SERVICE MANUAL

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Cursor® 9
Tier 4B (final) and Stage IV
Engine

See the following page for engine model numbers

Part number 48076851
1st edition English
November 2016
Replaces part numbers 47606172, 47606162, 47606142, 47606152

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Safety rules

Personal safety



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual you will find the signal words DANGER, WARNING, and CAUTION followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.

Machine safety

NOTICE: *Notice indicates a situation that, if not avoided, could result in machine or property damage.*

Throughout this manual you will find the signal word Notice followed by special instructions to prevent machine or property damage. The word Notice is used to address practices not related to personal safety.

Information

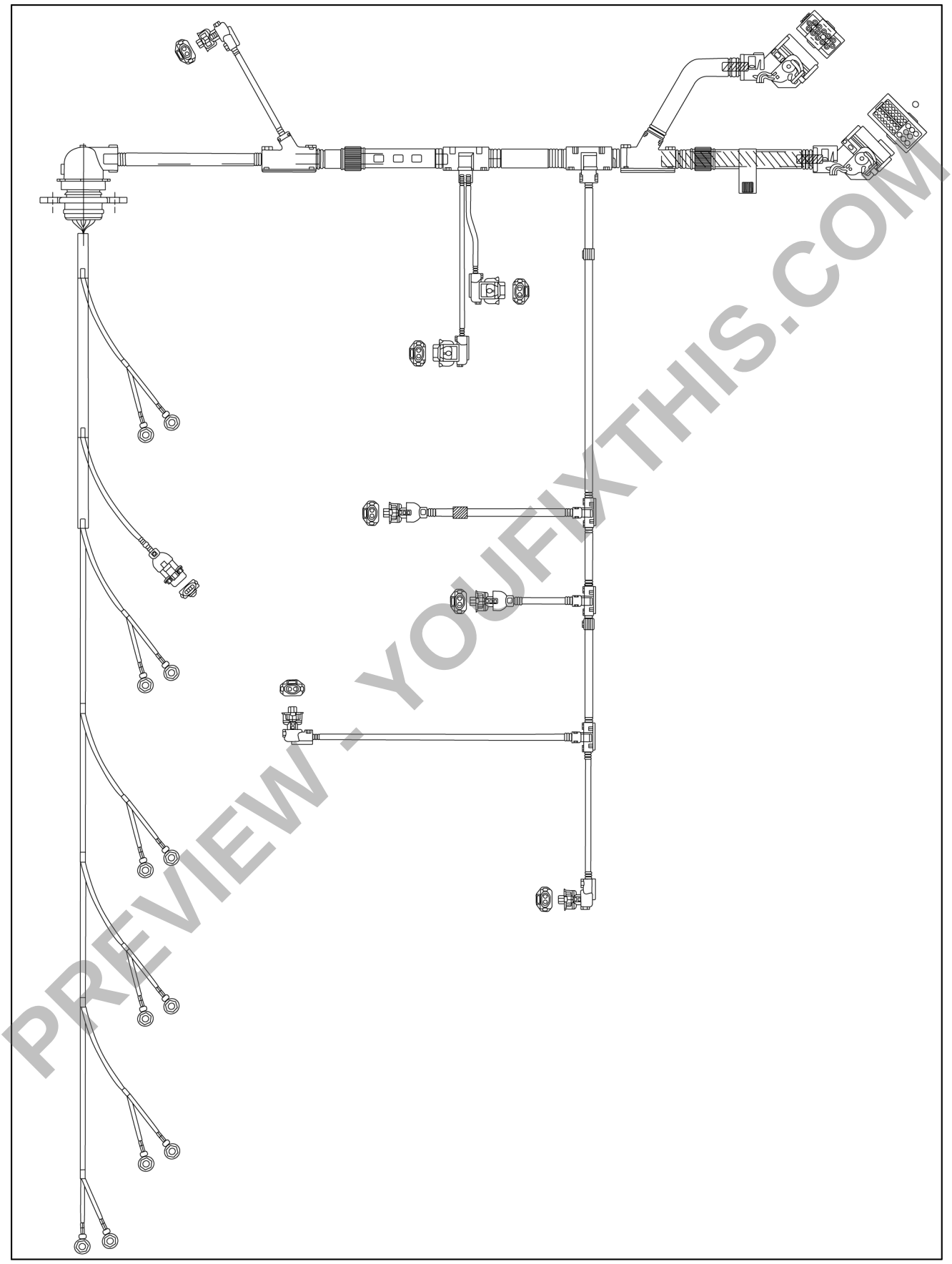
NOTE: *Note indicates additional information that clarifies steps, procedures, or other information in this manual.*

Throughout this manual you will find the word Note followed by additional information about a step, procedure, or other information in the manual. The word Note is not intended to address personal safety or property damage.

