SERVICE MANUAL

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Cursor® 13
Single Stage Turbocharger
Tier 4B (final) and Stage IV
Engine

See the following page for engine model numbers

CNH INDUSTRIAL

Part number 47869981
English
May 2015
Replaces part numbers 47607266, 47607276, 47607286, 47607296

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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.*

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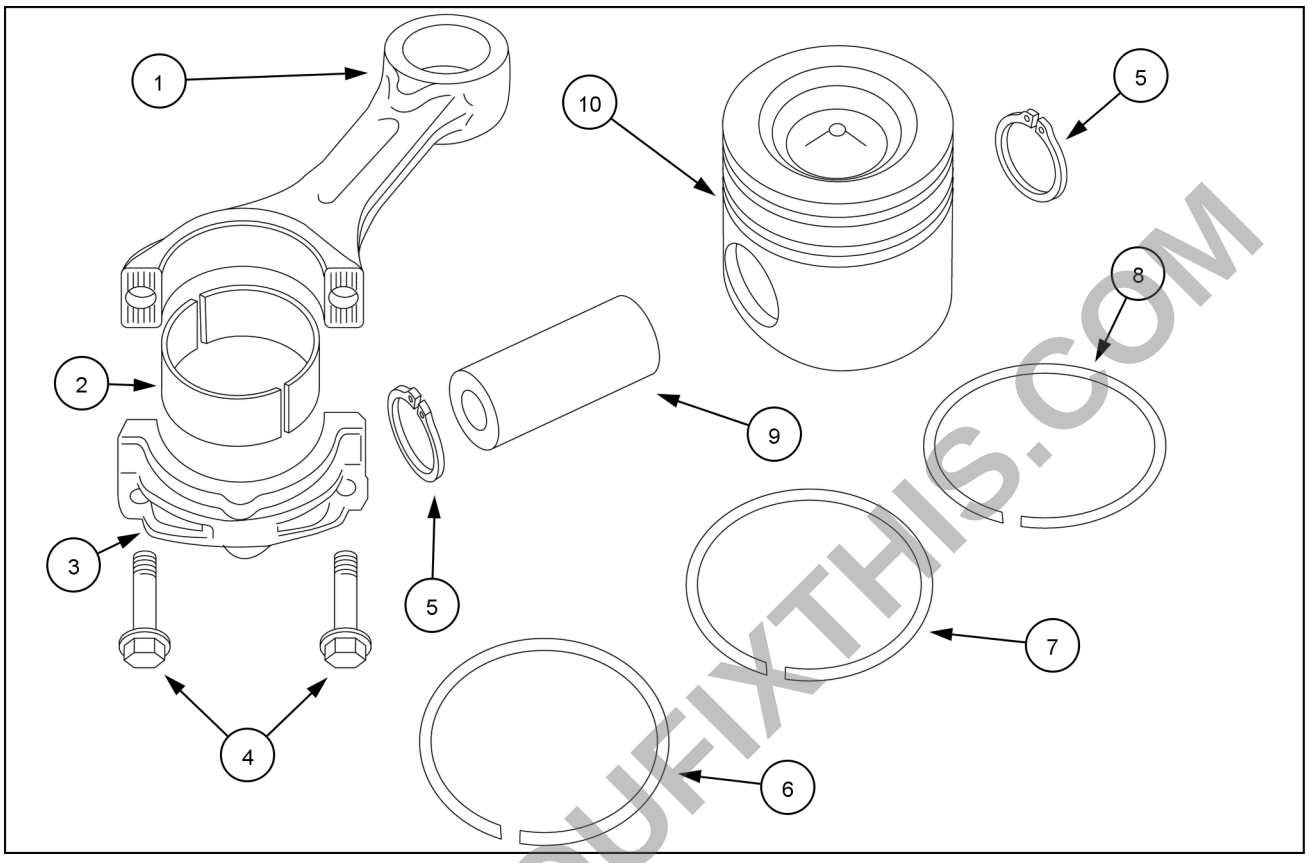
Engine - Troubleshooting

