cross tube - Remove

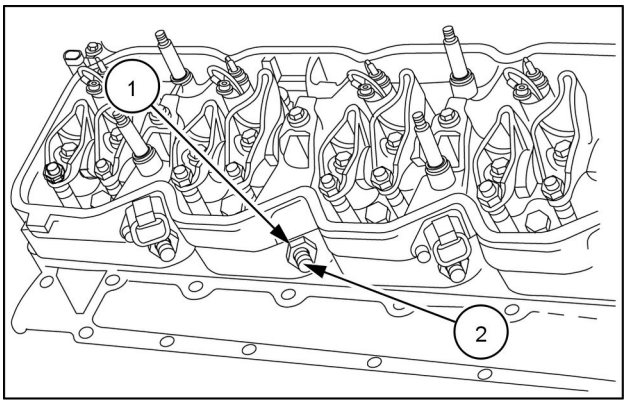
F4DE9484, F4HE9484, F4HE0484G*J109, F4HE0484G*J102, F4HE9484C*J102, F4HE9484C*J103, F4DE9684, F4DE9687, F4HE9684, F4HE9687, F4HE9687G*J100, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

Prior operation:
Injector fuel lines - Disconnect (10.218)

NOTICE: *Make sure the area around the cross tube is clean. Once they are removed, there is a greater risk of contaminating the internal components.*

1. Remove the bolts **(1)** and remove the cross tubes **(2)**.

NOTE: *Disassembled cross tubes must not be used again. Replace them with new ones during reassembly.*



NHIL13ENG0605AA 1

Next operation:
Fuel injectors Cross tube - Install (10.218)

Engine - 10

Turbocharger and lines - 250

F4CE9484 , F4CE9487A , F4CE9487N , F4CE9684 , F4DE9484 , F4DE9684B*J111 , F4DE9684M*J101 , F4DE9684M*J103 , F4DE9684 , F4DE9687 , F4GE9484C*J601 , F4GE9484 , F4GE9684 , F4HE0484G*J102 , F4HE0484G*J109 , F4HE9484C*J102 , F4HE9484C*J103 , F4HE9484 , F4HE9684 , F4HE9687G*J100 , F4HE9687

Engine - 10

Intake and exhaust manifolds and muffler - 254

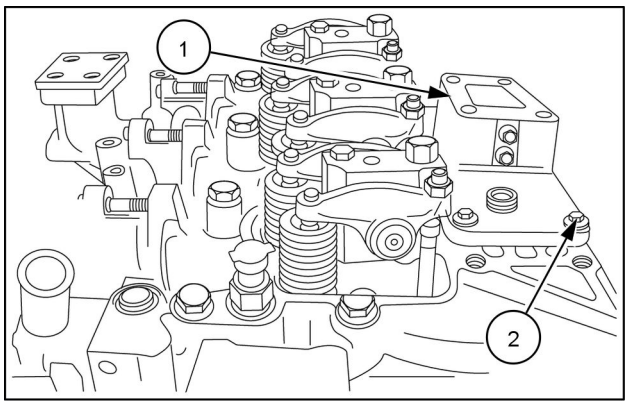
F4CE9484 , F4CE9487A , F4CE9487N , F4CE9684 , F4DE9484 , F4DE9684B*J111 , F4DE9684M*J101 , F4DE9684M*J103 , F4DE9684 , F4DE9687 , F4GE9484C*J601 , F4GE9484 , F4GE9684 , F4HE0484G*J102 , F4HE0484G*J109 , F4HE9484C*J102 , F4HE9484C*J103 , F4HE9484 , F4HE9684 , F4HE9687G*J100 , F4HE9687

Intake manifold - Install

F4CE9484, F4GE9484, F4CE9487N, F4CE9487A, F4GE9484C*J601, F4CE9684, F4GE9684

Prior operation:
Intake manifold - Remove (10.254)

1. Apply a new gasket to the mounting surface of the intake manifold **(1)** plate and torque the bolts **(2)** to **20 - 28 N·m** (**15 - 21 lb ft**).
2. If the duct from the intake manifold has been removed, install new gaskets and apply **LOCTITE® 5999** to the intake air heater mounting surface (if applicable).