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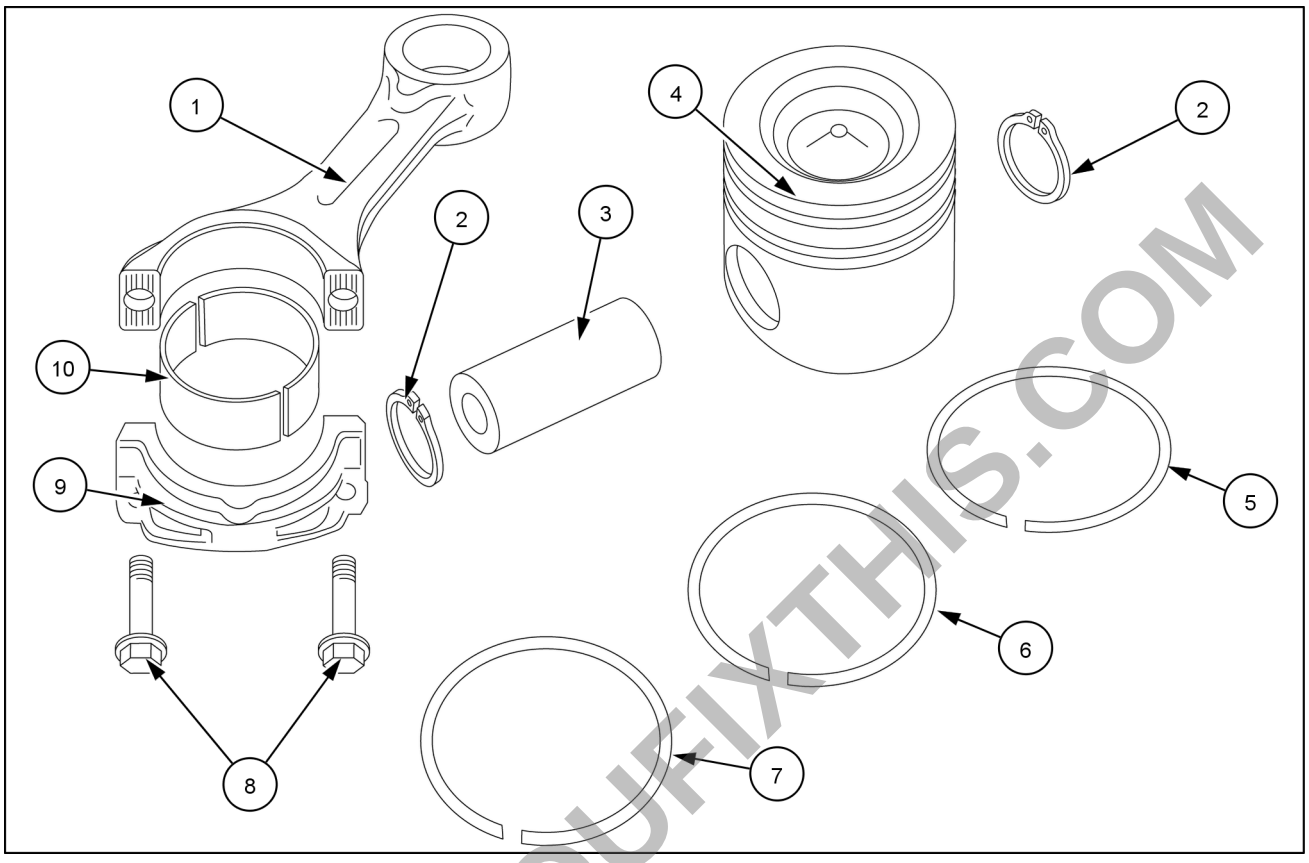
Engine wiring harness - Detailed view



NHIL13ENG1047HA 1

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Connecting rod and piston - Exploded view



NHIL13ENG1005FA 1

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

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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 - Service limits