Problem	Possible Cause	Correction
Engine will not start	An engine no start is defined as an engine that will crank but will not start. The most likely causes of this failure are issues related to the battery, fuel system or low engine compression.	1. Faulty battery, voltage too low. 2. Insufficient fuel level 3. Contaminated fuel (water or air) 4. Clogged fuel filter 5. Faulty fuel injectors 6. Faulty glow plugs (if equipped) 7. Faulty fuel lift pump (if equipped) 8. Faulty high pressure pump 9. Low engine compression 10. Engine timing incorrect
The engine starts then stalls	This symptom is usually caused by fuel leakage or a clogged fuel filter.	Visually inspect the fuel system for external leakage. If leakage is found, repair as necessary. Check fuel system pressure for adequate pressure. If fuel pressure is lower than expected, repair as necessary.
Engine will not crank	An engine no-crank condition is defined as an engine that will not crank. Possible failures include a dead or weak battery, an open battery disconnect switch (if equipped) or a starting system failure.	1. Check battery voltage. Charge or replace the battery as necessary. 2. Verify the status of the battery disconnect switch (if equipped). The switch must be closed. 3. Check the starting system for possible failures. Check the starter relay and battery voltage at the starter. Perform a voltage drop test between the battery and the engine starter to check the starter wiring. Repair as necessary.
The engine is difficult to start	The cause of an engine hard start condition is similar to those of an engine no start condition. Failures can include inadequate fuel pressure, air supply, engine compression, faulty glow plugs or incorrect injection timing during start up.	1. Faulty battery, voltage too low. 2. Insufficient fuel level 3. Contaminated fuel (water or air) 4. Clogged fuel filter 5. Faulty fuel injectors 6. Faulty glow plugs (if equipped) 7. Faulty fuel lift pump (if equipped) 8. Faulty high pressure pump 9. Restricted air induction system 10. Low engine compression 11. Engine timing incorrect
Engine has a slow cranking condition	A slow engine crank condition can be caused by a weak battery, worn starter internal engine resistance. Extremely cold operating temperatures can also be a factor in a slow engine crank condition.	1. Load test the battery. Charge or replace the battery as necessary. 2. Perform a voltage drop test on the starting circuit. There should be a drop less than **0.5 V** on both the positive and negative circuits. If the drop is greater than **0.5 V**, repair as necessary. 3. Bench test the starter. If the starter operates slower than expected, replace the starter.

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Connecting rod and piston - Overview



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(1) Connecting rod
(2) Half bearings
(3) Connecting rod cap
(4) Cap bolts
(5) Snap ring
(6) Oil control ring
(7) Bevel cut intermediate ring
(8) Trapazoidal combustion ring
(9) Piston pin
(10) Piston

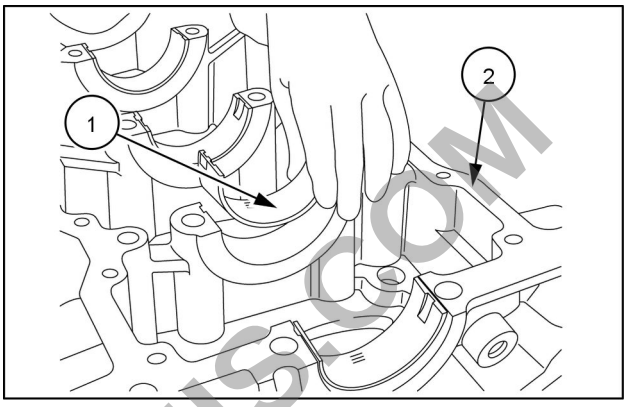
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Crankcase Under block - Install

Prior operation:
Crankcase Under block - Remove (10.001)

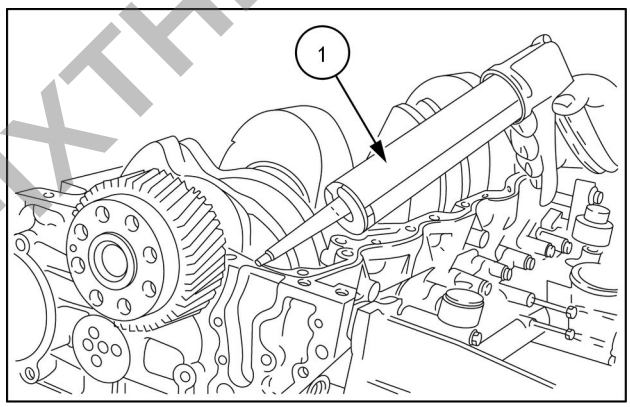
1. Place the appropriate bearing halves **(1)** in the under block.



NHIL13ENG1193AA 1

2. Apply silicone **LOCTITE® 5970™** to the block as shown in the figure.

NOTE: *Install the under block within 10 minutes of sealant application. Always use new screws whenever the under block is removed.*

