# SERVICE MANUAL

## F6AFL413A*U001

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# INTRODUCTION

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## INTRODUCTION

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# Safety rules Warnings and safety requirements [113508627 - V1 - 07 March 2025]

## 1) Danger to persons. Warnings - safety instructions for the operator and maintenance personnel

The main sources of risk to the health and safety of the operator and maintenance personnel are related to: the environment in which the "finished" machine operates, the temperatures reached by the engine surfaces, the engine liquid/fluids, the toxicity of the liquid/fluids and the exhalation of exhaust gases.

There are also possible sources of risk: the presence of guards and surfaces with sharp edges, the use of solvents and cleaning powders, the high pressure of liquids/fluids in the engine circuits, the methods used for handling the engine and components.

It is therefore essential to observe the following safety instructions.

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|---|---|
| | Risk of injury:<br>Use designated PPE (gloves, safety shoes, glasses, etc.)<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Risk of injury:<br>Use suitable clothing, preferably tight-fitting; do not wear chains, rings, etc.<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Risk of intoxication or poisoning<br>Make sure that no combustible vapours or gasses are present in the area in which the engine is to operate.<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Risk of intoxication or poisoning<br>Do not breathe fumes from liquids, fluids and solvents. Do not breathe in engine exhaust fumes.<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Risk of burns<br>The engine and the exhaust heat up during operation. Before working on the inside of the engine compartment, and to prevent the risk of burns, open the engine compartment and let the components cool down to a temperature which allows them to be touched.<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Risk of injury:<br>Avoid contact with liquids and fluids when the engine is hot: risk of burns.<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Risk of injury:<br>All flammable fluids and liquids must be handled with care according to the product safety data sheets.<br>In case of accidental contact, consult product safety data sheets.<br>Store fluids and liquids in containers that comply with regulations.<br>Failure to comply with these prescriptions can result in the risk of serious injury. |

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| | Risk of injury:<br>The engine oil is highly pollutant and harmful. In case of contact with the skin, wash thoroughly with soap and water. Protect skin and eyes appropriately; work in accordance with accident prevention regulations.<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Fire risk<br>Pay close attention to glowing parts and guards with warning pictograms.<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Fire risk!<br>Fire hazard: pay careful attention to flammable liquids, dusts and vapours.<br>Failure to comply could result in death or serious injury. |
| | Risk of explosion<br>Engine with CNG - LNG fuel systems: make the fuel system safe (LOTO) before working on it; accidental leakage of gas from the system can cause it to explode.<br>Failure to comply could result in death or serious injury. |
| | Risk of injury:<br>During maintenance work on the engine, pay careful attention to sharp parts and/or edges and/or surfaces such as guards, heat shields (if present)<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Risk of injury:<br>Due to the high pressure in the pipes which go from the high pressure pump to the rail and from the rail to the electro-injectors, do not under any circumstances:<br>- disconnect the pipes with the engine running;<br>- reuse the disassembled pipes.<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Risk of injury:<br>When the engine is hot, the pressure inside the cooling circuit can be such that it may expel the hot liquid in an extremely violent manner with the risk of burns. Only open the refill plug of the coolant tank when the engine is cold.<br>Failure to comply with these prescriptions can result in the risk of serious injury. |
| | Risk of injury when lifting and carrying heavy loads!<br>Use suitable lifting equipment and load securing devices.<br>Failure to comply could result in death or serious injury. |
| | Risk of injury and accidents in the case of improper use!<br>Observe the maintenance instructions. If in any doubt, contact the Service Network before proceeding.<br>Failure to comply could result in death or serious injury. |

## 2) Risk of serious damage to the engine. Warnings - requirements for the correct use and maintenance of the engine

The main warnings - instructions to be followed when working on the engine in order to correctly carry out component replacement and/or engine maintenance operations are provided.

Compliance with the following instructions will protect the engine from potential damage.

| | |
|---|---|
| | General prescriptions<br>For correct engine operation, only use recommended oils or oils with the required characteristics. In the case of refilling, do not mix oils with different characteristics. Failure to observe these indications will void the guarantee.<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |
| | General prescriptions<br>Before pressure washing mechanical parts, protect electrical connectors and any control units. Do not use excessive washing pressures < 2 bar, keep the lance more than 20 cm away from the engine.<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |
| | General prescriptions<br>Extraordinary maintenance operations are the only to be carried out by qualified personnel with the appropriate technical knowledge and equipped with suitable working and protection means. All the technical instructions are provided in the FPT repair and technical manuals.<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |
| | General prescriptions<br>Worn, damaged or consumable parts must be replaced with original FPT parts.<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |
| | General prescriptions<br>Always keep the work area clean during workshop operations; immediately clean the surfaces of the work area from any liquids, fluids or oils which may have leaked.<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |
| | General prescriptions<br>Before working on the electrical system, disconnect the batteries from the system. Disconnect the ground cable and then the positive cable. The order must be reversed when connecting the batteries. Do not reverse the polarity of the cables on the battery; it can cause irreparable damage to control units.<br>Failure to observe the indications provided could cause damage to the engine. |
| | General prescriptions<br>Do not start the engine with quick charger power packs.<br>Disconnect the battery from the electrical system before charging.<br>Failure to observe the indications provided could cause damage to the engine. |
| | General prescriptions<br>Do not utilize fast screw tightening tools.<br>Failure to observe the indications provided could cause damage to the engine. |

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| | General prescriptions<br>The forced regeneration of the exhaust gas post-treatment device is a procedure which must always be carried out by Service Centres and can only be activated via a diagnostics tool.<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |
| | General prescriptions<br>The components of the common rail system will be quickly damaged if the fuel contains water or other impurities. Immediately carry out the operation on the pre-filter to drain the water in the supply circuit.<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |
| | General prescriptions<br>Replace the auxiliary belt if abrasions, cracks or tears, oil or fuel soiling can be seen<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |
| | General prescriptions<br>Make sure that the oil dipstick is fully inserted and that the oil filler cap is fully tightened in a clockwise direction.<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |
| | Maintenance not carried out correctly!<br>In order to maintain the efficiency of the all parts of the engine during use, the specifications indicated in this preventive maintenance plan and the relevant replacement procedures must be carried out punctually.<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |
| | General prescriptions<br>If the installation of mechanical or electromechanical optionals is required, always refer to the "FPT Installation Guide" documents.<br>Failure to observe the indications provided could cause damage to the engine and its electrical architecture. |
| | General risk, general prescriptions<br>The engine must not be started up and used unless it meets the safety requirements for the machine on which it is mounted and before it has been ascertained that it complies with local standards and regulations.<br>Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty. |
| | General risk, general prescriptions<br>The engine must not be started up and used unless it meets the safety requirements for the machine on which it is mounted and before it has been ascertained that it complies with local standards and regulations.<br>Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty. |
| | General risk, general prescriptions<br>Engines must only be used for the applications declared by the manufacturer<br>Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty |

## Warnings - specific instructions for marine applications

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| | General prescriptions<br>Each time the engine is started, check that the sea water intake valve is open. Dry operation of the sea water pump causes irreversible damage to the internal impeller within just a few seconds.<br>Non-compliance, full or partial, with these specifications may entail the risk of serious engine damage and may also, at times, invalidate the warranty. |

## 3) Generic risk. Warnings - safety instructions for the operator and maintenance personnel and for correct engine maintenance

The main warnings - instructions to be observed when working on the engine are provided in order to carry out maintenance operations on the engine correctly, to avoid potential dangerous situations for the operator and maintenance personnel.

Compliance with the following instructions will also protect the engine from potential damage.

| | |
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| | General risk, general prescriptions<br>Maintenance checks and interventions must be carried out with the engine switched off, unless specifically indicated by the type of check or intervention. Becoming familiar with some simple control and verification procedures is very important.<br>Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle. |
| | Risk of injury and accidents in the case of improper use!<br>Observe the maintenance instructions. If in any doubt, contact the Service Network before proceeding.<br>Failure to comply could result in death or serious injury. |
| | General prescriptions<br>Any intervention on the systems and any maintenance operations must be carried out by authorized technicians.<br>The equipment and tools used for fine-tuning, maintenance or repair work must be approved by the manufacturer.<br>Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle. |
| | General prescriptions<br>Before proceeding with any work on the engine, operation or maintenance, carefully read the technical service documentation, owner's manual and repair manual of both the engine and the complete vehicle to learn all the functional and necessary notions for repairs<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | General prescriptions<br>All flammable fluids and liquids must be handled with care according to the product safety data sheets.<br>Store fluids and liquids in containers that comply with regulations.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | Fire risk<br>Do not smoke or light open flames near batteries, flammable liquids and fluids.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |

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| | General prescriptions<br>Use the specific and general tools according to the specifications of the respective user and maintenance manuals. Check the state of wear and the suitability of the tools which are not subject to periodical checks.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | General prescriptions<br>Handling of components during maintenance work must be assessed in advance in order to choose the best solution to be adopted according to weight, shape-volume and position<br>Failure to observe this indication could lead to serious risks to health and damage to the engine - component. |
| | General specifications (handling of components «> 25kg»)<br>When lifting using a crane or hoist, pay careful attention to the affixing points. The items attached must be cantilevered. Furthermore, the affixing point must be firm, to prevent structural yield during the lifting stages.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | General specifications (engine lifting accessories)<br>Lifting the engine by means of cranes or hoists must only be carried out using the engine lifting accessories on the engine. Use hoists or cranes with a lifting capacity appropriate to the weight of the engine. Do not stand under the manoeuvring area during handling<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | General prescriptions<br>Use only the specific equipment listed in the repair manual and standard equipment that complies with regulations.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | General specifications – engine stop<br>In emergency situations, if present, switch off the engine using the emergency stop button. Before working on the engine, wait for the surfaces to cool down.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | General prescriptions<br>Always carry out interventions with the engine stopped; if special circumstances require maintenance with the engine running, consider all the risks involved before proceeding. Pay close attention to moving parts.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | Risk of injury:<br>Make sure that the guards of moving parts are correctly positioned and pay attention to the warning pictograms on the engine.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | General prescriptions<br>Pay close attention to the adhesive safety labels on the engine.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | General prescriptions<br>The safety guards should only be removed when the engine is switched off and must always be reset correctly at the end of the operation before starting the engine.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |

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| | General prescriptions<br>Maintenance procedures requiring engine start-up, for example during the forced regeneration procedure of ATS systems.<br>The guards present on moving parts must be properly secured; wear sound-proof headphones.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | General risk, general prescriptions<br>Always keep the engine clean; remove oil, fuel and coolant stains.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | General risk, general prescriptions<br>Do not leave external objects on the engine.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |

## Warnings - safety and operating instructions related to the engine application

Depending on the application, potentially dangerous conditions such as unexpected engine start-up may occur. Before proceeding with engine operations, it is always necessary to ensure that these potential hazards cannot occur. The specifications and functional descriptions in the operating and maintenance manual of the complete machine must be observed.

Affix appropriate signs to the control station of the machine to indicate that the engine - machine is undergoing maintenance; use appropriate devices that inhibit accidental start-up of the engine.

The complete machine may have auxiliary devices such as emergency switches/emergency buttons; these are to be used in the event of an emergency.

When the engine is warm and in specific engine - machine assembly conditions, the belt pulleys of the auxiliary organs can rotate.

It is therefore essential to adhere to the following safety instructions

| | |
|---|---|
| | General specifications – engine stop<br>In emergency situations, if present, switch off the engine using the emergency stop button. Before working on the engine, wait for the surfaces to cool down.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |
| | Risk of injury:<br>Always operate with a cold engine in order to prevent electromechanical engine components from activating suddenly due to the temperatures reached by the engine. |
| | General risk, general prescriptions<br>The work required to ensure the best possible use and preservation of the engine must only be assigned to personnel with proven competence and equipped with tools whose suitability is recognised by FPT.<br>Failure to observe this indication could lead to serious personal injury and damage to the engine. |

## Gen-set applications - Warnings - specific instructions

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| | General prescriptions<br>The conditions which cause the emergency generator assembly to start may occur unexpectedly. Always pay careful attention to the safety precautions indicated by the Manufacturer of the assembly and the generator Bodybuilder to ensure the maximum safety of the maintenance technicians<br>Failure to observe this indication could cause serious personal injury. |

## 4) Safeguarding the environment. Warnings - requirements to safeguard the environment

The main warnings - instructions for environmental protection are given.

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| | Disposal of liquids<br>Arrange containers to recover the coolant, diesel and oil from the power steering and fan control hydraulic systems.<br>Correct behavior will ensure that vehicle is used as environmentally friendly as possible. |
| | General risk, general prescriptions<br>Dispose of consumables in accordance with the law, for example: filters, fluids and any rags - paper rags soaked in liquids and fluids. FPT Service Network workshops are equipped for this.<br>Correct behavior will ensure that vehicle is used as environmentally friendly as possible. |
| | General prescriptions<br>Rags soaked in flammable liquids must be replaced in containers which are suitable and comply with current legislation.<br>Correct behavior will ensure that vehicle is used as environmentally friendly as possible. |

# Torque - Engine [113469145 - V1 - 07 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Crankshaft main bearing caps | 10 screws M12 x 1.5 x 120 | Step 1 — Pre-tightening | **50 +/- 6 N·m** |
| | | Step 2 — Tighten | **80 +/- 6 N·m** |
| | | Step 3 — Angle tightening | **90°** |
| Crankshaft connecting rod caps | 8 screws M8 x 1 | Step 1 — Tighten | **20 +/- 1 N·m** |
| | | Step 2 — Angle tightening | **60°** |
| Camshaft longitudinal retaining plate | 2 screws M8 x 1.25 x 18 | | **23 +/- 2.3 N·m** |
| Timing gear | 6 screws M8 x 1.25 x 20 | | **34 +/- 3.4 N·m** |
| Timing gearbox | | 13 screws M8 x 1.25 x 25 | **23 +/- 2.3 N·m** |
| | | 13 screws M8 x 1.25 x 35 | **23 +/- 2.3 N·m** |
| Engine flywheel housing | | 9 screws M12 x 1.75 x 40 | **110 +/- 11 N·m** |
| | | 2 screws M8 x 1.25 x 40 | **35 +/- 3.5 N·m** |
| Lower crankcase | | 8 screws M10 x 1.5 x 130 | **67 +/- 6.7 N·m** |
| | | 4 screws M12 x 1.75 x 130 | **118 +/- 11.8 N·m** |
| Lifting eyelets | 2 screws M10 x 1.5 x 125 | | **67 +/- 6.7 N·m** |
| Lifting eyelets | 2 screws M10 x 1.5 x 25 | | **67 +/- 6.7 N·m** |
| Oil pressure regulator valve | 1 screw M8 x 1.25 x 36 | | **33 +/- 3.3 N·m** |
| Oil pump | 3 screws M8 x 1.25 x 3 | | **33 +/- 3.3 N·m** |
| Suction strainer | 2 screws M8 x 1.25 x 14 | | **23 +/- 2.3 N·m** |
| Suction strainer | 1 screw M6 x 1 x 12 | | **10 +/- 1 N·m** |
| Oil sump | 14 screws M8 x 1.25 x 16 | | **23 +/- 2.3 N N·m** |
| Oil sump | 4 screws M10 x1.5x130 | | **67 +/- 6.7 N·m** |
| Lubricant oil drain plug in the sump | 2 caps M22 x 1.5 x 12 | | **50 +/- 5 N·m** |
| Cylinder head | 4 screws M12 x 1.5 x 165 | Step 1 — | **65 +/- 3.25 N·m** |
| | | Step 2 — Angle tightening | **90°** |
| | | Step 3 — Angle tightening | **60°** |
| Cylinder head | 6 screws M15 x 1.5 x 193 | Step 1 — | **130 +/- 6.5 N·m** |
| | | Step 2 — Angle tightening | **90°** |
| | | Step 3 — Angle tightening | **90°** |
| Cylinder head | 6 screws M8 x 1.25 x 117 | | **34 +/- 3.4 N·m** |
| Cylinder head plugs | 1 plug — | | **75 +/- 7.5 N·m** |
| Electro-injector brackets | 4 nuts M8 x 1.25 | | **18 +/- 1.8 N·m** |
| Electro-injector brackets | 4 studs M8 x 1.25 x 65 | | **28 +/- 1.4 N·m** |
| Rocker arm unit | 12 screws M6 x 1 x 75 | | **10 +/- 1 N·m** |
| Head cover | 10 screws M6 x1 x 40 | | **10 +/- 1 N·m** |
| Overhead | | 8 screws M6 x 1 x 20 | **10 +/- 1 N·m** |
| Intake manifold | | 14 screws M6 x 1 x 20 | **10 +/- 1 N·m** |
| | | 4 caps M12 x 1.5 | **20 +/- 2 N·m** |
| Engine air vent | | 3 nuts M6 x1 | **10 N·m** (**89 lb in**) |
| | | 1 screw M6 x 1 x 80 | **10 N·m** (**89 lb in**) |
| | | 1 screw M8 x 1.25 | **23 N·m** (**204 lb in**) |
| Common Rail | 2 screws M8 x 1.25 x 55 | | **23 +/- 2.3 N·m** |
| Fuel delivery pipes to the electro-injectors | 4 rail-side couplings M14 x 1.5 | | **35 +/- 1.75 N·m** |
| Fuel delivery pipes to the electro-injectors | 4 injector-side couplings M12 x 1.5 | | **25 +/- 1.25 N·m** |
| Delivery fuel pipe from the pump to the rail | | 1 high pressure fuel pump-side coupling M16 x 1 | **45 +/- 2.25 N·m** |
| | | 1 rail-side coupling M14 x 1.5 | **35 +/- 1.75 N·m** |

| Description | Quantity | Step | Value |
|---|---|---|---|
| Bracket retaining the delivery fuel pipe from the pump to the rail | 3 screws M6 x 1 x 10 | | **10 +/- 1 N·m** |
| Bracket retaining the fuel return pump from the rail and from the high pressure pump | | 1 screw M6 x 1 x 16 | **10 +/- 1 N·m** |
| Injector fuel return pipe brackets | | screw M8 x 1.25 x 18 | **23 +/- 2.3 N·m** |
| Control socket coupling | M12 x 1.5 | | **14 +/- 1.4 N·m** |
| Fuel pipe fittings between the pump and filter | M10 x 1.5 x 18 | | **25 +/- 2.5 N·m** |
| Control socket lubrication pipe | | 1 screw M12 x 1.5 | **40 +/- 4 N·m** |
| | | 1 fitting M14 x 1.5 | **40 +/- 4 N·m** |
| Socket for the service air compressor control | 2 screws M10 x 1.5 x 20 | | **45 +/- 4.5 N·m** |
| High pressure fuel pump | 3 nuts M8 x 1.25 | | **23 +/- 2.3 N·m** |
| High pressure fuel pump | 3 studs M8 x 1.25 x 12 | | **11 +/- 1.1 N·m** |
| High-pressure pump gear | 1 nut M18 x 1.5 | | **80 +/- 4 N·m** |
| High pressure fuel pump spacer | 4 screwsM6 x 1 x 16 | | **10 +/- 1 N·m** |
| Blow-by filter | | 7 screws M6 x 1 x 13 | **10 +/- 2 N·m** |
| Exhaust manifold | 9 studs M8 x 1.25 x 52 | | **11 +/- 3 N·m** |
| Exhaust manifold | 9 nuts M8 x 1.25 | Pre-tightening | **28 +/- 1.4 N·m** |
| | | Tighten | **23 +/- 2.3 N·m** |
| Thermostat cover | 3 screws M6 x 1 x 12 | | **10 +/- 1 N·m** |
| Crankshaft pulley | 7 screws M10 x 1.5 x 30 | | **70 +/- 7 N·m** |
| Fan pulley control mount | 4 screws M8 x 1.25 x 25 | | **23 +/- 2.3 N·m** |
| Fan control pulley | 4 screws M8 x 1.25 x 18 | | **23 +/- 2.3 N·m** |
| Engine coolant input pipe | | 3 screws M8 x 1.25 x 65 | **23 +/- 2.3 N·m** |
| | | 1 screw M8 x 1.25 x 14 | **25 +/- 2.5 N·m** |
| Alternator | | 1 screw M10 x 1.5 x 130 + 1 nut M10 x 1.5 | **45 +/- 4.5 N·m** |
| Belt adjusting screw | | 1 screw M8 x 1.25 | **20.5 +/- 2.5 N·m** |
| | | 1 nut M8 x 1.25 | **20.5 +/- 2.5 N·m** |
| Alternator tensioning bracket | | 2 screws M10 x 1.5 x 25 + 2 nuts M10 x 1.5 | **45 +/- 4.5 N·m** |
| Oil filter bracket | | 1 fitting M20 x 1.5 x 18 | **35 +/- 5 N·m** |
| | | 1 fitting (if present) M24 x 1.5 | **45 +/- 4.5 N·m** |
| | | 1 plug (if present) M27 x 2 | **18 +/- 2.5 N·m** |
| Oil filter | 1 cartridge M27 x 2 | | **18 +/- 2.5 N·m** |
| Lubricant return pipe from turbocharger | 2 screws M6 x 1 x 20 | | **10 +/- 1 N·m** |
| Lubricant oil return pipe from turbocharger bracket | 1 screw M6 x 1 x 10 | | **10 +/- 1 N·m** |
| Lubricant oil delivery pipe to turbocharger | | 1 screw M10 x 1 x 19 | **25 +/- 2.5 N·m** |
| | | 1 nut M14 x 1.5 | **35 +/- 3.5 N·m** |
| Turbocharger heat shield | | 2 screws M6 x 1 x 10 | **10 +/- 1 N·m** |
| | | 1 screw M8 x 1.2 5x 12 | **23 +/- 2.3 N·m** |
| Fuel filter mount - version without pre-filter | 4 screws M8 x 1.25 x 40 | | **23 +/- 2.3 N·m** |
| Fuel filter mount - version with pre-filter | 4 screws M8 x 1.25 x 20 | | **23 +/- 2.3 N·m** |
| Air bleeding on the fuel filter bracket | 1 screw M10 | | **4 +/- 0.5 N·m** |
| Fuel Pre-filter | cartridge — | | **20 +/- 3 N·m** |

| Description | Quantity | Step | Value |
|---|---|---|---|
| Fuel filter | 1 cartridge M20 x 1.5 | | **22 +/- 3 N·m** |
| Pre-heating glow plugs | 4 glow plugs M8 x 1 | | **9 +/- 1 N·m** |
| Glow plug harness mount | 3 screws M6 x 1 x 14 | | **10 +/- 1 N·m** |
| Crankshaft rpm sensor | 1 screw M6 x 1 x 16 | | **9 +/- 0.9 N·m** |
| Camshaft timing sensor | 1 screw M6 x 1 x 16 | | **9 +/- 0.9 N·m** |
| Air temperature and pressure sensor | 1 screw M6 x 1 x 16 | | **9 +/- 0.9 N·m** |
| Low engine oil pressure sensor | 1 sensor M14 x 1.5 | | **35 +/- 3.5 N·m** |
| Coolant temperature sensor | 1 sensor M12 x 15 | | **20 +/- 5 N·m** |
| Fuel temperature sensor | 1 sensor — | | **30 +/- 5 N·m** |
| Exhaust gas linkage pipe | 2 screws M12 x 1.5 x 24 | | **25 +/- 2.5 N·m** |
| Exhaust gas absolute pressure sensor | 1 sensor M14 x 1.5 | | **15 +/- 1.5 N·m** |
| Pressure sensor on rail RDS4.2 | 1 sensor M18 x 1.5 | | **70 +/- 5 N·m** |
| Overpressure valve on the rail PLV4-18 | 1 valve M20 x1.5 | | **100 +/- 5 N·m** |
| Engine cable fixing bracket | 3 screws M8 x 1.25 x 20 | | **23 +/- 2.3 N·m** |
| EGR valve | 2 screws M6 x 1 x 20 | | **10 +/- 1 N·m** |
| EGR heat exchanger | | 5 nuts M8 x 1.25 | **23 +/- 2.3 N·m** |
| | | 1 screw M6 x 1 x 14 | **10 +/- 1 N·m** |
| EGR heat exchanger | 5 studs M8 x 1.25 x 80 | | **23 +/- 2.3 N·m** |
| Pressure relief valve on rail | 1 coupling — | | **100 +/- 5 N·m** |
| Mixer exhaust gas pipe | | **1 V** clamp M10 | **25 +/- 2.5 N·m** |
| | | **1 V** clamp M10 | **7 +/- 0.7 N·m** |
| Balancing weights | 4 screws M8 x 1.25 x 90 | Step 1 — Pre-tightening | **20 +/- 6 N·m** |
| | | Step 2 — Tighten | **60°** |
| Water in fuel pre-filter presence sensor | 1 sensor M10 x 1.5 | | **1.85 +/- 0.65 N·m** |
| Exhaust gas temperature sensor | | 1 fitting M14 x 1.5 x 12 | **45 +/- 4.5 N·m** |
| | | 1 screw M6 x 1.5 x 12 | **10 +/- 1 N·m** |
| Turbocharger | | 3 nuts M10 x 1.5 x 10 | **28 +/- 1.5 N·m** |
| | | 3 studs M10 x 1.5 x 40 | **25 +/- 1.25 N·m** |
| Engine flywheel | 8 screws M12 x 1.75 x 42.5 | Step 1 — | **30 +/- 3 N·m** |
| | | Step 2 — | **90°** |
| Starter motor | 3 screws M10 x 1.5 | | **45 +/- 4.5 N·m** |

# Conversion factors [113413495 - V1 - 07 March 2025]

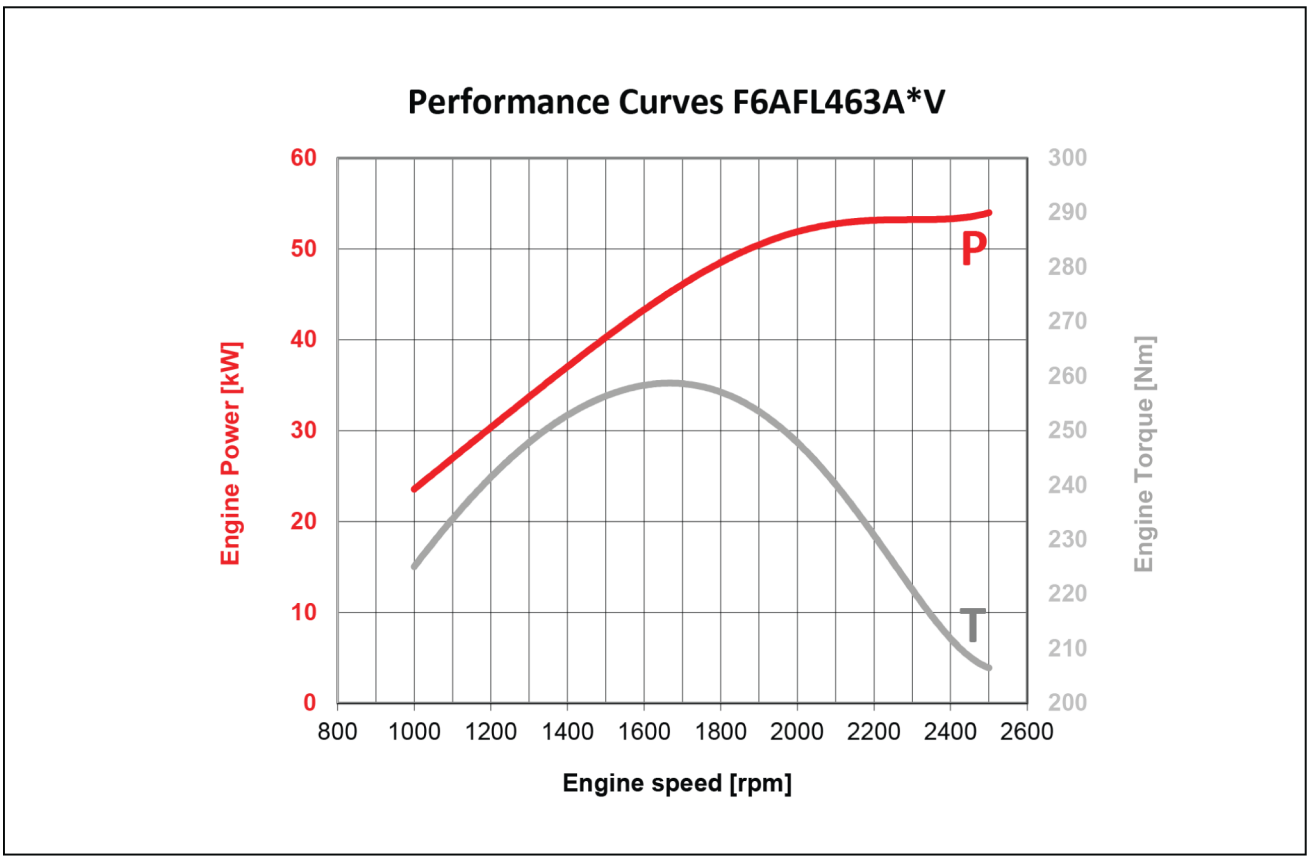
## Conversions between the main units of measurements of the international system and the most commonly used derived units

### Power

| Specifications |
|---|
| **Power** |
| 1 kW = 1.36 CV |
| **1.00 kW** (**1.36 hp**) |
| 1 CV = 0.736 kW |
| 1 CV = 0.986 Hp |
| **0.735 kW** (**1.000 hp**) |
| 1 Hp = 1.014 CV |
| **Torque** |
| 1 N·m = 0.102 kgm |
| 1 kgm = 9.81 N·m |
| **Rpm** |
| 1 rad/s = 1 RPM x 0.1047 |
| 1 RPM = 1 rad/s x 9.5493 |
| **Pressure** |
| 1 bar = 1,02 Kg/cm² |
| 1 Kg/cm² = 0,981 bar |
| **100.0 kPa** (**1.0 bar**) |
| Unless there is a specific need for accuracy:<br>• The unit Nm is converted into kgm for simplicity according to a ratio of 10:1<br>1 kgm = 10 N·m.<br>• The unit bar is converted into kg/cm2 for simplicity according to a ratio of 1:1<br>1 Kg/cm² = 1 bar. |
| **Temperature** |
| **0.0 °C** (**32.0 °F**) |
| **1.0 °C** (**33.8 °F**) |

# Power specification - Engine horse power characteristics curves [113469138 - V2 - 07 March 2025]

Maximum power **53.9 kW** (**73.3 hp**).

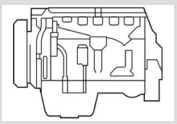
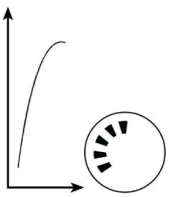
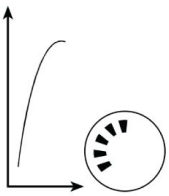


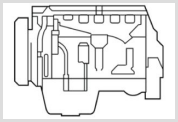
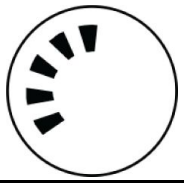
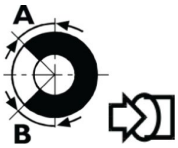
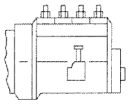
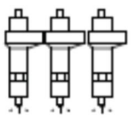
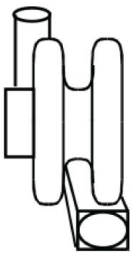

NHIL25ENG0008FA 1

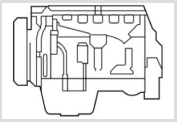
- Maximum POWER **53.9 kW** (**73.3 hp**) (73.3 CV) at **2500 RPM**
- Maximum TORQUE **260.00 N·m** (**191.77 lb ft**) **26.5 kgm** (**191.7 ftlbs.**) at **1800 RPM**

# General specification - Engine - Technical data [113469146 - V1 - 07 March 2025]

## General characteristics

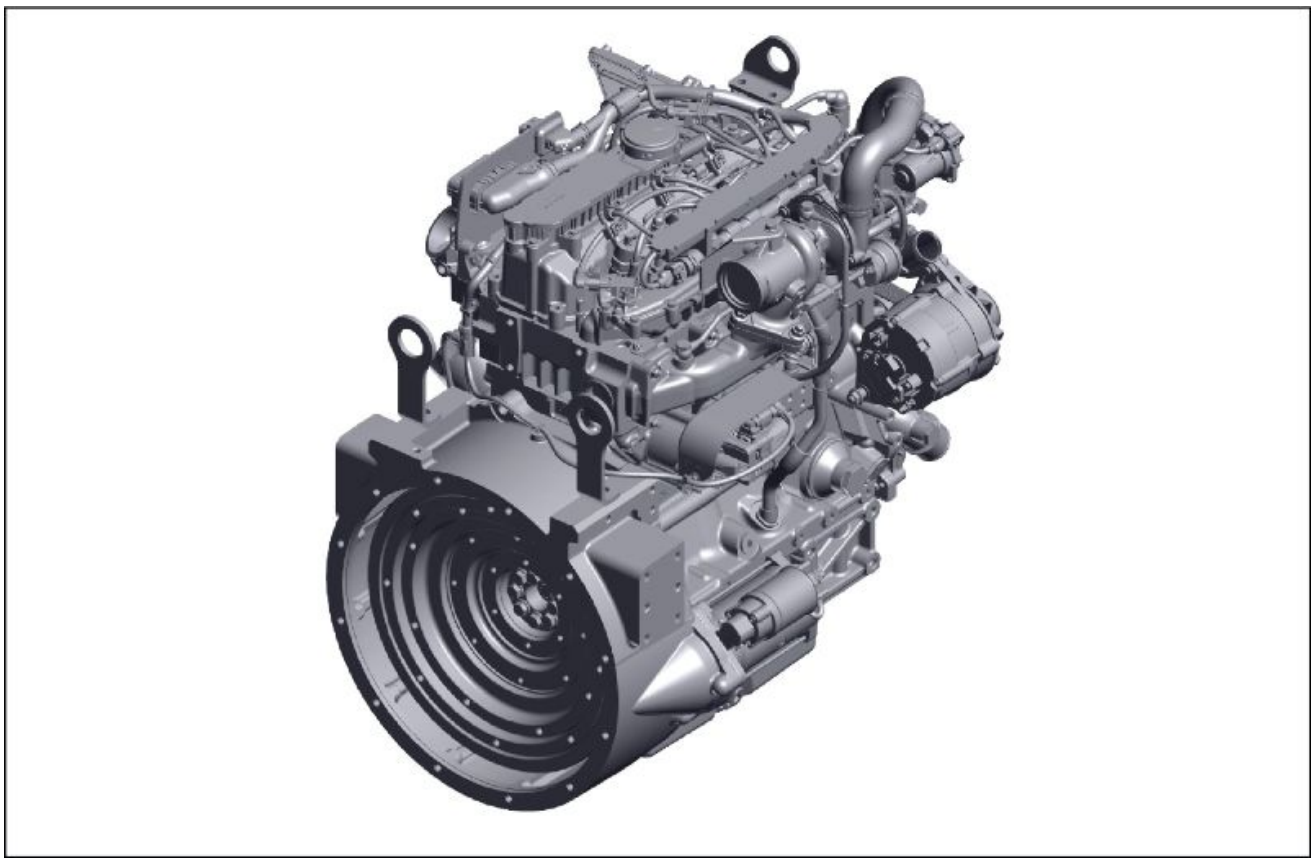
|  | **Type** | **F28ESVPN F6AFL463A*V** |
|---|---|---|
| | Cycle | 4-stroke diesel |
| | Fuel supply | Turbocharged |
| | Injection | Direct |
| | Number of cylinders | 4 in-line |
| | Bore | **90.8 mm** (**3.6 in**) |
| | Stroke | **108 mm** (**4 in**) |
| | Total displacement | **2797 cm³** (**171 in³**) |
| $\varrho$ | Compression ratio | 17:1 |
|  | Maximum power | **53.9 kW** (**73.3 hp**) ( 73.3 CV) **2500 RPM** |
|  | Max. torque | **260.0 N·m** (**2301.2 lb in**) ( **26.5 kgm** (**191.7 ftlbs.**)) **1800 RPM** |
| | Engine low idle speed | **800 +/- 100 RPM** |

|  | **Type** | **F28ESVPN F6AFL463A*V** |
|---|---|---|
|  | Maximum engine idle speed | **2650 +/- 100 RPM** |
|  | Timing gear | |
| | Start before TDC | A= **16°** |
| | End after BDC | B= **40°** |
| | Start before BDC | D= **67°** |
| | End after TDC | C= **28°** |
|  | Power supply | High pressure fuel feed electronic system type BOSCH MD1CS069–7.22. Consisting of BOSCH CP4.1 high pressure pump, injectors, BOSCH hydraulic accumulator (common rail) HFR-16 OHW, pressure and temperature sensors |
| | Injection system | BOSCH common rail system |
| | Electro-injectors type Nozzle type | CRI2.16 OHW PVDLLA 147 PV3 |
|  | Firing order | 1 - 3 - 4 - 2 |
| | Injection pressure | **1600 bar** (**23200 psi**) |
|  | Supercharging | Turbocharger |
| | Turbocharger type: | Wastegate (WGT) — TEL |
| | EGR | Outer |
| | Lubrication | Forced by gear pump, pressure relief valve, oil filter, heat exchanger with 5 elements |

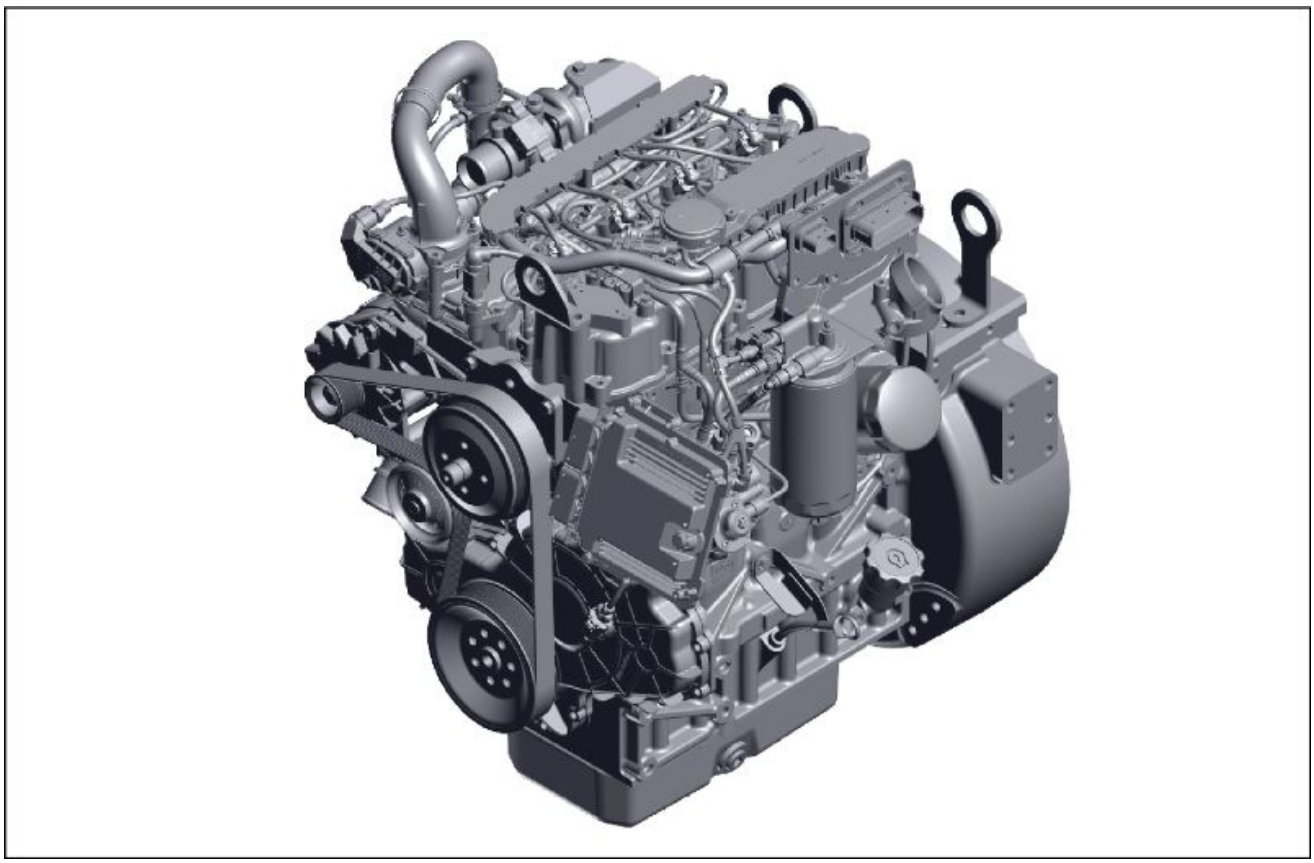
|  | **Type** | **F28ESVPN F6AFL463A*V** |
|---|---|---|
| | Oil pressure with engine warmed up **100 °C** (**212 °F**): | |
| | At idle speed | **3.7 +/- 0.5 bar @ 1400 RPM** |
| | At maximum speed | **3.7 +/- 0.5 bar @ 2300 RPM** |
| - | Cooling | By centrifugal pump, thermostat, radiator, heat exchanger, intercooler |
| | Water pump drive | Belt driven |
| | Thermostat | |
| | Start of opening: | **79 +/- 2 °C** |
| | Maximum opening | **94 °C** (**201 °F**) |
| | Refilling | |
| | Cooling circuit **(*) (1)** | **5.0 L** (**1.3 US gal**) |
| | Lubrication system **(*) (2)** | |
| | Total capacity (first filling) **(*) (2)** | 8.5 L ( 7.65 kg) |
| | Periodic replacement | |
| | Oil sump at minimum level | 5.5 L ( 4.95 kg ) |
| | Oil sump at maximum level | 8 L ( 7.2 kg ) |
| | Fuel tank | - |

**(*)** It is prohibited to mix fluids of different brands and origins in the circuit.
**(1)** The quantities refer to the engine in the standard configuration. The coolant must be compliant with standard ASTM D-6210.
**(2)** For oil specifications, refer to the oils table.

# Product overview - Engine [113474421 - V1 - 27 February 2025]



NHIL25ENG0088FA 1



NHIL25ENG0089FA 2

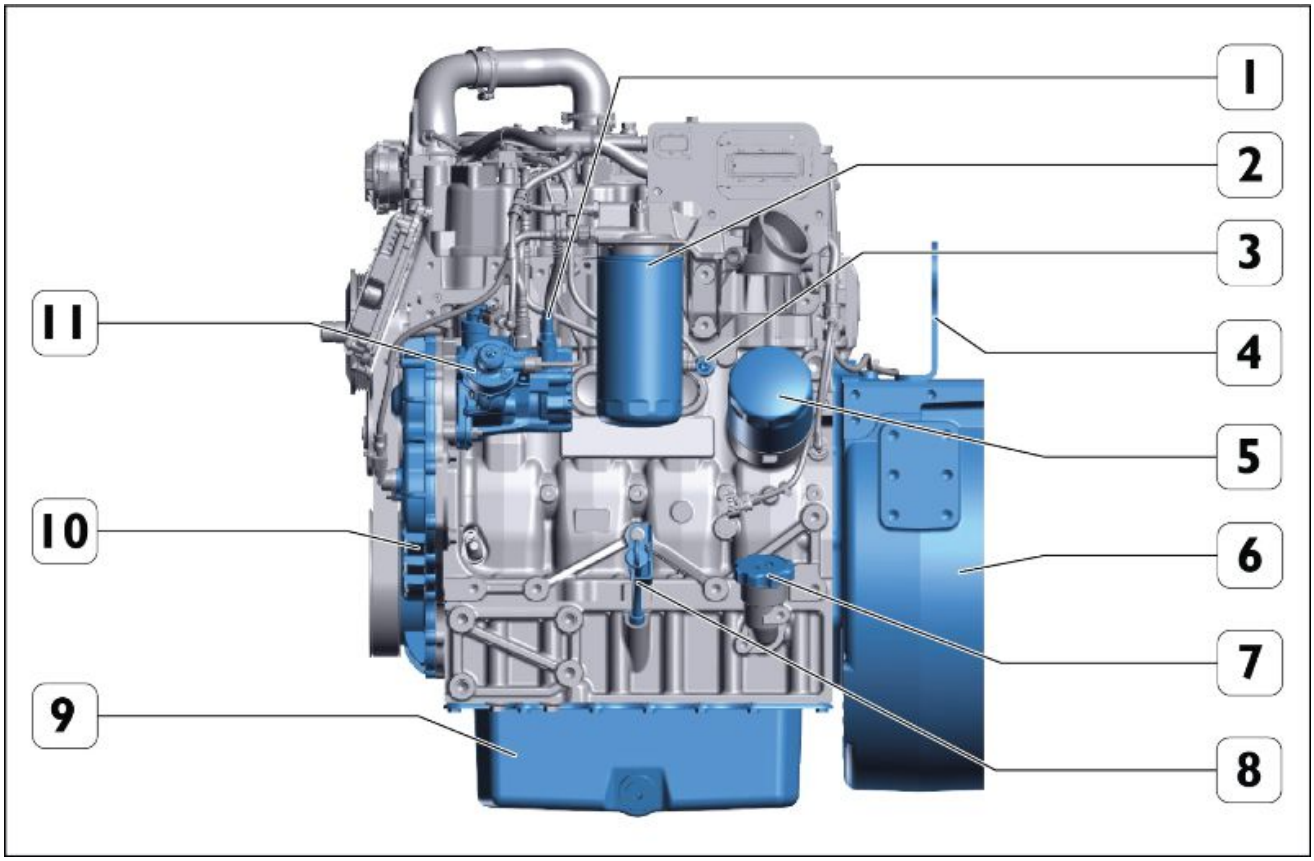
The F28ESVPN (F6AFL463A*V) is a 4-cylinder in-line turbo engine with 2 valves per cylinder; it belongs to the F28 series and operates according to a four-stroke diesel cycle.

The engine fuel system is electronically controlled and based on the direct injection of the fuel in the combustion chamber by means of a high-pressure pump and the common rail.

The intake and exhaust valves are timed with the camshaft tappets, the push rods and the rocker arm assembly.

# Product overview - Engine [113474423 - V1 - 06 March 2025]

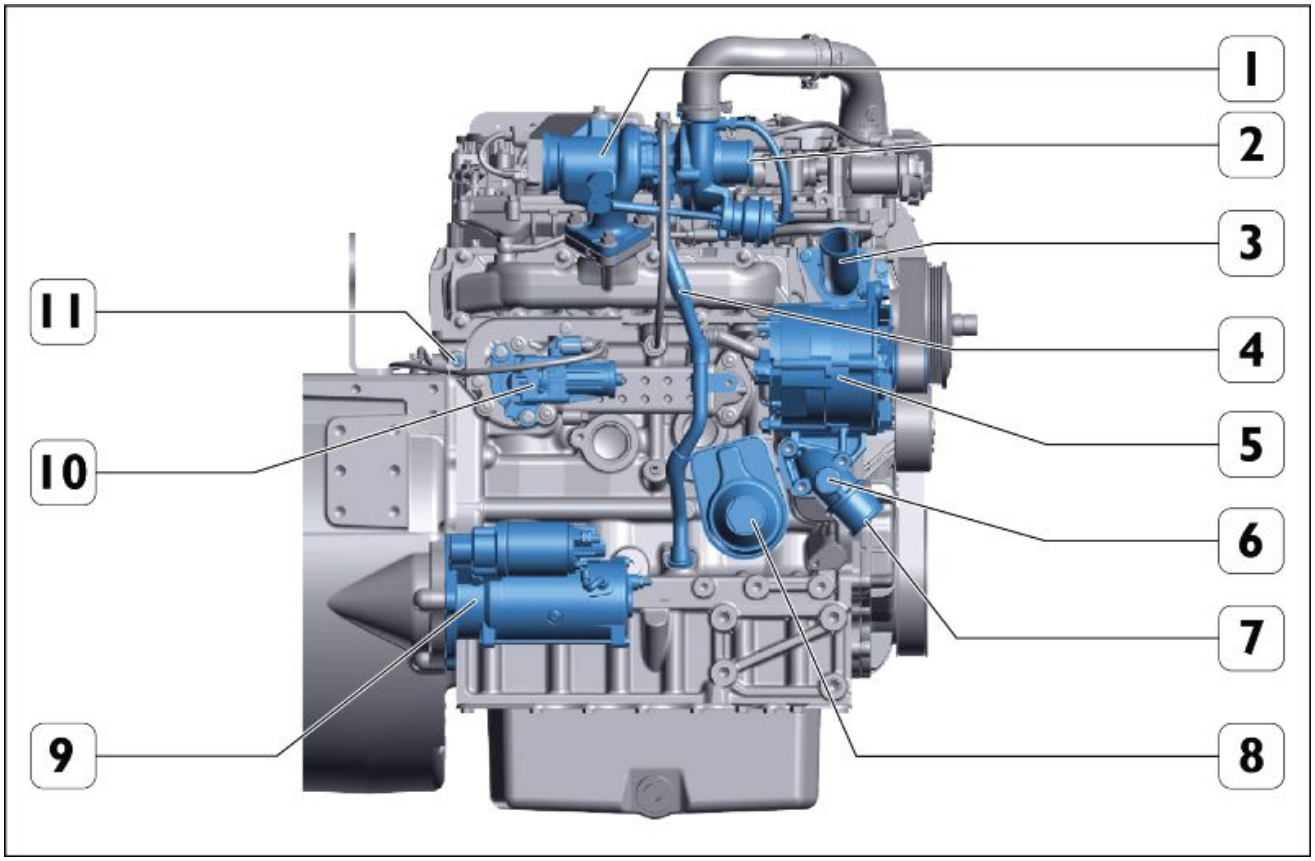
## LEFT SIDE VIEW




NHIL25ENG0090FA 1

| Item | Description |
|---|---|
| 1 | Fuel inlet |
| 2 | Fuel filter |
| 3 | Fuel outlet |
| 4 | Lifting eyelet |
| 5 | Oil filter |
| 6 | Engine flywheel housing |
| 7 | Oil filler spout |
| 8 | Oil dipstick |
| 9 | Oil sump |
| 10 | Timing gear cover |
| 11 | High pressure fuel pump |

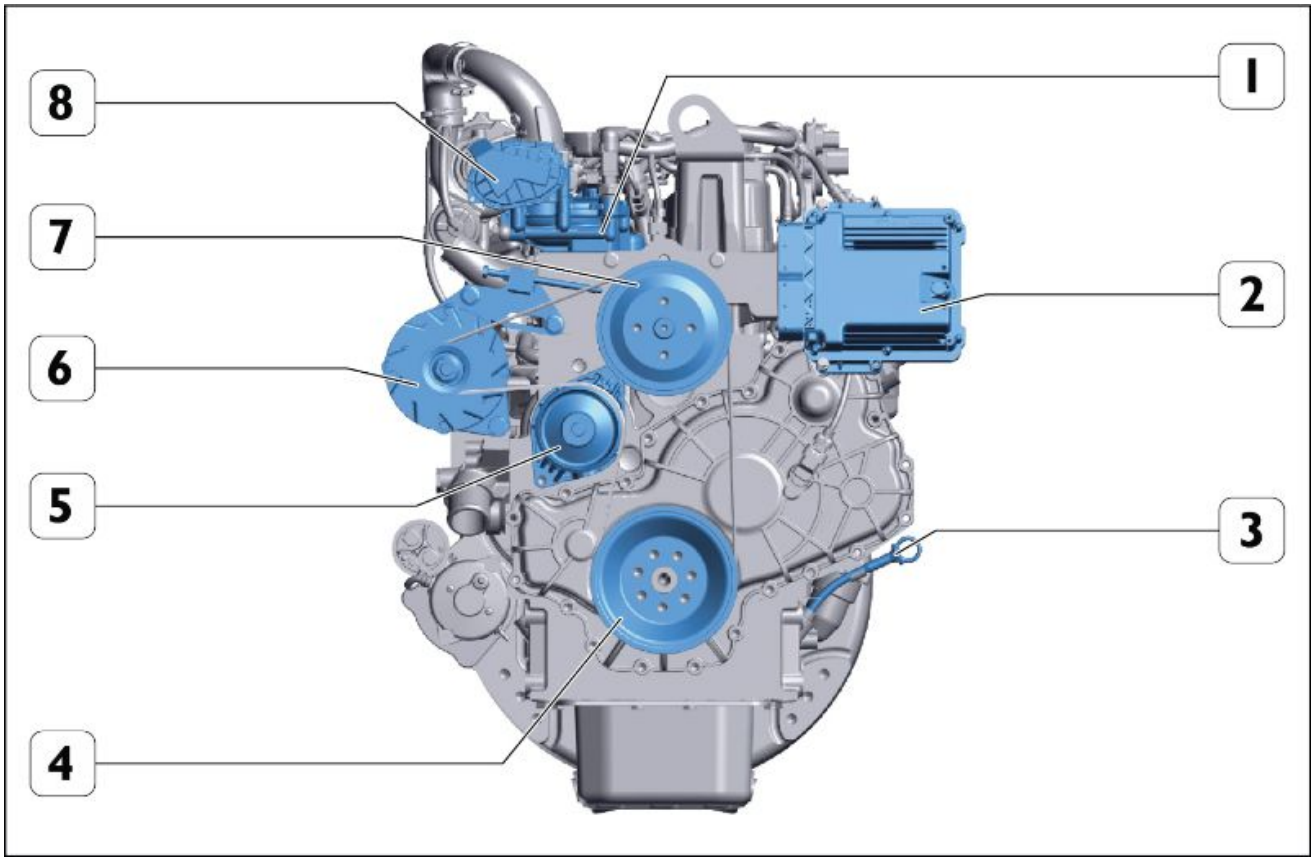
## RIGHT SIDE VIEW




NHIL25ENG0091FA 2

| Item | Description |
|---|---|
| 1 | Turbocharger |
| 2 | Turbocharger air inlet |
| 3 | Engine coolant output pipes |
| 4 | Lubricant return pipe from turbocharger |
| 5 | Alternator |
| 6 | Cab heating water inlet |
| 7 | Engine coolant inlet pipe |
| 8 | Engine oil cooler |
| 9 | Starter motor |
| 10 | EGR valve |
| 11 | ATS water passage |

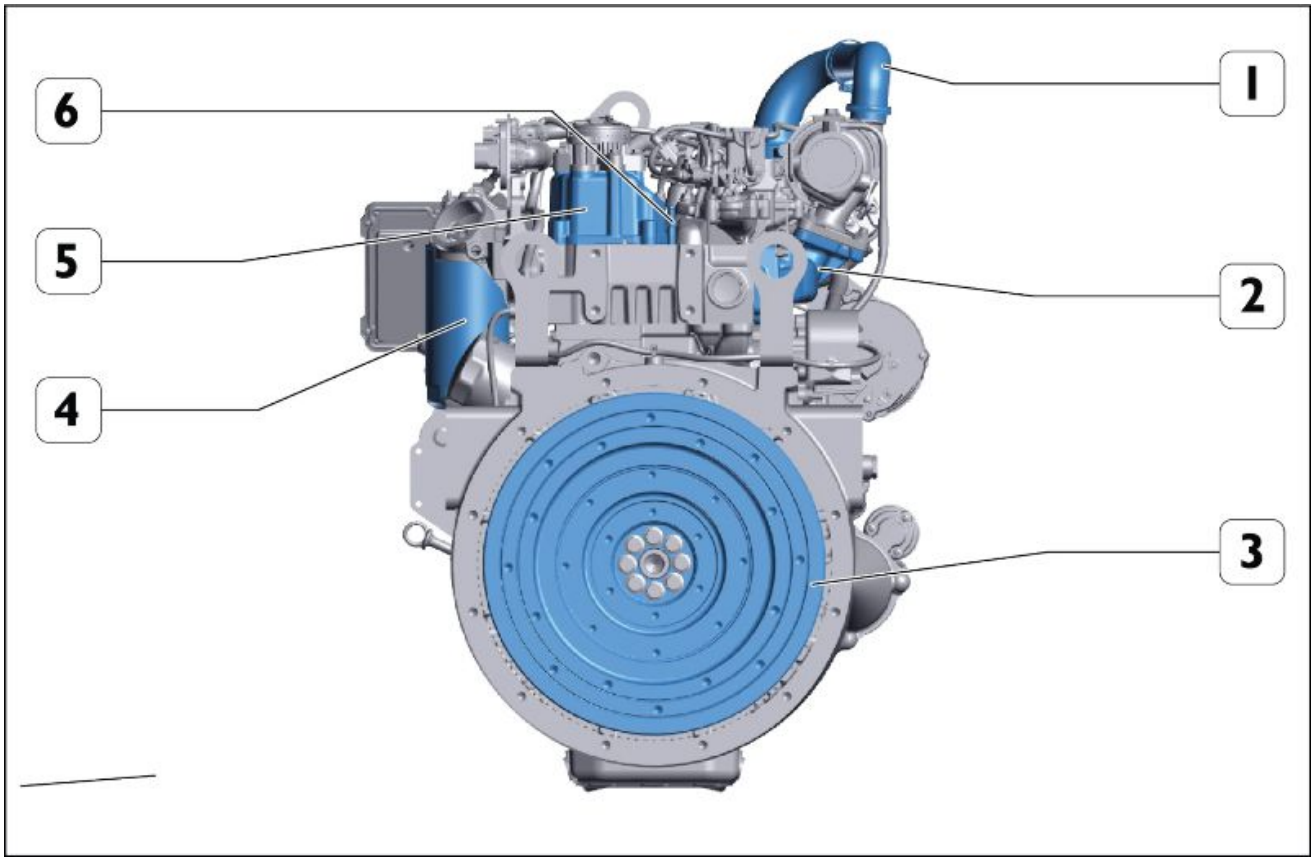
## FRONT SIDE VIEW




NHIL25ENG0092FA 3

| Item | Description |
|---|---|
| 1 | Intake manifold |
| 2 | Engine control unit |
| 3 | Engine oil dipstick |
| 4 | Crankshaft pulley |
| 5 | Water pump |
| 6 | Alternator |
| 7 | Fan drive pulley |
| 8 | Throttle body (TVA) |

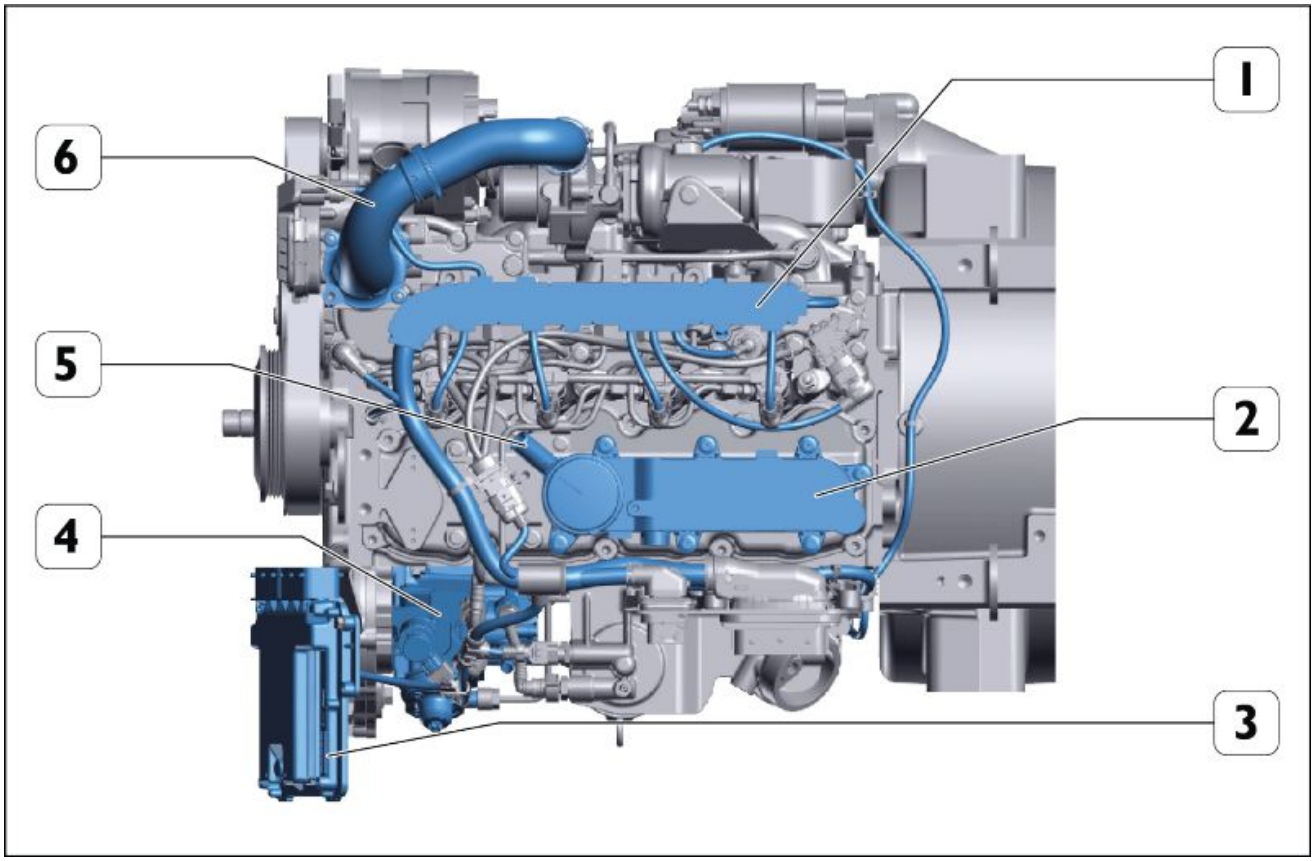
## REAR VIEW




NHIL25ENG0093FA 4

| Item | Description |
|---|---|
| 1 | Air inlet pipe |
| 2 | Exhaust manifold |
| 3 | Engine flywheel housing |
| 4 | Fuel filter |
| 5 | Tappet cover |
| 6 | Degassing pipe |

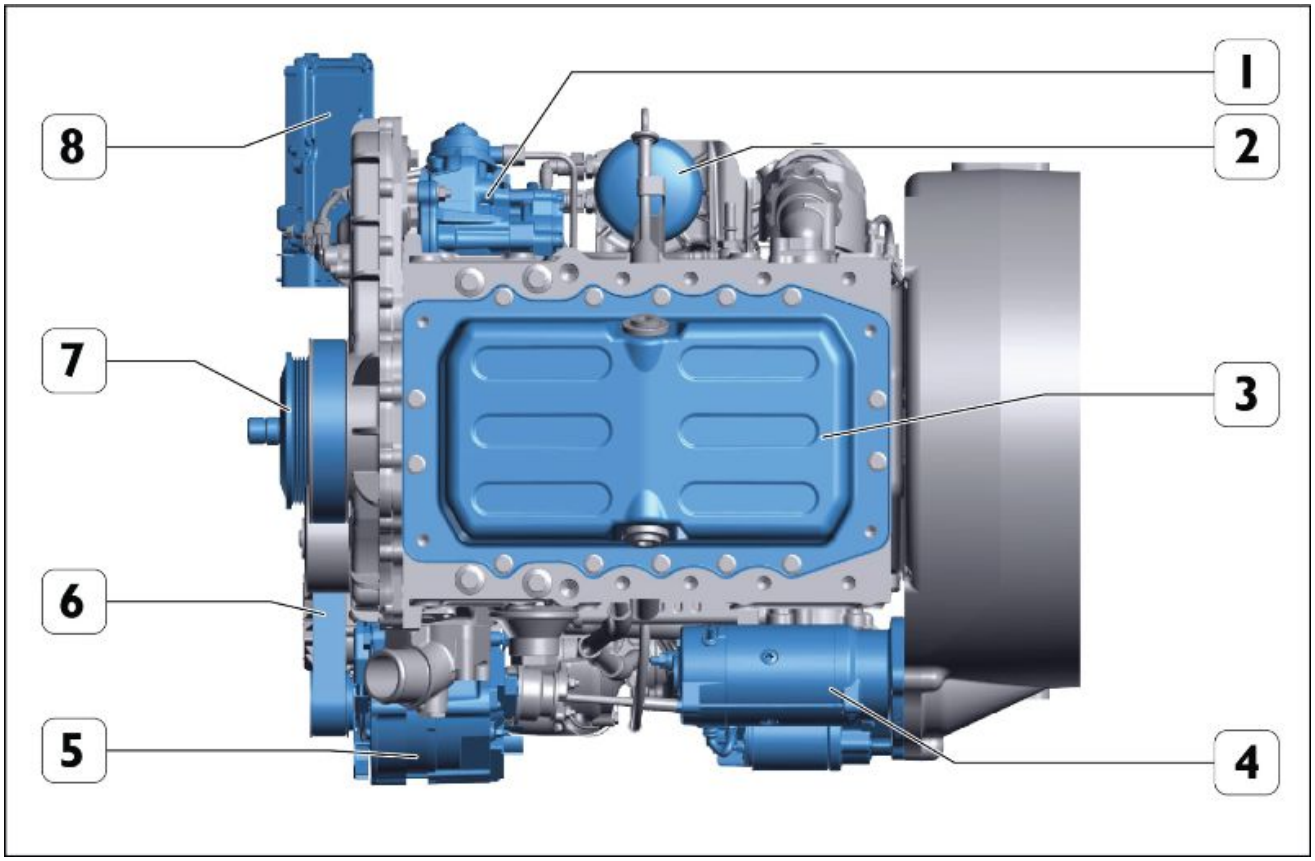
## TOP VIEW




NHIL25ENG0094FA 5

| Item | Description |
|---|---|
| 1 | Common rail |
| 2 | Blow-by filter unit |
| 3 | Engine control unit |
| 4 | High pressure fuel pump |
| 5 | Blow-By outlet |
| 6 | Air inlet pipe |

## VIEW FROM UNDERNEATH




NHIL25ENG0095FA 6

| Item | Description |
|---|---|
| 1 | High pressure fuel pump |
| 2 | Fuel filter |
| 3 | Oil sump |
| 4 | Starter motor |
| 5 | Alternator |
| 6 | Auxiliary assembly drive belt |
| 7 | Fan drive pulley |
| 8 | Engine control unit |

# SERVICE MANUAL

## Engine

### F6AFL413A*U001

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[10.210] Lift pump and lines ..... 10.8

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[10.250] Turbocharger and lines ..... 10.12

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[10.500] Selective Catalytic Reduction (SCR) exhaust treatment ..... 10.14

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[10.414] Fan and drive ..... 10.17

[10.304] Engine lubrication system ..... 10.18

# Engine - 10

## Engine and crankcase - 001

**F6AFL413A*U001**

# Contents

# Engine - 10

## Engine and crankcase - 001


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Install - Weight fastening screws . . . . . 25

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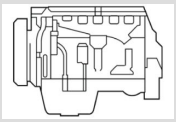
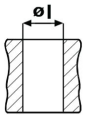
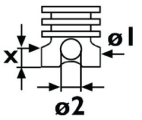
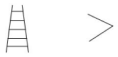
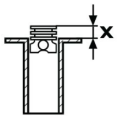
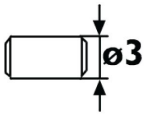
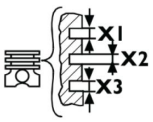
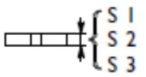
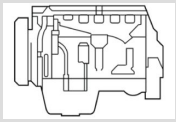
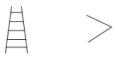
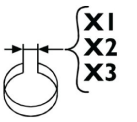
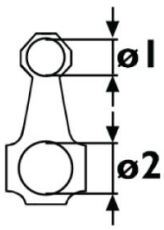
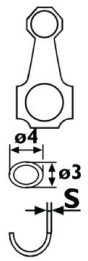
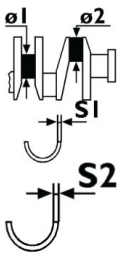
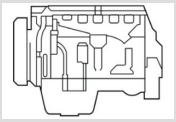
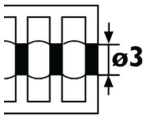
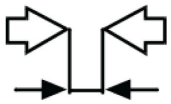
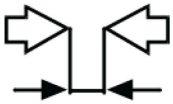
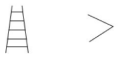
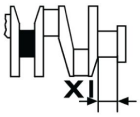
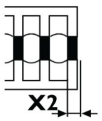
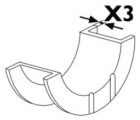
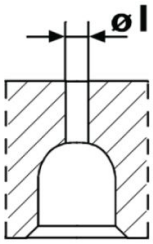
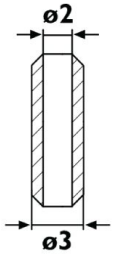
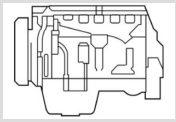
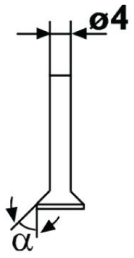
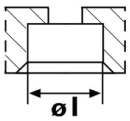
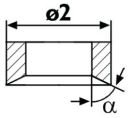
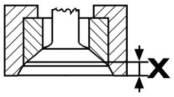
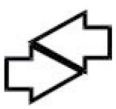
Assemble - Crankcase base . . . . . 28

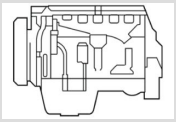
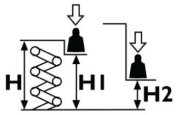
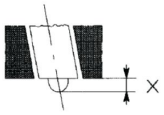
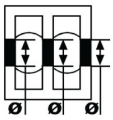
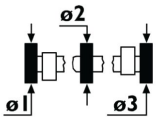
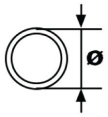
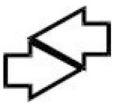
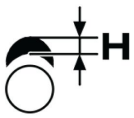
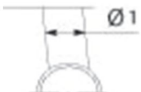
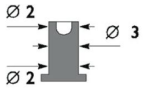
# Engine - Service limits - Technical data and installation clearances [113469141 - V1 - 27 February 2025]

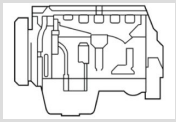
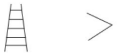
|  | Type | | F28ESVPN |
|---|---|---|---|
| Crank gear elements and cylinder assembly | | | |
|  | Cylinder liners: | Ø 1 | **90.800 – 90.820 mm** (**3.575 – 3.576 in**) |
| | > | Ø 1 | **0.40 mm** (**0.02 in**) |
|  | Pistons: | | |
| | Measuring dimension | X | **16.0 mm** (**0.6 in**) |
| | Outer diameter | Ø 1 | **90.706 – 90.720 mm** (**3.571 – 3.572 in**) |
| | Pin seat | Ø 2 | **33.994 – 34.000 mm** (**1.338 – 1.339 in**) |
| | Piston - cylinder liners | | **0.080 – 0.114 mm** (**0.003 – 0.004 in**) |
|  | Piston diameter | Ø 1 | **0.40 mm** (**0.02 in**) |
|  | Protrusion of the pistons from the crankcase (value on the basis of the head gasket thickness) | | |
| | Head seal thickness **0.85 mm** (**0.03 in**) | X | **-0.20 – -0.05 mm** (**-0.01 – -0.00 in**) |
| | Head seal thickness **0.95 mm** (**0.04 in**) | | **-0.06 – 1.00 mm** (**-0.00 – 0.04 in**) |
|  | Piston pin | Ø 3 | **33.979 – 33.985 mm** (**1.338 – 1.338 in**) |
| | Piston type: | | |
| | Piston pin - pin seat | | **0.009 – 0.021 mm** (**0.000 – 0.001 in**) |
|  | Piston ring slots | Piston type: | |
| | | X1 **(*)** | **2.39 mm** (**0.09 in**) |
| | | X2 | **2.06 – 2.08 mm** (**0.08 – 0.08 in**) |
| | | X3 | **2.54 – 2.56 mm** (**0.0 – 0.10 in**) |
| | **(*)** Measured on Ø of **87.8 mm** (**3.5 in**) | | |
|  | Circlips | S1 **(**)** | **2.281 – 2.306 mm** (**0.090 – 0.091 in**) |
| | | S2 | **1.970 – 1.990 mm** (**0.078 – 0.078 in**) |
| | | S3 | **2.470 – 2.490 mm** (**0.097 – 0.098 in**) |
| | Measured at **1.5 mm** (**0.1 in**) from outer Ø. | | |

|  | **Type** | | **F28ESVPN** |
|---|---|---|---|
| | Piston rings - slots | Piston type: | |
| | | 1 | **0.084 – 0.109 mm** (**0.003 – 0.004 in**) |
| | | 2 | **0.070 – 0.110 mm** (**0.003 – 0.004 in**) |
| | | 3 | **0.050 – 0.090 mm** (**0.002 – 0.004 in**) |
|  | Circlips | | **0.40 mm** (**0.02 in**) |
|  | Circlip end opening in cylinder liner: | | |
| | | X1 | **0.25 – 0.40 mm** (**0.01 – 0.02 in**) |
| | | X2 | **0.60 – 0.80 mm** (**0.02 – 0.03 in**) |
| | | X3 | **0.25 – 0.45 mm** (**0.01 – 0.02 in**) |
|  | Connecting rod small end bush seat | Ø 1 | **37.010 – 37.030 mm** (**1.457 – 1.458 in**) |
| | Big-end bearing seat | Ø2 | **59.000 – 59.016 mm** (**2.323 – 2.323 in**) |
|  | Diameter of connecting rod small end bush | | |
| | Inner | Ø 3 | **34.010 – 34.020 mm** (**1.339 – 1.339 in**) |
| | Big end half-bearings | S | **1.974 – 1.984 mm** (**0.078 – 0.078 in**) |
| | Piston pin - bush | | **0.025 – 0.041 mm** (**0.001 – 0.002 in**) |
| | Big end half-bearings | | - |
|  | 5 main journals | Ø 1 | **74.190 – 74.210 mm** (**2.921 – 2.922 in**) |
| | Main journals 1 - 2 - 3 - 4 | Ø 1 | **68.190 – 68.210 mm** (**2.685 – 2.685 in**) |
| | Crankpins | Ø 2 | **54.990 – 55.010 mm** (**2.165 – 2.166 in**) |
| | Main half-bearings | S1 | **2.166 – 2.176 mm** (**0.085 – 0.086 in**) |
| | Big end half-bearings | S2 | **1.974 – 1.984 mm** (**0.078 – 0.078 in**) |

|  | **Type** | | **F28ESVPN** |
|---|---|---|---|
|  | Main bearings | | |
| | nº 5 | Ø 3 | **78.575 – 78.600 mm** (**3.094 – 3.094 in**) |
| | nº 1 - 2 - 3 - 4 | Ø 3 | **72.588 – 72.610 mm** (**2.858 – 2.859 in**) |
|  | Half bearings main journals | | |
| | nº 5 | Ø 3 | **0.013 – 0.097 mm** (**0.0 – 0.004 in**) |
| | nº 1 - 2 - 3 - 4 | Ø 3 | **0.260 – 0.880 mm** (**0.010 – 0.035 in**) |
|  | Half-bearings - crankpins | | **0.022 – 0.078 mm** (**0.001 – 0.003 in**) |
|  | Main half-bearings Big end half-bearings | | - |
|  | Main journal for shoulder | X1 | **29.60 – 29.65 mm** (**1.17 – 1.17 in**) |
|  | Main bearings for shoulder | X2 | **24.50 – 24.55 mm** (**0.96 – 0.97 in**) |
|  | Shoulder half-rings | X3 | **2.40 – 2.45 mm** (**0.09 – 0.10 in**) |
| | Crankshaft shoulder | | **0.150 – 0.350 mm** (**0.006 – 0.014 in**) |
| Cylinder head - timing gear | | | |
|  | Valve guide seats on the cylinder head | Ø 1 | **12.960 – 12.995 mm** (**0.510 – 0.512 in**) |
|  | Valve guides | Ø 2 | **8.023 – 8.038 mm** (**0.316 – 0.316 in**) |
| | | Ø 3 | **13.012 – 13.025 mm** (**0.512 – 0.513 in**) |

|  | **Type** | | **F28ESVPN** |
|---|---|---|---|
|  | Valves: | | |
| | | Ø 4 α | **7.980 – 8.000 mm** (**0.314 – 0.315 in**) **60°** |
| | | Ø 4 α | **7.970 – 7.990 mm** (**0.314 – 0.315 in**) **60°** |
| | Valve stem and relative guide | | **0.023 – 0.058 mm** (**0.001 – 0.002 in**) |
| | | | **0.033 – 0.068 mm** (**0.001 – 0.003 in**) |
|  | Seat on the head for valve seat: | | |
| | | Ø 1 | **38.915 – 38.945 mm** (**1.532 – 1.533 in**) |
| | | Ø 1 | **35.415 – 35.445 mm** (**1.394 – 1.395 in**) |
|  | Outer diameter of valve seats; valve seat inclination on cylinder head: | | |
| | | Ø 2 α | **38.990 – 39.010 mm** (**1.535 – 1.536 in**) |
| | | Ø 2 α | **35.490 – 35.510 mm** (**1.397 – 1.398 in**) |
|  | X Recessing | | **0.353 – 0.653 mm** (**0.014 – 0.026 in**) |
| | | | **0.358 – 0.658 mm** (**0.014 – 0.026 in**) |
|  | Between valve seat and head | | **0.045 – 0.095 mm** (**0.002 – 0.004 in**) |
| | | | **0.045 – 0.095 mm** (**0.002 – 0.004 in**) |
| | Valve seats | | - |

|  | **Type** | | **F28ESVPN** |
|---|---|---|---|
|  | Valve spring height: | | |
| | Free spring | H | **46.5 mm** (**1.8 in**) |
| | Under a load of: | | |
| | **320 +/- 16 N** | H1 | **32 mm** (**1 in**) |
| | **560 +/- 25 N** | H2 | **22.50 mm** (**0.89 in**) |
|  | Injector protrusion | X | **2.48 mm** (**0.10 in**) |
|  | Seat for camshaft bush no. 1 (flywheel side) | | **40.069 – 40.119 mm** (**1.578 – 1.579 in**) |
| | Camshaft seats no. 2 - 3 - 4 | | **50.975 – 51.025 mm** (**2.007 – 2.009 in**) |
| | Camshaft seats no. 5 | | **59.222 – 59.248 mm** (**2.332 – 2.333 in**) |
|  | Camshaft supporting pins | | |
| | 1 | Ø 1 | **39.975 – 40.025 mm** (**1.574 – 1.576 in**) |
| | 2→ 4 | Ø 2–3–4 | **50.881 – 50.926 mm** (**2.003 – 2.005 in**) |
| | 5 | Ø 5 | **53.995 – 54.045 mm** (**2.126 – 2.128 in**) |
|  | Bushing inside diameter after drive-in Outer bushing diameter | Ø | **54.094 – 54.149 mm** (**2.130 – 2.132 in**) **59.335 – 59.393 mm** (**2.336 – 2.338 in**) |
|  | Bushing and seat in the crankcase | | **0.049 – 0.154 mm** (**0.002 – 0.006 in**) |
| | Bushing and supporting pin | | **0.049 – 0.154 mm** (**0.002 – 0.006 in**) |
|  | Maximum lift: | | |
| | | H | **6.02 mm** (**0.24 in**) |
| | | H | **5.79 mm** (**0.23 in**) |
|  | Tappet washer seat in crankcase | Ø1 | **18.000 – 18.018 mm** (**0.709 – 0.709 in**) |
|  | Tappet washer outer diameter: | | |
| | | Ø2 | **17.966 – 17.984 mm** (**0.707 – 0.708 in**) |
| | | Ø3 | **16 mm** (**1 in**) |
| | Between tappets and seats | | **0.016 – 0.052 mm** (**0.001 – 0.002 in**) |

|  | **Type** | **F28ESVPN** |
|---|---|---|
|  | Tappets | - |

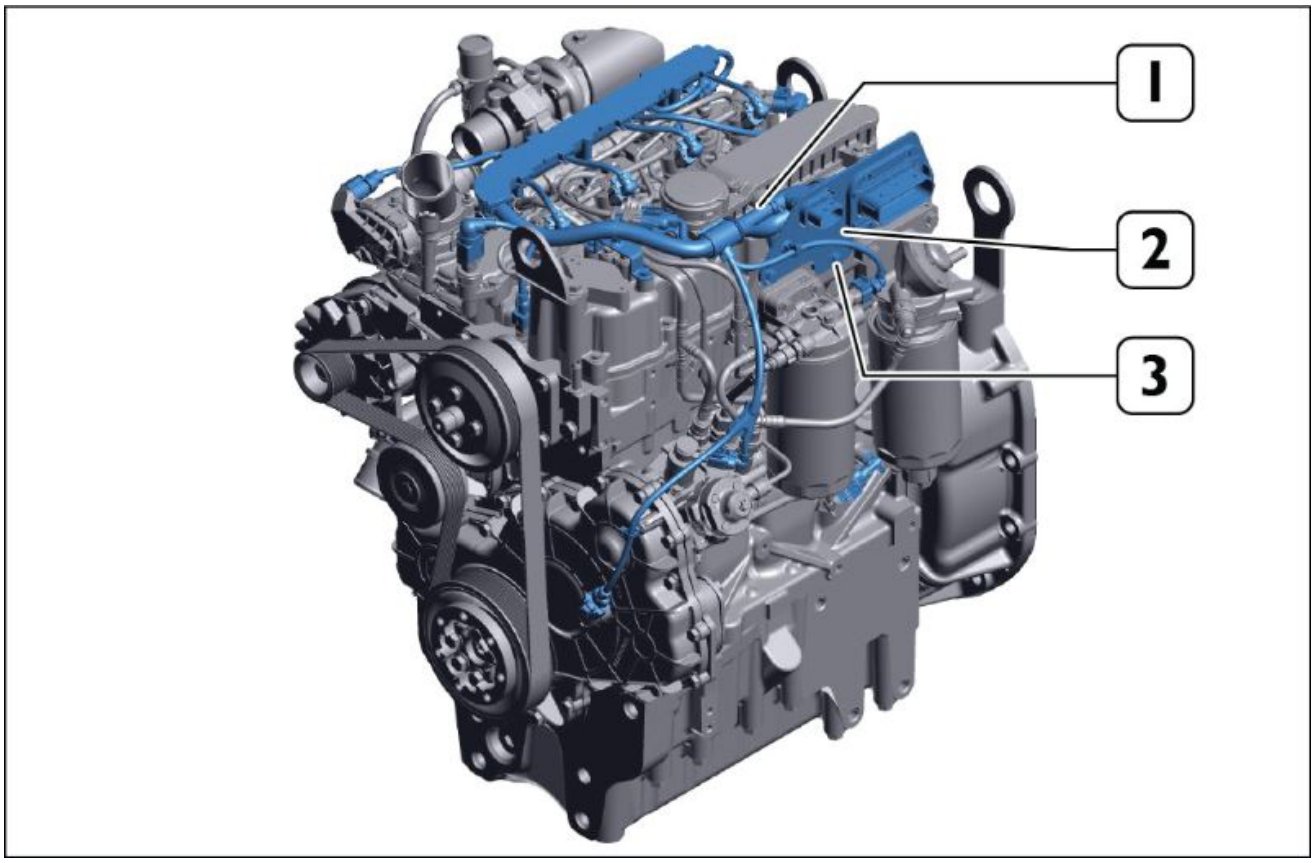
# Engine - Disassemble [113469149 - V1 - 07 March 2025]

| Tool / Material | |
|---|---|
| Assemblies overhaul revolving stand (bearing capacity **1000.00 daN** (**2248.09 lbf**) , torque **120.00 daN·m** (**885.07 lb ft**)) | 99322205 |
| Brackets fixing engine to revolving stand 99322205 | 99361026 |
| Crankshaft lifting tackle | 99360500 |
| Flywheel crank handle (use with 99360222) | 99360221 |
| Key for crankshaft front gasket installation and and timing cover centering | 99346270 |
| Pinion (use with 99360221) | 99360222 |
| Remover,cartridge filter | 99360076 |
| Socket wrench ( **8.0 mm** (**0.3 in**)) for removing and refitting glow plugs | SP2275 |
| Tool for removing gaskets | 99363204 |
| Tool to remove crankshaft rear gasket | 99340056 |

# Engine - Disassemble - Disassembly of the engine at the bench [113469150 - V1 - 26 February 2025]

1. Disconnect the engine cable **(1)** from the control unit, from the injectors, and from all sensors and senders to which it is connected.

***NOTE:*** *Suitably cover all connectors to prevent any oxidation and damages.*



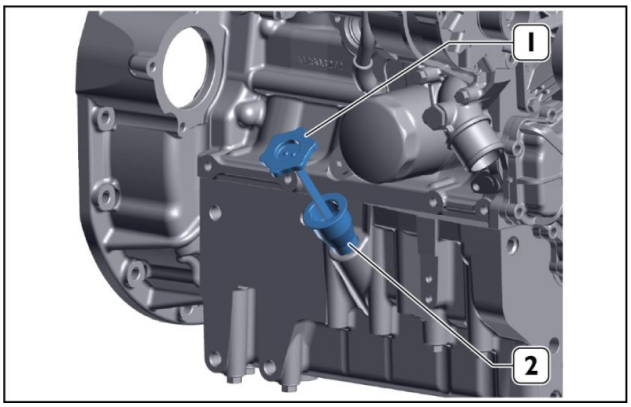

NHIL25ENG0097FA 1

2. To ease the removal, loosen the screws **(2)** from the mounting bracket **(3)** of the engine wiring.
3. Remove the retainers of the engine cable **(1)** and remove the cable.

# Engine - Remove - Removing the oil level dipstick and its housing [113469152 - V1 - 26 February 2025]

***NOTE:*** *Depending on the engine version, the oil cap / dipstick, may be on the RIGHT or LEFT side.*

1. Remove the dipstick **(1)** and remove its housing **(2)**.




NHIL25ENG0098FA 1

# Engine - Install - Installation on stand and engine lubricant oil draining [113469151 - V1 - 26 February 2025]

***NOTE:*** *General prescriptions Before any intervention, always ensure that operators are familiar with the safety and functional requirements of the engine and the vehicle indicated in the document. Strictly observe the safety warnings. Before moving an assembly, make sure that all the parts are well secured. Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle*

NHIL25ENG0099FA 1

1. Fit the brackets 99361026 on the engine crankcase in the relative screws and tighten the fastening screws.

| Tool / Material | |
|---|---|
| Brackets fixing engine to revolving stand 99322205 | 99361026 |

2. Lift the engine and place it on the rotating stand 99322205 using the special lifting hooks, a sling bar and a hoist.

| Tool / Material | |
|---|---|
| Assemblies overhaul revolving stand (bearing capacity **1000.00 daN** (**2248.09 lbf**) , torque **120.00 daN·m** (**885.07 lb ft**)) | 99322205 |

3. Tighten the screws securing the brackets to the rotating stand and tighten the fastening screws to the specified torque.
4. Drain the engine lubricant oil by unscrewing the lubricant oil drain plug located in the lower part of the oil sump.