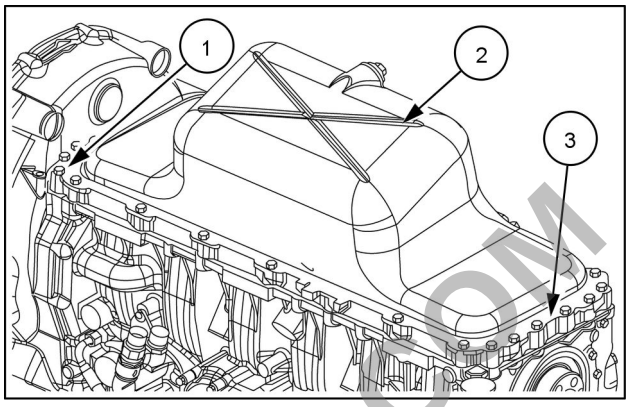
Engine specifications	
Compression ratio	15.9:1
Bore	**117 mm** (**4.6 in**)
Stroke	**135 mm** (**5.3 in**)
Cylinder spacing	**138 mm** (**5.4 in**)
Displacement	**8710 cm³**
Turbocharging	Inter-cooled, Direct injection
Lubrication	Forced by gear pump, relief valve single action oil filter
Oil pressure (Warm engine) - Idling - Peak RPM	 **4 bar** (**58 psi**) **5 bar** (**73 psi**)
Cooling	Liquid cooled
Water pump control	Belt driven
Thermostat (Start of opening)	**83.5 - 86.5 °C** (**182.3 - 187.7 °F**)
Intake valve timing - Opens before TDC - Closes after BDC Exhaust valve timing - Opens before BDC - Closes after TDC	 **17 °** **31 °** **48 °** **9 °**
Valve lash setting (when engine is cold) - Intake - Exhaust (with brake and/or camshaft 504326209) - Exhaust (without brake)	 **0.4 mm** (**0.016 in**) **0.4 mm** (**0.016 in**) **0.6 mm** (**0.024 in**)
Firing Order	1 - 4 - 2 - 6 - 3 - 5
Injection pressure	**1800 bar** (**26100 psi**)
Injector calibration	**290 - 302 bar** (**4205 - 4379 psi**)
Cylinder block and piston	
Cylinder liner bore - Upper - Lower	 **130.500 - 130.525 mm** (**5.138 - 5.139 in**) **129.510 - 129.535 mm** (**5.099 - 5.100 in**)
Cylinder liner external diameter - Upper - Lower	 **130.461 - 130.486 mm** (**5.136 - 5.137 in**) **129.475 - 129.500 mm** (**5.097 - 5.098 in**)
Clearance between the OD of liners and ID of bores - Upper - Lower	 **0.014 - 0.064 mm** (**0.001 - 0.003 in**) **0.010 - 0.060 mm** (**0.0004 - 0.0024 in**)
Cylinder liner - ID A* - ID B* * Selection class - Protrusion	 **117.000 - 117.012 mm** (**4.606 - 4.607 in**) **117.010 - 117.022 mm** (**4.607 - 4.607 in**) **0.035 - 0.065 mm** (**0.001 - 0.003 in**)
Pistons - Measuring dimension - External diameter (supplied as spares) - External diameter (production only) - Pin bore	 **15 mm** (**0.591 in**) **116.894 - 116.906 mm** (**4.602 - 4.603 in**) **116.904 - 116.916 mm** (**4.603 - 4.603 in**) **52.016 - 52.022 mm** (**2.048 - 2.048 in**)
OD of piston - ID of cylinder liner	**0.094 - 0.118 mm** (**0.004 - 0.005 in**)
Piston protrusion	**0.873 - 1.117 mm** (**0.034 - 0.044 in**)
Piston pin diameter	**51.994 - 52.000 mm** (**2.047 - 2.047 in**)

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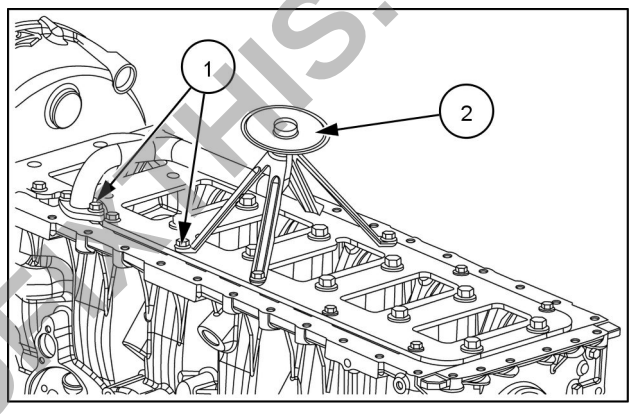
Engine oil pan - Remove

1. Remove the screws **(1)**.
2. Remove the mounting plate **(3)**, oil pan **(2)** and gasket.



NHIL13ENG0928AA 1

3. Remove the screws **(1)** and disconnect the oil pick up tube **(2)**.



NHIL13ENG0929AA 2

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Intake air pressure and temperature sensor - General specification