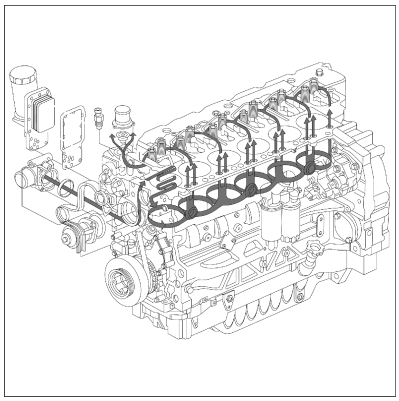
NHIL13ENG0624AA 1

Engine cooling system - Dynamic description

F4DE9484, F4DE9684, F4DE9687, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

The engine cooling system, closed circuit forced circulation type, generally incorporates the following components:

- Expansion Tank - Placement, shape and dimension are subject to change according to the engine's equipment.
- Radiator - Has the duty to dissipate the heat produced by the engine. The heat is conducted to the cooling liquid which is then ran through the radiator. Application determines placement and dimensions.
- Viscous Fan - Increases the heat dissipating power of the radiator by pulling fresh air over the fins of the radiator. Also moves ambient air over the engine itself to increase cooling power. This item is also dependant on application.
- Heat Exchanger - Cools the lubrication oil. Also application specific.
- Centrifugal Water Pump - Used to circulate the cooling liquid. Usually belt driven.
- Thermostat - regulates the circulation of the cooling liquid.
- If applicable, the circuit may be extended to the compressor.



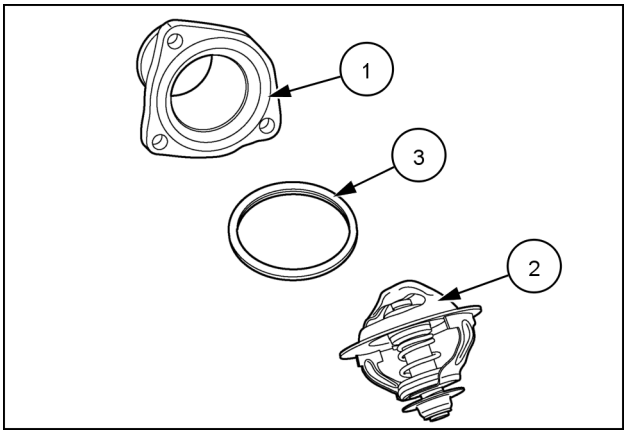
NHIL13ENG0630GA 1

Coolant thermostat - Install

F4DE9484, F4HE9484, F4HE0484G*J109, F4HE0484G*J102, F4HE9484C*J102, F4HE9484C*J103, F4DE9684, F4DE9687, F4HE9684, F4HE9687, F4HE9687G*J100, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

Prior operation:
Coolant thermostat - Remove (10.400)

1. Install the seal **(3)** around the flange of the thermostat **(2)**.
2. Install the thermostat **(2)** into the housing **(1)** and secure the assembly to the cylinder head using the three mounting bolts.

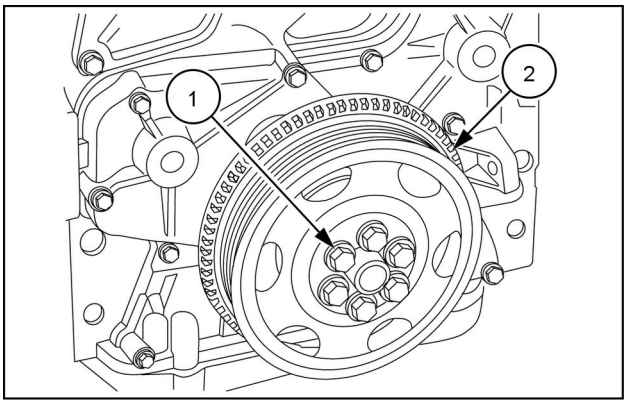


86082981 1

Fan and drive - Remove -Drive Pulley

Prior operation:
Belt - Remove (10.414)

1. Remove the bolts **(1)** and remove the cooling fan pulley **(2)** from the crankshaft.



NHIL13ENG0666AA 1

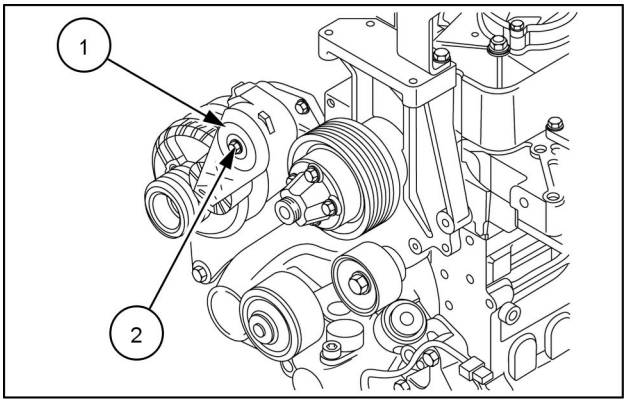
Next operation:
Fan and drive - Install (10.414)

Belt tensioner - Install

F4GE9484, F4GE9484C*J601, F4DE9484, F4HE9484, F4HE0484G*J109, F4HE0484G*J102, F4HE9484C*J102, F4HE9484C*J103, F4GE9684, F4DE9684, F4DE9687, F4HE9684, F4HE9687, F4HE9687G*J100, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