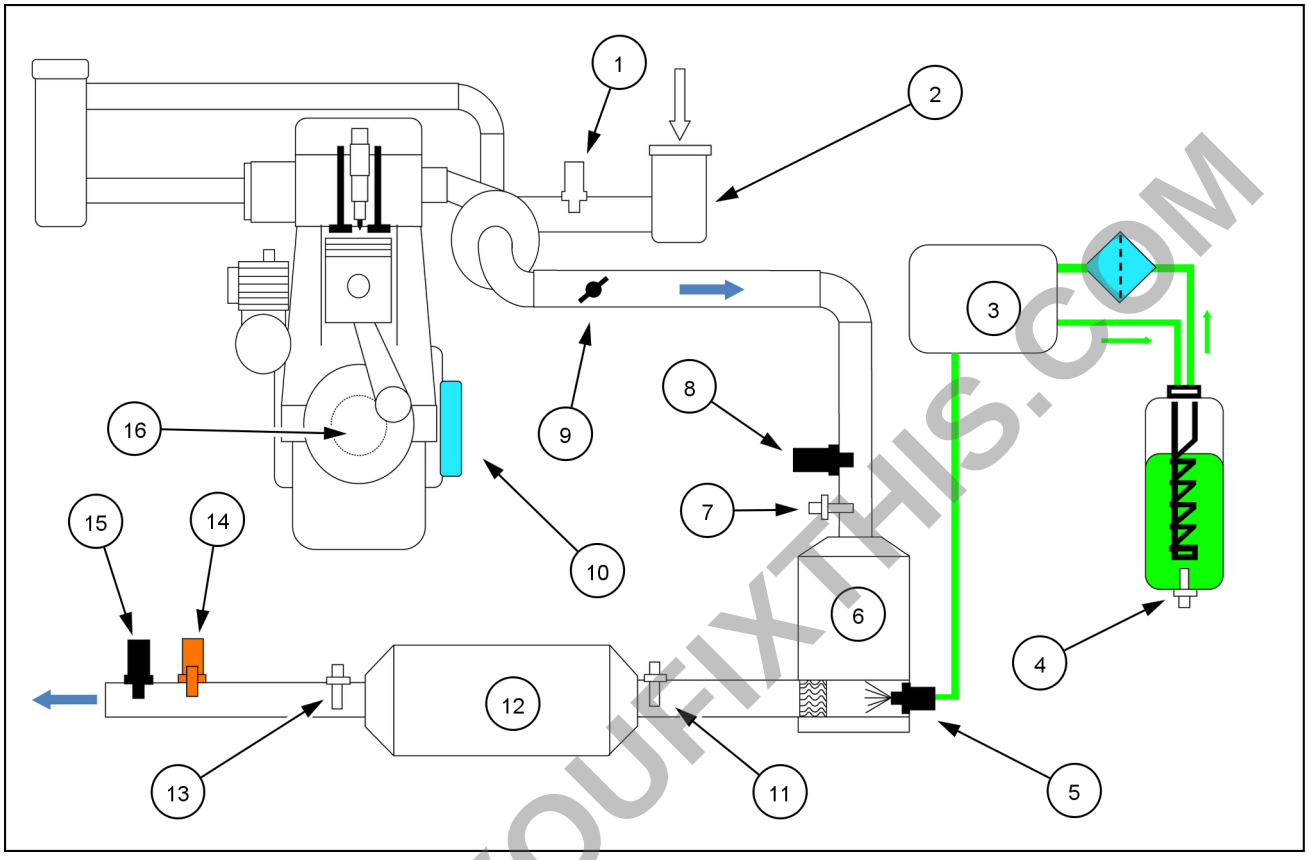


NHIL13ENG1240AA 2

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Selective Catalytic Reduction (SCR) exhaust treatment - Dynamic description



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(1) Intake air humidity and temperature sensor
(2) Air filter
(3) Supply module
(4) Diesel Exhaust Fluid (DEF)/AdBlue® tank
(5) DEF/AdBlue® dosing module
(6) DOC and mixer
(7) DOC upstream temperature sensor
(8) NOx sensor
(9) Exhaust flap
(10) Engine Control Unit (ECU)
(11) SCR upstream temperature sensor
(12) SCR catalyst
(13) SCR downstream temperature sensor
(14) NH3 sensor
(15) NOX sensor
(16) Engine

The supply module contains an electronically controlled pump motor and reverting valve and an electronically monitored pressure and temperature sensor.

Each of these elements is controlled or monitored by the Engine Control Unit (ECU).

DEF/AdBlue® drawn from the DEF/AdBlue® storage tank is pressurized by the Supply module pump. The DEF/AdBlue® pressure is sensed by the Supply module pressure sensor. Once the pressure is stabilized at approximately **9.0 bar** (**130.5 psi**), the system is ready for normal operation. During cold weather operation the Dosing module solenoid is energized (actuated) for approximately **1.0 s**. If this opening of the dosing valve causes a pressure drop, then the pipe (tube) is assumed to be free of ice (blockage). Otherwise defrosting is continued for **5.0 min** then re-checked. This process is repeated up to five times. DEF/AdBlue® system pressure needs to be between **5.5 - 11.0 bar** (**79.8 - 159.5 psi**) to assure correct dosing quantities.