Pin	Description
1	Ground
2	Temperature signal
3	**5 V** Supply
4	Pressure signal

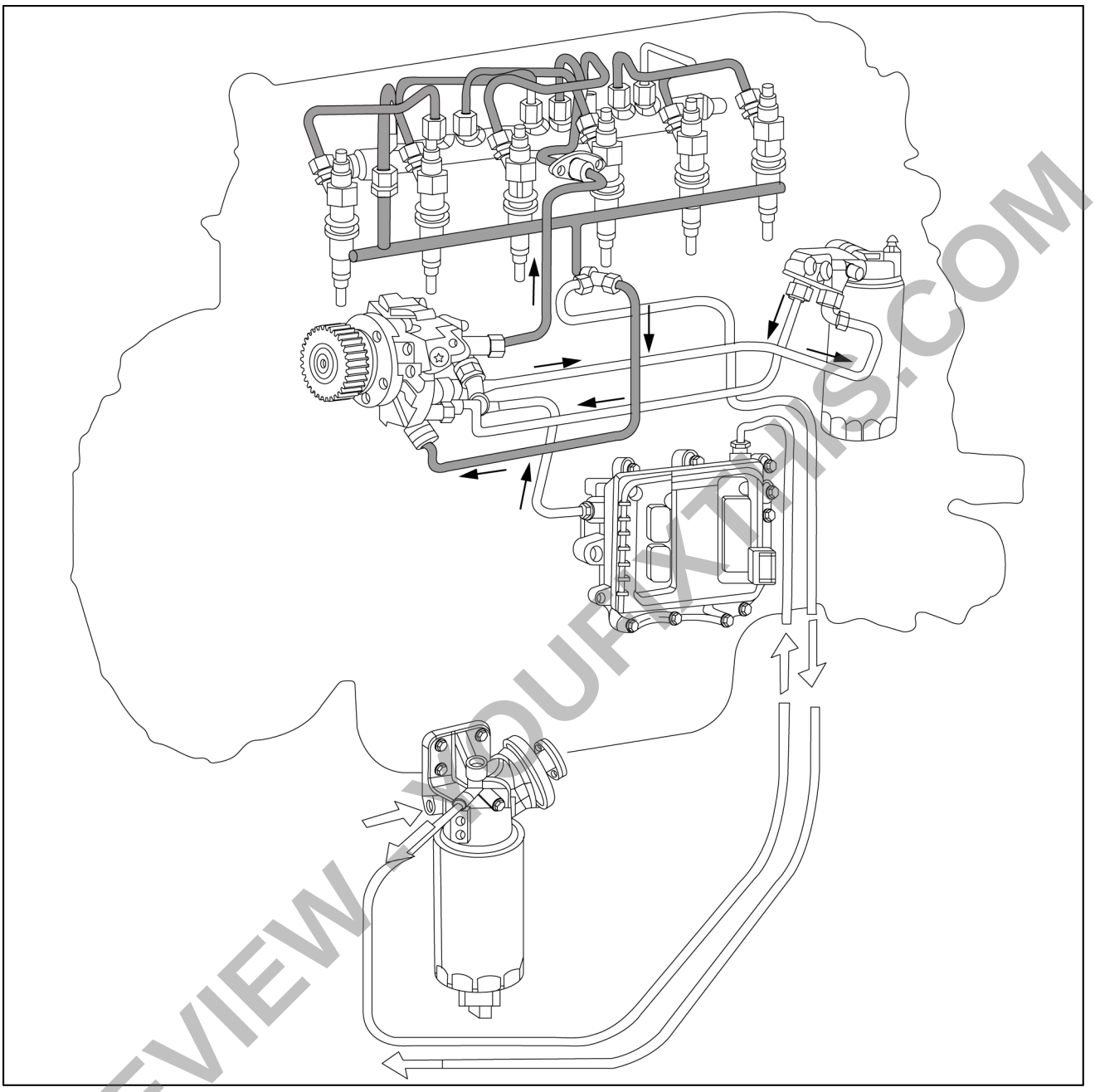
Pressure	Volts
6.9 bar (100 psi)	**0.400 V**
79.3 bar (1150 psi)	**4.650 V**

Temperature	Ohms
-40 °C (-40 °F)	**45303 Ω**
-30 °C (-22 °F)	**26108 Ω**
-20 °C (-4 °F)	**15458 Ω**
-10 °C (14 °F)	**9395 Ω**
-5 °C (23 °F)	**7413 Ω**
0 °C (32 °F)	**5895 Ω**
5 °C (41 °F)	**4711 Ω**
10 °C (50 °F)	**3791 Ω**
15 °C (59 °F)	**3068 Ω**
20 °C (68 °F)	**2499 Ω**
25 °C (77 °F)	**2056 Ω**
30 °C (86 °F)	**1706 Ω**
35 °C (95 °F)	**1411 Ω**
40 °C (104 °F)	**1174 Ω**
50 °C (122 °F)	**833.8 Ω**
60 °C (140 °F)	**595.4 Ω**
70 °C (158 °F)	**435.6 Ω**
80 °C (176 °F)	**322.5 Ω**
90 °C (194 °F)	**243.1 Ω**
100 °C (212 °F)	**186.6 Ω**
110 °C (230 °F)	**144.2 Ω**
120 °C (248 °F)	**112.7 Ω**
130 °C (266 °F)	**89.28 Ω**