# Engine - Assemble [113469844 - V1 - 06 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Air bleeding on the fuel filter bracket | 1 screw M10 | | **4 +/- 0.5 N·m** |
| Air temperature and pressure sensor | 1 screw M6 x 1 x 16 | | **9 +/- 0.9 N·m** |
| Alternator | | 1 screw M10 x 1.5 x 130 + 1 nut M10 x 1.5 | **45 +/- 4.5 N·m** |
| Alternator tensioning bracket | | 2 screws M10 x 1.5 x 25 + 2 nuts M10 x 1.5 | **45 +/- 4.5 N·m** |
| Blow-by filter | | 7 screws M6 x 1 x 13 | **10 +/- 2 N·m** |
| Bracket retaining the delivery fuel pipe from the pump to the rail | 3 screws M6 x 1 x 10 | | **10 +/- 1 N·m** |
| Bracket retaining the fuel return pump from the rail and from the high pressure pump | | 1 screw M6 x 1 x 16 | **10 +/- 1 N·m** |
| Camshaft timing sensor | 1 screw M6 x 1 x 16 | | **9 +/- 0.9 N·m** |
| Common Rail | 2 screws M8 x 1.25 x 55 | | **23 +/- 2.3 N·m** |
| Control socket coupling | M12 x 1.5 | | **14 +/- 1.4 N·m** |
| Control socket lubrication pipe | | 1 screw M12 x 1.5 | **40 +/- 4 N·m** |
| | | 1 fitting M14 x 1.5 | **40 +/- 4 N·m** |
| Coolant temperature sensor | 1 sensor M12 x 15 | | **20 +/- 5 N·m** |
| Crankshaft pulley | 7 screws M10 x 1.5 x 30 | | **70 +/- 7 N·m** |
| Crankshaft rpm sensor | 1 screw M6 x 1 x 16 | | **9 +/- 0.9 N·m** |
| Cylinder head | 4 screwsM12 x 1.5 x 165 | Step 1 — | **65 +/- 3.25 N·m** |
| | | Step 2 — Angle tightening | **90°** |
| | | Step 3 — Angle tightening | **60°** |
| Delivery fuel pipe from the pump to the rail | | 1 high pressure fuel pump-side coupling M16 x 1 | **45 +/- 2.25 N·m** |
| | | 1 rail-side coupling M14 x 1.5 | **35 +/- 1.75 N·m** |
| EGR heat exchanger | 5 studs M8 x 1.25 x 80 | | **23 +/- 2.3 N·m** |
| EGR valve | 2 screws M6 x 1 x 20 | | **10 +/- 1 N·m** |
| Electro-injector brackets | 4 studs M8 x 1.25 x 65 | | **28 +/- 1.4 N·m** |
| Engine air vent | | 3 nuts M6 x1 | **10.0 N·m (88.5 lb in)** |
| | | 1 screw M6 x 1 x 80 | **10.0 N·m (88.5 lb in)** |
| | | 1 screw M8 x 1.25 | **23.0 N·m (203.6 lb in)** |
| Engine cable fixing bracket | 3 screws M8 x 1.25 x 20 | | **23 +/- 2.3 N·m** |
| Engine coolant input pipe | | 3 screws M8 x 1.25 x 65 | **23 +/- 2.3 N·m** |
| | | 1 screw M8 x 1.25 x 14 | **25 +/- 2,5 N·m** |
| Engine flywheel housing | | 9 screws M12 x 1.75 x 40 | **110 +/- 11 N·m** |
| | | 2 screws M8 x 1.25 x 40 | **35 +/- 3.5 N·m** |
| Exhaust gas absolute pressure sensor | 1 sensor M14 x 1.5 | | **15 +/- 1.5 N·m** |
| Exhaust gas linkage pipe | 2 screws M12 x 1.5 x 24 | | **25 +/- 2.5 N·m** |
| Exhaust gas temperature sensor | | 1 fitting M14 x 1.5 x 12 | **45 +/- 4.5 N·m** |
| | | 1 screw M6 x 1.5 x 12 | **10 +/- 1 N·m** |
| Exhaust manifold | 9 nuts M8 x 1.25 | Pre-tightening | **10 +/- 0.5 N·m** |
| | | Tighten | **28 +/- 1.4 N·m** |

| Description | Quantity | Step | Value |
|---|---|---|---|
| Fan control pulley | 4 screws M8 x 1.25 x 18 | | **23 +/- 2.3 N·m** |
| Fan pulley control mount | 4 screws M8 x 1.25 x 25 | | **23 +/- 2.3 N·m** |
| Fuel Pre-filter | 1 cartridge — | | **23 +/- 3 N·m** |
| Fuel delivery pipes to the electro-injectors | 4 rail-side couplings M14 x 1.5 | | **35 +/- 1.75 N·m** |
| Fuel filter | 1 cartridge M20 x 1.5 | | **22 +/- 3 N·m** |
| Fuel filter mount - version with pre-filter | 4 screws M8 x 1.25 x 20 | | **23 +/- 2.3 N·m** |
| Fuel filter mount - version without pre-filter | 4 screws M8 x 1.25 x 40 | | **23 +/- 2.3 N·m** |
| Fuel pipe fittings between the pump and filter | M10 x 1.5 x 18 | | **25 +/- 2.5 N·m** |
| Glow plug harness mount | 3 screws M6 x 1 x 14 | | **10 +/- 1 N·m** |
| Head cover | 10 screws M6 x1 x 40 | | **10 +/- 1 N·m** |
| High pressure fuel pump | 3 nuts M8 x 1.25 | | **23 +/- 2.3 N·m** |
| High pressure fuel pump spacer | 4 screws M6 x 1 x 16 | | **10 +/- 1 N·m** |
| High-pressure pump gear | 1 nut M18 x 1.5 | | **80 +/- 4 N·m** |
| Injector fuel return pipe brackets | | 1 screw M8 x 1.25 x 18 | **23 +/- 2.3 N·m** |
| Intake manifold | | 14 screws M6 x 1 x 20 | **10 +/- 1 N·m** |
| | | 4 caps M12 x 1.5 | **20 +/- 2 N·m** |
| Lifting eyelets | 2 screws M10 x 1.5 x 125 | | **67 +/- 6.7 N·m** |
| Lower crankcase | | 8 screws M10 x 1.5x 130 | **67 +/- 6.7 N·m** |
| | | 4 screws M12 x 1.75 x 130 | **118 +/- 11.8 N·m** |
| Lubricant oil delivery pipe to turbocharger | | 1 screw M10 x 1 x 19 | **25 +/- 2.5 N·m** |
| | | 1 nut M14 x 1.5 | **35 +/- 3.5 N·m** |
| Lubricant oil drain plug in the sump | 2 caps M22 x 1.5 x 12 | | **50 +/- 5 N·m** |
| Lubricant oil return pipe from turbocharger bracket | 1 screw M6 x 1 x 10 | | **10 +/- 1 N·m** |
| Lubricant return pipe from turbocharger | 2 screws M6 x 1 x 20 | | **10 +/- 1 N·m** |
| Oil pressure regulator valve | 1 screw M8 x 1.25 x 36 | | **33 +/- 3.3 N·m** |
| Oil filter | 1 cartridge M27 x 2 | | **18 +/- 2.5 N·m** |
| Oil filter bracket | | 1 fitting M20 x 1.5 x 18 | **35 +/- 5 N·m** |
| | | 1 fitting (if present) M24 x 1.5 | **45 +/- 4.5 N·m** |
| | | 1 plug (if present) M27 x 2 | **18 +/- 2.5 N·m** |
| Oil pump | 3 screws M8 x 1.25 x 36 | | **33 +/- 3.3 N·m** |
| Oil sump | 4 screws M10 x1.5 x 130 | | **67 +/- 6.7 N·m** |
| Overhead | | 8 screws M6 x 1 x 20 | **10 +/- 1 N·m** |
| Pre-heating glow plugs | 4 glow plugs M8 x 1 | | **9 +/- 1 N·m** |
| Rocker arm unit | 12 screws M6 x 1 x 75 | | **10 +/- 1 N·m** |
| Socket for the service air compressor control | 2 screws M10 x 1.5 x 20 | | **45 +/- 4.5 N·m** |
| Suction strainer | 1 screw M6 x 1 x 12 | | **10 +/- 1 N·m** |
| Thermostat cover | 3 screws M6 x 1 x 12 | | **10 +/- 1 N·m** |
| Timing gear | 6 screws M8 x 1.25 x 20 | | **34 +/- 3.4 N·m** |

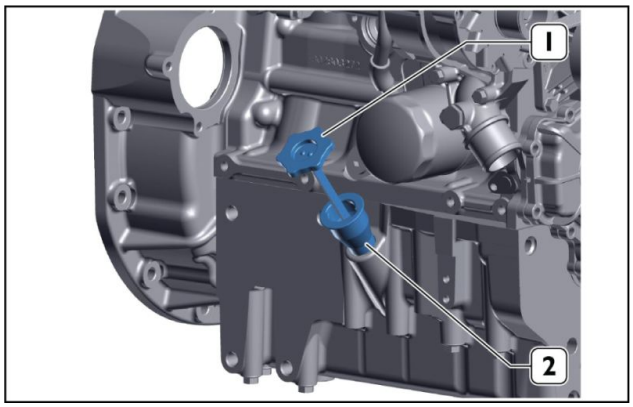
| Description | Quantity | Step | Value |
|---|---|---|---|
| Timing gearbox | | 13 screws M8 x 1.25 x 25 | **23 +/- 2.3 N·m** |
| | | 13 screws M8 x 1.25 x 35 | **23 +/- 2.3 N·m** |
| Turbocharger | | 3 nuts M10 x 1.5 x 10 | **28 +/- 1.5 N·m** |
| | | 3 studs M10 x 1.5 x 40 | **25 +/- 1.25 N·m** |

| Tool / Material | |
|---|---|
| Assemblies overhaul revolving stand (bearing capacity **1000.000 daN** (**2248.090 lbf**), torque **120.00 daN·m** (**885.07 lb ft**)) | 99322205 |
| Belt tension control device (frequency from **10 Hz** to **600 Hz**) | 99395849 |
| Brackets fixing engine to revolving stand 99322205 | 99361026 |
| Crankshaft rear seal installer | 99346259 |
| Engine TDC positioning tool | 99360612 |
| Flywheel crank handle (use with 99360222) | 99360221 |
| Key for crankshaft front gasket installation and and timing cover centering | 99346270 |
| Pinion (use with 99360221) | 99360222 |
| Remover,cartridge filter | 99360076 |
| Remover,cartridge filter | 99360076 |
| Socket wrench ( **8.0 mm** (**0.3 in**)) for removing and refitting glow plugs | SP2275 |

# Engine - Remove - oil level dipstick and its housing [113471381 - V1 - 06 March 2025]

***NOTE:*** *Depending on the engine version, the oil cap / dipstick, may be on the right or left side.*

1. Install the housing **(2)** and insert the oil dipstick **(1)**.




NHIL25ENG0211FA 1

# Engine - Check - Checks and inspections [113471386 - V1 - 05 March 2025]

***NOTICE:*** *The following checks must be executed after the engine has been installed on the vehicle. Check that the fluid top-ups and refilling operations have been completed to the specified levels.*

1. Start the engine and keep it running at slightly above idle speed and wait for the coolant temperature to reach the specified value for the thermostat valve to open and then check the following.
2. Check for water leakage from the connecting manifolds of the engine cooling circuit pipes and cab interior heating pipes, if necessary tighten the O-rings further.
3. Carefully check the fuel filter pipe fittings.
4. Check that there are no oil leaks from the cylinder head and cover, the oil sump and crankcase, heat exchanger oil filter and relative housings between the various pipes of the lubrication circuit.
5. Check that there are no fuel leaks from the fuel pipes.
6. Check that there are no air leaks from the pneumatic pipes (if fitted).
7. Check the correct operation of the warning lights on the instrument panel and equipment disconnected when the engine was disconnected.
8. Check and carefully bleed the engine cooling system by repeatedly draining it.

# Engine - Visual inspection [113471387 - V1 - 05 March 2025]

Before starting the engine, carry out the following checks:

- Checking the levels and checking for any leaks from the fuel, cooling and lubrication circuits.

After starting the engine and with the engine running, perform the following checks and inspections:

- Check for any leaks from the fuel, coolant and lubricant circuits.
- Make sure that there are no unusual noises or clinks while the engine is running.
- Visually check the exhaust smoke (colour of the exhaust emissions).
- Visually check the coolant level in the expansion tank.

# Crankcase - Prepare - Crankcase system [113334062 - V1 - 13 February 2025]

## Preparation

- Ignition switch set to OFF position.

# Crankcase - Check - Oil filler cap [113375892 - V1 - 21 February 2025]

1. Visually check the oil filler cap
   - Visually check for pollution and blow by (oil filler cap dismounted).
   - Go to step **2**.
2. Check oil filler cap
   - If no pollution or blow by, refer to **Crankcase - Check - Ventilation crankcase system (10.001)**
   - If pollution or blow by is present, go to step **3**.
3. Possible root cause
   - Vapour coming out
   - Emulsion (condensation and fuel) visible: oil mist clogged and/or incorrect oil type or viscosity.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

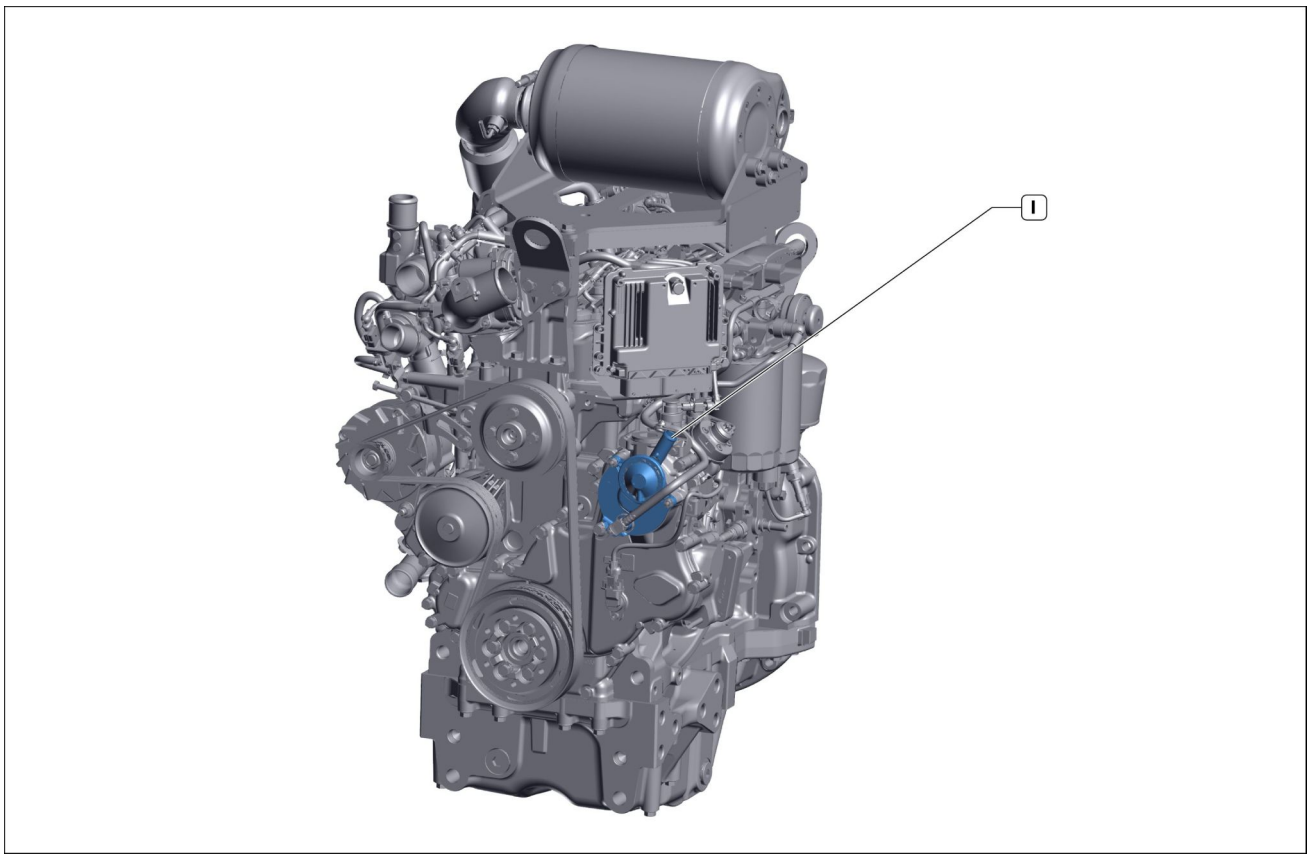
# Crankcase - Check - Ventilation crankcase system [113375893 - V1 - 21 February 2025]

1. Visually check the ventilation lines
   - Check ventilation lines for damage, leaks, pollution and blockage.
   - See figures below for aid and go to step **2**.

NHIL25ENG0457TA 1

**Connection from crankcase to intake air system**

| Item | Description |
|---|---|
| 1 | Pipe from crankcase system |
| 2 | Connector to intake air system |




NHIL25ENG0458TA 2

**Blow-by valve pipe connector**

| Item | Description |
|---|---|
| 1 | Blow-by valve connector |

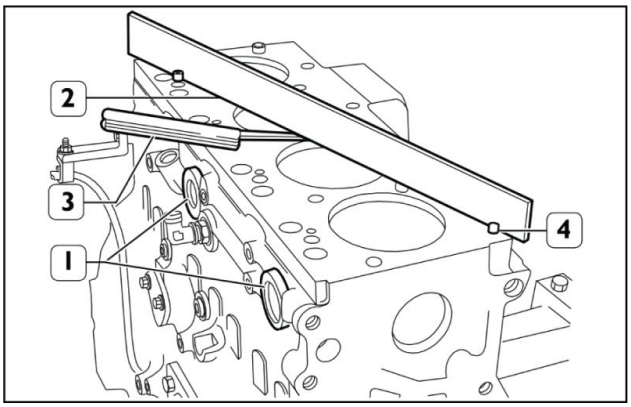
2. Check ventilation crankcase system
   - No damage or leaks.
   - No blockage(blockages in the crankcase system may lead to higher boost pressure).
   - If the ventilation crankcase system is OK, go to step **4**.
   - If the ventilation crankcase system is NOT OK, go to step **3**.
3. Possible root cause
   - Oil separator clogged.
   - Lines damaged, cracked, aged or clogged.
   - Rubber seals are damaged or aged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The crankcase system works properly.

# Crankcase - Check - Engine block [113418843 - V2 - 04 March 2025]

1. Check that the cylinder head face, on the crankcase, does not present deformations.
2. This check can be carried out, after having removed the dowel pins **(4)** with a calibrated rule **(2)** and feeler gauge **(3)**.
3. After ascertaining the areas of deformation, correct the contact surface with a grinding machine.
4. Planarity error shall not exceed:




NHIL25ENG0216AA 1

| Technical data | |
|---|---|
| Planarity error | **0.075 mm** (**0.003 in**) |

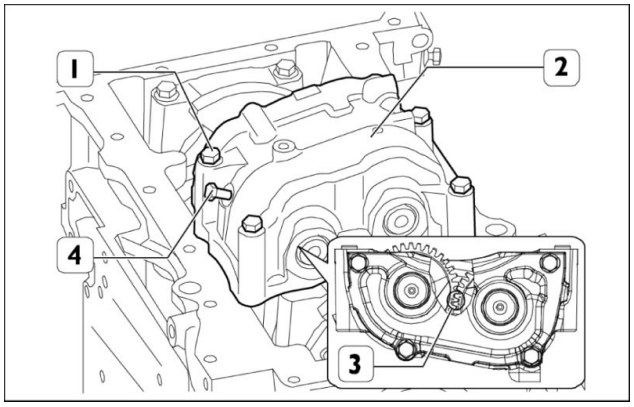
***NOTE:*** *Crankcase levelling shall be performed only after checking that piston protrusion from the cylinder is not exceeding the specified value.*

5. Check the state of the cylinder assembly **(1)** machining plugs; if they are rusty or there is any doubt at all about their seal, change them.
6. When levelling is completed, reset cylinders liner chamfer as shown in the Figure **1**.

# Crankcase - Remove - Weight fastening screws [113427678 - V1 - 04 March 2025]

**Prior operation:**
**Engine oil pan - Remove - Oil sump (10.102)**

1. Bring cylinder 1 to **118°** before the TDC and check that the marks **(3)** stamped on the gears of the balancing weights **(2)** for timing are aligned as shown in figure **1**.
2. Use the pin **(4)** to temporarily block the rotation of the balancing weights **(2)**.
3. After having blocked the additional balancing masses **(2)** through the pin **(3)** unscrew the fastening screws **(1)** and remove it from the crankcase.



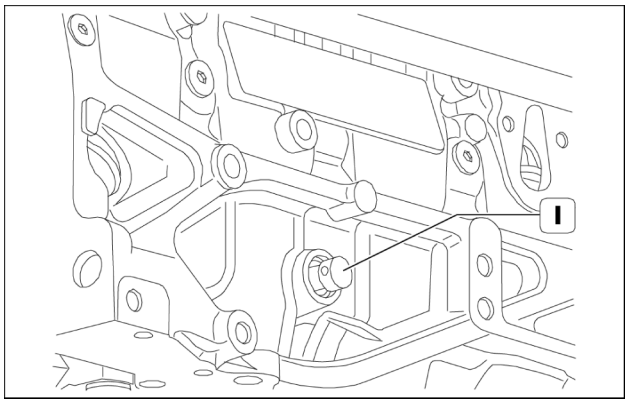

NHIL25ENG0294AA 1

# Crankcase - Install - Weight fastening screws [113427679 - V1 - 04 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Balancing weights | 4 screwsM8 x 1.25 x 90 | Step 1 — Pre-tightening | **20 +/- 6 N·m** |
| | | Step 2 — Tighten | **60°** |

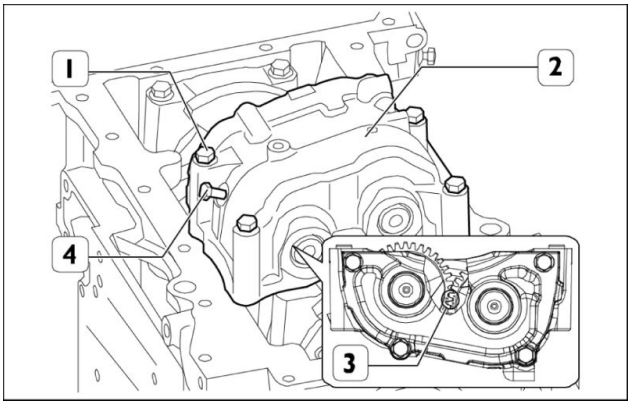
| Tool / Material | |
|---|---|
| Engine TDC positioning tool | 99360612 |

1. Move the 1st cylinder **118°** before the TDC. In this condition, the engine is timed, insert the special tool **(1)** in the crankcase that will intercept the hole in the crankshaft.




NHIL25ENG0295AA 1

2. Rotate the engine of 180°.
3. Fit the housing containing the balancing weights **(2)** that were already timed during disassembling using the fastening pin **(4)**.
4. If the pin **(4)** was not engaged during the disassembly phase, and as a result the balancing weights **(2)** are not timed, proceed as follows.
5. Align the marks **(3)** stamped on the gears of the balancing weights **(2)** for timing, as indicated in the figure **2**.
6. Use the pin **(4)** to temporarily block the rotation of the balancing weights **(2)**.
7. Fit the housing containing the balancing weights **(2)** and tighten the fastening screws **(1)** on the crankcase to the prescribed torque.

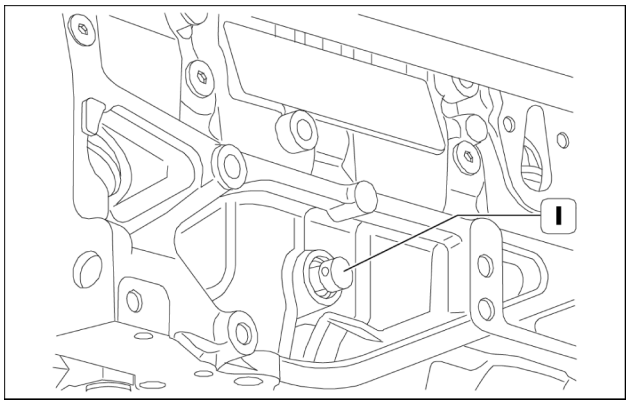



NHIL25ENG0296AA 2

| Description | Quantity | Step | Value |
|---|---|---|---|
| Balancing weights | 4 screwsM8 x 1.25 x 90 | Step 1 — Pre-tightening | **20 +/- 6 N·m** |
| | | Step 2 — Tighten | **60°** |

8. Remove the locking pin **(4)** from the balancing weights **(2)**.

9. Remove the special tool **(1)** in the crankcase in order to release the rotation of the crankshaft.

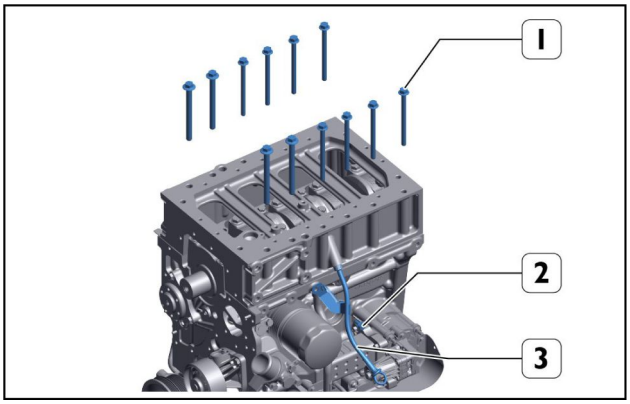



NHIL25ENG0297AA 3

**Next operation:**
**Engine oil pan - Install - Oil sump (10.102)**

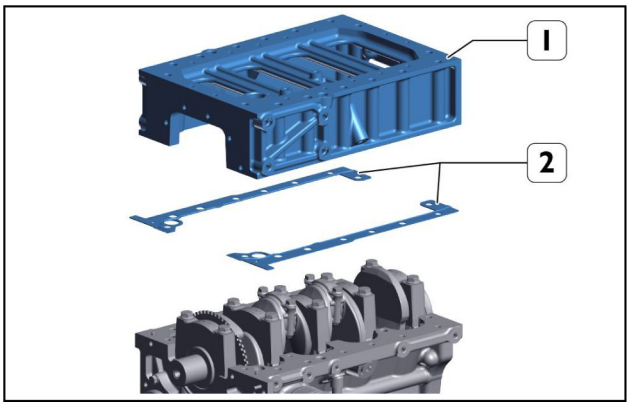
# Crankcase - Remove - Lower crankcase [113469832 - V2 - 06 March 2025]

1. Unscrew the fastening screws **(1)**, remember to remove the oil dipstick by unscrewing the screw **(2)** of the mounting bracket.




NHIL25ENG0145FA 1

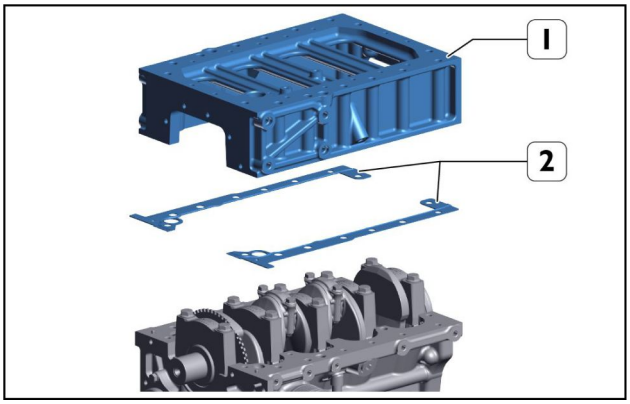
2. Remove the lower crankcase **(1)** recovering the gasket **(2)**.



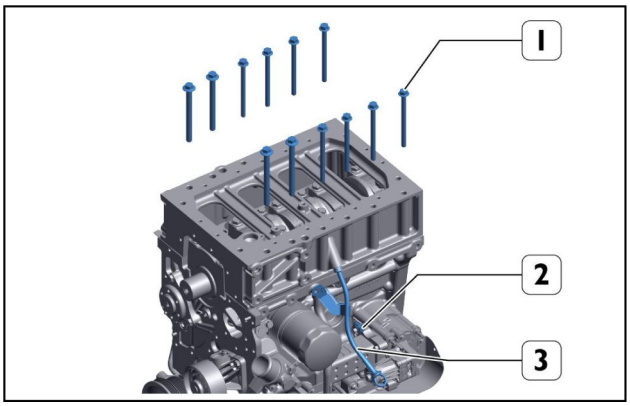

NHIL25ENG0146FA 2

# Crankcase - Assemble - Crankcase base [113469887 - V1 - 06 March 2025]

1. Correctly position the gasket **(2)** and the lower crankcase **(1)**.
2. Tighten the fastening screws **(1)** to the specified torque.




NHIL25ENG0153FA 1




NHIL25ENG0154FA 2

| Description | Step | Value |
|---|---|---|
| Lower crankcase | 8 screws M10 x 1.5 x 130 | **67 +/- 6.7 N·m** |
| | 4 screws M12 x 1.75 x 130 | **118 +/- 11.8 N·m** |

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## Pan and covers - 102

**F6AFL413A*U001**

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## Pan and covers - 102


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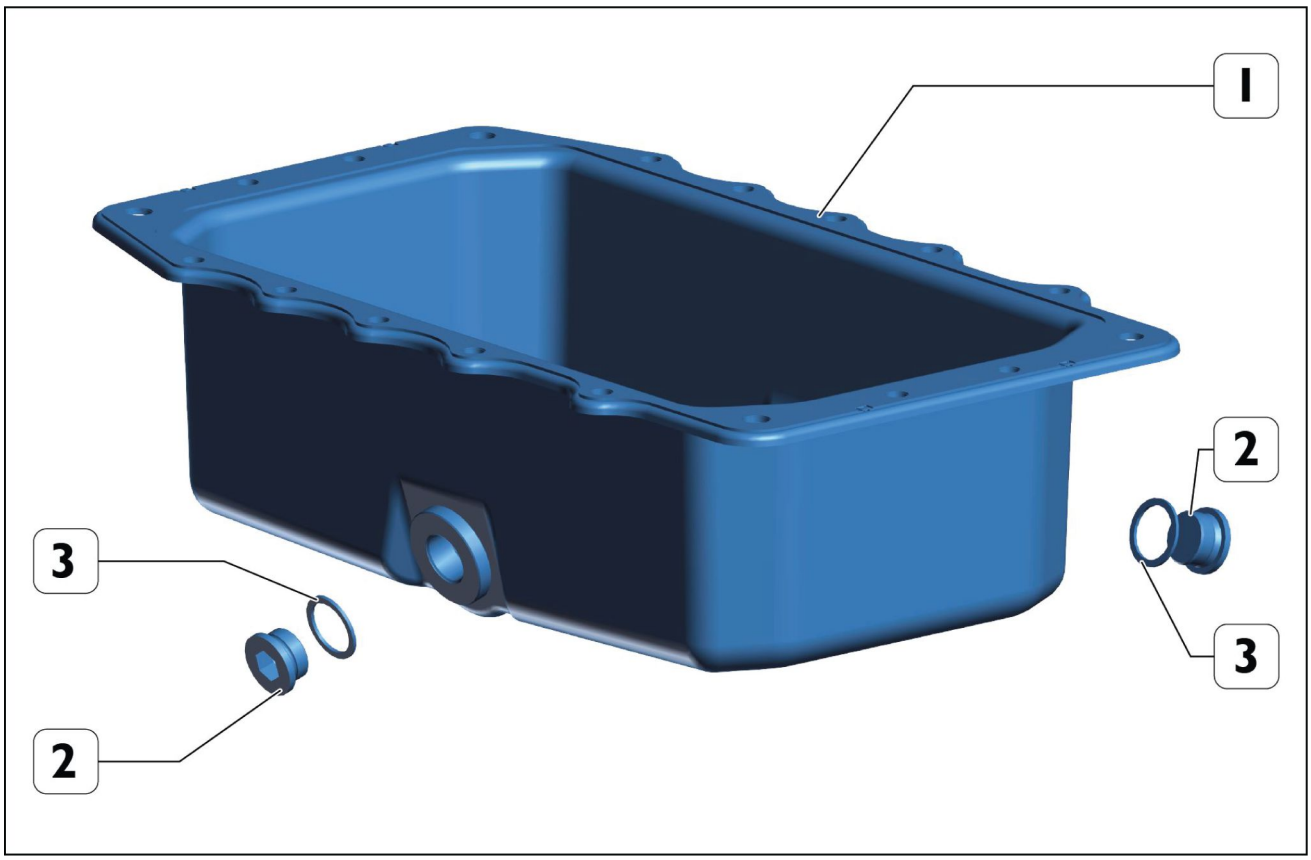
# Engine oil pan - Overview - Oil sump [113418860 - V1 - 26 February 2025]

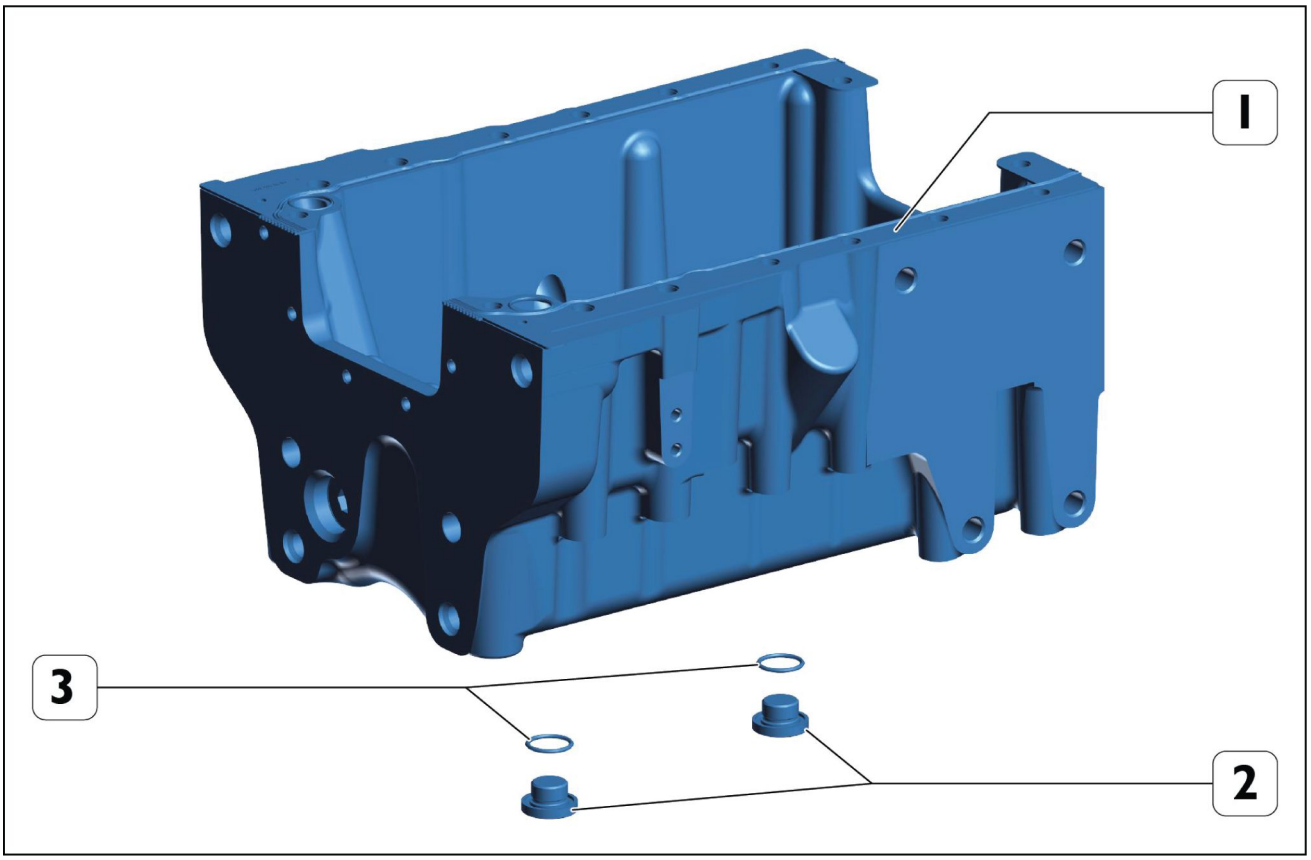
## Engine sump — F28ETVPN (CE) — F28ESVPN (CE)




NHIL25ENG0213TA 1

1. Oil sump gasket
2. Oil drain plugs on sump
3. Oil drain plug gaskets on sump

## Sump — F28ETVPS (AG) — F28ESVPS (AG)




NHIL25ENG0214TA 2

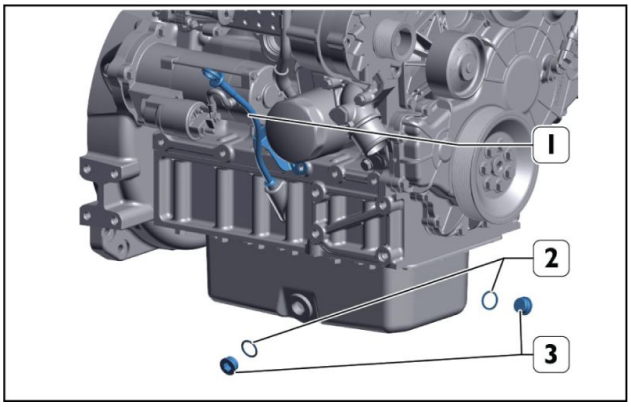
1. Oil sump gasket
2. Oil drain plugs on sump
3. Oil drain plug gaskets on sump

# Engine oil pan - Remove - Oil sump [113418859 - V1 - 26 February 2025]

1. Position an appropriate container for the oil collection below the sump in line with the drain plugs **(3)**.

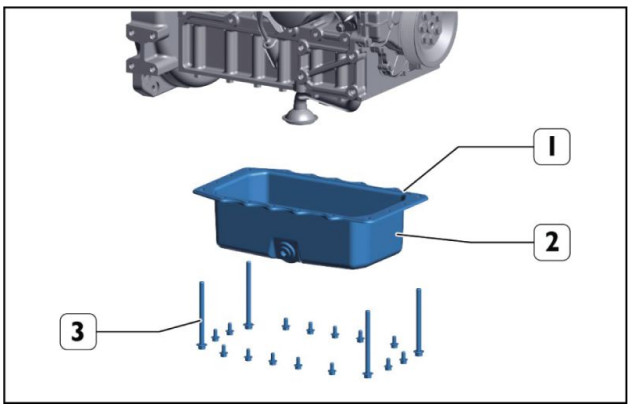
***NOTE:*** *It is recommended that the oil is drained while hot.*

2. To make the oil flow easier, unscrew the filler plug **(1)** and remove the oil dipstick.
3. Unscrew the drain plugs **(3)**, recovering the gaskets **(2)** and let the lubricant contained in the oil sump flow out completely.




NHIL25ENG0220FA 1

4. Unscrew the fastening screws **(3)** and remove the oil sump **(2)** recovering the gasket **(1)**.

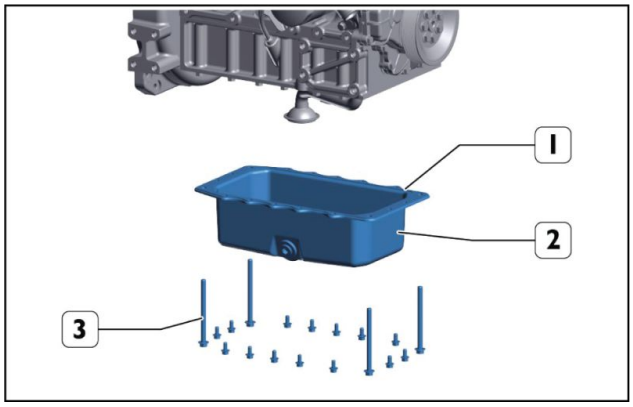



NHIL25ENG0221AA 2

# Engine oil pan - Install - Oil sump [113418863 - V1 - 04 March 2025]

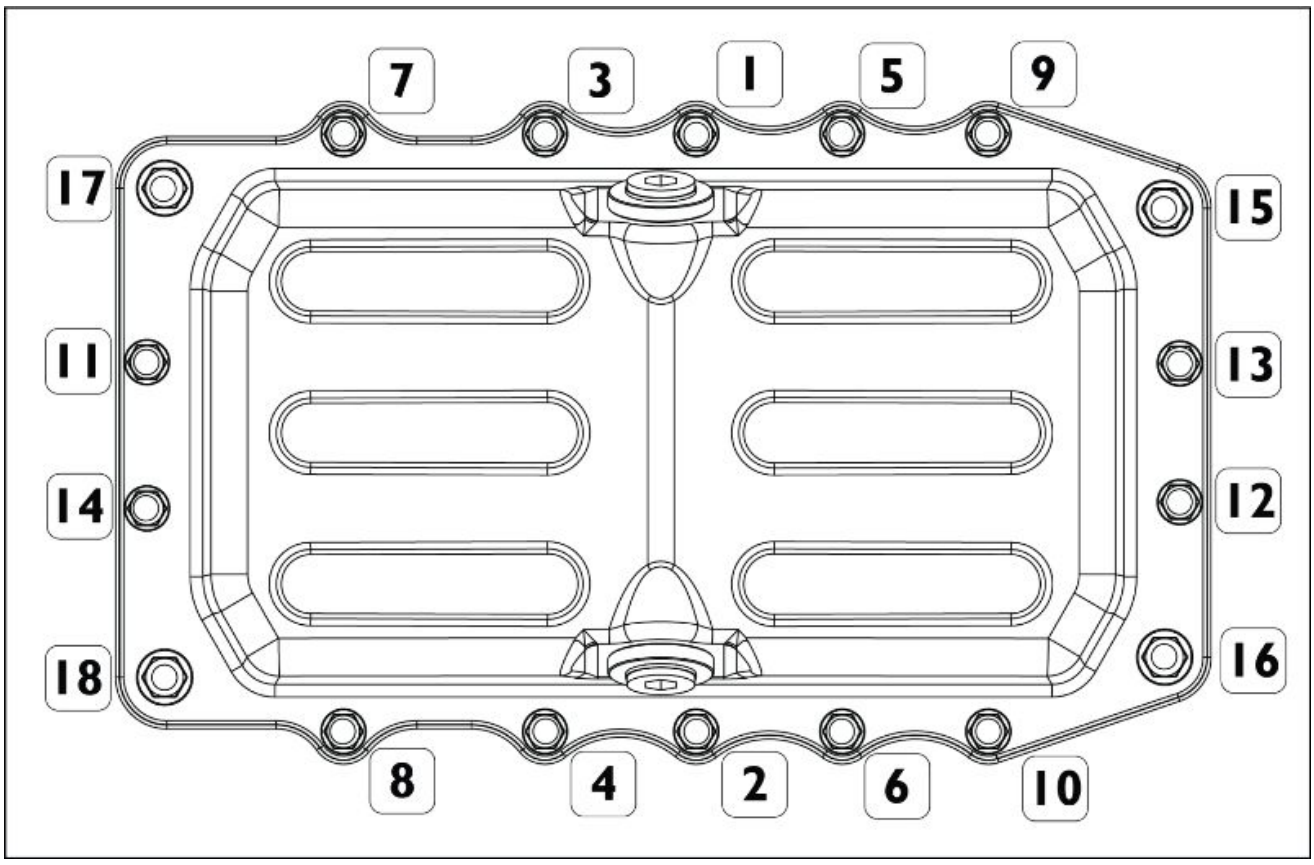
| Description | Quantity | Step | Value |
|---|---|---|---|
| Lubricant oil drain plug in the sump | 2 caps M22 x 1.5 x 12 | | **50 +/- 5 N·m** |
| Oil sump | 4 screws M10 x 1.5 x 1 30 | | **67 +/- 6.7 N·m** |

1. Position the gasket **(1)** on the oil sump **(2)**.
2. Fit the oil sump **(2)** in position on the crankcase and tighten the fastening screws **(3)** to the torque specified and in the order shown in the figure **2**.




NHIL25ENG0222AA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Oil sump | 14 screws M8 x 1.25 x 16 | | **23 +/- 2.3 N·m** |
| Oil sump | 4 screws M10 x 1.5 x 130 | | **67 +/- 6.7 N·m** |

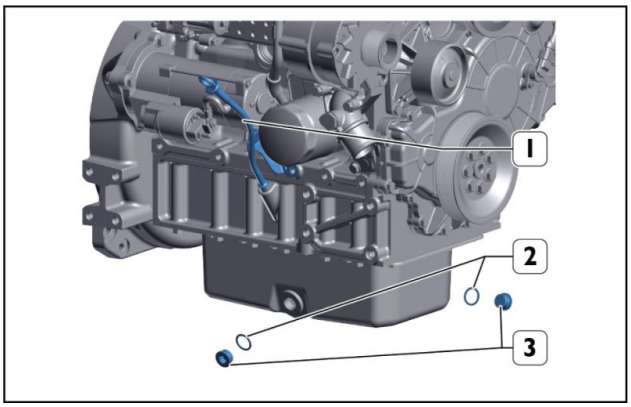



NHIL25ENG0223FA 2

**Diagram showing the oil sump fastening screws tightening order.**

***NOTE:*** *General prescriptions: For correct engine operation, only use recommended oils or oils with the required characteristics. In the case of refilling, do not mix oils with different characteristics. Failure to observe these indications will void the guarantee. Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty*

3. Using the new gaskets **(2)** tighten the drain plugs **(3)** in the oil sump and tighten it to the prescribed torque.



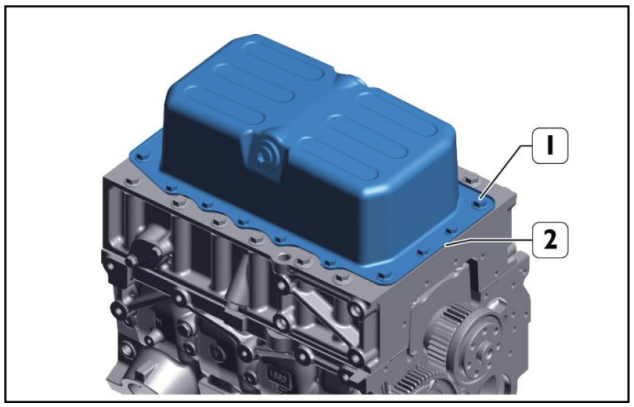

NHIL25ENG0224FA 3

| Description | Quantity | Step | Value |
|---|---|---|---|
| Lubricant oil drain plug in the sump | 2 caps M22 x 1.5 x 12 | | **50 +/- 5 N·m** |

4. Fill it with clean oil through the filler pipe and check the oil level with the dipstick **(1)**: The level must be near the MAX mark indicated on the dipstick. Otherwise, top up the necessary quantity through the filler pipe, then tighten the filling cap **(1)**.

# Engine oil pan - Remove - Oil sump [113469820 - V1 - 06 March 2025]

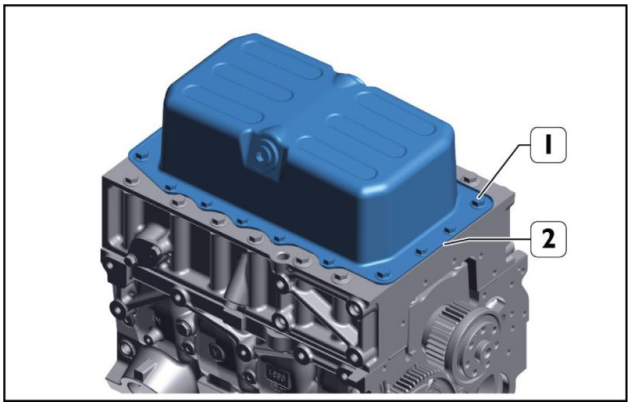
1. Rotate the engine of **180°**.
2. Unscrew the fastening screws **(1)** and remove the oil sump **(2)** recovering the gasket.




NHIL25ENG0143FA 1

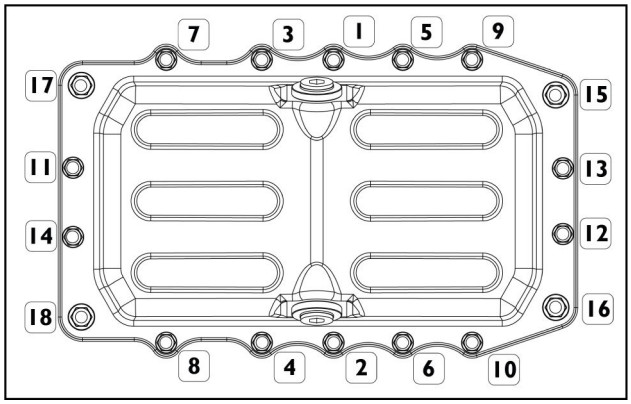
# Engine oil pan - Assemble - Oil sump [113469821 - V1 - 06 March 2025]

1. Correctly position the new gasket on the crankcase.
2. Correctly position the oil sump **(2)** on the crankcase, paying attention to the gasket and tighten the fastening screws **(1)** to the specified torque and according to the sequence shown in the figure **2**.




NHIL25ENG0156FA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Oil sump | 14 screws M8 x 1.25 x 16 | | **23 +/- 2.3 N·m** |
| Oil sump | 4 screws M10 x 1.5 x 130 | | **67 +/- 6.7 N·m** |




NHIL25ENG0157AA 2

**Diagram showing the oil sump fastening screws tightening order**

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**F6AFL413A*U001**

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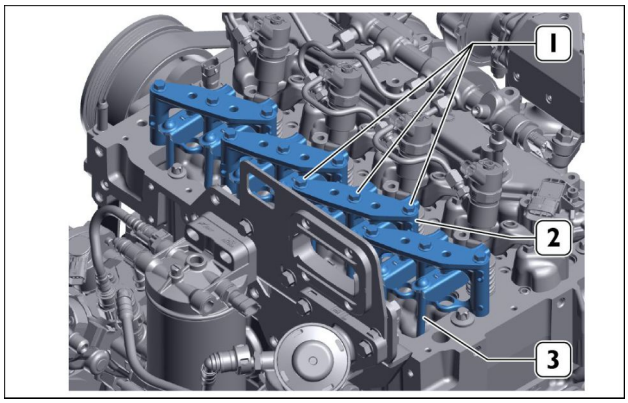
# Rocker arm - Remove - Rocker arm assy [113430434 - V1 - 04 March 2025]

**Prior operation:**
Remove the engine cable as described in the procedure **Engine wiring harness - Remove - Engine cables (55.015)**.
**Prior operation:**
Remove the tappet cover as described in the procedure **Valve cover - Remove - Rocker cover (10.101)**.

1. Unscrew the screws **(1)** and remove the suction and exhaust rocker arms assembly **(2)**.
2. Remove the rocker arm control rods **(3)**.

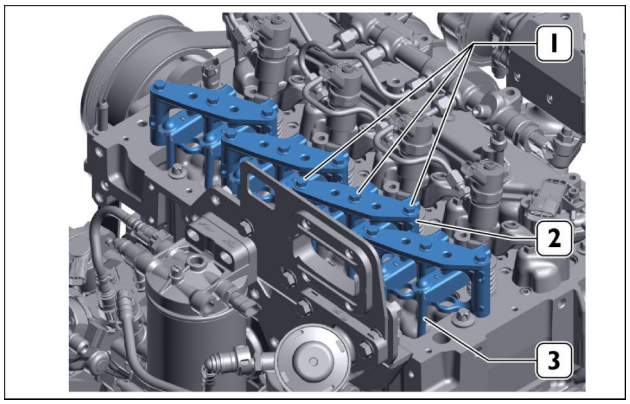



NHIL25ENG0336TA 1

# Rocker arm - Install - Rocker arm assy [113430436 - V1 - 04 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Rocker arm unit | 12 screws M6 x 1 x 75 | | **10 +/- 1 N·m** |

1. The rocker arm control rods must not be deformed; the tappets must not show signs of seizure or wear; otherwise replace them.
2. Intake and exhaust valve control rods are identical and are therefore interchangeable.
3. Insert the rocker arm control rods **(3)**.
4. Refit the intake and exhaust rocker arms unit **(2)** and tighten the screws **(1)** to the prescribed torque.




NHIL25ENG0337TA 1

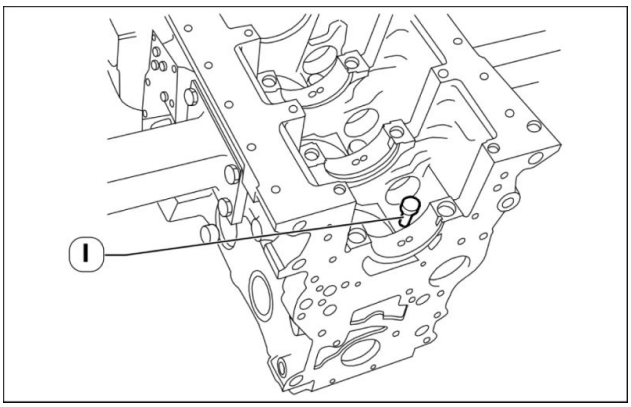
**Next operation:**
Install the tappet cover as described in the procedure **Valve cover - Remove - Rocker cover (10.101)**
**Next operation:**
Install the engine cable as described in the procedure **Engine wiring harness - Remove - Engine cables (55.015)**.

# Camshaft - Assemble - Camshaft [113427971 - V1 - 19 February 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Camshaft longitudinal retaining plate | 2 screws M8 x 1.25 x 18 | | **23 +/- 2.3 N·m** |

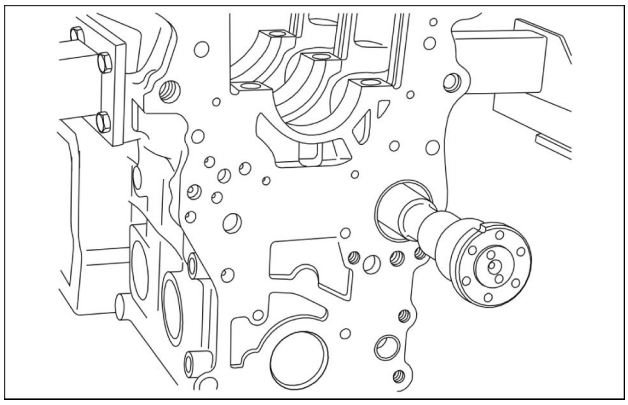
## Fitting tappets - Camshaft

1. Lubricate the tappets **(1)** and fit them into the relevant seats on the crankcase.




NHIL25ENG0329AA 1

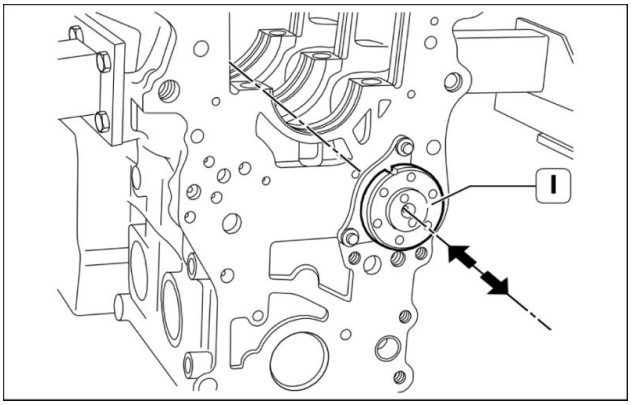
2. Lubricate the bushing and the other mounts and fit the camshaft **(1)** making sure during the operation that the bushing and the mounts are not damaged.
3. Position the plate **(1)** retaining the camshaft **(3)** with the slot facing the upper side of the crankcase and the marking facing the actuator, tighten the screws **(2)** to the prescribed torque.



NHIL25ENG0330AA 2

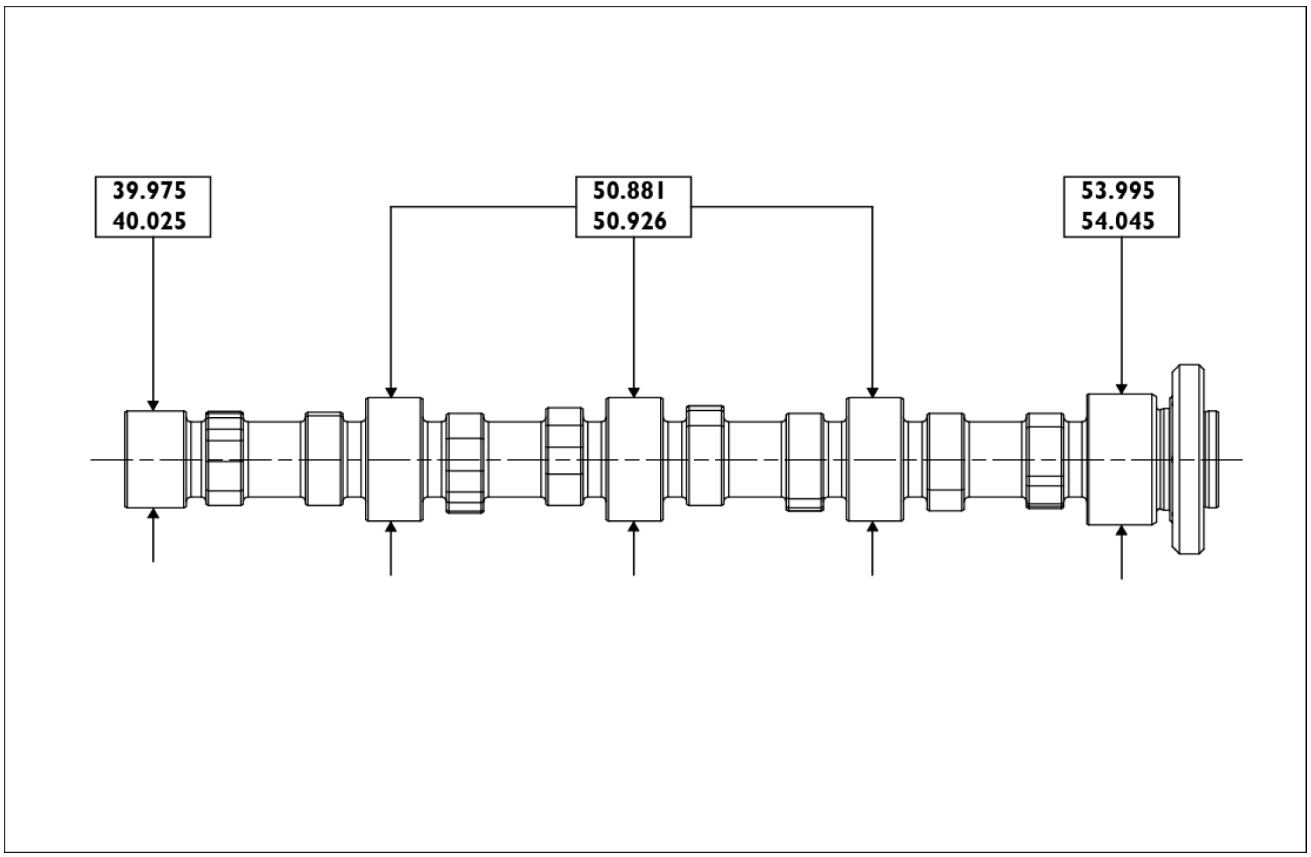
| Description | Quantity | Step | Value |
|---|---|---|---|
| Camshaft longitudinal retaining plate | 2 screws M8 x 1.25 x 18 | | **23 +/- 2.3 N·m** |

4. Check the camshaft end float **(1)**. It must be **0.23 +/- 0.13 mm**.




NHIL25ENG0331AA 3

# Camshaft - Check - Camshaft [113427973 - V1 - 04 March 2025]

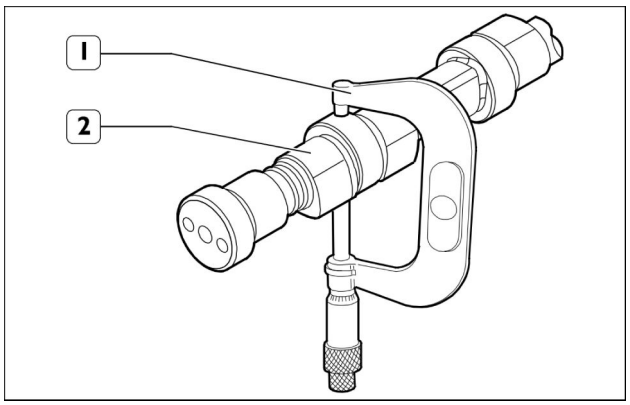



NHIL25ENG0327FA 1

**Camshaft main data - The data provided refers to the standard diameter (dimensions in mm) of the pins**

## Checking cam lift and pin alignment

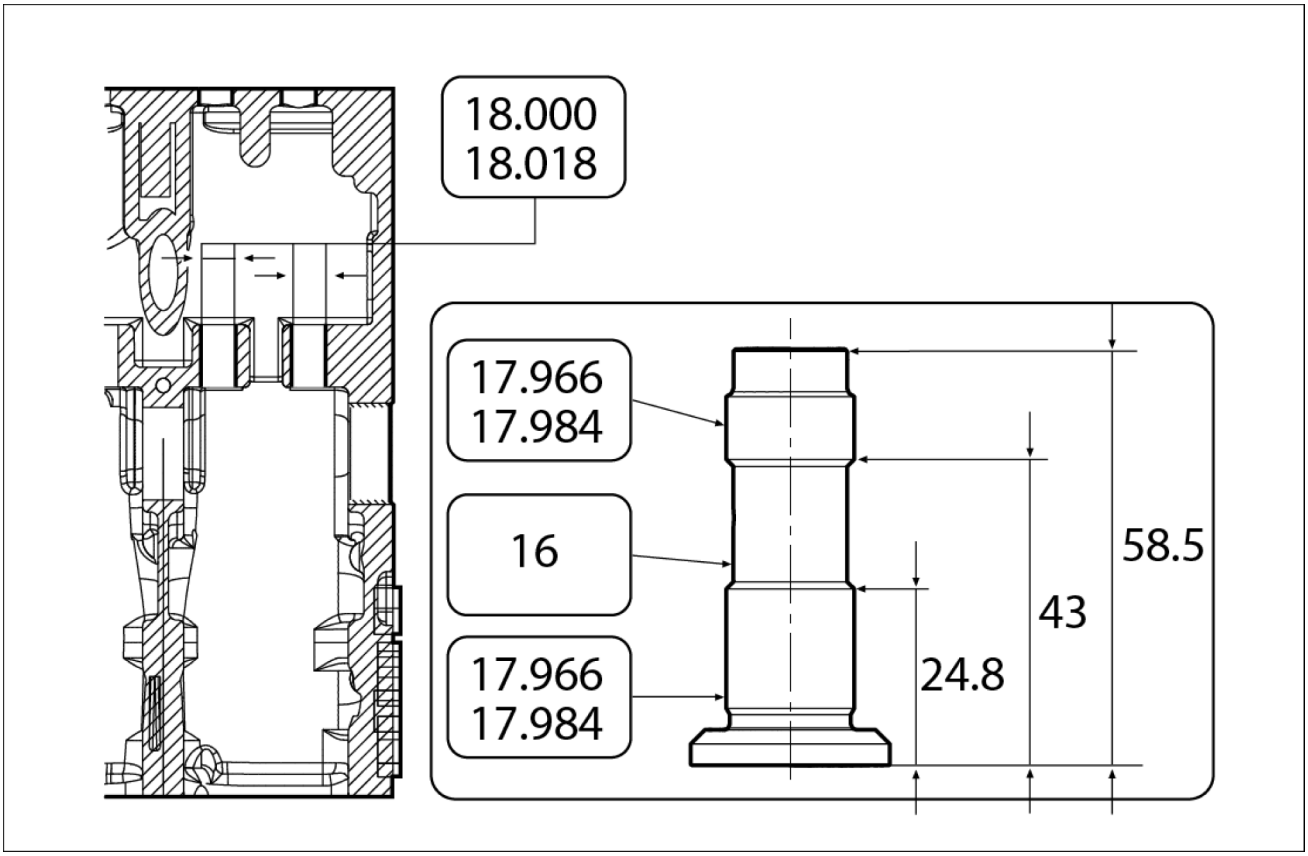
1. Position the camshaft on the tailstocks and using a centesimal gauge on the central support, check that the alignment error does not exceed **0.04 mm** (**0.00 in**), otherwise replace the camshaft.
2. Then, check the cam lifting: It must be **6.02 mm** (**0.24 in**) for the exhaust cams and **5.79 mm** (**0.23 in**) for the intake cams; in case of different values, replace the shaft.
3. Check camshaft **(2)** pin diameter using a micrometer **(1)** on two perpendicular axes.




NHIL25ENG0328AA 2

# Camshaft - Check - Tappets [113428019 - V1 - 19 February 2025]

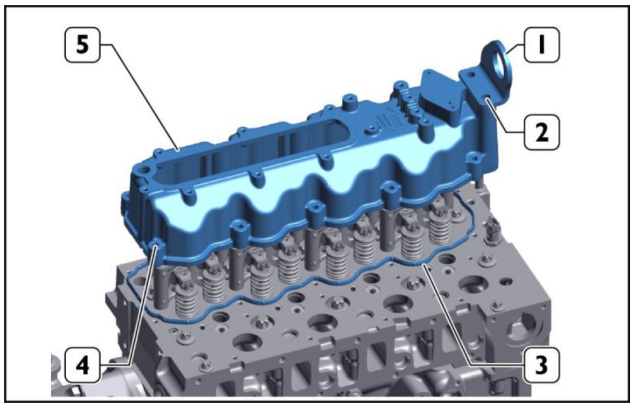
1. Perform tappet measurements and make sure these correspond with their main data and with the data of the crankcase seats as in the figure.




NHIL25ENG0335FA 1

# Camshaft - Remove - Tappet cover [113469242 - V1 - 07 March 2025]

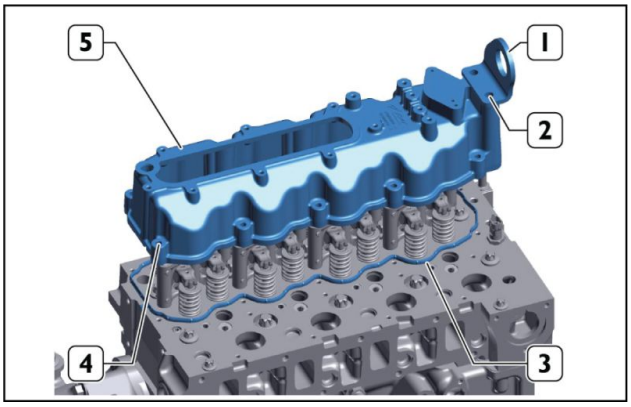
1. Unscrew the fastening screws **(2)** and remove the lifting eyelet **(1)**.
2. Unscrew the screws **(4)** and remove the tappet cover **(5)**, recovering the gasket **(3)**.




NHIL25ENG0131FA 1

# Camshaft - Assemble - Tappet cover [113469987 - V1 - 06 March 2025]

1. Place a new gasket **(3)** on the tappet cover **(5)**.
2. Install the tappet cover **(5)** with a new gasket **(3)** and tighten the fastening screws **(4)** to the specified torque following the sequence and methods shown in the figure **2**.

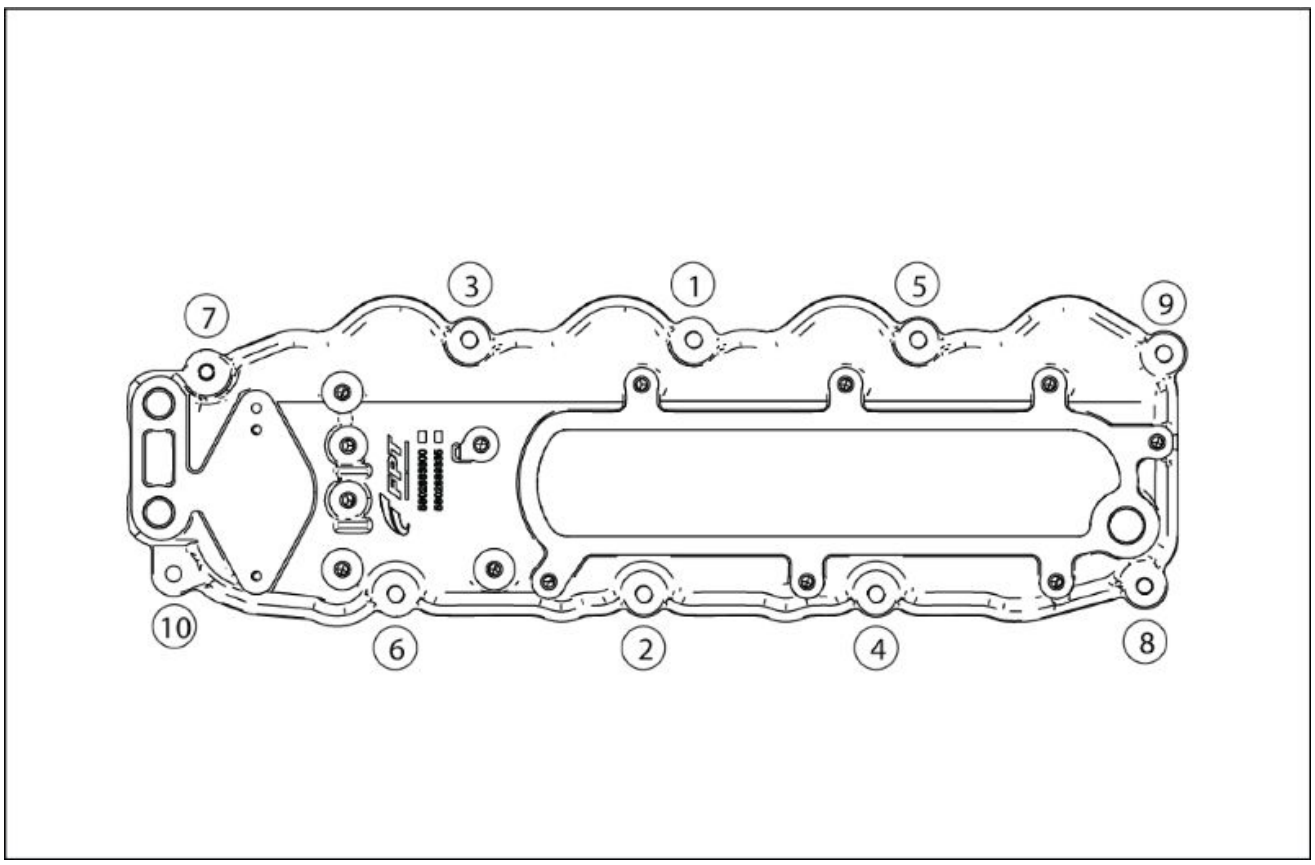



NHIL25ENG0175FA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Head cover | 10 screws M6 x 1 x 40 | | **10 +/- 1 N·m** |

3. Correctly position the lifting eyelets **(1)** and tighten the fastening screws **(2)** to the specified torque.

| Description | Quantity | Value |
|---|---|---|
| Lifting eyelets | 2 screws M10 x 1.5 x 125 | **67 +/- 6.7 N·m** |

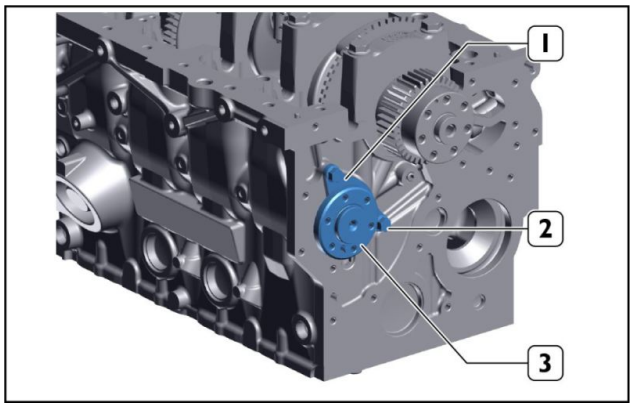



NHIL25ENG0176FA 2

**Diagram of tightening sequence for tappet cover fastening screws**

# Camshaft - Remove [113469835 - V1 - 27 February 2025]

1. Unscrew the screws **(2)** an remove the retaining plate **(1)** of the camshaft **(3)**.
2. Carefully withdraw the camshaft **(3)** from the crankcase.




NHIL25ENG0147FA 1

# Camshaft - Check - Fit tappets and camshaft [113469836 - V1 - 27 February 2025]

1. Check the bushes as described in **Camshaft bushings - Check - Bushes (10.106)**.
2. Check the tappet sleeves as described in **Camshaft - Check - Tappets (10.106)**
3. Check the camshaft as described in **Camshaft - Check - Camshaft (10.106)**
4. Fit the tappets and camshaft as described in **Camshaft - Assemble - Camshaft (10.106)**

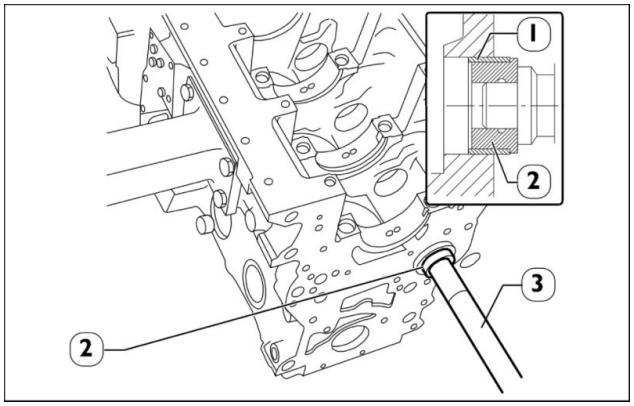
# Camshaft bushings - Replace - Bushes [113428014 - V1 - 04 March 2025]

| Tool / Material | |
|---|---|
| Camshaft bush assembly and disassembly punch (use with 99370006) | 99360362 |
| Handle,interchangeable driver | 99370006 |

## Camshaft bushes replacement

1. To replace the rear bushing **(1)** use the same drift **(2)** and grip **(3)** as for the disassembly and assembly.

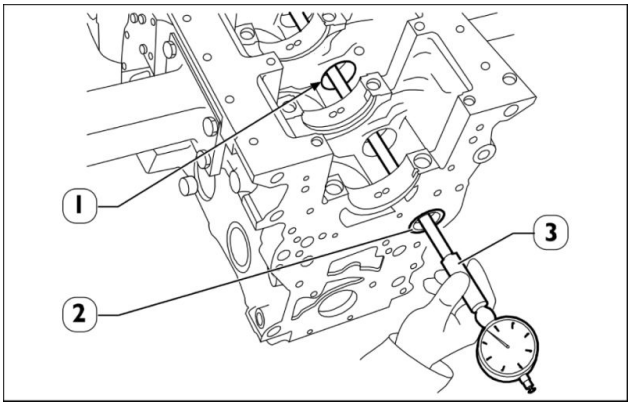
***NOTE:*** *Bushing **(1)** for assembly must be oriented so that the lubrication holes match with those on the seat of the crankcase.*



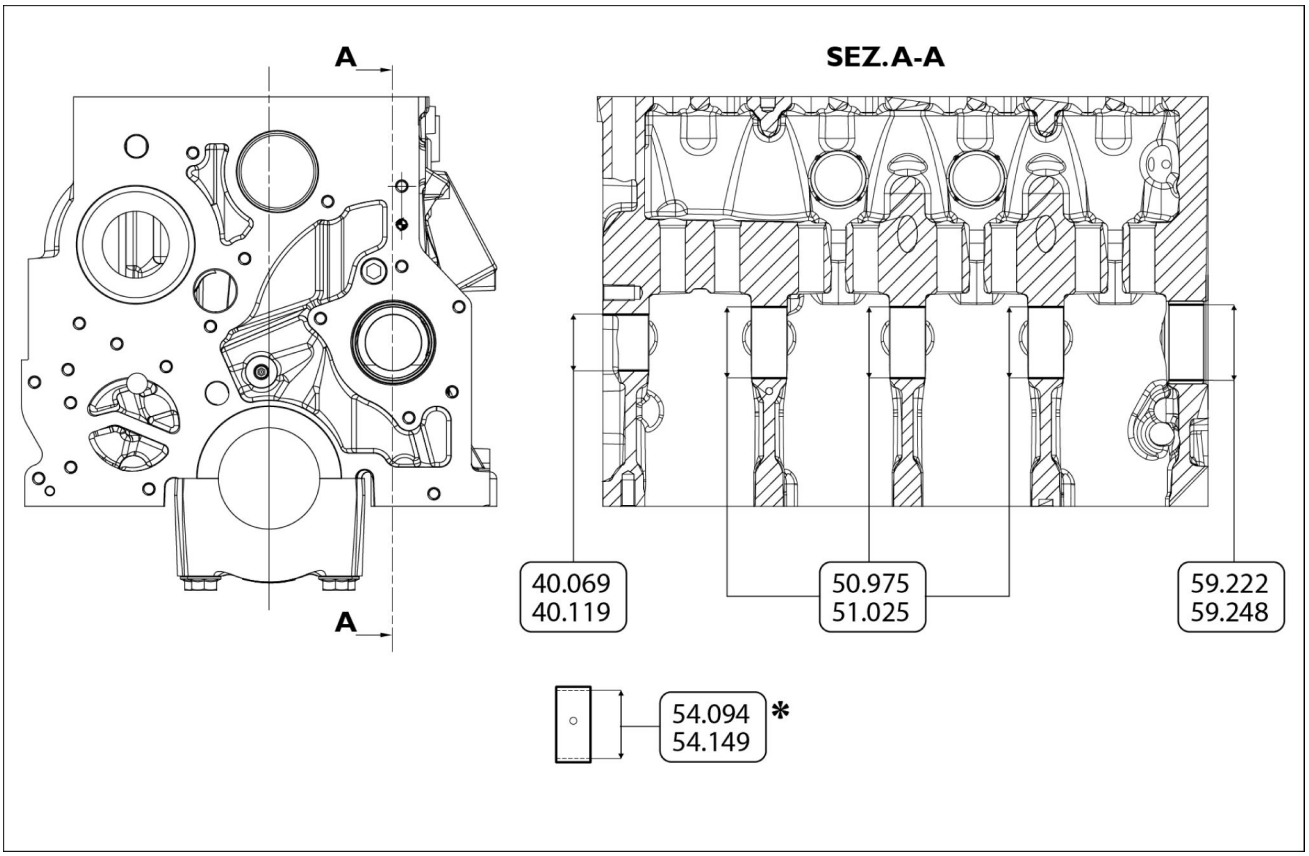

NHIL25ENG0334AA 1

# Camshaft bushings - Check - Bushes [113428015 - V1 - 04 March 2025]

1. The bushing **(2)** for the camshaft must be forced into its seat.
2. The internal surfaces must show no signs of seizure or worn.
3. Use a bore meter **(3)** to measure the diameter of the bushing **(2)** and the intermediate seats **(1)** of the camshaft.
4. Measurements should be performed on two perpendicular axes.




NHIL25ENG0332AA 1




NHIL25ENG0333TA 2

**Camshaft bush and housing main data- (*)Value to be obtained after the installation of the bush (dimensions in mm).**

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# Valves - Overview - Throttle position sensor [113427390 - V1 - 18 February 2025]

## Throttle body (TVA)

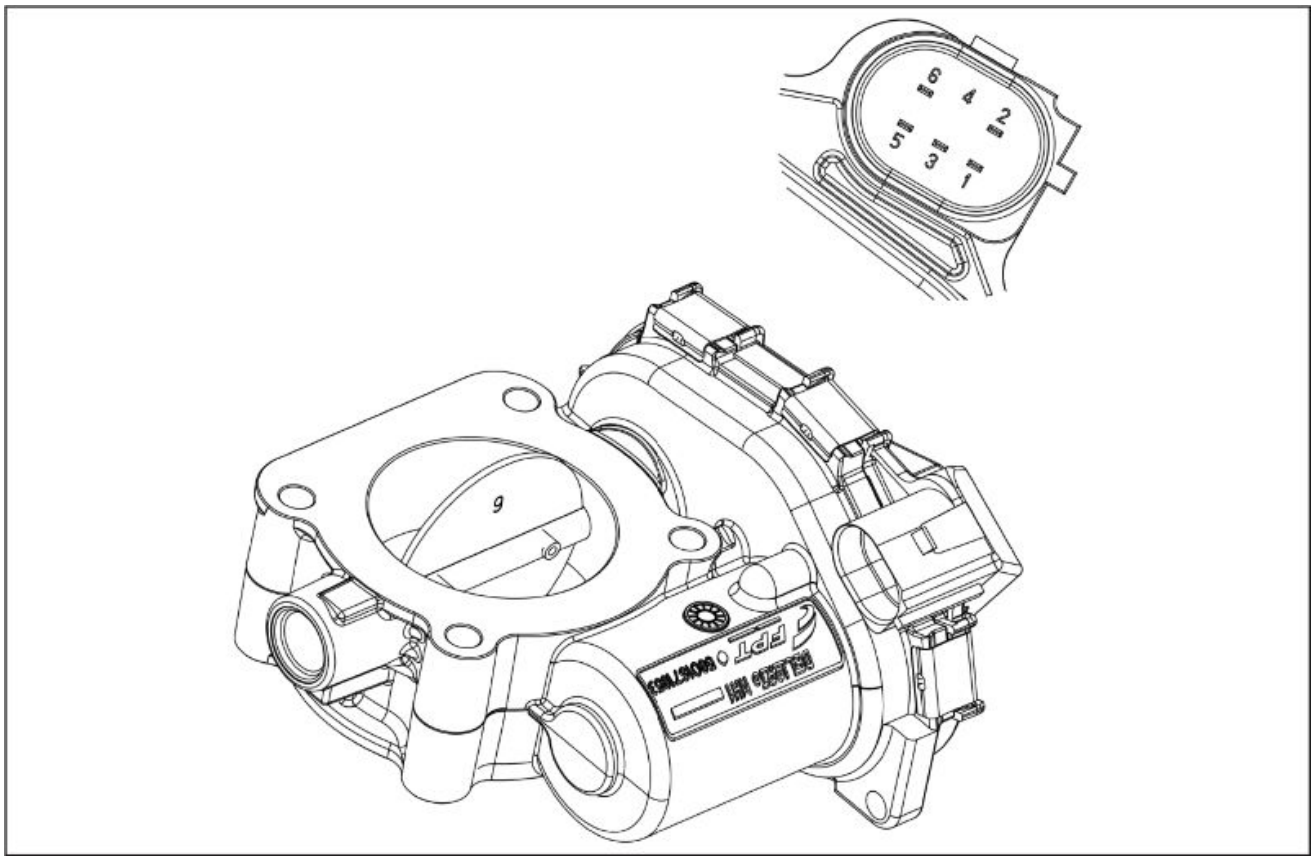
A motorised valve is fit between the engine air intake and the intake manifold that regulates the quantity of air to be sent to the cylinders at each cycle.

Contains a position sensor and an actuator for the electric valve motor.

The sensor is powered at **5 V**.

## Sensor-actuator pin-out

| Pin | DeFromCablescription |
|---|---|
| 1 | TVA valve position sensor power supply |
| 2 | TVA valve position sensor power supply |
| 3 | TVA valve position sensor ground |
| 4 | Not connected |
| 5 | TVA valve position sensor signal output |
| 6 | TVA valve DC motor actuator positive |

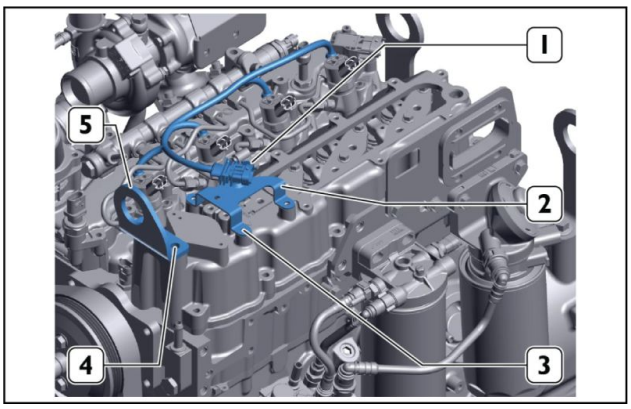



NHIL25ENG0263FA 1

# Valve cover - Remove - Rocker cover [113427231 - V1 - 04 March 2025]

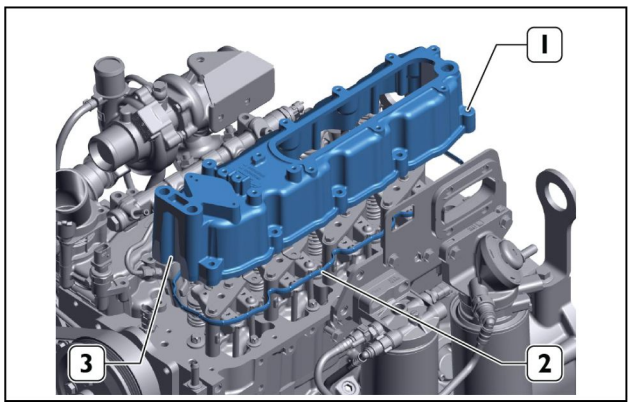
**Prior operation:**
Remove the engine cable as described in the procedure **Engine wiring harness - Remove - Engine cables (55.015)**.
**Prior operation:**
Disconnect the fuel pipes as described in the procedure **Glow plug system - Remove - Pipes (55.202)**.
**Prior operation:**
Remove the engine breather filter unit as described in the procedure **Fuel breather - Remove - Engine breather (10.216)**.

1. Disconnect the wiring of the glow plugs **(1)**.
2. Unscrew the screws **(3)** and remove the glow plug wiring retainer bracket **(2)**.
3. Unscrew the screws **(4)** and remove the lifting eyelet **(5)**.



NHIL25ENG0240TA 1

4. Unscrew the screws **(1)** and remove the tappet cover **(3)** recovering the gasket **(2)**.

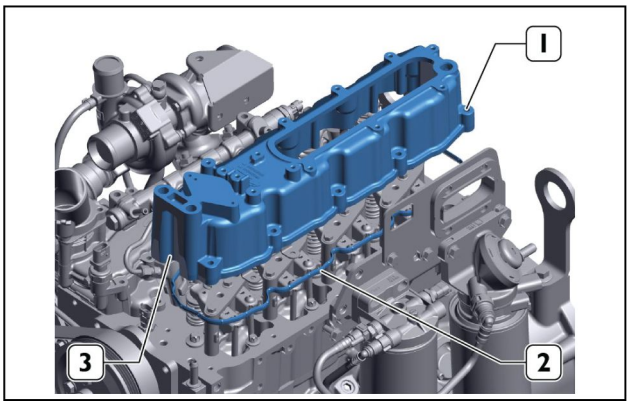


NHIL25ENG0241TA 2

# Valve cover - Install - Rocker cover [113427232 - V1 - 04 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Glow plug harness mount | 3 screws M6 x 1 x 14 | | **10 +/- 1 N·m** |
| Head cover | 10 screws M6 x 1 x 40 | | **10 +/- 1 N·m** |
| Lifting eyelets | 2 screws M10 x 1.5 x 125 | | **67 +/- 6.7 N·m** |

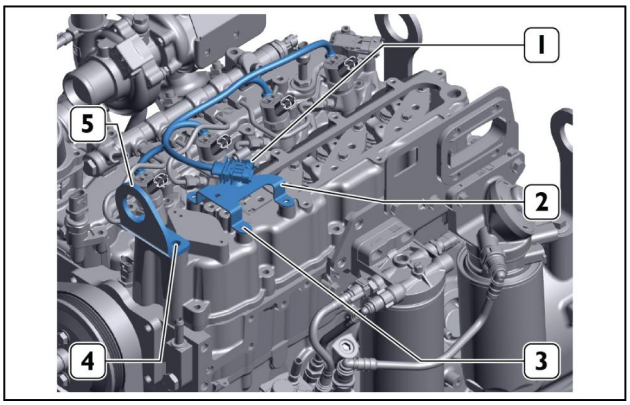
1. Fit a new gasket **(3)** on the tappet cover **(2)**.
2. Install the tappet cover **(3)** with a new gasket **(2)** and tighten the screws **(1)** to the prescribed torque.




NHIL25ENG0242TA 1

| Descrip-tion | Quantity | Step | Value |
|---|---|---|---|
| Head cover | 10 screws M6 x1 x 40 | | **10 +/- 1 N·m** |

3. Position the lifting eyelet **(5)** and tighten the screws **(4)** to the prescribed torque.




NHIL25ENG0243TA 2

| Descrip-tion | Quantity | Step | Value |
|---|---|---|---|
| Lifting eyelets | 2 screws M10 x 1.5 x 125 | | **67 +/- 6.7 N·m** |

4. Position the bracket **(2)** supporting the wiring of the glow plugs and tighten the screws **(3)** to the prescribed torque.

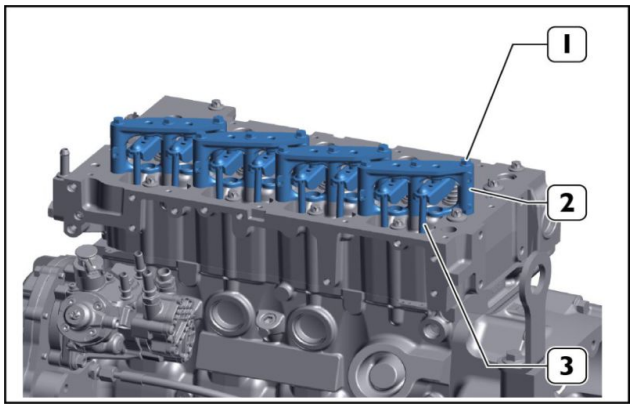
| Descrip-tion | Quantity | Step | Value |
|---|---|---|---|
| Glow plug harness mount | 3 screws M6 x 1 x 14 | | **10 +/- 1 N·m** |

**Next operation:**
Fit the engine breather filter unit as described in the procedure **Fuel breather - Install - Engine breather (10.216)**.
**Next operation:**
Connect the fuel pipes, as described in the procedure **Glow plug system - Install - Pipes (55.202)**.
**Next operation:**

Fit the engine cable **Engine wiring harness - Install - Engine cables (55.015)**.

# Valve cover - Remove - Rocker arms assembly [113469249 - V1 - 07 March 2025]

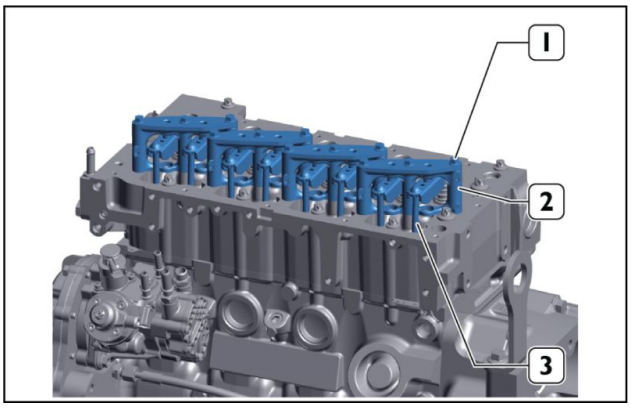
1. Unscrew the screws **(1)** and remove the intake and exhaust rocker arms assembly **(2)**.
2. Remove the rocker arm control rods **(3)**.




NHIL25ENG0132FA 1

# Valve cover - Install - Rocker arms assembly [113469947 - V1 - 06 March 2025]

1. The control rods **(3)** of the rocker arms must have no deformations; the tappets must show no trace of seizure or wear; if they do, replace them.
2. Intake and exhaust valve pushrods **(3)** are identical and are therefore interchangeable.
3. Insert the rocker arm control rods **(3)**.
4. Reassemble the intake and exhaust rocker arm assembly **(2)** and tighten the fastening screws **(1)** to the specified torque.




NHIL25ENG0174FA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Rocker arm unit | 12 screws M6 x 1 x 75 | | **10 +/- 1 N·m** |

# Cylinder head - Prepare - Cylinder mechanics [113375895 - V1 - 13 February 2025]

## Preparation

General checks

- Battery voltage is sufficient.
- Vehicle fuses are OK.
- Engine oil level correct.
- Engine is warm, if possible.
- No deposits on the undersides of the valve heads.
- Offboard tools: cylinder compression tester tool and cylinder pressure loss tester tool.

# Cylinder head - Check - Cylinder mechanics [113375896 - V1 - 21 February 2025]

## Check cylinder compression

Preparation

- Ignition switch set to OFF position.
- Remove the fuel injectors.
- With suitable piping fixtures, seal off the fuel rail outlets to the fuel injectors.
- Unplug the connectors of the crankshaft and camshaft speed sensors.

***NOTE:*** *The compression test is used to compare the pressure conditions in the individual combustion chambers.*

1. Check cylinder compression
   - Follow the Cylinder compression tester tool operator manual to connect the pressure gauge to cylinder number 1.
   - Crank the engine for **8 s** and record the maximum pressure reached.
   - Refer to step 1 and 2 for all the cylinders.
   - Perform compression test for each cylinder twice.
   - Calculate average compression pressure for each cylinder and compare the results.
   - Refer the figure **1** for indications and go to step **2**.
2. Check cylinder compression
   A. Compression should build up quickly in a healthy engine.
   B. Similar compression pressure values between all cylinders.
   C. If the cylinder compression is OK, refer to **Cylinder head - Check - Cylinder pressure loss (10.101)**
   D. If the cylinder compression is NOT OK, go to step **3**.
3. Possible root cause
   - Low compression reading on the first stroke, followed by gradually increasing pressure on successive strokes: worn piston rings and/or cylinder.
   - Low compression reading on the first stroke, which does not build up during successive strokes: leaking valves or a faulty head gasket.
   - Low reading from two adjacent cylinders: faulty head gasket between the two cylinders.
   - Engine mechanical failure. Deviating compression in one or more cylinders.
   - Further check with pressure loss test.