As the DEF/AdBlue® system needs to be evacuated when the engine is not running to prevent potential damage due to frozen DEF/AdBlue®, the system requires filling and pressurizing after each engine start. DEF/AdBlue® system evacuation is accomplished by the Supply module reverting valve, internal to the supply module, which removes the DEF/AdBlue® from all of the lines and returns it to the storage tank by reversing the direction of the DEF/AdBlue® flow. During system evacuation the system pressure is expected to drop to **0.2 bar** (**3.6 psi**) within **40.0 s**.

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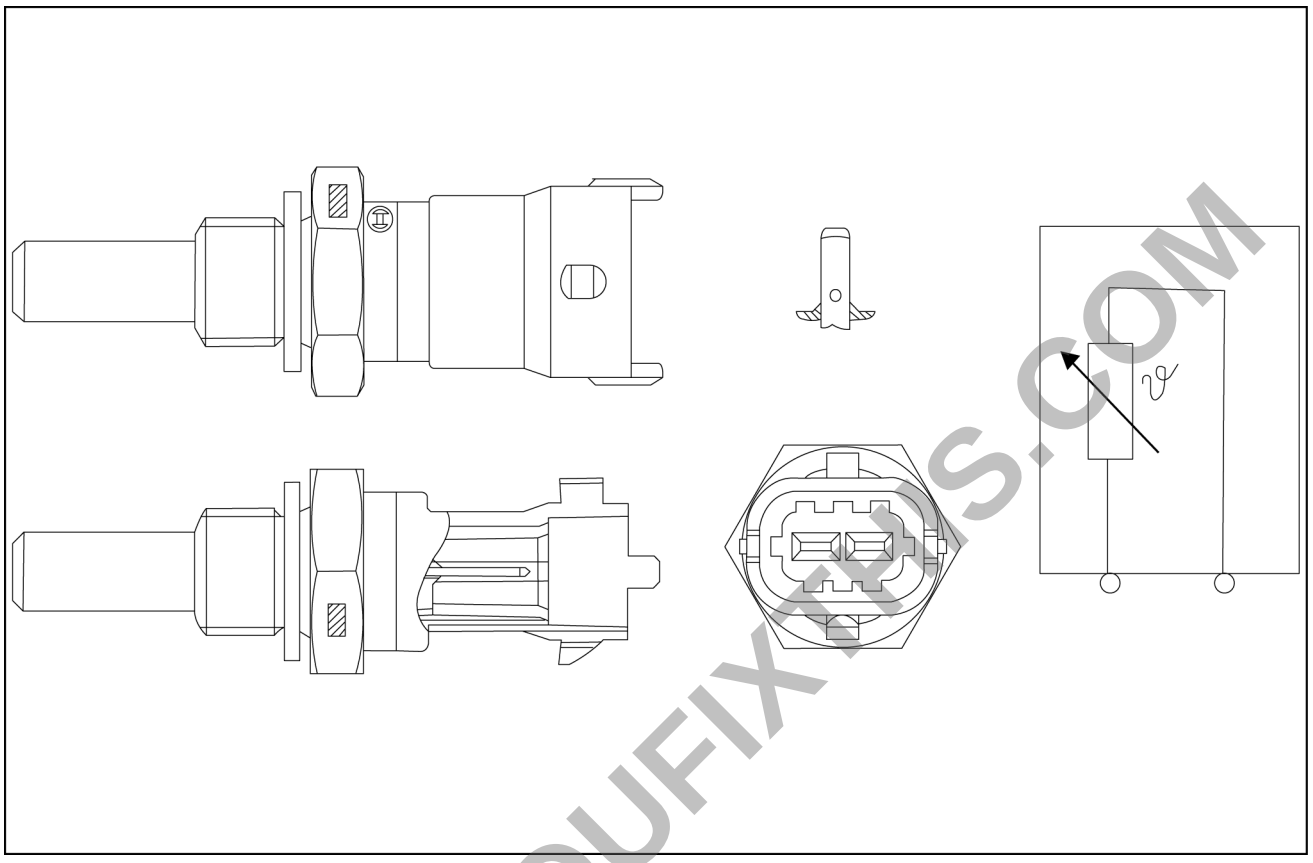
Engine - Service limits