Prior operation:
Belt tensioner - Remove (10.414)

1. Install the belt tensioner **(1)** and torque the mounting bolt **(2)** to **37 - 49 N·m** (**27 - 36 lb ft**).



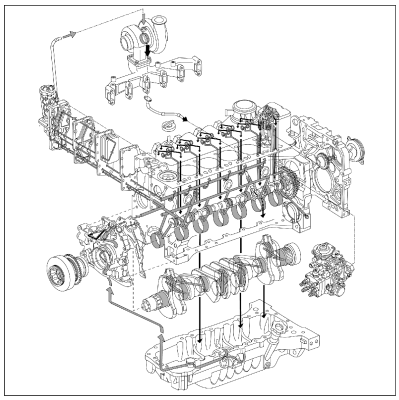
NHIL13ENG0670AA 1

Next operation:
Belt - Install (10.414)

Engine lubrication system - Exploded view

F4CE9484, F4CE9487N, F4CE9487A, F4CE9684

Lubrication by forced circulation is achieved through the oil pump, placed in the front part of the engine block. From the pan, the lubrication oil flows to the crankshaft, to the camshaft and to the valve train. Lubrication involves the heat exchanger as well, the turbocharger and the eventual compressor for any eventual compressed air system. All these components may often vary according to the specific duty and will therefore be examined in the specific section.



NHIL13ENG0676GA 1

LUBRICATION SYSTEM LAYOUT (6 cylinder engines)

Engine oil pump - Remove

F4CE9484, F4CE9487N, F4CE9487A, F4DE9484, F4CE9684, F4DE9684, F4DE9687, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

Prior operation:
Crankshaft damper - Remove (10.110)

1. Please refer to **Engine block cover Front - Remove (10.102)** for oil pump removal instructions.

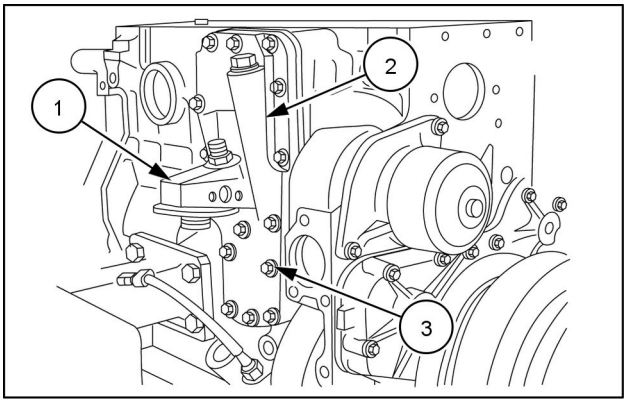
Next operation:
Engine oil pump - Install (10.304)

Engine oil cooler - Remove

F4GE9484, F4GE9484C*J601, F4HE9484, F4HE0484G*J109, F4HE0484G*J102, F4HE9484C*J102, F4HE9484C*J103, F4GE9684, F4HE9684, F4HE9687, F4HE9687G*J100

Prior operation:
Engine oil filter - Remove (10.304)

1. Remove the mounting bolts **(3)**.
2. Remove the oil filter base **(1)**, oil cooler **(2)**, and all of the gaskets.



NHIL13ENG0686AA 1

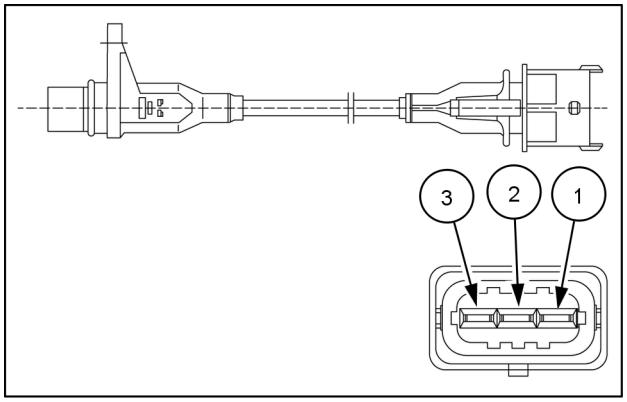
Next operation:
Engine oil cooler - Install (10.408)

Engine speed/RPM sensor

Engine timing sensors

Engine speed/RPM sensor Camshaft - Overview

F4DE9484, F4DE9684, F4DE9687, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111



NHIL13ENG0640AA 1

This is an inductive sensor located at the rear left hand side of the engine. The timing sensor generates signals obtained from a magnetic flux field closing through the holes in the timing gear on the camshaft. The signal generated by this sensor is utilized by the electronic control unit as an injection phase signal.
Although it is similar to the flywheel sensor, these two devices are not interchangeable because of the different external shape.
The timing sensor is connected to the control unit on pins 23C - 30C. The sensor impedance is **~900 Ω**.