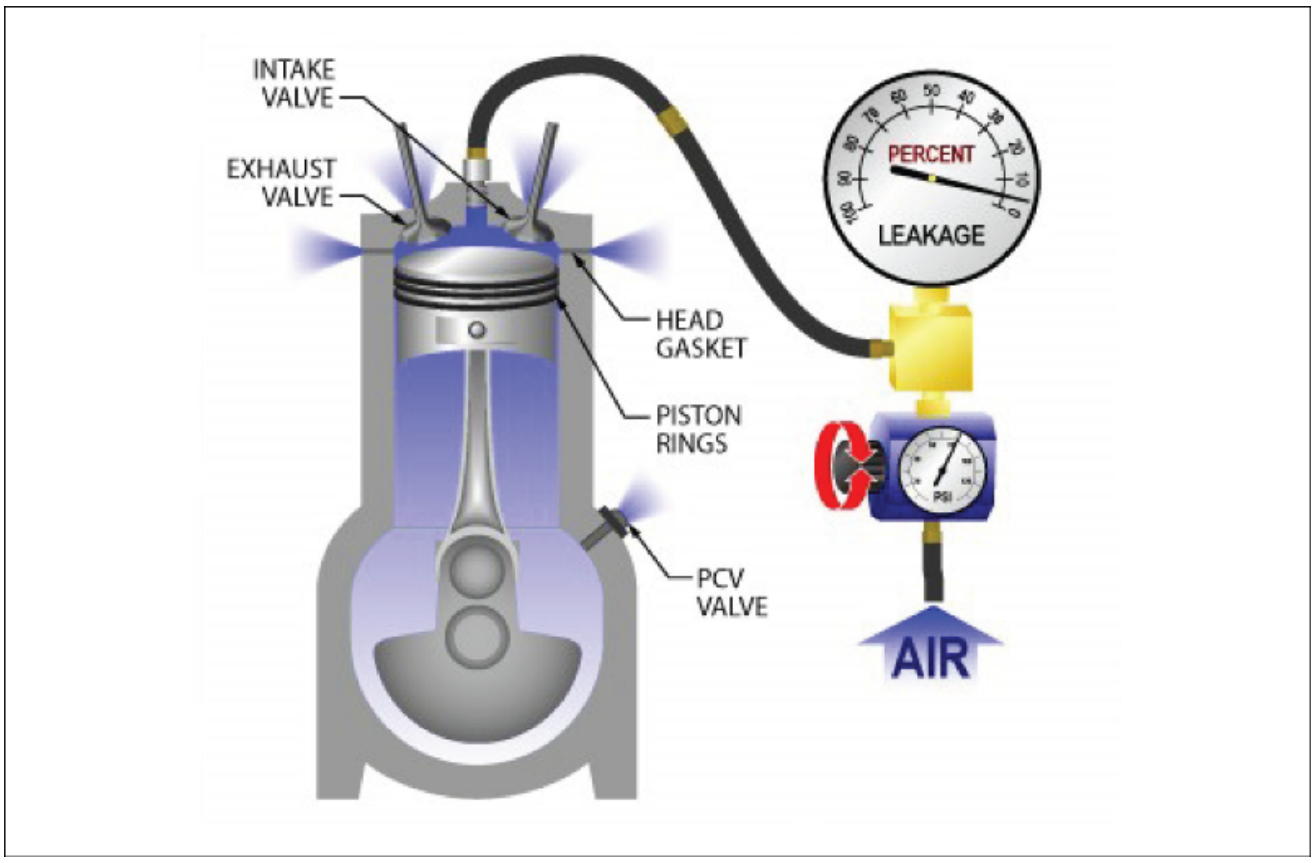
NHIL25ENG0544BA 1

***NOTE:*** *After having eliminated the cause of the error, delete the fault memory and repeat the reading.*

# Cylinder head - Check - Cylinder pressure loss [113375897 - V1 - 21 February 2025]

1. Preparation
   - Ignition switch set to OFF position.
   - Remove the fuel injectors.
   - With suitable piping fixtures, seal off the fuel rail outlets to the fuel injectors.
   - The piston must be exactly in the TDC of the compression stroke using a TDC indicator tool.
   - Connect the pressure loss tester to the compressed air network ( from **5.0 – 10 bar** (**72.5 – 0.0 psi**) ) and calibrate the tester.
2. Check cylinder pressure loss
   - Follow the Cylinder pressure loss tester tool operator manual to connect the tool to the suspicious cylinder.
   - The pressure loss resulting from leakage is indicated in percent on the Pressure Gauge.
   - Check for leaks and noises.
   - Refer the figure **1** for indications and go to step **3**.

***NOTE:*** *The expected value for the pressure loss is displayed as a percentage.*




NHIL25ENG0543FA 1

**Schematic of the pressure loss test**

3. Check cylinder pressure loss
   - If the indicated air leakage percentage is in the OK area, go to step **5**.
   - If the indicated air leakage percentage is not in the OK area, go to step **4**.
4. Possible root cause
   - Noises in the exhaust – Exhaust valve leaking.
   - Noises in the intake tract – Inlet valve leaking.
   - Noises on crankcase ventilation, oil filler cap or oil dipstick – Wear of cylinder track, piston rings, crack or hole in the piston, defective cylinder head gasket.
   - Noises at the injector opening of the adjacent cylinder – cylinder head gasket leaking.
   - Bubble formation in the cooling system – cylinder head gasket leaks, crack(s) in the cylinder head.

***NOTE:*** *After having eliminated the cause of the error, delete the fault memory and repeat the reading.*

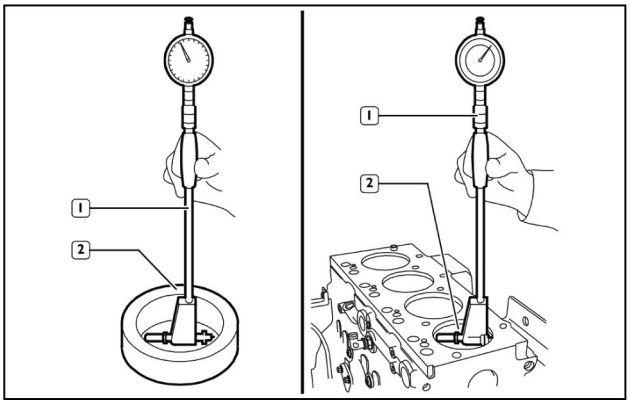
5. The cylinder works properly.

# Cylinder head - Check - Cylinder barrels [113418852 - V1 - 26 February 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Crankshaft main bearing caps | 10 screws M12 x 1.5 x 120 | Step 1 — Pre-tightening | 50 +/- **6.00 N·m** (**53.10 lb in**) |
| | | Step 2 — Tighten | 80 +/- **6.00 N·m** (**53.10 lb in**) |
| | | Step 3 — Angle tightening | **90°** |

## Cylinder liner checks and measurements

1. Once the engine is disassembled, thoroughly clean the cylinder-crankcase assembly.
2. Use the proper rings to handle the cylinder block.
3. Check thoroughly that no cracks are to be noticed on the crankcase.
4. Check the condition of casting hole plugs. If the caps are rusted or there is any doubt over the efficiency of the seal the produce, replace the caps with new ones.
5. Inspect the surfaces of the cylinder liners; they should not be scored, seized, ovalized, conical or worn to excess.

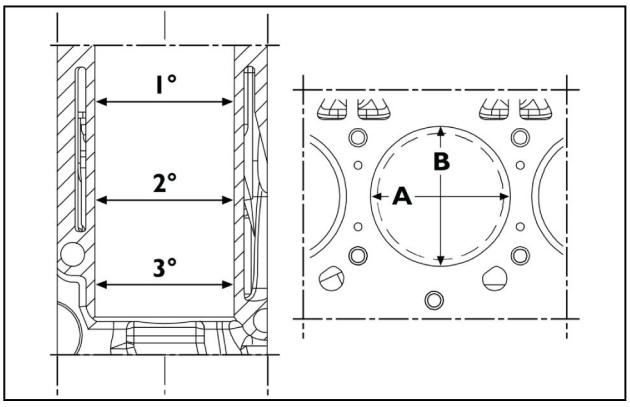



NHIL25ENG0217AA 1

***NOTE:*** *General prescriptions If a ring gauge is not available, zero using a micrometer. Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle*

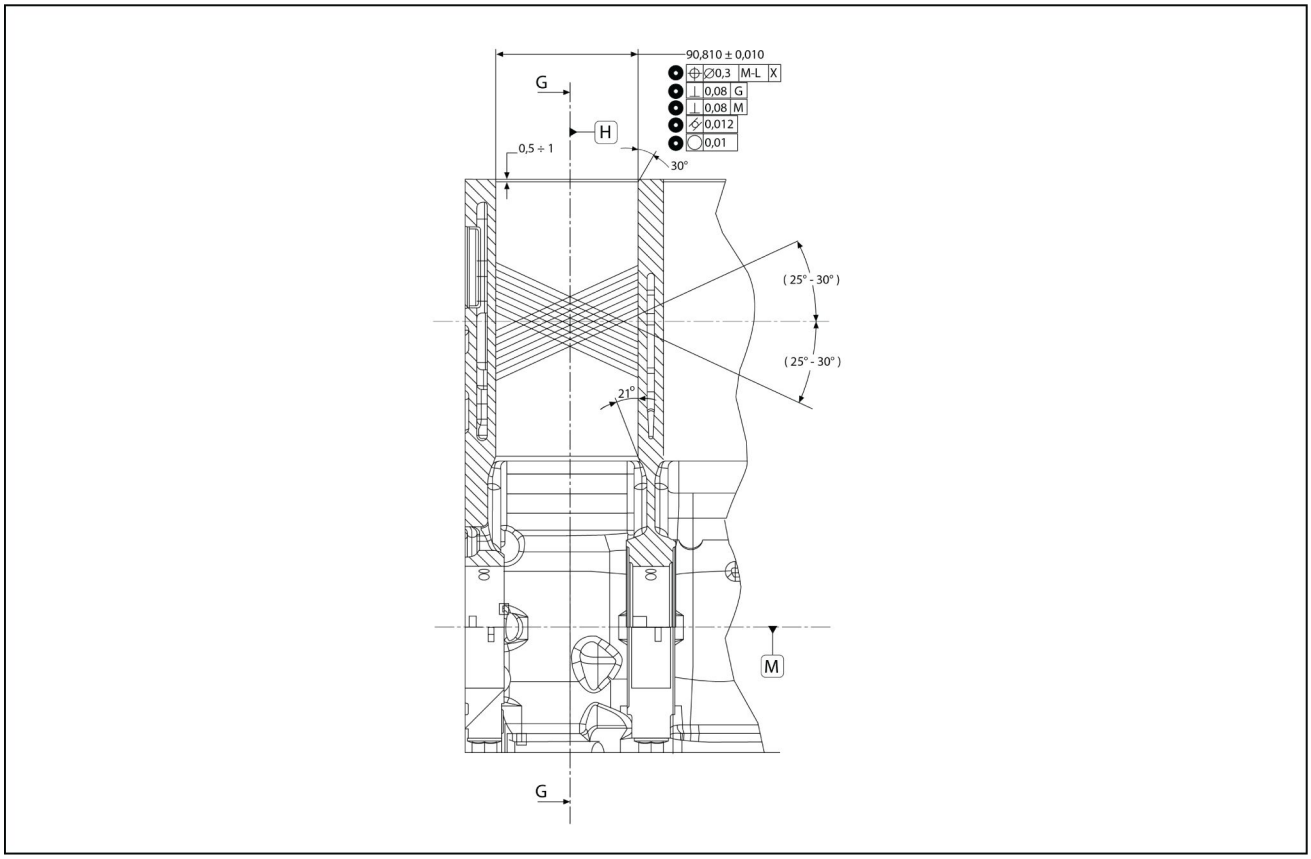
The internal diameter of the cylinder liners is checked to ascertain the extent of ovalization, taper and wear, using the bore meter **(1)** fitted with a dial gauge previously reset on the ring gauge **(2)** of the diameter of the cylinder liner.

6. Measurements shall be performed on each cylinder, at three different heights in the bore and on two planes perpendicular with each other: one parallel to the longitudinal axis of the engine **(A)** and the other perpendicular to it **(B)**; the greatest wear is usually found to be on this surface and during the first measurement.
7. Should ovalisation, taper or wear be found, bore and grind the cylinder liners. The cylinder liners must be refaced in relation to the diameter of the pistons provided as a replacement part, increased by 0.4 mm and the recommended assembly clearance.




NHIL25ENG0218AA 2

***NOTE:*** *When reworking, all the liners must have the same oversize **0.40 – 0.80 mm** (**0.02 – 0.03 in**).*




NHIL25ENG0219FA 3

8. Check main bearing housings as follows:
9. Fit the main bearings caps on the supports without bearings.
10. Tighten the fastening screws to the required torque value.

| Description | Quantity | Step | Value |
|---|---|---|---|
| Crankshaft main bearing caps | 10 screws M12 x 1.5 x 120 | Step 1 — Pretightening | 50 +/- **6.00 N·m** (**53.10 lb in**) |
| | | Step 2 — Tighten | 80 +/- **6.00 N·m** (**53.10 lb in**) |
| | | Step 3 — Angle tightening | **90°** |

11. Use the proper internal gauge to check whether the seat diameter is falling within the specified value.
12. Replace crankcase if higher value is found.

# Cylinder head - Remove - Cylinder head [113419169 - V1 - 04 March 2025]

### Prior operation:

Position a suitable container to catch any fuel.

### Prior operation:

Remove the engine cable as described in the procedure **Engine wiring harness - Remove - Engine cables (55.015)**.

### Prior operation:

Remove the exhaust manifold as described in the procedure **Exhaust manifold - Remove - Exhaust manifold (10.254)**.

### Prior operation:

Remove the supply system as described in the procedure **Common rail pressure sensor - Remove - High pressure accumulator (55.010)**.

### Prior operation:

Remove the intake manifold as described in the procedure **Intake manifold - Remove - Intake manifolds (10.254)**.

### Prior operation:

Remove the fuel filter bracket as described in the procedure **Pre-filter - Remove - Filter support (10.206)**.

### Prior operation:

Remove the injectors as described in the procedure **Fuel injectors - Remove - Injectors (10.218)**.

### Prior operation:

Remove the glow plugs as described in the procedure **Glow plug system - Remove - PREHEATER PLUGS (55.202)**.

### Prior operation:

Remove the valves and rocker arm assembly as described in the procedure **Rocker arm - Remove - Rocker arm assy (10.106)**.

### Prior operation:

Remove the drive belt as described in the procedure **Radiator to water pump hoses - Remove - Water pump drive belt (10.400)** .

### Prior operation:

Remove the alternator as described in the procedure **Alternator - Remove (55.301)**.

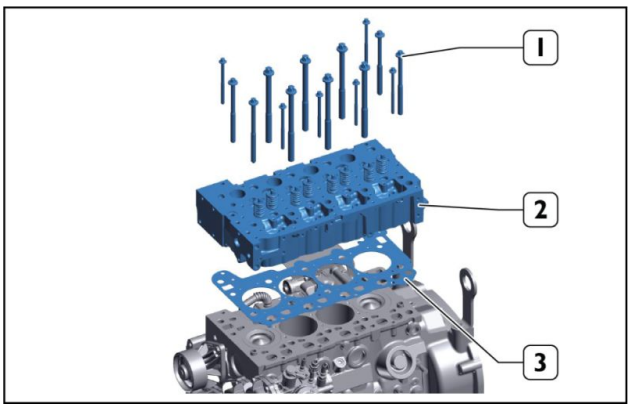
## Prior operation:

Remove the fan drive pulley bracket as described in the procedure **Fan - Remove - Fan hub mount (10.414)**.

## Prior operation:

Remove the thermostat unit as described in the procedure **Coolant thermostat - Remove - Thermostat (10.400)**.

1. Unscrew the screws **(1)** and remove the cylinder head **(2)** recovering the gasket **(3)**.

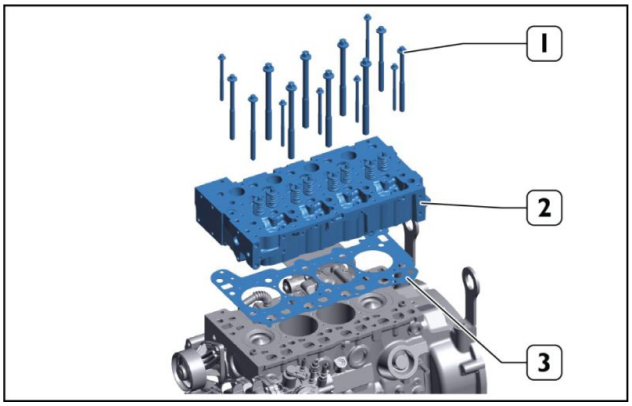



NHIL25ENG0231FA 1

# Cylinder head - Install - Cylinder head [113419170 - V1 - 04 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Cylinder head | 4 screws M12 x 1.5 x 165 | Step 1 — | **65 +/- 3.25 N·m** |
| | | Step 2 — Angle tightening | **90°** |
| | | Step 3 — Angle tightening | **60°** |

1. Check that the mating surfaces of the cylinder head and crankcase are clean.
2. Keep the cylinder head gasket clean.
3. Position the cylinder head gasket **(3)** with the thickness indicated in the section **General specification - Engine - Technical data ()** , with the “UP“ mark facing the head.




NHIL25ENG0238FA 1

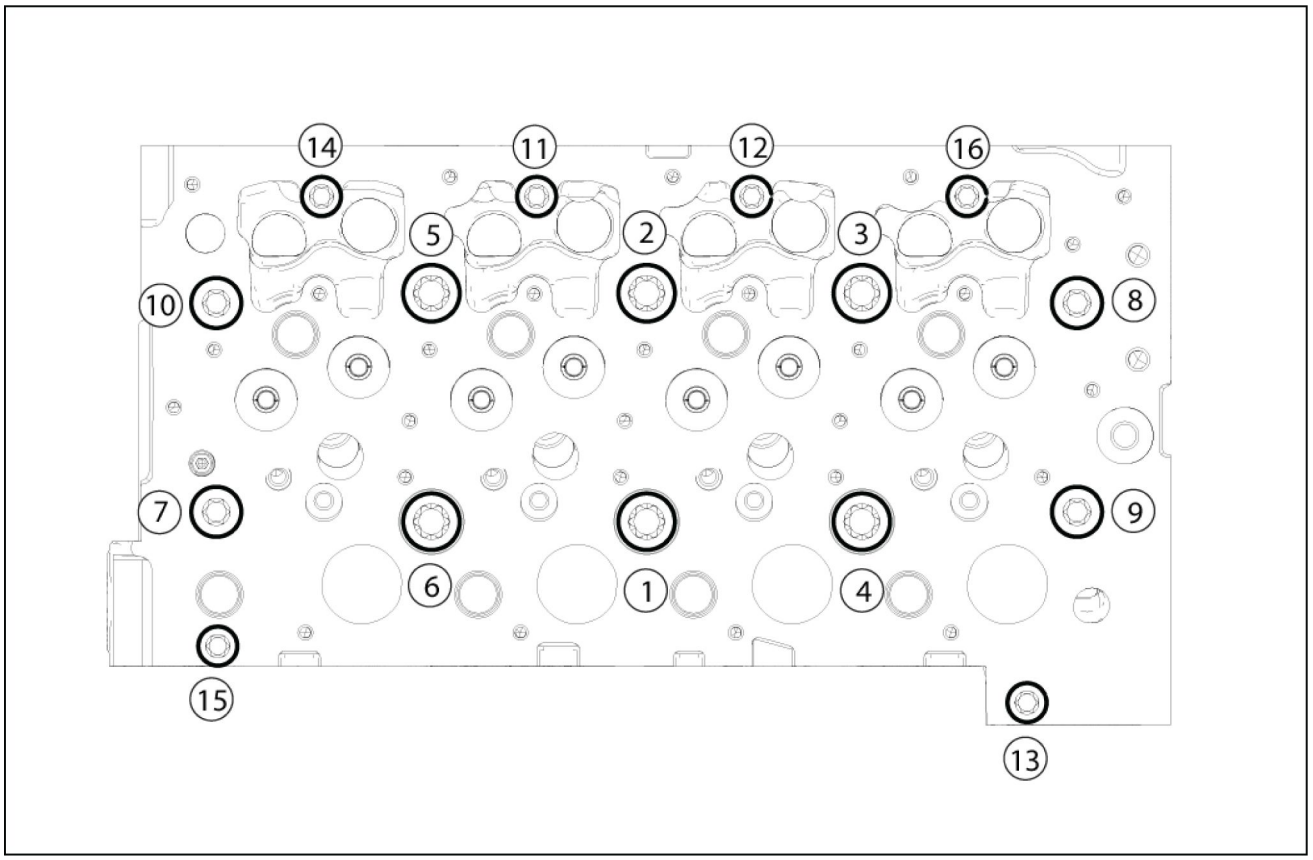
***NOTE:*** *It is important to leave the gasket sealed in its packaging until right before assembly.*

***NOTE:*** *Always check that the screw threads and their holes do not show signs of wear or traces of dirt prior to assembly.*

4. Fit the cylinder head and tighten the new fastening screws **(1)** to the prescribed torque.

| Description | Quantity | Step | Value |
|---|---|---|---|
| Cylinder head | 6 screws M15 x 1.5 x 193 | Step 1 — | **65 +/- 6.25 N·m** |
| | | Step 2 — Angle tightening | **90 °C** |
| | | Step 3 — Angle tightening | **90 °C** |
| Cylinder head | 6 screws M8 x 1.25 x 117 | | **34 +/- 3.4 N·m** |
| Cylinder head | 4 screws M12 x 1.5 x 165 | Step 1 — | **65 +/- 3.25 N·m** |
| | | Step 2— Angle tightening | **90 °C** |
| | | Step 3 — Angle tightening | **60 °C** |

## Head screw tightening order




NHIL25ENG0239TA 2

**Diagram showing the cylinder head fastening screws tightening order.**

**Next operation:**
Remove the thermostat unit as described in the procedure **Coolant thermostat - Install - Thermostat (10.400)**.
**Next operation:**
Remove the fan drive pulley mount as described in the procedure **Fan - Install - Fan hub mount (10.414)**.
**Next operation:**
Fit the alternator as described in the procedure **Alternator - Install (55.301)**.
**Next operation:**
Fit the drive belt as described in the procedure **Radiator to water pump hoses - Install - Water pump drive belt (10.400)**.
**Next operation:**
Fit the rocker arm and valve unit as described in the procedure **Rocker arm - Install - Rocker arm assy (10.106)**.
**Next operation:**
Fit the glow plug as described in the procedure **Glow plug system - Install - Preheater plugs (55.202)**.
**Next operation:**
Fit the injectors as described in the procedure **Fuel injectors - Install - Injectors (10.218)**.
**Next operation:**
Fit the fuel filter bracket, as described in the procedure **Pre-filter - Install - Filter support (10.206)**.
**Next operation:**
Install the intake manifold as described in the procedure **Intake manifold - Install - Intake manifold (10.254)**.
**Next operation:**
Fit the fuel system, as described in the procedure **Common rail pressure sensor - Remove - High pressure accumulator (55.010)**.
**Next operation:**
Fit the exhaust manifold as described in the procedure **Exhaust manifold - Install - Exhaust manifold (10.254)**.
**Next operation:**
Fit the engine breather assembly **Fuel breather - Install - Engine breather (10.216)**.
**Next operation:**
Fit the engine cable as described in the procedure **Engine wiring harness - Install - Engine cables (55.015)**.

# Cylinder head - Check - Cylinder head [113419171 - V1 - 04 March 2025]

## Prior operation:

## Valves - Disassemble - Valves (10.101)

## Checking cylinder block head contact surface

1. After having identified any deformed areas, regrind the head mating surface using a grinder.
2. Planarity error must not exceed **0.075 mm** (**0.003 in**).
3. Check the condition of the cylinder assembly caps: replace them if they are oxidised or if there is any doubt regarding their seal.

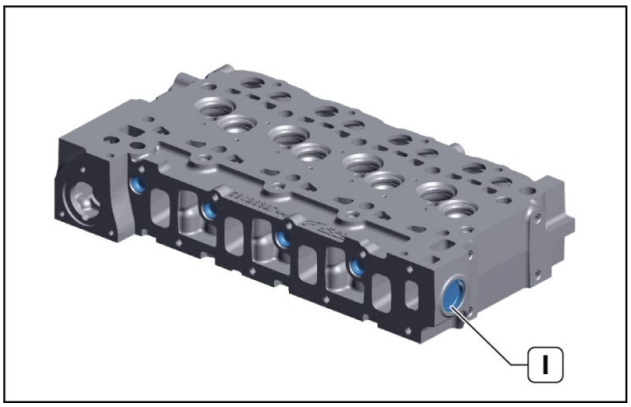
# Cylinder head - Check - Cylinder head [113419293 - V1 - 04 March 2025]

## Checking moistened cylinder head gasket

1. This check must be carried out with the designated tools.
2. Use a pump to fill with water heated to approx. **90 °C** and at a pressure of **2 – 3 bar**.
3. Replace the spring seat plugs **(1)** if they are found to leak, using a suitable drift for their removal/installation.

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

4. Replace if there are any leaks from the cylinder head.




NHIL25ENG0232AA 1

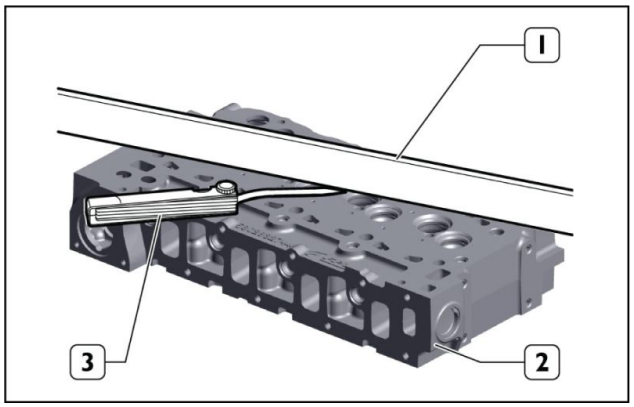
# Cylinder head - Check - Cylinder head [113419294 - V1 - 04 March 2025]

## Cylinder head contact surface check

1. Check the supporting surface of the head **(2)** on the cylinder block with a rule **(1)** and a feeler gauge **(3)**.

***NOTE:*** *Distortion found along the whole cylinder head shall not exceed* ***0.20 mm*** *(****0.01 in****).*

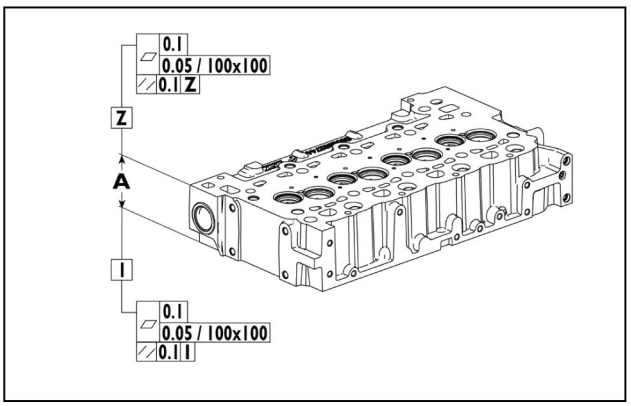
2. If higher values are found grind the cylinder head according to values and indications shown in the following figure.




NHIL25ENG0233AA 1

3. Check that the nominal thickness **(A)** of the cylinder head is **90 +/- 0.1 mm**.
4. If removing material from the contact surface of the cylinder head do not exceed the maximum allowed value **(B) 0.13 mm**.

***NOTE:*** *After regrinding, check the valve recessing and if necessary regrind the valve seats to meet the prescribed valve recess.*




NHIL25ENG0234AA 2

# Cylinder head - Check - Cylinder head [113419295 - V1 - 17 February 2025]

## Checking the planarity of the head on the cylinder block

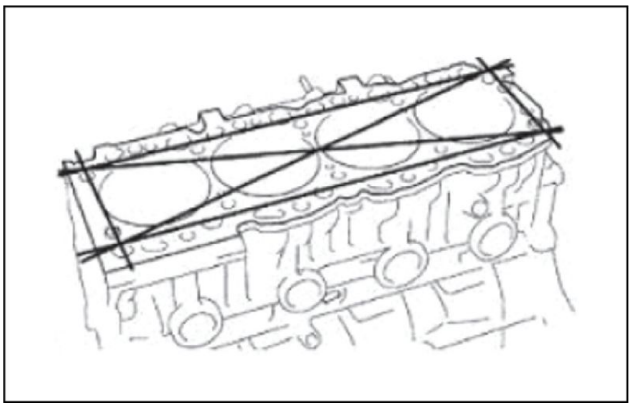
1. Checking the planarity of the head on the cylinder block
2. Check the flatness.

   First check the main flatness and then check the sector flatness:

# Cylinder head - Check - Cylinder head [113419296 - V1 - 04 March 2025]

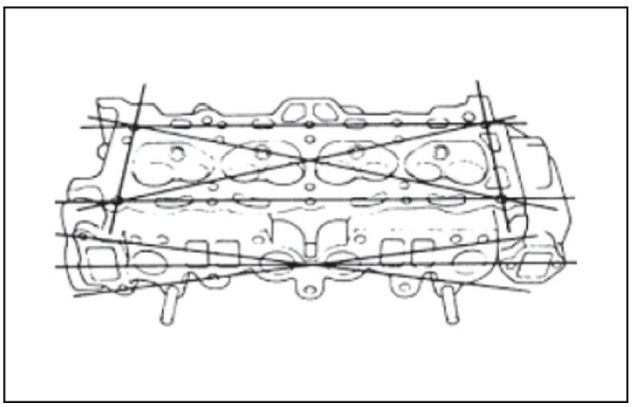
## Main flatness

1. It can be checked by means of a rigid rod to be positioned along the characteristic, diagonal and perimeter directions of the crankcase.



NHIL25ENG0235FA 1

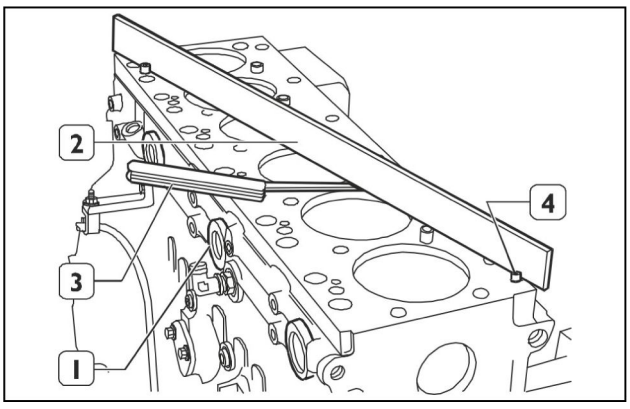
2. It can be checked by means of a rigid rod to be positioned along the characteristic, diagonal and perimeter directions of the head.



NHIL25ENG0236FA 2

3. Any deformation points found must be measured using a thickness gauge to ensure that they fall within the limits of the general tolerance:

   For the tolerance values refer to table: **General specification - Engine - Technical data ()** .




NHIL25ENG0237FA 3

# Cylinder head - Check - Cylinder head [113419297 - V1 - 04 March 2025]

## Sector flatness

1. It can be measured using a " sector dial gauge": Slide the dial gauge along the surface where deformation has been detected as a result of the main flatness check, to make sure that the sector deformation values are within the limits:

   For the tolerance values refer to table: **General specification - Engine - Technical data ()** .

# Cylinder head - Check - Cylinder head [113419299 - V1 - 04 March 2025]

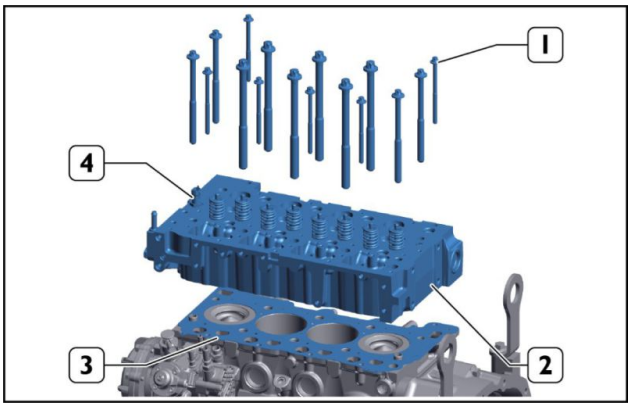
## Only for the head

1. After ascertaining the areas of deformation, it is possible to assess the levelling of the contact surface with a grinding machine.

   The maximum quote that can be removed must be equal to the additional thickness given by the installation of the thickest gasket available.

# Cylinder head - Remove [113469250 - V1 - 07 March 2025]

1. Unscrew the coolant temperature sensor **(4)** from the cylinder head **(2)**.
2. Unscrew and remove the screws **(1)** securing the cylinder head.
3. Position eyebolts on the cylinder head **(2)**, connect them using wire cables or a specific tool and use the lifter to detach the cylinder head **(2)** from the crankcase.
4. Recover the cylinder head gasket **(3)** from the crankcase 4.




NHIL25ENG0133FA 1

# Cylinder head - Install [113469912 - V1 - 06 March 2025]

1. Check that the mating surfaces of the head seal and crankcase are clean.
2. There are two types of cylinder head gaskets **(3)**:
   1. Type A, thk. **0.85 mm** (**0.03 in**).
   2. Type B, thk. **0.95 mm** (**0.04 in**).
3. Check the protrusion S of the pistons as indicated in the table **General specification - Engine - Technical data ()** .

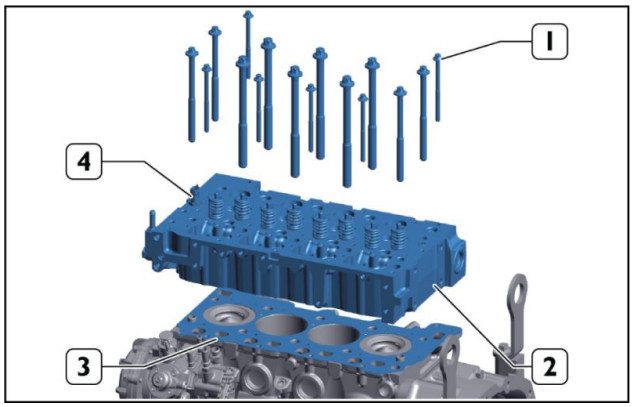
   If S is between **0.20 – 0.05 mm** (**0.01 – 0.00 in**), use a type A gasket.

   If S is between **0.06 – 0.10 mm** (**0.00 – 0.00 in**), use a type B gasket.
4. Keep the cylinder head **(2)** gasket **(3)** clean.
5. Pay attention to the cable reference dowels present on the surface of the crankcase and fit the cylinder head **(2)** gasket **(3)**.
6. Connect metal ropes or the specific tool to the eyebolts and use the lifting device to place the cylinder head **(2)** on the crankcase.

***NOTE:*** *If the valves have not been removed from the cylinder head, they must be reinstalled before installing the cylinder head on the crankcase.*

7. After fitting the cylinder head **(2)**, screw in the new fastening screws **(1)** and tighten them in three stages, following the order and methods shown in the figure **Fan and drive - Assemble - Fan drive pulley mount (10.414)**.

***NOTE:*** *Always check, before each installation, that the threads of holes and screws do not show any signs of wear or dirt.*

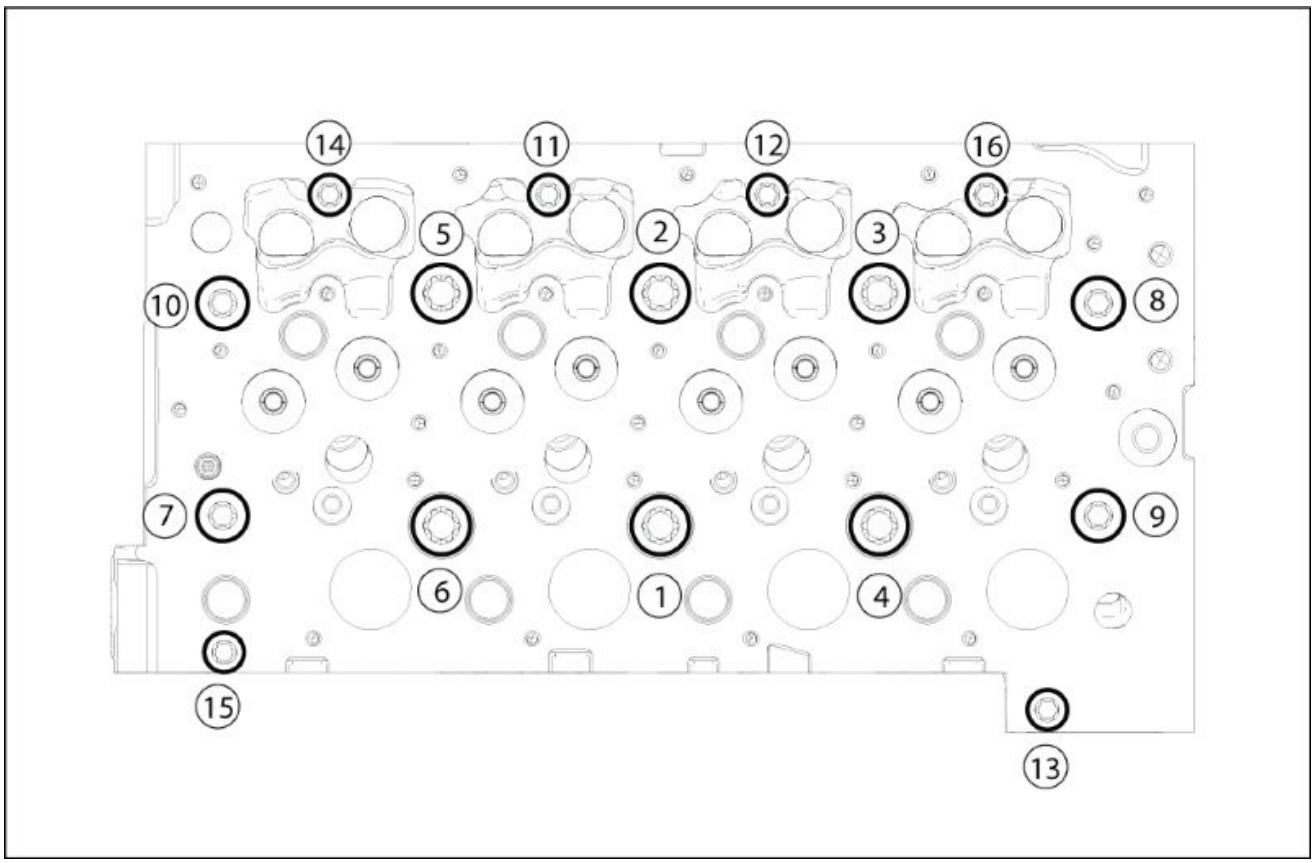


NHIL25ENG0172FA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Cylinder head | 6 screws M15 x 1.5 x 193 | Step 1 — | **130 +/- 6.5 N·m** |
| | | Step 2 — Angle tightening | **90°** |
| | | Step 3 — Angle tightening | **90°** |
| Cylinder head | 6 screws M8 x 1.25 x 117 | | **34 +/- 3.4 N·m** |
| Cylinder head | 4 screws M12 x 1.5 x 165 | Step 1 — | **65 +/- 3.25 N·m** |
| | | Step 2 — Angle tightening | **90°** |
| | | Step 3 — Angle tightening | **60°** |

8. Install the coolant temperature sensor on the cylinder head **(4)**.

| Description | Quantity | Value |
|---|---|---|
| Coolant temperature sensor | 1 sensor M12 x 15 | **20 +/- 5 N·m** |




NHIL25ENG0173FA 2

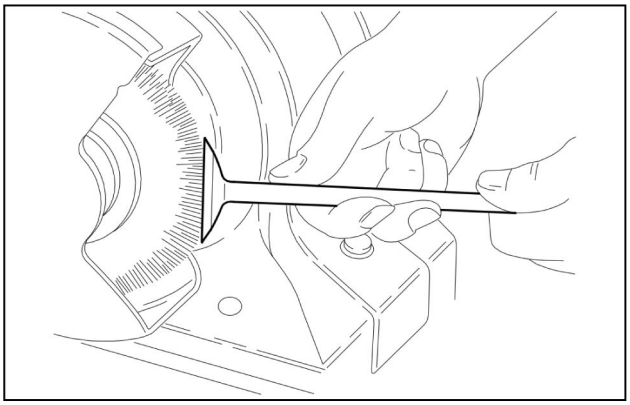
**Diagram of the tightening sequence of the cylinder head fastening screws**

# Valves - Cleaning - Valves [113427249 - V1 - 04 March 2025]

**Prior operation:**
**Valves - Disassemble - Valves (10.101)**

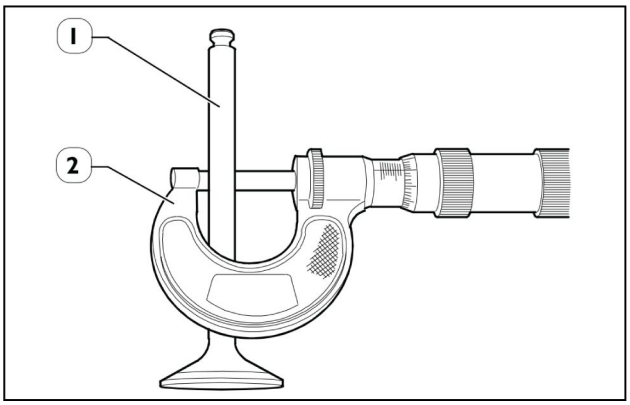
## Removing carbon deposits, checking and grinding valves

1. Remove all carbon deposits from the valves using a wire brush.
2. Check that the valves show no signs of seizing, scoring or cracking.
3. Regrind the valve seats, if required, removing as little material as possible.



NHIL25ENG0249AA 1

4. Check the valve stem **(1)** using a micrometer **(2)** : it must be between:




NHIL25ENG0250AA 2

| Valve | Diameter |
|---|---|
| Intake | **7.980 – 8.000 mm** (**0.314 – 0.315 in**) |
| Exhaust | **7.970 – 7.990 mm** (**0.314 – 0.315 in**) |

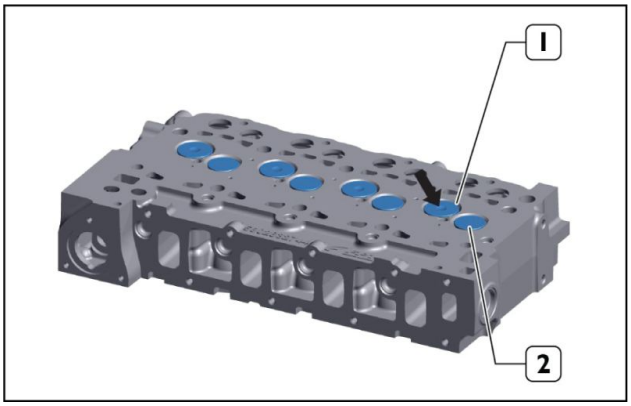
# Valves - Disassemble - Valves [113427250 - V1 - 04 March 2025]

| Tool / Material | |
|---|---|
| Engine valves remover/installer | 99360268 |

## Valve removal

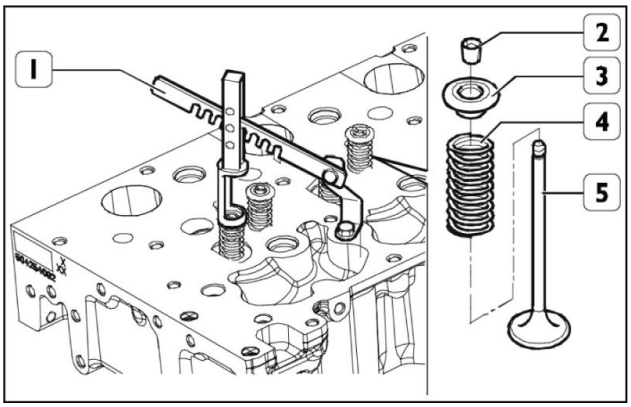
1. Before removing the valves from the cylinder head, number them so that they can be re-installed in the same positions they were removed from if they are to be re-used.

***NOTE:*** *The intake valves **(1)** have a greater diameter than the exhaust valves **(2)**. The central cavity (→) of the intake valve mushroom **(2)** distinguishes it from that of the exhaust valve **(1)**.*



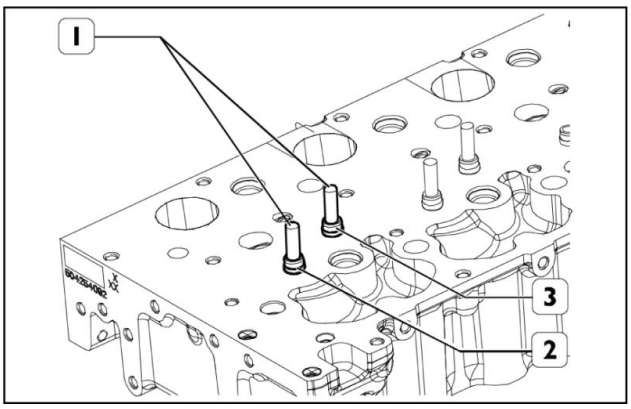

NHIL25ENG0251AA 1

2. Valve removal shall be performed using tool **(1)** and pressing the cap **(3)** so that when compressing the springs **(4)**, the cotters **(2)** can be removed. Then remove: The plate **(3)** and the springs **(4)**.
3. Repeat the operation on all the valves **(5)**.



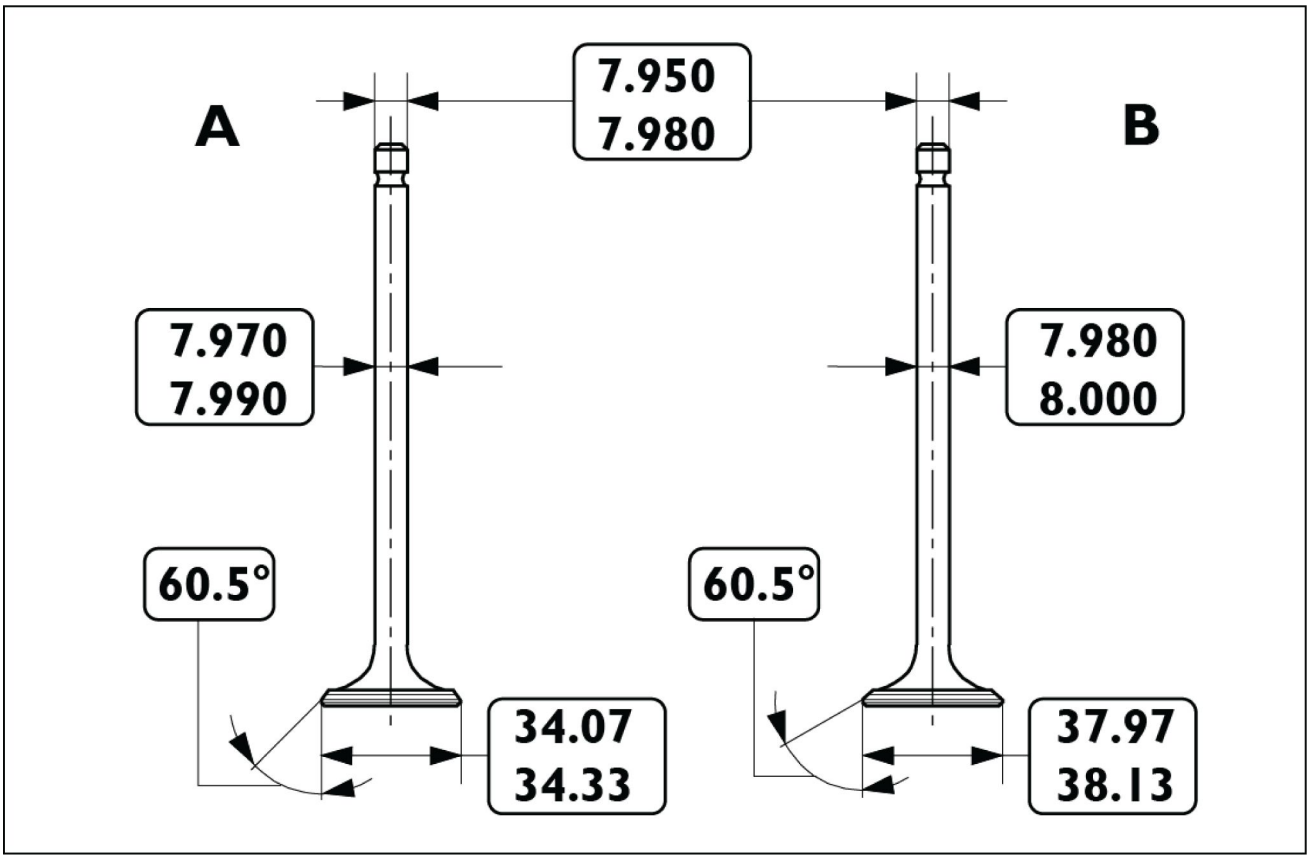

NHIL25ENG0252FA 2

4. Turn the cylinder head upside down and remove the valves **(1)**.
5. Remove the sealing rings **(2)**, **(3)** from the relative valve guides.




NHIL25ENG0253AA 3

# Valves - Measure [113427251 - V1 - 04 March 2025]




NHIL25ENG0254FA 1

**Intake and exhaust valve main data**

A. Discharge valve

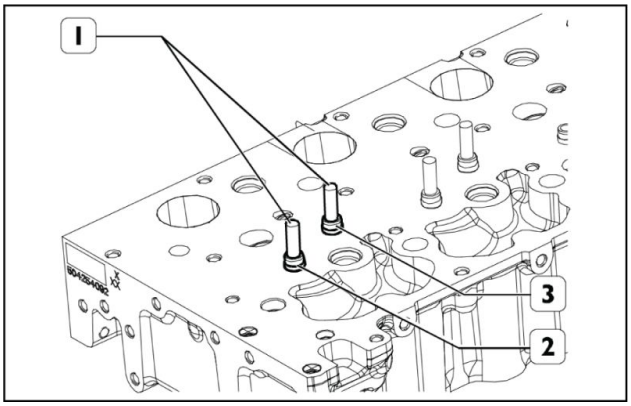
B. Intake valve

# Valves - Assemble - Valves [113427252 - V1 - 04 March 2025]

| Tool / Material | |
|---|---|
| Engine valves remover/installer | 99360268 |

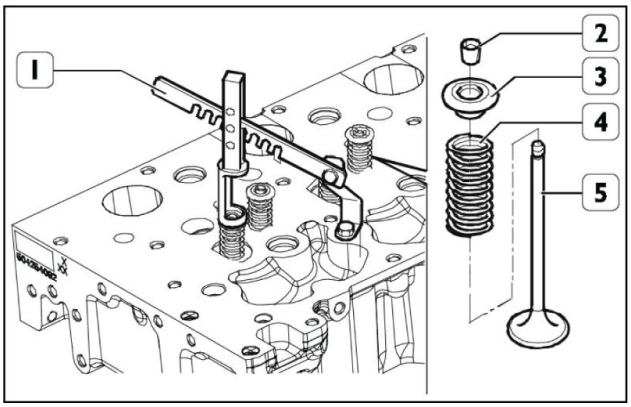
## Valve fitting

1. Lubricate the stem of the valves **(1)** and insert them into the relevant valve guides according to the position marked during removal.
2. Fit the seal rings **(2)** and **(3)** onto the valve guide.




NHIL25ENG0255AA 1

3. Position on the cylinder head: the spring **(4)** and upper plate **(3)** : Using tool **(1)** compress the spring **(4)** and fasten the plate **(3)** to the valve **(5)** with the cotters **(2)**.



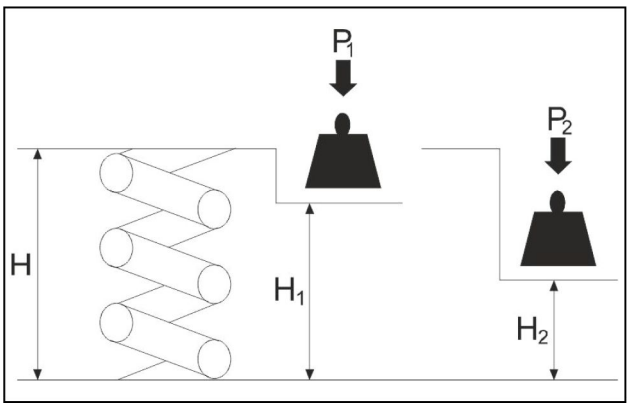

NHIL25ENG0256FA 2

# Valves - Check - Valves Spring [113427253 - V1 - 04 March 2025]

**Prior operation:**
**Valves - Disassemble - Valves (10.101)**

## Valve spring check

1. Prior to assembling, check the valve spring flexibility using a suitable tool. Compare the elastic deformation and load data with those of the new springs shown in the following table.




NHIL25ENG0257AA 1

## Key data for checking intake and exhaust valve springs

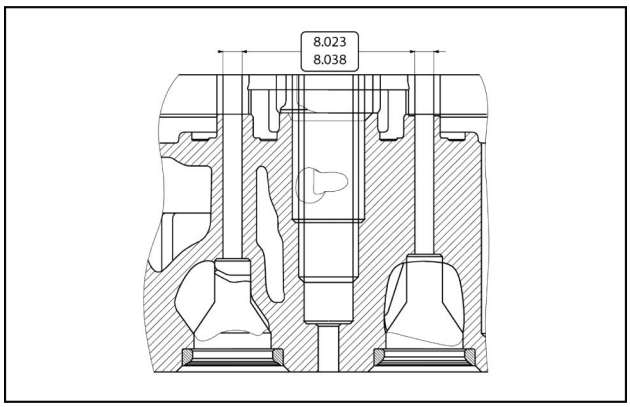
| Height | | Under a load of: | |
|---|---|---|---|
| H | **46.5 mm** (**1.8 in**) | Free | |
| H1 | **32 mm** (**1 in**) | P1 | **320 +/- 16 mm** |
| H2 | **22.5 mm** (**0.9 in**) | P2 | **560 +/- 25 mm** |

# Valves - Check - Valves guide [113427254 - V1 - 04 March 2025]

**Prior operation:**
**Valves - Disassemble - Valves (10.101)**

## Valve guide check

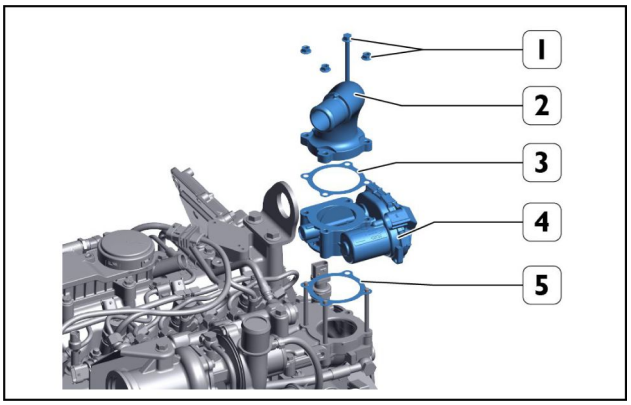
1. Use a bore gauge, measure the internal diameter of the valve guides; it must be equal to the value shown figure **1**.




NHIL25ENG0547AA 1

# Valves - Remove - Throttle valve [113469213 - V1 - 07 March 2025]

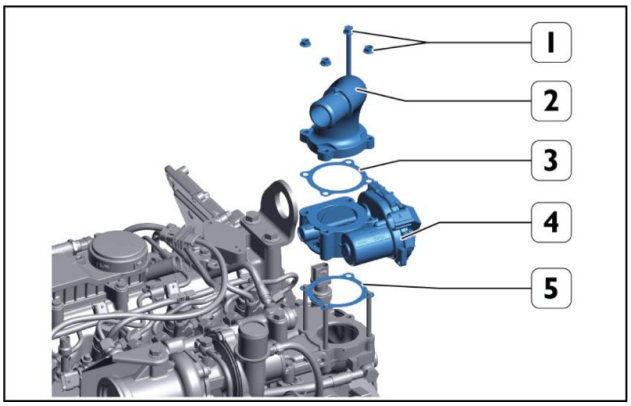
1. Unscrew the nuts **(1)** and the fastening screw **(1)** and remove the engine air intake **(2)**, recovering the gasket **(3)**.
2. Remove the throttle valve **(4)**, recovering the gasket **(5)**, and remove the studs.




NHIL25ENG0129FA 1

# Valves - Assemble - Throttle valve [113470097 - V1 - 06 March 2025]

1. Tighten the studs to the prescribed torque and install the throttle valve **(4)**, with a new gasket **(5)**.
2. Install the engine air vent **(2)** with a new gasket **(3)** and tighten the nuts and the fastening screw **(1)** to the prescribed torque.




NHIL25ENG0180FA 1

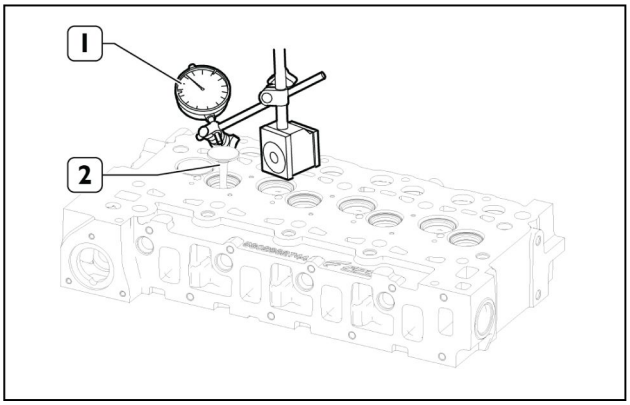
| Description | Step | Value |
|---|---|---|
| Engine air vent | 3 nuts M6 x1 | **10 N·m** |
| | 1 screw M6 x 1 x 80 | **10 N·m** |
| | 1 screw M8 x 1.25 | **23 N·m** |

# Valve seat - Check - Valve seat [113427239 - V1 - 04 March 2025]

**Prior operation:**
**Valves - Disassemble - Valves (10.101)**

## Checking clearance between valve stem and valve guide and centring valves

1. Insert the valve **(2)** in its seat and let the head protrude about ten millimetres.
2. The checks are made using a magnetic comparator **(1)** positioned as shown, the assembly clearance is:




NHIL25ENG0244AA 1

| Valve | Assembly clearance |
|---|---|
| Intake | **0.016 – 0.031 mm** (**0.001 – 0.001 in**) |
| Draining | **0.026 – 0.041 mm** (**0.001 – 0.002 in**) |

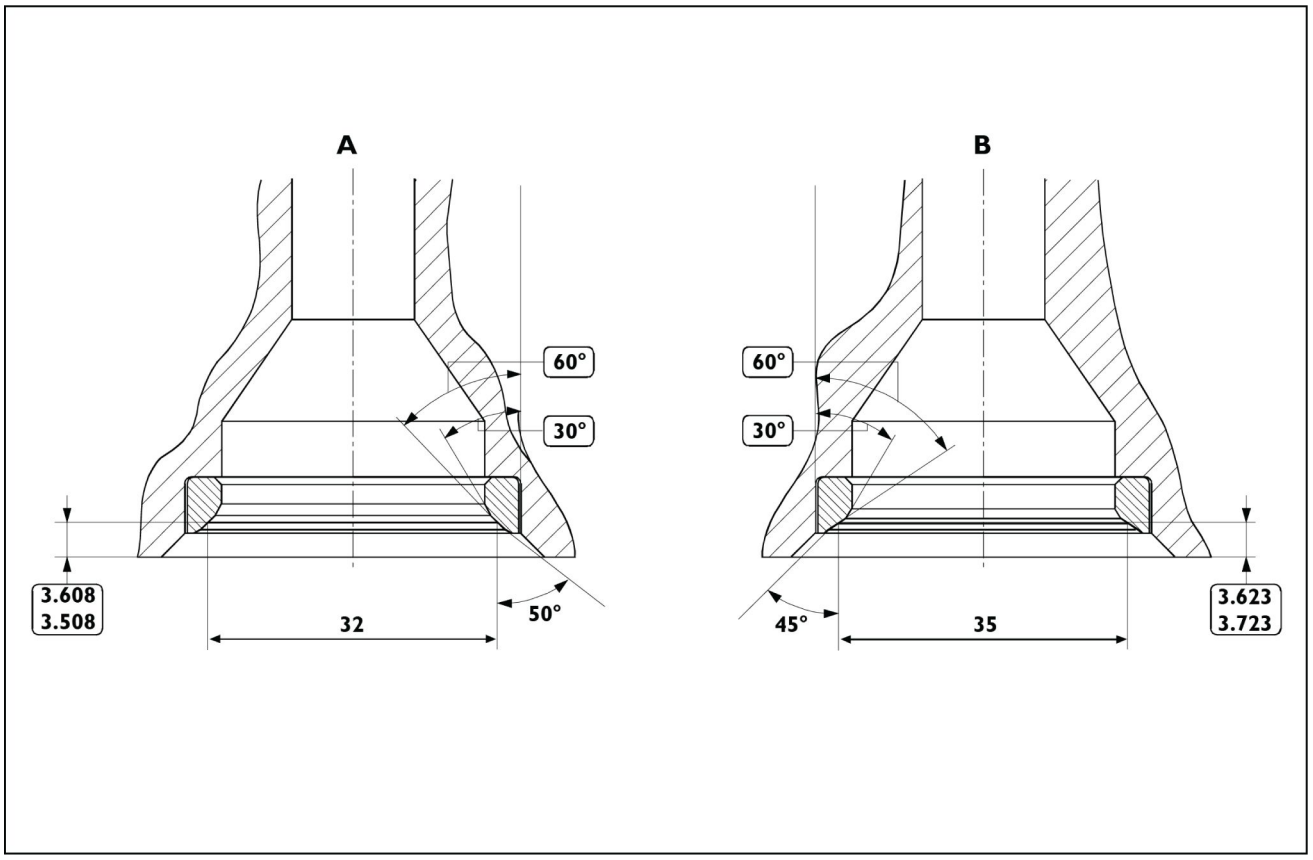
3. Making the valve **(2)** turn, check that the run out error is no greater than **0.007 mm** (**0.000 in**).
4. If there is an excessive radial clearance or centring error, recheck the valve dimensions and replace the worn parts.

# Valve seat - Replace - Valve seat [113427242 - V1 - 04 March 2025]

**Prior operation:**
**Valves - Disassemble - Valves (10.101)**

| Tool / Material | |
|---|---|
| Base,dial gauge,countershaft bearing adjustment(use with 99395604) | 99370415 |
| Dial gauge ( **0.0 – 5.0 mm** (**0.0 – 0.2 in**)) | 99395603 |
| Drift for fitting valve guide(use with 99360288) | 99360293 |
| Drift for removing valve guide | 99360288 |
| Installer for valve guide seal | 99360292 |
| Valve guide hole reamer | 99390310 |

## Regrinding - replacing valve seats



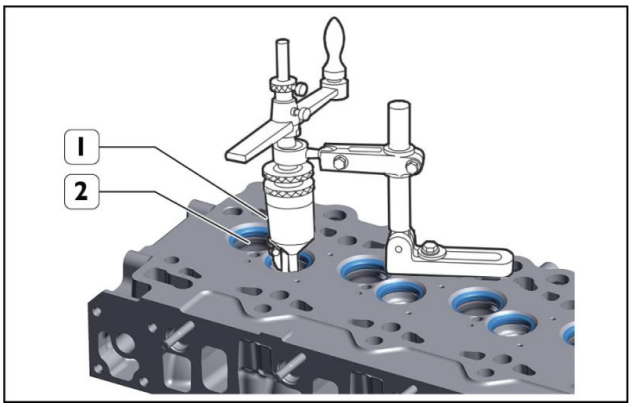

NHIL25ENG0245FA 1

**Main data of engine valve seats**

A. Exhaust

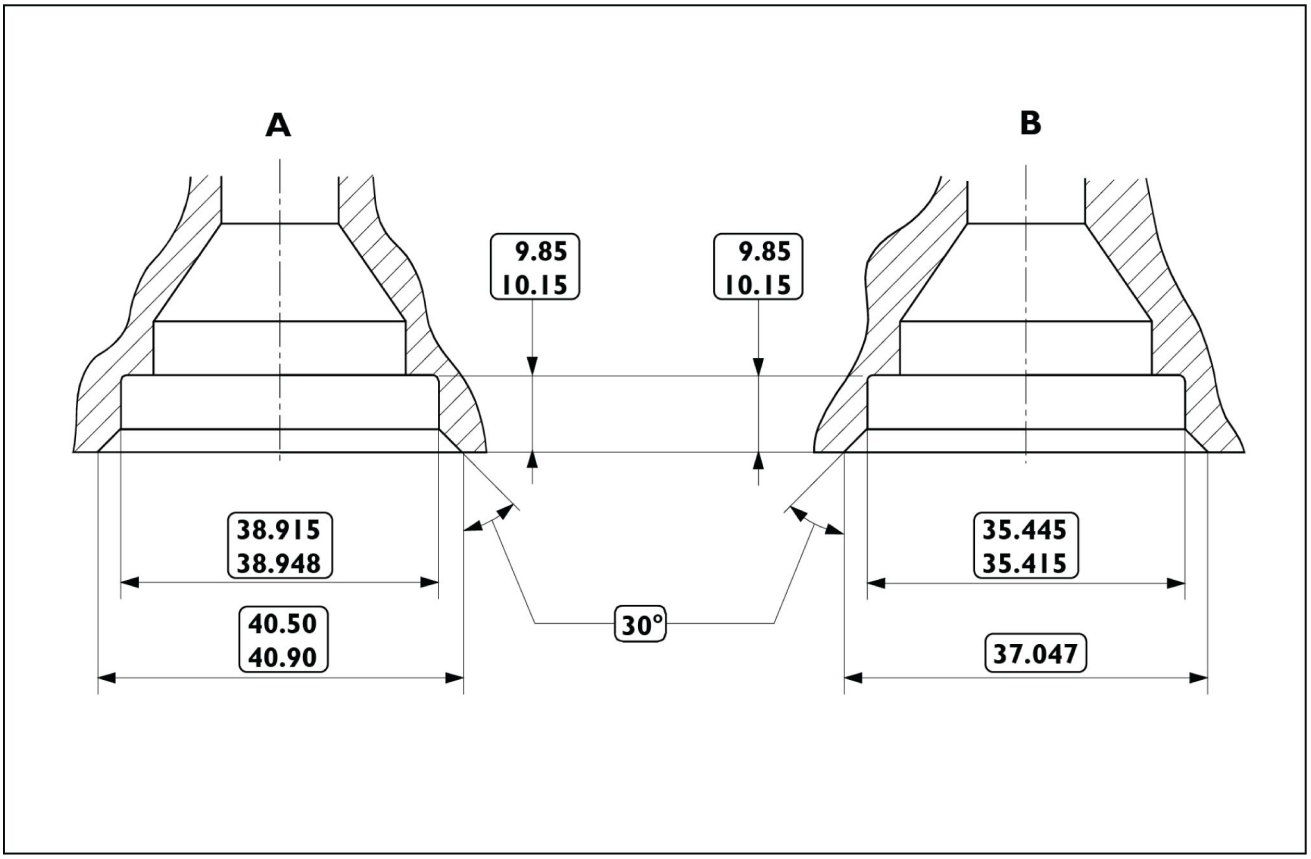
B. Intake

1. Check that main data of the valves seats are coherent with those in the figure.
2. If slight scoring or burnout is found, regrind using the tool **(1)** according to the angle values shown in the figure **2**.




NHIL25ENG0246FA 2

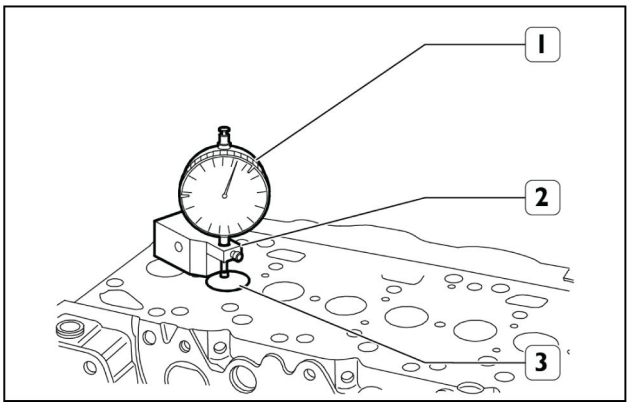
| Tool / Material | |
|---|---|
| Valve guide hole reamer | 99390310 |




NHIL25ENG0247FA 3

A. Exhaust
B. Intake

3. If the valve seats cannot be restored by only regrinding, it is possible to mount the inserts supplied as spares.
4. In this case regrind the seats on the cylinder head and fit the valve seats.
5. To fit the valve seats in the cylinder head, heat the cylinder head to **80.0 – 100.0 °C** (**176.0 – 212.0 °F**) and, using a suitable drift, fit it in the new previously cooled valve seats **(2)**.
6. Then use the specific tool to regrind the valve seats to the values indicated in the figure **4**.
7. After regrinding, use the base **(2)** and the dial gauge **(1)** to check that the recess value of the valves **(3)** is as specified.




NHIL25ENG0248AA 4

| Tool / Material | |
|---|---|
| Base,dial gauge,countershaft bearing adjustment(use with 99395604) | 99370415 |
| Dial gauge ( **0.0 – 5.0 mm** (**0.0 – 0.2 in**)) | 99395603 |

| Tool / Material | |
|---|---|
| Drift for removing valve guide | 99360288 |

| Tool / Material | |
|---|---|
| Installer for valve guide seal | 99360292 |

| Tool / Material | |
|---|---|
| Drift for fitting valve guide(use with 99360288) | 99360293 |

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# Engine - 10

## Connecting rods and pistons - 105

**F6AFL413A*U001**

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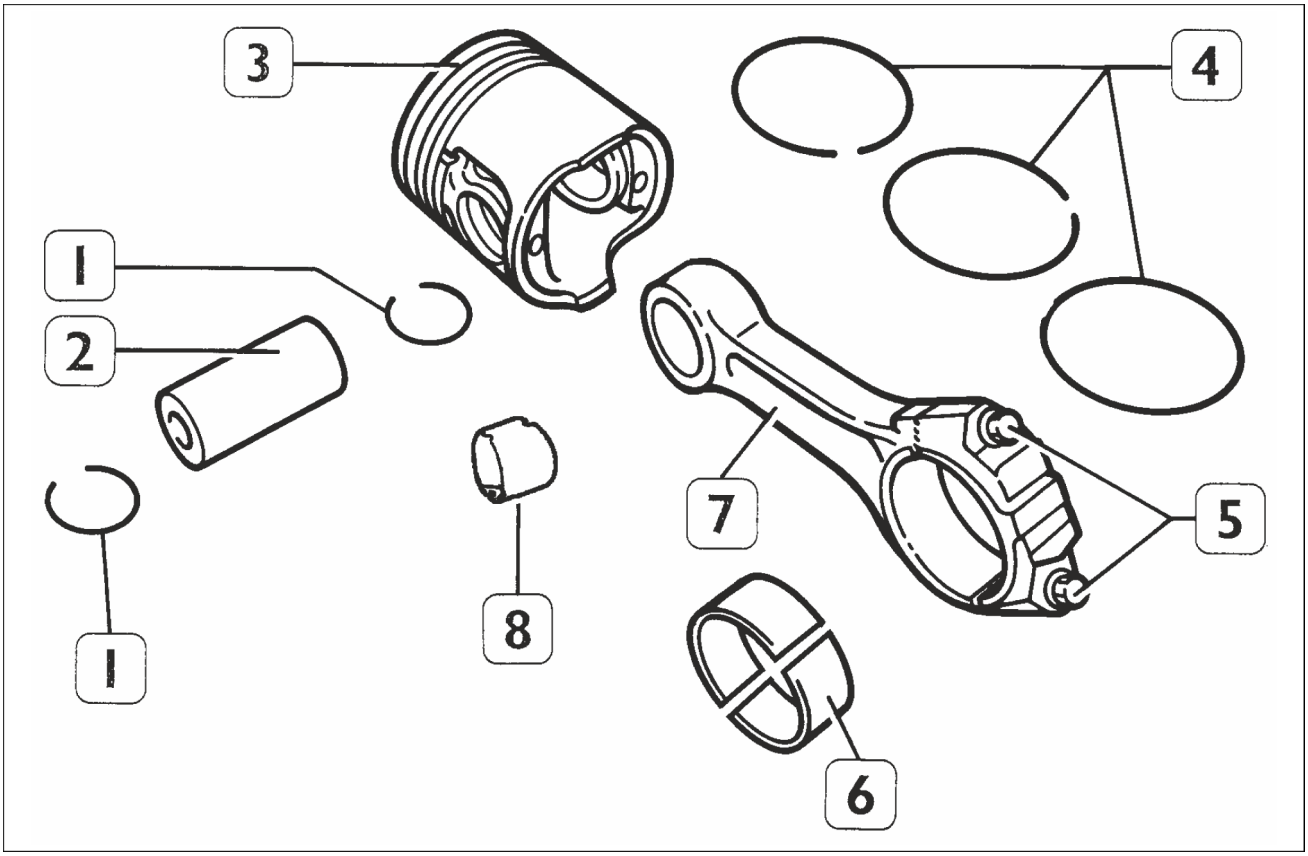
# Connecting rod and piston - Overhaul - Engine components [113427441 - V1 - 04 March 2025]

## Overhauling the connecting rod-piston assembly

1. Overhaul the piston connecting rod assembly components as described hereafter.




NHIL25ENG0276FA 1

| Item | Description |
|---|---|
| 1 | Retaining rings |
| 2 | Pin |
| 3 | Piston |
| 4 | Piston rings |
| 5 | Screws |
| 6 | Half bearings |
| 7 | Connecting rod |
| 8 | Bushing |

2. Make sure the pistons do not show any sign of seizing, scoring, cracking or excessive wear; otherwise, replace as necessary.
3. For the overhaul of the piston-connecting rod assembly perform the procedures indicated below in the following order:

***NOTE:*** *The pistons are supplied with spare parts increased by* ***0.4 mm*** *(****0.0 in****).*

**Next operation:**
**Piston - Disassemble - Compression rings (10.105)**
**Next operation:**
**Piston - Disassemble - Piston (10.105)**
**Next operation:**
**Piston - Measure - Piston (10.105)**
**Next operation:**
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**Next operation:**
**Connecting rod and piston - Check - Connecting rod and piston (10.105)**
**Next operation:**
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**Next operation:**
**Piston - Assemble (10.105)**
**Next operation:**
**Crankshaft - Measure -Crankshaft (10.103)**
**Next operation:**
**Piston - Check - Piston (10.105)**

# Connecting rod and piston - Check - Connecting rod and piston [113427802 - V1 - 04 March 2025]

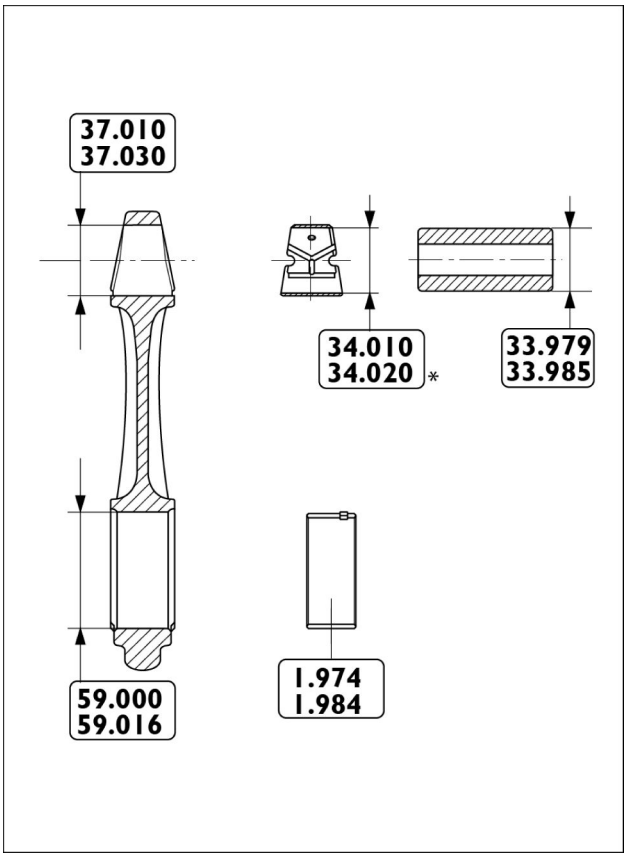
## Connecting rods

Main data of the connecting rod, bushing, piston pin and half-bearings (*) Inner diameter to be obtained after driving in the small end and reboring with borer.

1. During checks make sure that the main data of the connecting rod, bushing, piston pin and half-bearings is that shown in the figure.

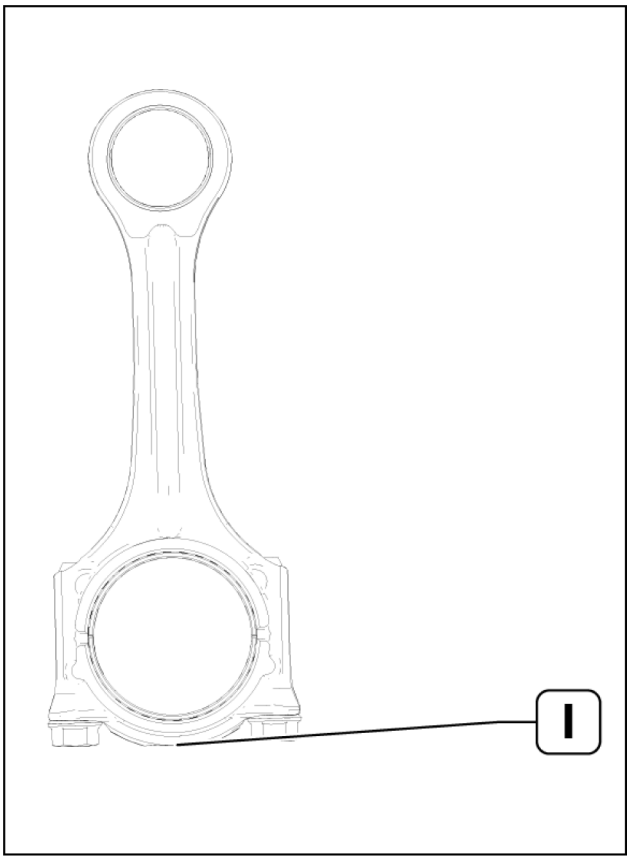
***NOTE:*** *To obtain better coupling, the connecting rod-cap coupling surfaces are knurled. Do not remove the knurling.*

2. Check the identification data of each connecting rod noting the code stamped in areas **(A)** and **(B)**.




NHIL25ENG0301BA 1

**(1)** dentification codes

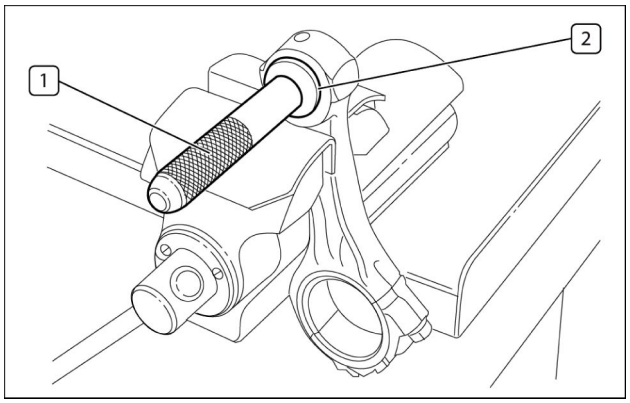



NHIL25ENG0548BA 2

## Connecting rod identification code

## Connecting rod small end bush check

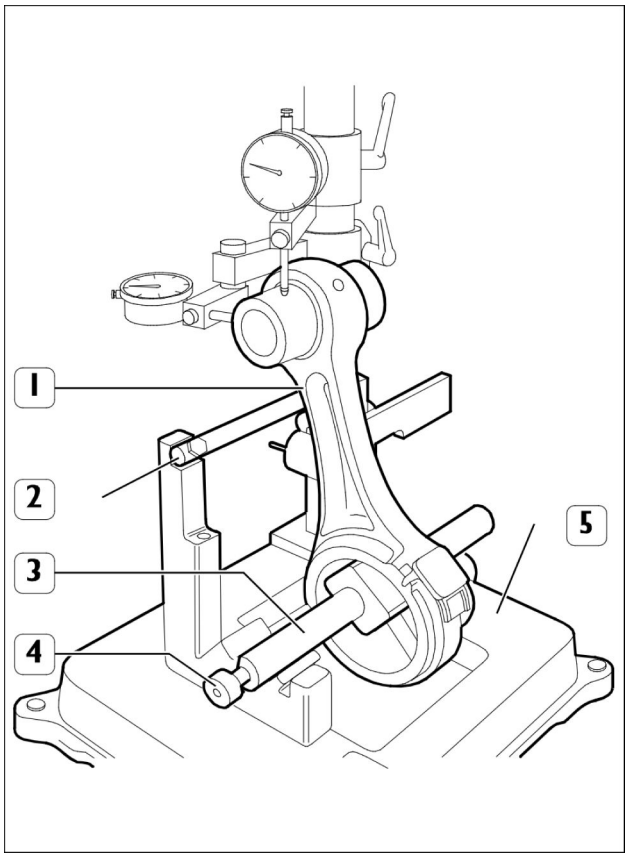
1. Check that the bushing in the small end has not come loose and shows no sign of seizure or scoring. Otherwise replace it.
2. Removal and refitting shall be performed using the proper drift.
3. When refitting make sure that the holes for the oil on the bushing coincide with those on the connecting rod small end.
4. Ream the bushing to obtain the specified diameter.




NHIL25ENG0303AA 3

## Alignment check

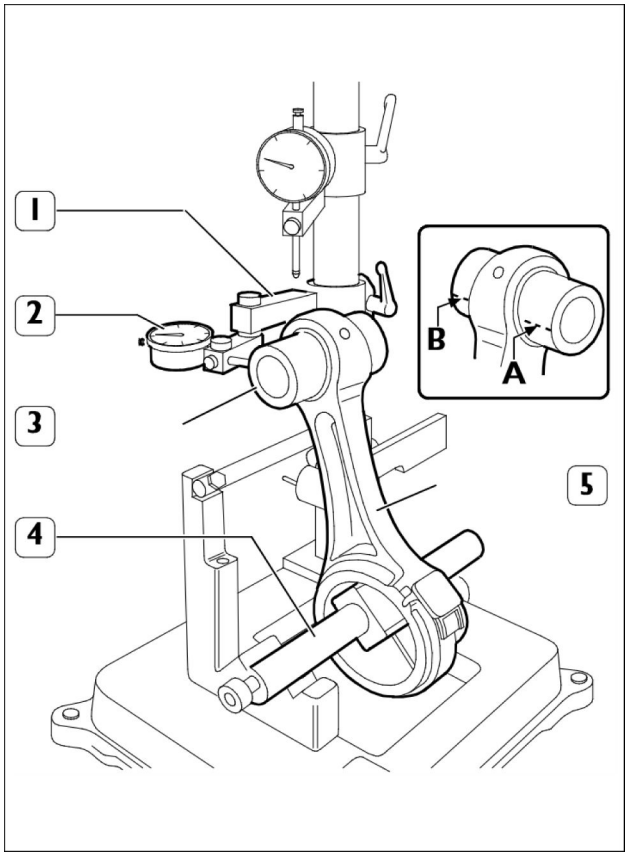
1. Check the alignment of the connecting rod axis **(1)** using a suitable device **(5)** proceed as follows:
2. Fit the connecting rod **(1)** on the spindle of the tool **(5)** and lock it with the screw **(4)**.
3. Set the spindle **(3)** on the V prisms resting the connecting rod **(1)** on the stop bar **(2)**.




NHIL25ENG0304BA 4

## Torsion check

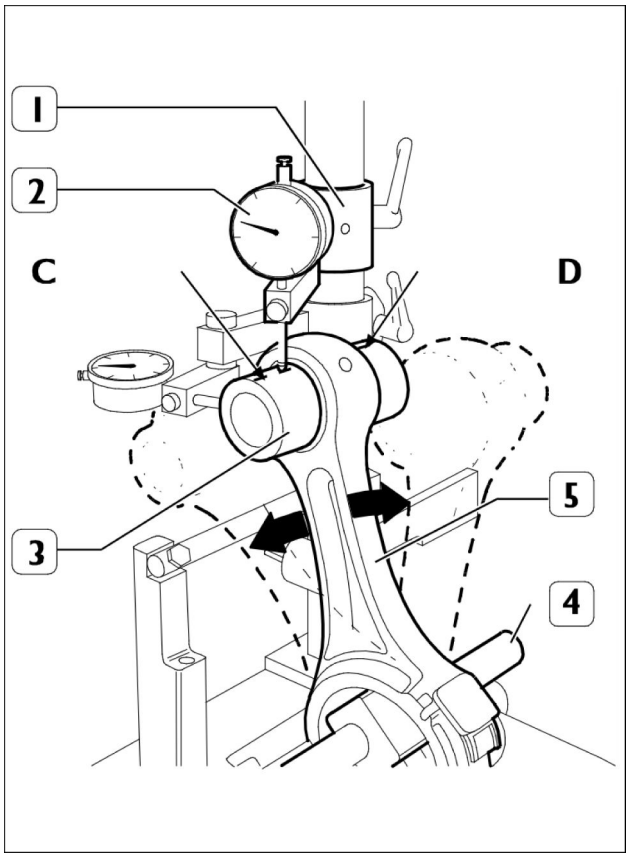
1. Check the bend of the connecting rod **(5)** by comparing two points **(A)** and **(B)** of the pin **(3)** on the horizontal plane of the connecting rod axis.
2. Position the mount **(1)** of the dial gauge **(2)** so that this pre-loads by approx. **0.05 mm** on the pin **(3)** at point **(A)** and reset the dial gauge **(2)**. Shift the spindle **(4)** with the connecting rod **(5)** and compare any deviation on the opposite side **(B)** of the pin **(3)**: the difference between **(A)** and **(B)** must not exceed **0.08 mm** (**0.00 in**).




NHIL25ENG0305BA 5

## Bending check

1. Check the bend of the connecting rod **(5)** by comparing two points **(C)** and **(D)** of the pin **(3)** on the vertical plane of the connecting rod axis.
2. Position the vertical support **(1)** of the dial gauge **(2)** so that this rests on the pin **(3)** at point **(C)**.
3. Swing the connecting rod to and fro, establishing the highest position of the pin and reset the dial gauge in this condition **(2)**.
4. Move spindle with connecting rod **(5)** and repeat the highest point check on opposite side **(D)** of pin **(3)**. The difference between points **(C)** and **(D)** must not exceed **0.08 mm** (**0.00 in**).

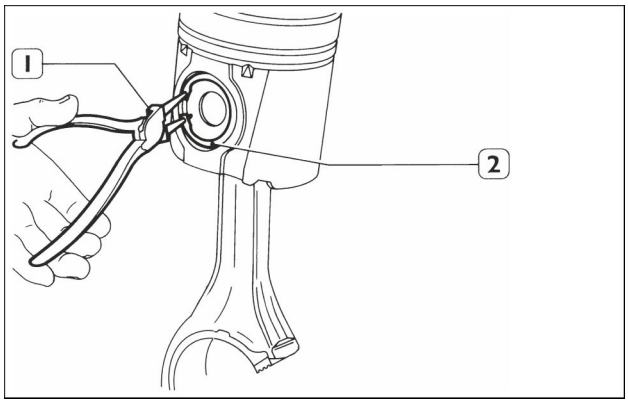



NHIL25ENG0306BA 6

# Piston - Disassemble - Piston [113427843 - V1 - 25 February 2025]

**Prior operation:**
**Piston - Disassemble - Compression rings (10.105)**

1. The circlips **(2)** of the piston pin are removed using tipped pliers **(1)**.

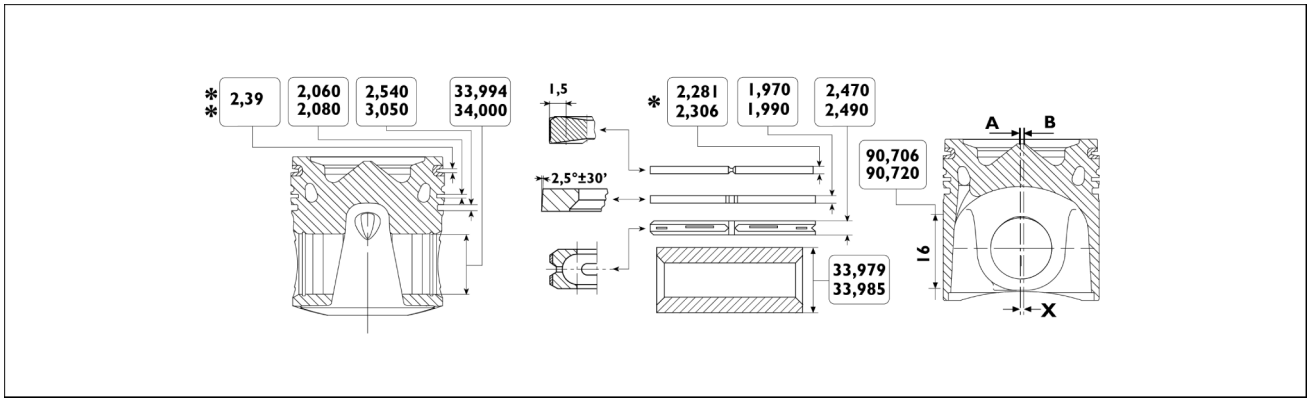



NHIL25ENG0308AA 1

# Piston - Measure - Piston [113427845 - V1 - 04 March 2025]

**Prior operation:**
**Piston - Disassemble - Compression rings (10.105)**

## Measuring the piston diameter




NHIL25ENG0309EA 1

**Main data of the piston with circlips and pin seats – (*)**

**(*)** The dimensions must be calculated at **1.5 mm** (**0.1 in**) from the outer diameter.

A. Piston axle

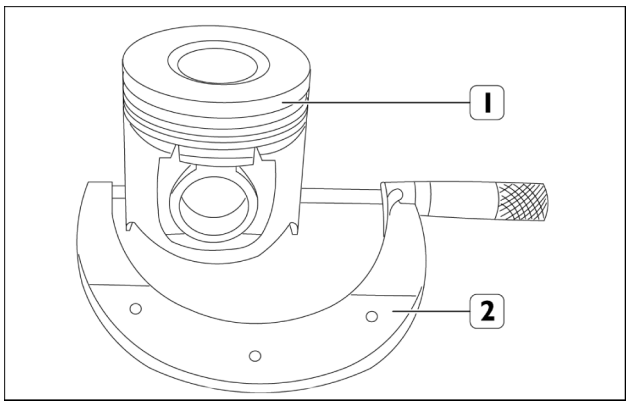
B. Piston axle

X. **0.6 +/- 0.15 mm**

## Pistons

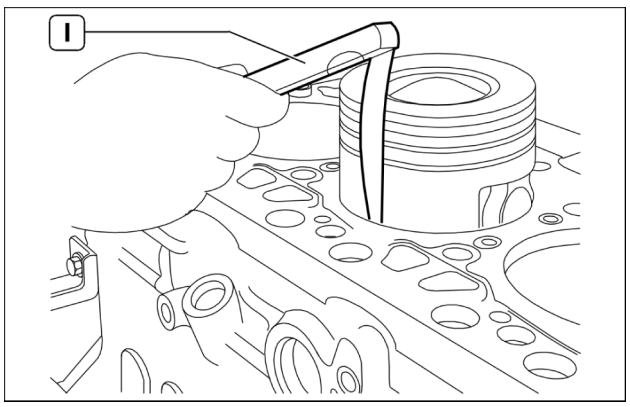
1. Using a micrometer **(2)** measure the piston diameter **(1)** to determine the assembly clearance.