Engine specifications	
Compression Ratio	16.5 : 1
Bore	**135 mm** (**5.3 in**)
Stroke	**150 mm** (**5.9 in**)
Displacement	**12880 cm³**
Turbocharging	Inter-cooled, Direct injection
Turbocharger type	Holset HE551
Lubrication	Forced by gear pump, relief valve single action
Oil Pressure (Warm engine) - Idling - Peak RPM	 **3 bar** (**43.5 psi**) **4.5 bar** (**65.3 psi**)
Cooling	Liquid cooled
Water pump control	Belt driven
Thermostat (Start of opening)	**81 °C** (**177.8 °F**)
Intake valve timing - Opens before TDC - Closes after BDC Exhaust valve timing - Opens before BDC - Closes after TDC	 **17 °** **30 °** **50 °** **9 °**
Valve lash setting (when engine is cold) - Intake - Exhaust	 **0.4 mm** (**0.016 in**) **0.6 mm** (**0.024 in**)
Firing Order	1 - 4 - 2 - 6 - 3 - 5
Cylinder block and piston	
Bores for cylinder liners: - Upper - Lower	 **153.500 - 153.525 mm** (**6.043 - 6.044 in**) **152.000 - 152.025 mm** (**5.984 - 5.985 in**)
Cylinder liners external diameter: - Upper - Lower	 **153.461 - 153.486 mm** (**6.042 - 6.043 in**) **151.890 - 151.915 mm** (**5.980 - 5.981 in**)
Clearance between the OD of liners and ID of bores - Upper - Lower	 **0.014 - 0.039 mm** (**0.001 - 0.002 in**) **0.085 - 0.135 mm** (**0.003 - 0.005 in**)
Cylinder liner - ID - ID under a load of **800 N** (**179.8 lb**) - Protrusion	 **135.000 - 135.013 mm** (**5.315 - 5.315 in**) **135.011 - 135.024 mm** (**5.315 - 5.316 in**) **0.045 - 0.075 mm** (**0.002 - 0.003 in**)
Pistons - Measuring dimension - External diameter (supplied as spares - External diameter (production only) - Pin bore	 **18 mm** (**0.709 in**) **134.861 - 134.873 mm** (**5.309 - 5.310 in**) **134.872 - 134.884 mm** (**5.310 - 5.310 in**) **54.010 - 54.018 mm** (**2.126 - 2.127 in**)
OD of piston - ID of cylinder liner	**0.127 - 0.151 mm** (**0.005 - 0.006 in**)
Piston protrusion	**0.12 - 0.42 mm** (**0.005 - 0.017 in**)
Piston pin diameter	**53.994 - 54.000 mm** (**2.126 - 2.126 in**)
Piston pin OD - pin bore	**0.010 - 0.024 mm** (**0.0004 - 0.0009 in**)
Piston ring grooves - Top - Middle - Bottom	 **3.100 - 3.120 mm** (**0.122 - 0.123 in**) **1.550 - 1.570 mm** (**0.061 - 0.062 in**) **5.020 - 5.040 mm** (**0.198 - 0.198 in**)
Piston rings - Combustion ring	 **3.000 mm** (**0.118 in**)

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Fuel temperature sensor - Overview



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The fuel temperature sensor detects the fuel temperature. This enables the Electronic Control Unit (ECU) to determine the fuel density, volume, and allows for the fuel delivery to be adjusted.

Torque: **35.0 N·m** (**25.8 lb ft**)

Resistance:

- **-10.0 °C** (**14.0 °F**) = **8100 - 10770 Ω**
- **20 °C** (**68 °F**) = **2280 - 2720 Ω**
- **80 °C** (**176 °F**) = **290 - 364 Ω**

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SPECIAL TOOL INDEX

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[55.301] Alternator 55.8
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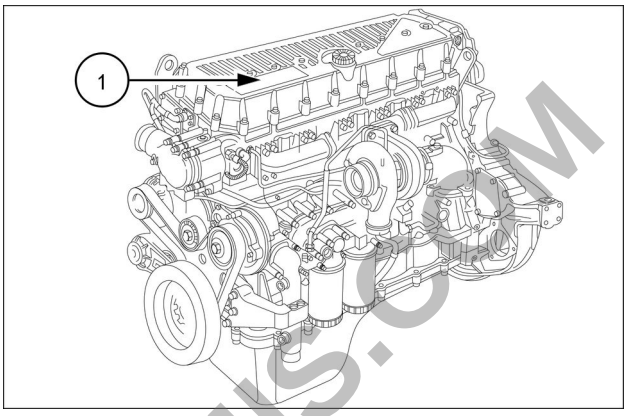
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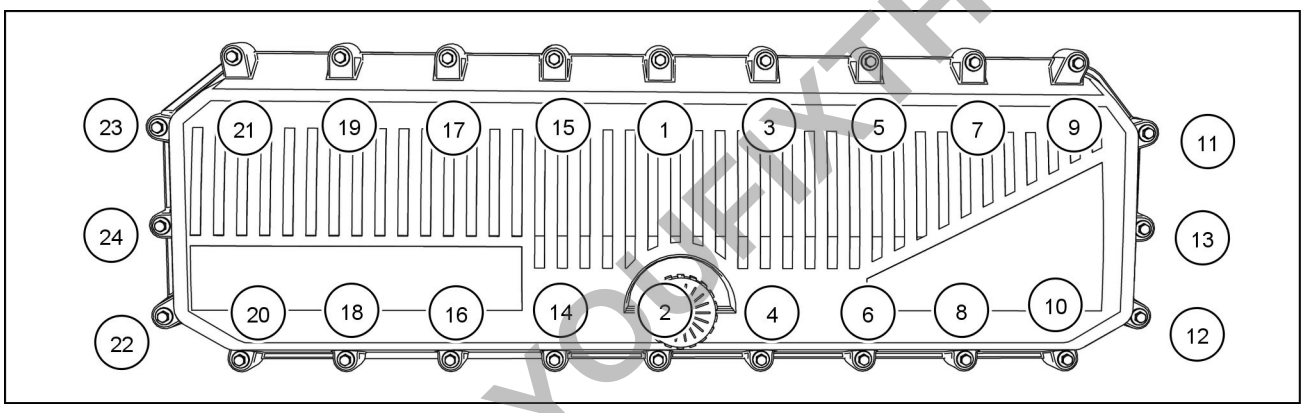
Valve cover - Install