Engine timing sensors - Remove

F4DE9484, F4HE9484, F4HE0484G*J109, F4HE0484G*J102, F4HE9484C*J102, F4HE9484C*J103, F4DE9684, F4DE9687, F4HE9684, F4HE9687, F4HE9687G*J100, F4DE9684M*J101, F4DE9684M*J103, F4DE9684B*J111

1. Remove the mounting nut and slide the timing sensor out of the timing gear housing.

Next operation:
Engine timing sensors - Install (55.015)

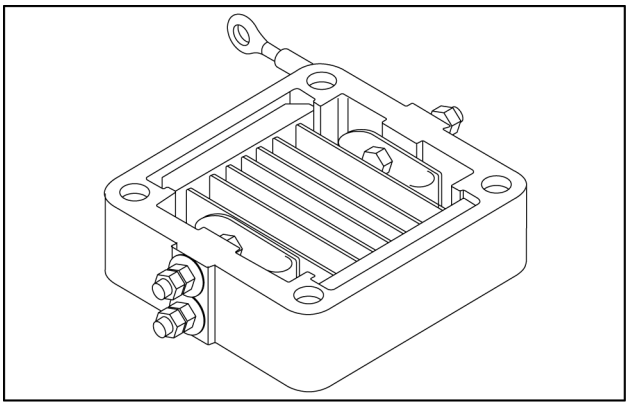
Electrical systems - 55

Alternator - 301

F4CE9484 , F4CE9487A , F4CE9487N , F4CE9684 , F4DE9484 , F4DE9684B*J111 , F4DE9684M*J101 , F4DE9684M*J103 , F4DE9684 , F4DE9687 , F4GE9484C*J601 , F4GE9484 , F4GE9684 , F4HE0484G*J102 , F4HE0484G*J109 , F4HE9484C*J102 , F4HE9484C*J103 , F4HE9484 , F4HE9684 , F4HE9687G*J100 , F4HE9687

Grid heater - Overview

F4CE9484, F4GE9484, F4CE9487N, F4CE9487A, F4GE9484C*J601, F4CE9684, F4GE9684



NHIL13ENG0653AA 1

It is a resistor assembled to the intake manifold and is utilized to heat the air during pre-post heating operations. It is fed by a tele-switch usually placed very close to the engine.

Specifications:

- Working voltage:
  - **12 V**
- Maximum possible air flow:
  - **0.034 cm³/sec** at a pressure of **138 kPa** (**20 psi**)

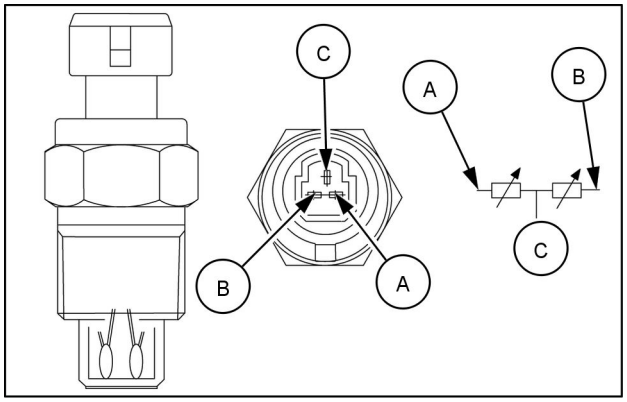
Electrical systems - 55

Engine intake and exhaust system - 014

F4CE9484 , F4CE9487A , F4CE9487N , F4CE9684 , F4DE9484 , F4DE9684B*J111 , F4DE9684M*J101 , F4DE9684M*J103 , F4DE9684 , F4DE9687 , F4GE9484C*J601 , F4GE9484 , F4GE9684 , F4HE0484G*J102 , F4HE0484G*J109 , F4HE9484C*J102 , F4HE9484C*J103 , F4HE9484 , F4HE9684 , F4HE9687G*J100 , F4HE9687

Engine coolant temperature sensor - Overview

F4CE9484, F4GE9484, F4CE9487N, F4CE9487A, F4GE9484C*J601, F4CE9684, F4GE9684



NHIL13ENG0660AA 1

The coolant temp sensor is assembled to the engine head close to the thermostat unit and its duty is to detect engine coolant temperature.

Specifications:

- Range of working temperatures
  - Connection side: **-40 - +150 °C** (**-40 - +302 °F**) for less than 10 minutes
  - Bulb side on engine: **-40 - +140 °C** (**-40 - +284 °F**)
  - Working tensions: **6 - 28 V**
- Settings:
  - **80 °C** (**176 °F**) - **304 - 342 Ω**
  - **20 °C** (**68 °F**) - **2262 - 2760 Ω**
  - **-10 °C** (**14 °F**) - **8244 - 10661 Ω**

Index

Electrical systems - 55

Engine oil system - 013