***NOTE:*** *The diameter is to be measured at **49.5 mm (1.9 in)** from the piston skirt end.*




NHIL25ENG0310AA 2

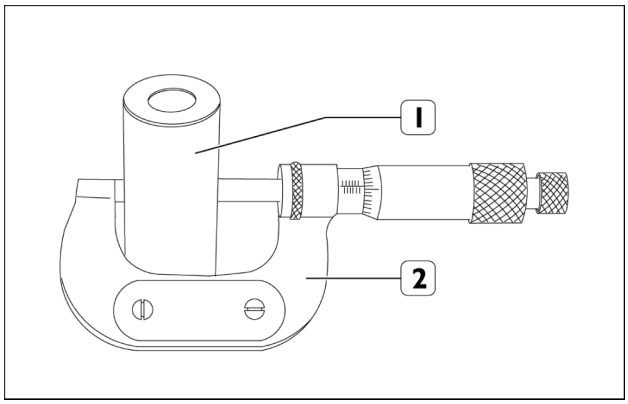
2. The clearance between the piston and the cylinder liner can also be checked with a feeler gauge **(1)** as shown in the figure.




NHIL25ENG0311AA 3

## Piston pins

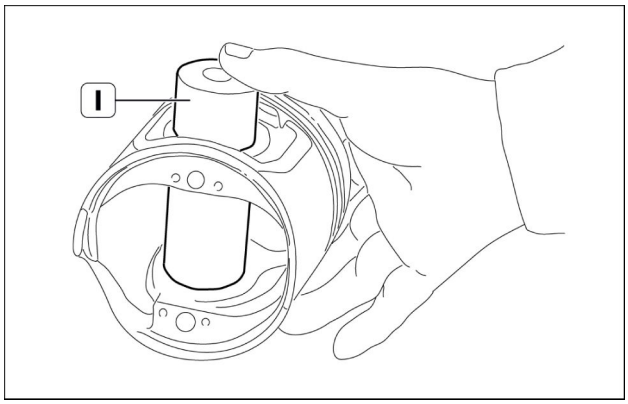
3. Measuring the diameter of the piston pin **(1)** using a micrometer **(2)**.




NHIL25ENG0312AA 4

## Conditions for correct pin/piston coupling

4. Lubricate the pin **(1)** and the relevant housing on the piston hubs with engine oil; Pin must be inserted in the piston with a light finger pressure and it should not come out by gravity.

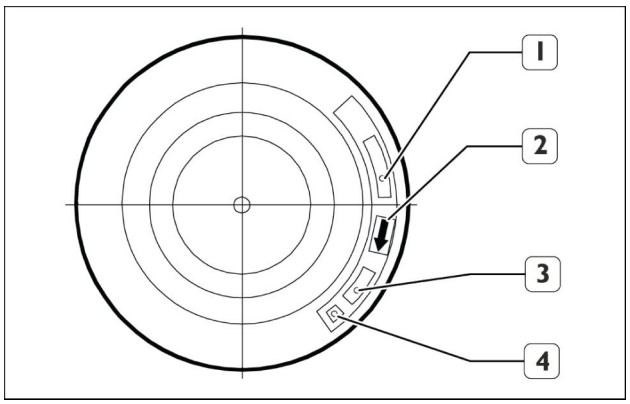



NHIL25ENG0313AA 5

# Piston - Pre-assemble [113427846 - V1 - 04 March 2025]

## Connecting rod-piston coupling

1. Before assembling the piston with the connecting rod, identify arrow **(2)** on the piston crown.



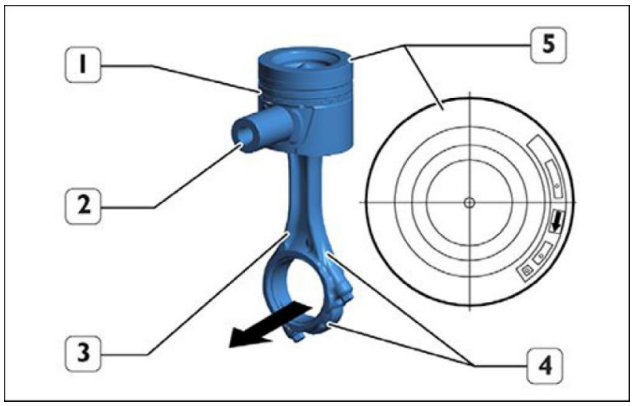

NHIL25ENG0314AA 1

| | |
|---|---|
| **(1)** | Part code |
| **(2)** | Arrow indication positioning of connecting rod - piston assembly (facing the front side of the crankcase) |
| **(3)** | Date of production |
| **(4)** | Marking indicating testing of the 1st slot insert |

The piston crown is marked as follows:

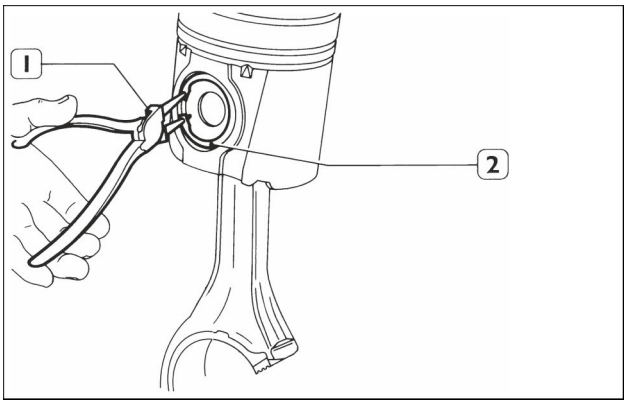
1. Part number and design modification number.
2. Arrow showing piston assembling direction into cylinder liner, this arrow shall face the front key of the crankcase.
3. Marking showing 1st slot insert testing.
4. Manufacturing date.

2. With the pin **(2)**, connect the piston **(1)** to the connecting rod **(3)** so that the piston **(1)** assembly reference arrow **(5)** in the cylinder liners and the numbers **(5)** printed on the connecting rod **(3)** appear as shown in the figure.




NHIL25ENG0315FA 2

3. Insert the piston rings **(2)** securing the pin.

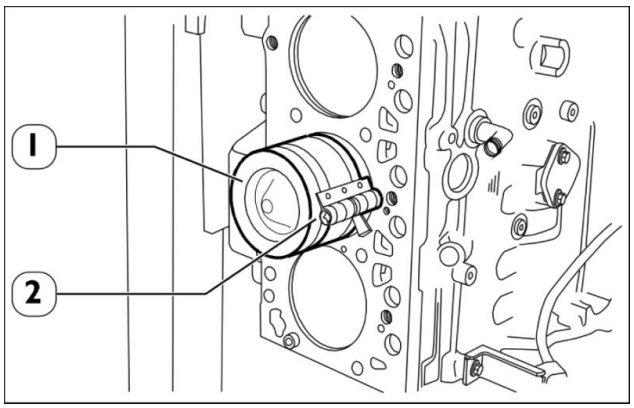



NHIL25ENG0316AA 3

# Piston - Assemble [113427847 - V1 - 04 March 2025]

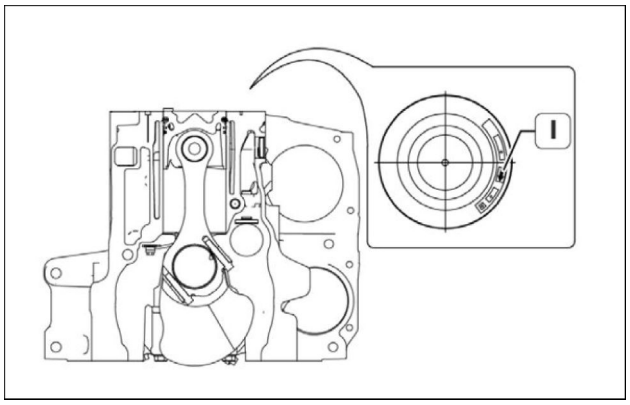
## Fitting the connecting rod-piston assembly into the cylinder liners

1. Lubricate the pistons well, including the circlips and the inside of the cylinder liners.
2. Using the clamp **(2)**, install the connecting rod-piston assemblies **(1)** in the cylinder linings checking that:
3. The number of each connecting rod corresponds to the cap coupling number.
4. The openings of the elastic rings must be out of phase with each other by: **120 °C**.
5. Connecting rod-piston assemblies shall have the same weight.




NHIL25ENG0317AA 1

6. The arrow **(1)** marked on the piston crown should face the front side of the crankcase or the slot obtained on the piston skirt should correspond to the oil nozzle position.



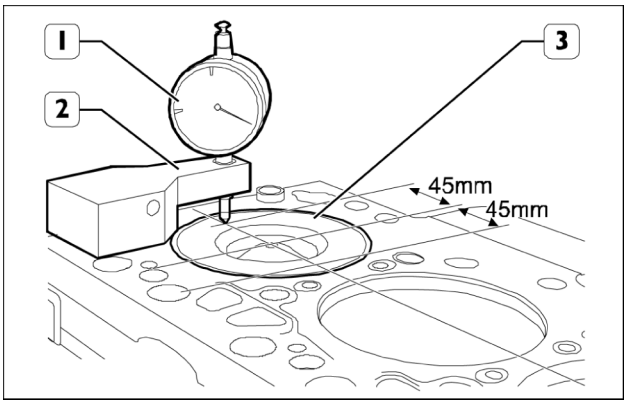

NHIL25ENG0318AA 2

# Piston - Check - Piston [113427848 - V1 - 19 February 2025]

**Prior operation:**
**Piston - Assemble (10.105)**

| Tool / Material | |
|---|---|
| Base,dial gauge,countershaft bearing adjustment(use with 99395604) | 99370415 |
| Dial gauge **0 – 5 mm** | 99395603 |

1. Once refitting of the connecting rod-piston assemblies is complete, use a dial gauge **(1)** together with a base **(2)** to check the protrusion of the pistons **(3)** at T.D.C. in relation to the top of the engine block, carrying out the following operations:




NHIL25ENG0319AA 1

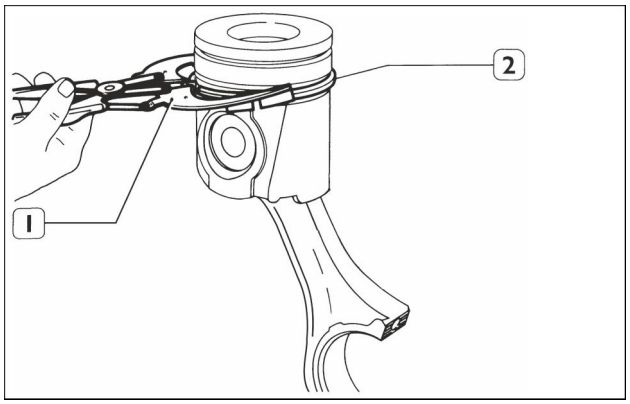
| Tool / Material | |
|---|---|
| Base,dial gauge,countershaft bearing adjustment(use with 99395604) | 99370415 |
| Dial gauge **0 – 5 mm** | 99395603 |

2. On piston 1, as indicated in the Figure and measuring at a distance of **45 mm** from the centre, measure protrusions S1 and S2 of the piston in relation to the top surface of the crankcase and then calculate the average: Scyl1 = (S1 + S2) /2.
3. Repeat the operation to calculate the average protrusion of pistons 2, 3, 4, 5 and 6 and calculate the average: S = (Scyl1 + Scyl2 + Scyl3 + Scyl4 + Scyl5 + Scyl6) /6.

# Piston - Disassemble - Compression rings [113427880 - V1 - 04 March 2025]

## Piston rings removal

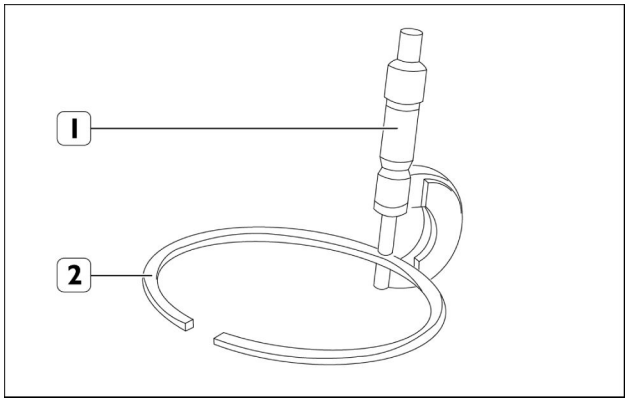
1. Removal of piston rings **(1)** from the pin **(2)** using pliers.




NHIL25ENG0320AA 1

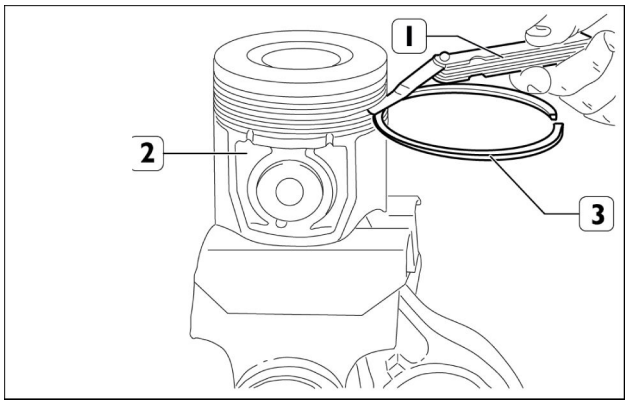
# Piston - Check - Compression rings [113427881 - V1 - 19 February 2025]

1. Check the sealing ring **(2)** thickness using a micrometer **(1)**.



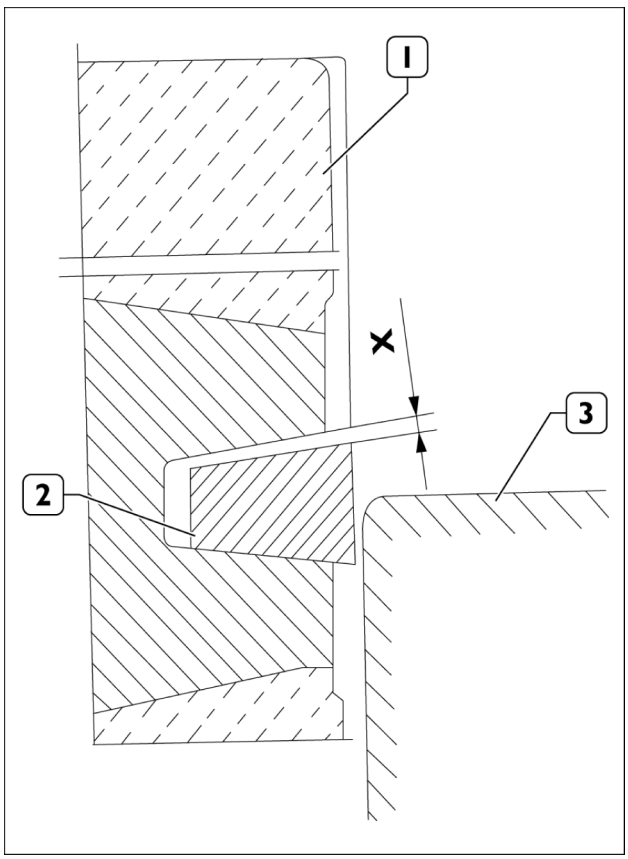

NHIL25ENG0321AA 1

2. Check the axial clearance between the seal rings **(3)** of the 2nd and 3rd slot and the relative seats on the piston **(2)** with a feeler gauge **(1)**.



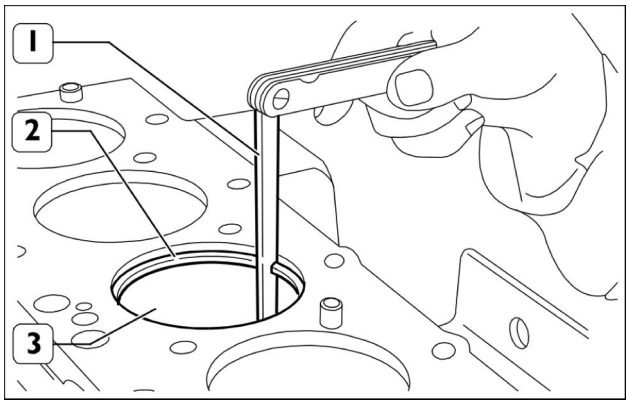

NHIL25ENG0322AA 2

3. Since the section of the first piston ring section is trapezoidal, the clearance between the slot and the ring is to be measured as follows; make the piston **(1)** protrude from the crankcase so the ring **(2)** in question comes out halfway from the cylinder liner **(3)**.
4. In this position and using a feeler gauge, check that the clearance **(X)** between the ring and the slot falls within the prescribed values.




NHIL25ENG0323BA 3

5. Use a feeler gauge **(1)** to measure the opening end clearance of the piston ring **(2)** fitted into the cylinder liner **(3)**.



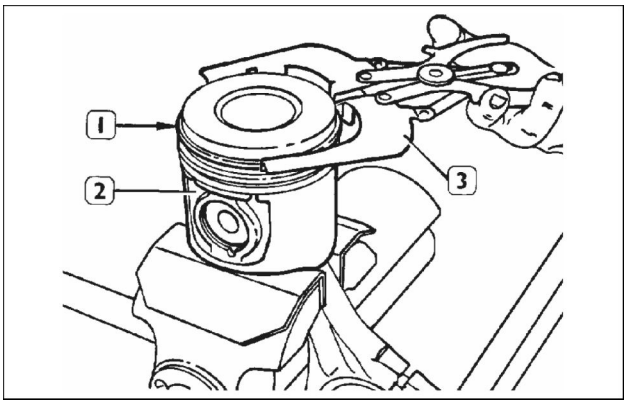

NHIL25ENG0324AA 4

# Piston - Assemble - Compression rings [113427882 - V1 - 04 March 2025]

## Fitting piston rings

1. Use pliers **(3)** to fit the piston rings **(1)** on the piston **(2)**.
2. The rings are to be fitted with the word TOP facing upwards and their openings are to be displaced in relation to the others by: **120°**.

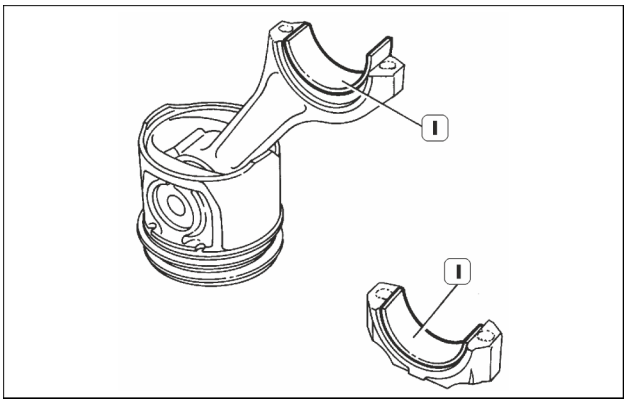
***NOTE:*** *Spare piston rings are supplied in the sizes below: standard, marked with yellow paint; - oversized by* ***0.4 mm*** *(****0.0 in****) and marked with green/yellow paint.*




NHIL25ENG0325AA 1

3. Support the half bearings **(1)** both on the connector rod and the cap.

***NOTE:*** *Not finding it necessary to replace the connecting rod bearings, you need to fit them back in exactly the same sequence and position as in removal. Do not make any adjustment on the half bearings.*

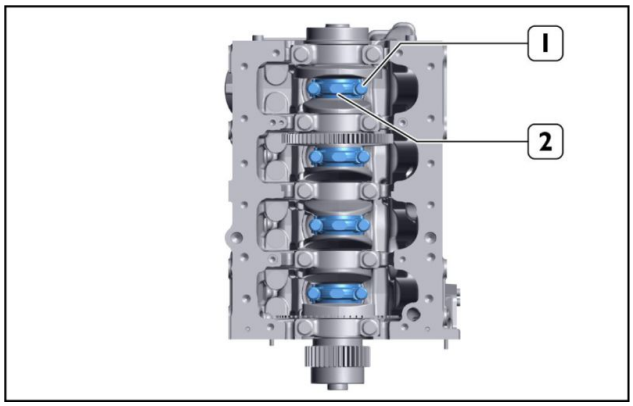



NHIL25ENG0326AA 2

# Piston - Remove [113469839 - V1 - 27 February 2025]

1. Remove the fastening screws **(1)** from the connecting rod caps **(2)** and remove them.
2. Withdraw the pistons including the connecting rods from the top of the crankcase.

***NOTE:*** *Keep the half-bearings in their housings since in case of use they shall be fitted in the same position found at removal.*




NHIL25ENG0148AA 1

# Piston - Install - Installation of connecting rod-piston assembly [113469840 - V1 - 27 February 2025]

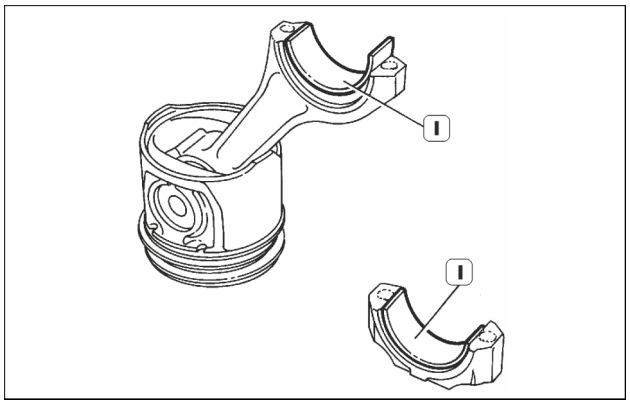
1. Check the piston components as described in **Piston - Measure - Piston (10.105)**.
2. Check the connecting rod as described in **Connecting rod and piston - Check - Connecting rod and piston (10.105)**.
3. Check the circlips as described in **Piston - Check - Compression rings (10.105)**.
4. Install the circlips as described in **Piston - Assemble - Compression rings (10.105)**.
5. Assemble the piston-connecting rod assembly as described in **Piston - Pre-assemble (10.105)**.
6. Assemble the big-end bearings as described in **Connecting rod bearing - Assemble (10.105)**.
7. Install the piston as described in **Piston - Assemble (10.105)**.
8. Check the protrusion of the pistons as described in **Piston - Check - Piston (10.105)**.

# Connecting rod bearing - Assemble [113427827 - V1 - 04 March 2025]

## Big end half-bearing fitting

1. Fit the half-bearings **(1)** on the connecting rod and cap.

***NOTE:*** *Not finding it necessary to replace the connecting rod bearings, refit them in exactly the same sequence and position as in removal. Do not make any adjustment on the half bearings.*




NHIL25ENG0307AA 1

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**F6AFL413A*U001**

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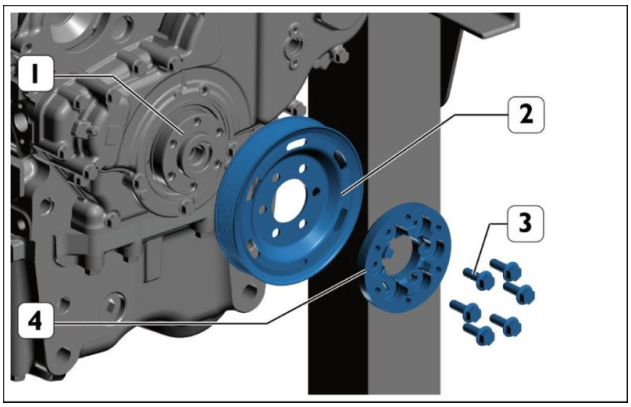
# Crankshaft pulley - Remove - Drive pulley on crankshaft [113427685 - V1 - 04 March 2025]

**Prior operation:**
Remove the belt as described in the procedure **Radiator to water pump hoses - Remove - Water pump drive belt (10.400)**.

1. Unscrew the fastening screws **(3)**, recover the spacer **(4)** and remove the crankshaft pulley **(2)** from the crankshaft **(1)**.



NHIL25ENG0300FA 1

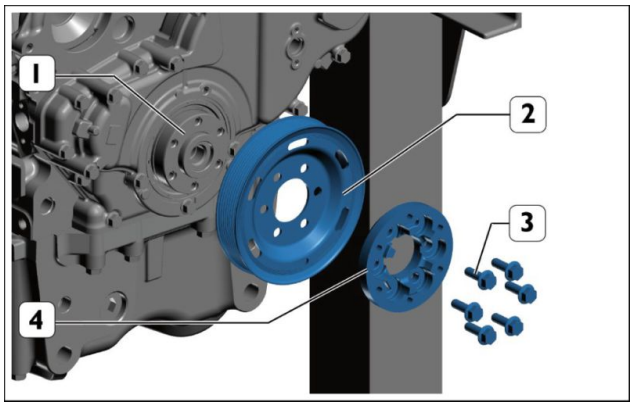
# Crankshaft pulley - Install - Drive pulley on crankshaft [113427687 - V1 - 04 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Crankshaft pulley | 7 screws M10 x 1.5 x 30 | **70 +/- 7 N·m** |

| Tool / Material | |
|---|---|
| Flywheel crank handle (use with 99360222) | 99360221 |
| Pinion (use with 99360221) | 99360222 |

1. Fit the crankshaft pulley **(2)** and the spacer **(1)** on the crankshaft **(1)** and tighten the fastening screws **(3)** to the prescribed torque.

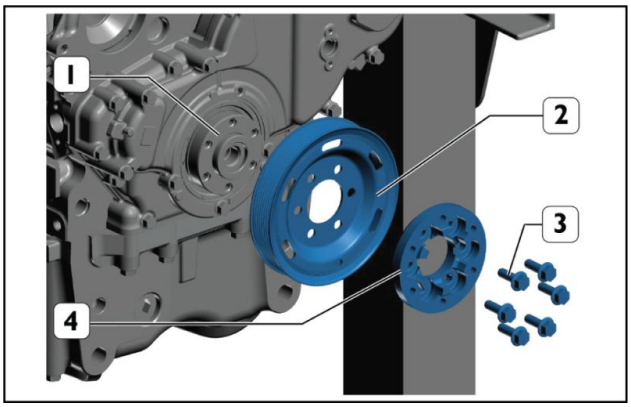
***NOTE:*** *The crankshaft rotation locking tool can facilitate the installation of the crankshaft pulley.*




NHIL25ENG0300FA 1

# Crankshaft pulley - Remove [113469194 - V1 - 26 February 2025]

1. Unscrew the fastening screws **(3)**, recover the spacer **(4)** and remove the crankshaft pulley **(2)** from the crankshaft **(1)**.




NHIL25ENG0117FA 1

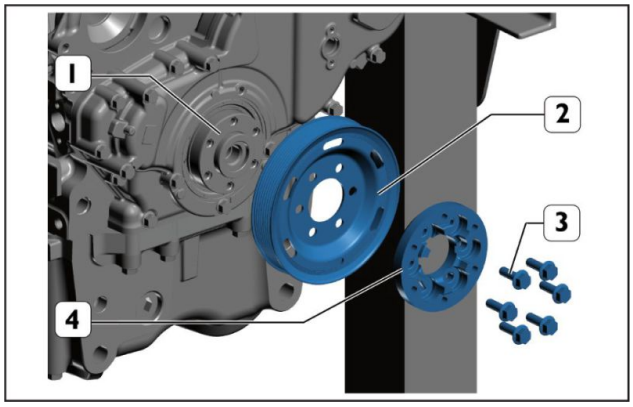
| Tool / Material | |
|---|---|
| Flywheel crank handle (use with 99360222) | 99360221 |

| Tool / Material | |
|---|---|
| Pinion (use with 99360221) | 99360222 |

# Crankshaft pulley - Assemble - Fitting the crankshaft pulley [113471229 - V1 - 28 February 2025]

1. Key the crankshaft pulley **(2)** and spacer **(4)** onto the crankshaft **(1)** and tighten the fastening screws **(3)** to the specified torque.

***NOTE:*** *The crankshaft rotation locking tool can facilitate the installation of the crankshaft pulley.*




NHIL25ENG0192FA 1

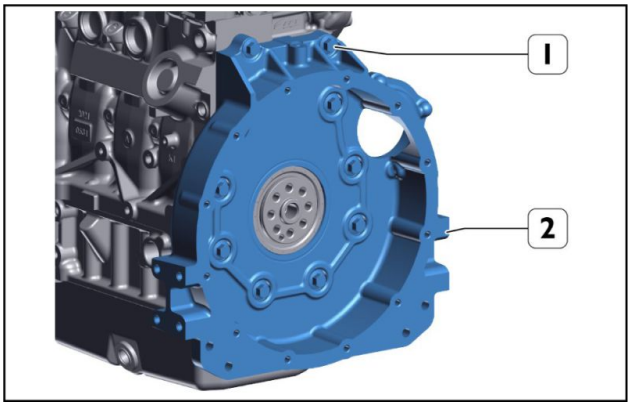
| Description | Step | Value |
|---|---|---|
| Crankshaft pulley | 7 screws M10 x 1.5 x 30 | **70 +/- 7 N·m** |

| Tool / Material | |
|---|---|
| Flywheel crank handle (use with 99360222) | 99360221 |

| Tool / Material | |
|---|---|
| Pinion (use with 99360221) | 99360222 |

# Engine flywheel - Remove - Engine flywheel housing [113469690 - V1 - 06 March 2025]

1. Unscrew the screws **(1)** and remove the flywheel housing **(2)**.

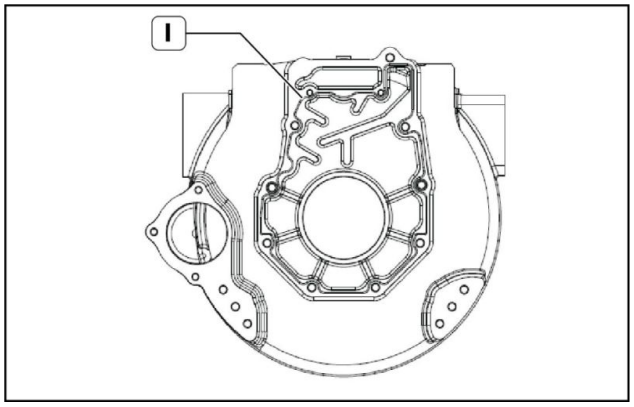



NHIL25ENG0142FA 1

# Engine flywheel - Assemble - Flywheel housing [113469691 - V1 - 06 March 2025]

1. Clean accurately the timing gear case and the crankcase.

***NOTICE:*** *The surface to be sealed MUST be clean in order to obtain perfect tightness. Apply sealant Loctite 5970* ***(1)*** *on the gear case in order to form a sealing bead of a few mm. See image . The sealant bead must be even (no lumps), with no air bubbles, and with no areas of a smaller diameter or even empty. Any flaws must be corrected. Do not apply an excessive amount of sealant: Too much sealant would be dispersed and come out on both sides of the joint thereby obstructing the passage of the lubricant. After applying the sealant, couple the parts within* ***10 min****.*

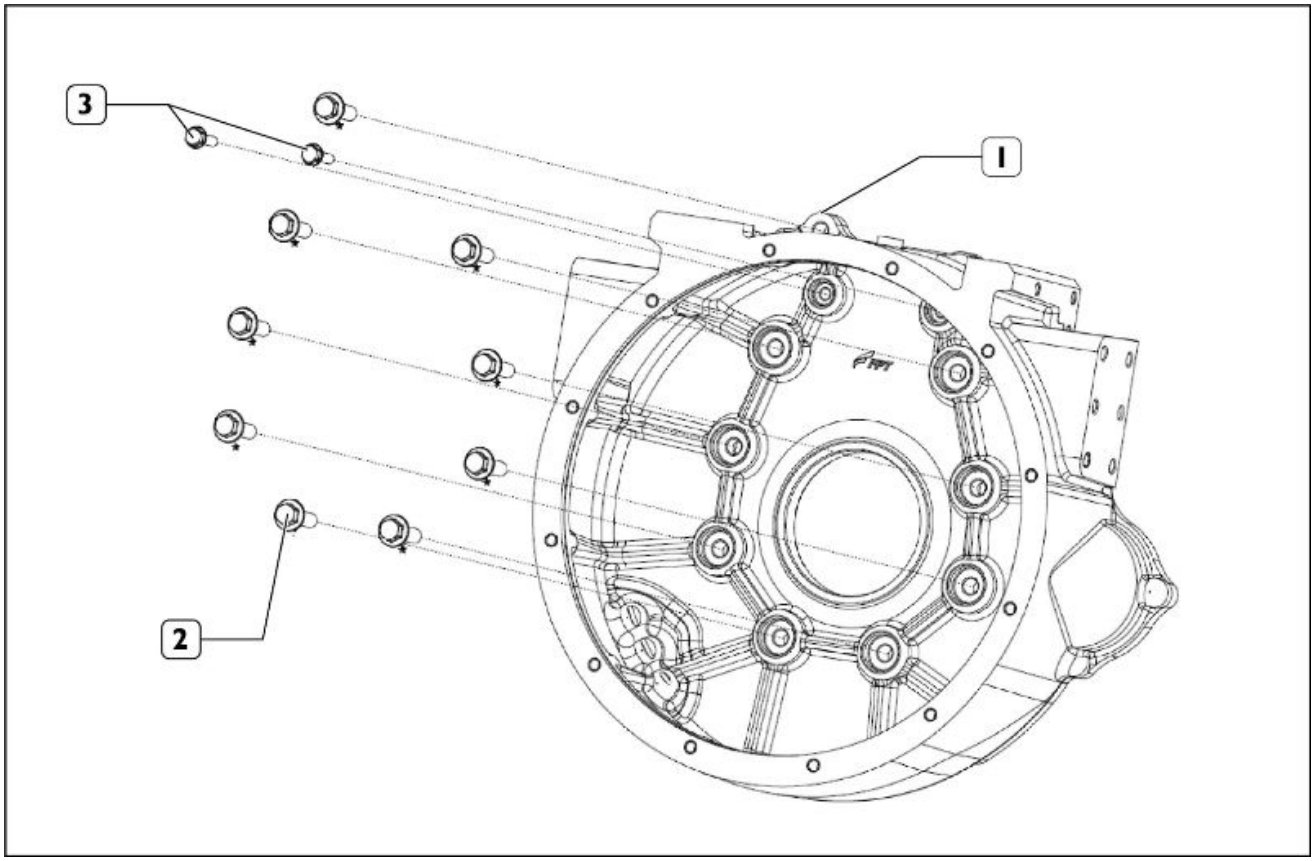



NHIL25ENG0158AA 1

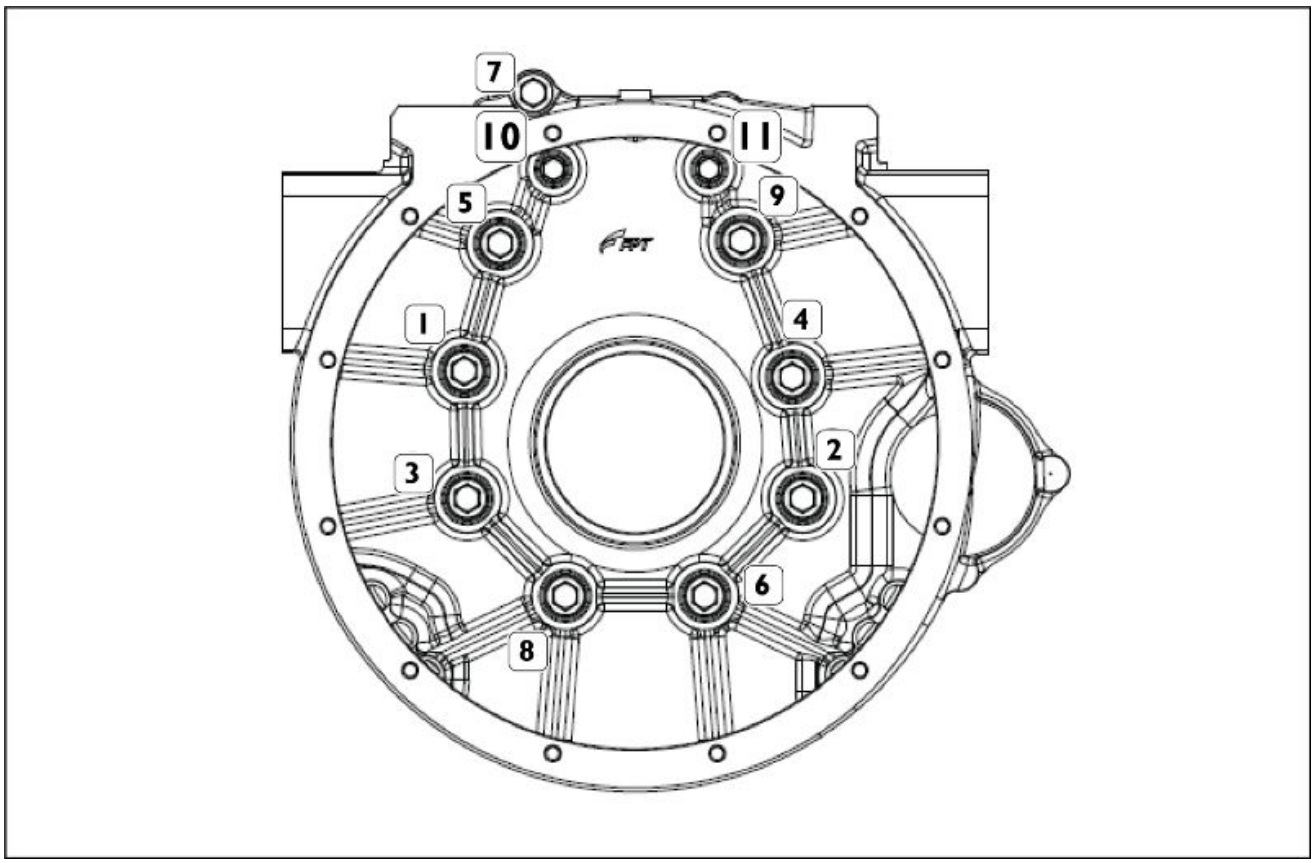
2. Refit the flywheel housing **(1)** to the engine crankcase and fit the fastening screws **(2)** and **(3)** in the same position found at removal. Tighten them to the specified torque values in the sequence shown in the figure .

***NOTE:*** *Always check, before each installation, that the threads of holes and screws do not show any signs of wear or dirt.*

| Description | Step | Value |
|---|---|---|
| Engine flywheel housing | 9 screws M12 x 1.75 x 40 | **110 +/- 11 N·m** |
| | 2 screws M8 x 1.25 x 40 | **35 +/- 3.5 N·m** |




NHIL25ENG0159FA 2




NHIL25ENG0160FA 3

**Diagram of the tightening sequence for the fastening screws of the flywheel housing**

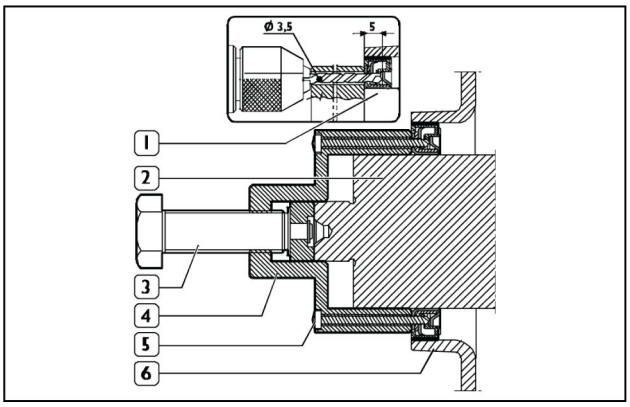
# Crankshaft oil seal - Remove - Crankshaft front gasket [113418976 - V1 - 04 March 2025]

## Prior operation:

## Crankshaft pulley - Remove - Drive pulley on crankshaft (10.103)

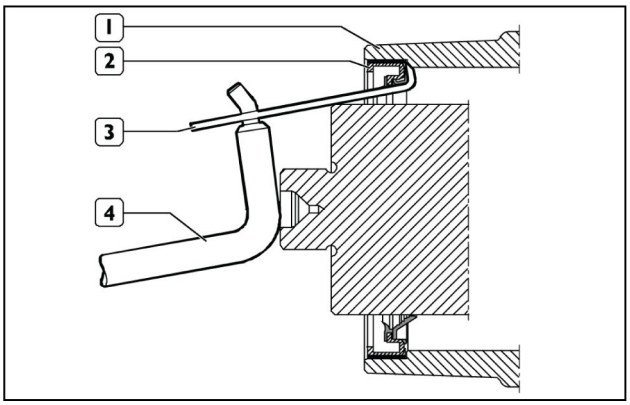
## Crankshaft front seal ring removal

1. To remove the seal ring **(1)** of the crankshaft **(2)** from the front cover **(6)** apply the specific tool **(4)** on the front tang of the crankshaft **(2)** and, through the guide holes of the tool, drill the internal seal ring **(1)** with a drill bit (Ø **3.5 mm** (**0.1 in**)) at a depth of **5 mm**.
2. Fasten the tool **(4)** to the inner seal ring **(1)** by screwing the 6 provided screws **(5)** .Proceed with the removal of the inner seal ring **(1)** by tightening the screw **(3)**.




NHIL25ENG0225AA 1

3. Use a tie rod **(3)** for the specific tool and a lever **(4)** to remove the external seal ring **(2)** from the front cover **(1)**.




NHIL25ENG0226AA 2

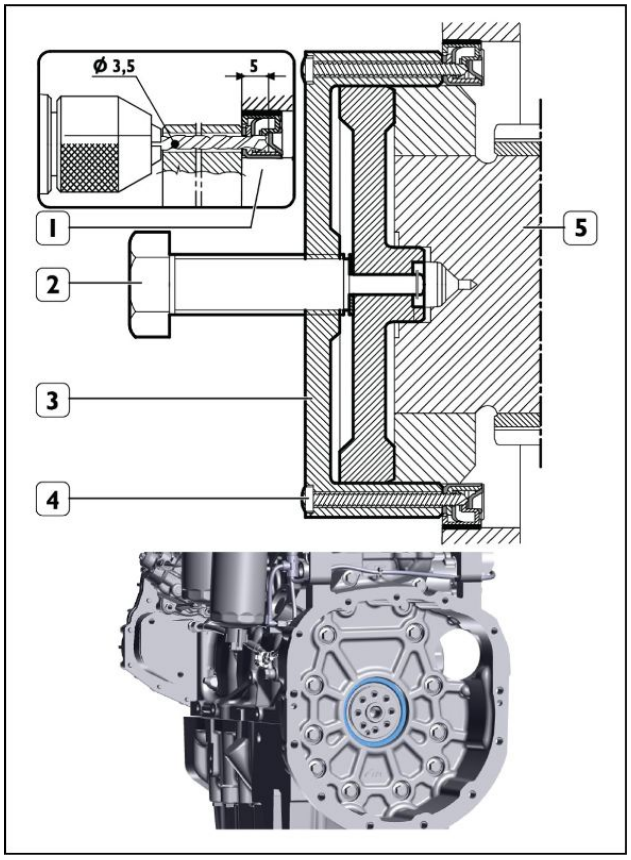
# Crankshaft oil seal - Remove - Crankshaft rear gasket [113418977 - V1 - 04 March 2025]

## Prior operation:

**Engine flywheel - Remove - Engine flywheel housing (10.103)**

## Crankshaft rear seal ring removal

1. To extract the crankshaft seal ring from the flywheel housing apply a suitable puller **(3)** on the rear tang **(5)**.
2. Through the tool guide holes, drill the internal seal ring with a drill bit (Ø **3.5 mm** (**0.1 in**)) to a depth of **5.0 mm** (**0.2 in**).
3. Extract the ring **(1)** by screwing the screw **(2)**.
4. Use the special tie rod of the tool and a lever to extract the external seal ring from the flywheel housing.



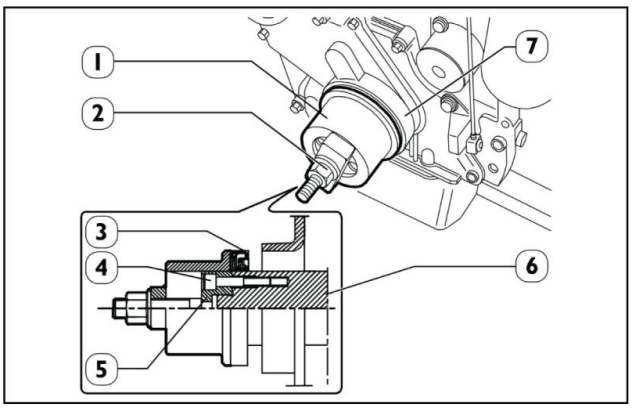

NHIL25ENG0228FA 1

# Crankshaft oil seal - Install - Crankshaft front gasket [113418978 - V1 - 04 March 2025]

| Tool / Material | |
|---|---|
| Key for crankshaft front gasket installation and timing cover centering | 99346270 |

## Crankshaft front seal ring refitting

1. Apply the part **(5)** of the special tool to the front crankshaft tang **(6)** securing it with the screws **(4)** and keying it onto the new sealing ring **(3)**.
2. Position part **(1)** on part **(5)**, tighten the nut **(2)** until the crankshaft seal ring **(3)** is fully installed on the front cover **(7)**.




NHIL25ENG0227AA 1

## Next operation:

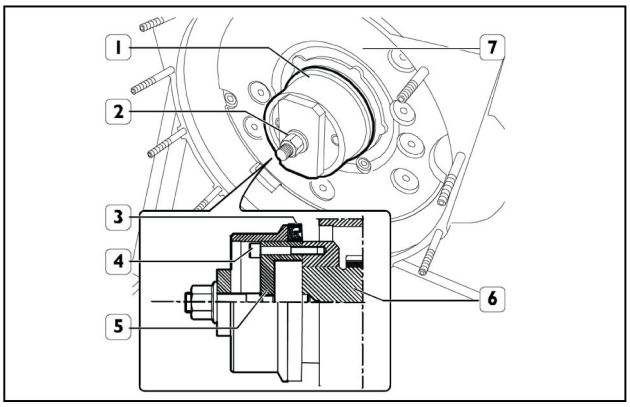
## Crankshaft pulley - Install - Drive pulley on crankshaft (10.103)

# Crankshaft oil seal - Install - Crankshaft rear gasket [113418979 - V1 - 04 March 2025]

| Tool / Material | |
|---|---|
| Crankshaft rear seal installer | 99346259 |

## Crankshaft rear seal ring refitting

1. Apply the part **(5)** of the special tool to the rear crankshaft tang **(6)** securing it with the screws **(4)** and fit the new seal ring **(3)**.
2. Position part **(1)** on part **(5)** and screw down the nut **(2)** to fit the seal fully **(3)** in the flywheel housing **(7)**.




NHIL25ENG0229AA 1

## Next operation:

**Engine flywheel - Assemble - Flywheel housing (10.103)**

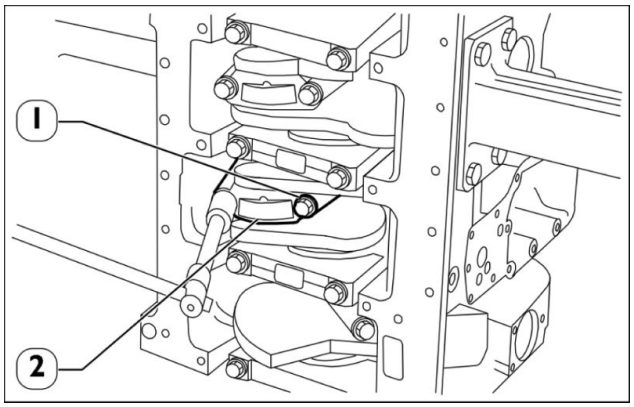
# Crankshaft - Disassemble - Cranshaft [113427443 - V1 - 04 March 2025]

**Prior operation:**
Remove the oil sump as described in the procedure **Engine oil pan - Remove - Oil sump (10.102)**
**Prior operation:**
Remove the balancing weights as described in the procedure **Crankcase - Remove - Weight fastening screws (10.001)**

| Tool / Material | |
|---|---|
| Crankshaft lifting tackle | 99360500 |

1. Loosen the screws **(1)** securing the connecting rod caps **(2)** and remove the relative retainers.

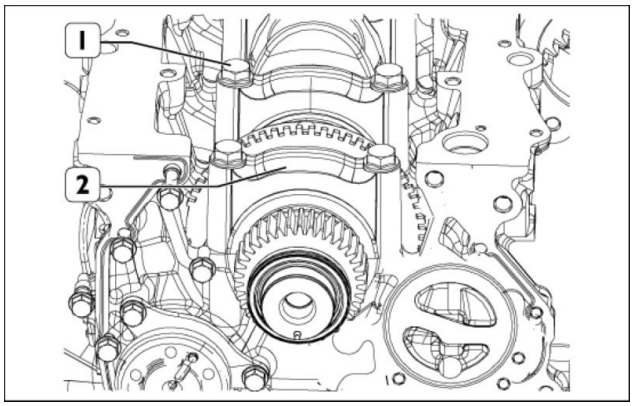
***NOTE:*** *Keep the half bearings in the respective seats since after the overhaul, they will have to be refitted in the same position.*




NHIL25ENG0277AA 1

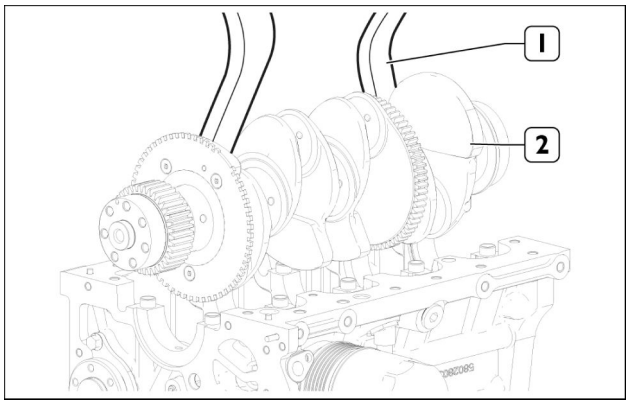
2. Unscrew the screws **(1)** and disassemble the main bearing caps **(2)**.
3. The last main bearing cap **(2)** and the relevant mount are fitted with shoulder half-bearing.

***NOTE:*** *Take note of lower and upper half bearing assembling positions since in case of reuse they shall be fitted in the same position found at removal.*




NHIL25ENG0278FA 2

4. Remove the crankshaft **(2)** from the block by means of the tool **(1)**.



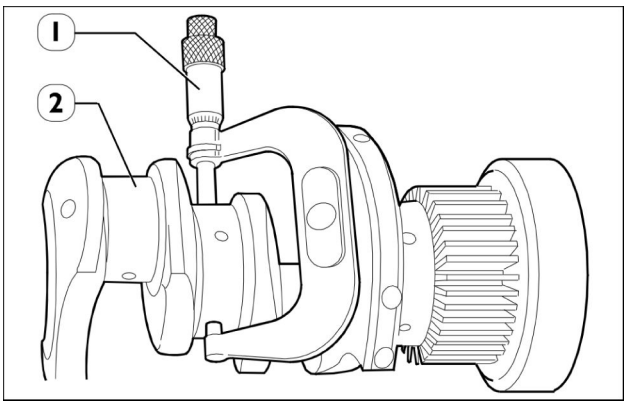

NHIL25ENG0279AA 3

# Crankshaft - Measure - Crankshaft [113427444 - V1 - 04 March 2025]

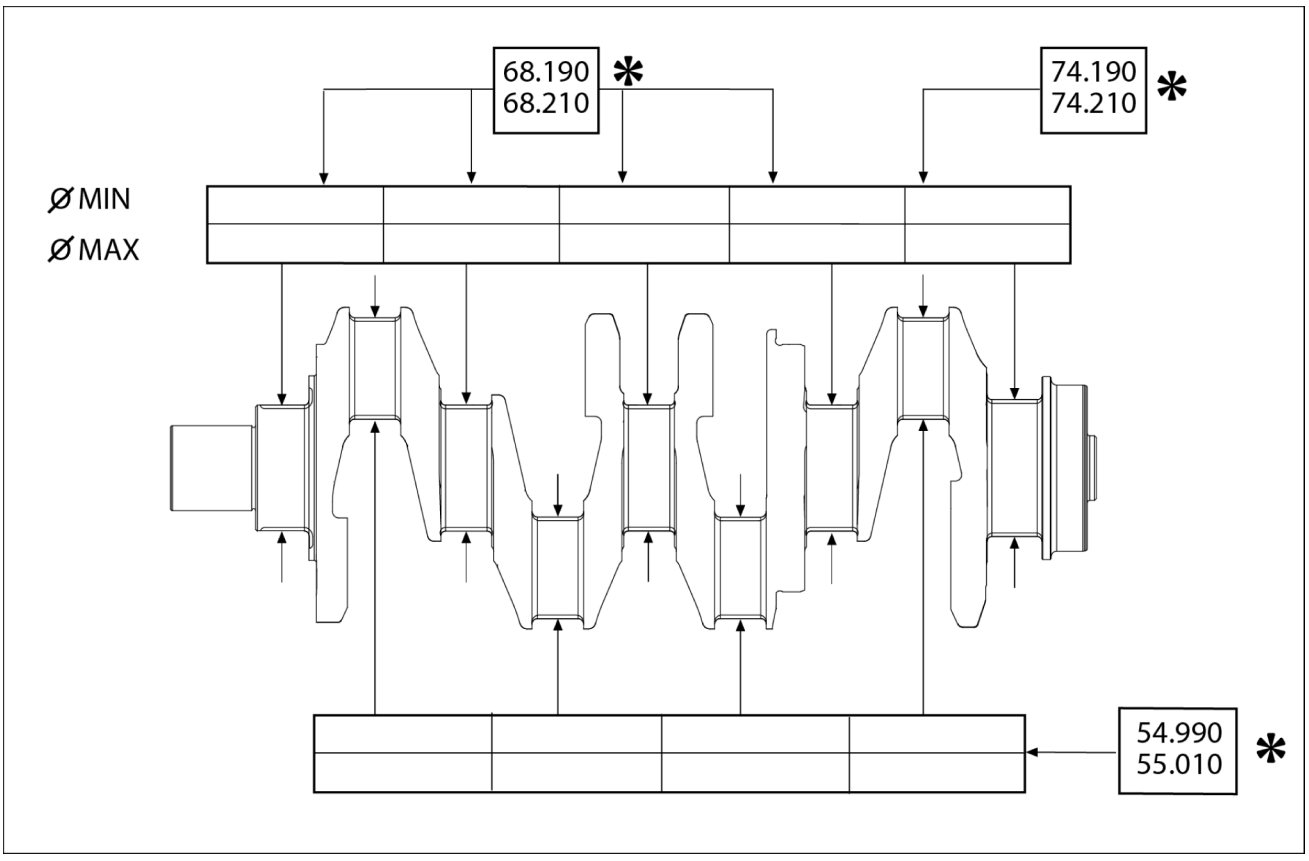
## Measuring main journals and crank pins

1. Grind journals and crankpins if seizure, scoring or excessive ovalisation are found. Before grinding the journals **(2)** measure them with a micrometer **(1)** to decide the final diameter to which the pins are to be ground.

***NOTE:*** *The main journals and crankpins must always be ground to the same undersize class.*
*Main journals and crankpins undersize shall be marked on the side of the crank arm no. 1.*
*For undersized crankpins: letter M. For undersized journals: letter B.*
*For undersized crankpins and journals: letters MB.*

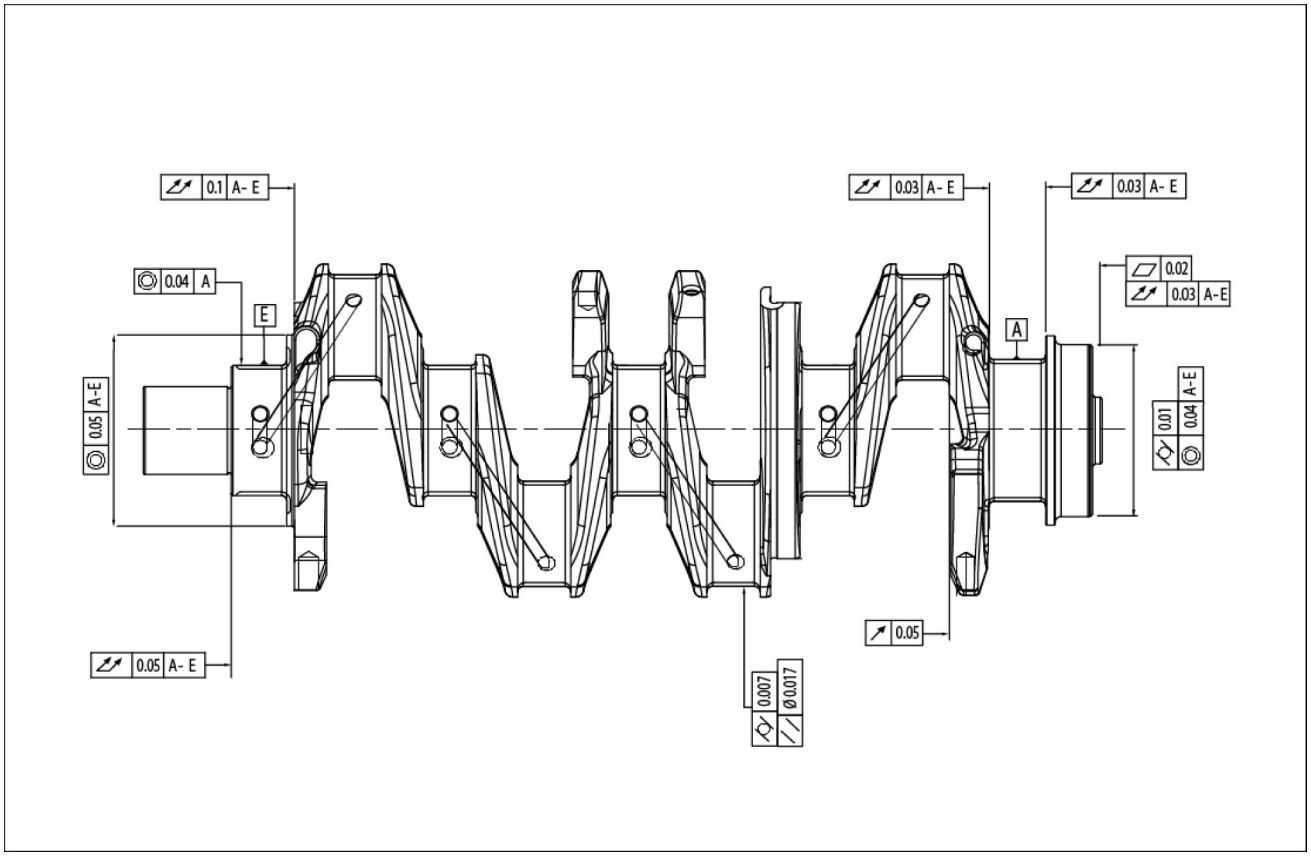



NHIL25ENG0280AA 1




NHIL25ENG0281FA 2

**Fill this table with the values measured on the output shaft supports and crankpins - (*) Rated value (dimensions in mm).**

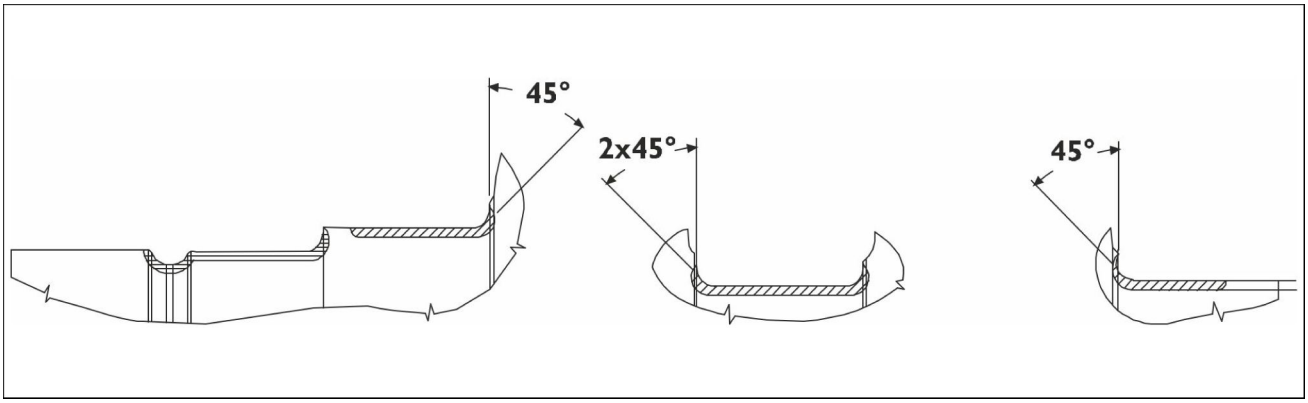



NHIL25ENG0282FA 3

**Main output shaft tolerances**

| Tolerances | Tolerances Characteristics | Graphic symbol |
|---|---|---|
| Shape | Circularity | O |
| | Cylindricity | /O/ |
| Orientation | Alignment | // |
| | Verticality | ⊥ |
| | Straightness | — |
| Position | Concentrically or coaxially | ◎ |
| Oscillation | Circular oscillation | ↗ |
| | Total oscillation | ↗↗ |

| Level of significance by product features | Graphic symbol |
|---|---|
| Critical | © |
| Important | ⊕ |
| Secondary | Θ |




NHIL25ENG0283EA 4

**Main bearing on timing system control side – intermediate main bearings – first main bearing on front side**

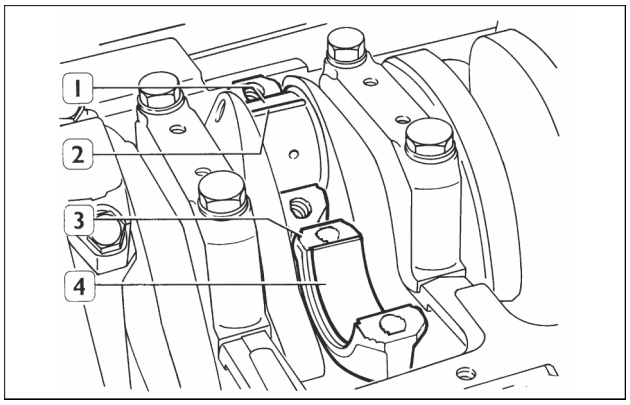
# Crankshaft - Measure -Crankshaft [113427445 - V1 - 04 March 2025]

**Prior operation:**
**Piston - Assemble (10.105)**

| Description | Quantity | Step | Value |
|---|---|---|---|
| Crankshaft connecting rod caps | 8 screws M8 x 1 | Step 1 — Tighten | **20 +/- 1 N·m** |
| | | Step 2 — Angle tightening | **60°** |

## Crankpin assembly clearance measurement

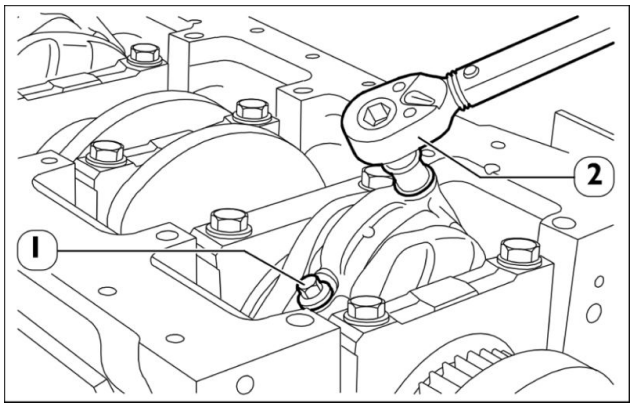
1. Carry out the following operations to measure the clearance:
2. Carefully clean the parts and remove any trace of oil.
3. Lay down a piece of calibrated wire **(2)** on the pins **(1)** of the crankshaft.
4. Fit the connecting rod caps **(3)** with the relative half-bearings **(4)**.




NHIL25ENG0289AA 1

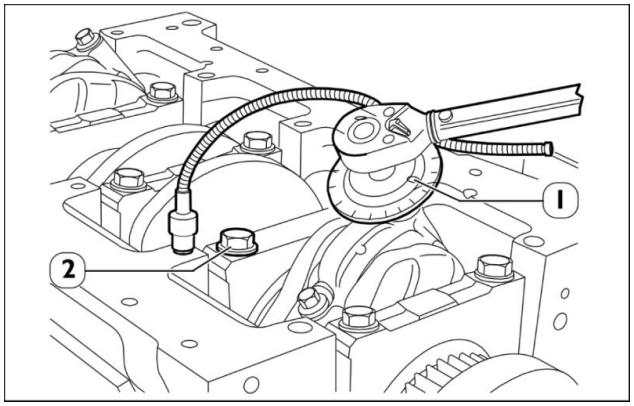
***NOTE:*** *General risk, general prescriptions*
*- When assembling, always replace with new parts: gaskets and sealing rings, split pins, safety plates and springs.*
*- The nuts and screws must be tightened to the specified torque with the thread dry and degreased.*
*Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle*

Tighten the screws **(1)**, pre-lubricated with the prescribed oil, with a torque wrench **(2)**.




NHIL25ENG0290AA 2

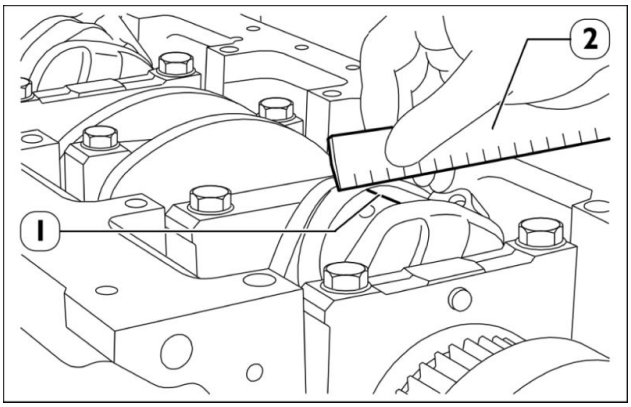
5. Apply the specific tool **(1)** to the socket wrench and tighten the screws **(2)** to the specified angle.




NHIL25ENG0291AA 3

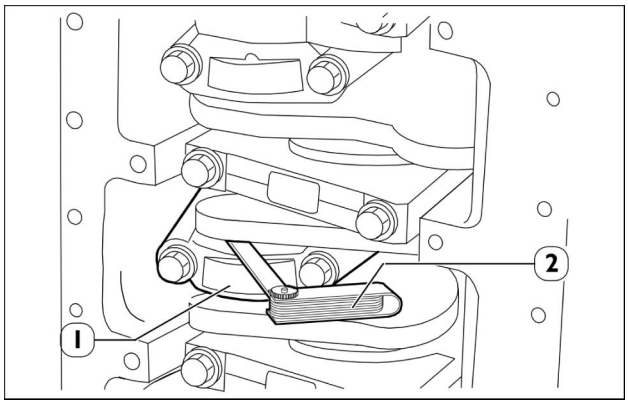
| Description | Quantity | Step | Value |
|---|---|---|---|
| Crankshaft connecting rod caps | 8 screws M8 x 1 | Step 1 — Tighten | **20 +/- 1 N·m** |
| | | Step 2 — Angle tightening | **60°** |

6. Remove the cap and find the existing clearance by comparing the calibrated wire width **(1)** with the scale indicated on the envelope **(2)** which contained the wire.




NHIL25ENG0292AA 4

7. If the clearance is not as prescribed, change the bearing shells and repeat the check.
8. On obtaining the prescribed clearance, lubricate the connecting rod half bearings and fit them permanently by tightening the screws securing the connecting rod caps as described.
9. Check manually that the connecting rods **(1)** are sliding axially on the crankshaft pins and that their axial clearance, measured with feeler gauge **(2)** is: **0.10 – 0.33 mm** (**0.00 – 0.01 in**).



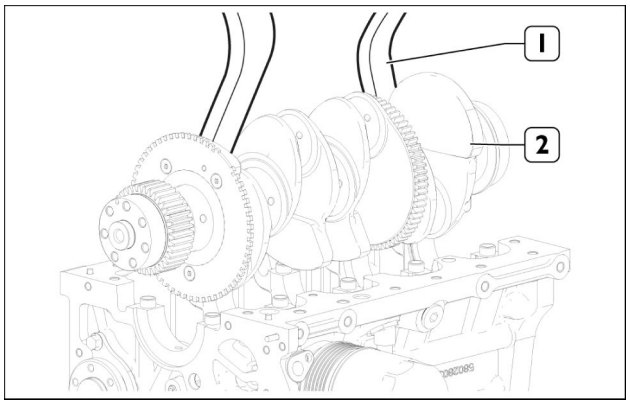

NHIL25ENG0293AA 5

# Crankshaft - Assemble - Crankshaft [113427446 - V1 - 04 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Crankshaft main bearing caps | 10 screws M12 x 1.5 x 120 | Step 1 — Pre-tightening | **50 +/- 6 N·m** |
| | | Step 2 — Tighten | **80 +/- 6 N·m** |
| | | Step 3 — Angle tightening | **90°** |

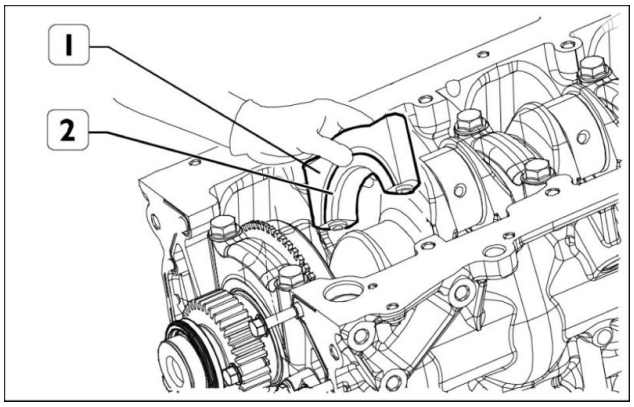
| Tool / Material | |
|---|---|
| Crankshaft lifting tackle | 99360500 |

1. Use the tool **(1)** to fit the crankshaft **(2)**.



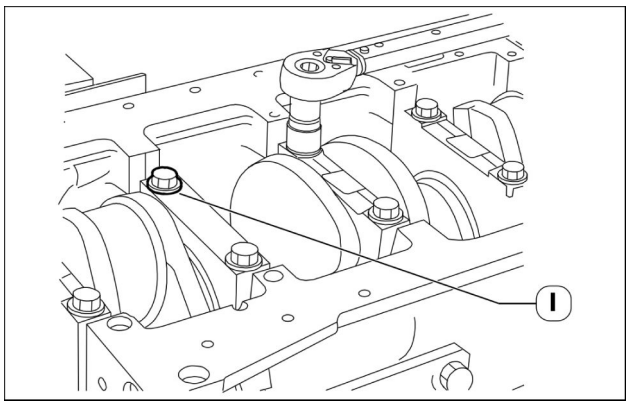

NHIL25ENG0284AA 1

2. Thoroughly clean the parts and eliminate all traces of oil.
3. Fit caps **(1)**, including the half bearings **(2)** on the relevant supports.



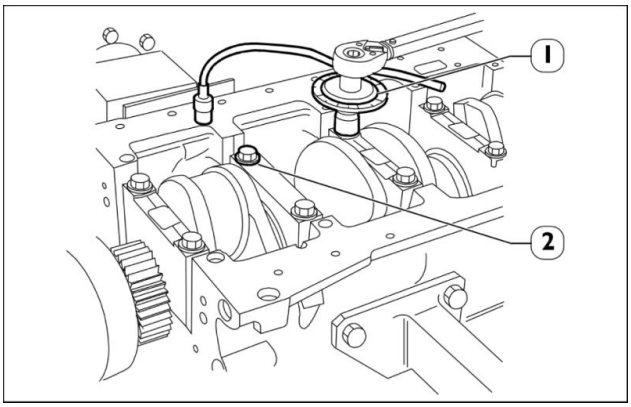

NHIL25ENG0285FA 2

4. Tighten the new prelubricated screws **(1)** and tighten them in two subsequent phases. Phase 1 with the torque wrench set to **80 +/- 6 N·m**.




NHIL25ENG0286AA 3

5. Phase 2 with the tool **(1)** positioned as shown in the figure **4**, tighten the screws **(2)** further with a **90 +/- 2°** angle.




NHIL25ENG0287AA 4

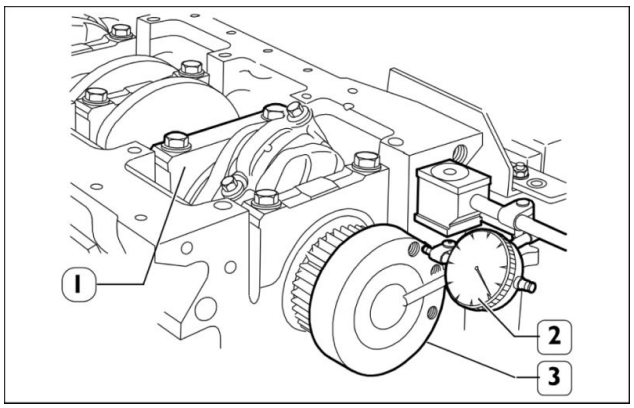
| Description | Quantity | Step | Value |
|---|---|---|---|
| Crankshaft main bearing caps | 10 screws M12 x 1.5 x 120 | Step 1 — Pre-tightening | **50 +/- 6 N·m** |
| | | Step 2 — Tighten | **80 +/- 6 N·m** |
| | | Step 3 — Angle tightening | **90°** |

**Next operation:**
Fit the oil sump, as described in the procedure **Engine oil pan - Install - Oil sump (10.102)**
**Next operation:**
Fit the balancing weights, as described in the procedure **Crankcase - Install - Weight fastening screws (10.001)**

# Crankshaft - Check - Crankshaft [113427447 - V1 - 04 March 2025]

## Check crankshaft axial clearance

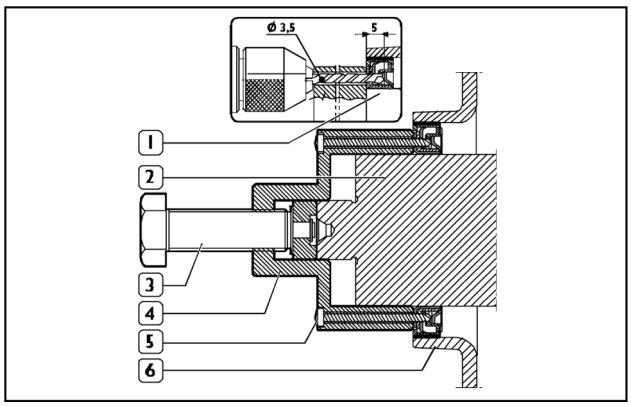
1. This check is carried out by placing a magnetic based dial gauge **(2)** on the output shaft **(3)** as indicated in the figure **1**. The normal value is **0.150 – 0.350 mm**.
2. If a higher value is detected, replace the main half bearings of the next to last rear support **(1)** carrying the thrust bearing and repeat the clearance check between the output shaft pins and the main half-bearings.




NHIL25ENG0288AA 1

# Crankshaft - Remove - Crankshaft front sealing ring [113469252 - V1 - 07 March 2025]

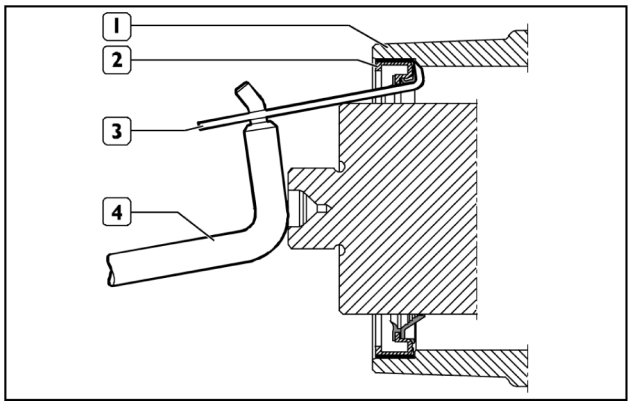
1. To remove the seal ring **(1)** of the crankcase **(2)** from the front cover **(6)** apply the specific tool **(4)** to the front crankshaft tang **(2)** and, through the tool guide holes, drill the internal seal ring **(1)** with a drill bit ( **3.5 mm** (**0.1 in**)) to a depth of **5.0 mm** (**0.2 in**).




NHIL25ENG0134AA 1

| Tool / Material | |
|---|---|
| Key for crankshaft front gasket installation and and timing cover centering | 99346270 |

2. Secure the tool **(4)** to the internal seal ring **(1)** screwing the 6 screws **(5)** provided and extract the internal seal ring **(1)** by screwing the screw **(3)**.
3. Use the special tie rod **(3)** of the specific tool and the lever **(4)** to remove the external seal ring **(2)** from the front cover **(1)**.

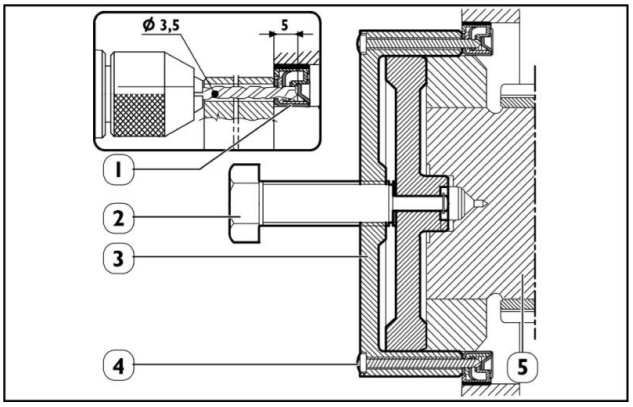



NHIL25ENG0135AA 2

| Tool / Material | |
|---|---|
| Tool for removing gaskets | 99363204 |

# Crankshaft - Remove - Crankshaft rear seal ring [113478753 - V1 - 06 March 2025]

1. To extract the crankshaft seal ring from the flywheel housing apply a suitable puller **(3)** on the rear tang **(5)**.
2. Through the tool guide holes, drill the internal seal ring with a drill bit (Ø **3.5 mm** (**0.1 in**)) to a depth of **5.0 mm** (**0.2 in**).
3. Secure the specific tool **(3)** to the ring **(1)** by screwing the 6 screws **(4)** provided.




NHIL25ENG0141AA 1

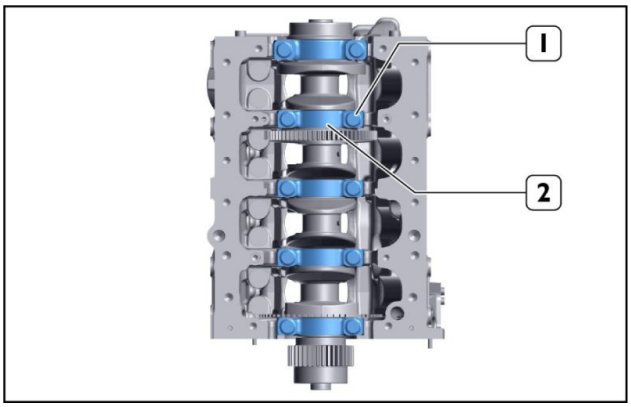
| Tool / Material | |
|---|---|
| Tool to remove crankshaft rear gasket | 99340056 |

4. Extract the ring **(1)** by screwing the screw **(2)**.
5. Use the special tie rod of the tool and a lever to extract the external seal ring from the flywheel housing.

# Crankshaft - Remove [113469622 - V1 - 27 February 2025]

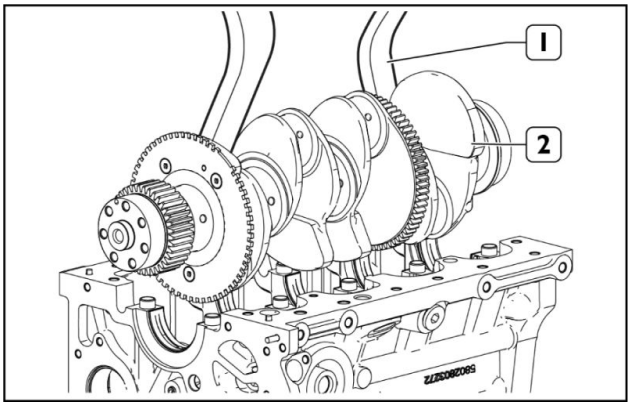
1. Remove the screws **(1)** and disassemble the main bearing caps **(2)**.
2. The last mount of the main bearing cap has the half-bearing provided with shoulder.

***NOTE:*** *Take note of lower and upper half bearing assembling positions since in case of reuse they shall be fitted in the same position found at removal.*




NHIL25ENG0149FA 1

3. Use the specific tool **(1)** to lift and remove the crankshaft **(2)** from the crankcase.

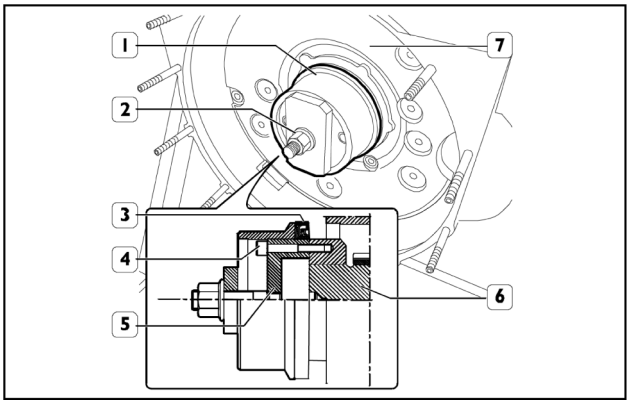



NHIL25ENG0150AA 2

| Tool / Material | |
|---|---|
| Crankshaft lifting tackle | 99360500 |

# Crankshaft - Assemble - Crankshaft rear gasket [113469624 - V1 - 06 March 2025]

1. Apply the part **(5)** of the special tool to the rear crankshaft tang **(6)** securing it with the screws **(4)** and fit the new sealing ring **(3)**.
2. Position part **(1)** on part **(5)**, tighten the nut **(2)** until the sealing ring **(3)** is completely installed in the flywheel housing **(7)**.

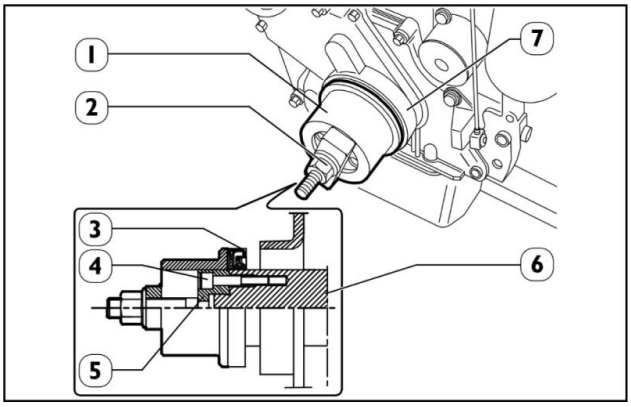



NHIL25ENG0161AA 1

| Tool / Material | |
|---|---|
| Crankshaft rear seal installer | 99346259 |

# Crankshaft - Service instruction - Crankshaft front sealing ring refitting [113469625 - V1 - 06 March 2025]

1. Apply the part **(5)** of the specific tool 99346270 (Keying device for centring front crankshaft gasket assembly and timing cover) to the front tang **(6)** of the crankshaft, secure it with the fastening screws **(4)** and fit a new seal ring **(3)**.
2. Position part **(1)** on part **(5)**, tighten the nut **(2)** until the crankshaft sealing ring **(3)** is completely installed in the front cover **(7)**.




NHIL25ENG0171AA 1

| Tool / Material | |
|---|---|
| Key for crankshaft front gasket installation and timing cover centering | 99346270 |

# Main bearings - Assemble [113427683 - V1 - 04 March 2025]

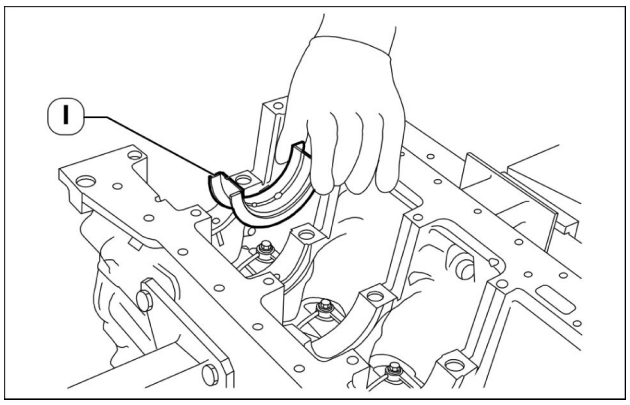
## Main bearings assembly

1. Clean accurately the main half-bearing **(1)** having the lubricating hole and fit them into their housings.

***NOTE:*** *Not finding it necessary to replace the main bearings, refit them in exactly the same sequence and position as in removal.*

***NOTE:*** *Do not attempt to adapt the bearings.*

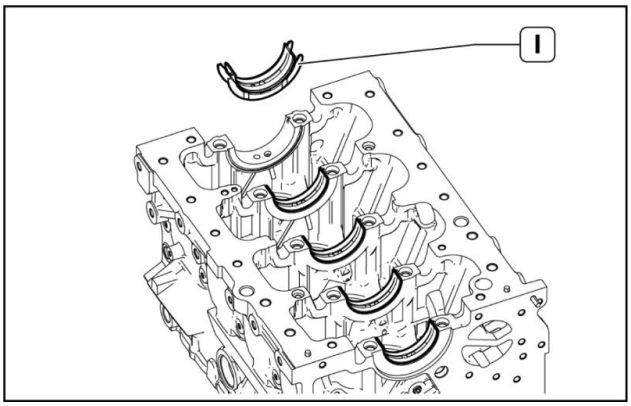
2. The second last main half-bearing **(1)** is fitted with shoulder half rings.




NHIL25ENG0299AA 1

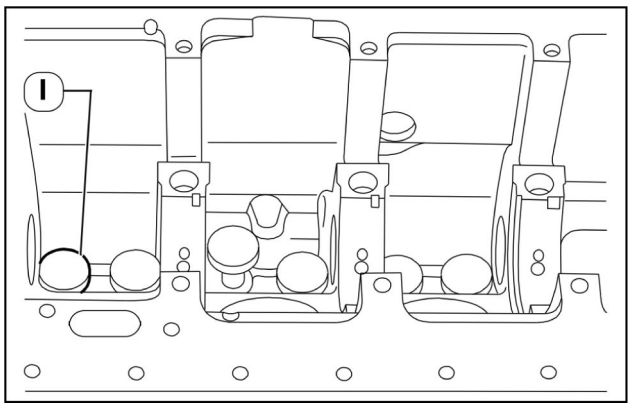
# Main bearings - Remove [113469843 - V1 - 27 February 2025]

1. Remove the main half-bearings **(1)**.




NHIL25ENG0151AA 1

2. Remove the tappets **(1)** from the crankcase.




NHIL25ENG0152AA 2

# Main bearings - Install - Fitting main half-bearings and crankshaft [113469856 - V1 - 05 March 2025]

1. Check the crankshaft as described in **Crankshaft - Measure - Crankshaft (10.103)**.
2. Install the main bearings as described in **Main bearings - Assemble (10.103)**.
3. Install the crankshaft as described in **Crankshaft - Assemble - Crankshaft (10.103)**.
4. Check the crankshaft thrust clearance as described in **Camshaft - Assemble - Camshaft (10.106)**.