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Fuel injection system - Overview



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The common rail fuel system is equipped with a special pump that maintains fuel at a constant high pressure regardless of phase and cylinder under injection. The high pressure fuel is accumulated in a common duct shared by all electric injectors. Therefore, fuel at injection pressure, calculated by the Engine Control Unit (ECU), is always available at the electric injection inlet. When the solenoid valve of an injector is energized by the ECU, high pressure fuel is taken directly from the rail and injected into the related cylinder.

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[55.012] Engine cooling system 55.7
[55.013] Engine oil system 55.8
[55.640] Electronic modules 55.9

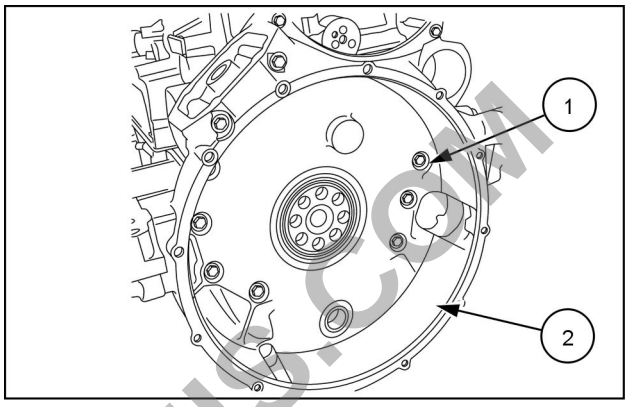
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Engine block cover Rear - Remove

Prior operation:
Engine flywheel - Remove (10.103)

1. Remove the retaining bolts **(1)** from the rear cover **(2)**.
2. Remove the rear cover **(2)** from the engine block.



NHIL13ENG0949AA 1

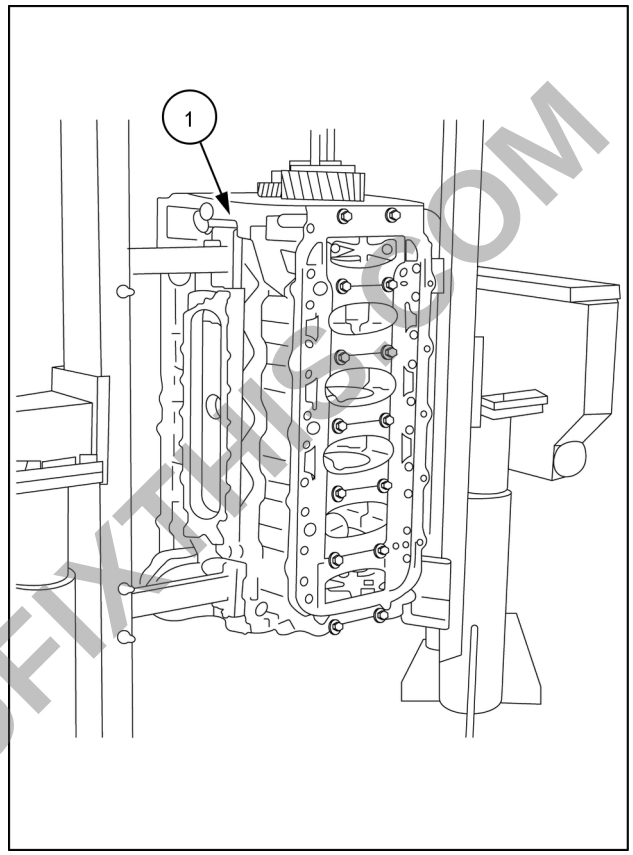
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Connecting rod and piston - Remove

Prior operation:
Engine oil pan - Remove (10.102)

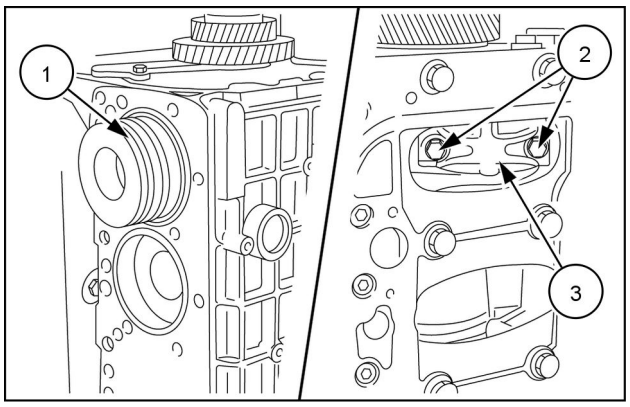
1. Rotate the block **(1)** to the vertical position.