Prior operation:
Valve cover - Remove (10.101)

1. Install the valve cover **(1)** onto the cylinder head.
2. Torque the bolts to **9 N·m** (**7 lb ft**) following the sequence shown in figure **2**.



NHIL13ENG1321FA 1

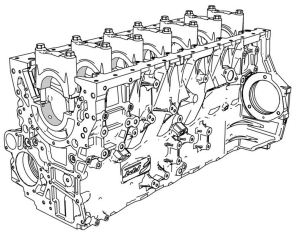


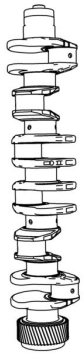
NHIL15ENG0090EA 2

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Bearing selection for an undersize crankshaft

-0.127 mm (-0.005 in)	



Main journal diameter	Class		1	2	3
92.843 - 92.853 mm (3.6552 - 3.6556 in)	1	(U)	Green/Black	Green/Black	Yellow/Black*
		(L)	Green/Black	Yellow/Black*	Yellow/Black*
92.853 - 92.863 mm (3.6556 - 3.6560 in)	2	(U)	Red/Black	Green/Black	Green/Black
		(L)	Green/Black	Green/Black	Yellow/Black*
92.863 - 92.872 mm (3.6560 - 3.6564 in)	3	(U)	Red/Black	Red/Black	Green/Black
		(L)	Red/Black	Green/Black	Green/Black

Red/Black = **3.031 - 3.041 mm** (**0.1193 - 0.1197 in**)
Green/Black = **3.041 - 3.051 mm** (**0.1197 - 0.1201 in**)
Yellow/Black* = **3.051 - 3.061 mm** (**0.1201 - 0.1205 in**)
* Production only. Substitute with Green/Black bearings if needed.

7. Verify the oil clearance is within the specifications below using plastic gauge. Refer to **Crankshaft Journal - Clearance (10.103)** for the proper procedure.
   - Main journals: **0.050 - 0.090 mm** (**0.0020 - 0.0035 in**)
   - Crank pin journals: **0.040 - 0.080 mm** (**0.0016 - 0.0031 in**)

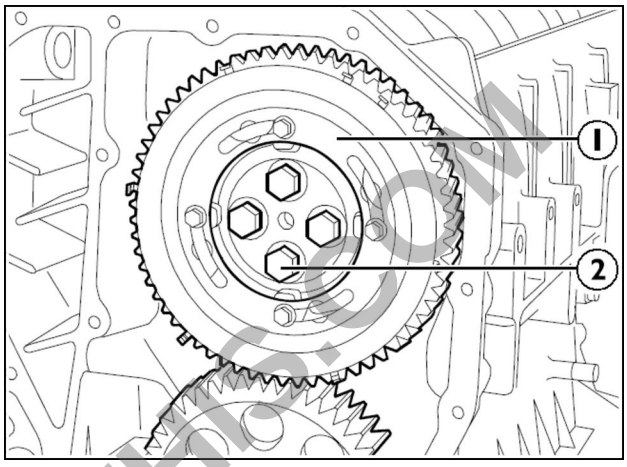
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Camshaft gear - Remove – Gear

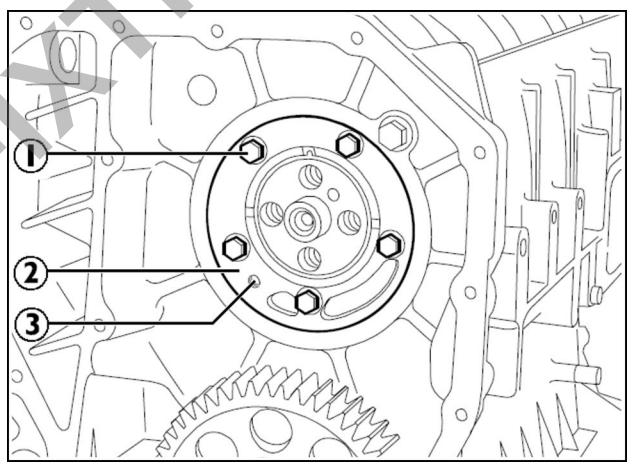
Prior operation:
Crankcase ventilation system - Remove (10.304)