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**F6AFL413A*U001**

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### Fuel tanks - 216


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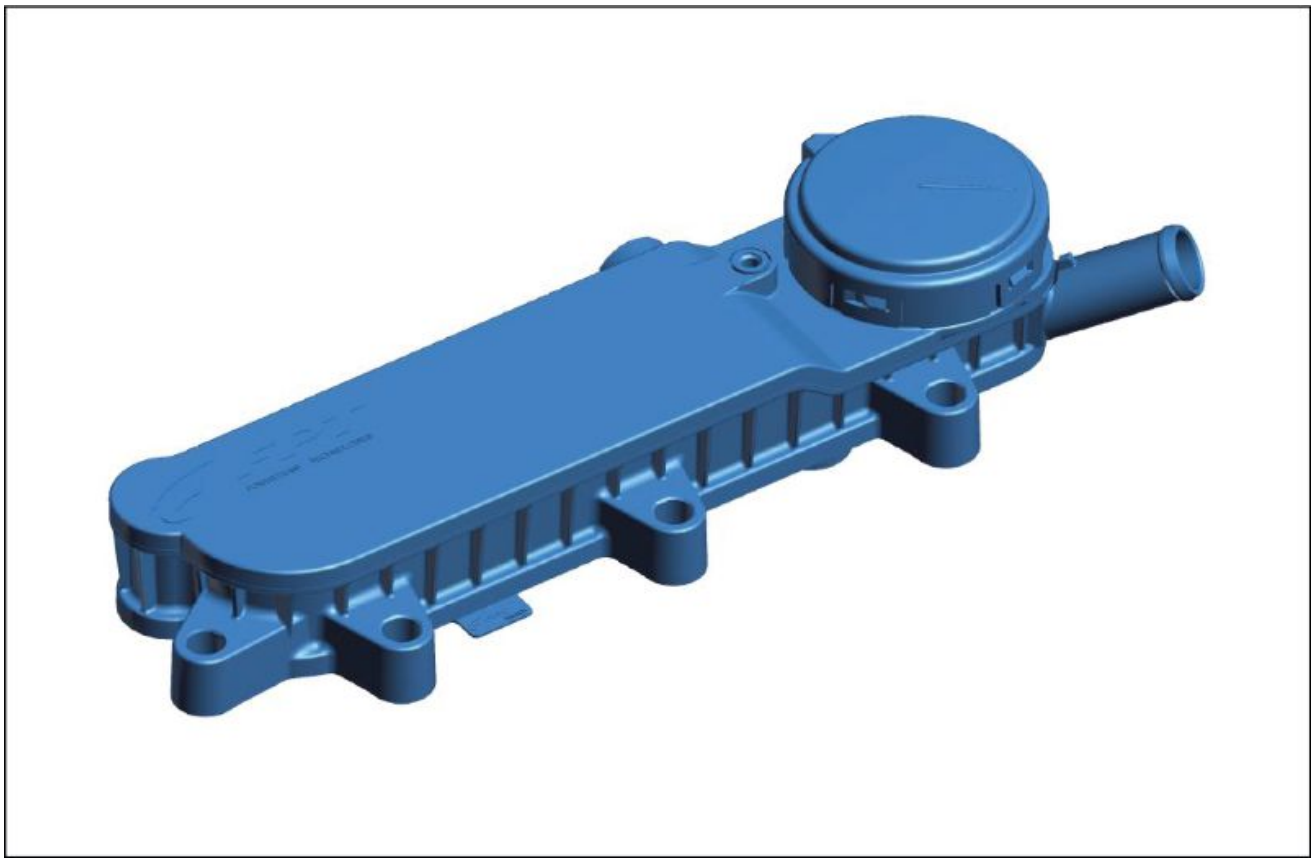
# Fuel breather - Overview - Oil vapour recirculation system [113418640 - V1 - 26 February 2025]



NHIL25ENG0215FA 1

The oil vapour recirculation circuit permits the separation and the condensation of the oil vapours contained in the gas originating from the crankcase for recovery in the sump. The remaining gas is then introduced in the intake circuit to be again burnt in the combustion chamber.

This gas consists of a mixture of air, combustion vapours and lubricant.

The gas originating from the crankcase rises up to the cylinder head, and is sent to the blow-by filter blow-by by the separator located inside the tappet cover, whose form and position determines an increase in the release speed of the oil vapours and at the same time condensates a part of them.

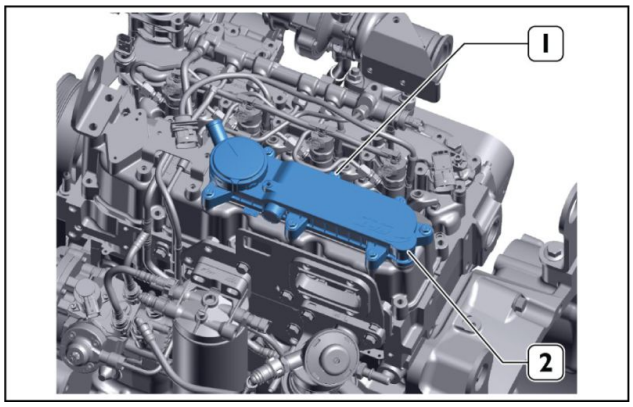
The condensed oil returns to the sump while the residual steam is directed, collected and filtered in the blow-by filter.

An additional part of the vapours condense in the blow-by filter and return to the oil sump via the channel whereas the remaining part is not released into the atmosphere but is recirculated in the intake through the breather pipe.

# Fuel breather - Remove - Engine breather [113419103 - V1 - 17 February 2025]

## Blow-by filter removal

1. Position a suitable container to collect the oil. Unscrew the fastening screws **(1)** and remove the blow-by filter unit **(2)**.



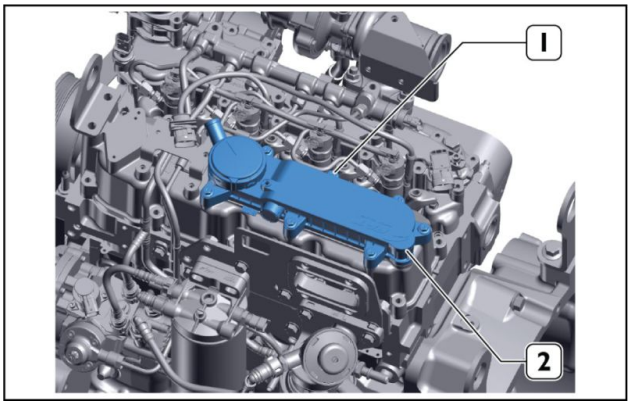

NHIL25ENG0230TA 1

# Fuel breather - Install - Engine breather [113419104 - V1 - 04 March 2025]

| Description | Step | Value |
|---|---|---|
| Blow-by filter | 7 screws M6 x 1 x 13 | **10 +/- 2 N·m** |

## Refitting the blow-by filter

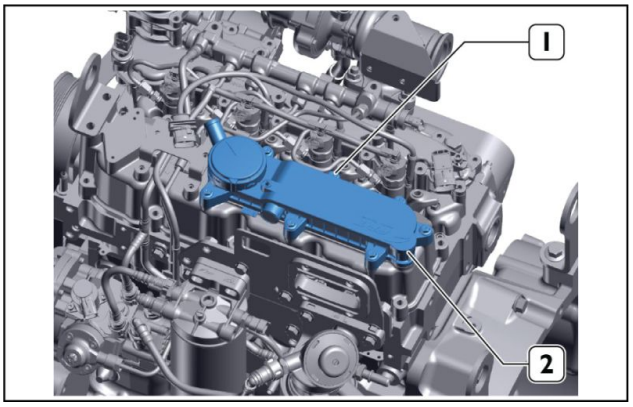
1. Fit the blow-by filter unit **(2)** and tighten the fastening screws **(1)** to the prescribed torque.




NHIL25ENG0230TA 1

# Fuel breather - Remove - Blow-by filter unit removal [113469155 - V1 - 26 February 2025]

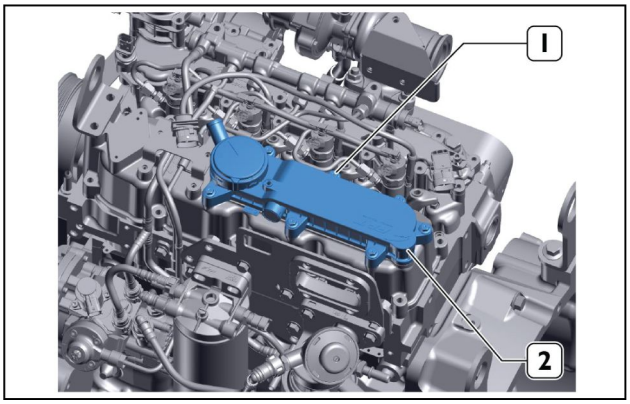
1. Place a suitable container to collect the oil. Unscrew the fastening screws **(1)** and remove the blow-by filter unit **(2)**.




NHIL25ENG0100TA 1

# Fuel breather - Assemble - Blow-by filter unit [113471377 - V1 - 05 March 2025]

1. Fit the blow-by filter unit **(2)** and tighten the fastening screws **(1)** to the prescribed torque.

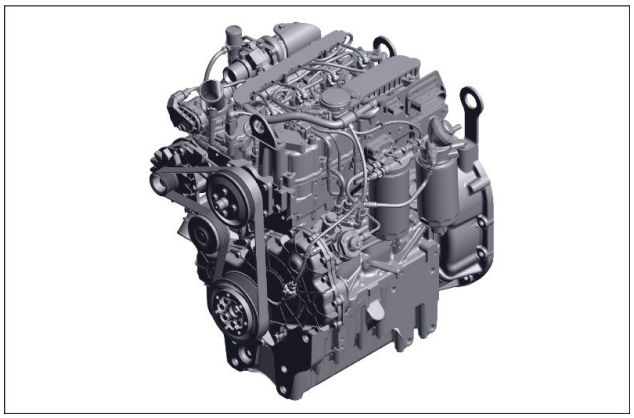



NHIL25ENG0209TA 1

| Description | Step | Value |
|---|---|---|
| Blow-by filter | 7 screws M6 x 1 x 13 | **10 +/- 2 N·m** |

# Fuel breather - Remove - Removing the rotating stand [113471378 - V1 - 06 March 2025]

1. Unscrew the fastening screws from the brackets 99361026 on the rotating stand 99322205.
2. Lift the engine from the rotating stand 99322205 using the lifting hooks, beam and hoist.
3. Unscrew the fastening screws and remove the brackets 99361026 from the engine crankcase.



NHIL25ENG0210FA 1

| Tool / Material | |
|---|---|
| Assemblies overhaul revolving stand (bearing capacity **1000 daN** (**2248 lbf**) | 99322205 |

| Tool / Material | |
|---|---|
| Brackets fixing engine to revolving stand 99322205 | 99361026 |

4. Tighten the oil drain plug housed in the lower part of the sump and tighten to the specified torque.

| Description | Quantity | Step | Value |
|---|---|---|---|
| Lubricant oil drain plug in the sump | 2 caps M22 x 1.5 x 12 | | **50 +/- 5 N·m** |

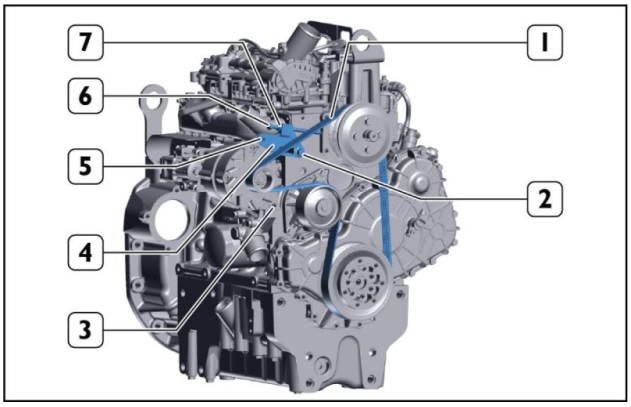
5. Top up with lubricant oil through the designated oil filler hole on the oil sump observing the quantities and quality as indicated in the section **General specification - Engine - Technical data ()** .

# Auxiliary fuel tank - Remove - Auxiliary unit drive belt [113469159 - V1 - 07 March 2025]

1. Loosen, without removing, the bolt **(3)** anchoring the alternator to its lower mount.
2. Unscrew the fastening screw **(2)** of the tensioning bracket **(4)** to the crankcase.
3. Loosen the belt tension of the auxiliary unit **(1)** by unscrewing the adjustment screw **(6)** on the relevant lock nut **(7)**.

***NOTE:*** *Risk of damage The flexible belt must be replaced with a new one every time it is removed from the vehicle. Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle*

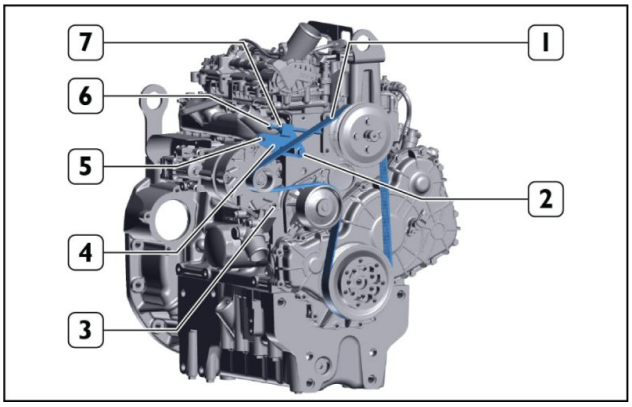
4. Remove the auxiliary unit belt **(1)** from all the pulleys: crankshaft pulley, water pump, alternator, fan drive pulley.
5. Unscrew the fastening screw **(5)** of the alternator and remove the tensioning bracket **(4)**.




NHIL25ENG0104FA 1

# Auxiliary fuel tank - Assemble - Auxiliary drive belt [113471311 - V1 - 06 March 2025]

1. Install the tensioning bracket **(4)** and tighten the fastening **(5)** screw to the specified torque.
2. Correctly position the drive belt **(1)** on all the pulleys: crankshaft pulley, water pump, alternator, fan drive pulley.
3. Tension the drive belt **(1)** and tighten the fastening screw **(6)** until the fastening screw **(2)** reaches the end of the duct that houses the bracket **(4)**.




NHIL25ENG0104FA 1

| Tool / Material | |
|---|---|
| Belt tension control device (frequency from **10.0 – 600 Hz**) | 99395849 |

4. Tighten the nut **(7)** and the fastening screw **(1)** to the specified torque.

| Description | Step | Value |
|---|---|---|
| Alternator tensioning bracket | 2 screws M10 x 1.5 x 25 + 2 nuts M10 x 1.5 | **45 +/- 4.5 N·m** |

5. Tighten the fastening screw **(4)** and the nut **(1)** securing the alternator to the support.

| Description | Step | Value |
|---|---|---|
| Alternator | 1 screw M10 x 1.5 x 130 + 1 nut M10 x 1.5 | **45 +/- 4.5 N·m** |

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## Lift pump and lines - 210

**F6AFL413A*U001**

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## Lift pump and lines - 210

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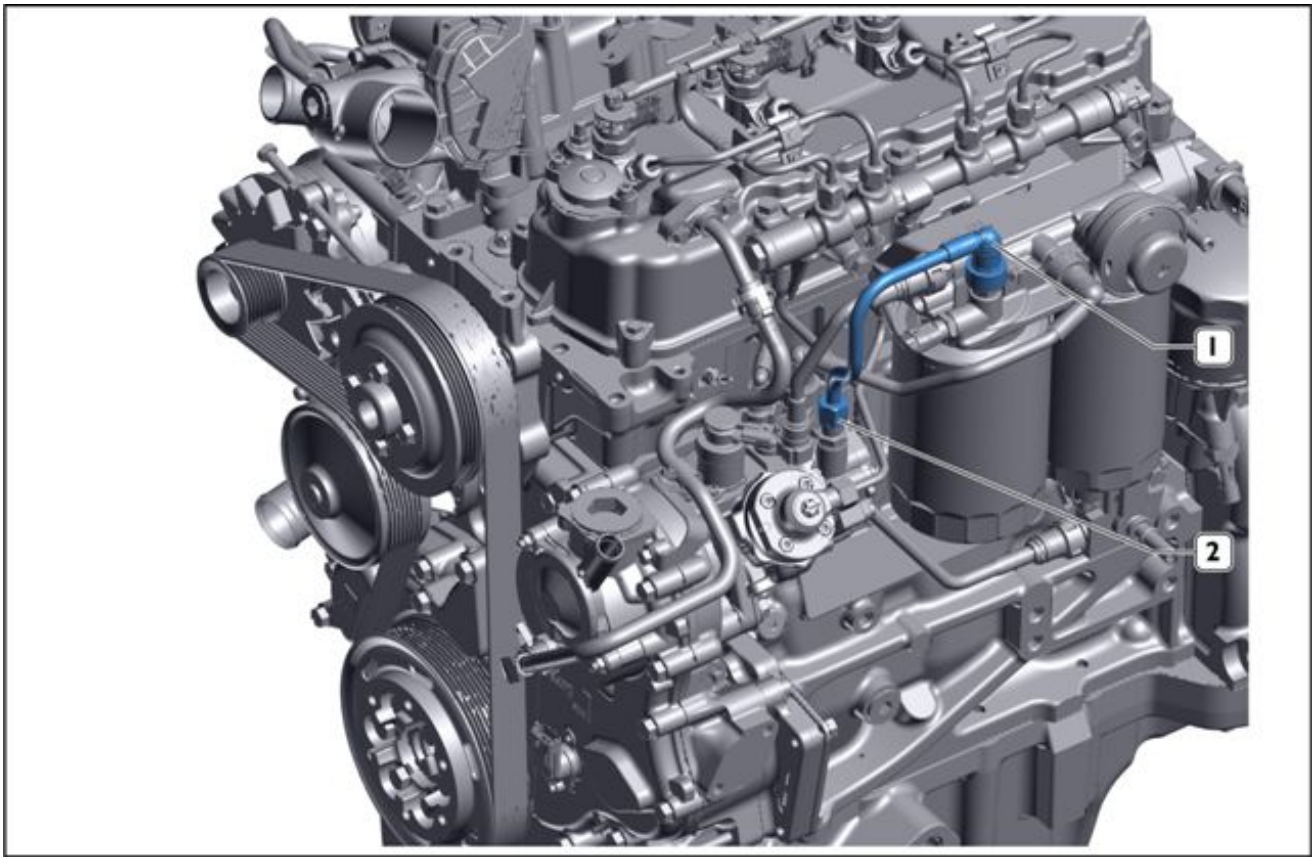
# Fuel lift pump - Prepare - Pressure between gear pump and main filter [113387889 - V1 - 14 February 2025]

## Preparation

- Visually check all related components for any signs of leakage.
- Install the vacuum gauge between the gear pump and main filter.

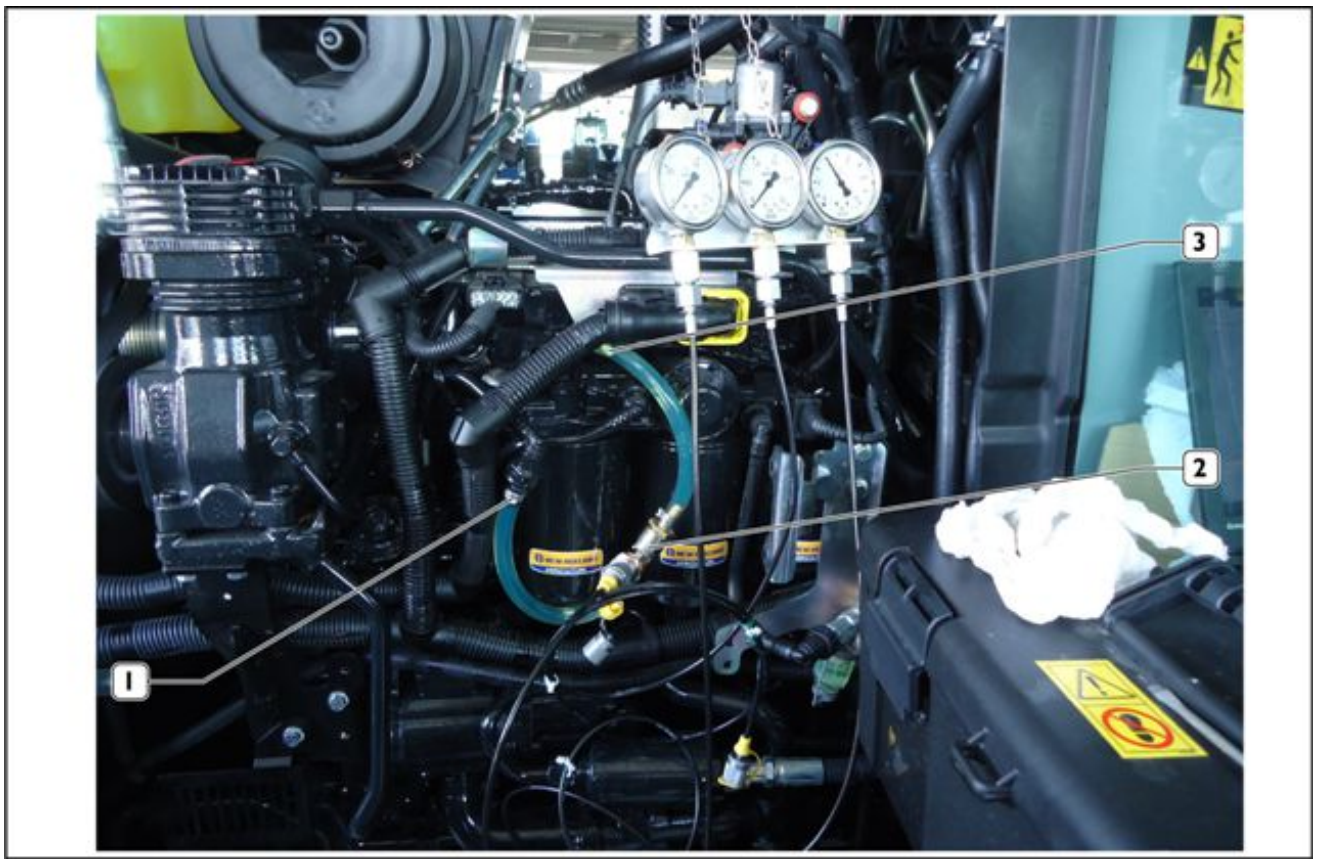



NHIL25ENG0495FA 1

**Location of pipe between gear pump and main filter**

| Item | Description |
|---|---|
| 1 | Main filter inlet |
| 2 | Gear pump outlet |

- Look figure below for preparation:




NHIL25ENG0496TA 2

**Gauge location (gear pump to main filter)**

| Item | Description |
|---|---|
| 1 | Gear pump outlet |
| 2 | T-connector gear pump outlet to main filter |
| 3 | Main filter inlet |

# Fuel lift pump - Check - Pressure between gear pump and main filter [113387890 - V1 - 22 February 2025]

## Check pressure between gear pump and main filter

Offboard tools

- Low pressure vacuum gauge.
- Adaptors.
- Hose.

Check pressure between gear pump and main filter

- Start or crank engine and let run for several minutes (please wait at least **30 s** while engine cranking sessions).
- Observe pressure built up in several engine conditions and note values.
- See table below for a list of expected results and go to step **1**.

***NOTE:*** *For the hydraulic measurement of the FUEL system under cranking condition, crank the engine no longer than* ***10 – 12 s*** *each time is recommended. The starter may be damaged if works continuously for a long time.*

| Engine condition | Pressure value (rel.) bar | | Remark |
|---|---|---|---|
| | Minimum | Maximum | |
| Low idle speed | **3.0 bar** (**43.5 psi**) | **6.5 bar** (**94.2 psi**) | At **850 RPM** |
| High idle | **3.0 bar** (**43.5 psi**) | **6.5 bar** (**94.2 psi**) | At **1500 RPM** |

1. Check if the pressures measured are in the range explained in the table above.
   A. If the expected results are OK, go to step **4**.
   B. If the expected results are NOT OK (Gear pump pressure too low, below minimum values), go to step **2**.
   C. If the expected results are NOT OK (Gear pump pressure too high, above maximum values), go to step **3**.
2. Possible root cause (Gear pump pressure too low, below minimum values).
   - Check tightness of tubes, connectors. Any small defect in tightness will lead to a reduced suction pressure. Air will be sucked into the system and the diesel flow will be reduced. (Check that there are no air bubbles in the backflow from the pump).
   - Tubes/connectors are damaged.
   - Pre-filter blocked or damaged
   - Tank ventilation blocked/dirty (open tank cap, and listen to sucking sound).
   - Overflow-valve in high pressure pump sticking in open position (check the high pressure pump backflow rate).
   - Rare but possible: defective gear pump (exclude the possibility of other fuel delivery components before making this conclusion).

3. Possible root cause (Gear pump pressure too high, above maximum values).
   - Main filter blocked or damaged (check if the main filter blocked or damaged).
   - Tubes damaged/blocked (between gear pump to high pressure pump).
   - Inlet high pressure pump blocked (check the filter in the inlet bolt of the pump).
   - Backflow pipe blocked or damaged (check high pressure pump backflow pressure).
   - Overflow valve in high-pressure-pump blocked, dirty, sticking in closed position (check the high pressure pump backflow rate).

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The system works properly.

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## Fuel filters - 206

**F6AFL413A*U001**

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# Fuel filters - Overview - Filter assembly [113434470 - V1 - 04 March 2025]

## Fuel filter/pre-filter

The function of the fuel filter is to retain the impurities contained in the fuel and protect the components in the fuel circuit.

It is located on the fuel filter/pre-filter bracket and from a functional point of view is included in the circuit upstream of the high pressure pump.

The fuel filter/pre-filter mount is fitted with: the fuel temperature sensor and the fuel heater.

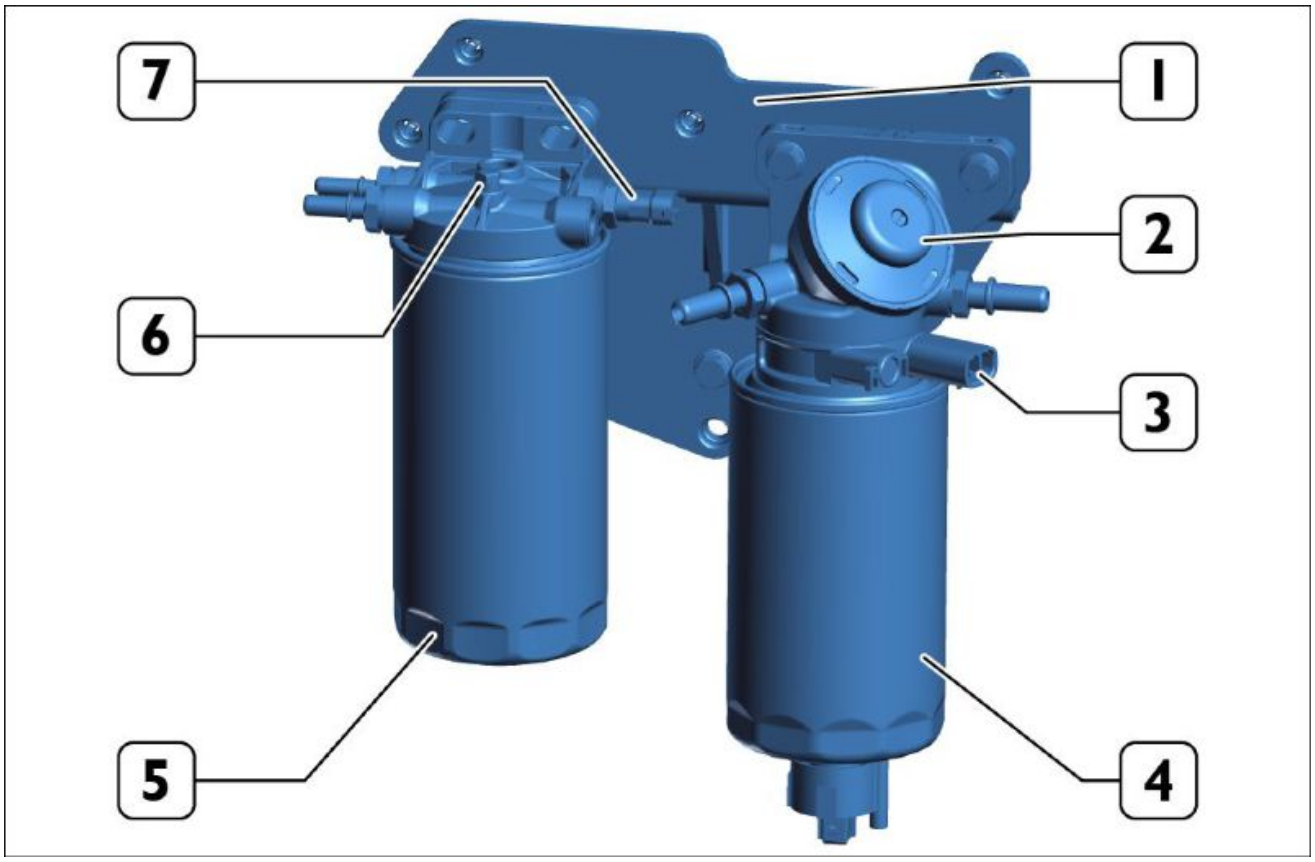
The fuel temperature indicated by the relative sensor at the MD1CS069–7.22 control unit makes it possible to accurately calculate the flow rate of the fuel to be injected in the cylinders.

The electric heater is activated when the fuel temperature is less than **0.0 °C** (**32.0 °F**) and is deactivated when the fuel temperature exceeds **5.0 °C** (**41.0 °F**).

The high water separation type fuel pre-filter is mounted on fuel filter/pre-filter mount and on the cartridge base it has a sensor for detecting water in the fuel circuit.

The presence of condensate in the filter is signalled by sensor when a warning light on the instrument panel comes on.

The fuel filter/pre-filter mount also houses a manual priming pump and a screw for bleeding the air from the system.




NHIL25ENG0341FA 1

| | |
|---|---|
| 1 | Fuel filter/pre-filter mount |
| 2 | Manual fuel pump (on the fuel pre-filter mount) |
| 3 | Electric fuel heater |
| 4 | Fuel pre-filter |
| 5 | Fuel filter |

| | |
|---|---|
| 6 | System air bleed screw |
| 7 | Fuel temperature sensor |

# Fuel filters - Prepare - External fuel leakage engine area [113387708 - V1 - 21 February 2025]

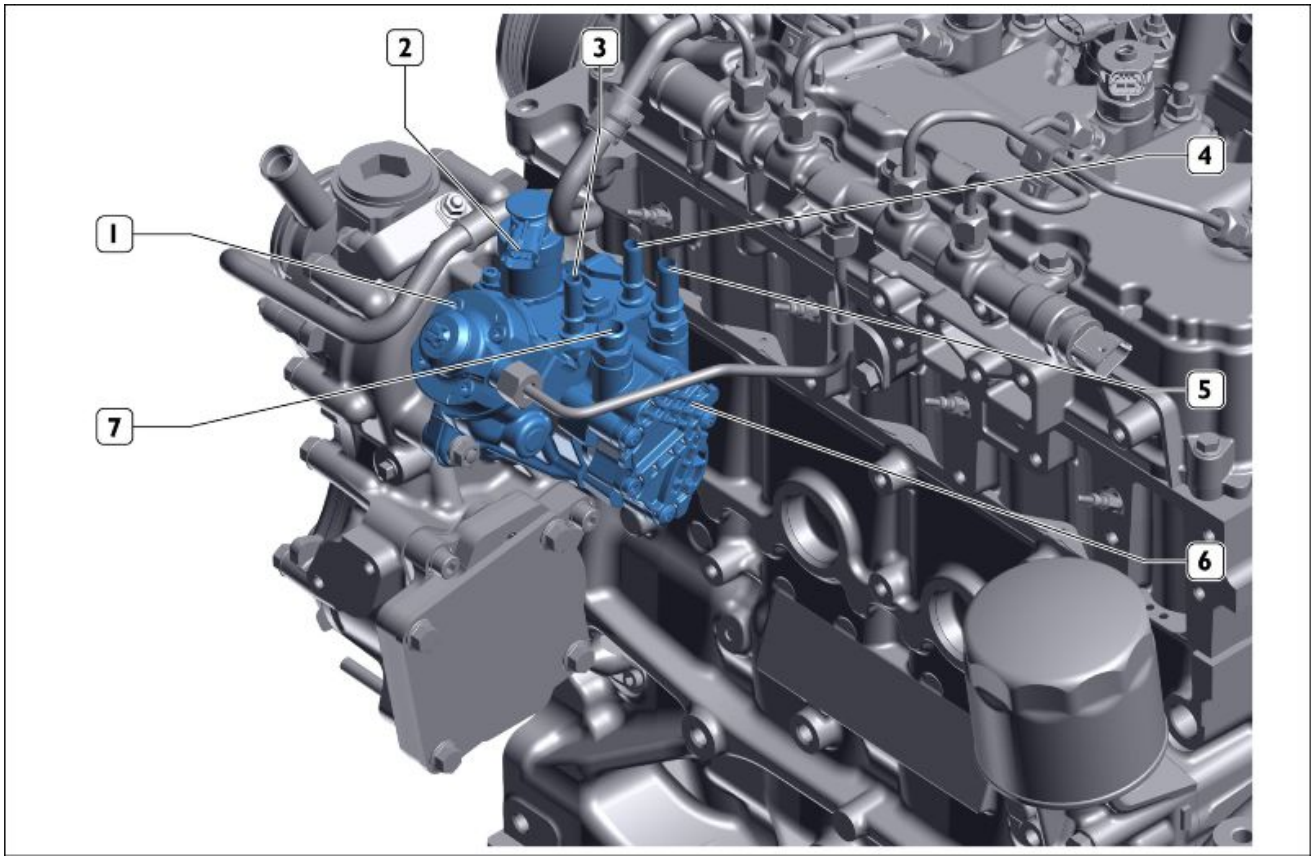
## Preparation

- Run the engine till it reaches normal operating temperature.

# Fuel filters - Check - External fuel leakage engine area [113387709 - V1 - 21 February 2025]

Check external fuel leakage engine area.

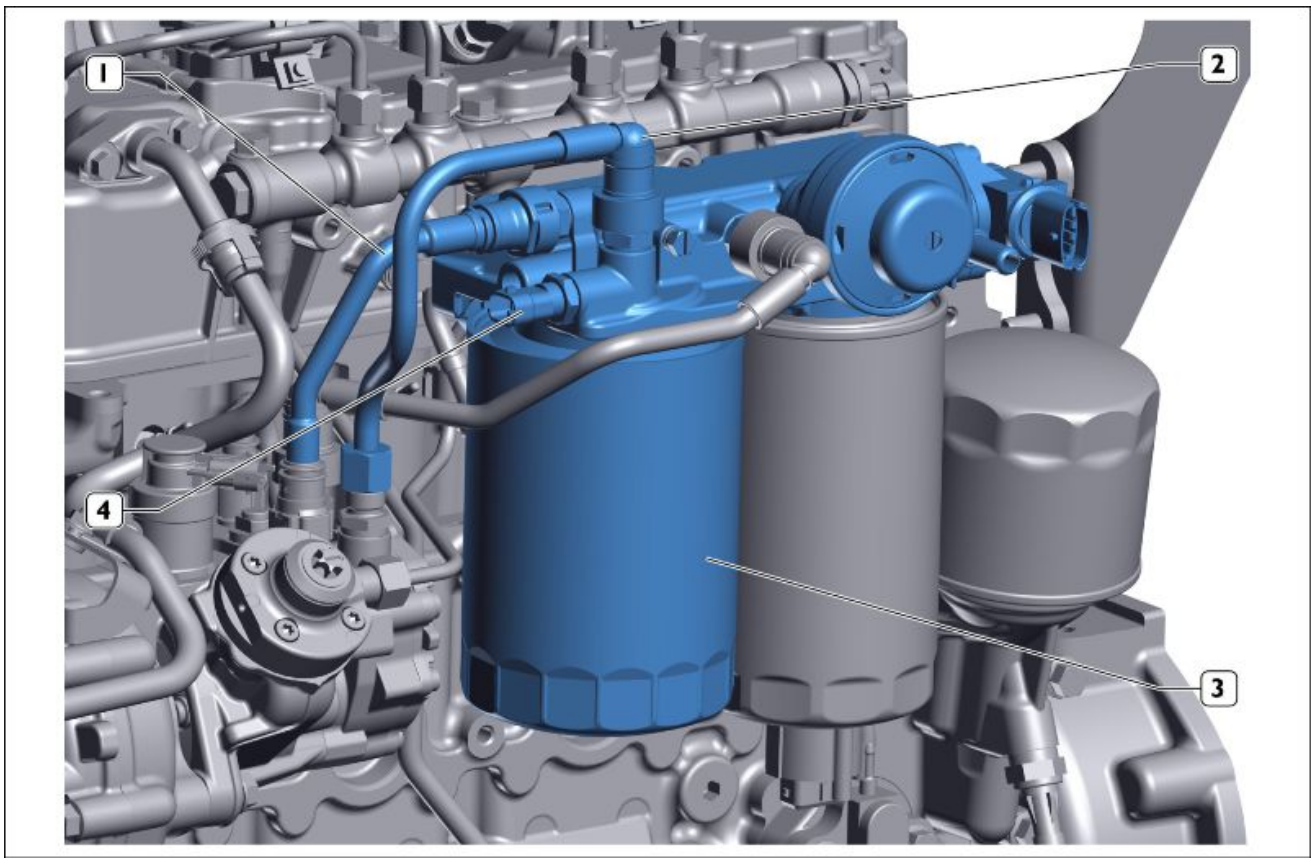
- Check for fuel leakage at low pressure hose connectors.
- Check connectors of the fuel filter.
- Check connectors of the high pressure pump.
- Check connectors of the metering unit.
- Check for kinked fuel hoses.
- Refer to Figure **1** for explanation and go to step **1**.




NHIL25ENG0464TA 1

**Location of the main components of the fuel pump**

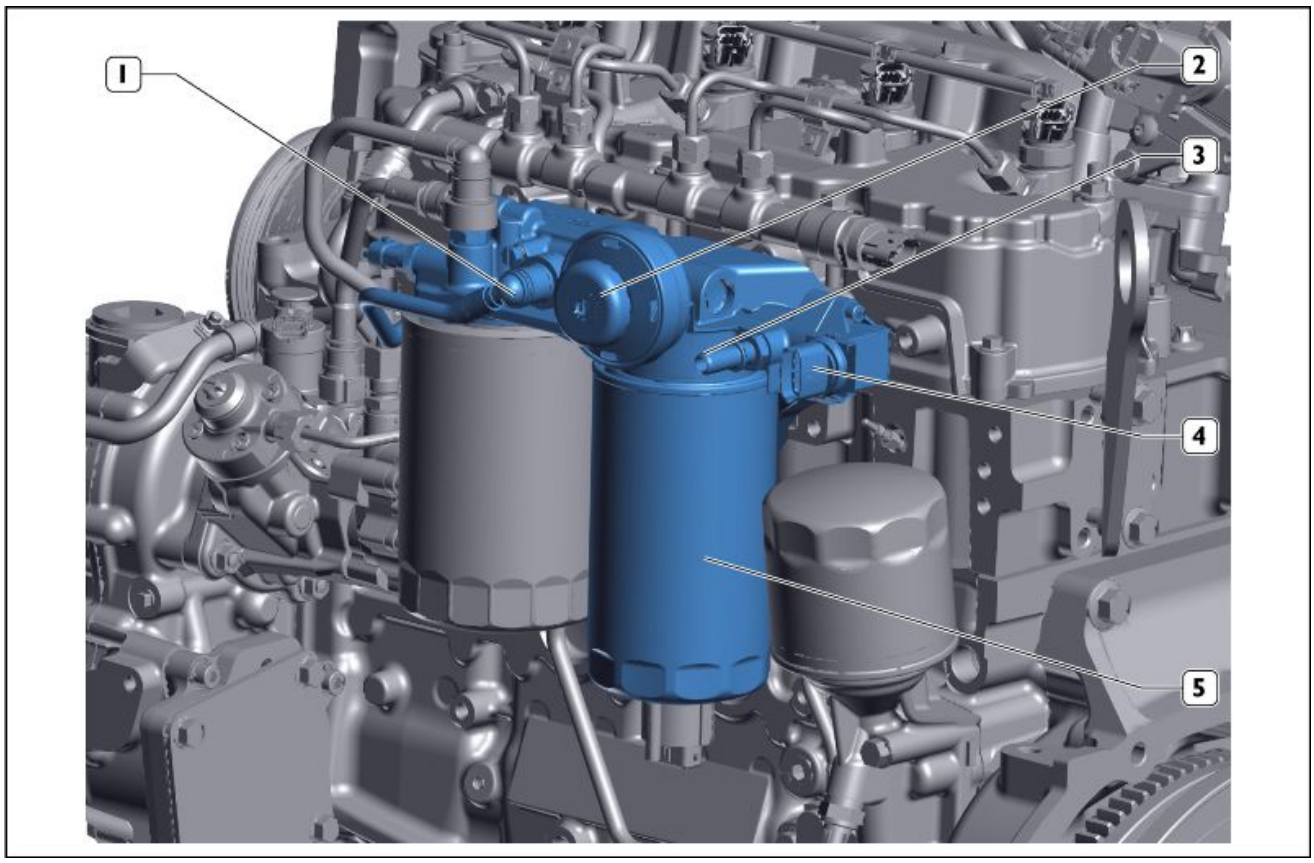
| Item | Description |
|---|---|
| 1 | High-pressure pump |
| 2 | Pressure regulator valve (fuel metering unit) |
| 3 | High pressure pump from main filter |
| 4 | Return to reservoir |
| 5 | Low pressure pump intake from pre-filter |
| 6 | Gear low pressure pump |
| 7 | Delivery from low pressure pump to main filter |




NHIL25ENG0465TA 2

**Location of the main filter components**

| Item | Description |
|---|---|
| 1 | Outlet from main filter outlet to high pressure pump |
| 2 | Main filter inlet from low pressure pump |
| 3 | Main fuel filter |
| 4 | Fuel temperature sensor |




NHIL25ENG0466TA 3

**Location of pre-filter components**

| Item | Description |
|---|---|
| 1 | Outlet from pre-filter to low pressure pump |
| 2 | Manual priming pump |
| 3 | Pre-filter inlet |
| 4 | Fuel heater |
| 5 | Pre-filter |

1. Check for visible external fuel leakage in the engine area
   A. If no external fuel leakage in the engine area is visible, go to step **3**.
   B. If external fuel leakage in the engine area is visible, go to step **2**.
2. Possible root cause
   - Connectors loose or worn.
   - Hoses are damaged.

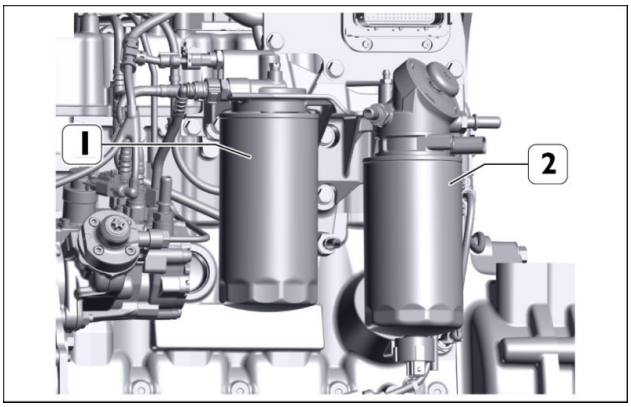
***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

3. The fuel system works properly.

# Fuel filters - Replace - Filter assembly [113434472 - V1 - 19 February 2025]

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

1. Position a container to collect the diesel oil under the fuel filter **(1)**.
2. Use the special tool to unscrew and remove the fuel filter **(1)** from the relevant filter bracket and recover the gasket.




NHIL25ENG0342FA 1

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

***NOTE:*** *Pay attention to the fuel temperature sensor and to the electric connections of the engine cable.*

3. Replace the fuel filter.
4. Moisten the fuel filter gasket **(1)** with a film of engine oil.
5. Manually screw the fuel filter **(1)** onto the support until it adheres to the gasket.

***NOTE:*** *Pay attention to the fuel temperature sensor and to the electric connections of the engine cable.*

6. Using the specific tool , further tighten the fuel filter **(1)** to the torque of:

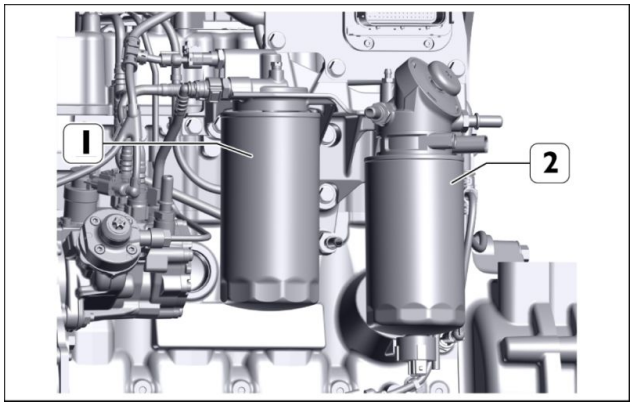
| Description | Quantity | Value |
|---|---|---|
| Fuel filter | 1 cartridge M20 x 1.5 | **22 +/- 3 N·m** |

7. After the fuel filter (1) has been replaced it is possible that air bubbles get trapped inside the fuel supply circuit.
8. Bleed any residual air from the fuel filter (1) by loosing the vent plug connecting it to a suitable container by a transparent flexible hose.
9. Operate the fuel pre-filter hand pump until the fuel coming out through the breather plug is completely free of air bubbles.
10. Tighten the bleeder plug to the specified torque.
11. Start the engine and let it run at idle for a few minutes to expel any remaining air.

# Fuel filters - Remove - Filter assembly [113434473 - V1 - 19 February 2025]

| Description | |
|---|---|
| Remover,cartridge filter | 99360076 |

1. Position a container to collect the diesel oil under the fuel filter **(1)**.
2. Use the specific tool to unscrew and remove the fuel filter **(1)** from the relative filter bracket and recover the gasket.




NHIL25ENG0343FA 1

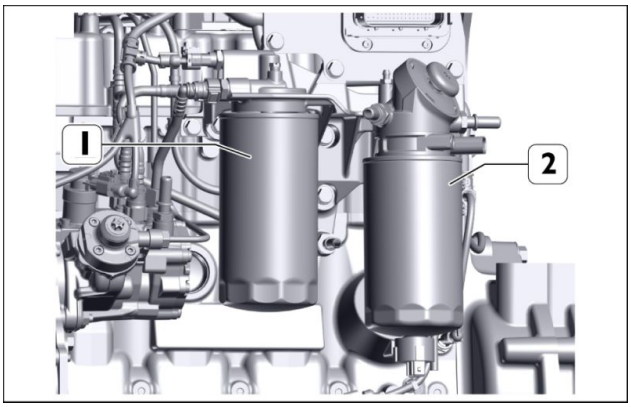
| Description | |
|---|---|
| Remover,cartridge filter | 99360076 |

***NOTE:*** *Pay attention to the fuel temperature sensor and to the electric connections of the engine cable.*

# Fuel filters - Install - Filter assembly [113434474 - V1 - 19 February 2025]

| Description | Quantity | Value |
|---|---|---|
| Air bleeding on the fuel filter bracket | 1 screw M10 | **4 +/- 0.5 N·m** |
| Fuel filter | 1 cartridge M20 x 1.5 | **22 +/- 3 N·m** |

1. Moisten the fuel filter gasket **(1)** with a film of engine oil.
2. Manually screw the fuel filter **(1)** onto the support until it adheres to the gasket.




NHIL25ENG0343FA 1

***NOTE:*** *Pay attention to the fuel temperature sensor and to the electric connections of the engine cable.*

3. Using the specific tool , further tighten the fuel filter **(1)** to the torque of:

| Description | Quantity | Value |
|---|---|---|
| Fuel filter | 1 cartridge M20 x 1.5 | **22 +/- 3 N·m** |

4. After the fuel filter **(1)** has been replaced it is possible that air bubbles get trapped inside the fuel supply circuit.
5. Bleed any residual air from the fuel filter **(1)** by loosing the vent plug connecting it to a suitable container by a transparent flexible hose.
6. Operate the fuel pre-filter hand pump until the fuel coming out through the breather plug is completely free of air bubbles.
7. Tighten the bleeder plug to the specified torque.

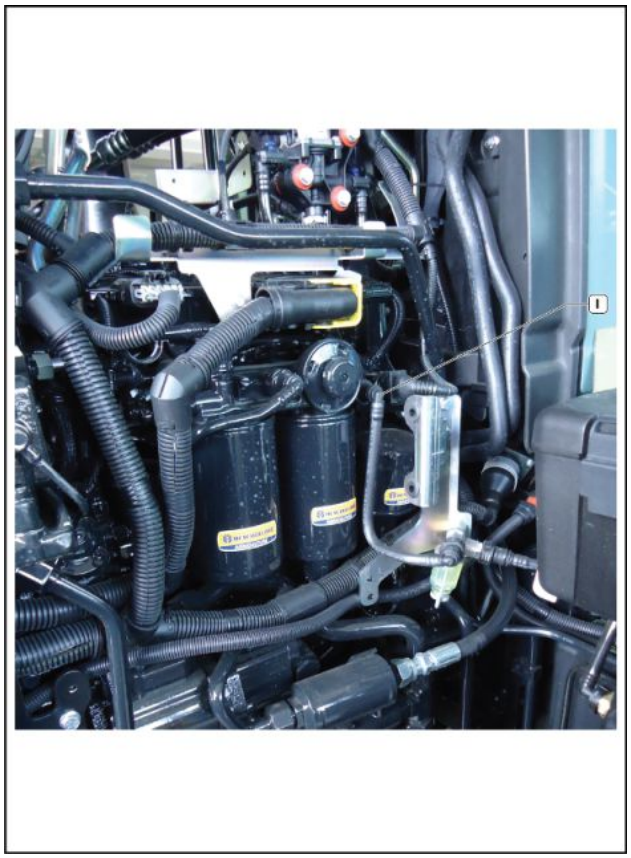
| Description | Quantity | Value |
|---|---|---|
| Air bleeding on the fuel filter bracket | 1 screw M10 | **4 +/- 0.5 N·m** |

8. Start the engine and let it run at idle for a few minutes to expel any remaining air.

# Pre-filter - Prepare - Suction pressure between tank and pre-filter [113387974 - V1 - 22 February 2025]

## Preparation

- Visually check all related components for any signs of leakage.
- Disconnect the pre-filter supply.
- Install the low pressure gauge between the fuel tank and pre-filter.
- Tighten all connections to make sure that there is no possibility of leakage.
- Look figure below for preparation:



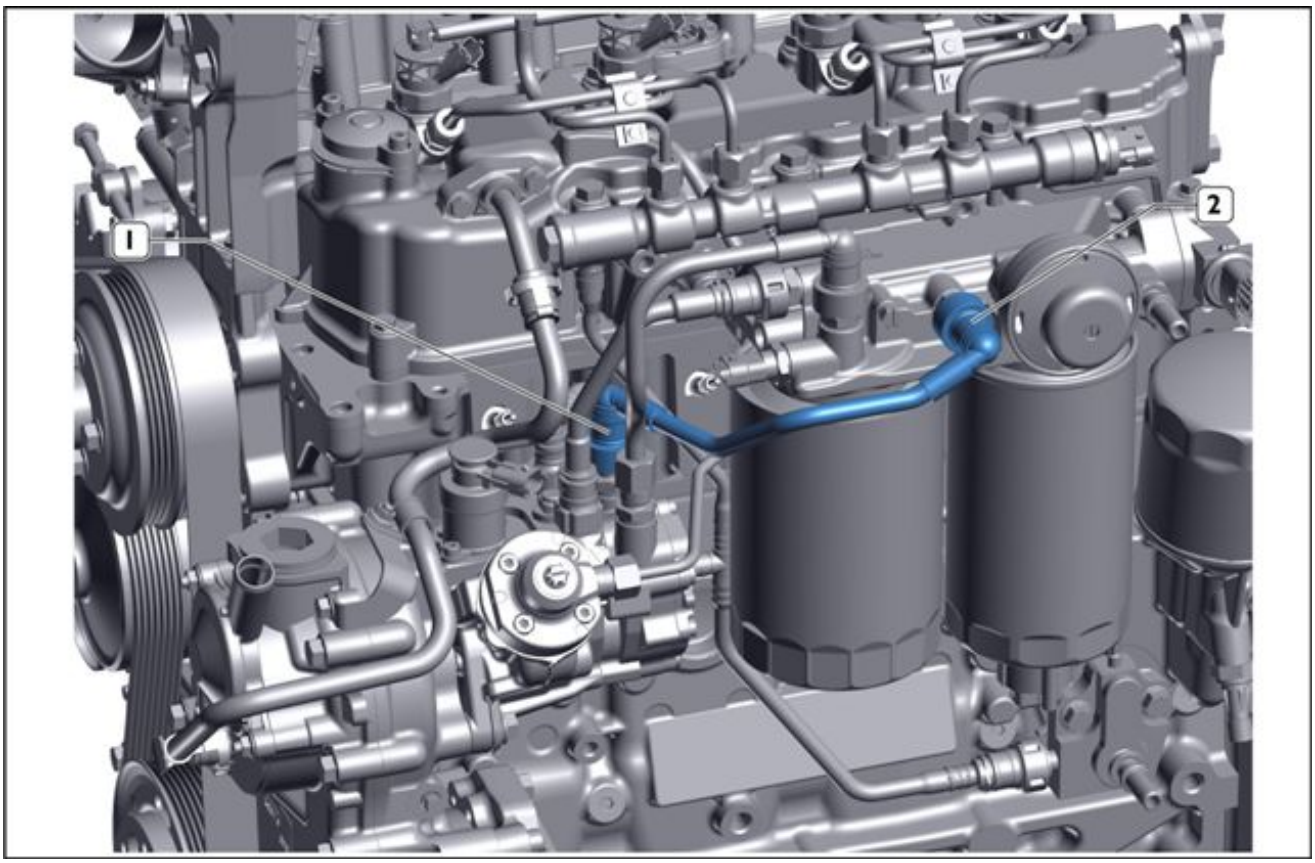

NHIL25ENG0498TA 1

| Item | Description |
|---|---|
| 1 | Pre-filter inlet |

# Pre-filter - Prepare - Suction pressure after pre-filter [113387975 - V1 - 13 February 2025]

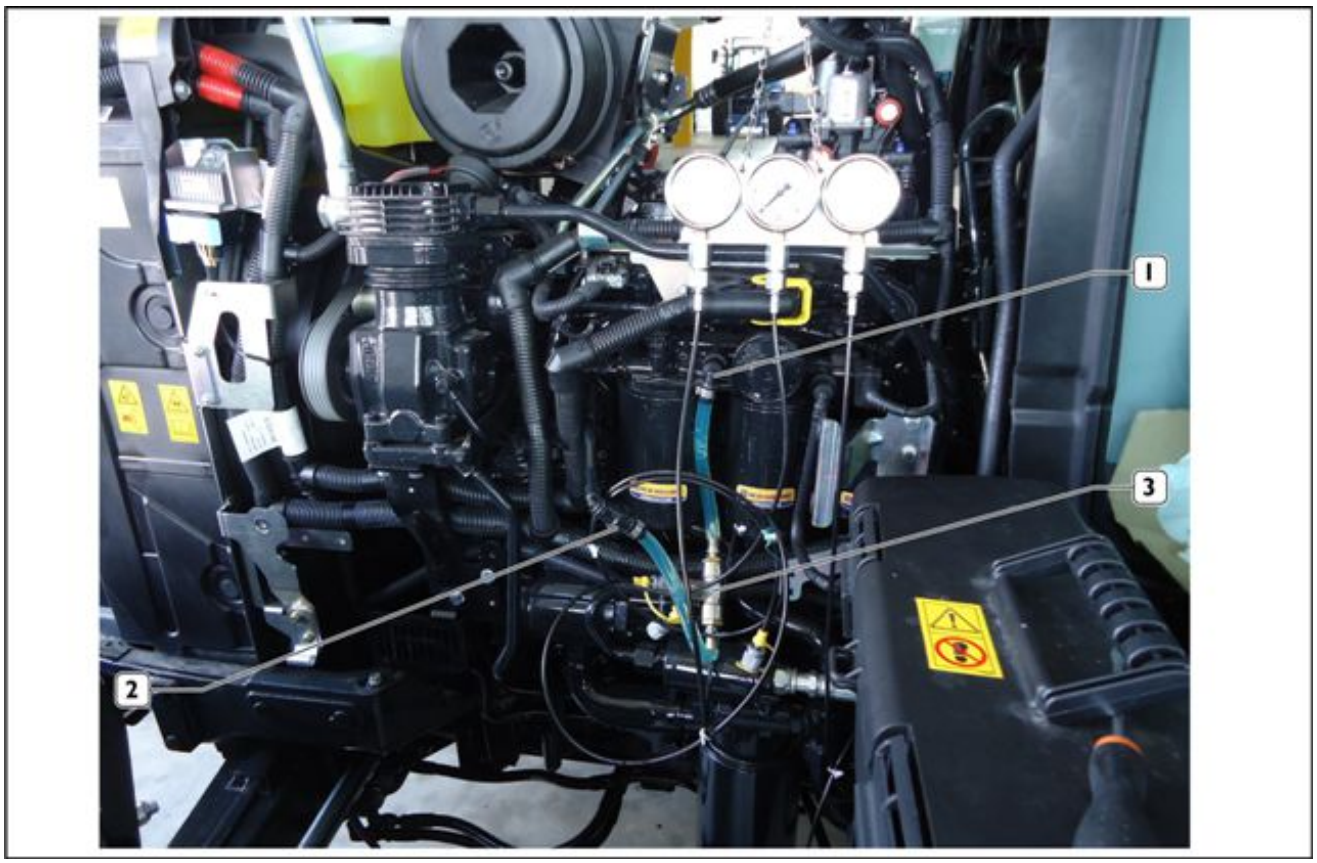
## Preparation

- Visually check all related components for any signs of leakage.
- Install the low pressure gauge at the pre-filter outlet.
- Look figure below for preparation:




NHIL25ENG0499FA 1

| Item | Description |
|---|---|
| 1 | Inlet fitting (low pressure pump) |
| 2 | Pre-filter outlet fitting |




NHIL25ENG0500TA 2

| Item | Description |
|---|---|
| 1 | Pre-filter outlet |
| 2 | Connecting hose to low pressure pump inlet |
| 3 | T-connector to manometer |

# Pre-filter - Check - Suction pressure between tank and pre-filter [113387976 - V1 - 22 February 2025]

Offboard tools

1. Low pressure vacuum gauge
2. Adaptors
3. Hose

Check suction pressure between tank to pre-filter

- Start the engine (can be delayed) and let run for several minutes.
- Observe suction pressure in several engine conditions. Check for leaks.
- Refer to table for a list of expected results and go to step **1**.

***NOTE:*** *For the hydraulic measurement of the FUEL system under cranking condition, crank the engine no longer than* ***10 – 12 s*** *each time is recommended. The starter may be damaged if works continuously for a long time.*

| Engine condition | Pressure value (rel.) bar | Remark |
|---|---|---|
| Low idle speed | **0.5 – 0.0 bar** (**7.2 – 0.0 psi**) | At **900 RPM** |
| High idle | **0.5 – 0.0 bar** (**7.2 – 0.0 psi**) | At **1500 RPM** |

1. Check if the pressures measured are in the range explained in the table above
   A. If the expected results are OK, go to step **4**.
   B. If the expected results are NOT OK (Suction pressure too low, above maximum values), go to step **2**.
   C. If the expected results are NOT OK (Suction pressure too high, below minimum values), go to step **3**.
2. Possible root cause (Suction pressure too low, above maximum values):
   - Insufficient fuel.
   - Check tightness of tubes, connectors. Any small defect in tightness will lead to a reduced suction pressure. Air will be sucked into the system and the diesel flow will be reduced (check that there are no air bubbles in the backflow from the pump).
   - Blocked or contaminated filters can reduce the suction pressure, check the pre-filter for blockage or damage and the main-filter blockage or damage.
   - Rare but possible: defective gear pump (exclude the possibility of other fuel delivery component problems before making this conclusion).
3. Possible root cause (Suction pressure too high, below minimum values):
   - Blocked or damaged tube, dirt in tank/tube.
   - Wrong diameter of the inlet pipe from tank to pre-filter.
   - Tank ventilation blocked/dirty (open tank cap, and listen to sucking sound).

***NOTE:*** *After having eliminated the cause of the error, delete the fault memory and repeat the reading.*

4. The system works properly.

# Pre-filter - Check - Suction pressure after pre-filter [113387977 - V1 - 22 February 2025]

Offboard tools

- Low pressure vacuum gauge
- Adaptors
- Hose

Check suction pressure at pre-filter outlet

- Start the engine (can be delayed) and let run for several minutes.
- Observe suction pressure in several engine conditions. Check for leaks.
- Refer to table for a list of expected results and go to step **1**.

***NOTE:*** *For the hydraulic measurement of the FUEL system under cranking condition, crank the engine no longer than* ***10 – 12 s*** *each time is recommended. The starter may be damaged if works continuously for a long time.*

| Engine condition | Pressure value (rel.) bar | Remark |
|---|---|---|
| Low idle speed | < **0.0 bar** | At **900 RPM** |
| High idle | < **0.0 bar** | At **1500 RPM** |

1. Check if the pressures measured are in the range explained in the table above.
   - If the expected results are OK, go to step **4**.
   - If the expected results are NOT OK (Suction pressure too low, above maximum values), go to step **2**.
   - If the expected results are NOT OK (Suction pressure too high, below minimum values), go to step **3**.
2. Possible root cause (Suction pressure too low, above maximum values):
   - Check tightness of tubes, connectors. Any small defect in tightness will lead to a reduced suction pressure. Air will be sucked into the system and the diesel flow will be reduced. (Check that there are no air bubbles in the backflow from the pump).
   - Less diesel in tank.
   - Pre-filter blocked or damaged.
   - Rare but possible: defective gear pump (exclude the possibility of other hydraulic component before making this conclusion).
   - If present: electrical lift pump defect.
3. Possible root cause (Suction pressure too high, below minimum values):
   - Pre-filter blocked or damaged
   - Tubes, connectors squeezed/damaged/wrong diameter.
   - Tank system dirty.
   - Tank ventilation blocked/dirty (open tank cap, and listen to sucking sound).

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The system works properly.

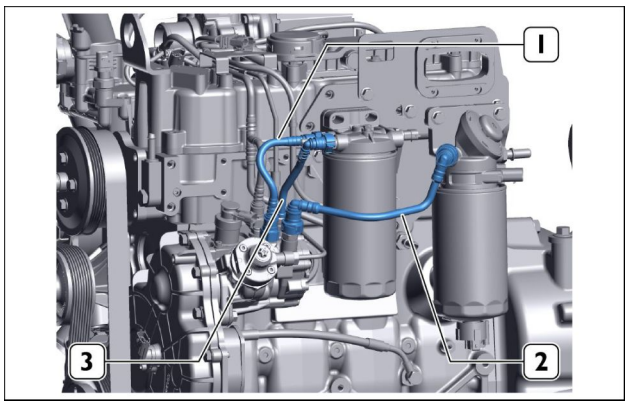
# Pre-filter - Remove - Filter support [113434476 - V1 - 19 February 2025]

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

## Removal of fuel filter bracket

### Versions with and without the fuel pre-filter

1. Disconnect the low-pressure fittings and remove the fuel pipes **(1)** and **(3)** from the fuel filter bracket.
2. Disconnect the low pressure unions and remove the fuel pipe **(2)** on the fuel filter/pre-filter mount.

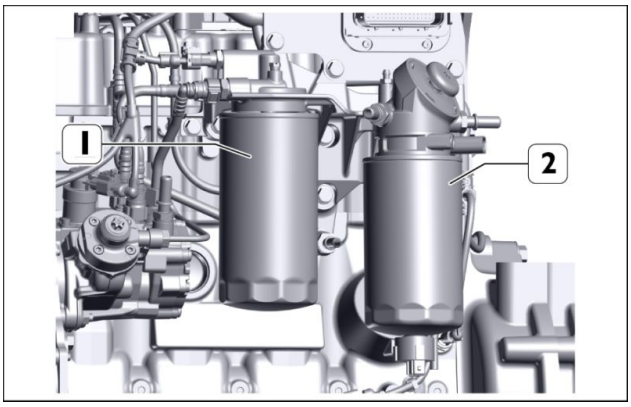



NHIL25ENG0344TA 1

3. Disconnect the electrical connections and partially remove the engine cable below the pre-fuel filter.

***NOTE:*** *Pay attention to the fuel pre-filter water presence sensor and to the electric connections of the engine cable.*

4. Use the specific tool to unscrew and remove the fuel pre-filter **(2)** from the relative filter mount and recover the gasket.




NHIL25ENG0342FA 2

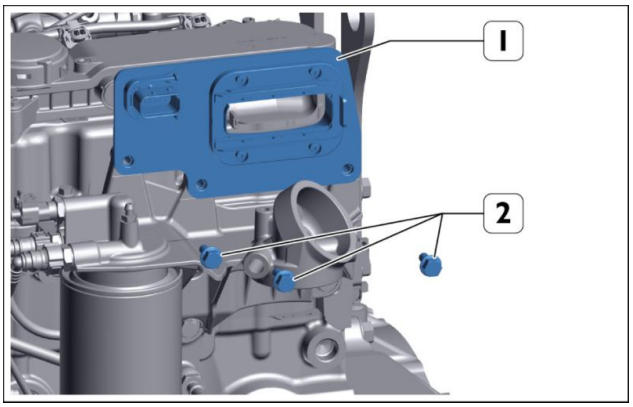
| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

5. Use the special tool to unscrew and remove the fuel filter **(1)** from the relevant filter bracket **(5)** and recover the gasket.

***NOTE:*** *Pay attention to the fuel temperature sensor and to the electric connections of the engine cable.*

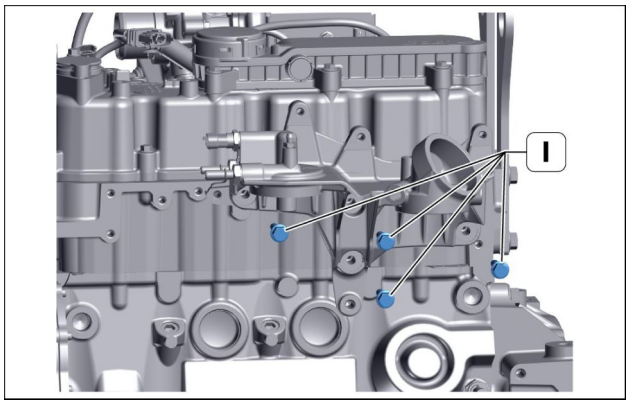
| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

6. Unscrew the screws **(2)** and remove the engine wiring connectors support yoke **(1)**.




NHIL25ENG0345FA 3

7. Unscrew the screws **(1)** and remove the fuel filter and pre-filter support yoke.




NHIL25ENG0346FA 4

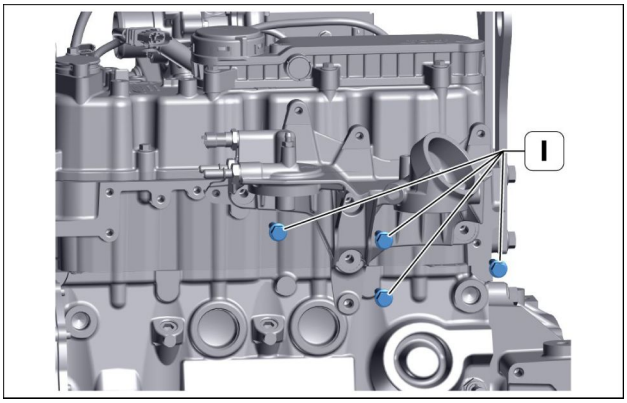
# Pre-filter - Install - Filter support [113434477 - V1 - 05 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Air bleeding on the fuel filter bracket | 1 screw M10 | **4 +/- 0.5 N·m** |
| Engine cable fixing bracket | 3 screws M8 x 1.25 x 20 | **23 +/- 2.3 N·m** |
| Fuel Pre-filter | 1 cartridge — | **20 +/- 3 N·m** |
| Fuel filter | 1 cartridge M20 x 1.5 | **22 +/- 3 N·m** |
| Fuel filter mount - version with pre-filter | 4 screws M8 x 1.25 x 20 | **23 +/- 2.3 N·m** |
| Fuel filter mount - version without pre-filter | 4 screws M8 x 1.25 x 40 | **23 +/- 2.3 N·m** |

## Fuel filter bracket refitting

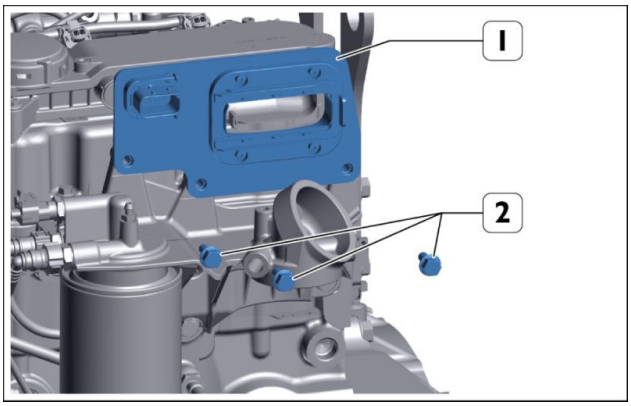
### Versions with and without the fuel pre-filter

1. Attach the filter and fuel pre-filter support bracket by tightening the screws **(1)** to the specified torque.




NHIL25ENG0346FA 1

2. Tighten the screws **(2)** and secure the support bracket **(1)** of the engine wiring connectors.

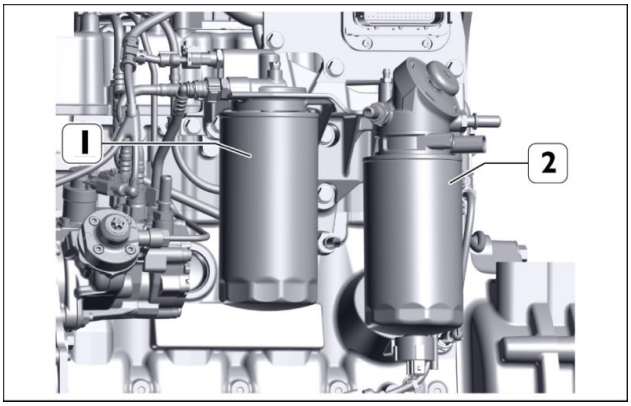



NHIL25ENG0345FA 2

3. Moisten the fuel filter gasket with a film of engine oil.
4. Manually screw the fuel filter **(1)** onto the support until it comes into contact with the gasket.

***NOTE:*** *Pay attention to the fuel temperature sensor and to the electric connections of the engine cable.*

5. Using the specific tool , further tighten the fuel filter **(1)** to the torque of:

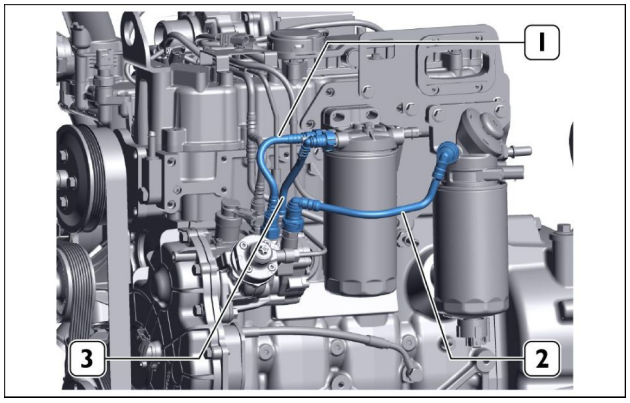



NHIL25ENG0342FA 3

6. Moisten the fuel pre-filter sealing gasket **(2)** with a film of engine oil.
7. Manually screw the fuel pre-filter **(2)** onto the support until it adheres to the gasket.

***NOTE:*** *Pay attention to the fuel pre-filter water presence sensor and to the electric connections of the engine cable.*

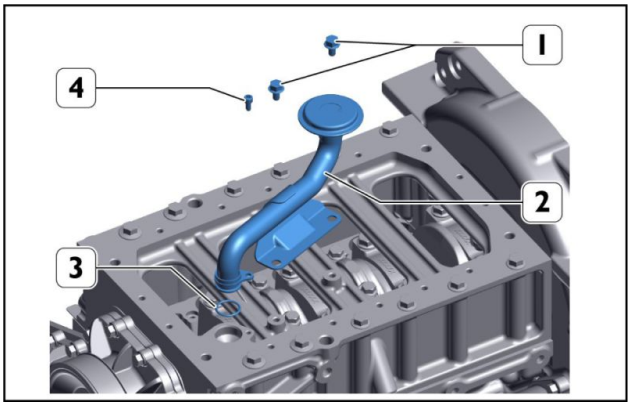
8. Using the specific tool , further tighten the fuel pre-filter **(2)** to the torque of:
9. Install the fuel pipe **(2)** onto the fuel filter / pre-filter bracket and connect the low pressure fittings.
10. Install the fuel pipes **(1)** and **(3)** from the fuel filter bracket and connect the low pressure fittings.
11. After the fuel filter has been replaced it is possible that air bubbles get trapped inside the fuel supply circuit.
12. Bleed any residual air from the fuel filter by loosing the vent plug connecting it to a suitable container by a transparent flexible hose.
13. Operate the fuel pre-filter hand pump until the fuel coming out through the breather plug is completely free of air bubbles.
14. Tighten the bleeder plug to the specified torque.
15. Start the engine and let it run at idle for a few minutes to expel any remaining air.




NHIL25ENG0344TA 4

# Fuel-water separator filter - Remove - Suction strainer [113469830 - V1 - 06 March 2025]

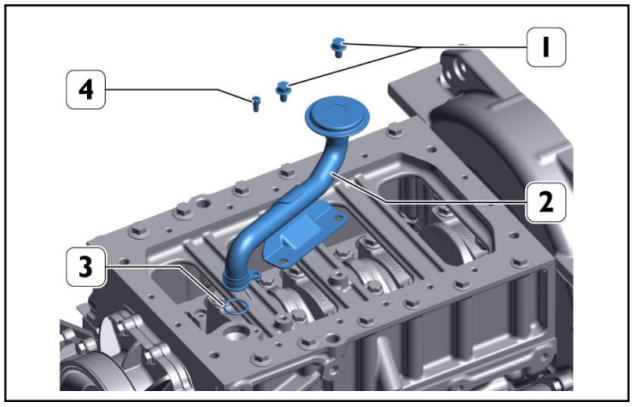
1. Unscrew the screws **(1)** and **(4)**. Remove the suction strainer **(2)** paying careful attention to the O-ring **(3)**.




NHIL25ENG0144FA 1

# Fuel-water separator filter - Install - Suction rose [113469831 - V1 - 06 March 2025]

1. Correctly position the suction strainer **(2)** paying careful attention to not damage the O-ring **(3)**.
2. Tighten the screws **(4)** and **(1)** to the prescribed torque.




NHIL25ENG0155FA 1

| Description | Quantity | Value |
|---|---|---|
| Suction strainer | 2 screws M8 x 1.25 x 14 | **23 +/- 2.3 N·m** |
| Suction strainer | 1 screw M6 x 1 x 12 | **10 +/- 1 N·m** |

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# Engine - 10

## Fuel injection system - 218

**F6AFL413A*U001**

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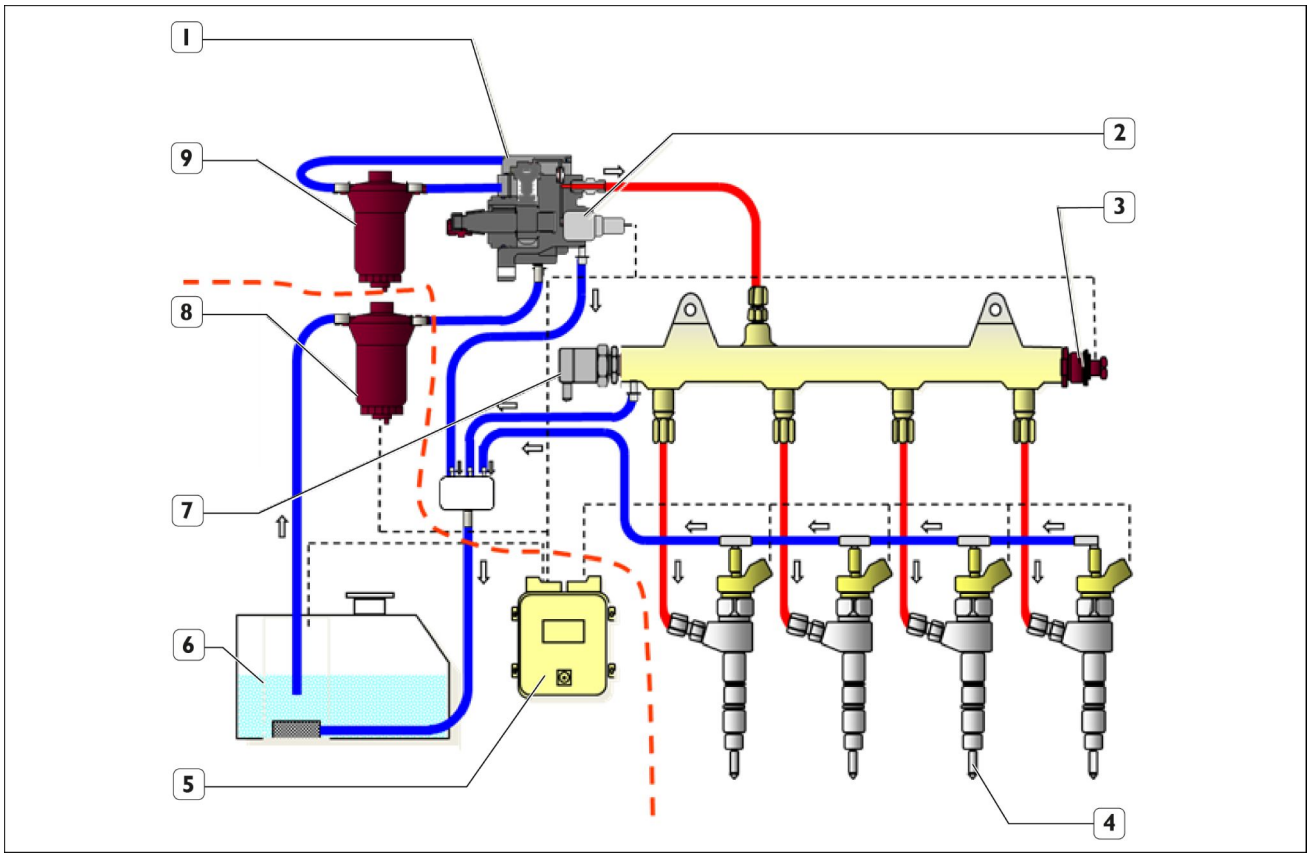
# Fuel injection system - Overview - Fuel feed [113430647 - V1 - 19 February 2025]

## Supply system

In order to reduce PARTICULATES emissions, very high injection pressures are required.

The Common Rail system allows injection of fuel at pressures reaching **1600 bar**, while the precision of the injection, obtained by means of the system's electronic management, optimises engine operation by limiting emissions and consumption.

## Fuel system diagram




NHIL25ENG0338FA 1

1. High-pressure fuel pump.
2. Fuel dosing unit.
3. Fuel pressure sensor on rail.
4. Injector.
5. Engine control unit MD1CS069–7.22.
6. Fuel tank.
7. Common rail pressure relief valve.
8. Fuel pre-filter with manual pump (part not supplied by FPT).
9. Fuel filter

The fuel is drawn in by the fuel tank and passes in the fuel pre-filter, which is equipped with a water detection sensor.

The mechanical fuel pump is of the gear type and is located inside the high-pressure pump.

Two by-pass valves are placed in parallel to the mechanical fuel pump. The first by-pass valve permits the fuel to flow from the exit of the mechanical pump to its inlet when the inlet pressure of the fuel filter exceeds the permitted limit.

The second by-pass valve makes it possible to fill the fuel system via the manual pump fit on the fuel filter/pre-filter mount.

The fuel dosing unit, fit on the high pressure pump, regulates the flow of the fuel necessary in the low pressure system.

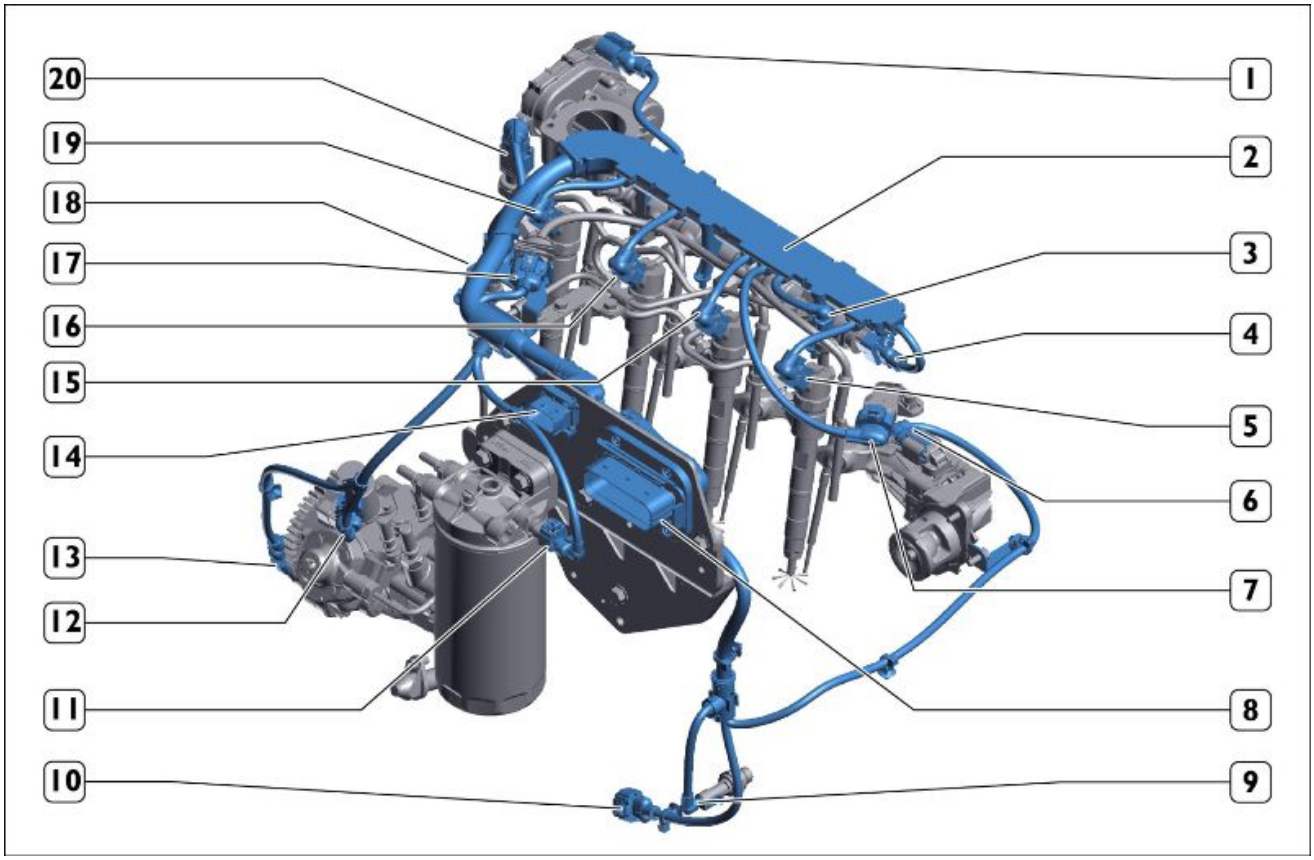
The distributor piston additionally increases the fuel pressure and sends the fuel through the delivery pipe to the Common rail and then to the electro-injectors.

The high pressure pump correctly supplies the Common rail. This solution, only pressurising the necessary fuel, improves energy efficiency and limits heating the fuel in the system

The function of the relief valve, mounted on the high-pressure pump, is to maintain the flow rate, at the flow regulator inlet, constant, regardless of the efficiency of the fuel filter and of the system situated upstream.

The fuel which leaks from the electro-injectors is recovered and sent to the tank again.

# Fuel injection system - Overview - Electric system [113430649 - V1 - 04 March 2025]




NHIL25ENG0339FA 1

| Item | Description |
|---|---|
| 1 | Throttle body connector |
| 2 | Engine cable |
| 3 | Air temperature sensor connector |
| 4 | Common Rail pressure sensor connector |
| 5 | Cylinder 4 injector solenoid valve connector |
| 6 | Pierburg EGR valve connector |
| 7 | Supercharging pressure and air temperature sensor connector |
| 8 | Vehicle connector |
| 9 | Low oil pressure valve connector |
| 10 | Crankshaft speed sensor (incremental speed) connector |
| 11 | Fuel temperature sensor connector |
| 12 | High pressure fuel pump dosing unit connector |
| 13 | Camshaft timing sensor (segmental speed) connector |
| 14 | Cylinder connector |
| 15 | Cylinder 3 injector solenoid valve connector |
| 16 | Cylinder 2 injector solenoid valve connector |
| 17 | Glow plugs connector |
| 18 | Coolant temperature sensor connector |
| 19 | Cylinder 1 injector solenoid valve connector |
| 20 | Exhaust gas absolute pressure sensor connector |

Through the sensors, present on the engine, the control unit controls the engine operation.

## Air pressure/temperature sensor

This is a component that integrates a temperature sensor and a pressure sensor. Mounted on the intake manifold, it measures the maximum air flow aspirated that serves to provide accurate calculation of the amount of fuel to inject at each cycle. The voltage at the outlet is proportional to the pressure and temperature detected by the sensor.

## Engine oil temperature - pressure sensor

Installed on the crankcase, it measures the engine oil 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 value of injection pressure is used to keep the pressure level under control and to determine the time duration of the injection electronic command.

## Fuel Temperature Sensor

This sensor is identical to the previous one. It detects the temperature of the fuel to give the control unit information about the fuel oil temperature conditions.

## Coolant temperature sensor

This is a variable resistance sensor that is able to measure coolant temperature and transmit a signal to the control unit reflecting the thermal conditions of the engine.

## Crankshaft sensor

It is an inductive sensor placed on the engine front side. Signals generated through the magnetic flow that closes on the phonic wheel, change their frequencies depending on crankshaft rotation speed.

## Timing sensor

It is an inductive sensor located in the rear left area of the engine. It generates signals obtained from magnetic flux lines which close through the holes situated in gears force fitted to the camshaft.

The signal generated by this sensor is used by the control unit as the injection timing signal. Though being equal to the crankshaft sensor, it is NOT interchangeable since it has a different outside shape.

## Self-diagnostics

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

## Synchronization search

By means of signals coming from camshaft sensor and crankshaft sensor, the cylinder on which fuel must be injected is recognised upon start-up.

## Injection control

The control unit, depending on information coming from sensors, controls the flow regulator, and changes pre-injection and main injection modes.

## Closed loop injection pressure check

Depending on the engine load measured by processing signals coming from various sensors, the control unit controls the regulator in order to always have an optimum pressure.

## Pilot and main injection advance control

The control unit, depending on signals coming from various sensors, computes the optimum injection point according to an internal mapping.

## Idle speed control

The control unit processes signals coming from various sensors and adjusts the amount of injected fuel. It controls the pressure regulator and changes the injection time of electro-injectors. Within certain thresholds, it also takes into account the battery voltage.

## Maximum speed limiting

By approximating to the maximum speed, the control unit limits the fuel flow rate by reducing the opening time of the injectors.

The engine maximum speed is **2750 +/- 100 RPM**. Above this speed the ECU deactivates the injectors.

## Cut Off

Fuel cut off upon deceleration is controlled by the control unit performing the following logics:

- It removes power supply from the injectors;
- It re-activates the injectors shortly before idling speed is reached;
- It controls the fuel flow regulator.

## Smokiness on acceleration control

With important load requests, the control unit, depending on signals received by air inlet meter and engine speed sensor, controls the flow regulator and changes the injectors actuation time, in order to avoid exhaust smokes.

## Checking fuel temperature

When the fuel temperature exceeds **78°** (measured by the sensor placed on fuel filter) the control unit intervenes and reduces the injection pressure. If the temperature exceeds **90°**, the power is reduced to **60%**.

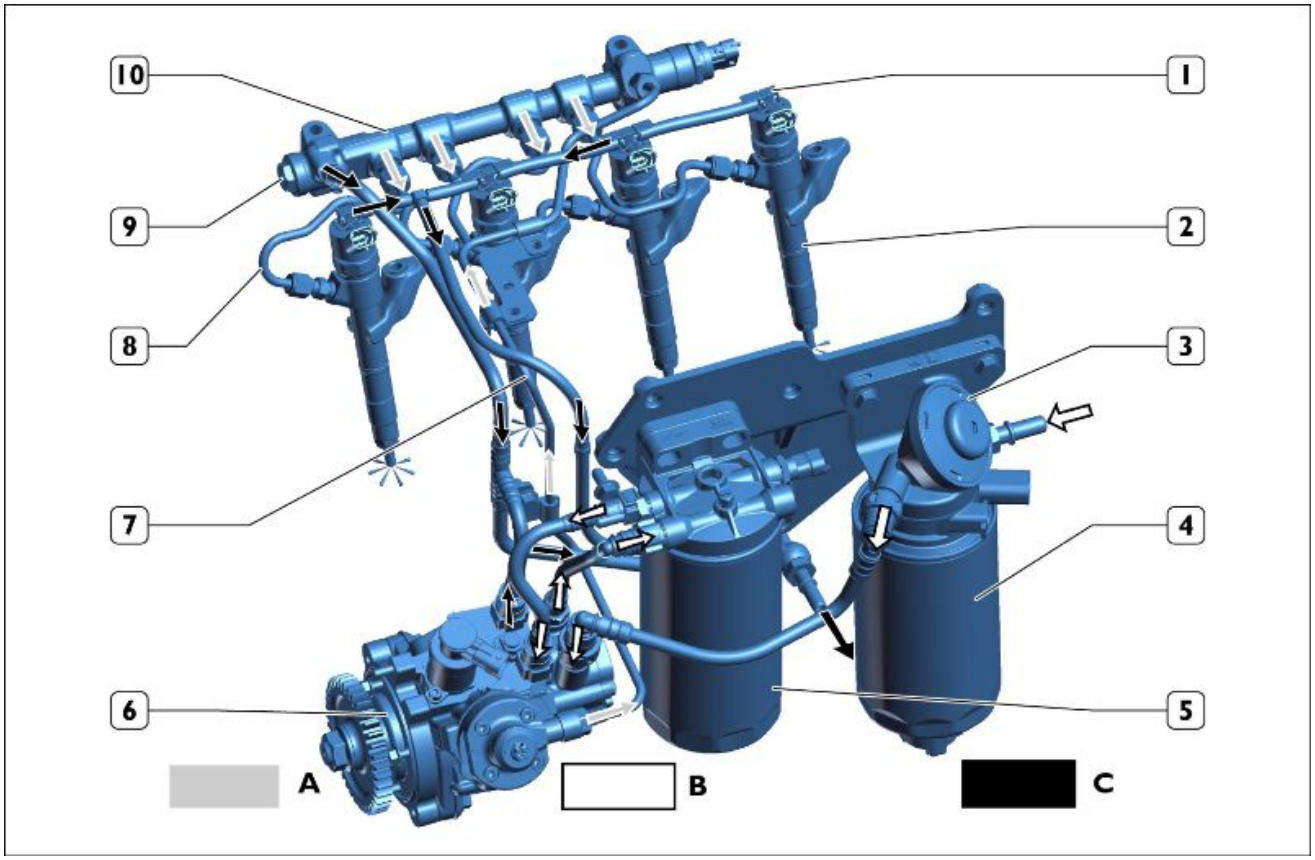
## After Run

The control unit microprocessor allows storing certain EPROM data, among which failure memory and Immobilizer information, in order to make them available upon the following start-up.