NHIL13ENG0976BA 1

2. Remove the bolts **(2)** from the connecting rod cap **(3)** and remove the cap **(3)** from the connecting rod.
3. Remove the piston **(1)** and the connecting rod assembly from the top side of the engine block.
4. Repeat these steps for the remaining cylinders.

NOTE: *Keep the connecting rod half bearings in the corresponding housings and or take note of their assembly position because they must be installed in the original position if they are reused.*



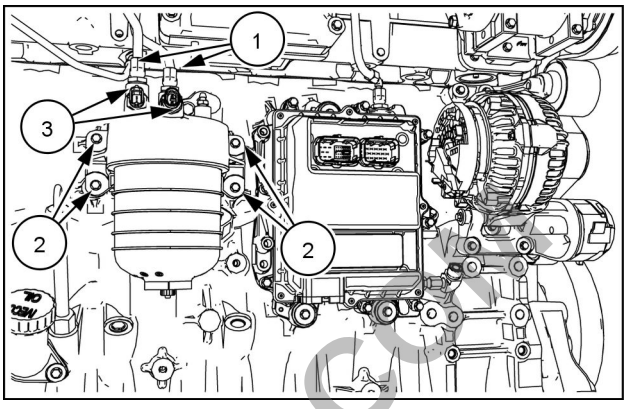
NHIL13ENG0934AA 2

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Fuel filter head - Remove

1. Place a container for collecting fuel under the fuel filter.
2. Disconnect the fuel lines **(1)**.
3. Disconnect the electrical connections **(3)**.
4. Remove the screws **(2)**, and filter head.