1. Loosen and remove the screws **(2)** and remove the gear **(1)** fitted with the phonic wheel.



CAMGEARF3C 1

2. Remove the screws **(1)** securing the shoulder plate **(2)**.
3. Using a mounting screw **(1)**, insert it into the threaded hole **(3)** on the shoulder plate **(2)**.
4. Turn the screw clockwise to remove the shoulder plate **(2)**.
5. Remove the sheet gasket.



SHOULDERPLATE 2

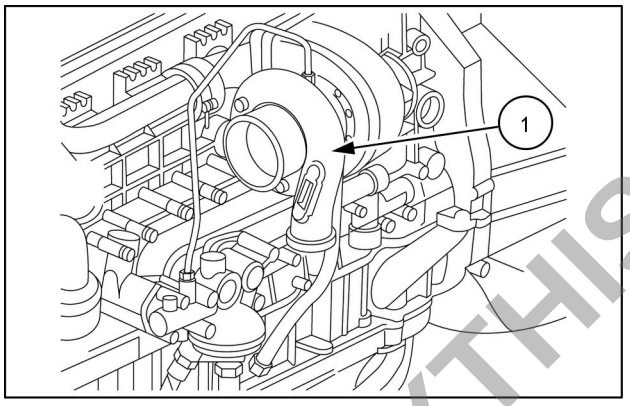
Next operation:
Camshaft - Timing adjust (10.106)

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Turbocharger - Functional diagram

The turbocharger **(1)** increases the air flow rate during the intake stroke of the combustion cycle. The contribution of extra air improves combustion and increases engine efficiency.
The exhaust gases are conveyed towards the turbocharger turbine where they give part of their energy and turn the turbine itself. During this step, the exhaust gas temperature drops to approximately **600 °C** (**1112 °F**).
A centrifuge compressor is mounted coaxially to the turbine with the task of aspirating and comprising the previously cleaned air from the external environment.
During compression, the air temperature increases and is cooled by the intercooler before being conveyed to the intake manifold.



NHIL13ENG1200AA 1

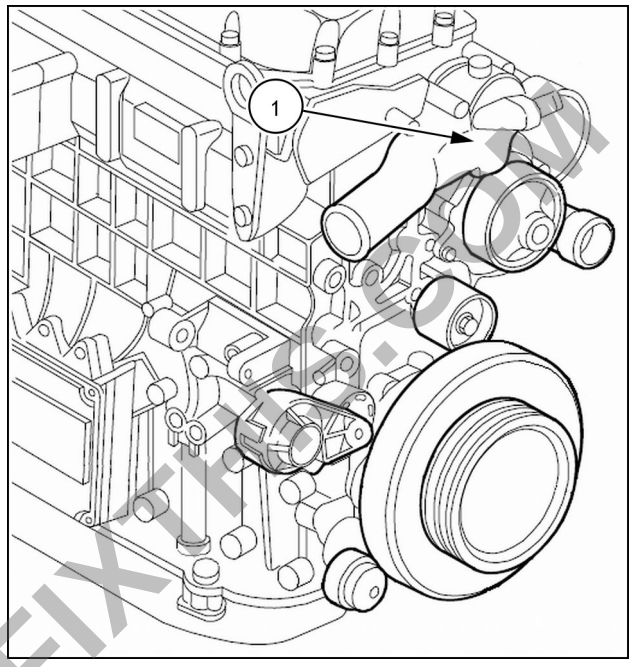
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Coolant thermostat - Install

Prior operation:
Coolant thermostat - Remove (10.400)