# Fuel injection system - Overview - Hydraulic system [113430650 - V1 - 04 March 2025]

## Hydraulic system

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 electro-injectors. At the electro-injector inlet therefore, there is always fuel at the injection pressure calculated by the ECU. When an injector solenoid valve is energised by the electronic control unit, the injection of fuel directly taken from rail takes place in the related cylinder.




NHIL25ENG0340FA 1

| Item | Description |
|---|---|
| A | High pressure |
| B | Low pressure |
| C | Fuel discharge |
| 1 | Fuel return from the injectors |
| 2 | Injector |
| 3 | Manual fuel pump (on the fuel pre-filter mount) |
| 4 | Fuel pre-filter |
| 5 | Fuel filter |
| 6 | Fuel high pressure pump |
| 7 | Fuel delivery pipe to the Common Rail |
| 8 | Fuel delivery pipe to the injectors from the high pressure rail |
| 9 | Pressure relief valve on rail |
| 10 | Common Rail |

The fuel system consists of a low pressure circuit and a high pressure circuit. The high pressure circuit is composed of the following pipes:

- Pipe connecting the high-pressure pump outlet to the common rail

- Common Rail
- Pipes supplying injectors from common rail.

The low pressure circuit is composed of the following pipes:

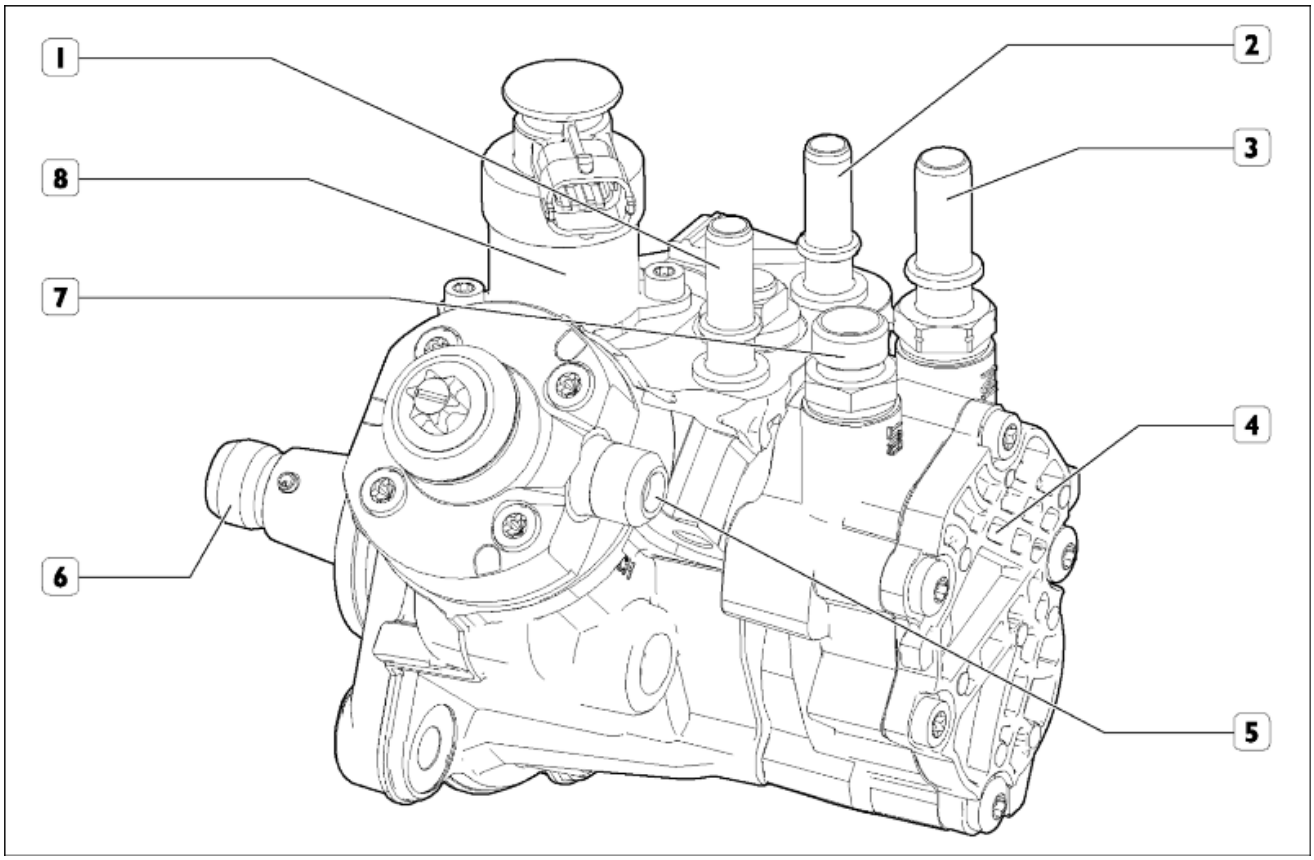
- Pipe from fuel tank to pre-filter
- Pipe from fuel pre-filter to mechanical pump
- Pipe from mechanical pump to fuel filter
- Pipe from fuel filter to high pressure pump.

The pipes of the fuel drain circuit from Common Rail, electro-injectors and the high pressure pump reflux complete the system.

# Injection pump - Overview - High pressure pump BOSCH CP4.1 [113435157 - V1 - 06 March 2025]

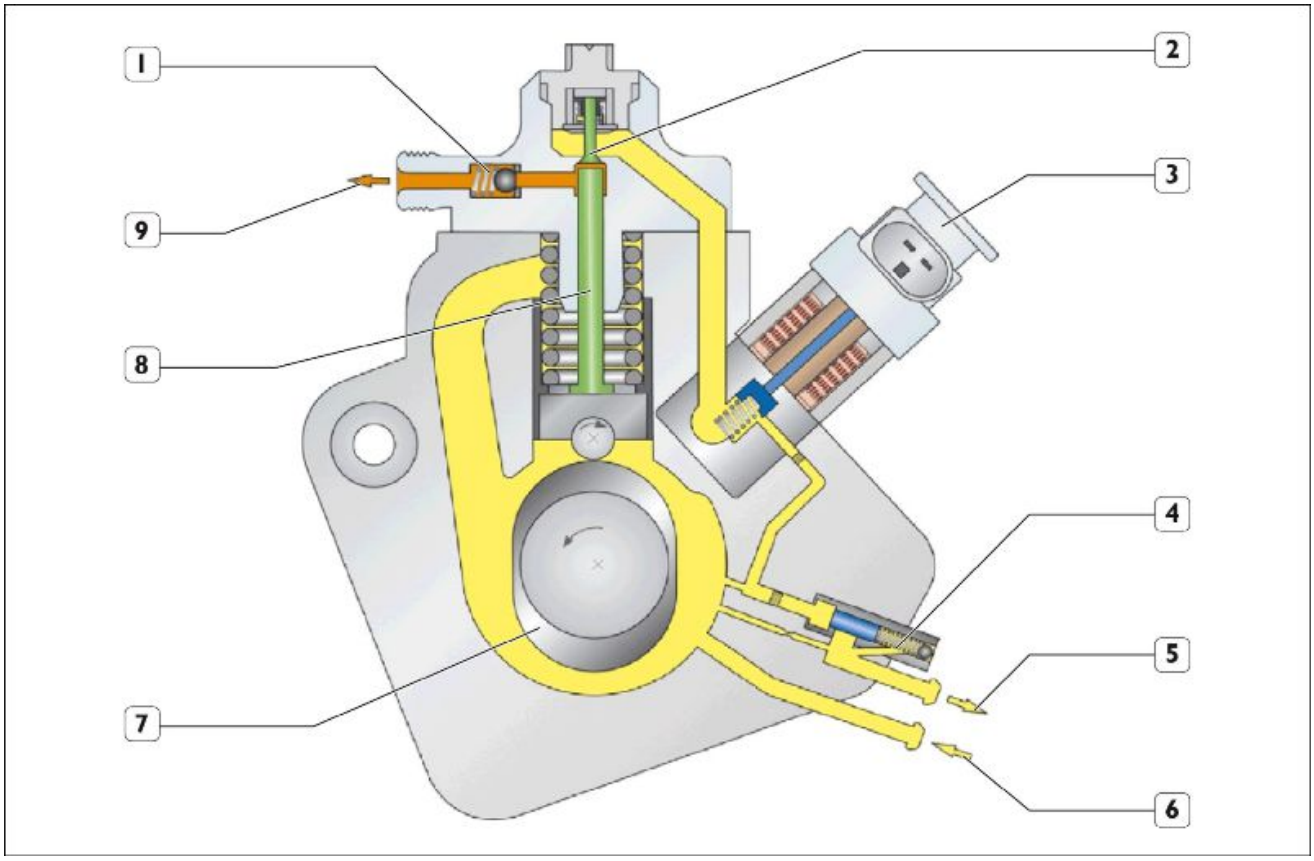
The CP4.1 high pressure pump is a pump with a single piston controlled by the timing gear. The mechanical fuel pump that is controlled by the high pressure pump shaft is fit on the rear side of the high pressure pump.

***NOTE:*** *The high pressure pump cannot be overhauled and therefore it must not be removed and the fastening screws must not be tampered with. The only operation that is possible is the replacement of the drive gear.*




NHIL25ENG0388FA 1

| Item | Description |
|---|---|
| 1 | Fuel entrance from the fuel filter |
| 2 | Fuel discharge (to the tank) |
| 3 | Fuel inlet from tank |
| 4 | Mechanical supply pump. |
| 5 | High pressure fuel delivery coupling (to the common rail). |
| 6 | Pump drive gear shaft. |
| 7 | Fuel outlet union (to the fuel filter). |
| 8 | Fuel dosing valve. |



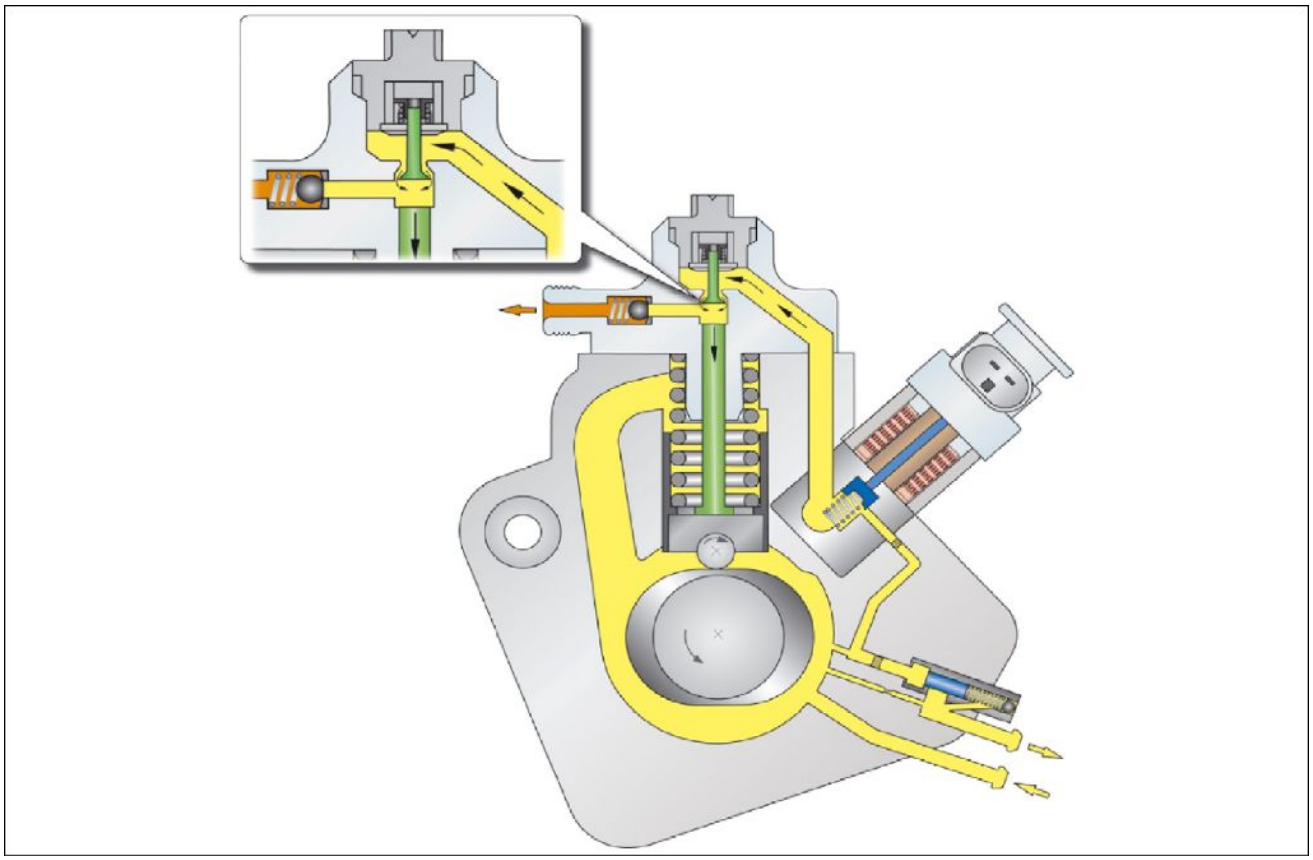

NHIL25ENG0389FA 2

| Item | Description |
|---|---|
| 1 | Ball delivery valve |
| 2 | Cap intake valve |
| 3 | Fuel dosing valve N290 |
| 4 | Fuel exhaust valve |
| 5 | Low pressure fuel exhaust (to the fuel tank) |
| 6 | Low pressure fuel inlet (from the fuel filter) |
| 7 | Pump shaft with cam |
| 8 | Piston |
| 9 | High pressure fuel delivery (to the common rail) |

The high pressure fuel pump comprises the following:

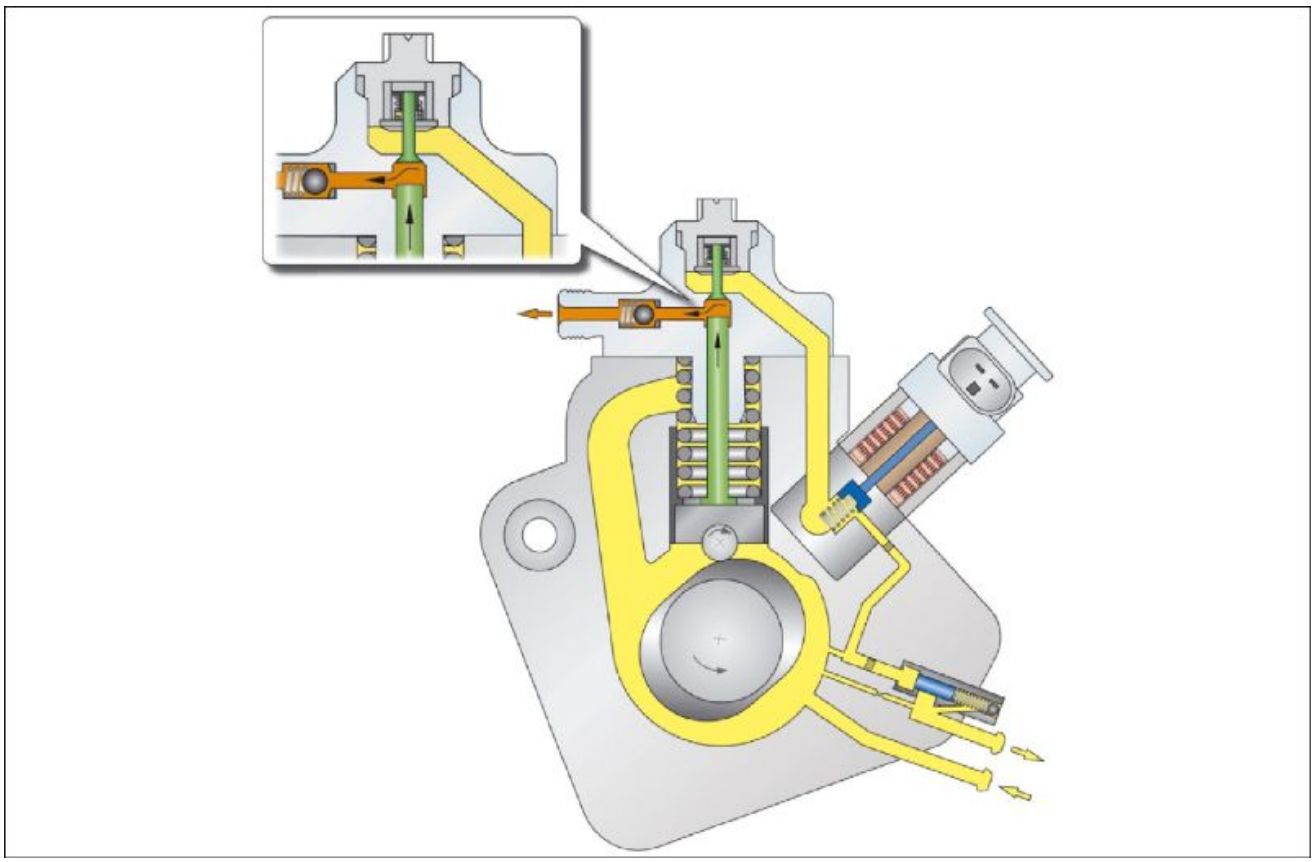
- A piston **(8)** operated by the pump control rod **(7)** equipped with a cam;
- Cap intake valve **(2)**;
- A ball delivery valve **(1)**;
- A fuel discharge valve **(4)**.

## High pressure pump CP4.1 operating diagrams



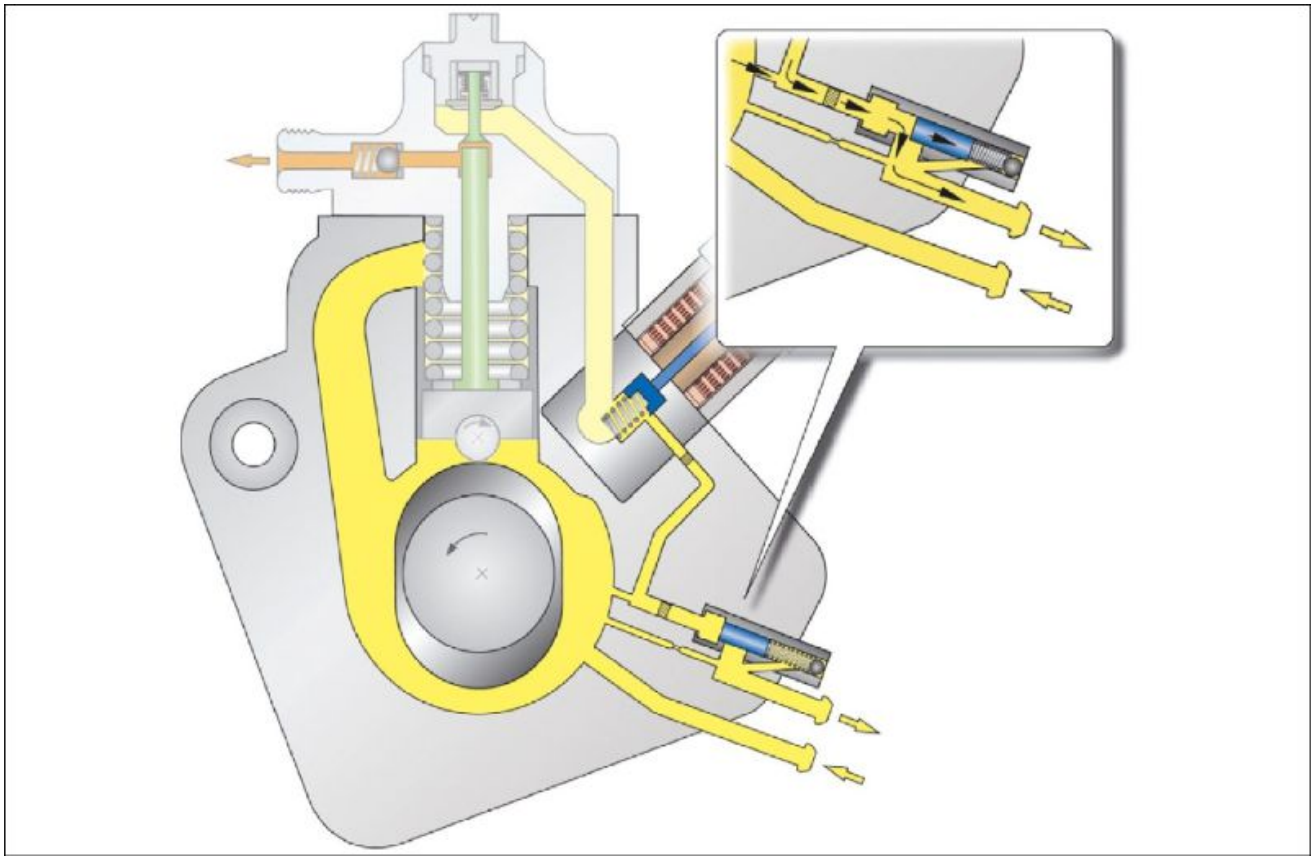
NHIL25ENG0390FA 3

**Intake step**



NHIL25ENG0391FA 4

**Injection step**



NHIL25ENG0392FA 5

**Exhaust step**

# High pressure pump - Overview - High pressure adj unit [113435160 - V1 - 06 March 2025]

## High-pressure fuel pump dosing unit

Situated at the inlet of the high pressure pump on the low pressure system, this flow regulator adjusts the quantity of fuel reaching the high pressure pump on the basis of the commands received from the electronic control unit.

It mainly consists of the following parts:

1. Tapered shutter
2. Valve control pin
3. Pre-load spring
4. Coils

In the absence of a control signal, the pressure regulator is normally open, and thus the high-pressure pump is in maximum delivery mode

The ECU regulates a PWM control signal which reduces, to a greater or lesser extent, the section carrying fuel to the high-pressure pump.

This component cannot be replaced individually and thus should not be dismantled.

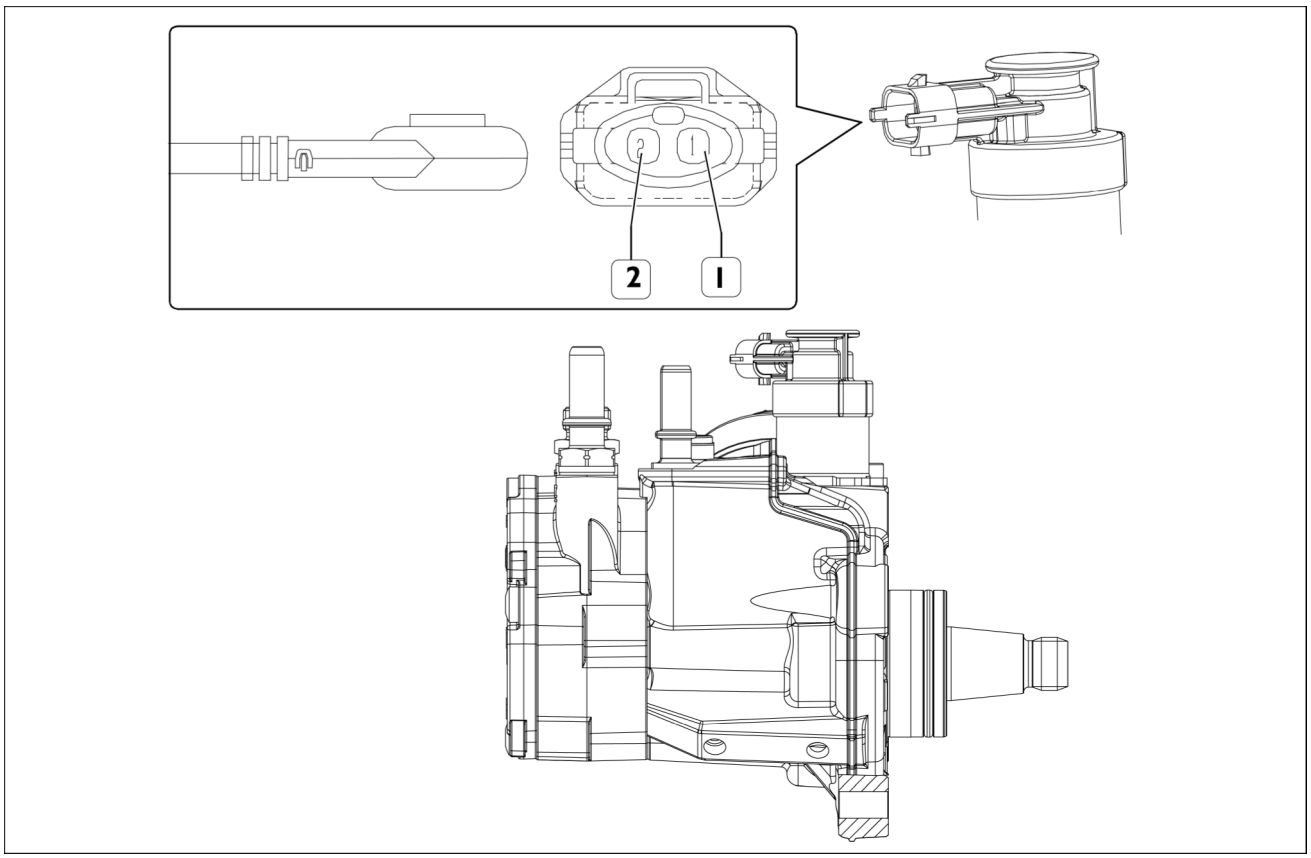
The quantity of fuel that powers the high pressure pump is dosed by the load regulator on the low pressure system; the flow regulator is managed by the control unit.

The delivery pressure to the rail is regulated between **250 – 1800 bar** (**3625 – 26100 psi**) by the control unit acting on the pressure regulator solenoid valve.

It is a N.O. solenoid valve.

Its resistance is:

| Technical data | |
|---|---|
| Pressure regulator solenoid valve resistance | = **3.2 Ω** |

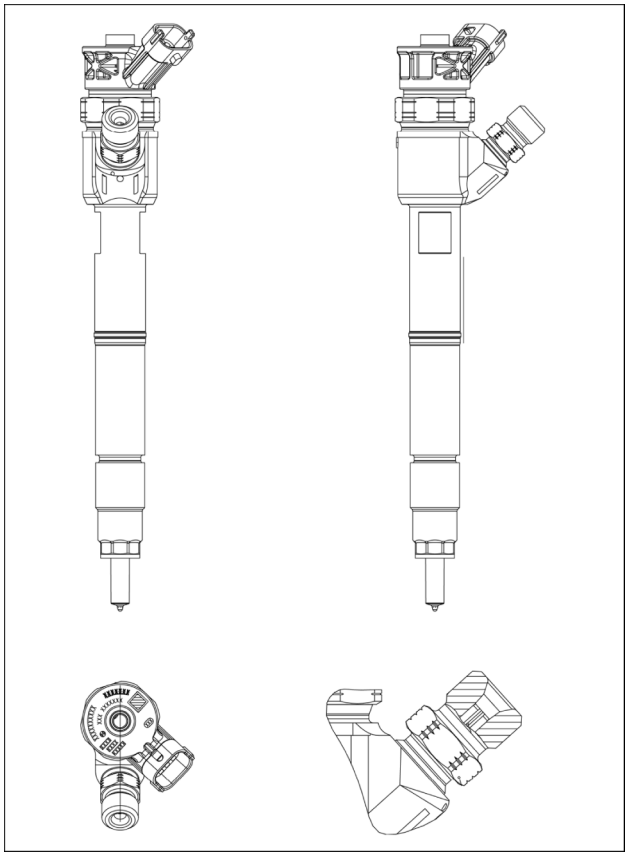



NHIL25ENG0393FA 1

## Valve pin-out

| Pin | DeFromCablescription |
|---|---|
| 1 | Feeding |
| 2 | Signal |

# Fuel injectors - Overview - Injectors [113435968 - V1 - 06 March 2025]



NHIL25ENG0406BA 1

## Electro Injectors

The electro-injector essentially consists of two parts:

- Actuator - spray nozzle consisting of a pressure rod, a needle and a jet.
- Driving solenoid valve made up of coil and pilot valve.

The N.O. type solenoid valve checks the lift of the nozzle needle.

## Beginning of injection

Upon being supplied with power, the coil moves up the shutter.

The control volume fuel flows to return duct causing control volume pressure drop.

At the same time, the fuel pressure in the pressure chamber causes the needle to rise resulting in the fuel being injected into the cylinder.

## End of injection

When power to the coil is cut off, the shutter closes again so as to re-create an equilibrium which moves the needle back into its closed position and stops the injection process.

This is an N.C. solenoid valve. They are individually connected to the engine control unit on connector 2.

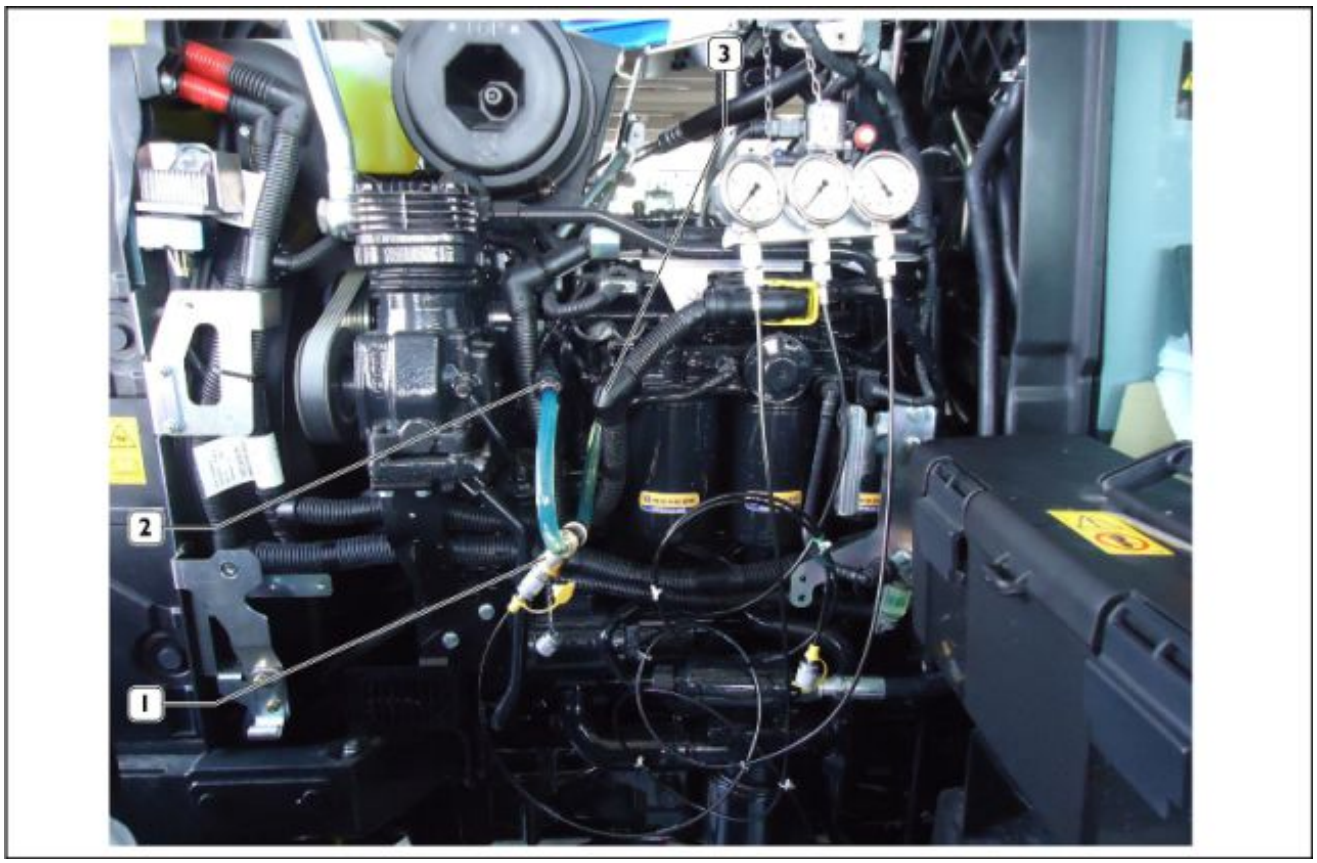
The resistance of the coil of each individual injector is:

| Technical data | |
|---|---|
| Injector coil resistance | **0.56 – 0.57 Ω** required. |

# Injection pump - Prepare - Pressure between main filter and high pressure pump [113387825 - V1 - 22 February 2025]

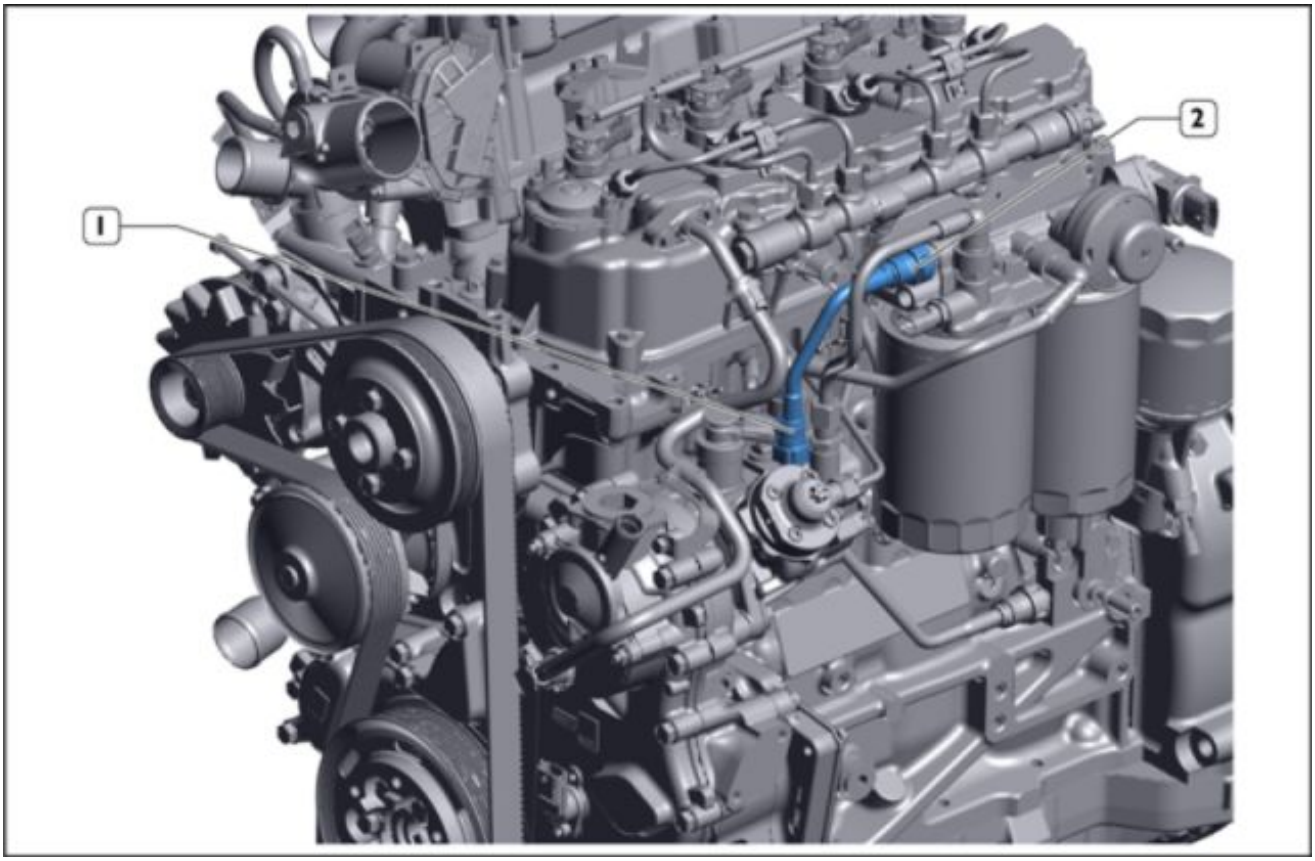
## Preparation

- Visually check all related components for any signs of leakage.
- Disconnected the pipe between main filter outlet and high pressure pump inlet.
- Connect the flexible tube to the two terminal (main filter outlet and high pressure pump inlet).
- Install the pressure gauge between the main filter and high pressure pump.
- Tighten the system (ensure that there is no leakage).
- To prepare for the operation, observe the figures below:




NHIL25ENG0488TA 1

| Item | Description |
|---|---|
| 1 | T-connector to manometer |
| 2 | High-pressure pump intake |
| 3 | Main filter outlet to high pressure pump |




NHIL25ENG0489FA 2

**Locations of high-pressure pump intake**

| Item | Description |
|---|---|
| 1 | High-pressure pump intake |
| 2 | Main filter outlet to high pressure pump |

# Injection pump - Check - Pressure between main filter and high pressure pump [113387826 - V1 - 22 February 2025]

Offboard tools

- Low pressure vacuum gauge.
- Adaptors.
- Hose

Check pressure between main filter and high pressure pump

- Start or crank engine and let run for several minutes (please wait at least **30 s** while engine cranking sessions).
- Observe pressure built up in several engine conditions and note values.
- See table below for a list of expected results and go to step **1** .

***NOTE:*** *For the hydraulic measurement of the FUEL system under cranking condition, crank the engine no longer than* ***10 – 12 s*** *each time is recommended. The starter may be damaged if works continuously for a long time.*

| Engine condition | Pressure value (rel.) bar | | Remark |
|---|---|---|---|
| | Minimum | Maximum | |
| Low idle speed | **3.0 bar** (**43.5 psi**) | **6.2 bar** (**89.9 psi**) | At **850 RPM** |
| High idle | **3.0 bar** (**43.5 psi**) | **6.2 bar** (**89.9 psi**) | At **1500 RPM** |

1. Check if the pressures measured are in the range explained in the table above.
   A. If the expected results are OK, go to step **4**.
   B. If the expected results are NOT OK (Gear pump pressure too low, below minimum values), go to step **2**.
   C. If the expected results are NOT OK (Gear pump pressure too high, above maximum values), go to step **3**.

***NOTE:*** *The pressure difference between at the main filter inlet and outlet should be less than* ***2.0 bar*** *(****29.0 psi****). Otherwise replace main filter.*

2. Possible root cause (Gear pump pressure too low, below minimum values):
   - Check tightness of tubes, connectors. Any small defect in tightness will lead to a reduced suction pressure. Air will be sucked into the system and the diesel flow will be reduced (check that there are no air bubbles in the backflow from the pump).
   - Main filter blocked or damaged.
   - Pre-filter blocked or damaged.
   - Tubes/connectors are damaged.
   - Overflow-valve in high pressure pump sticking in open position (check the high pressure pump backflow rate).
   - Rare but possible: defective gear pump (exclude the possibility of other fuel delivery component problems before making this conclusion).

3. Possible root cause (Gear pump pressure too high, above maximum values):
   - Tubes/connectors between main-filter and high pressure pump blocked or damaged (check main filter blocked or damaged).
   - Overflow valve in high-pressure-pump blocked, dirty, sticking in closed position (check the high pressure pump backflow rate).
   - Inlet high pressure pump blocked (check the filter in the inlet bolt of the pump).
   - Backflow pipe blocked or damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

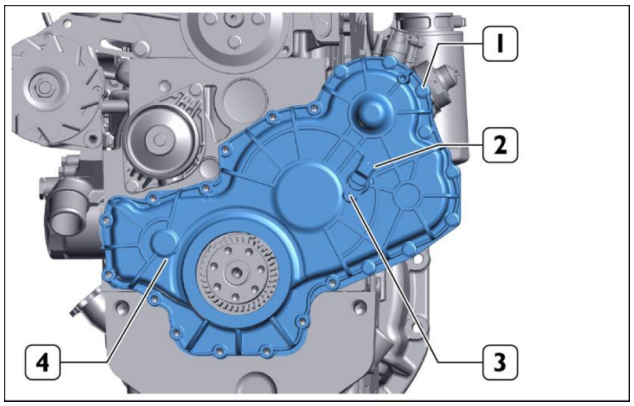
4. The system works properly.

# Injection pump - Remove - Injection pump assy [113435162 - V1 - 21 February 2025]

**Prior operation:**
Disconnect the engine cable as described in the procedure **Engine wiring harness - Remove - Engine cables (55.015)**.
**Prior operation:**
Remove the low-pressure fuel pipes as described in the procedure **Glow plug system - Remove - Pipes (55.202)**.
**Prior operation:**
Remove the fuel filter as described in the procedure **Fuel filters - Remove - Filter assembly (10.206)**.
**Prior operation:**
Remove the fuel filter bracket as described in the procedure **Pre-filter - Remove - Filter support (10.206)**.
**Prior operation:**
Remove the water pump drive belt as described in the procedure **Radiator to water pump hoses - Remove - Water pump drive belt (10.400)**.
**Prior operation:**
Remove the crankshaft pulley as described in the procedure **Crankshaft pulley - Remove - Drive pulley on crankshaft (10.103)**
**Prior operation:**
Remove the crankshaft front gasket as described in the procedure **Crankshaft oil seal - Remove - Crankshaft front gasket (10.103)**.

## High pressure pump removal

1. Unscrew the screw **(3)** and remove the camshaft timing sensor **(2)**.
2. Unscrew the screws **(1)** and remove the timing gear case **(4)**.



NHIL25ENG0394TA 1

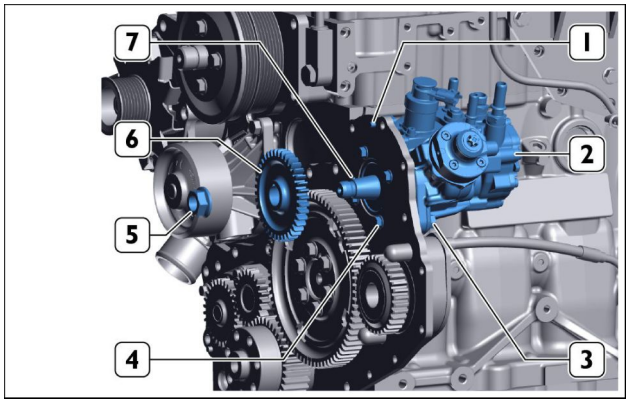
3. Unscrew the nut **(5)** from the high pressure pump spindle and remove the gear **(6)**.

***NOTE:*** *Pay attention to the reference dowel pin **(7)**.*

4. Unscrew the nuts **(3)** from the studs and remove the high pressure pump **(2)**.

***NOTE:*** *Pay attention to the reference dowel pin **(1)**.*

5. Unscrew the screws **(4)** and remove the spacer and the relevant gasket.
6. Unscrew the studs securing the high-pressure pump **(2)** from the gear case.



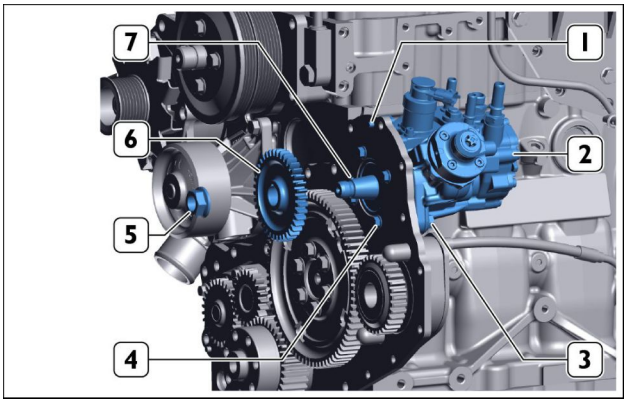
NHIL25ENG0395TA 2

# Injection pump - Install - Injection pump assy [113435163 - V1 - 06 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Camshaft timing sensor | 1 screw M6 x 1 x 16 | | **9 +/- 0.9 N·m** |
| High pressure fuel pump | 3 nuts M8 x 1.25 | | **23 +/- 2.3 N·m** |
| High-pressure pump gear | 1 nut M18 x 1.5 | | **80 +/- 4 N·m** |
| Timing gearbox | | 13 screws M8 x 1.25 x 25 | **23 +/- 2.3 N·m** |
| | | 13 screws M8 x 1.25 x 35 | **23 +/- 2.3 N·m** |

## Refitting high pressure pump

1. Tighten the studs on the gear case for the high pressure pump retainer **(2)**.



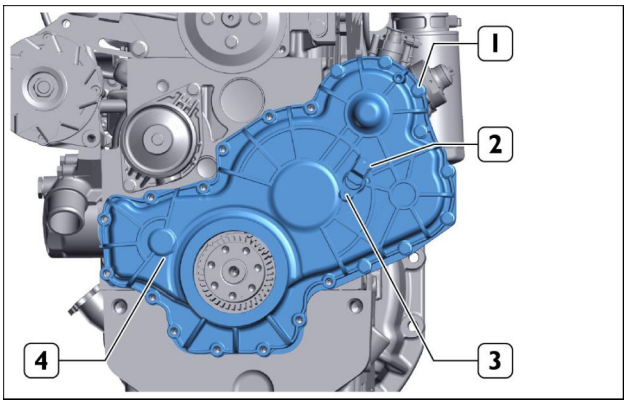

NHIL25ENG0396TA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| High pressure fuel pump | 3 studs M8 x1.2 5x12 | | **11 +/- 1.1 N·m** |

2. Fit the spacer, complete with a new gasket and tighten the screws **(4)** to the prescribed torque.
3. Fit the high pressure pump **(2)** in the correct position using the reference pin **(1)** and tighten the nuts **(3)** to the prescribed torque.
4. Fit the pump drive gear **(6)** on the high pressure pump spindle provided with a key **(7)** and tighten the nut **(5)** to the prescribed torque.

***NOTE:*** *Pay attention to the correct orientation of the pump drive gear **(6)** with respect to the high pressure pump spindle to prevent sticking with the key **(7)**.*

5. Fit the timing gear case **(4)** and tighten the screws **(1)** to the prescribed torque.
6. Install the camshaft timing sensor **(2)** and tighten the screw **(3)** to the prescribed torque.



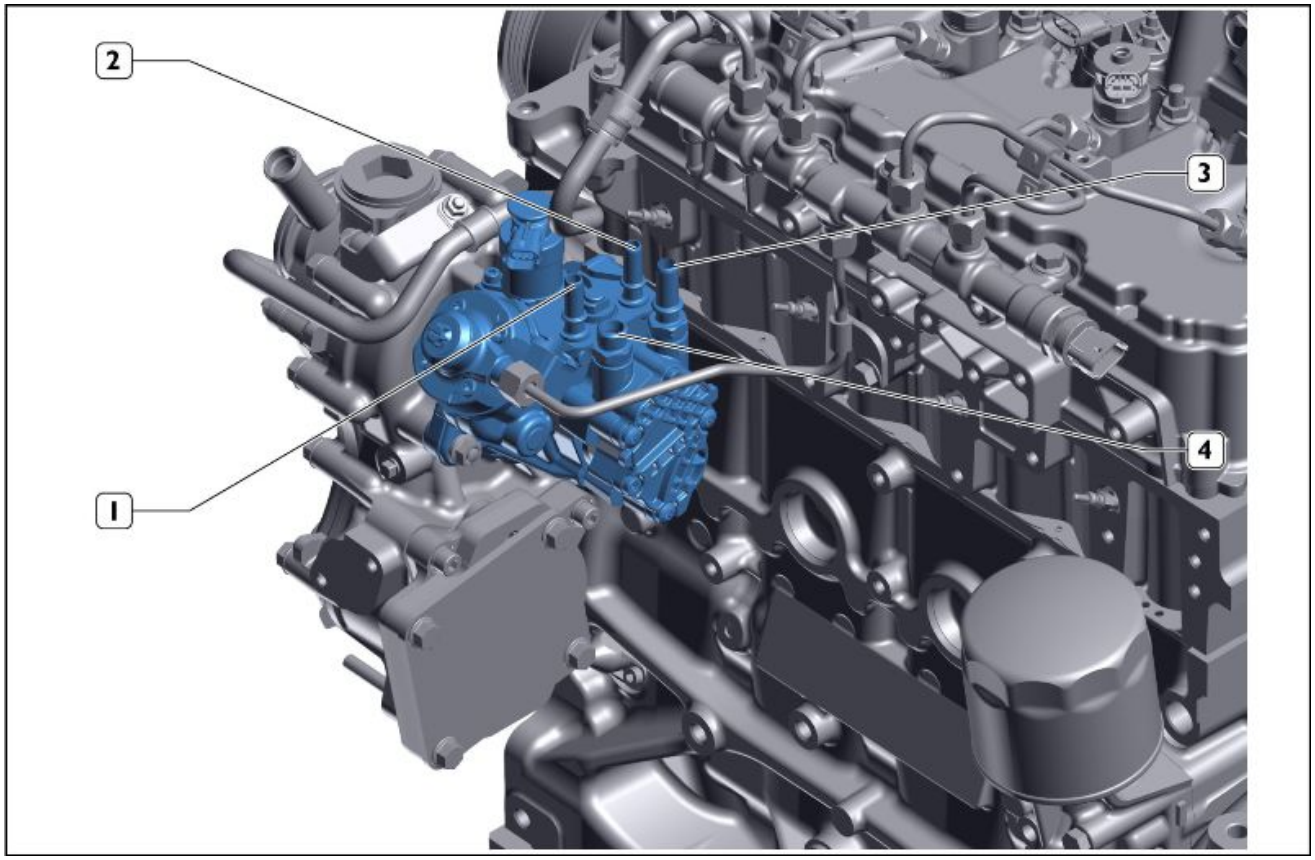

NHIL25ENG0397TA 2

**Next operation:**
Fit the crankshaft front gasket **Crankshaft oil seal - Install - Crankshaft front gasket (10.103)**.
**Next operation:**
Fit the crankshaft pulley, as described in the procedure **Crankshaft pulley - Install - Drive pulley on crankshaft (10.103)**.
**Next operation:**
Fit the water pump drive belt, as described in the procedure **Radiator to water pump hoses - Install - Water pump drive belt (10.400)**.
**Next operation:**
Fit the fuel filter bracket, as described in the procedure **Engine oil filter - Install - Filter support (10.304)**.
**Next operation:**
Fit the fuel filter as described in the procedure **Fuel filters - Replace - Filter assembly (10.206)**.
**Next operation:**
Fit the low pressure and high pressure fuel pipes, as described in the procedure **Glow plug system - Install - Pipes (55.202)**.
**Next operation:**
Connect the engine cable as described in the procedure **Engine wiring harness - Install - Engine cables (55.015)**.

# High pressure pump - Prepare - High pressure pump backflow rate [113387847 - V1 - 22 February 2025]

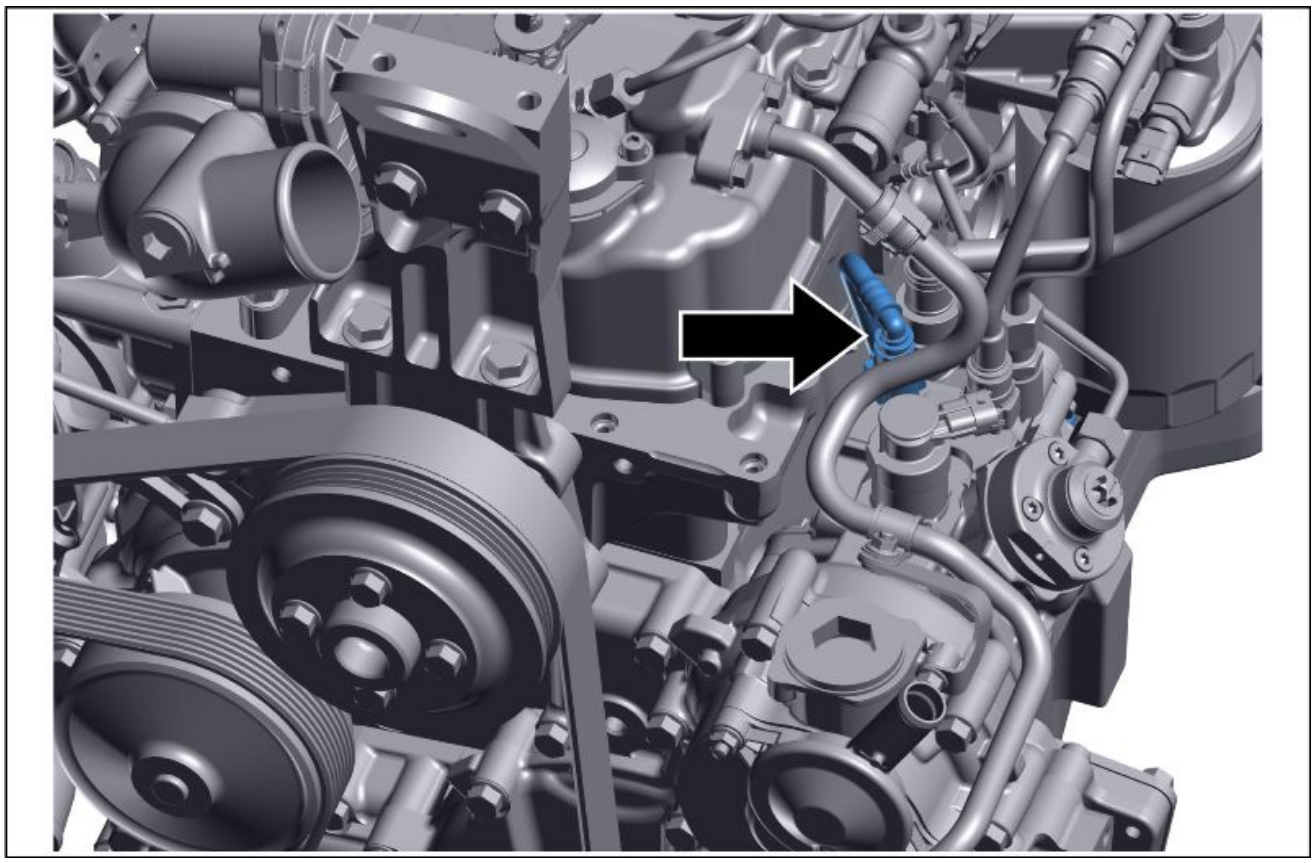
## Preparation

1. 
   - Visually check all related components for any signs of leakage.
   - Disconnect the pipe between the backflow outlet of the high pressure pump.
   - Install a closing plug to prevent any leak from the high pressure pump backflow.
   - Connect the flexible tube with the high pressure pump backflow outlet.
   - Prepare the measuring cup and stopwatch.
   - To prepare for the operation, observe the figures below.




NHIL25ENG0490FA 1

| Item | Description |
|---|---|
| 1 | High pressure pump from main filter |
| 2 | Return to reservoir |
| 3 | Low pressure pump intake from pre-filter |
| 4 | Delivery from low pressure pump to main filter |



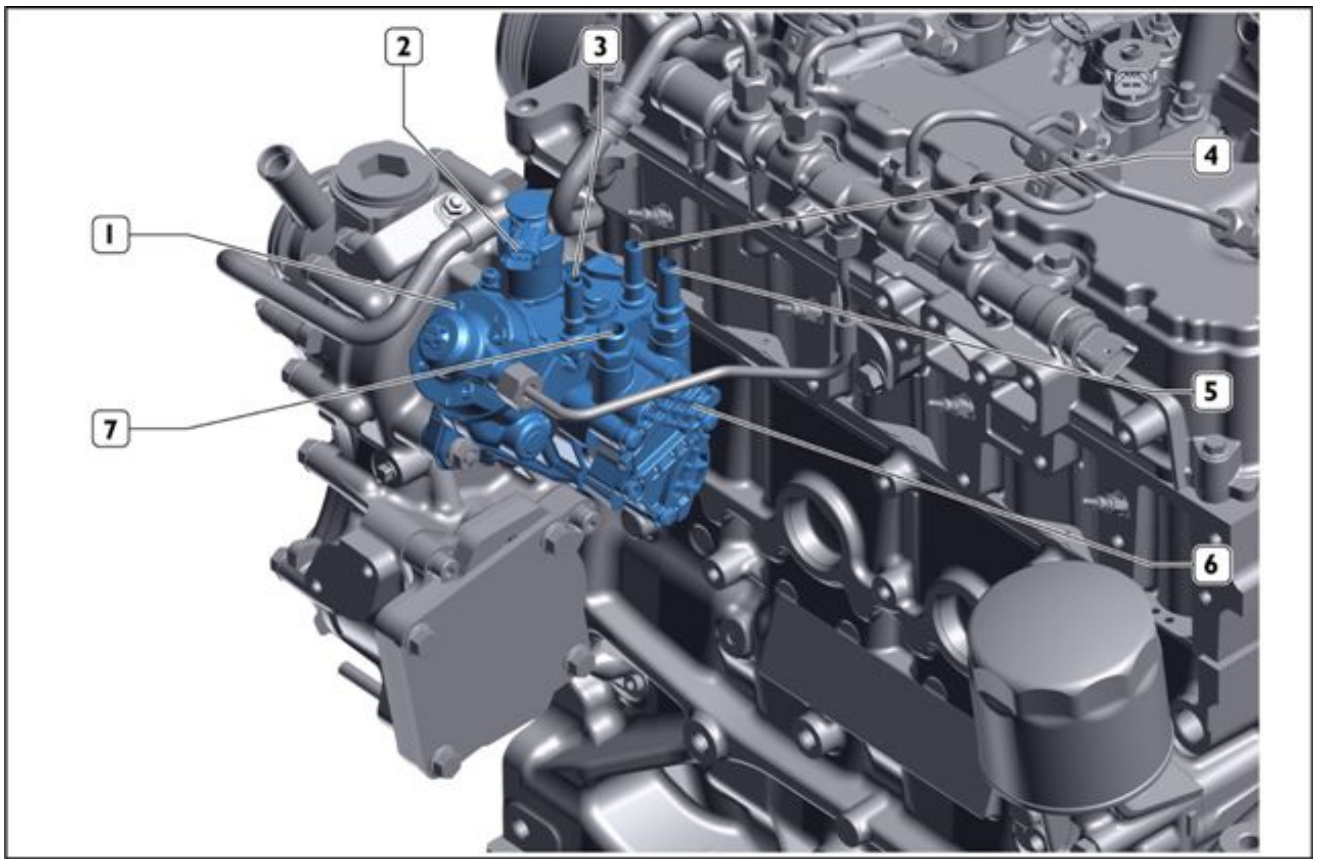
NHIL25ENG0491TA 2

**Location of the high pressure pump return**

# High pressure pump - Prepare - High pressure system backflow rate [113387848 - V1 - 22 February 2025]

## Preparation

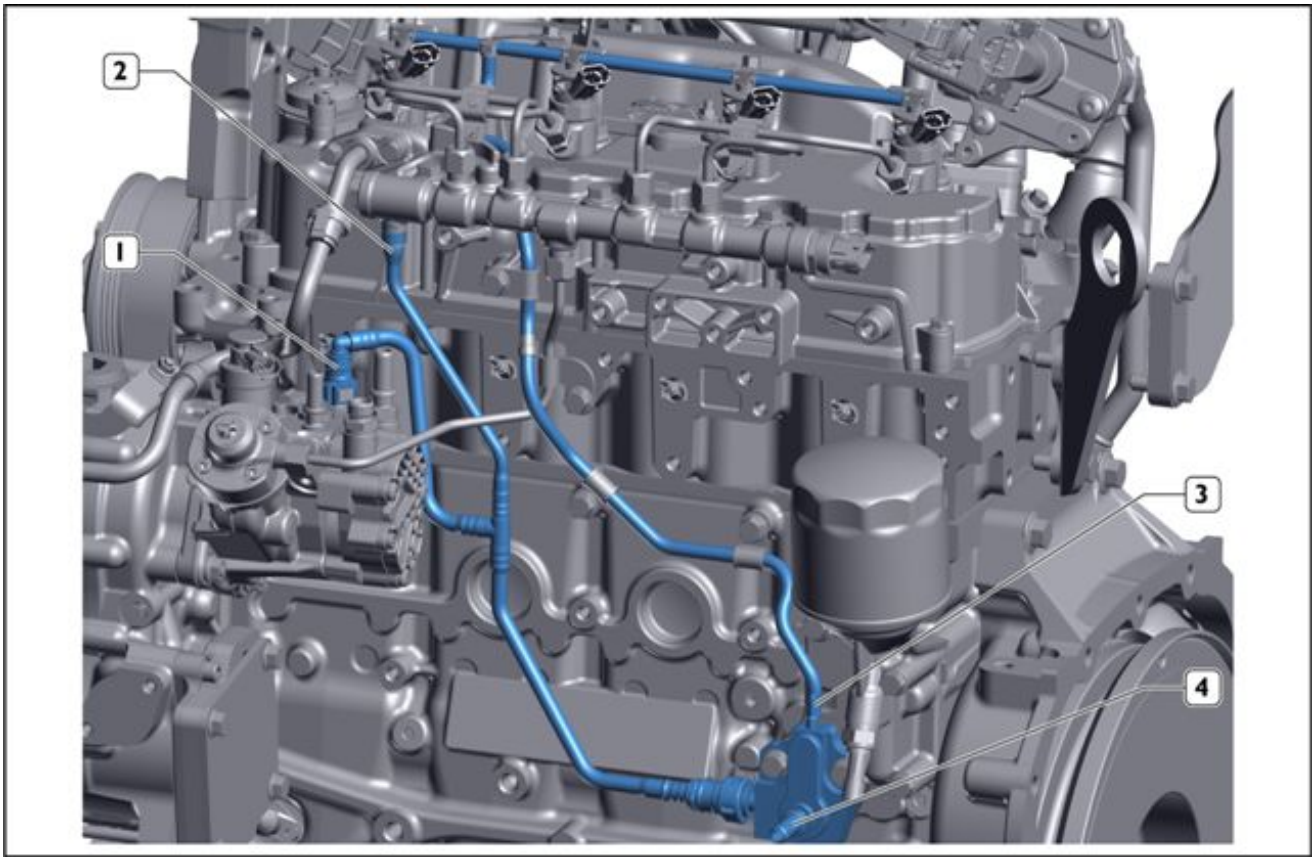
- Visually check the components to ensure there are no external fuel leaks.
- Disconnect the backflow pipe to the tank from the high pressure pump.
- Install second tube as a provisional backflow line from the high-pressure-pump backflow and the tank.
- Fit the plug to close the backflow fitting to the tank from the high pressure pump.
- Disconnect the total backflow pipe to the tank.
- Connect a second hose between the total backflow line and the measuring cup.
- Provide stop watch and measuring cup (minimum **250 mL** (**1 US cup**).
- To prepare for the operation, Refer to figure **1**.




NHIL25ENG0493FA 1

**Location of the main components of the fuel pump**

| Item | Description |
|---|---|
| 1 | High-pressure pump |
| 2 | Pressure regulator valve (fuel metering unit) |
| 3 | High pressure pump from main filter |
| 4 | Return to reservoir |
| 5 | Low pressure pump intake from pre-filter |
| 6 | Gear low pressure pump |
| 7 | Delivery from low pressure pump to main filter |




NHIL25ENG0494FA 2

**Location of the backflow line**

| Item | Description |
|---|---|
| 1 | Backflow fitting to tank from high pressure pump |
| 2 | Pressure limiting valve backflow fitting |
| 3 | Injectors total backflow fitting |
| 4 | Total backflow to tank |

# High pressure pump - Prepare - Rail pressure adjustment [113387849 - V1 - 22 February 2025]

## Preparation

General checks

- Battery voltage is sufficient.
- Vehicle fuses are OK.
- Connectors/plugs OK. No loose contact or corrosion.
- Offboard tool Diagnosis tester.

# High pressure pump - Prepare - Rail pressure during cranking [113387850 - V1 - 14 February 2025]

## Read parameters during cranking

Offboard tool

- Diagnosis tester.

## Preparation

- Set the key to ON.
- Connect the diagnostic tester.
- Start active diagnosis: "Read Parameters".

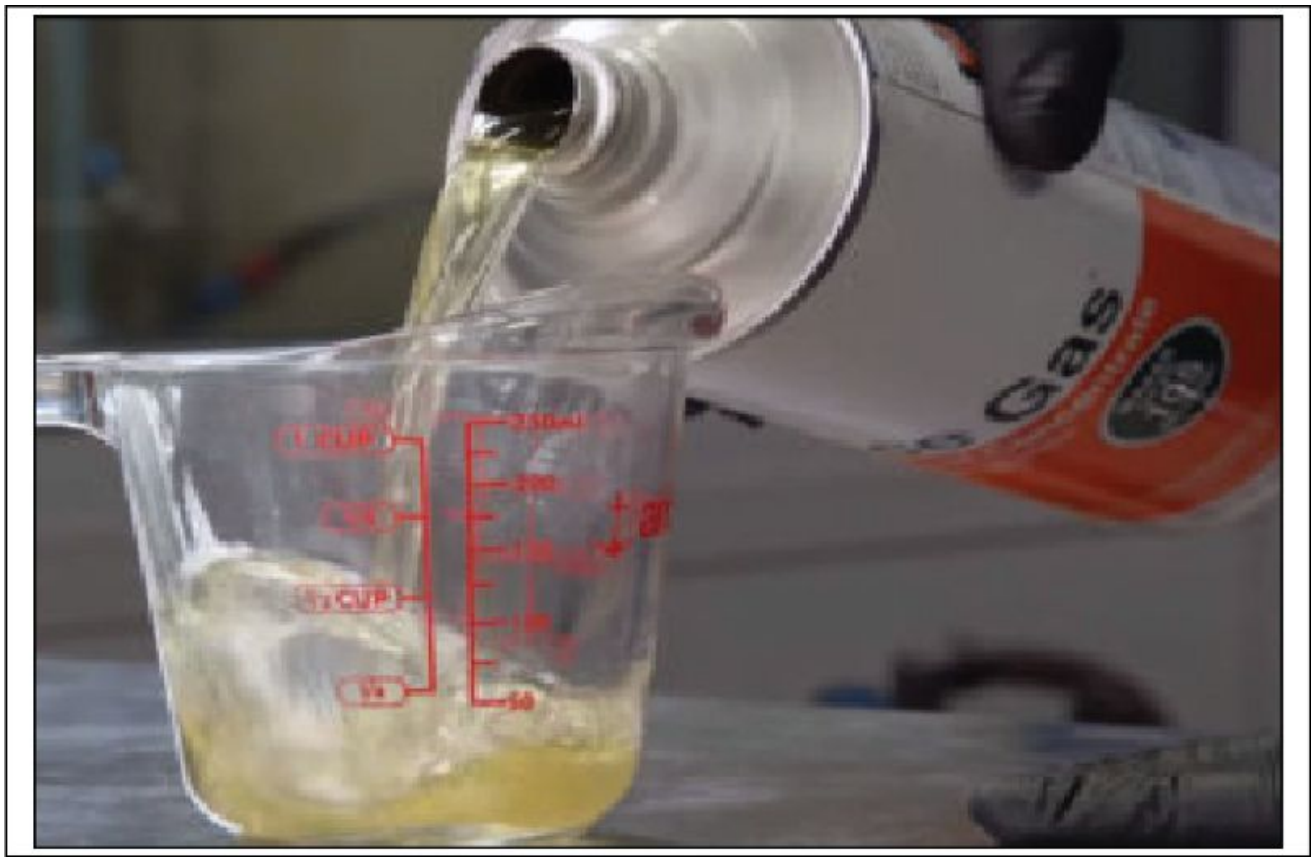
# High pressure pump - Check - High pressure pump backflow rate [113387851 - V1 - 22 February 2025]

Offboard tools

- Measuring cup (minimum capacity. **1.5 L** (**0.4 US gal**)).
- Adaptors/blanking plug
- Hose
- Stopwatch

Check high pressure pump backflow rate

- Start engine until diesel runs out the flexible tube from pump.
- In case of non-starter: crank until diesel runs out the flexible tube from pump.
- Use empty measuring cup.
- Start to fill the cup while the engine runs for specific time period.
- In case of non-starter: crank multiple times (max **10 s** per cranking) until requested time period is reached.
- Note the diesel volume of measuring cup.
- Refer to figure **1** and table below for a list of expected results and go to step **1**.



NHIL25ENG0492TA 1

**Example of transfer diesel from collecting container to measurement cup**

***NOTE:*** *For the hydraulic measurement of the FUEL system under cranking condition, crank the engine no longer than* ***10 – 12 s*** *each time is recommended. The starter may be damaged if works continuously for a long time.*

| Engine condition | Volume mL | Remark |
|---|---|---|
| Idle **60 s** | **500.00 – 800.00 mL** (**2.11 – 3.38 US cup**) | **850 RPM** |

1. Check if the volumes measured are in the range explained in the table above.
   A. If the expected results are OK, go to step **3**.
   B. If the expected results are NOT OK, go to step **2**.
2. Possible root cause (volume rate is noticeable too low)
   - Insufficient fuel
   - Check tightness of tubes and connectors. Any small defect in tightness will lead to a reduced suction pressure. Air will be sucked into the system and the diesel flow will be reduced. (Check that there are no air bubbles in the backflow from the pump).
   - Check tubes, connectors squeezed/damaged/wrong diameter. (If there are no bubble in the backflow, check the pipeline).
   - Main filter blocked. (If delta pressure over than **40 kPa** (**0 bar**), replace main filter).
   - Tank ventilation is blocked or restricted. Open the tank cap, and listen to sucking sound.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

3. The high pressure pump works properly.

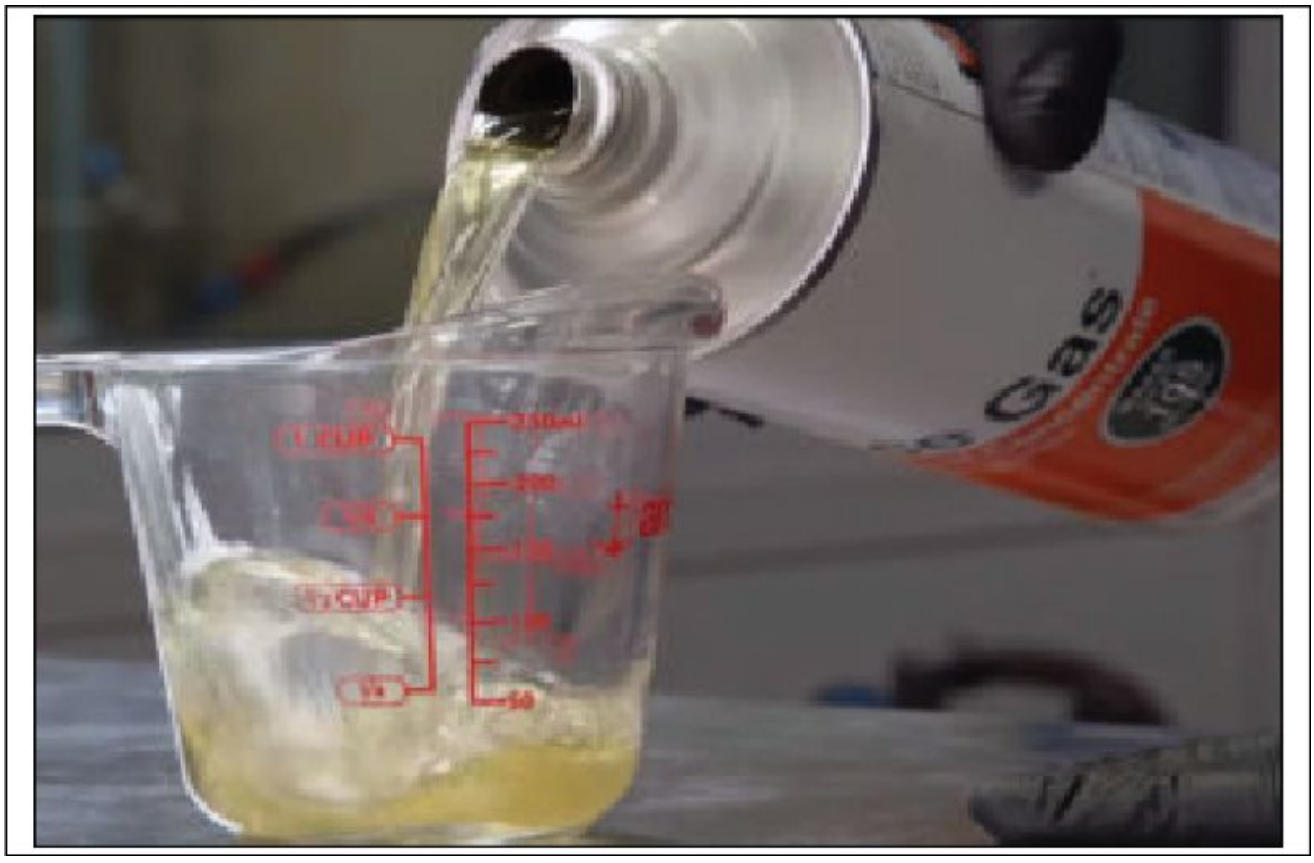
# High pressure pump - Check - High pressure system backflow rate [113387852 - V1 - 22 February 2025]

Offboard tools

- Flexible tube and adaptor to junction bolts.
- Measuring cup (minimum **250 mL** (**1 US cup**)).
- Stopwatch

Check high pressure system backflow rate.

- If possible run engine until coolant temperature of **65 °C** (**149 °F**) is reached.
- Crank/start engine until diesel runs out the tube.
- Use empty measuring cup.
- Start engine and start the stop watch.
- If case of non-starter: Crank engine multiple times (maximum **10 s** each) until specific time period is reached.
- Start to fill the cup while the engine runs for specific time period.
- Note the total diesel volume of measuring cup.
- See figure and table below for a list of expected results and go to step **1**.




NHIL25ENG0492TA 1

**Example of backflow fuel from container to measuring cup**

***NOTE:*** *For the hydraulic measurement of the FUEL system under cranking condition, crank the engine no longer than* ***10 – 12 s*** *each time is recommended. The starter may be damaged if works continuously for a long time.*

| Engine condition | Volume mL | Remark |
|---|---|---|
| Idle **60 s**) | From | At **850 RPM** (4-valve engine) |
| High idle **60 s**) | From | At **1500 RPM** (4-valve engine) |
| Idle **60 s**) | From | At **800 RPM** (2-valve engine) |
| High idle **60 s**) | From **86.4 – 129.6 mL** (**0.4 – 0.5 US cup**) | At **1500 RPM** (2-valve engine) |

1. Check if the volumes measured are in the range explained in the table above.
   A. If the expected results are OK, go to step **3**.
   B. If the expected results are NOT OK, go to step **2**.
2. Possible root cause
   - Pressure limiting valve backflow leaky, check PLV backflow.
   - Injector leaky, check backflow of each injector individually.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

3. The high pressure system works properly.

# High pressure pump - Check - Rail pressure adjustment [113387853 - V1 - 22 February 2025]

## Preparation

- Set the key to ON.
- Connect the diagnostic tester.

## Check

- Modify the fuel pressure in the rail (pressure rail).
- The fuel pressure adjustment is possible in the range from **250 – 1600 bar** (**3625 – 23200 psi**).
- Go to step **1**.

1. Rail pressure adjustment check
   A. The fuel pressure in the rail is into specified pressure range.
   B. If rail pressure adjustment is OK go to step **3**.
   C. If rail pressure adjustment is not OK, go to step **2**.
2. Possible root cause
   - Electrical defect of fuel system's components (e.g.: rail pressure sensor, fuel pump, fuel injector). Check wiring harness and component electrically.
   - Mechanical defect of fuel system's components (e.g.: faulty fuel pressure limiting valve).
   - Clogged fuel filters.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

3. The injector works properly.

# High pressure pump - Check - Rail pressure during cranking [113387854 - V1 - 14 February 2025]

## Check

- Crank the engine for **5 s**.
- Read out the rail pressure value.
- Go to **1**.

1. Read parameters during cranking
   A. All values within specified range or similar to typical value!
   B. Rail pressure value larger **120 bar**.
   C. If parameters during cranking are OK go to **3**.
   D. If parameters during cranking are not OK, go to **2**.
2. Possible root cause
   - No sufficient low pressure fuel supply.
   - Fuel leakage at the high pressure system.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

3. The injector works properly.

# High pressure pump - Prepare - External fuel leakage high pressure system [113389113 - V1 - 13 February 2025]

## Preparation

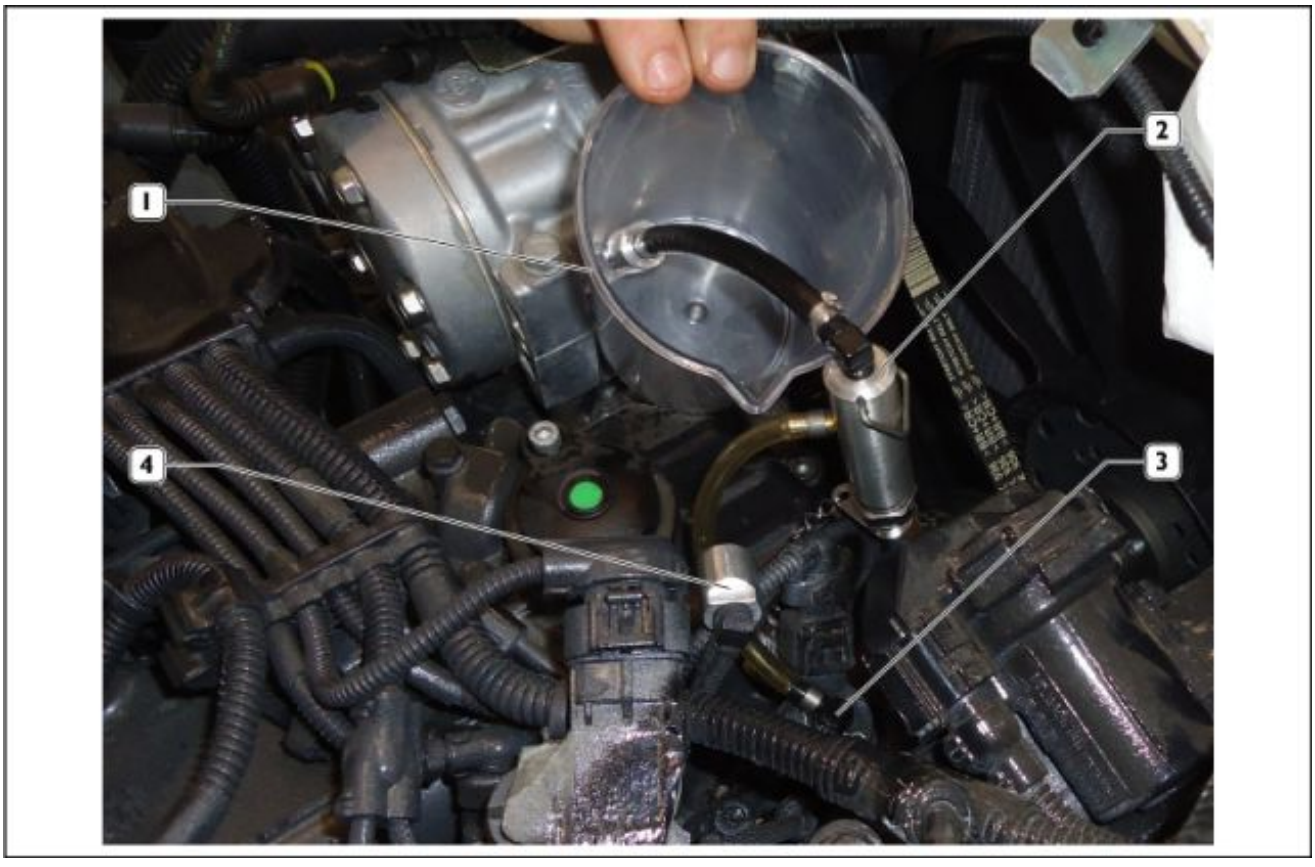
- Access the top part of the engine.

# High pressure pump - Prepare - Single injector backflow rate [113389114 - V1 - 22 February 2025]

## Preparation

If there is a strong suspicion for a too high injector backflow it is recommend to check all injectors individually.

- Visually check the components to ensure there are no external fuel leaks.
- Disconnect the backflow hose on injector 1.
- Plug the injectors backflow pipe.
- Connect the pipe of the tool for measuring the injectors backflow pressure and flow rate on injector 1.
- Prepare the stopwatch and measuring cup (min. **250 mL** (**1 US cup**))
- Insert the pipe from the tool for measuring the injectors flow rate and backflow pressure into the measuring cup
- Look the figures below for preparation:




NHIL25ENG0503TA 1

| Item | Description |
|---|---|
| 1 | Measuring cup |
| 2 | Equipment for measuring flow rate and injector backflow pressure |
| 3 | Injector backflow fitting |
| 4 | Plug |

# High pressure pump - Prepare - Injector cut out activation check [113389115 - V1 - 13 February 2025]

## Preparation

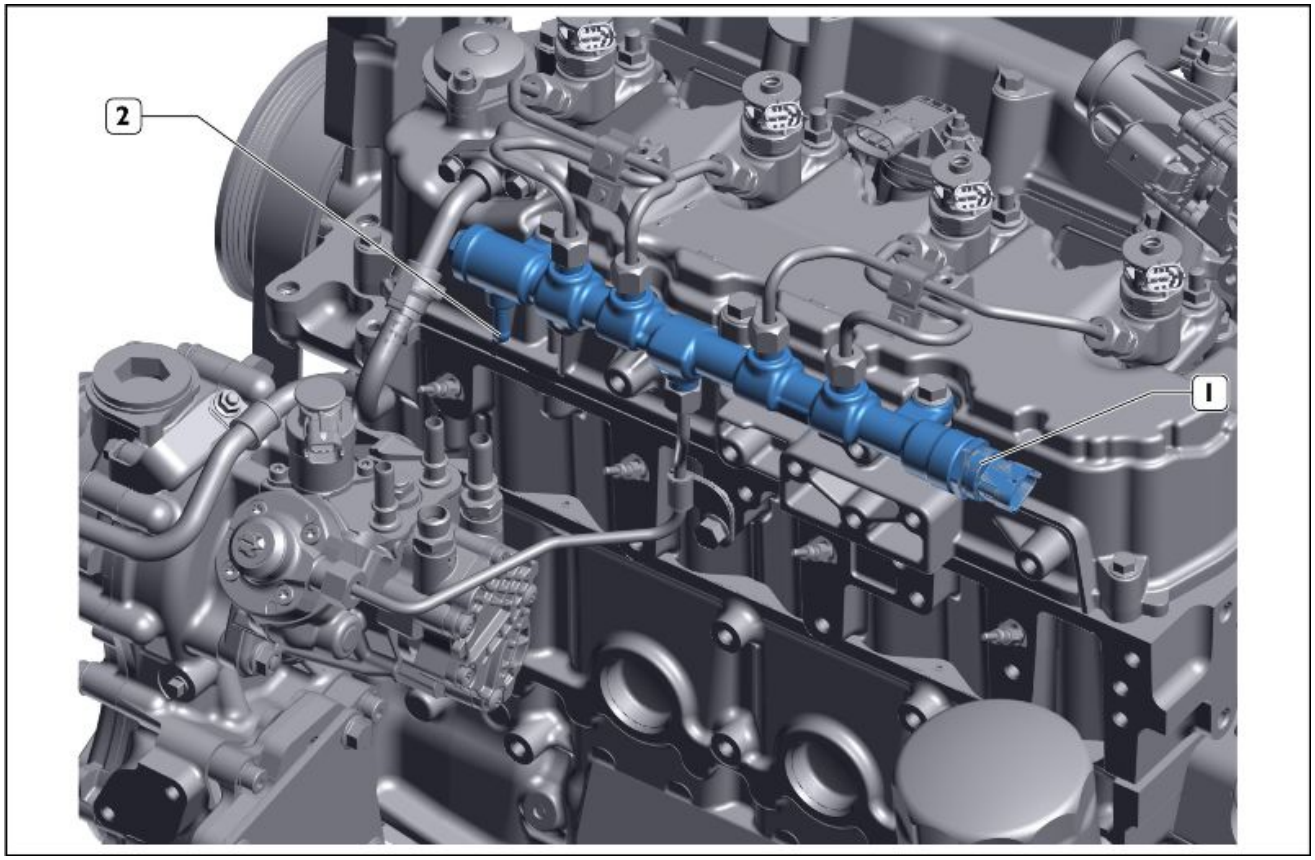
General checks

- Battery voltage is sufficient.
- Vehicle fuses are OK.
- Connectors/plugs OK. No loose contact or corrosion.
- Offboard tool Diagnosis tester.

# High pressure pump - Check - External fuel leakage high pressure system [113389116 - V1 - 22 February 2025]

Check fuel leakage at rail and injectors

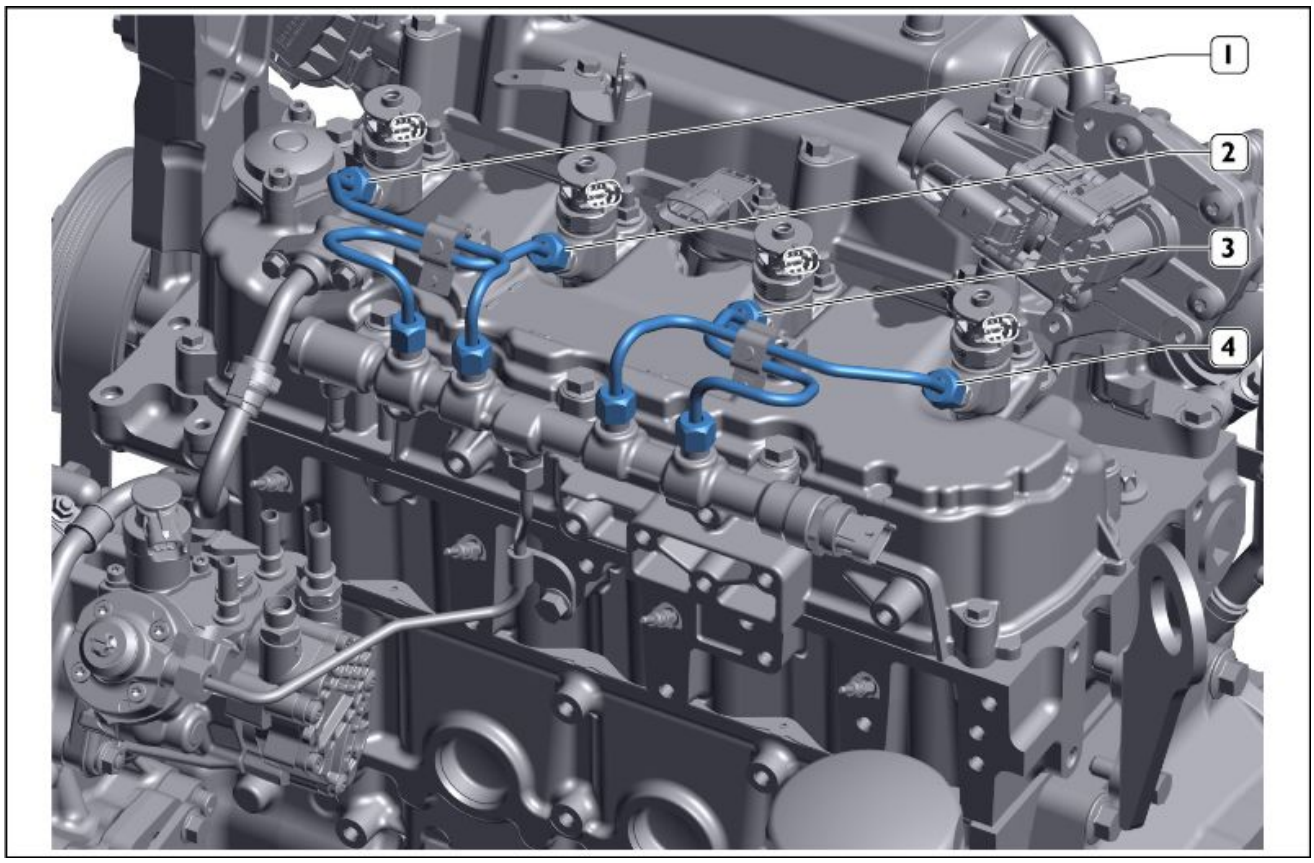
- Check the odours to identify any fuel contamination.
- Visually check for any fuel contamination.
- Refer to figure **1** and **2**, then go to step **1**.




NHIL25ENG0467TA 1

**Location of pressure sensor and limiting valve on the rail**

| Item | Description |
|---|---|
| 1 | Pressure sensor |
| 2 | Pressure limiting valve |




NHIL25ENG0502TA 2

**Location of the fuel rail and injectors**

| Item | Description |
|---|---|
| (1–4) | Injector high pressure inlets |

1. Check fuel leakage at rail and injectors
   A. No fuel odours are identified.
   B. No visible fuel in the high-pressure connectors.
   C. If there is no odour of fuel and no sign of any fuel at the connectors, go to step **3**.
   D. If there is an odour of diesel and or signs of fuel at the high-pressure connectors, go to step **2**.
2. Possible root cause
   - Damaged or leaking rail connectors.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

3. The fuel high pressure system works properly.

# High pressure pump - Check - Single injector backflow rate [113389117 - V1 - 22 February 2025]

Offboard tools

- Equipment for measuring flow rate and injector backflow pressure.
- Measuring cup **250 mL** (**1 US cup**)).
- Stopwatch.

Check single injector backflow rate

- If possible run engine until coolant temperature of **75 – 90 °C** (**167 – 194 °F**) is reached.
- Crank/start engine until diesel runs out the tube.
- Use empty measuring cup.
- Leave the engine running, insert the pipe in the measuring device and start the stop watch.
- Observe the diesel volume that runs into the measuring device. Use the same time period as in previous check of the high-pressure system backflow rate ( **60 s**).
- Note the injector individual diesel volume.
- Repeat previous steps for every injector.
- Refer to table below for a list of expected results and go to step **1**.