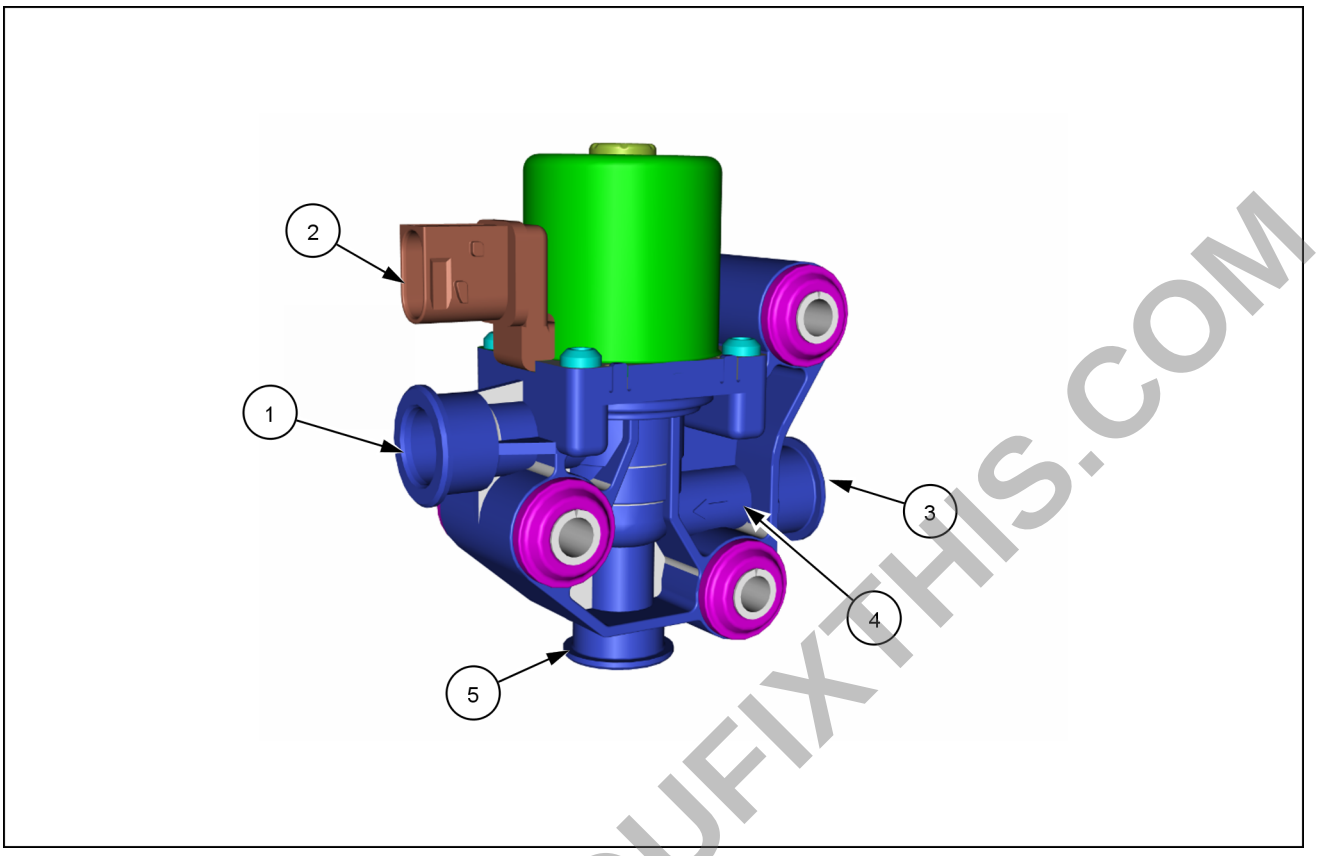


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Coolant control valve - Overview



NHVM15ENG0001FA 1

(1) Outlet port for system defreeze
(2) Electrical connector
(3) Inlet port
(4) Directional arrow
(5) Bypass port for dosing module injector

NOTICE: *The coolant control valve is directional, if the coolant flow through the valve is reverse (hoses hooked up incorrectly), the valve will be damaged. Verify the coolant is flowing the correct direction as indicated by the arrow* ***(4)*** *on the valve.*

The coolant control valve is located in a coolant line connected to the engine. When this two position three way valve is not activated, it sends engine coolant through both the supply module, and the Diesel Exhaust Fluid (DEF)/AdBlue® supply lines as well as the dosing module injector to thaw the DEF/AdBlue® fluid as the engine is started in freezing climates. DEF/AdBlue fluid freezes at **-11 °C** (**12 °F**). It also degrades at elevated temperatures.

When the DEF/AdBlue® fluid is above freezing, the coolant control valve is activated to only send engine coolant through the DEF/AdBlue® dosing module injector to then control the maximum temperature of the module as the engine is operated under load. This temperature regulation minimizes the degradation of the fluid because of the elevated exhaust temperature. When the engine coolant control valve is activated, coolant is not circulated through the supply module to prevent heating of the fluid.

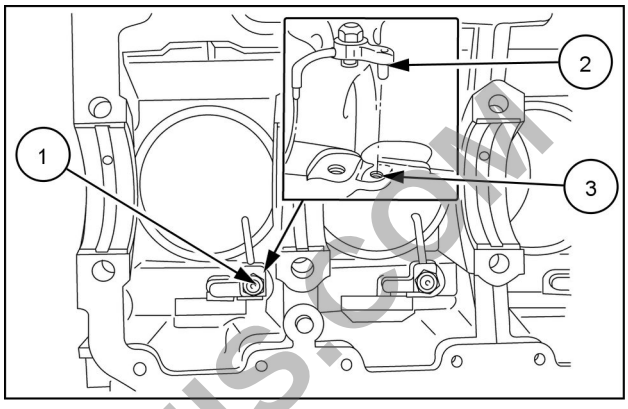
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Piston cooling Spray nozzle - Install

Prior operation:
Piston cooling Spray nozzle - Remove (10.304)

1. Install the oil spray nozzle **(2)**. Make sure the positioning dowel is properly positioned in the hole in the block **(3)**.
2. Lubricate the retaining bolt **(1)** with clean engine oil.
3. Torque the bolt to **33 - 37 N·m** (**24 - 27 lb ft**).