1. Install the thermostat and housing **(1)** using the appropriate tools.

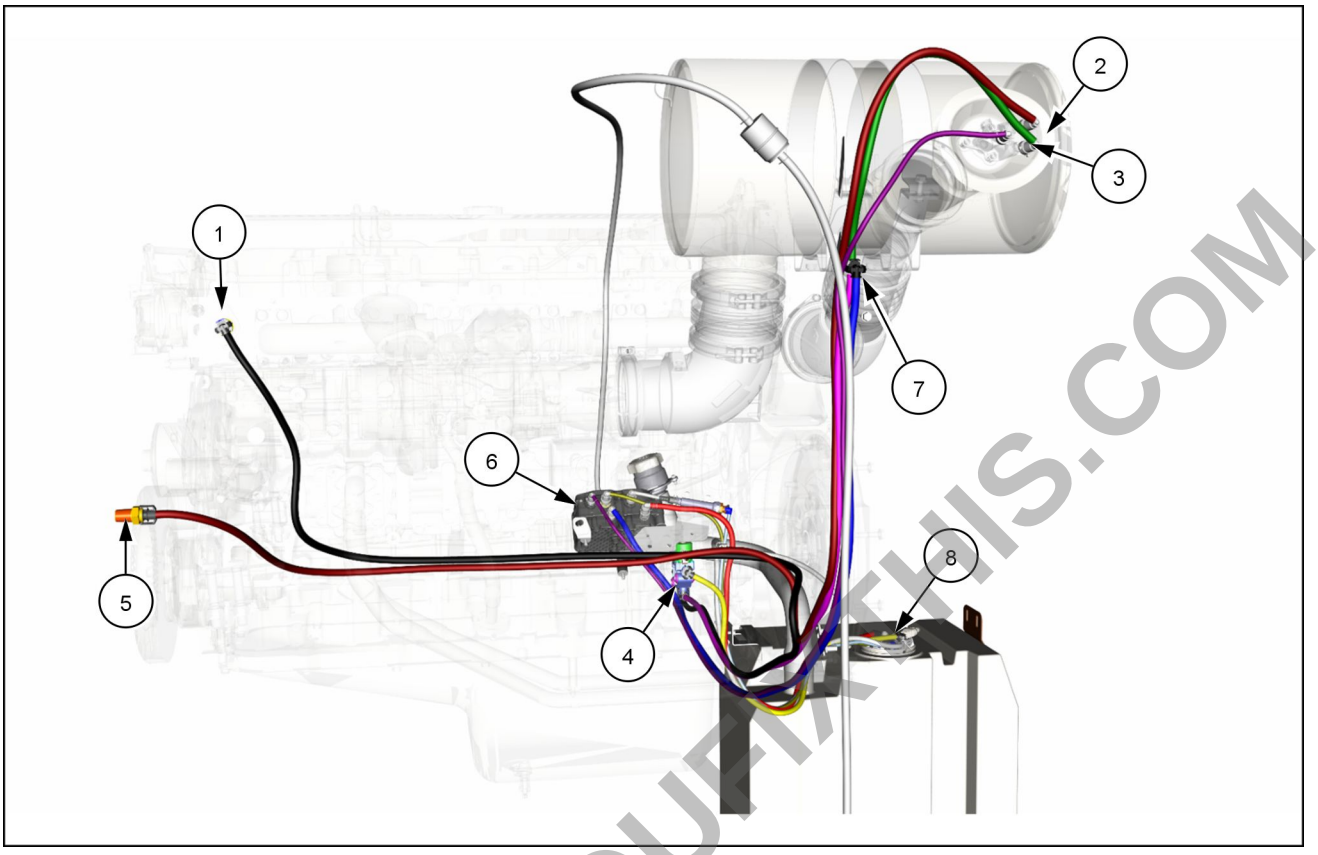


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Defrosting / Heating Flow



NHIL15ENG0091JA 3

The defrosting flow goes from the:

- Engine **(1)** to the coolant control valve **(4)**
- Coolant control valve **(4)** to the tank spiral **(8)** (fluid level and temperature sending unit)
- Tank spiral **(8)** to the supply module **(6)**
- Supply module ‘T’ connection **(7)** to the dosing module **(2)**
- Dosing module **(2)** back to the engine cooling system **(5)**

DEF/AdBlue® heating control - Defrosting state

- Supply pump is not running to avoid damage of system components.
- System is heating up until “Defrosting OFF” thresholds for all heating circuits have been reached.

NOTICE: *Even if condition “DEFROSTING OFF” was not reached, the system will try to start-up after* ***68 min*** *defrosting time has elapsed.*

Signal	Threshold	
	ON	OFF
Fluid tank temperature	Less than **-10.0 °C** (**14.0 °F**)	Greater than **-8.0 °C** (**17.6 °F**)
Supply module temperature	Less than **-4.0 °C** (**24.8 °F**)	Greater than **-4.0 °C** (**24.8 °F**)

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Electrical systems - 55

Engine starting system - 201

F3HFE613A*B003 , F3HFE613B*B001 , F3HFE613B*B002 , F3HFE613D*B001 , F3HFE613D*B002 , F3HFE613G*B001 , F3HFE613G*B002

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Cnh Industrial Cursor 13, Cursor 13 Single Stage Turbocharger Tier 4B (final) and Stage IV Engine, F3HFE613A*B003, F3HFE613B*B001, F3HFE613B*B002, F3HFE613D*B001, F3HFE613D*B002, F3HFE613G*B001, F3HFE613G*B002 Service Manual

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