***NOTE:*** *Wait for approx.* ***1 – 2 min*** *between the measurement carried out on one injector and the next to allow the fuel flow to stabilise in the hose.*

| Engine condition | Volume mL / 60 s | | Remark |
|---|---|---|---|
| | Minimum | Maximum | |
| Idle | **4.0 mL** (**0.0 US cup**) | **6.0 mL** (**0.0 US cup**) | At **800 RPM** (4-valve engine) |
| High idle | **9.6 mL** (**0.0 US cup**) | **14.4 mL** (**0.1 US cup**) | At **1500 RPM** (4-valve engine) |
| Idle | **18.0 mL** (**0.1 US cup**) | **24.0 mL** (**0.1 US cup**) | At **850 RPM** (2-valve engine) |
| High idle | **20.0 mL** (**0.1 US cup**) | **30.0 mL** (**0.1 US cup**) | At **1500 RPM** (2-valve engine) |

1. Check if the volumes measured are in the range explained in the table above.
   A. If no large deviation of the single injector backflow rates between the single injectors, go to step **3**.
   B. If no individual injector backflow rate larger than three times the backflow rates of the injector with the smallest amount of backflow rate, go to step **3**.
   C. If the injectors backflow rate are NOT OK, go to step **2**.
2. Possible root cause (backflow rate too high)
   - If there are one/some injectors that shows a volume-rate above more than 3-times compared to the injector with the lowest rate, replace the injectors with this high volume rates.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

3. The injector works properly.

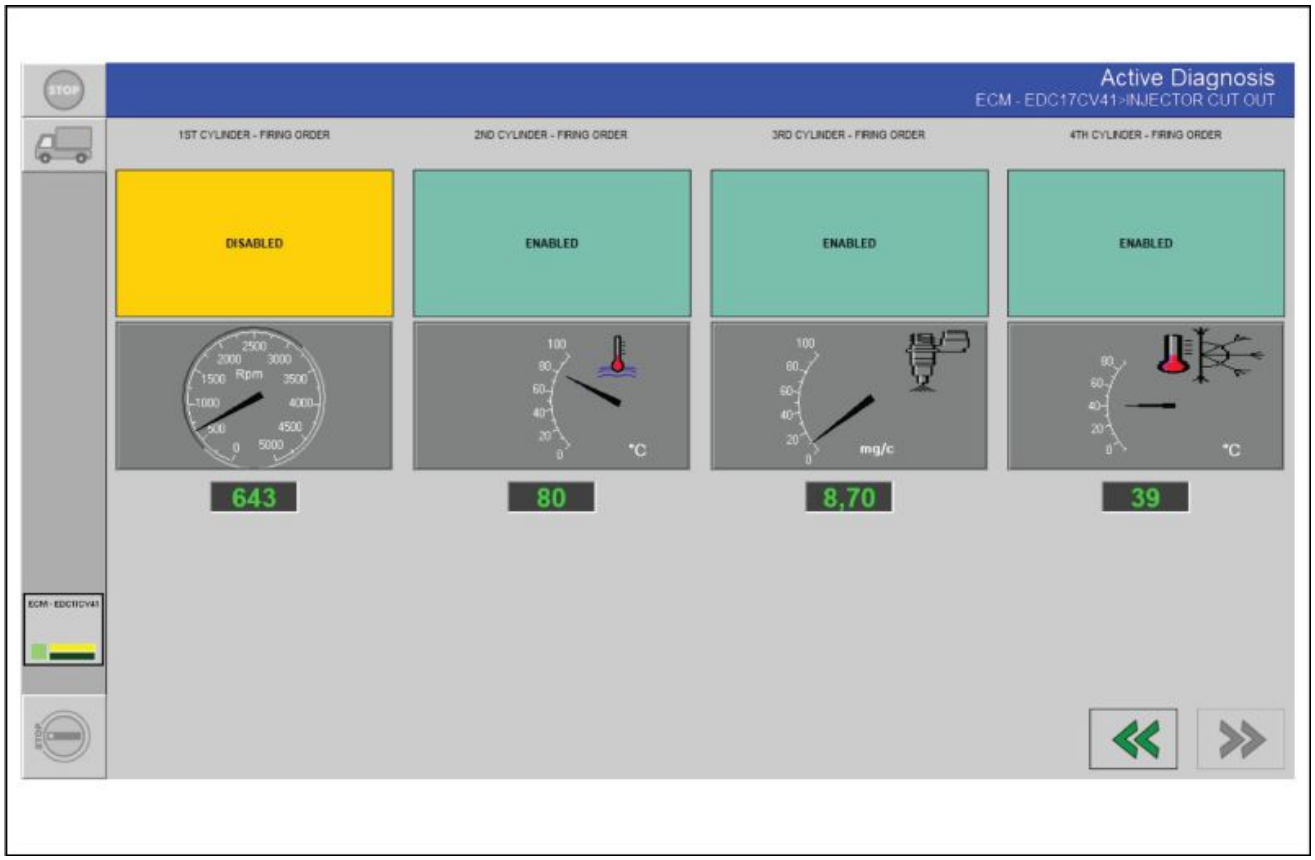
# High pressure pump - Check - Injector cut out activation check [113389118 - V1 - 22 February 2025]

## Preparation

- Turn the ignition key to ON.
- Start the engine and set its required RPM.
- Connect the diagnostic tester.

## Check

- Deactivate a single injector, so the injector do no longer deliver fuel to the cylinder.
- Observe change in system behaviour, such as changed of sound or increasing vibration.
- Repeat previous check with each cylinder.
- Go to step **1**.




NHIL25ENG0504FA 1

1. Injector cut out activation check
   A. If an injector, which is not delivering sufficient quantity, is deactivated, the system behaviour should not change greatly.
   B. If a working injector is deactivated, the sound will change and the engine will shake noticeably.
   C. If Injector cut out activation is OK go to step **3**.
   D. If Injector cut out activation is not OK, go to step **2**.

2. Possible root cause
   - Electrical defect of the injector, check wiring harness and component electrically.
   - Mechanical defect of the injector, e.g. seized fuel injector.
   - Engine mechanical defect - Cylinder head gasket damaged - Valve control damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

3. The injector works properly.

# High pressure pump - Remove [113469263 - V1 - 27 February 2025]

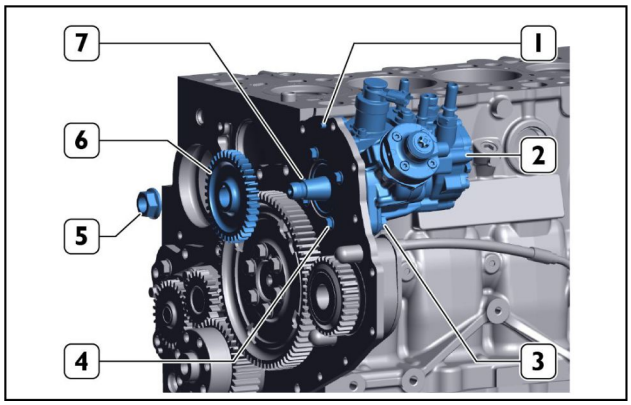
1. Unscrew the nut **(5)** from the high pressure pump shaft and remove the gear **(6)**.

***NOTE:*** *Pay attention to the reference dowel pin **(7)**.*

2. Unscrew the nuts **(3)** from the studs and remove the high pressure pump **(2)**.

***NOTE:*** *Pay attention to the reference dowel pin **(1)**.*

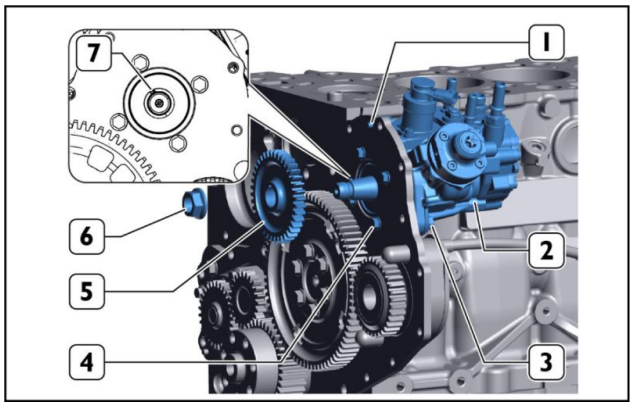
3. Unscrew the screws **(4)** and remove the spacer and the relevant gasket.
4. Unscrew the studs securing the high pressure pump **(2)** from the gear case.




NHIL25ENG0137TA 1

# High pressure pump - Assemble [113469264 - V1 - 07 March 2025]

1. Screw in the studs for fastening the high-pressure pump **(2)** to the gear case.




NHIL25ENG0167FA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| High pressure fuel pump | 3 studs M8 x 1.2 5 x 12 | | **11 +/- 1.1 N·m** |

2. Correctly insert a new gasket and install the spacer by tightening the fastening screws **(4)** to the specified torque.

| Description | Quantity | Step | Value |
|---|---|---|---|
| High pressure fuel pump spacer | 4 screws M6 x 1 x 16 | | **10 +/- 1 N·m** |

3. Fit the high-pressure pump **(2)** and tighten the nuts **(3)** to the specified torque.

***NOTE:*** *Pay attention to the reference dowel pin **(1)**.*

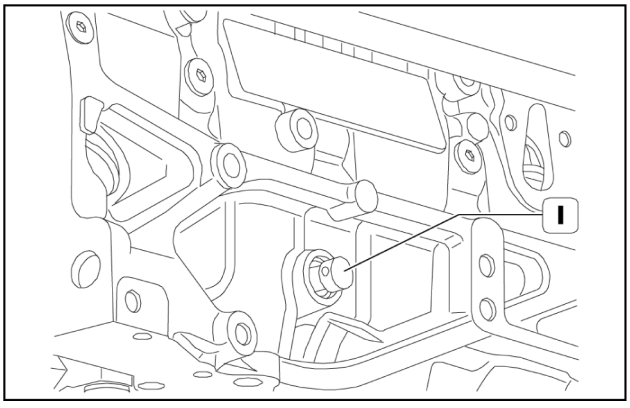
| Description | Quantity | Step | Value |
|---|---|---|---|
| High pressure fuel pump | 3 studs M8 x 1.2 5 x 12 | | **11 +/- 1.1 N·m** |

4. Turn the spindle until the reference dowel **(7)** is in the position shown in the figure.
5. Insert the gear and tighten the nut **(5)** on the high pressure pump shaft to the specified torque.

***NOTE:*** *Pay attention to the reference dowel pin **(7)**.*

| Description | Quantity | Step | Value |
|---|---|---|---|
| High pressure fuel pump | 3 studs M8 x 1.25 x 12 | | **11 +/- 1.1 N·m** |

6. Remove the special tool **(1)** in the crankcase in order to release the rotation of the crankshaft.



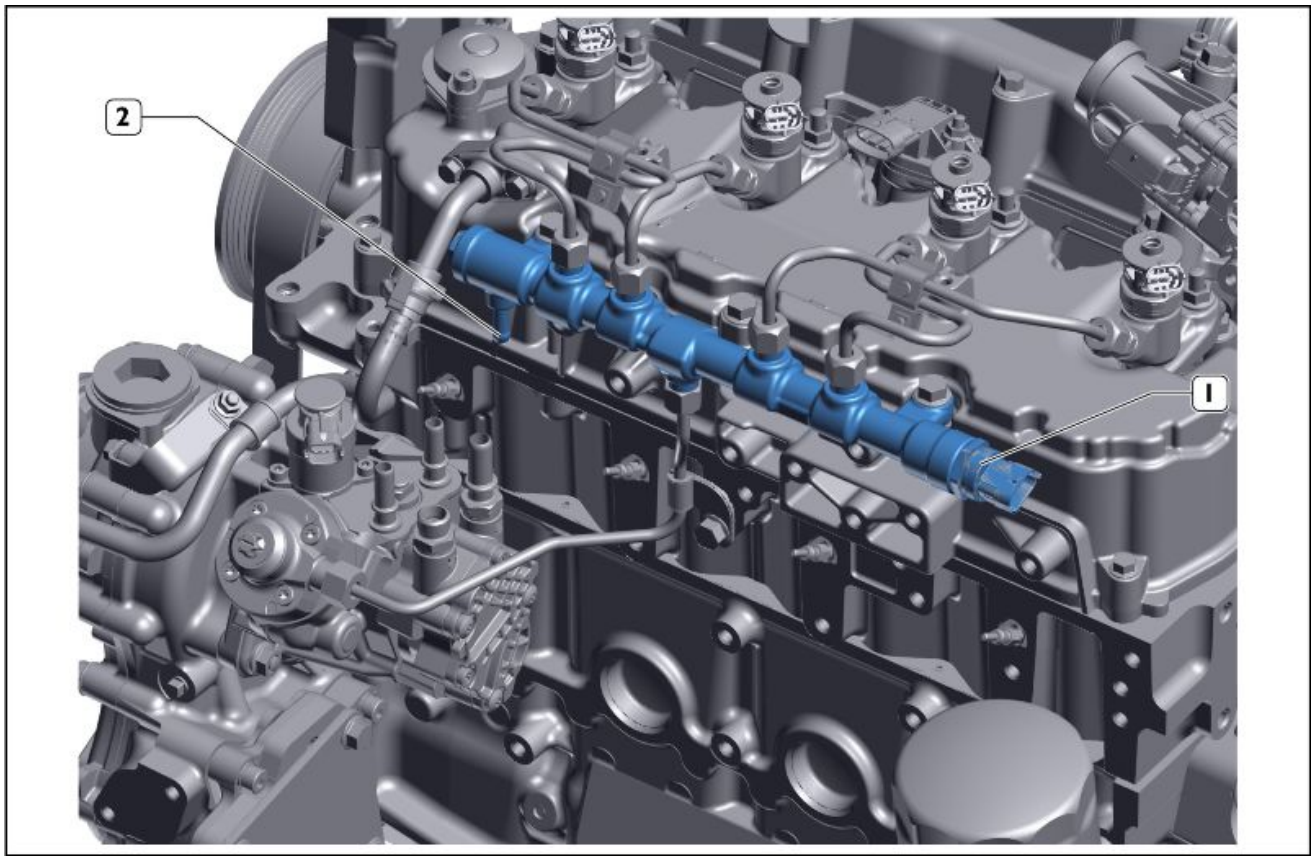

NHIL25ENG0168AA 2

| Tool / Material | |
|---|---|
| Engine TDC positioning tool | 99360612 |

# Common rail - Prepare - Pressure limiting valve (PLV) backflow rate [113387711 - V1 - 13 February 2025]

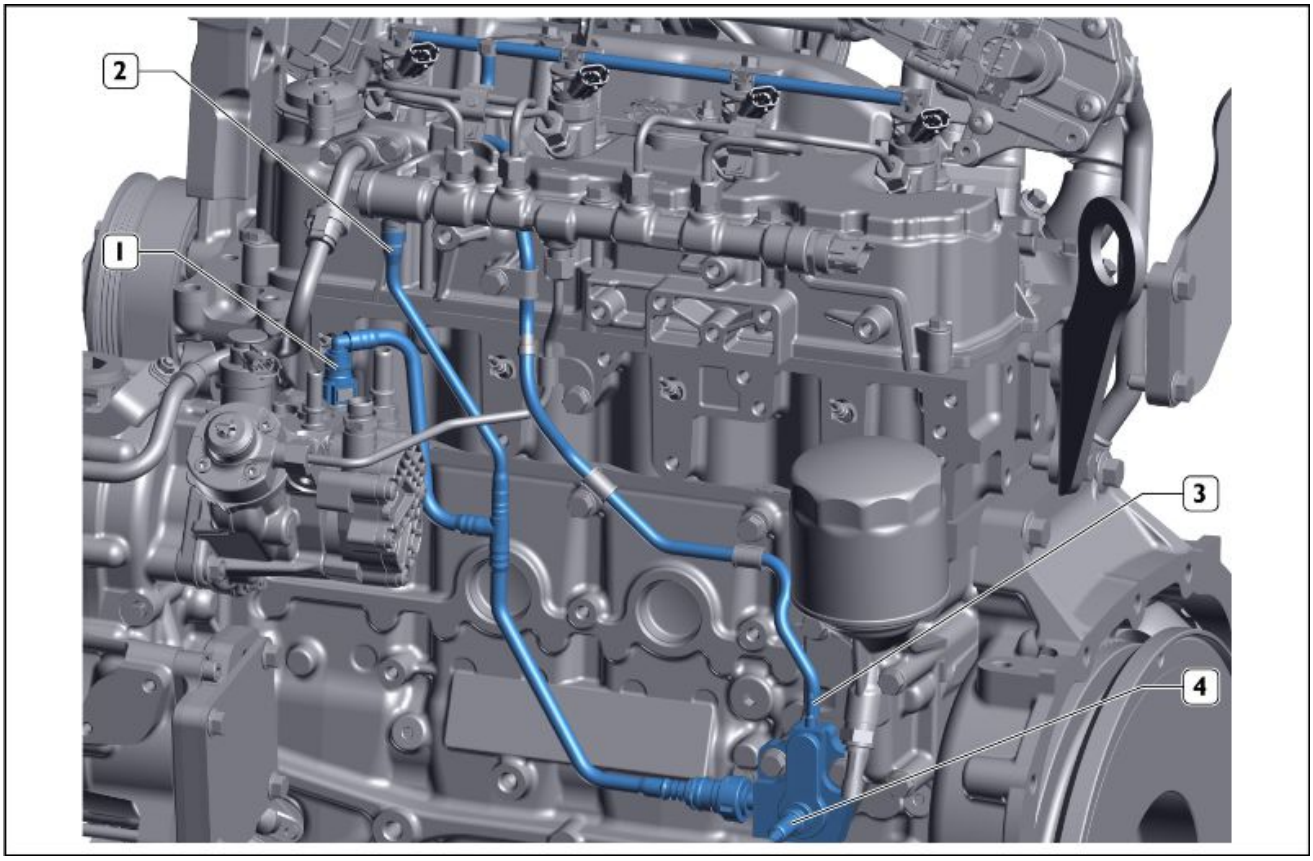
## Preparation

- Disconnect the connection pipe to the pressure limiting valve fitting (PLV).
- Connect the adaptor and hose to the pressure limiting valve backflow line (PLV).
- Plug the fitting on the connecting pipe to the pressure limiting valve (PLV).
- Tighten the system (ensure that there is no leakage).
- Prepare the measuring cup.
- To prepare for the operation, observe the figures below.




NHIL25ENG0467TA 1

| Item | Description |
|---|---|
| 1 | Pressure sensor |
| 2 | Pressure limiting valve |




NHIL25ENG0468TA 2

**Location of the backflow line**

| Item | Description |
|---|---|
| 1 | Backflow fitting to tank from high pressure pump |
| 2 | Pressure limiting valve backflow fitting |
| 3 | Injectors total backflow fitting |
| 4 | Total backflow to tank |

# Common rail - Check - Pressure limiting valve (PLV) backflow rate [113387712 - V1 - 21 February 2025]

## Check

Offboard tools

- Hose and adapter at the fitting on the PLV valve.
- Plug the fitting on the connecting pipe to the pressure limiting valve (PLV).
- Measuring cup (minimum **250.00 mL** (**1.06 US cup**)).

Check: Engine can start.

- If possible second person should increase speed to **1500 RPM** and go to step **1**.

Check: Engine cannot start.

- Turn the ignition to ON position and use the starter to crank the engine and go to step **1**.

***NOTE:*** *For the measurement of backflow in **60 s** under cranking condition, crank the engine for 5-6 times, and **10 – 12 s** (**10 – 12 s**)each time is recommended. The starter may be damaged if works continuously for a long time.*

1. Check there is no return flow into the pressure limiting valve outlet (PLV).
   A. If there is no return flow into the pressure limiting valve outlet (PLV), go to step **3**.
   B. If there is a return flow into the pressure limiting valve outlet (PLV), go to step **2**.
2. Possible root cause
   - Pressure limiting valve (PLV) in the opening position.
   - Leak in the pressure limiting valve (PLV).

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

3. The pressure limiting valve (PLV) works properly.

# Common rail - Disassemble - Over presure valve [113435963 - V1 - 25 February 2025]

1. Use a wrench to loosen the relief valve and unscrew it manually from the rail.
2. If present, remove the O-ring gasket.
3. Clean the thread of the relief valve and the contact surface of the rail.
4. Plug the seat of the relief valve on the rail using a plastic cap to prevent contamination.

# Common rail - Assemble - Over presure valve [113435964 - V1 - 06 March 2025]

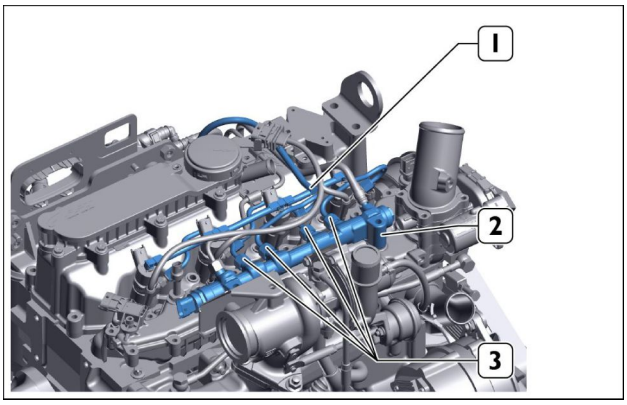
| Description | Quantity | Value |
|---|---|---|
| Pressure relief valve on rail | 1 coupling — | **100 +/- 5 N·m** |

1. Remove the plastic cap from the relief valve seat on the rail.
2. Inspect the thread and the contact surfaces of the relief valve and the rail.
3. If damage or wear is found, replace the concerned parts.
4. If fitted, install a new eyelet gasket.
5. Prior to assembly, lubricate the relief valve thread and clamp.
6. Manually screw the relief valve on the rail and tighten to a torque of:

# Fuel injectors - Remove - Injectors [113435998 - V1 - 25 February 2025]

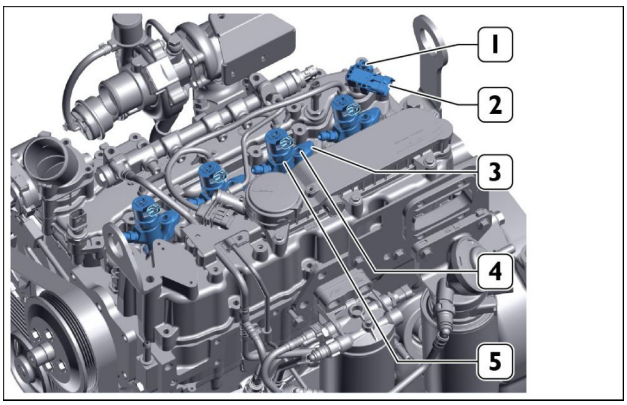
**Prior operation:**
Disconnect the engine cable from the injector cable as described in the procedure **Engine wiring harness - Remove - Engine cables (55.015)**.

1. Position a suitable container to catch any fuel.
2. Disconnect the fuel return pipe **(1)** from the injectors .
3. Disconnect the high pressure pipe fittings **(3)** from the injectors and from the rail **(2)**.



NHIL25ENG0407TA 1

4. Unscrew the screw **(1)** and remove the air temperature and supercharging pressure sensor **(2)**.
5. Unscrew the nuts **(4)** recovering the relevant washers, remove the injector **(5)** together with the fixing bracket **(3)**, from the head and mark it with the cylinder to which it belongs.
6. Unscrew the studs housed on the head.



NHIL25ENG0408TA 2

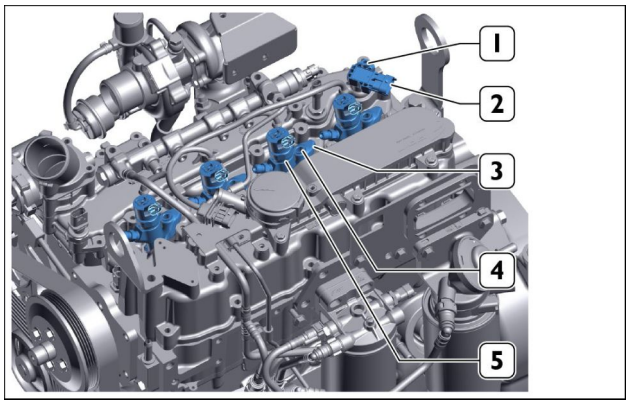
# Fuel injectors - Install - Injectors [113435999 - V1 - 06 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Air temperature and pressure sensor | 1 screw M6 x 1 x 16 | | **9 +/- 0.9 N·m** |
| Electro-injector brackets | 4 nuts M8 x 1.25 | | **18 +/- 1.8 N·m** |
| Fuel delivery pipes to the electro-injectors | 4 rail-side couplings M14 x 1.5 | | **35 +/- 1.75 N·m** |

1. Fit the studs and tighten them to the specified torque.

***NOTE:*** *Replace washers before refitting the injector.*

2. Fit the electro-injector **(5)** on the head together with the fixing bracket **(3)** and tighten the nuts **(4)**, together with their washers, to the prescribed torque.
3. Fit the air temperature and supercharging pressure sensor **(2)** and tighten the screw **(2)** to the prescribed torque.




NHIL25ENG0408TA 1

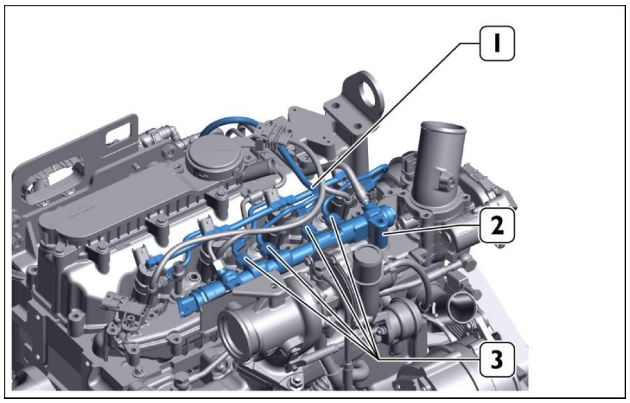
| Description | Quantity | Step | Value |
|---|---|---|---|
| Electro-injector brackets | 4 studs M8 x 1.25 x 65 | | **28 +/- 1.4 N·m** |

4. Connect the high pressure pipe couplings **(3)** on the injectors and on the rail **(2)**.

***NOTE:*** *The pipes **(3)**, as they are subject to high pressure, must be replaced each time they are removed.*

5. Connect the fuel return pipe **(1)** from the electro-injectors.

***NOTE:*** *Visually check that the pipes are not blocked or damaged*




NHIL25ENG0407TA 2

| Description | Quantity | Step | Value |
|---|---|---|---|
| Fuel delivery pipes to the electro-injectors | 4 injector- side couplings M12 x 1.5 | | **25 +/- 1.25 N·m** |

**Next operation:**
Connect the engine cable from the injector wiring, as described in the procedure **Engine wiring harness - Install - Engine cables (55.015)**.

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# Engine - 10

## Air cleaners and lines - 202

**F6AFL413A*U001**

# Contents

# Engine - 10

## Air cleaners and lines - 202


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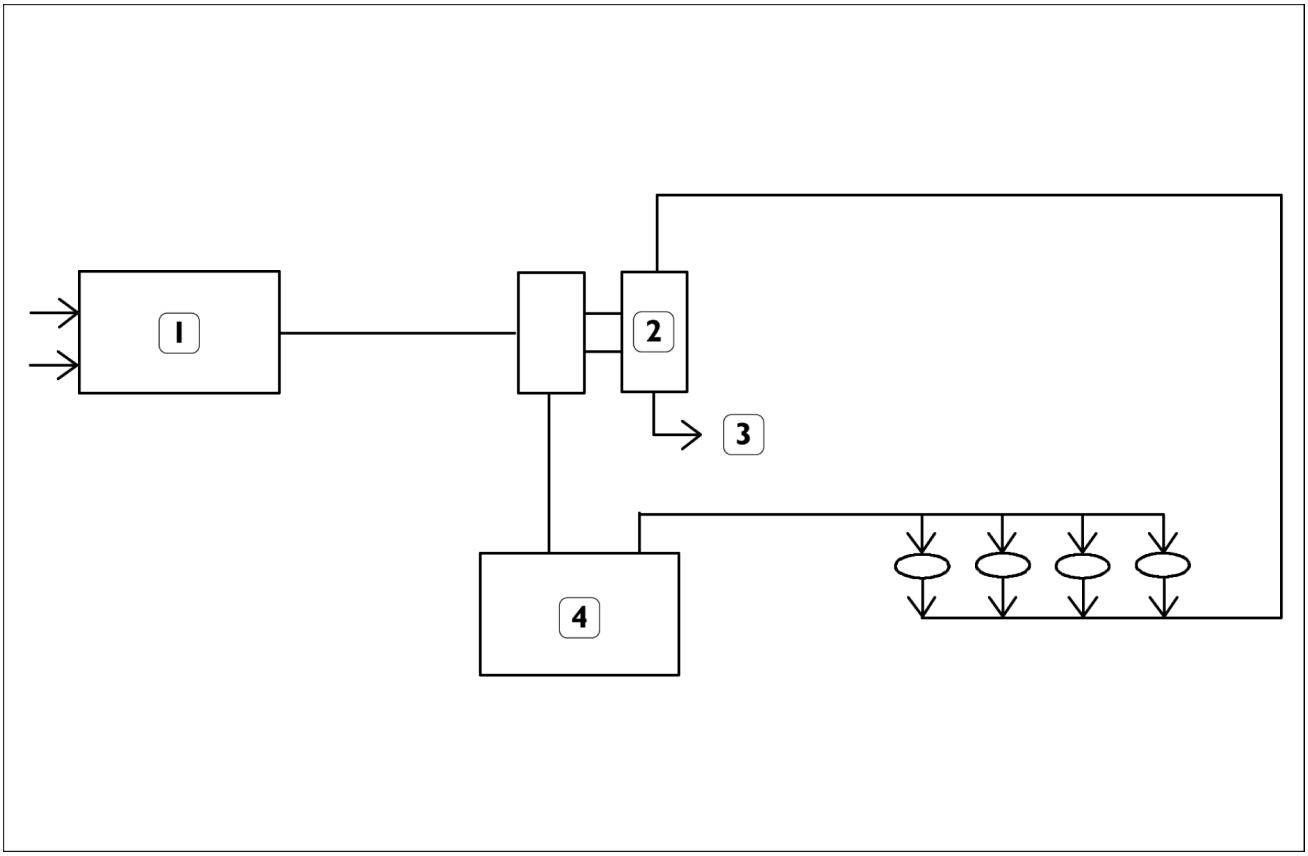
# Air cleaners and lines - Overview - Supercharging [113434582 - V1 - 05 March 2025]

The supercharging system consists of: an air filter **(1)**, a turbocharger **(2)** and the intercooler **(3)**.

The air filter is the dry type comprising a filter cartridge that should be replaced at regular intervals.

The function of the turbocharger is to use the energy of the engine's exhaust gas to deliver pressurised air to the cylinders.

The intercooler consists of an air/water exchanger mounted on the engine coolant radiator with the function of lowering the temperature of the compressed air exiting the turbocharger.




NHIL25ENG0351FA 1

| Item | Description |
|---|---|
| 1 | Air filter |
| 2 | Turbocharger |
| 3 | To flush |
| 4 | Intercooler |

# Air cleaners and lines - Prepare - Charge air system [113387736 - V1 - 21 February 2025]

## Preparation

- Ignition switch set to OFF position.
- Air filter is clean.
- Offboard tools: recommended tools BOSCH SMT 300.

NHIL25ENG0545FA 1

**Example of smoke test tool (Bosch SMT 300)**

# Air cleaners and lines - Check - Charge air system [113387737 - V1 - 21 February 2025]

## Visually check air charge piping

1. Visually check the following air charge piping for damages, loose fittings, tightness:
   - Air charge pipes upstream and downstream the turbo charger.
   - Pipes upstream and downstream the charge air cooler.
   - Pipe from the charge air cooler to the intake air manifold.
   - Refer to **1** for aid and go to step **2**

NHIL25ENG0476TA 1

**Boost pressure lines**

| Item | Description |
|---|---|
| 1 | Exhaust pipe outlet from Turbocharger |
| 2 | Supercharging air pipe to heat exchanger |

NHIL25ENG0477TA 2

**Boost pressure lines to intake air manifold**

| Item | Description |
|---|---|
| 1 | Pipe from the charge air cooler to intake air manifold |

2. Check air charge piping:
   A. Charge pipes are not damaged.
   B. No loose clamps.
   C. If air charge piping is not damaged, refer to **Air cleaners and lines - Check - Charge air system (10.202)** .
   D. If air charge piping is damaged, go to step **3**.
3. Possible root cause
   - Charge pipes damaged.
   - Loose clamps.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Air cleaners and lines - Check - Charge air system [113387738 - V1 - 21 February 2025]

## Check air cooler and pressure pipes with smoke test tool

***NOTE:*** *Basic Testing Procedure*

1. The following procedure 5 describe how to perform a basic testing procedure in order to detect air cooler and/or pressure pipes leakages. Through this procedure is possible to check the following components:
   - Gasket leak.
   - Clamps leak.
   - Pipe/manifold damages.
   - Charge air cooler damages.
2. Procedure:
   - Connect the smoke test tool to workshop air supply.
   - Connect the smoke test tool to battery supply terminals.
   - Connect smoke supply hose to system being tested (flow control valve full opened).
   - Press “ON” button and fill system with smoke for **5 min**.
   - Use white light supplied and look for exiting smoke or use ultraviolet light supplied to look for fluorescent dye deposit at exact location of a leak.
   - Refer to **1** for aid and go to step **3**.

NHIL25ENG0478TA 1

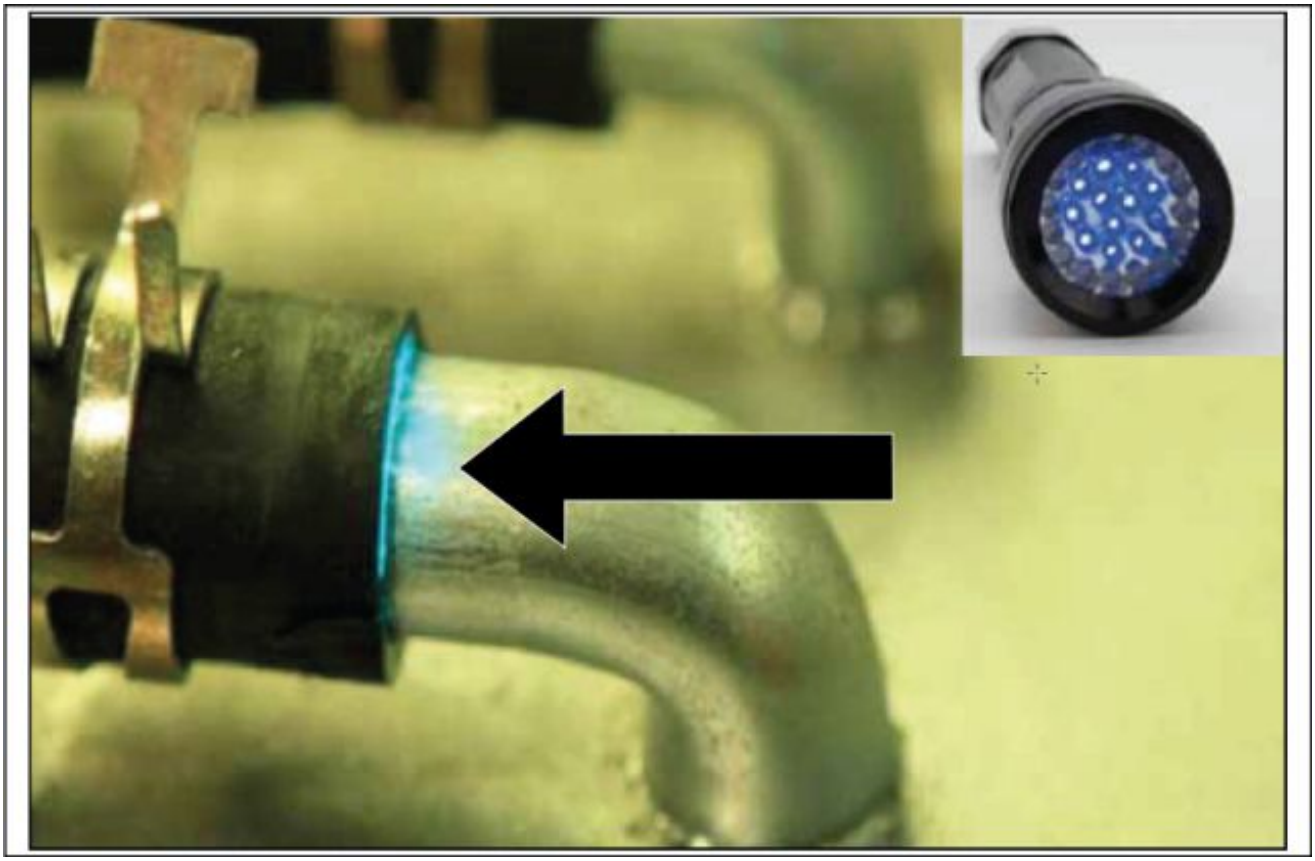
**Example of smoke test tool for air intake leakage check**

NHIL25ENG0479TA 2

**Example of leakage detection with smoke test tool**

NHIL25ENG0480FA 3

**Vapours can be identified under white light (example)**



NHIL25ENG0481TA 4

**Dye can be identified under UV light with yellow glass**

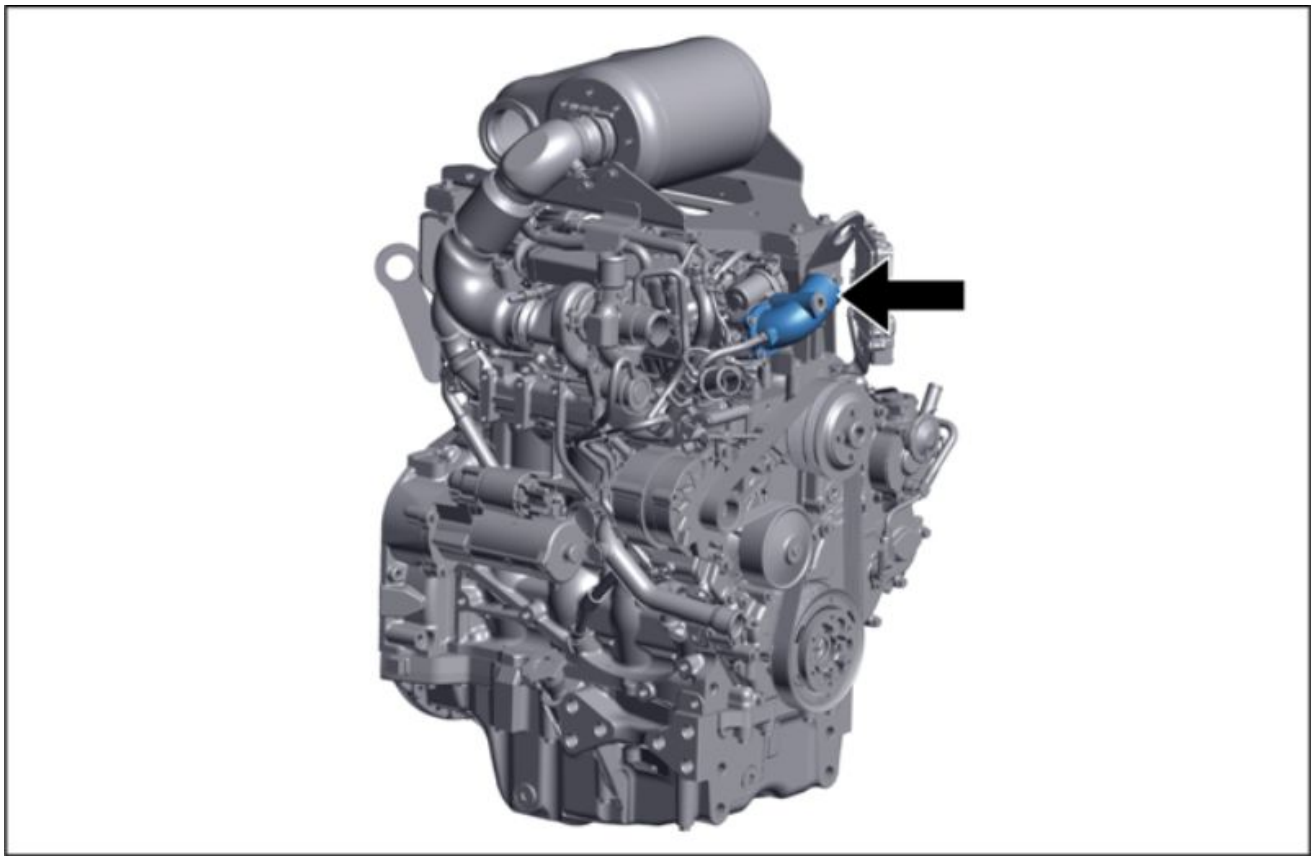
3. Smoke leak test the air cooler and charged air pipes with smoke leak tester.
   A. Charge air pipes are not damaged.
   B. Charge air pipes are correctly fitted.
   C. Charge air cooler pipes are not damaged.
   D. Charge air cooler pipes are correctly fitted.
   E. Charge air cooler is not damaged.
   F. Gasket/seals are not damaged.
   G. If charge air cooler is not damaged, refer to **Air cleaners and lines - Check - Charge air system (10.202)**.
   H. If charge air cooler is damaged, go to step **4**.
4. Possible root cause
   - Charge air pipes are damaged.
   - Charge air pipes are not correctly fitted.
   - Charge air cooler pipes are damaged.
   - Charge air cooler pipes are not correctly fitted.
   - Gasket/seals are damaged.
   - Intake air manifold is not correctly fitted and/or damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Air cleaners and lines - Check - Charge air system [113387739 - V1 - 21 February 2025]

## Visually check intake air manifold

1. Visually check intake air manifold
   - Start engine and run the engine in idle.
   - Visually check the intake air manifold for leaks/wall cracks.
   - Refer to **1** for aid and go to step **2**.



NHIL25ENG0482FA 1

**Intake air manifold location**

2. Visually check intake air manifold
   1. Intake air manifold correctly fixed and not damaged.
   2. If intake air manifold is OK, refer to **Air cleaners and lines - Check - Intake air system (10.202)**.
   3. If intake air manifold is NOT OK, go to step **3**.
3. Possible root cause
   - Intake air manifold is not correctly fixed or damaged.
   - Damaged gasket.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Air cleaners and lines - Check - Intake air system [113387740 - V1 - 21 February 2025]

1. Check charge air cooler
   - Ignition switch set to OFF position.
   - Check charge air cooler for cracks and damages.
   - Check the charge air pipes to/from the air cooler for damage/spits/loose fitting.
   - Check on air leakage using pressurized air.
   - Ignition switch set to ON position and start engine.
   - Check on air leakage during idle.
   - Refer to **1** for aid and go to step **2**.

NHIL25ENG0483TA 1

**Charge air cooler pipes**

| Item | Description |
|---|---|
| 1 | Pipe from turbocharger to supercharging air heat exchanger |
| 2 | Charge air cooler pipe to intake air manifold |

2. Check charge air cooler
   - Charge air cooler is neither damaged nor cracked.
   - Charge air cooler pipes are neither damaged nor cracked.
   - If charge air cooler is not damaged, go to step **4**.
   - If charge air cooler is damaged, go to step **3**.

3. Possible root cause
   - Damaged charge air cooler.
   - Damaged charge air cooler pipes.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The charge air system works properly.

# Air intake lines - Prepare - Intake air system [113387717 - V1 - 13 February 2025]

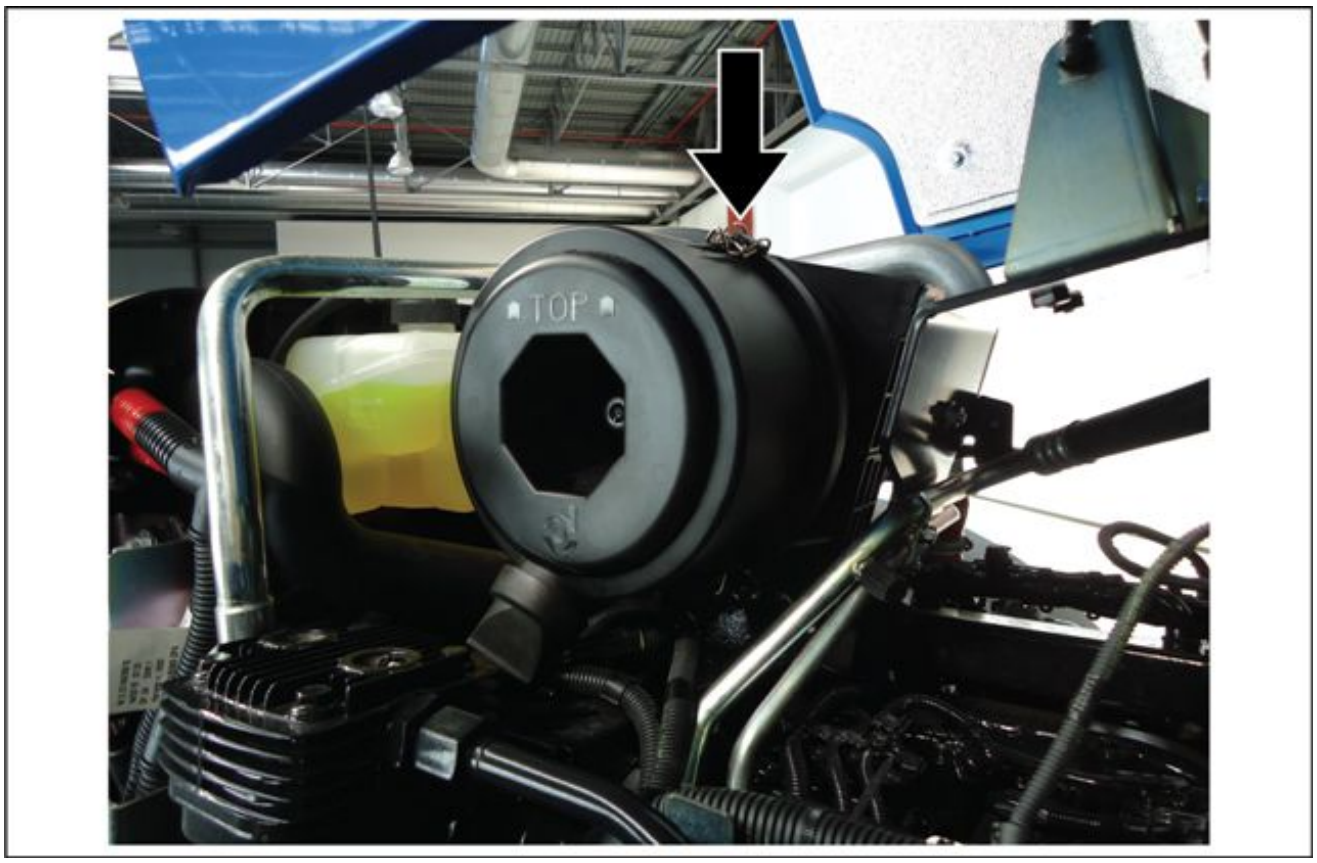
## Preparation

- Ignition switch set to OFF position.
- Air filter clean.

# Air intake lines - Check - Intake air system [113387718 - V1 - 21 February 2025]

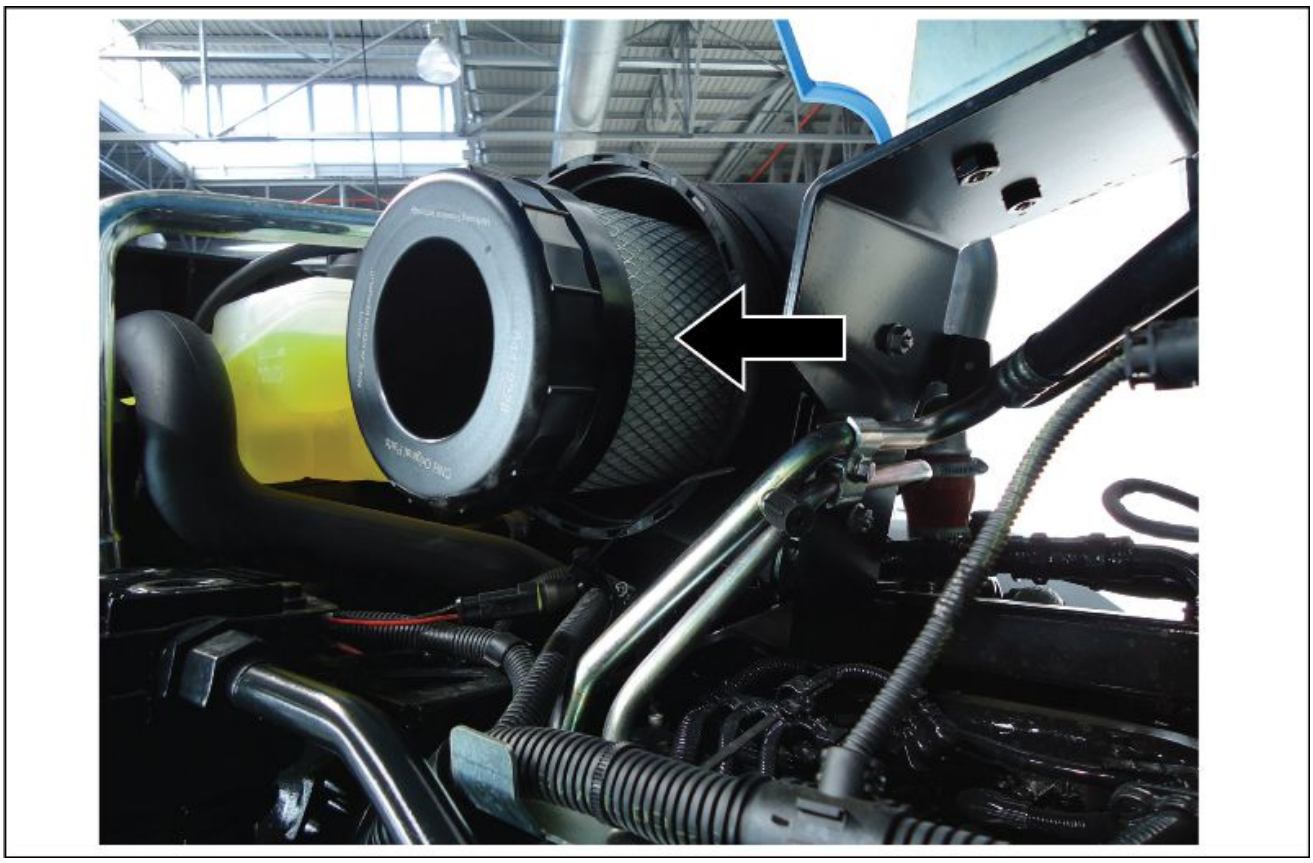
## Visually check air filter and housing

1. Visually check air filter and housing.
   - Check air filter cover/housing clamps for correct fitting and tightness.
   - Open the air filter and housing.
   - Visually check air filter and housing for any contamination.
   - Visually check air filter and housing for physical damage.
   - Refer to **1** for aid and go to step **2**.




NHIL25ENG0472TA 1

**Air filter housing clamps**



NHIL25ENG0473TA 2

**Intake air filter**

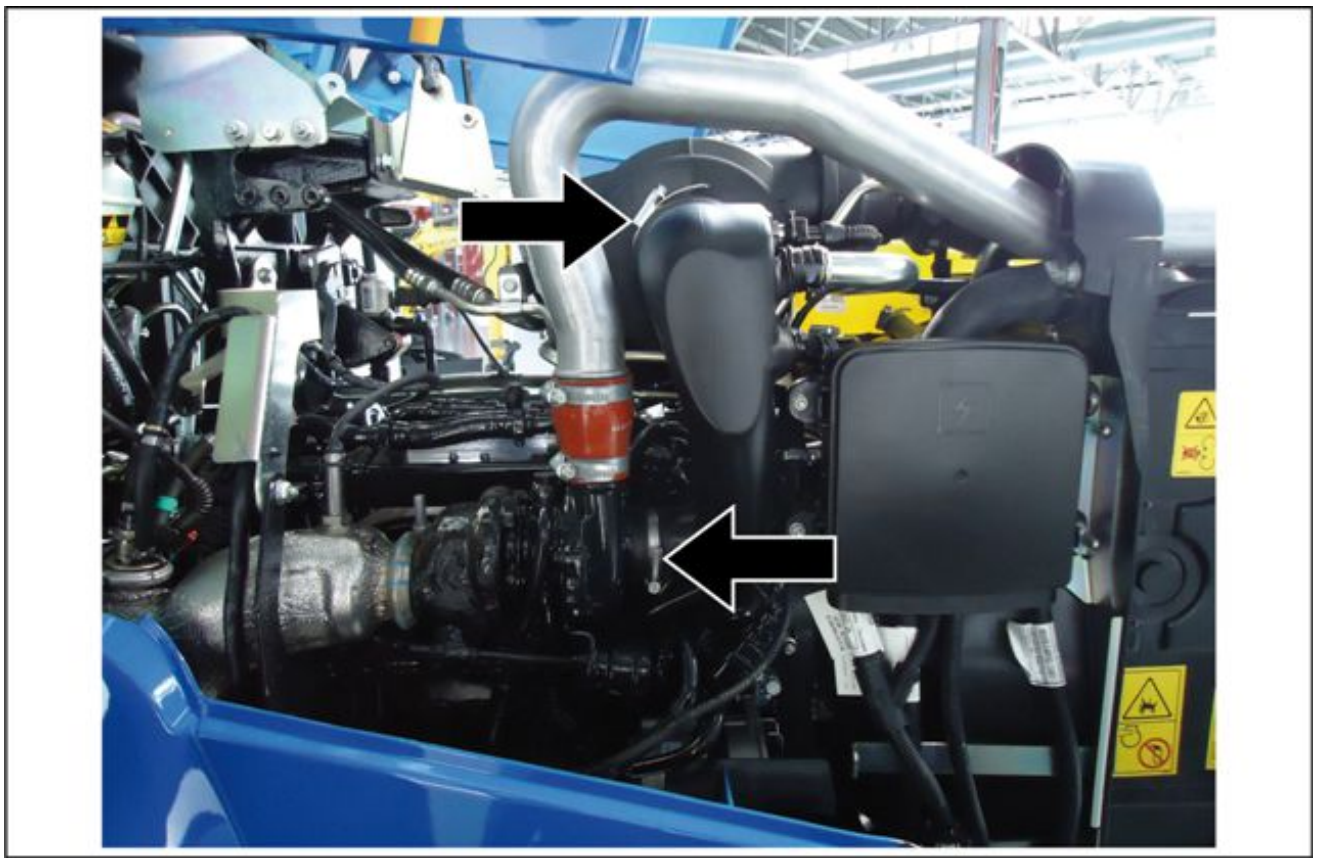
2. Check if air filter and housing are OK.
   A. No loose clamps.
   B. Air filter are not clogged.
   C. Air filter housing are not damaged.
   D. If air filter and housing are OK, refer to **Air intake lines - Check - Intake air system (10.202)**.
   E. If air filter and housing are NOT OK, go to step **3**.
3. Possible root cause
   - Loose clamps.
   - Air filter clogged, causing too low air flow.
   - Damaged air filter housing.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Air intake lines - Check - Intake air system [113387719 - V1 - 21 February 2025]

## Visually check air pipes

1. Visually check air pipes.
   - Visually check intake air pipes for correct fittings and tightness.
   - Refer to **1** for aid and go to step **2**.



NHIL25ENG0474TA 1

**Intake air pipe upstream of the turbocharger**

2. Check if air pipes are OK.
   A. Air pipes are not damaged.
   B. Air pipes are installed correctly.
   C. If air pipes are OK, go to step **4**.
   D. If air pipes are NOT OK, go to step **3**.
3. Possible root cause
   - Air pipes are damaged.
   - Air pipes are not installed correctly.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The intake air system works properly.

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# Engine - 10

## Turbocharger and lines - 250

**F6AFL413A*U001**

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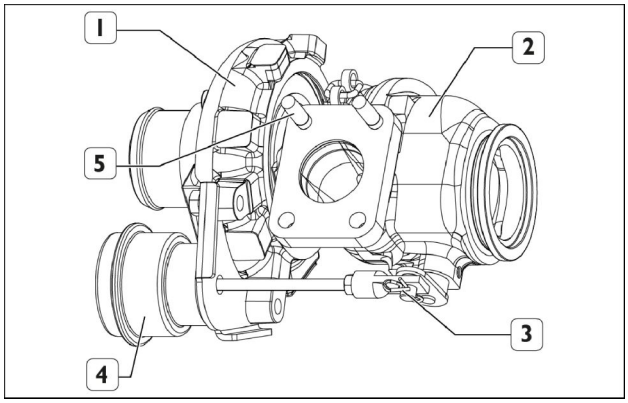
# Turbocharger - Overview [113434611 - V1 - 06 March 2025]

The turbocharger, installed on the exhaust manifold, mainly comprises:

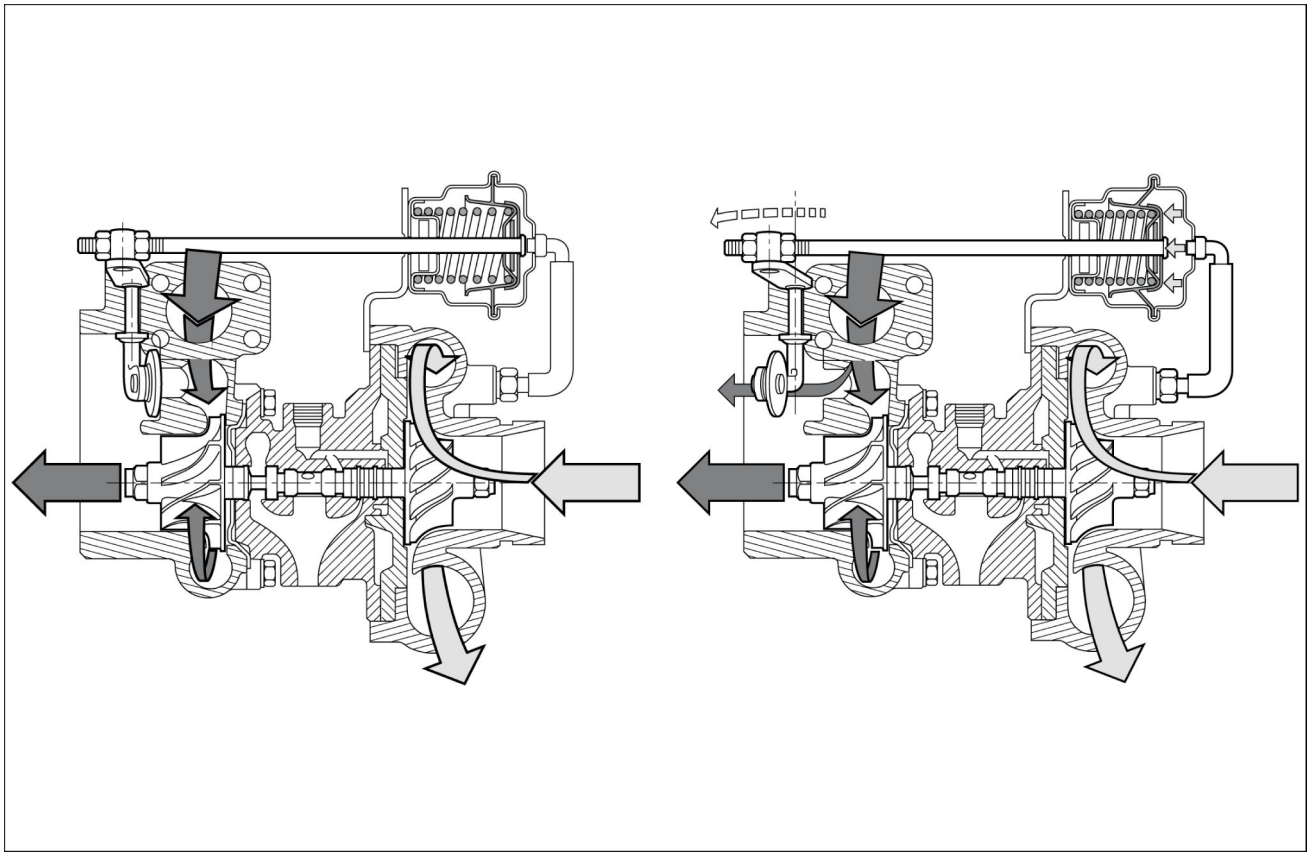
- A central casing housing a shaft supported by bushings at whose opposite ends are fitted the turbine and the compressor wheels;
- A turbine casing and a compressor casing mounted on the end of the central body;
- Overpressure relief valve (Wastegate) applied on the turbine casing. Its function is to choke the exhaust gas outlet, sending a portion of the exhaust gas straight into the exhaust pipe when the turbocharging pressure downstream from the turbocharger reaches the calibration value




NHIL25ENG0352AA 1

| Item | Description |
|---|---|
| 1 | Compressor body. |
| 2 | Turbine body. |
| 3 | Waste Gate actuator lever. |
| 4 | Waste-Gate valve pneumatic actuator. |
| 5 | Stud for fixing the turbocharger to the exhaust manifold. |

## Waste Gate Valve



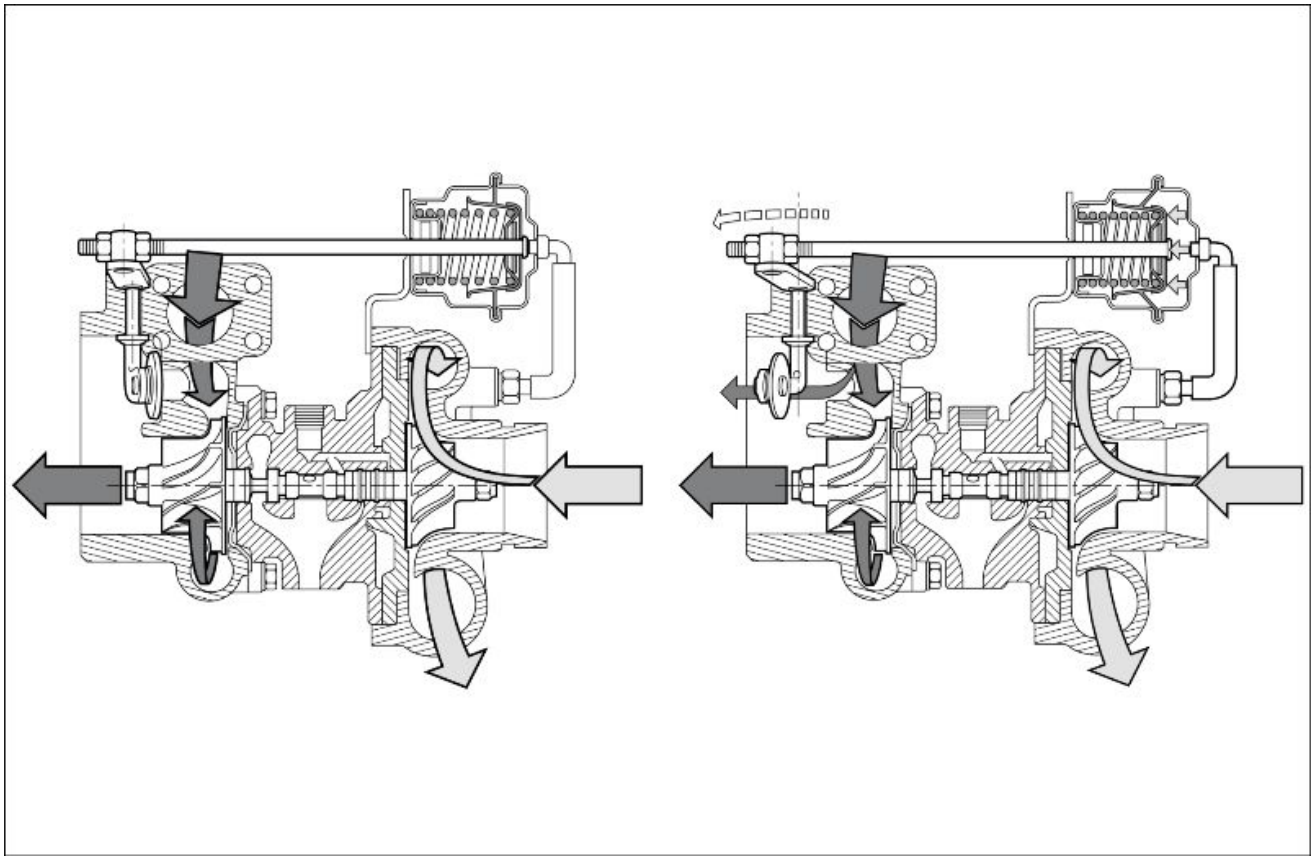
NHIL25ENG0353TA 2

| Item | Description |
|---|---|
| A | Closed throttle valve. |
| B | Throttle valve open. |

Section showing a turbocharger with a waste-gate valve

***NOTE:*** *Verifying an anomalous operation of the engine, due to the booster system, it is recommended, before performing controls on the turbocharger, to check the efficiency of the sealing gaskets and the fixing of the connection sleeves, making sure of clogging absence inside intake sleeves, air filter or inside radiators.*
*If the turbocharger damage is due to lack of lubrication, check that the oil circulation pipes are not broken or clogged and in that case replace it.*

# Turbocharger - Overview - Waste gate valve [113434620 - V1 - 06 March 2025]



NHIL25ENG0354FA 1

**Demonstrative cross-section of a turbocharger with waste-gate valve**

The turbocharger is equipped with a pressure regulator valve fit on the exhaust manifold upstream of the turbine and controlled by a pneumatic actuator, connected by a pipe to the intake manifold.

Its purpose is to limit the quantity of the exhaust gas that acts on the turbine, sending a part directly into the exhaust pipe when the boost pressure downstream of the compressor reaches the maximum prescribed value.

***NOTE:*** *Verifying an anomalous operation of the engine, due to the booster system, it is recommended, before performing controls on the turbocharger, to check the efficiency of the sealing gaskets and the fixing of the connection sleeves, making sure of clogging absence inside intake sleeves, air cleaner or inside radiators. If the turbocharger damage is due to a lack of lubrication, check that the oil circulation pipes are not burst or clogged, in which case replace them or repair the fault.*

# Turbocharger - Prepare - Turbo system [113387713 - V1 - 21 February 2025]

## Preparation

- This check requires the pressure hand pump as off-board tool.

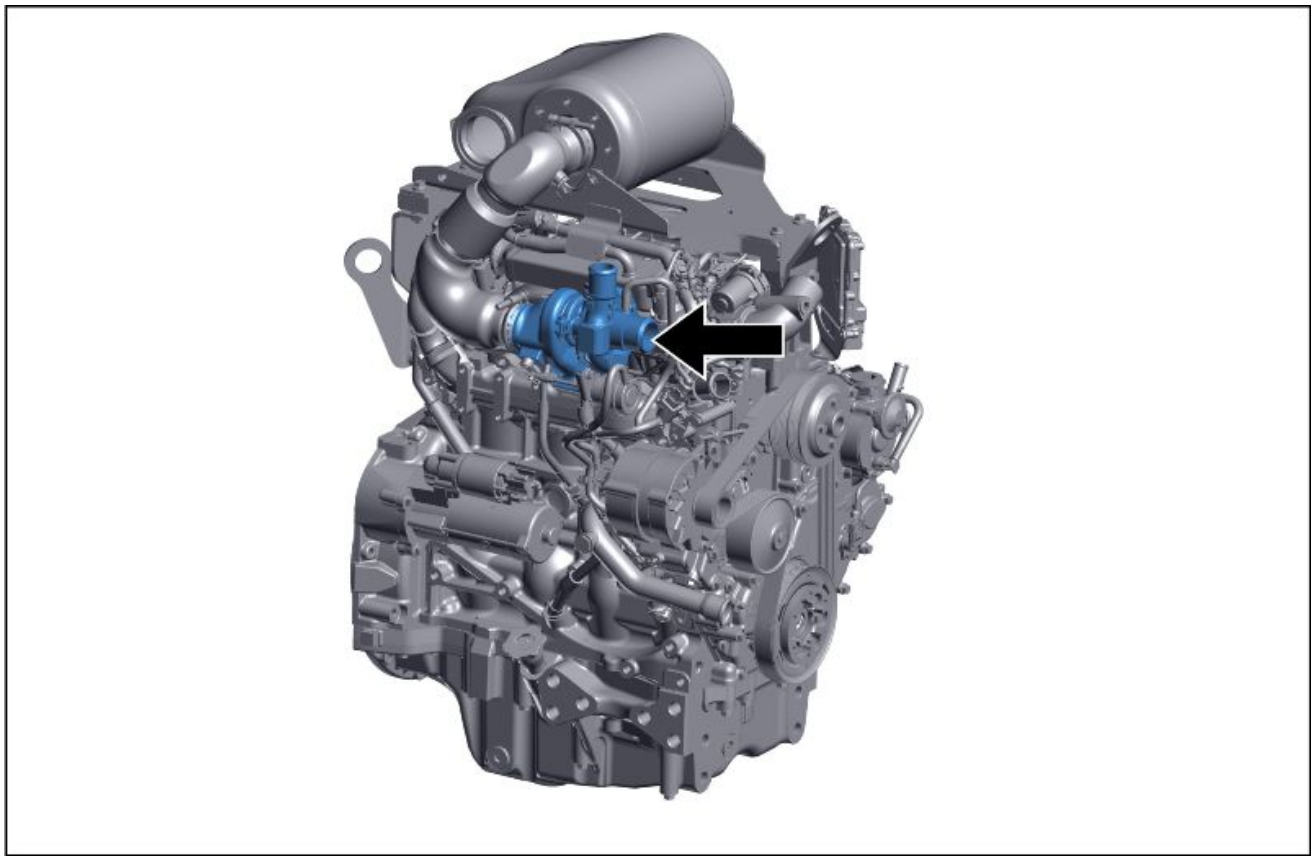
NHIL25ENG0542FA 1

# Turbocharger - Check - Turbo system [113387714 - V1 - 21 February 2025]

## Check turbo charger

1. Check turbo charger.
   - Start engine in low idle.
   - Check the turbo charger mechanical sounds.
   - Turn the ignition switch to OFF position.
   - Dismount the air intake and boost pressure pipes to get access to the turbo charger blades.
   - Visually check the turbo charger for debris.
   - Check manually the rotation of the turbo charger wheel by moving it.
   - Check manually the bearing of the turbo charger by feel if it is moving under pressure.
   - Refer to **1** for aid and go to step **2**.

***NOTE:*** *Please take special care/attention to not damage the turbo. Use clean gloves when touching the turbo wheel blade. Only use small amount of force to move the wheel.*



NHIL25ENG0470FA 1

**Air turbo charger**

2. Check turbo charger
   A. Bearing of the turbo charger not damaged.
   B. Compressor and/or turbine wheels of the turbo charger not blocked or stiff.
   C. Turbo charger not damaged.
   D. If turbo charger is not damaged, refer to **Turbocharger - Check - Turbo system (10.250)**.
   E. If turbo charger is damaged, go to step **3**.
3. Possible root cause
   - Bearing of the turbo charger damaged.
   - Compressor and/or turbine wheels of the turbo charger blocked or stiff.
   - Turbo charger damaged.

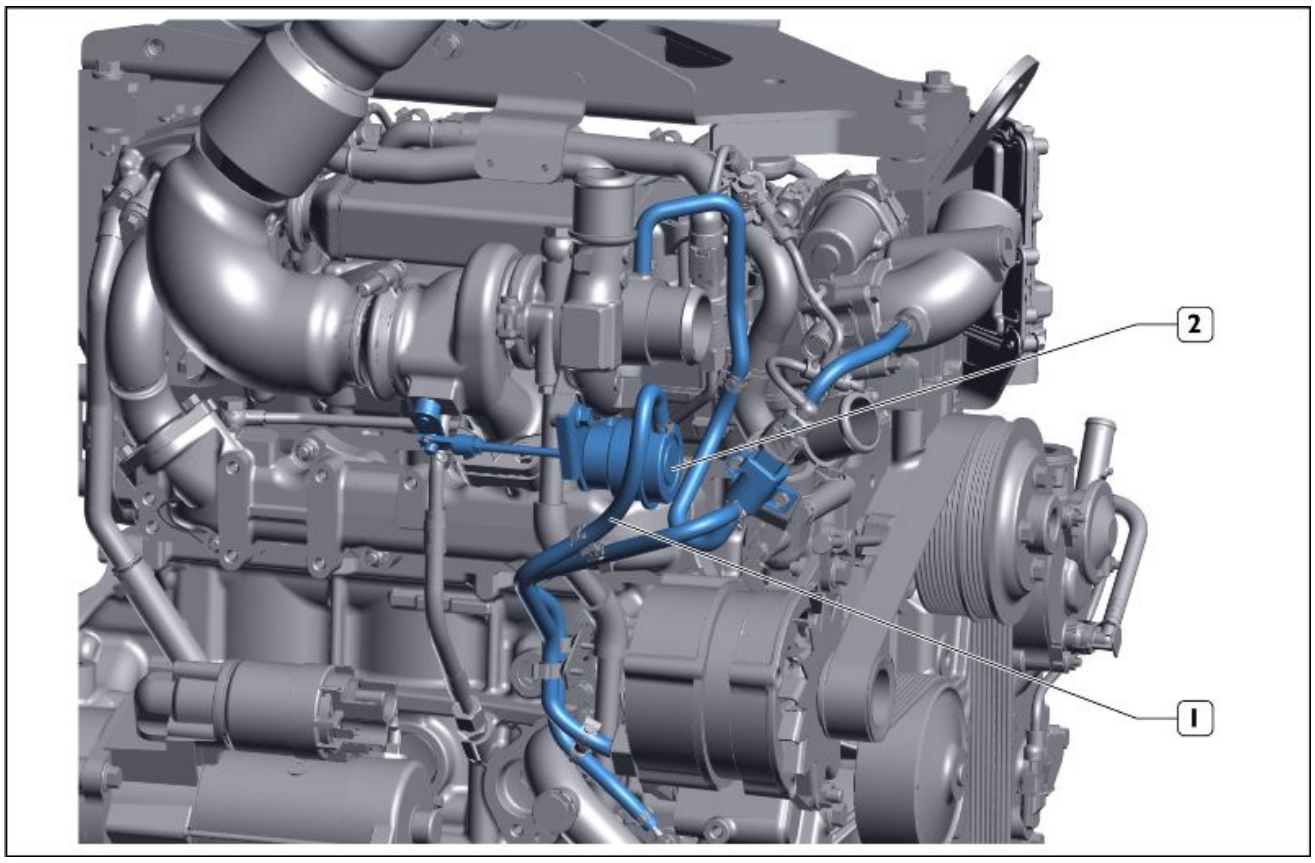
***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Turbocharger - Check - Turbo system [113387715 - V1 - 21 February 2025]

## Check wastegate valve

1. Check wastegate valve.
   - Visually check the wastegate valve for debris.
   - Check if the hose of the wastegate valve is lose or damaged.
   - Use a pressure hand pump to check the correct actuation of the wastegate valve.
   - Refer to **1** for aid and go to step **2**.

***NOTE:*** *Pump and monitor gradually the pressure at wastegate valve in order to check if the actuation of the valve is reached at lower pressure than* ***2.5 bar*** *(absolute pressure). The air pressure changes constantly depending on altitude or weather conditions. Therefore, the pressure is absolutely measured during our tests. The pressure is always related to absolute zero - the absolute vacuum p(abs)= p(amb) +p(bar).*




NHIL25ENG0471TA 1

**Wastegate valve**

| Item | Description |
|---|---|
| 1 | Wastegate valve hose |
| 2 | Wastegate valve |

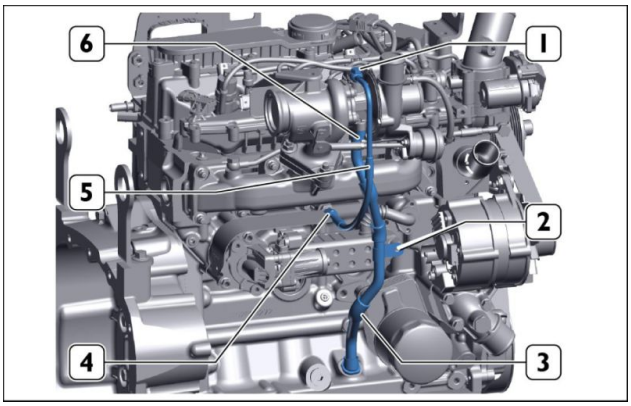
2. Check wastegate valve.
   A. Wastegate valve hose not lose and not damaged.
   B. Wastegate valve leverage not blocked and not damaged.
   C. Wastegate valve not blocked and not damaged.
   D. Check the moving of the wastegate rod at approximately **2.5 bar** (absolute pressure) for the actuation of the valve.
   E. If wastegate valve is not damaged, go to step **4**.
   F. If wastegate valve is damaged, go to step **3**.
3. Possible root cause
   - Wastegate valve hose lose or damaged.
   - Wastegate valve leverage blocked or damaged.
   - Wastegate valve blocked or damaged (probably caused by damaged valve spring).

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The turbo charger works properly.

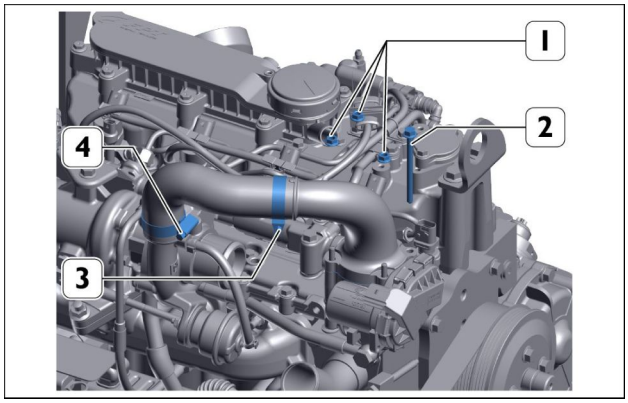
# Turbocharger - Remove [113434630 - V1 - 06 March 2025]

1. Unscrew the fittings **(1)** and **(4)** and remove the oil delivery pipe **(5)** to the turbocharger.
2. Unscrew the fastening screw **(2)** of the oil return pipe mounting bracket **(3)** from the turbocharger.
3. Unscrew the fastening screws **(6)** and remove the oil return pipe **(3)** from the turbocharger.



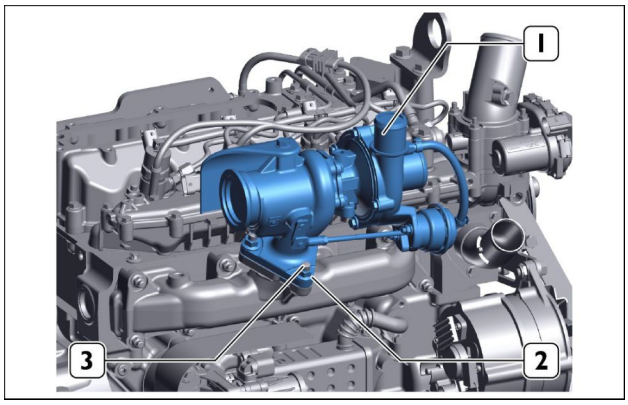

NHIL25ENG0355TA 1

4. Before proceeding to dismantle the turbocharger, the air line must be removed. Loosen the collars **(3)** and **(4)** and remove the pipe.




NHIL25ENG0356TA 2

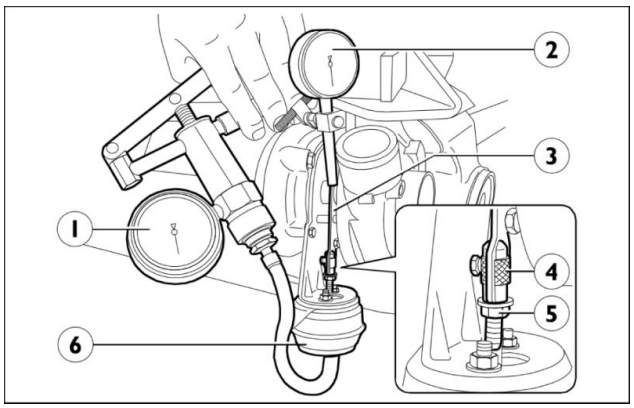
5. Unscrew the nuts **(2)** and remove the turbocharger **(1)**, together with the wastegate valve, recovering the relevant gasket.
6. If necessary, remove the studs **(3)** from the exhaust manifold and replace them.




NHIL25ENG0357TA 3

# Turbocharger - Check [113434631 - V1 - 06 March 2025]

## Check and adjustment




NHIL25ENG0361AA 1

1. Cover air, exhaust gas and lubricant inlets and outlets.
2. Thoroughly clean the turbocharger outside using anti-corrosive and antioxidant fluid and check the actuator **(6)**.
3. Clamp the turbocharger in a vice.
4. Disconnect the pipe of the actuator **(6)** and fit the pump pipe to the actuator pipe **(1)** filler.
5. Apply the magnetic stand gauge **(2)** to exhaust gas inlet flange in the turbine.
6. Set gauge feeler pin **(2)** on the end of the tie rod **(3)** and set gauge to zero **(2)**.
7. Using the pump **(1)**, deliver compressed air at a pressure of **1.9 +/- 0.002 bar** into the actuator **(6)**. Make sure that this pressure value remains constant for the entire duration of the check. Otherwise, replace the actuator **(6)**.
8. In these conditions the tie rod must have travelled the specified stroke **5.30 +/- 0.4 mm** .

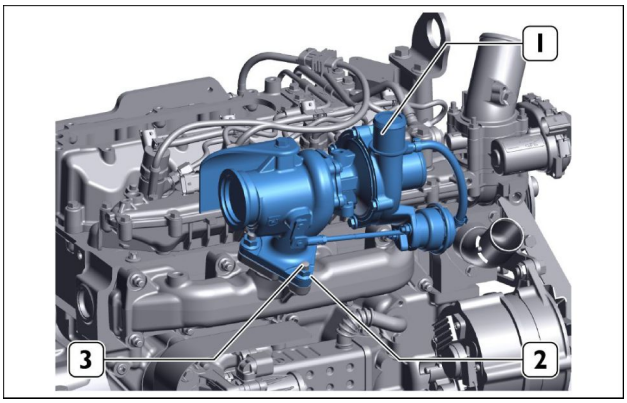
***NOTE:*** *During the operation, beat the actuator **(6)** slightly in order to eliminate possible sticking of the actuator internal spring.*

9. If a different value is found, loosen the nut **(5)** and operate properly the knurled ring nut **(4)**.

# Turbocharger - Install [113434632 - V1 - 06 March 2025]

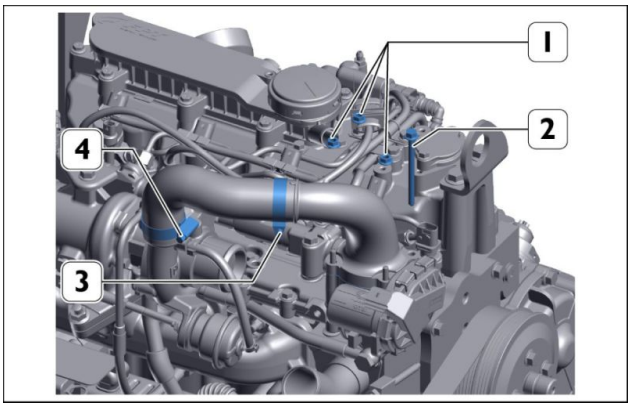
| Description | Quantity | Step | Value |
|---|---|---|---|
| Lubricant oil delivery pipe to turbocharger | | 1 screw M10 x 1 x 19 | **25 +/- 2.5 N·m** |
| | | 1 nut M14 x 1.5 | **35 +/- 3.5 N·m** |
| Lubricant oil return pipe from turbocharger bracket | 1 screw M6 x 1 x 10 | | **10 +/- 1 N·m** |
| Lubricant return pipe from turbocharger | 2 screws M6 x 1 x 20 | | **10 +/- 1 N·m** |
| Turbocharger | | 3 nuts M10 x 1.5 x 10 | **28 +/- 1.5 N·m** |
| | | 3 studs M10 x 1.5 x 40 | **25 +/- 1.25 N·m** |

1. If removed, tighten the studs **(3)** on the exhaust manifold and tighten them to the specified torque.
2. Fit the turbocharger **(1)** together with the wastegate valve onto the exhaust manifold and correctly position a new gasket.
3. Tighten the fastening nuts **(1)** to the prescribed torque.



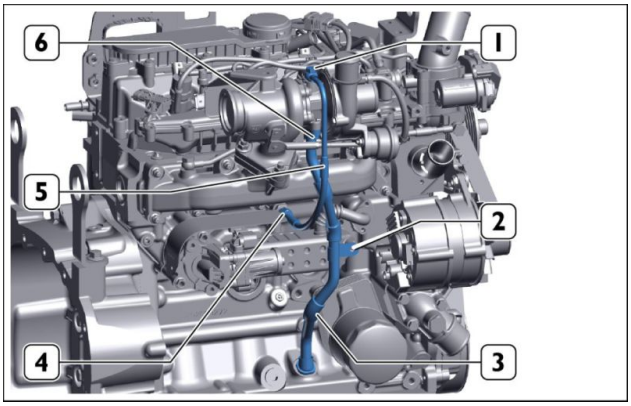

NHIL25ENG0362TA 1

4. Install the air pipe.
   Insert the pipe complete with the two collars on **(3)** **(4)** on the side of the compressor delivery and air intake respectively.




NHIL25ENG0363FA 2

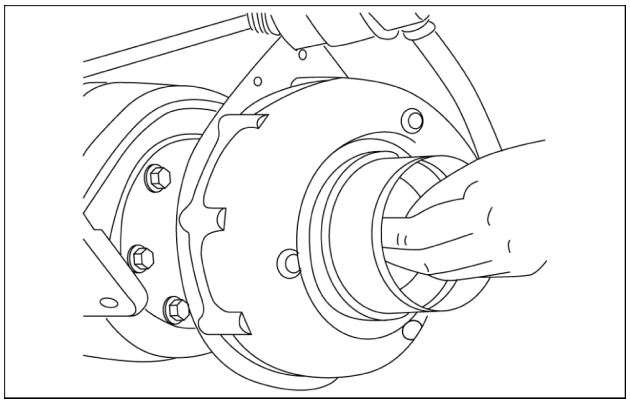
5. Connect the oil return pipe **(3)** from the turbocharger and tighten the fastening screws **(6)** to the prescribed torque.
6. Tighten the screw **(2)** fastening the support bracket of the oil return pipe **(3)** from the turbocharger.
7. Connect the oil delivery pipe **(5)** to the turbocharger and tighten the couplings **(1)** and **(4)** to the prescribed torque.




NHIL25ENG0364TA 3

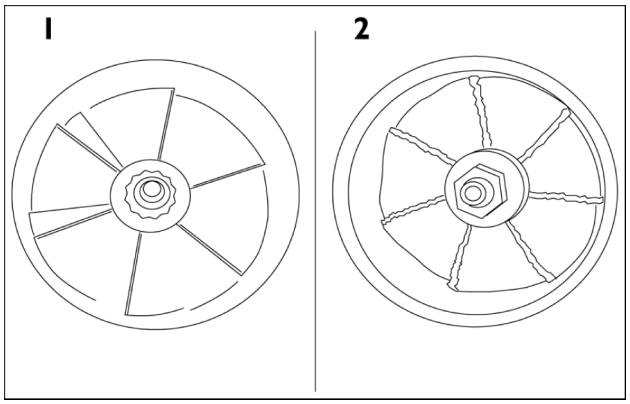
# Turbocharger - Visual inspection [113434649 - V1 - 06 March 2025]

1. Only proceed with the engine stopped.
2. Manually tighten the shaft but allowing it still to rotate, and check for any jams.



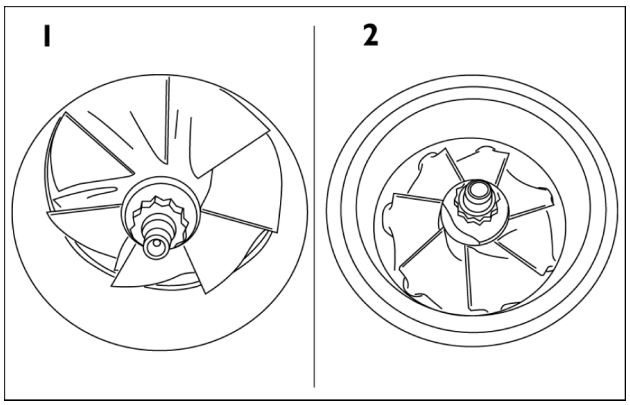
NHIL25ENG0358AA 1

3. Check for any wear in the housing inside the compressor.
   1. There are no signs of wear on the inner diameter of the compressor.
   2. Signs of contact between the rotor and the inner diameter of the compressor.




NHIL25ENG0359AA 2

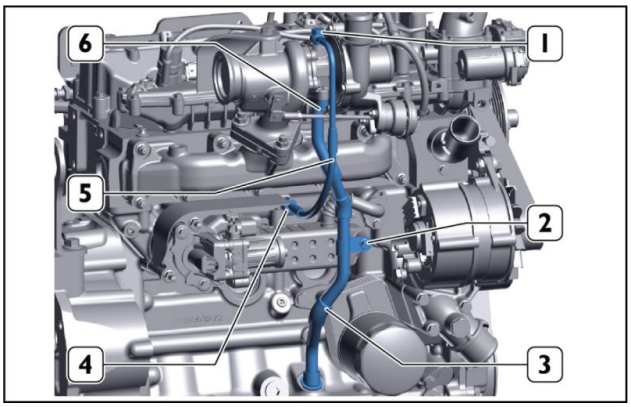
4. Visually check the condition of the compressor, blades and turbine.
   1. There are no signs of wear on the inner diameter of the compressor.
   2. Signs of contact between the rotor and the inner diameter of the compressor.