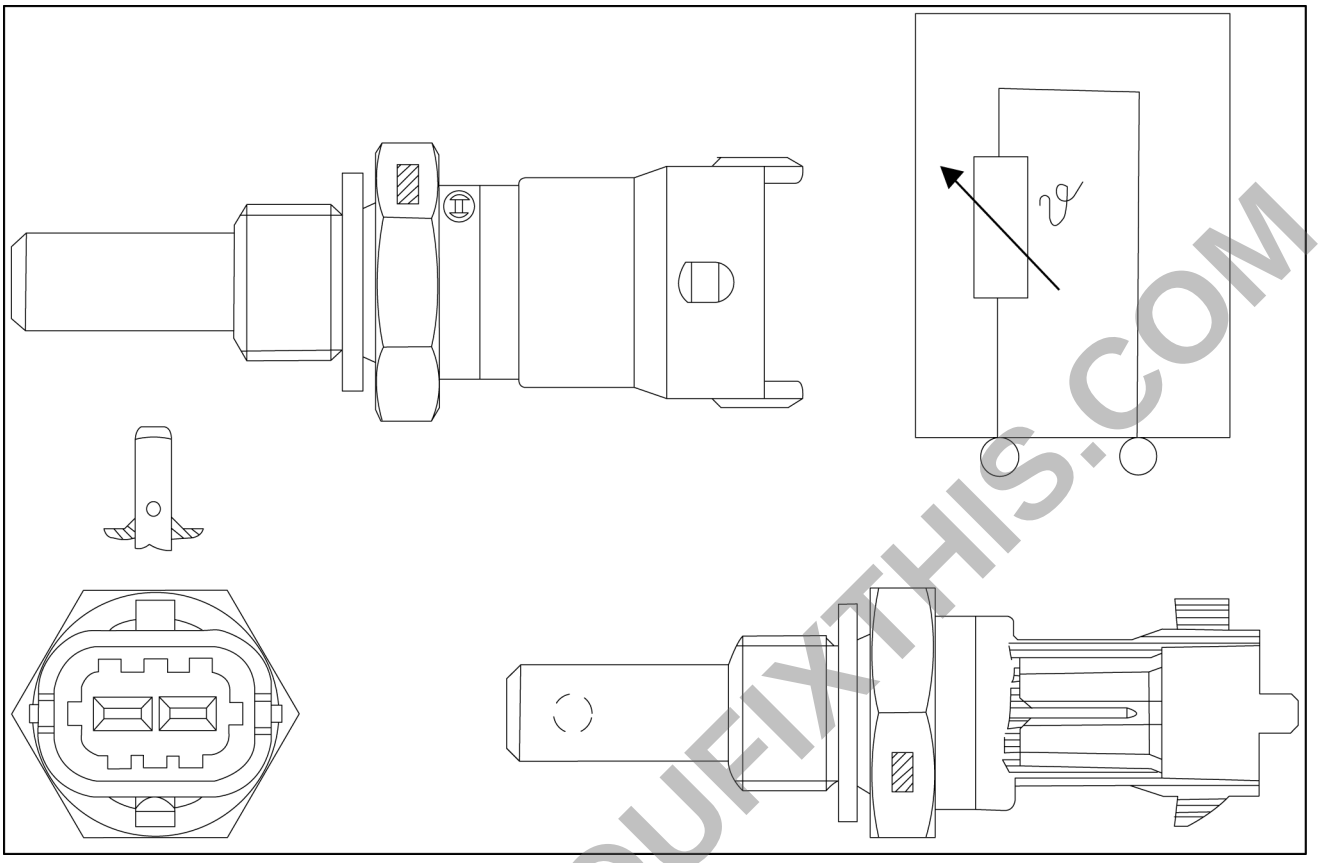


NHIL13ENG0958AA 1

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Fuel temperature sensor - Technical Data



NHIL13ENG1022FA 1

Specifications	
Manufacturer	Bosch
Tightening torque	**35 N·m** (**26 lb ft**)

Resistance chart

Temperature	Resistance (minimum)	Resistance (maximum)
-40 °C (**-40 °F**)	**40490 Ω**	**50136 Ω**
-30 °C (**-22 °F**)	**23580 Ω**	**28647 Ω**
-20 °C (**-4 °F**)	**14096 Ω**	**16827 Ω**
-10 °C (**14 °F**)	**8642 Ω**	**10152 Ω**
0 °C (**32 °F**)	**5466 Ω**	**6326 Ω**
10 °C (**50 °F**)	**3542 Ω**	**4043 Ω**
20 °C (**68 °F**)	**2351 Ω**	**2649 Ω**
25 °C (**77 °F**)	**1941 Ω**	**2173 Ω**
30 °C (**86 °F**)	**1615 Ω**	**1798 Ω**
40 °C (**104 °F**)	**1118 Ω**	**1231 Ω**
50 °C (**122 °F**)	**798 Ω**	**870 Ω**
60 °C (**140 °F**)	**573 Ω**	**618 Ω**
70 °C (**158 °F**)	**421 Ω**	**451 Ω**
80 °C (**176 °F**)	**313 Ω**	**332 Ω**
90 °C (**194 °F**)	**237 Ω**	**250 Ω**
100 °C (**212 °F**)	**182 Ω**	**191 Ω**
110 °C (**230 °F**)	**140 Ω**	**148 Ω**
120 °C (**248 °F**)	**109 Ω**	**116 Ω**
130 °C (**266 °F**)	**86 Ω**	**93 Ω**

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