NHIL25ENG0360AA 3

# Turbocharger - Remove - Removing the lubricant oil delivery and return pipes from the turbocharger [113469156 - V1 - 26 February 2025]

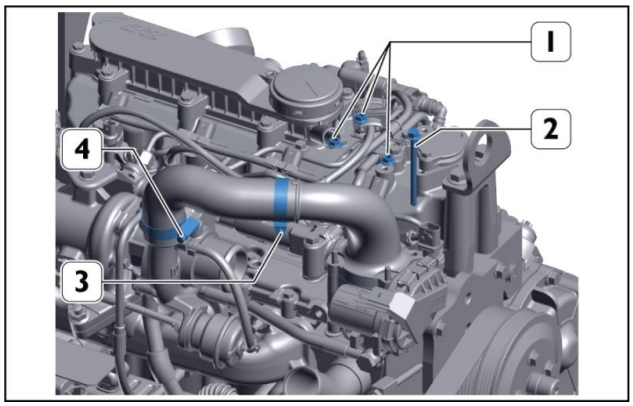
1. Unscrew the screw **(1)** and the fitting **(4)** and remove the lubricant oil delivery pipe **(5)** that connect the crankcase to the turbocharger.
2. Unscrew the fastening screws **(6)** on the lower part of the turbocharger, recovering the relevant gasket.
3. Unscrew the screw **(2)** of the mounting bracket of the lubricant oil drain pipe **(3)** from the turbocharger.
4. Remove the lubricant oil drain pipe **(3)** from the turbocharger.




NHIL25ENG0101TA 1

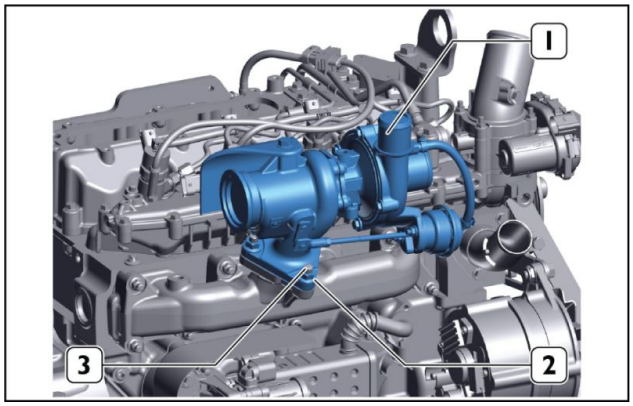
# Turbocharger - Disassemble [113469157 - V1 - 07 March 2025]

1. Before proceeding to dismantle the turbocharger, the air line must be removed. Loosen the collars **(3)** and **(4)** and remove the pipe.




NHIL25ENG0102TA 1

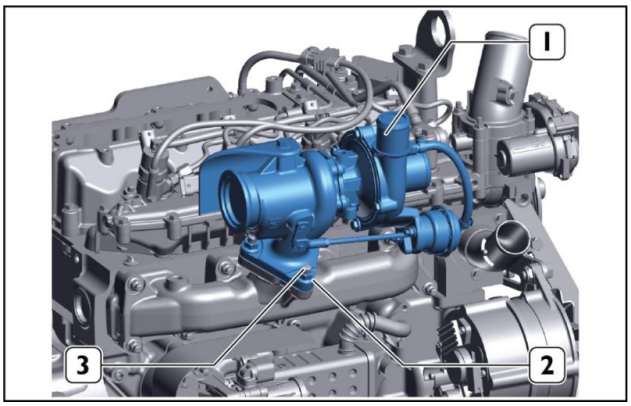
2. Unscrew the nuts **(2)** and remove the turbocharger **(1)** , together with the wastegate valve, recovering the relevant gasket.
3. Unscrew the studs **(3)** from the exhaust manifold.




NHIL25ENG0103TA 2

# Turbocharger - Assemble [113471312 - V1 - 05 March 2025]

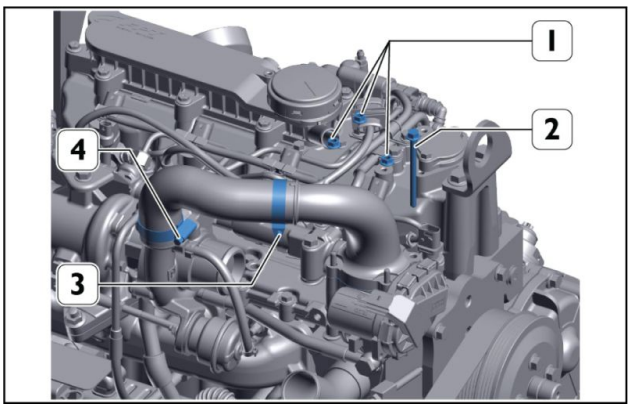
1. Screw the studs **(3)** onto the exhaust manifold.
2. Fit the turbocharger **(1)** together with the wastegate valve onto the exhaust manifold and correctly position a new gasket.
3. Tighten the fastening nuts **(1)** to the prescribed torque.




NHIL25ENG0103TA 1

| Description | Step | Value |
|---|---|---|
| Turbocharger | 3 nuts M10 x 1.5 x 10 | **28 +/- 1.5 N·m** |
| | 3 studs M10 x 1.5 x 40 | **25 +/- 1.25 N·m** |

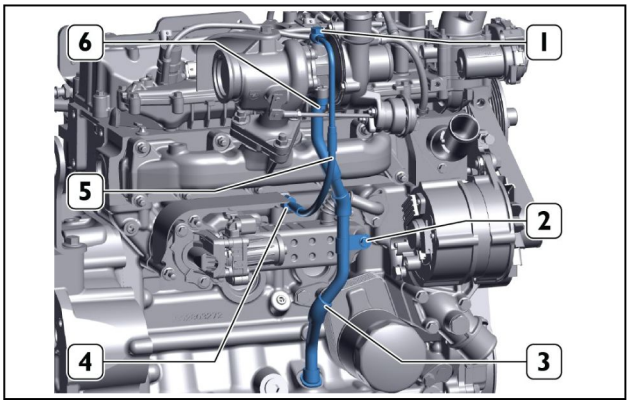
4. Install the air pipe. Insert the pipe complete with the two collars on **(3) (4)** on the side of the compressor delivery and air intake respectively.




NHIL25ENG0207TA 2

# Turbocharger - Install - Installation of lubricant oil delivery and return pipe from turbocharger [113471314 - V1 - 05 March 2025]

1. Fit a new gasket and tighten the screws **(6)** securing the lubricant oil return pipe **(3)** to the turbocharger.




NHIL25ENG0208TA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Lubricant return pipe from turbocharger | 2 screws M6 x 1 x 20 | | **10 +/- 1 N·m** |

2. Introduce the lubricant oil return pipe **(3)** from the turbocharger into the engine crankcase with a new sealing ring.
3. Install the fixing bracket of the pipe **(3)** to the crankcase and tighten the fastening screw **(2)** to the specified torque.

| Description | Quantity | Step | Value |
|---|---|---|---|
| Lubricant oil return pipe from turbocharger bracket | 1 screw M6 x 1 x 10 | | **10 +/- 1 N·m** |

4. Install the lubricant oil delivery pipe **(5)** connecting the crankcase to the turbocharger and tighten the fittings **(1)** and **(3)** to the specified torque.

| Description | Quantity | Step | Value |
|---|---|---|---|
| Lubricant oil delivery pipe to turbocharger | 1 screw M10 x 1 x 19 | 1 screw M10 x 1 x 19 | **25 +/- 2.5 N·m** |
| | | 1 nut M14 x 1.5 | **35 +/- 3.5 N·m** |

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# Engine - 10

## Intake and exhaust manifolds and muffler - 254

**F6AFL413A*U001**

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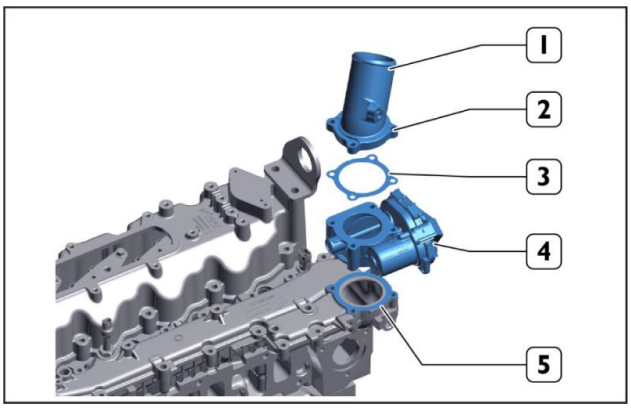
# Intake manifold - Remove - Intake manifolds [113427393 - V1 - 04 March 2025]

**Prior operation:**
Disconnect the engine cable as described in the procedure **Engine wiring harness - Remove - Engine cables (55.015)**.
**Prior operation:**
Remove the common rail assembly as described in the procedure **Common rail pressure sensor - Remove - High pressure accumulator (55.010)**.

## Throttle valve removal on CE and AG engines version TCA

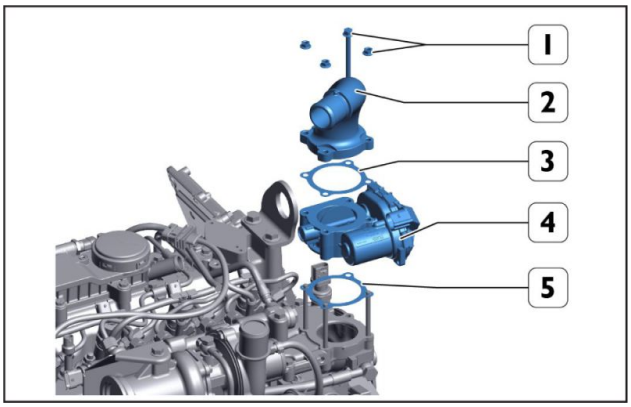
1. Unscrew the nuts **(2)** and the fastening screws and remove the engine air intake **(1)** recovering the gaskets **(3)**.
2. Remove the throttle valve **(4)**, recovering the gasket **(5)**, and remove the studs.




NHIL25ENG0264FA 1

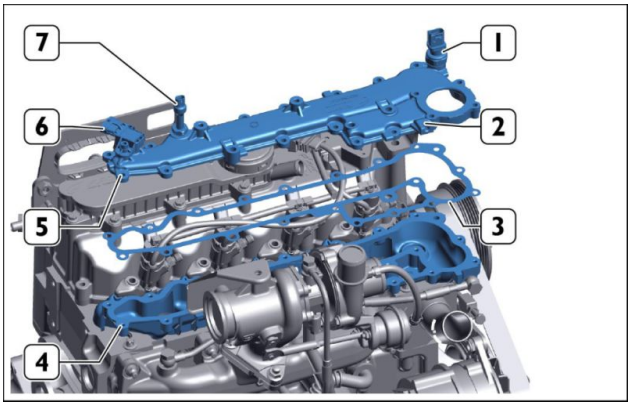
## Throttle valve removal on CE and AG engines version TC

3. Unscrew the nuts **(1)** and the fastening screw **(1)** and remove the engine air intake **(2)**, recovering the gasket **(3)**.
4. Remove the throttle valve **(4)**, recovering the gasket **(5)**, and remove the studs.




NHIL25ENG0265FA 2

5. Unscrew the fastening screws **(5)** and remove the intake manifold **(2)**, the temperature sensor assembly **(7)**, supercharging pressure sensor **(6)** and air temperature and exhaust gas absolute pressure sensor **(1)**, from the overhead **(4)**.
6. Recover the gasket **(3)** from the overhead **(6)**.
7. Unscrew the fastening screws and remove the overhead **(4)**.

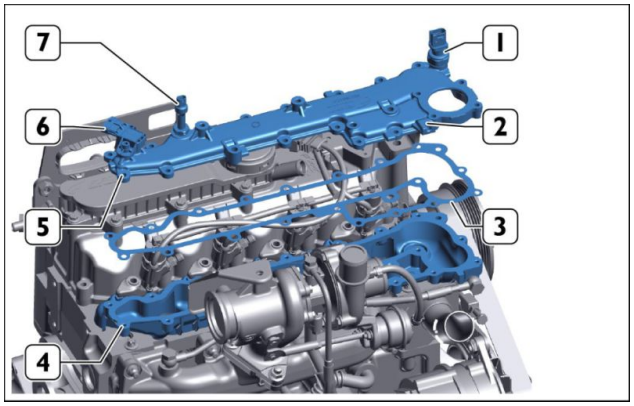



NHIL25ENG0266TA 3

# Intake manifold - Install - Intake manifold [113427394 - V1 - 04 March 2025]

| Description | Step | Value |
|---|---|---|
| Engine air vent | 3 nuts M6 x1 | **10 N·m (89 lb in)** |
| | 1 screw M6 x 1 x 80 | **10 N·m (89 lb in)** |
| | 1 screw M8x1.25 | **23 N·m (204 lb in)** |
| Intake manifold | 14 screws M6 x 1 x 20 | **10 +/- 1 N·m** |
| | 4 caps M12 x 1.5 | **20 +/- 2 N·m** |
| Overhead | 8 screws M6 x 1 x 20 | **10 +/- 1 N·m** |

1. Install the rocker cover **(4)** and tighten the fastening screws to the prescribed torque.




NHIL25ENG0267TA 1

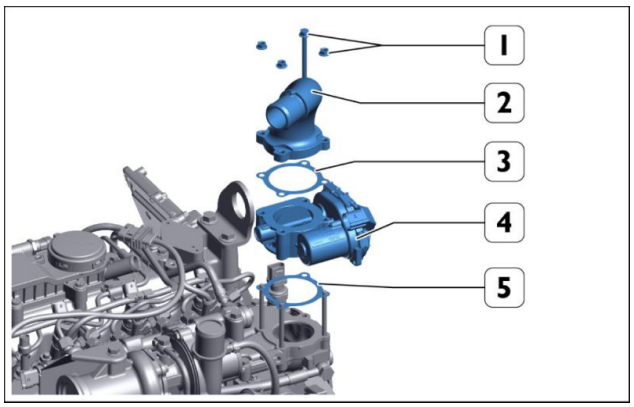
| Description | Step | Value |
|---|---|---|
| Overhead | 8 screws M6 x 1 x 20 | **10 +/- 1 N·m** |

2. Position the gasket **(3)** on the rocker cover **(4)**.
3. Fit the intake manifold **(2)**, complete with the temperature sensor **(7)**, air temperature and supercharging pressure sensor **(6)** and the exhaust gas absolute pressure sensor **(1)**, and tighten the fastening screws **(5)** to the prescribed torque.

| Description | Step | Value |
|---|---|---|
| Intake manifold | 14 screws M6 x 1 x 20 | **10 +/- 1 N·m** |
| | 4 caps M12 x 1.5 | **20 +/- 2 N·m** |

## Throttle valve assembly

4. Tighten the studs to the prescribed torque and install the throttle valve **(4)**, with a new gasket **(5)**.
5. Install the engine air vent **(2)** with a new gasket **(3)** and tighten the nuts and the fastening screw **(1)** to the prescribed torque.



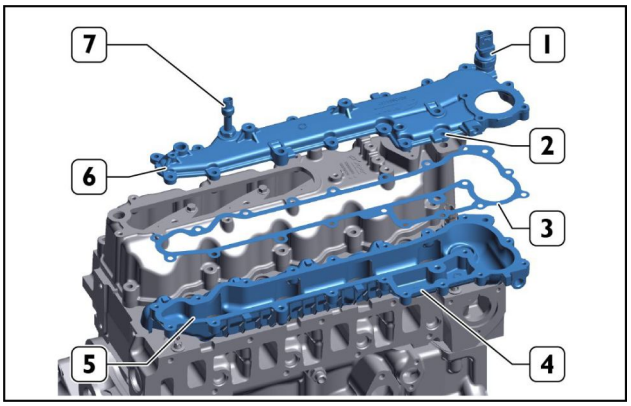

NHIL25ENG0268FA 2

| Description | Step | Value |
|---|---|---|
| Engine air vent | 3 nuts M6 x1 | **10 N·m** |
| | 1 screw M6 x 1 x 80 | **10 N·m** |
| | 1 screw M8x1.25 | **23 N·m** |

**Next operation:**
Fit the common rail assembly, as described in the procedure **Common rail pressure sensor - Install - High pressure accumulator (55.010)**.
**Next operation:**
Connect the engine cable as described in the procedure **Engine wiring harness - Install - Engine cables (55.015)**.

# Intake manifold - Remove [113469214 - V1 - 26 February 2025]

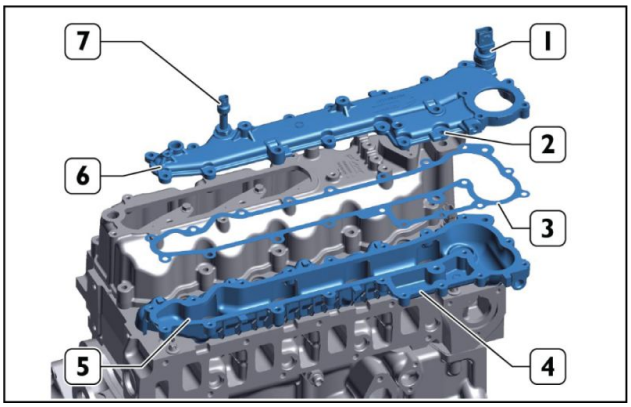
1. Unscrew the temperature sensor **(7)** and the exhaust gas absolute pressure sensor **(1)**.
2. Unscrew the fastening screws **(2)** and remove the intake manifold **(6)**, recovering the gasket from the overhead **(4)**.
3. Unscrew the fastening screws **(5)** and remove the overhead **(4)**, recovering the relevant gaskets.




NHIL25ENG0130TA 1

# Intake manifold - Assemble [113470074 - V1 - 28 February 2025]

1. Install the overhead **(4)** and tighten the fastening screws **(5)** to the specified torque and following the sequence and methods shown in the figure **2**.




NHIL25ENG0177TA 1

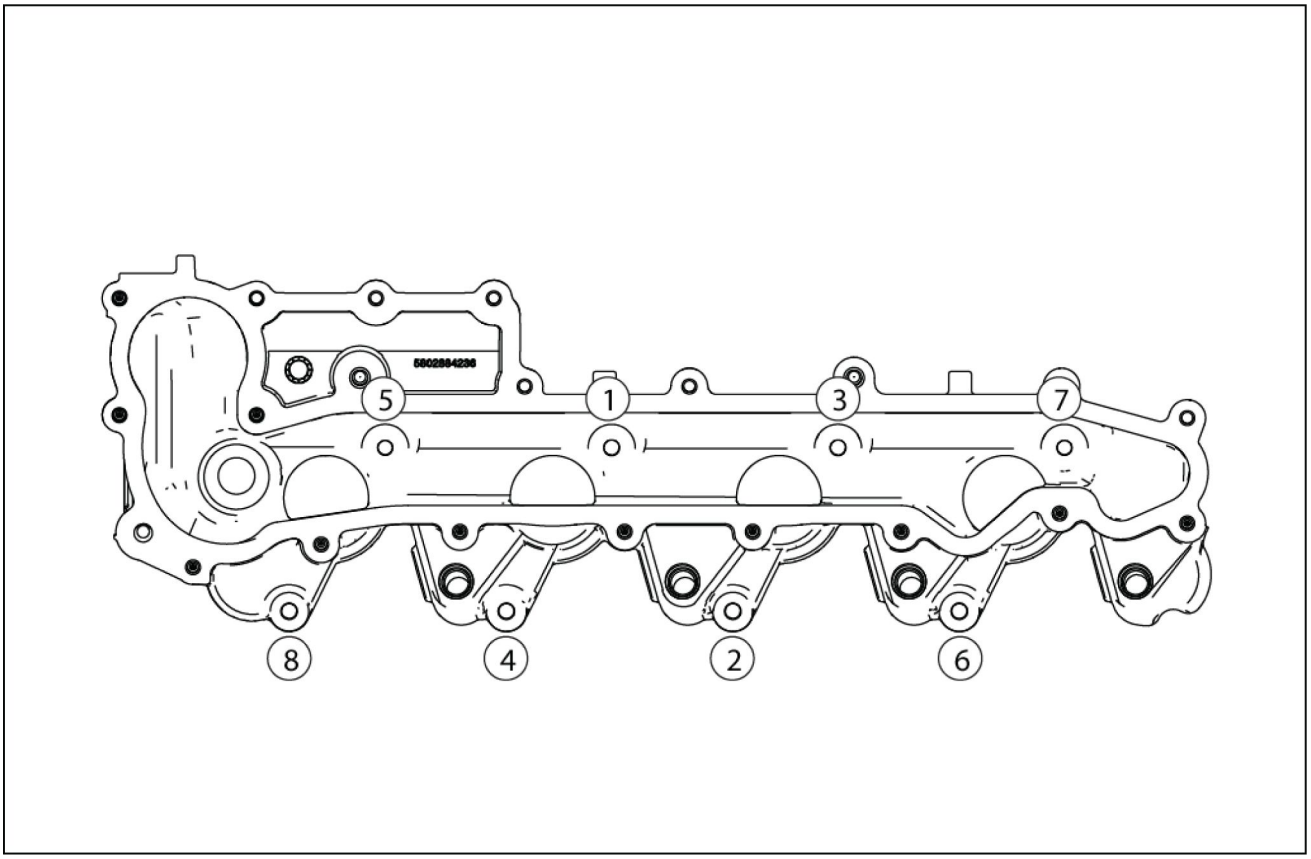
| Description | Step | Value |
|---|---|---|
| Overhead | 8 screws M6 x 1 x 20 | **10 +/- 1 N·m** |

2. Fit the intake manifold **(6)**, correctly positioning a new gasket and tighten the fastening screws **(2)** to the specified torque and following the sequence and methods shown in the figure.

| Description | Step | Value |
|---|---|---|
| Intake manifold | 14 screws M6 x 1 x 20 | **10 +/- 1 N·m** |
| | 4 caps M12 x 1.5 | **20 +/- 2 N·m** |

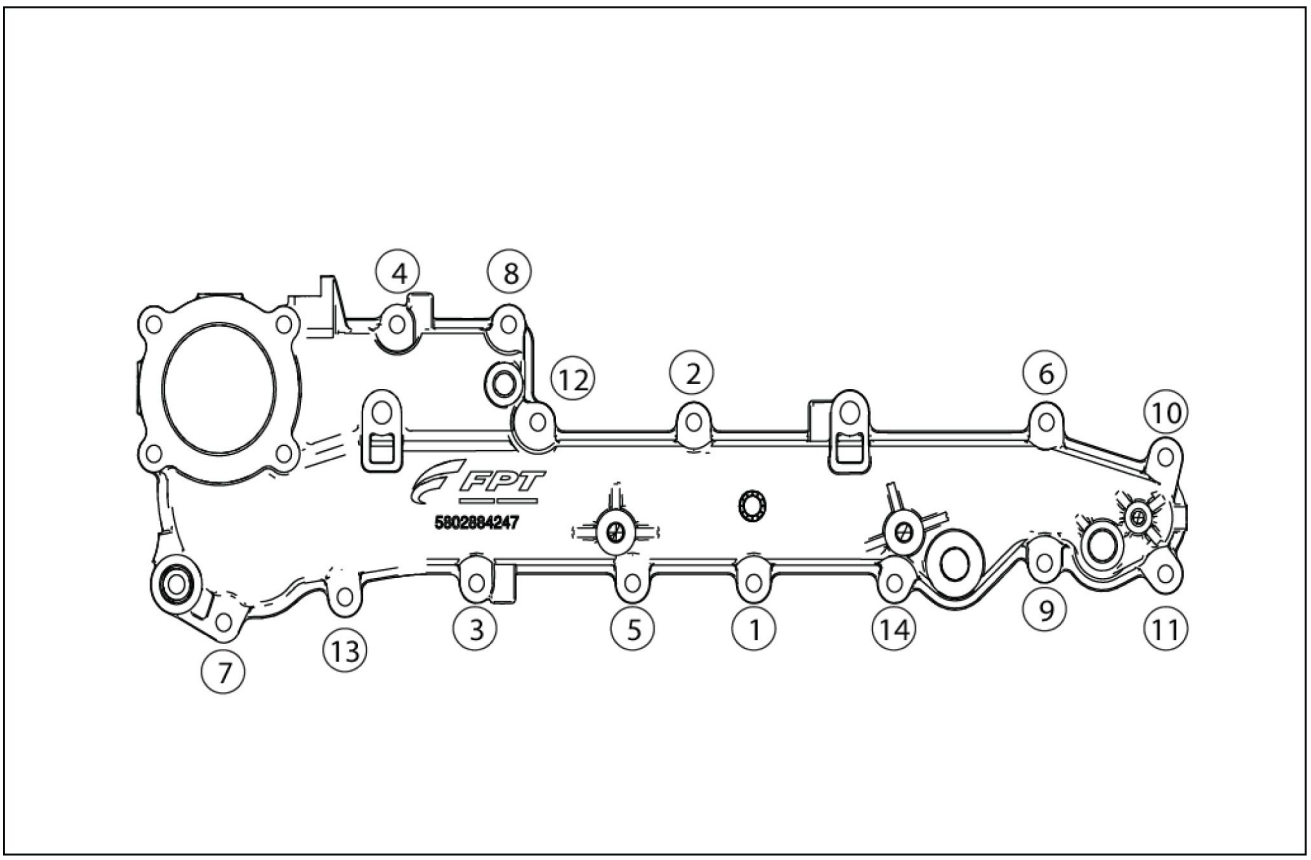
3. Fit the temperature sensor **(7)** and the exhaust gas absolute pressure sensor **(1)**.

| Description | | Step | Value |
|---|---|---|---|
| Exhaust gas absolute pressure sensor | 1 sensor M14 x 1.5 | | **15 +/- 1.5 N·m** |
| Exhaust gas temperature sensor | | 1 fitting M14 x 1.5 x 12 | **45 +/- 4.5 N·m** |
| | | 1 screw M6 x 1.5 x 12 | **10 +/- 1 N·m** |




NHIL25ENG0178FA 2

**Diagram of tightening sequence for overhead fastening screws.**



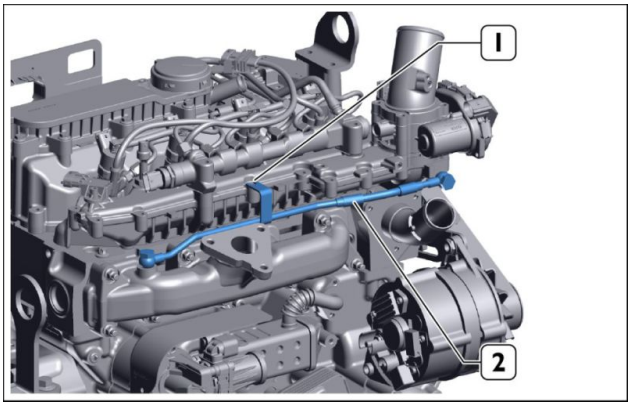

NHIL25ENG0179FA 3

**Diagram of tightening sequence for intake manifold fastening screws.**

# Exhaust manifold - Remove - Exhaust manifold [113427395 - V1 - 04 March 2025]

**Prior operation:**
Remove the turbocharger as described in the procedure **Turbocharger - Remove (10.250)**

1. Unscrew the fastening screw **(1)** of the exhaust gas pipe supporting bracket, which is the same one of the intake manifold.
2. Unscrew the fittings and remove the exhaust gas pipe **(2)**.

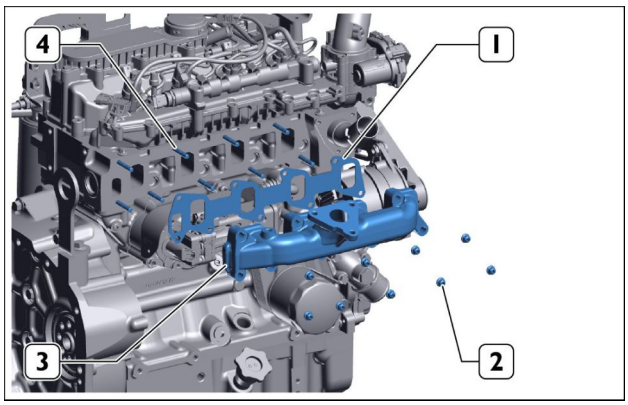



NHIL25ENG0269TA 1

3. Unscrew the fastening nuts **(2)** and disconnect the exhaust manifold **(3)** from the studs **(4)** of the cylinder head, recovering the gasket **(1)**.

***NOTE:*** *Always replace the gasket **(1)** with a new one at any disassembly. Check the thread of the nuts and studs: there must be no sign of wear or deposit of dirt..*

4. Unscrew the studs **(4)**.

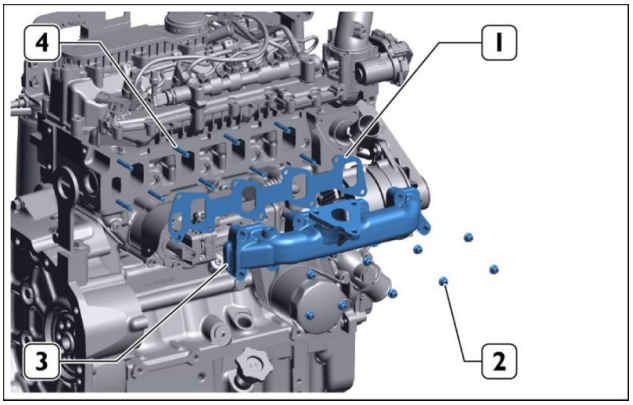



NHIL25ENG0270TA 2

# Exhaust manifold - Install - Exhaust manifold [113427396 - V1 - 04 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Exhaust gas linkage pipe | 2 screws M12 x 1.5 x 24 | | **25 +/- 2.5 N·m** |
| Exhaust manifold | 9 nuts M8 x 1.25 | Pre-tightening | **10+/- 0.5 N·m** |
| | | Tighten | **28 +/- 1.4 N·m** |

1. Tighten the studs **(4)** to the prescribed torque:



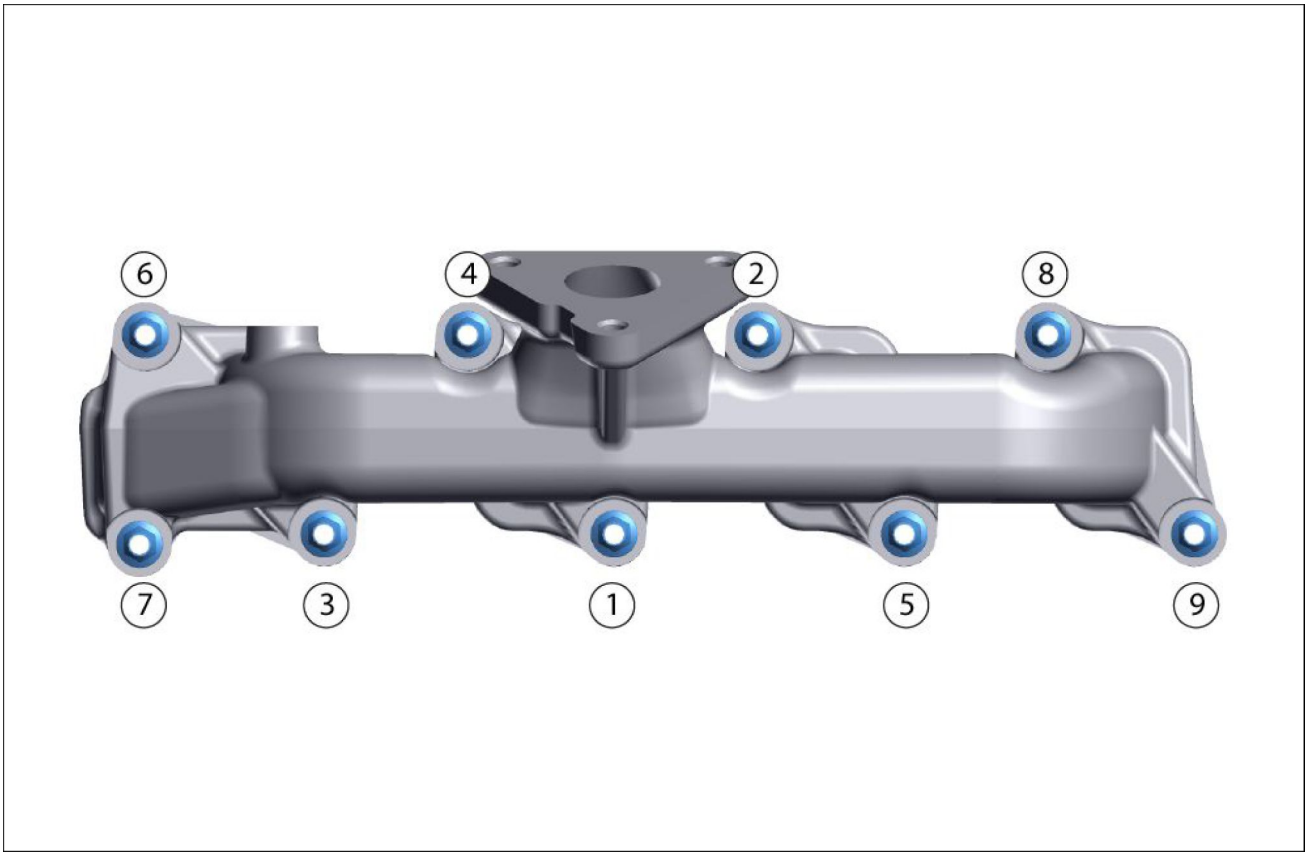

NHIL25ENG0271TA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Exhaust manifold | 9 studs M8 x 1.25 x 52 | | **11+/- 3 N·m** |

2. Position a new gasket **(1)** on the cylinder head studs **(4)**.
3. Fit the exhaust manifold **(3)** on the cylinder head studs **(4)** and tighten, following the tightening order indicated below in the figure **2**, the retaining nuts **(2)** to the prescribed torque.

***NOTE:*** *At each disassembly, always replace the gasket **(1)** with a new one. Check the threads on the nuts and studs: there may not be any traces of wear or deposits of dirt.*

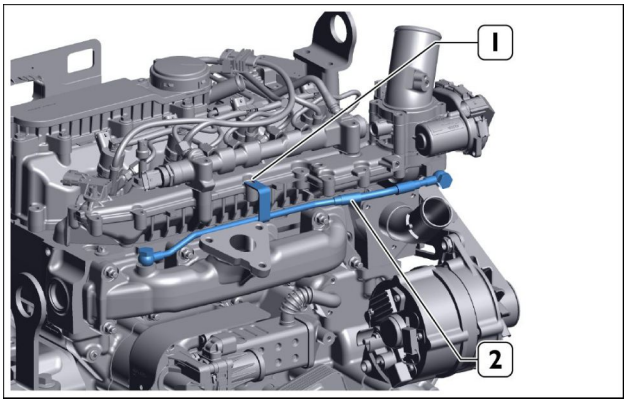
| Description | Quantity | Step | Value |
|---|---|---|---|
| Exhaust manifold | 9 nuts M8 x 1.25 | Pre-tightening | **10+/- 0.5 N·m** |
| | | Tighten | **28 +/- 1.4 N·m** |




NHIL25ENG0272FA 2

**Diagram showing the exhaust manifold fastening screws tightening order.**

4. Position the exhaust gas pipe **(2)** and tighten the couplings to the prescribed torque.
5. Tighten the screw **(1)** on the exhaust gas pipe support bracket, which is the same as the intake manifold.



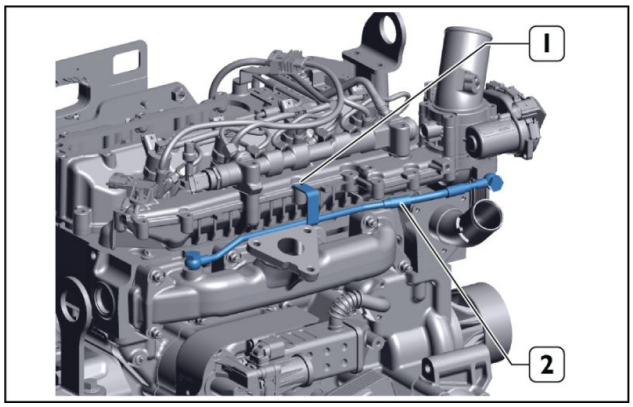

NHIL25ENG0273TA 3

| Description | Quantity | Value |
|---|---|---|
| Exhaust gas linkage pipe | 2 screws M12 x 1.5 x 24 | **25 +/- 2.5 N·m** |

**Next operation:**
Install the turbocharger, as described in the procedure **Turbocharger - Install (10.250)**

# Exhaust manifold - Remove [113469161 - V1 - 26 February 2025]

1. Unscrew the screw **(1)** of the exhaust gas pipe support yoke, which is the same of the intake manifold.
2. Unscrew the fittings and remove the exhaust gas pipe **(2)**.

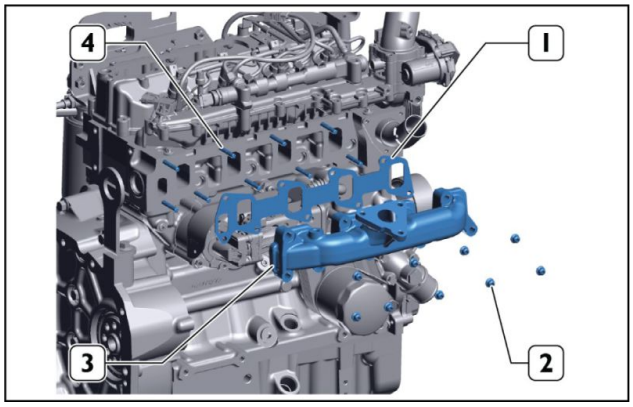



NHIL25ENG0106TA 1

3. Unscrew the fastening screws **(2)** and remove the exhaust manifold **(3)** from the cylinder head, recovering the gasket **(1)**.

***NOTE:*** *Always replace the gasket **(1)** with a new one at any disassembly. Check the thread of nuts and studs: it must not show any signs of wear or deposits of dirt.*

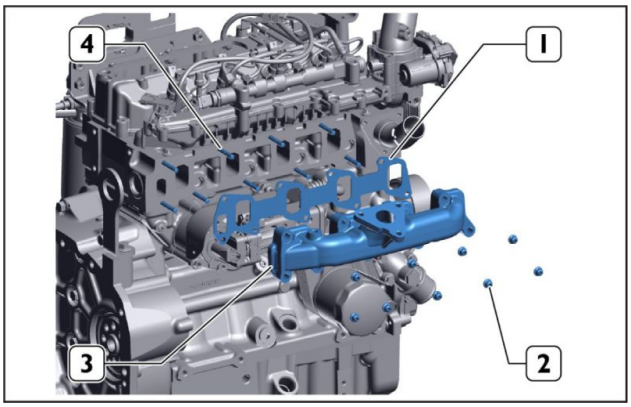
4. Unscrew the studs **(4)**.




NHIL25ENG0107TA 2

# Exhaust manifold - Assemble [113471251 - V1 - 06 March 2025]

1. Tighten the studs **(4)** to the specified torque:




NHIL25ENG0201TA 1

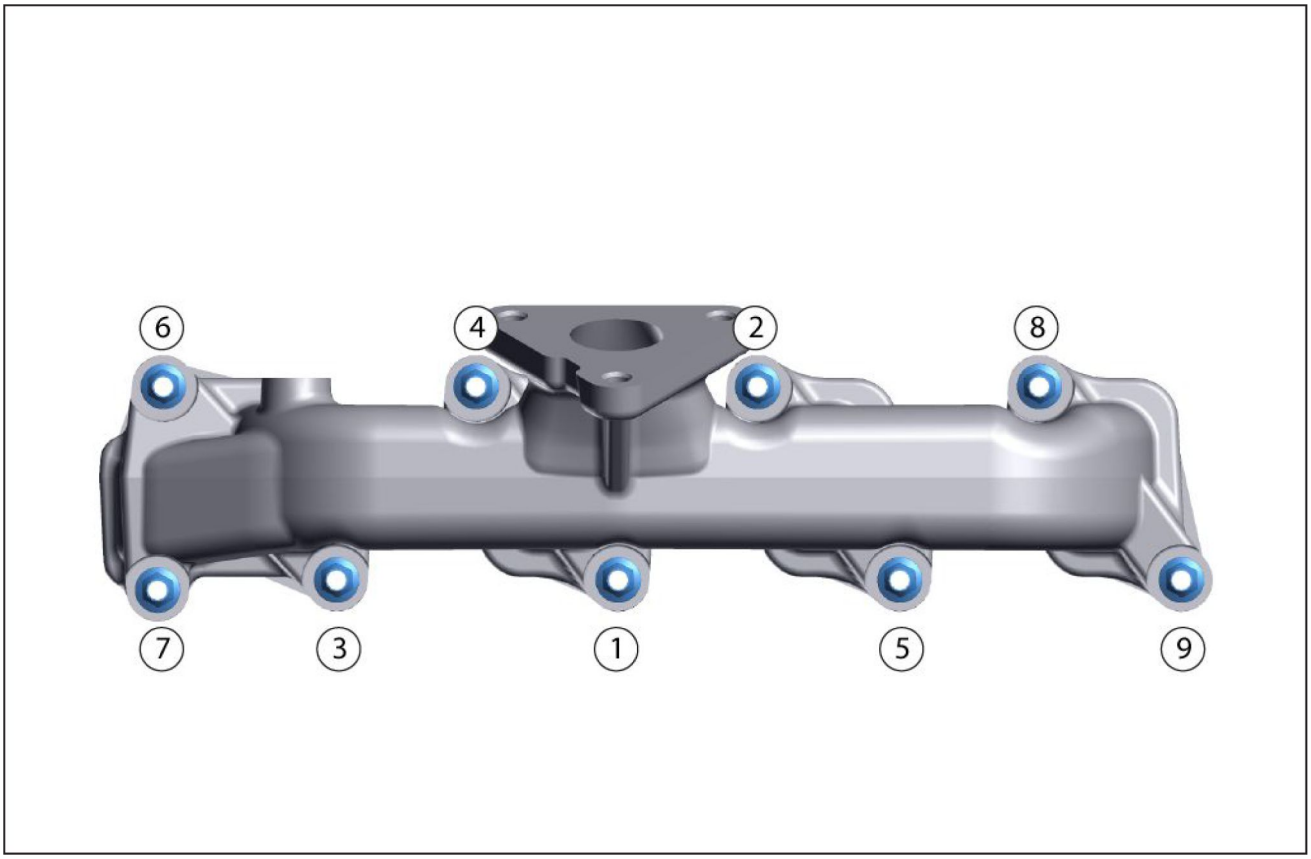
| Description | Quantity | Step | Value |
|---|---|---|---|
| Exhaust manifold | 9 studs M8 x 1.25 x 52 | | **11 +/- 3 N·m** |

2. Position a new gasket **(1)** on the cylinder head studs **(4)**.
3. Fit the exhaust manifold **(3)** on the cylinder head studs **(4)** and tighten, following the tightening order indicated below in the figure, the retaining nuts **(2)** to the prescribed torque.

***NOTE:*** *Always replace the gasket **(1)** with a new one at any disassembly.*

Check the thread of nuts and studs: it must not show any signs of wear or deposits of dirt.

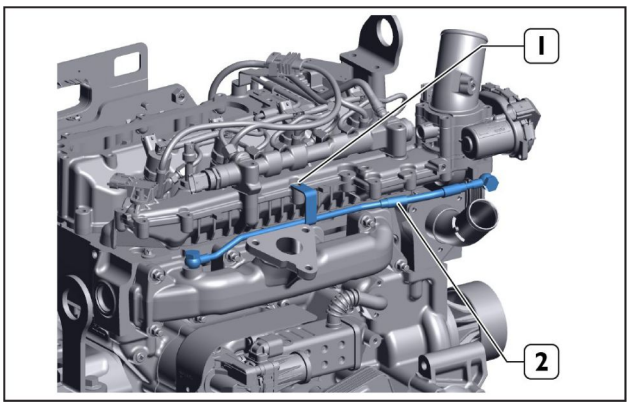
| Description | Quantity | Step | Value |
|---|---|---|---|
| Exhaust manifold | 9 nuts M8 x 1.25 | Pretightening | **11 +/- 3 N·m** |
| | | Tighten | **28 +/- 1.4 N·m** |




NHIL25ENG0202TA 2

**Diagram of tightening sequence for exhaust manifold fastening screws.**

4. Position the exhaust gas pipe **(2)** and tighten the couplings to the prescribed torque.




NHIL25ENG0203TA 3

| Description | Quantity | Value |
|---|---|---|
| Exhaust gas linkage pipe | 2 screws M12 x 1.5 x 24 | **25 +/- 2.5 N·m** |

5. Tighten the screw **(1)** securing the bracket supporting the exhaust gas pipe which is the same the intake manifold.

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# Engine - 10

## Selective Catalytic Reduction (SCR) exhaust treatment - 500

**F6AFL413A*U001**

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## Selective Catalytic Reduction (SCR) exhaust treatment - 500

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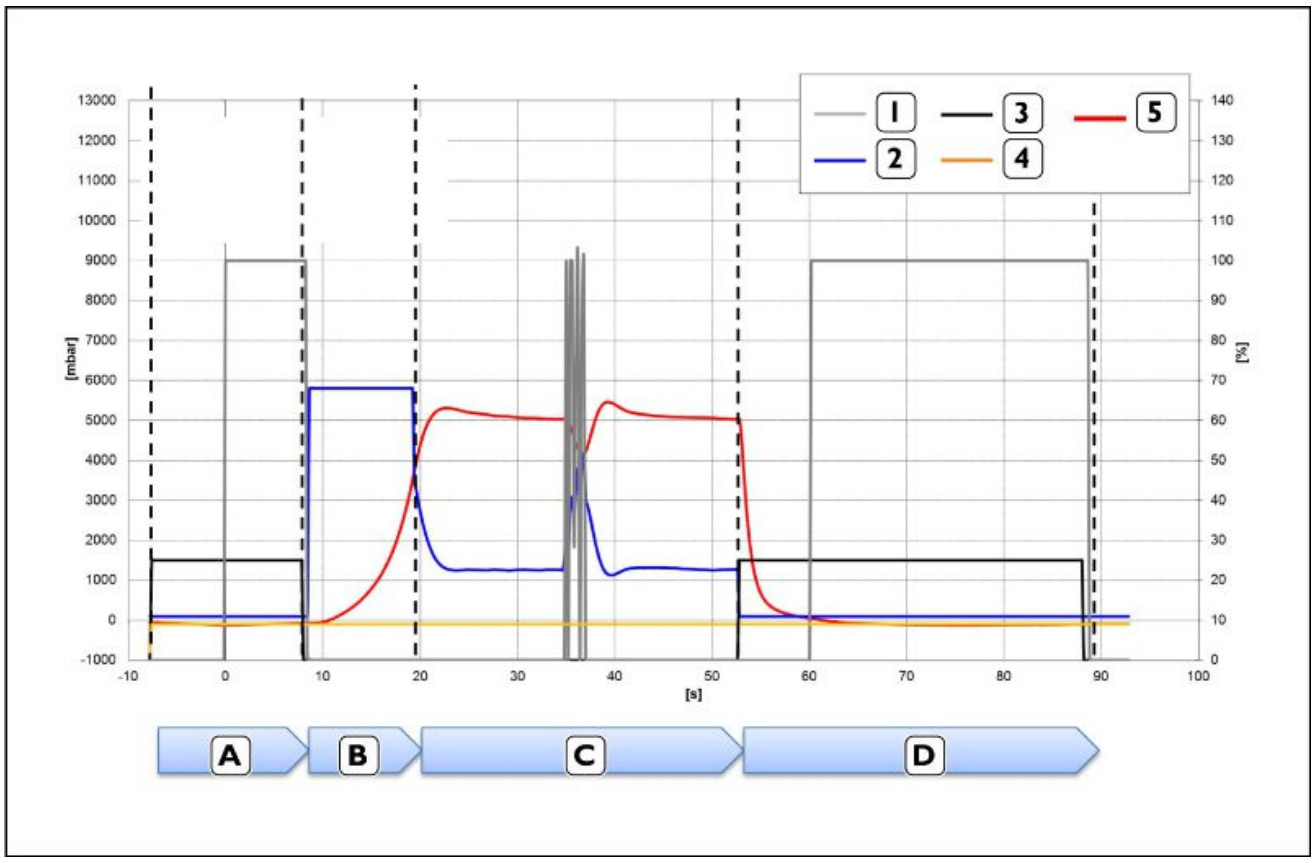
# Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing System Check (UDST) Bosch 6.5 and Bosch 3.3 [113389271 - V1 - 26 February 2025]

The Urea-Dosing-System-Test (UDST) is a test procedure carried out by the diagnostic instrument, and which allows the correct installation and operation of the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** Fluid dosing components to be checked.



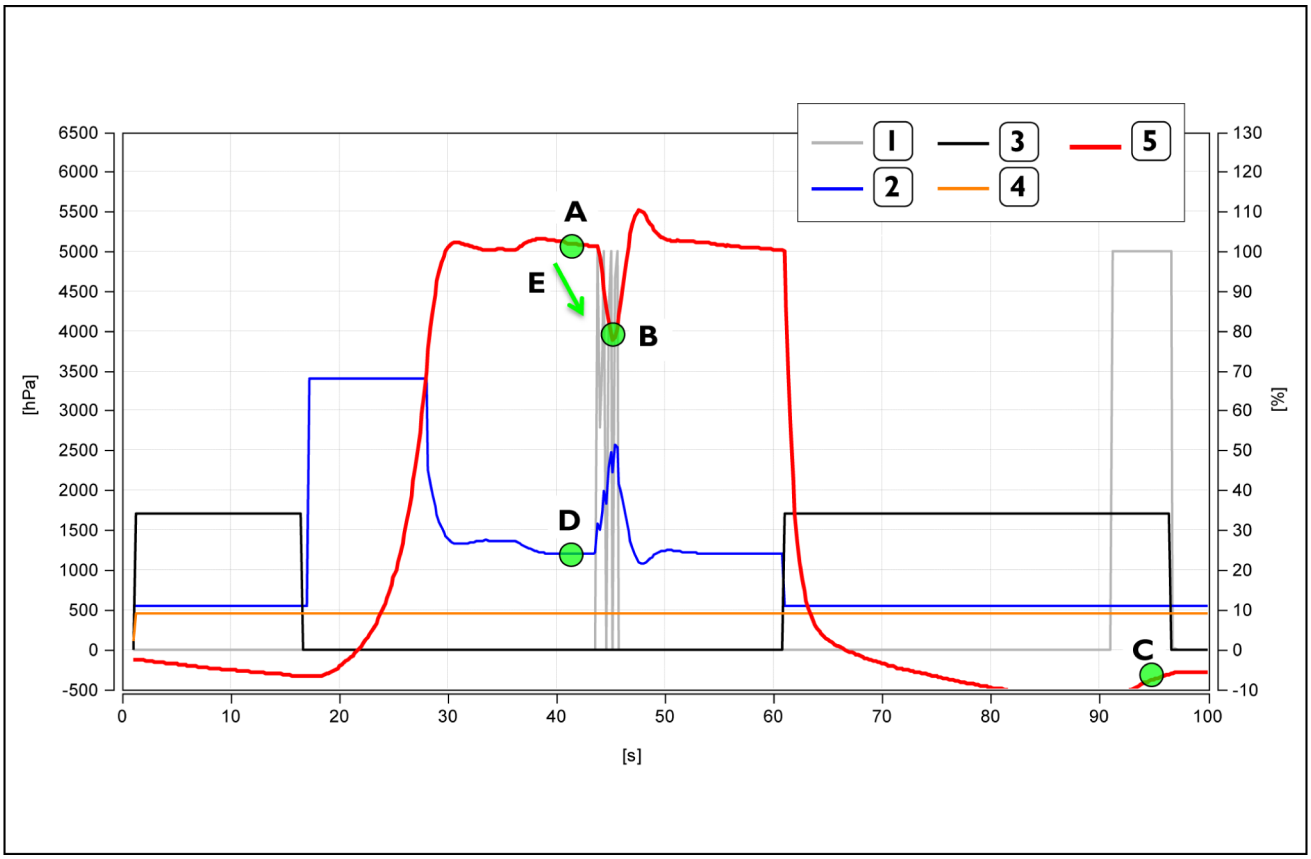

NHIL25ENG0506FA 1

| Item | Description |
|---|---|
| 1 | DC dosing module |
| 2 | DC pump |
| 3 | DC return pump |
| 4 | SCR status |
| 5 | Pressure **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid |

## Main sections of the UDST test procedure

| Assessment point | Section | Description |
|---|---|---|
| To | Pressure reduction | Brief emptying stage to bring the system to a specific start phase of the procedure |
| B | Pressure filling and increase | Filling the system following an increase in pressure until the nominal threshold **5 bar** is reached |
| C | Stabilising pressure and injection | Stabilising phase of the pressure following a short injection |
| D | Emptying | Emptying phase of the lines, the dosing module and the supply module |

## Assessment of the UDST test procedure




NHIL25ENG0507FA 2

| Item | Description |
|---|---|
| 1 | DC dosing module |
| 2 | DC pump |
| 3 | DC return pump |
| 4 | SCR status |
| 5 | Pressure **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** |

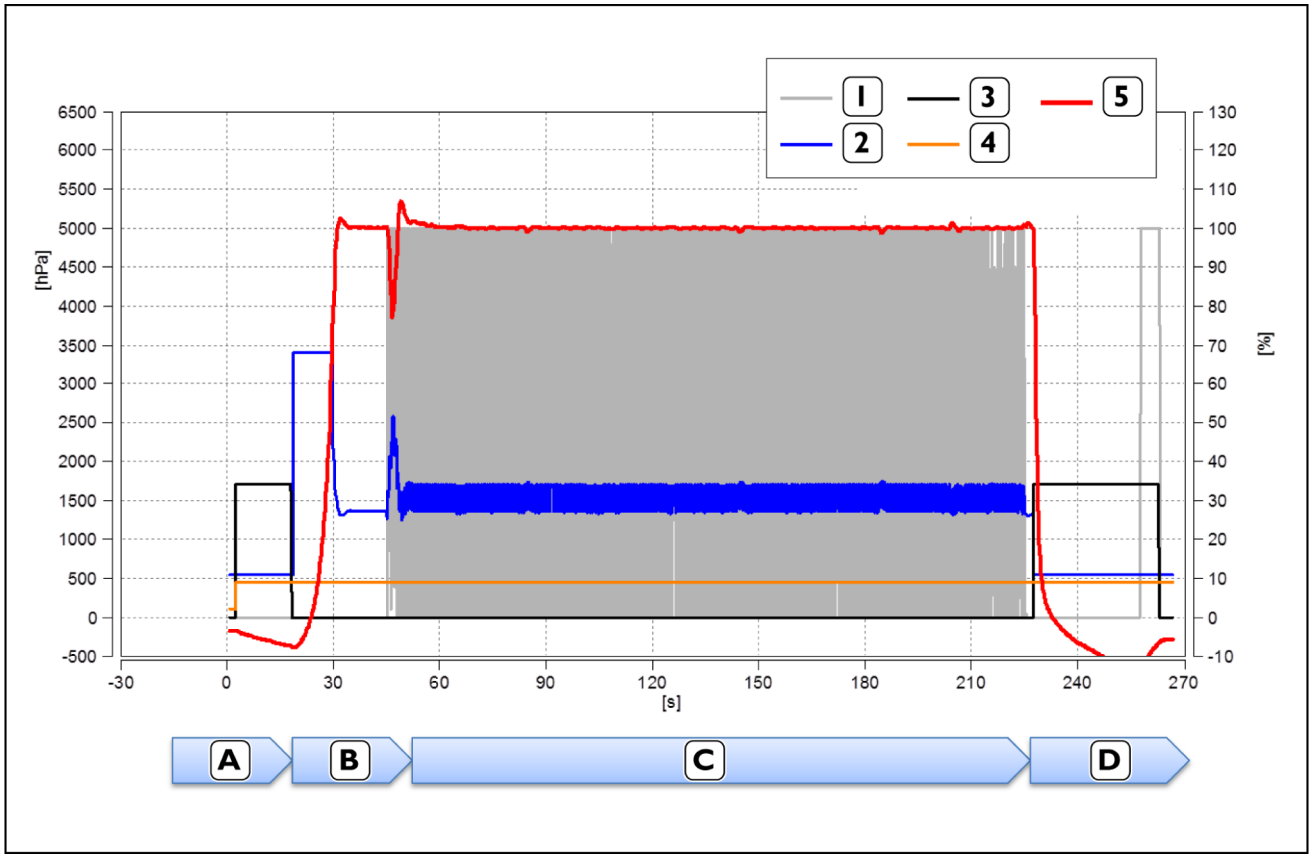
| Assess-ment point | Type | Upper limit | Lower limit |
|---|---|---|---|
| To | Operating pressure | **5300 m bar** | **4700 m bar** |
| B | Pressure on injection | No limit applied, data used to calculate the drop in pressure during injection | |
| C | Pressure on emptying | **0 3 bar** | **–1000 m bar** |
| D | Pump working cycle | **28%** | **18%** |
| E | Pressure drop during injection | **–m bar** | **250 bar** |

# Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing Valve Check (UDVC) Bosch 6.5 and Bosch 3.3 [113389272 - V1 - 26 February 2025]

The Urea-Dosing-Valve-Check (UDVC) is a test procedure carried out by the diagnostic instrument, which allows the correct amount of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid injected by the dosing module to be checked. The procedure involves removing the dosing module and checking the amount injected using a graded container.

During the procedure, a flow rate of 2000 g/h and an injection amount of **100 g** is considered. The amount of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid injected must be between ± **10%** the nominal value.

| Test | Flow Rate | Amount injected | Test duration | Lower limit of injected amount | Upper limit of injected amount |
|---|---|---|---|---|---|
| UDVC | 2000 g/h | **100 g** | **270 s** | **90 g** | **110 g** |




NHIL25ENG0508FA 1

| Item | Description |
|---|---|
| 1 | DC dosing module |
| 2 | DC pump |
| 3 | DC return pump |
| 4 | SCR status |
| 5 | Pressure **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid |

## Main sections of the UDVC test procedure

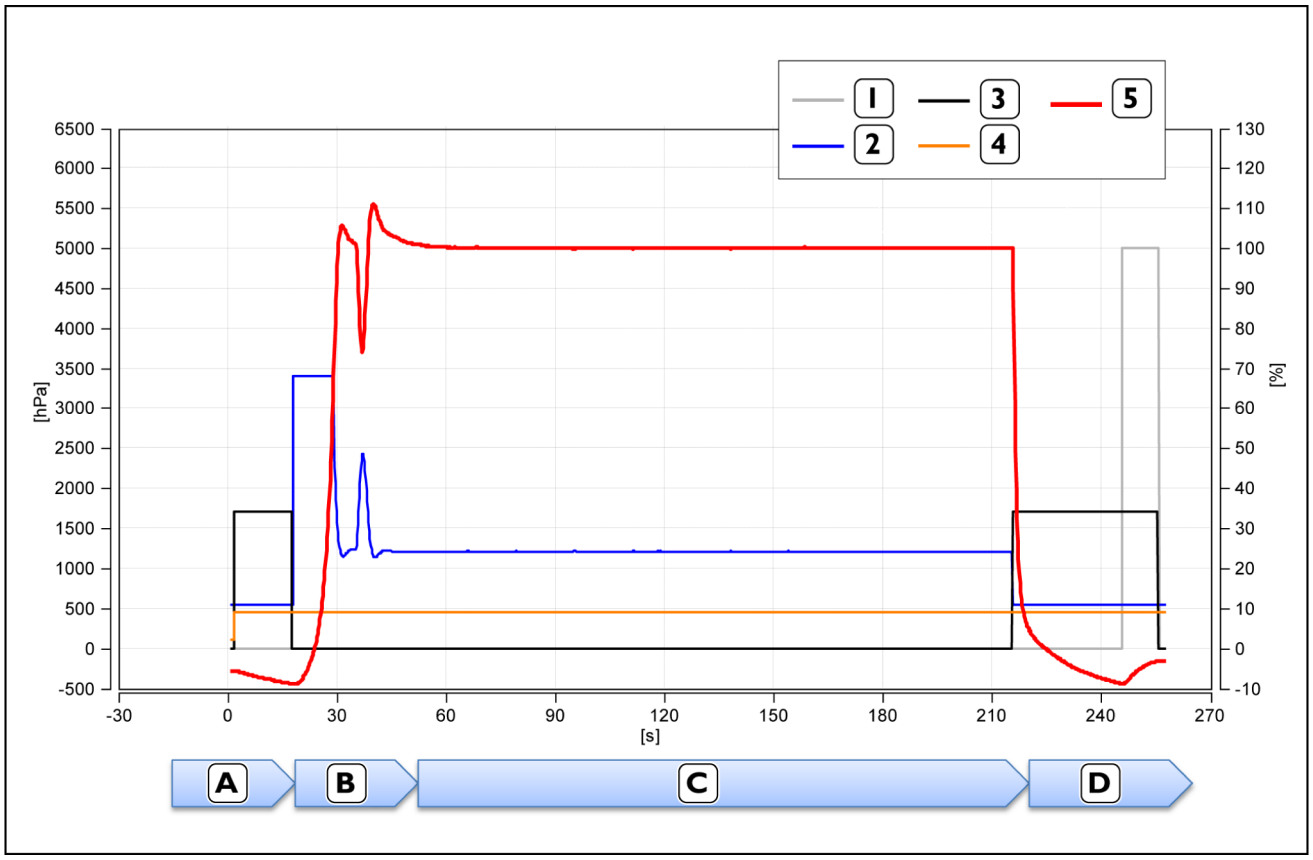
The UDVC procedure can be divided into 4 sequential sections:

| Assess-ment point | Section | Description |
|---|---|---|
| A | Pressure reduction | Brief emptying stage to bring the system to a specific start phase of the procedure |
| B | Pressure filling and increase | Refilling the system after an increase in pressure |
| C | Stabilising pressure and injection | Pressure stabilisation phase followed by injection |
| D | Evacuation | Emptying phase of the lines, the dosing module and the supply module |

# Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing Leakage Check (UDLC) Bosch 6.5 and Bosch 3.3 [113389273 - V1 - 26 February 2025]

The Urea-Dosing-Leakage-Check (UDLC) is a test procedure carried out by the diagnostic instrument, which allows verification of an **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid leak by pressurising the system for a specific length of time. **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid is not injected during the test.

| Test | Flow Rate | Amount injected | Test duration | Criteria of acceptability |
|---|---|---|---|---|
| UDLC | 0 g/h | **0 g** | **250 s** | No **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid leak |

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| Item | Description |
|---|---|
| 1 | DC dosing module |
| 2 | DC pump |
| 3 | DC return pump |
| 4 | SCR status |
| 5 | Pressure **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid |

## Main sections of the UDLC test procedure

The UDLC procedure can be divided into 4 sequential sections:

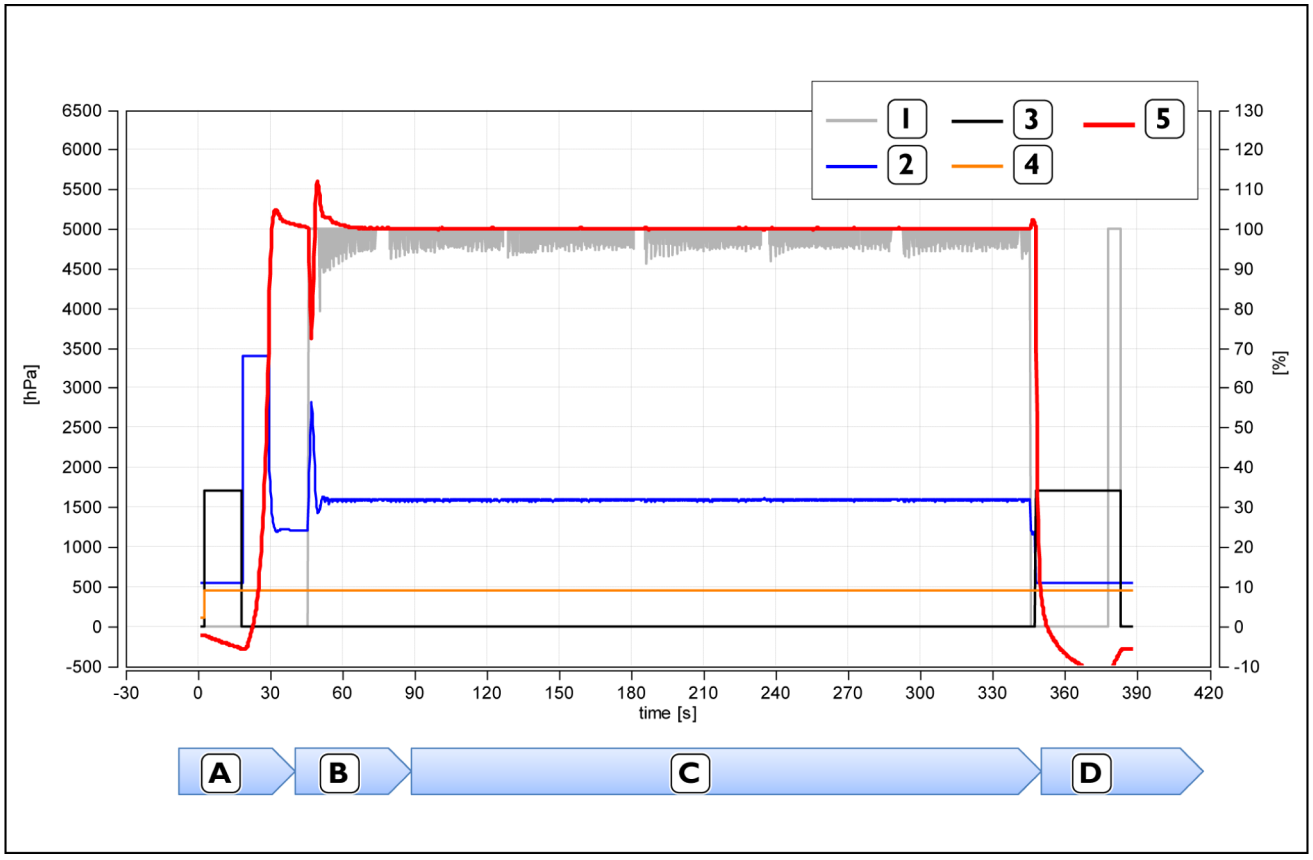
| Assess-ment point | Section | Description |
|---|---|---|
| A | Pressure reduction | Brief emptying stage to bring the system to a specific start phase of the procedure |
| B | Pressure filling and increase | Refilling the system after an increase in pressure |
| C | Pressure stabilisation | Pressure stabilisation phase |
| D | Evacuation | Emptying phase of the lines, the dosing module and the supply module |

# Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing Pump Check (UDPC) Bosch 6.5 and Bosch 3.3 [113389274 - V1 - 26 February 2025]

The Urea-Dosing-Pump-Check (UDVC) is a test procedure carried out by the diagnostic instrument, which allows the correct amount of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid injected by the dosing module to be checked. The procedure involves removing the dosing module and checking the amount injected using a graded container.

During the procedure, a flow rate of 3120 g/h and an injection amount of **260 g** is considered for a period of **390 s**.

| Test | Flow Rate | Amount injected | Test duration | Criteria of acceptability |
|---|---|---|---|---|
| UDPC | **3120 g** | **260 g** | **390 s** | Stable pressure during the entire test. |




NHIL25ENG0510FA 1

| Item | Description |
|---|---|
| 1 | DC dosing module |
| 2 | DC pump |
| 3 | DC return pump |
| 4 | SCR status |
| 5 | Pressure **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid |

## Main sections of the UDPC test procedure

1. The UDPC procedure can be divided into 4 sequential sections:

| Assess-ment point | Section | Description |
|---|---|---|
| A | Pressure reduction | Brief emptying stage to bring the system to a specific start phase of the procedure |
| B | Pressure filling and increase | Refilling the system after an increase in pressure |
| C | Stabilising pressure and injection | Stabilising phase of the pressure followed by an injection equal to the maximum flow rate deliverable |
| D | Evacuation | Emptying phase of the lines, the dosing module and the supply module |

# Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module [113389275 - V1 - 26 February 2025]

## Description

The M-F42A supply module in the exhaust gas after- treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)** serves basically to take the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®**fluid from the tank and send it under pressure to the dosing module Y-F44A.

The supply module M-F42A consists basically of a diaphragm pump which takes the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** from the tank and sends it to the dosing module Y-F44A. It is equipped with a circuit connected to the engine cooling system which, in the case of low temperature, prevents the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid from freezing. The amount of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid sent to the dosing module Y-F44A and the injection pressure are both controlled by the engine control unit and are based on the engine operating conditions and the signals sent by the sensors. To prevent damage to the pump and the dosing module, the supply module has a filter inside which cleans the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid of any impurities.

To refer to the technical data relating to the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid supply module M-F42A.

To refer to the technical data relating to the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid Y-F44A dosing module.

## Troubleshooting

1. Use the diagnostic instrument to carry out the Urea Dosing System Test (UDST), refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing System Check (UDST) Bosch 6.5 and Bosch 3.3 (10.500)**.
2. On the basis of the system conditions, the test will return the following fault modes:

| Fault Mode | Description | Connection |
|---|---|---|
| EM-0 | No fault and/or anomaly present. System responds correctly | - |
| EM-1 | Obstruction on the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid return line | ERROR MODE – 1 |
| EM-2 | **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid leak from the delivery line | ERROR MODE – 2 |
| EM-3 | Operating pressure too low | ERROR MODE – 3 |
| EM-4 | Pressurised line blocked | ERROR MODE – 4 |
| EM-5 | Fault relating to return valve | ERROR MODE – 5 |

| Fault Mode | Description | Connection |
|---|---|---|
| EM-99 | Theoretical anomaly or fault, not foreseeable | ERROR MODE – 99 |

ERROR MODE – 1

If the UDST tests returns EM-1 mode, proceed as follows:

A: Obstruction on the return line.

1. Visually check that there are no obstructions or crushed sections on the lines relating to the return line.
2. Clean or replace the damaged lines.
3. Repeat the UDST test and check that the fault has been resolved.

B: Valve clogged or non-return valve blocked (does not open).

1. Check that the **DIESEL EXHAUST FLUID (DEF)/ ADBLUE®** fluid returns correctly.
2. Disconnect the return line connector from the supply module and start the UDST procedure. Visually check that there is a constant flow of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid. If the flow is not constant, go back to the fault identification procedure.
3. Repeat the UDST test and check that the fault has been resolved.

C: Impurities in the return line filter.

1. Go back to the fault identification procedure.
2. Repeat the UDST test and check that the fault has been resolved.

D: Pump malfunction.

1. Go back to the fault identification procedure.

   Repeat the UDST procedure and check that the fault has been resolved.

   ERROR MODE – 2

   If the UDST tests returns EM-2 mode, proceed as follows:

A: **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid leak from the delivery line.

1. Visually check that there are no leaks from the lines. Repair or replace the damaged line.
2. Visually check there are no leaks from the connections on the dosing module. Repair or replace the damaged component (if present).
3. Visually check there are no leaks from the connections on the supply module (delivery). Repair or replace the damaged component (if present).
4. Repeat the UDST test and check that the fault has been resolved.

B: Obstruction on the **DIESEL EXHAUST FLUID (DEF)/ ADBLUE®** fluid suction line.

1. Visually check that there are no obstructions or crushed sections on the lines relating to the suction line. Repair or replace the damaged line.
2. Repeat the UDST test and check that the fault has been resolved.

C: Clogging of the supply module pre-filter.

1. Make sure that the supply module pre-filter is not clogged. Replace the supply module pre-filter if necessary.

   Carry out the Urea Dosing Leakage Check (UDLC) procedure, refer to **Diesel Exhaust Fluid (DEF)/ AdBlue®/ARLA tank - Test - Urea Dosing Leakage Check (UDLC) Bosch 6.5 and Bosch 3.3 (10.500)**.

   During the UDLC test, the supply module brings the system up to pressure and keeps it pressurised for a given period of time. During the test, **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid injection is not activated. This is useful for checking for the presence of leaks or gaps.

   Repeat the UDST procedure and check that the fault has been resolved.

   ERROR MODE – 3

   If the UDST tests returns EM-3 mode, proceed as follows:

A: Operating pressure too low - **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank empty.

1. Check the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid level in the tank. Restore the correct level of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid.

B: Incorrect connection of the inlet and outlet lines on the supply module or on the tank.

1. Check that the inlet and outlet lines are both connected correctly. Pay careful attention to the indications on the supply module.

C: Serious **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid leak from the pressurised components.

1. Visually check that there are no leaks from the lines. Repair or replace the damaged line.
2. Repeat the UDST test and check that the fault has been resolved.

D: Obstruction in the aeration line of the fluid tank.

1. Check that the aeration line of the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank is not obstructed by crystallised Urea or a restricted section. Clean / repair or replace the damaged line.

E: Obstruction on the **DIESEL EXHAUST FLUID (DEF)/ ADBLUE®** fluid suction line.

1. Visually check that there are no obstructions or crushed sections on the lines relating to the suction line. Repair or replace the damaged line.

F: Clogging of the supply module pre-filter.

1. Make sure that the supply module pre-filter is not clogged. Replace the supply module pre-filter if necessary.

G: Leak on the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid suction line.

1. Visually check that there are no leaks relating to the suction line. Repair or replace the damaged line.

***NOTE:*** *Leaks relating to the suction line are extremely difficult to detect. There are no clear leaks outwards but the air is being sucked in.*

***NOTE:*** *In you are in any doubt, carry out a test using a new suction line and supply the pump module from a separate tank filled with* ***DIESEL EXHAUST FLUID (DEF)/ADBLUE®*** *fluid.*

1. Visually check that the O-rings on the connections of the supply module and the tank are not damaged. Replace the damaged O-rings.
2. Check that the suction line from the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank is not damaged. If necessary, replace the suction line from the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank.

H: Supply module fault (faulty diaphragm pump, faulty return valve…).

1. Go back to the fault identification procedure.

I: Drift of values returned from the pressure sensor.

1. Go back to the fault identification procedure.

Carry out the Urea Dosing Valve Check (UDVC) procedure, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing Valve Check (UDVC) Bosch 6.5 and Bosch 3.3 (10.500)** . During the UDVC test, it is possible to evaluate the volume of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid supplied by the injector. The verification is possible by disassembling the injector and delivering into a graded container.

Carry out the Urea Dosing Pump Check (UDPC) procedure, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing Pump Check (UDPC) Bosch 6.5 and Bosch 3.3 (10.500)**. During the UDPC test it is possible to evaluate the maximum flow rate of the supply module pump. The verification is possible by disassembling the injector and delivering into a graded container.

The pressure must remain stable during the entire test.

Carry out the UDLC procedure, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing Leakage Check (UDLC) Bosch 6.5 and Bosch 3.3 (10.500)**. During the UDLC test, the supply module brings the system up to pressure and keeps it pressurised for a given period of time. During the test, **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid injection is not activated. This is useful for checking for the presence of leaks or gaps.

Repeat the UDST procedure and check that the fault has been resolved.

ERROR MODE – 4

If the UDST tests returns EM-4 mode, proceed as follows:

A: Dosing valve blocked (in both the open and the closed position).

- Repeat the UDST test twice. The first time to release the system and the second time to verify the presence of operating conditions.

***NOTE:*** *The ADBLUE FLUID injector may block due to deposits of crystallised Urea. The condition can often be resolved by repeating the test or dissolving the deposits with* ***DIESEL EXHAUST FLUID (DEF)/ADBLUE®*** *fluid..*

- If the second test also gives a negative result, go back to the fault identification procedure.

***NOTE:*** *The dosing module must be replaced if it has been subjected to thermal damage resulting from exposure to excessively high temperatures. The* ***DIESEL EXHAUST FLUID (DEF)/ADBLUE®*** *fluid injector may block due to deposits of crystallised Urea. The condition can often be resolved by repeating the test or dissolving the deposits with* ***DIESEL EXHAUST FLUID (DEF)/ADBLUE®*** *fluid.*

B: Serious obstruction on the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid delivery line.

1. Visually check that there are no obstructions or crushed sections on the lines relating to the delivery line. Repair or replace the damaged line.
2. Check that the delivery line is not clogged with solid particles. Clean or replace the line as necessary.

Carry out the UDVC procedure, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing Valve Check (UDVC) Bosch 6.5 and Bosch 3.3 (10.500)**. During the UDVC test, it is possible to evaluate the volume of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid supplied by the injector. The verification is possible by disassembling the injector and delivering into a graded container.

Carry out the UDPC procedure, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing Pump Check (UDPC) Bosch 6.5 and Bosch 3.3 (10.500)**. During the UDPC test it is possible to evaluate the maximum flow rate of the supply module pump. The verification is possible by disassembling the injector and delivering into a graded container.

The pressure must remain stable during the entire test.

Repeat the UDST procedure and check that the fault has been resolved.

ERROR MODE – 5

If the UDST tests returns EM-5 mode, proceed as follows:

A: Fault relating to the purging pump

1. Check operation of the purging pump and, if it is not working correctly, go back to the fault identification procedure.

   Carry out the UDPC procedure, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Urea Dosing Pump Check (UDPC) Bosch 6.5 and Bosch 3.3 (10.500)**. During the UDPC test it is possible to evaluate the maximum flow rate of the supply module pump. The verification is possible by disassembling the injector and delivering into a graded container.

   The pressure must remain stable during the entire test.

   Repeat the UDST procedure and check that the fault has been resolved.

   ERROR MODE – 99

   If the UDST tests returns EM-99 mode, proceed as follows:

A: Theoretical anomaly or fault, not foreseeable.

1. Fault which has not occurred before. Repeat the UDST test
2. If the UDST test confirms error EM-99, contact the Technical Help Desk.

# Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - AdBlue level and temperature sensor [113389276 - V1 - 26 February 2025]

The **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** quality, level and temperature sensor B-F43-46 is present in the exhaust gas after treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**) and measures the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid temperature, level and quality inside the tank.

To refer to the technical data relating to the **DEF/ADBLUE®** temperature and level sensor B-F43-46, **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - AdBlue level and temperature sensor (10.500)**.

## Diagnostics procedure

1. Use the diagnostic tool to acquire the data relating to the temperature of the fluid in the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank. Use a digital thermometer with a probe to acquire the temperature data relating to the fluid in the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank. Compare the data provided by the diagnostic tool with the data acquired directly using the digital thermometer.
   A. If the temperature values match, this indicates that the temperature read by the sensor is correct. Go to step **2**.
   B. If the temperature values do not coincide, this indicates that the sensor might not be working correctly. Go back to the fault identification procedure.
2. Use the diagnostic instrument to acquire the data relating to the level of liquid present in the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank in the following conditions:
   - **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank completely empty ( **0%**).
   - **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank full to **50%**, use the capacity data to determine the exact amount of liquid to be introduced.
   - **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank completely empty ( **100%**).

   Analyse the three sets of data provided by the diagnostic instrument, checking that they are consistent with the three different test conditions.
   A. If the values related to the level sensor are consistent, this indicates that the sensor is working correctly. Continue with the troubleshooting procedure.
   B. If the values relating to the level sensor are not consistent, check the efficiency of the electrical wiring and carry out the fault identification procedure.

# Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Crossover valve [113407986 - V1 - 26 February 2025]

## Description:

The **DEF/ADBLUE®** Y-F60 tank heating valve is present in the exhaust gas after treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**and serves to prevent both freezing of the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid and overheating of the dosing module. The switching valve is a 2 position/3 way type solenoid valve. On the basis of the temperature detected by the NTC sensor, the switching valve closes or opens the passage for the engine coolant into the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank heating coil. The cooling circuit for the dosing module always stays open. The first position allows the cooling of the Dosing Module while the second position allows heating of the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank and the relative lines.

To refer to the technical data relating to the **DEF/ADBLUE®** Y-F60 heating valve, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Crossover valve (10.500)**.

## Diagnostics procedure

1. Check the internal resistor of the **DEF/ADBLUE®** tank heating valve Y-F60. Proceed as follow:
   - Use a multimeter to check that the resistance recorded between the two pins of the connector of the valve Y-F60 is between **30 – 34 Ω** and **25 °C** for version **24 V** and **20 – 24 Ω** and **25 °C** for version **12 V**.
     A. If the resistance measured is between **30 – 34 Ω** and **25 °C** for the **24 V** version and **20 – 24 Ω** and **25 °C** for the **12 V** version, go to step **2**.
     B. If the resistance measured is not between **30 – 34 Ω** and **25 °C** for the **24 V** version and **20 – 24 Ω** and **25 °C** for the **12 V** version, this indicates that the component might not be working correctly. Go back to the fault identification procedure.
2. Start the engine and bring it to stabilised thermal conditions. Power the valve Y-F60 and use a special digital thermometer with a probe to check that the temperature of the fluid in the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank rises.
   A. If there is an increase in the temperature of the liquid in the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank, go to step **3**.
   B. If there is no increase in the temperature of the liquid in the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid tank, this indicates that the component might not be working correctly. Go back to the fault identification procedure.

3. Use the diagnostic instrument to disable and clear the fault code. Restore the operating conditions of the vehicle and check that the fault code relating to the **DEF/ADBLUE®** Y-F60 tank heating valve does not activate.
   A. If the fault code relating to the **DEF/ADBLUE®** tank heating valve is not active, this indicates that the sensor is operating correctly. Carry out the fault identification procedure.
   B. If the fault code relating to the **DEF/ADBLUE®** tank heating valve is active, check the efficiency of the wiring and continue with the fault identification procedure.

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## Exhaust Gas Recirculation (EGR) exhaust treatment - 501

**F6AFL413A*U001**

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# Exhaust Gas Recirculation (EGR) valve - Overview - EGR assembly [113427259 - V1 - 18 February 2025]

The EGR exhaust gas recirculation system comprises a heat exchanger and a flow regulating valve.

The heat exchanger lowers the temperature of the exhaust gas which is partially sent to the combustion chamber. This operation lowers the combustion temperature of the mixture. This is done because the exhaust gas, which is completely inert, mixes with the mixture and slows down the rate of combustion.

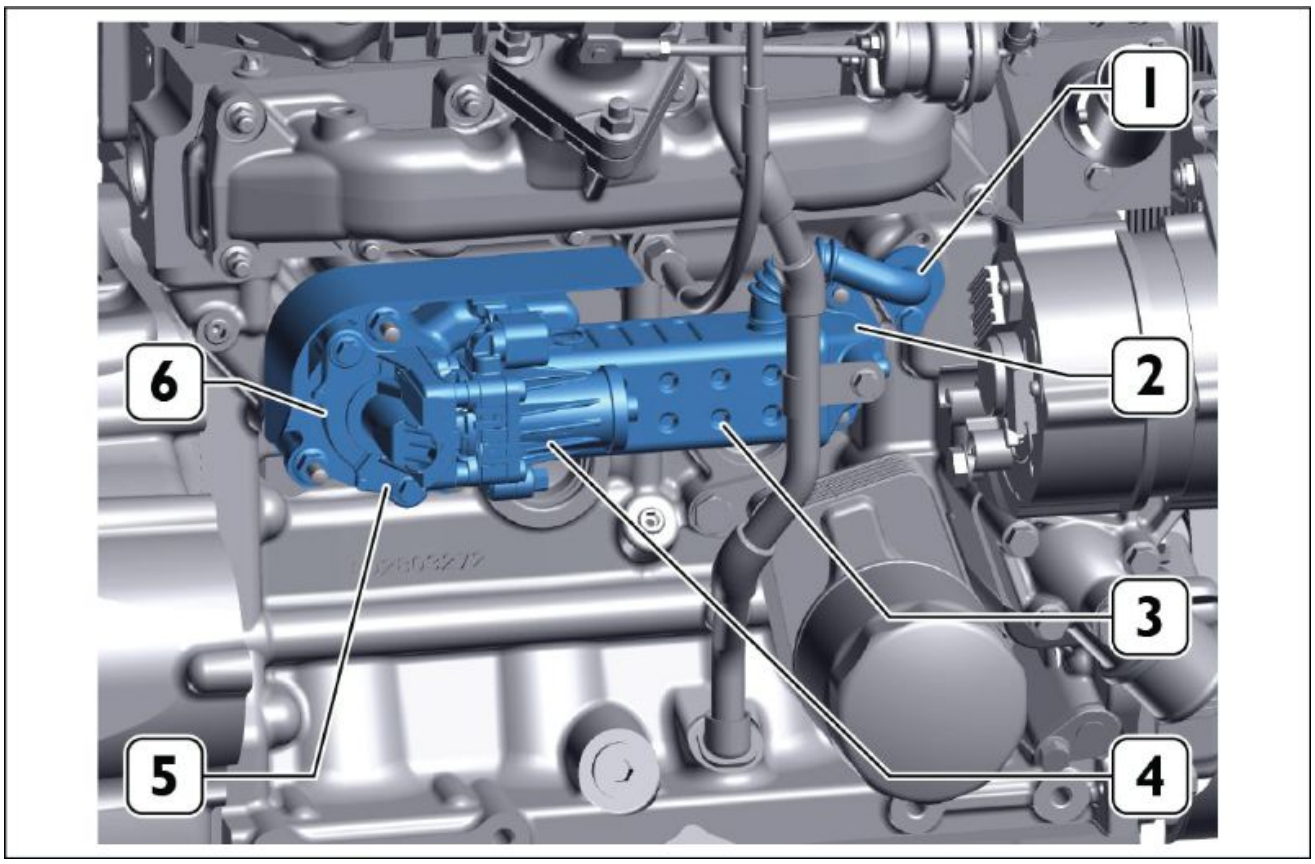
Lowering this temperature considerably reduces NOx (Nitrogen Oxide) emissions which are harmful to the environment.

The body of the heat exchanger is composed of a bundle of tubes cooled externally by the engine coolant. The part of the exhaust gas intended for recirculation, is sent to the shell and tube exchanger and is cooled.

The EGR flow regulating valve is mounted on the end of the heat exchanger.

The recirculation exhaust gas flow is controlled by an electrically controlled plate valve.

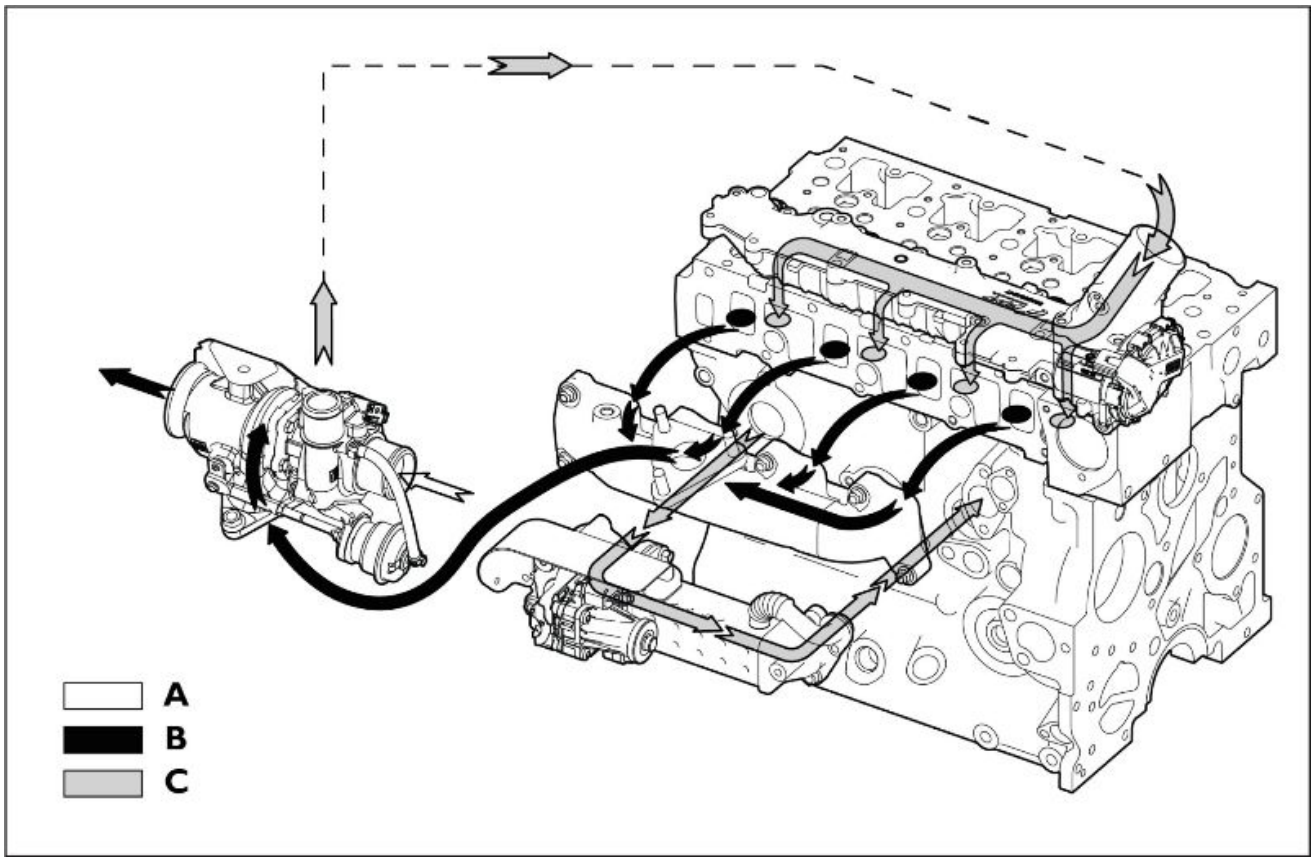
To ensure higher efficiency and longer durability to the valve, the valve is cooled by engine coolant from heat exchanger.




NHIL25ENG0259TA 1

1. Coolant pipe from EGR heat exchanger to crankcase.
2. Exhaust gas outlet from EGR to crankcase.
3. EGR heat exchanger exhaust gas/coolant.
4. EGR valve.
5. Coolant pipe inlet from crankcase to EGR valve.
6. EGR exhaust gas inlet from crankcase to EGR valve.

## Operation diagram




NHIL25ENG0260FA 2

A. Intake air entering the turbocharger from the air filter.

B. Exhaust gas.

C. Compressed air from turbocharger to engine air intake / EGR exhaust gas recirculation.

# Exhaust Gas Recirculation (EGR) valve - Overview - EGR modulating solenoid valve [113427269 - V1 - 18 February 2025]

## Exhaust gas valve (EGR)

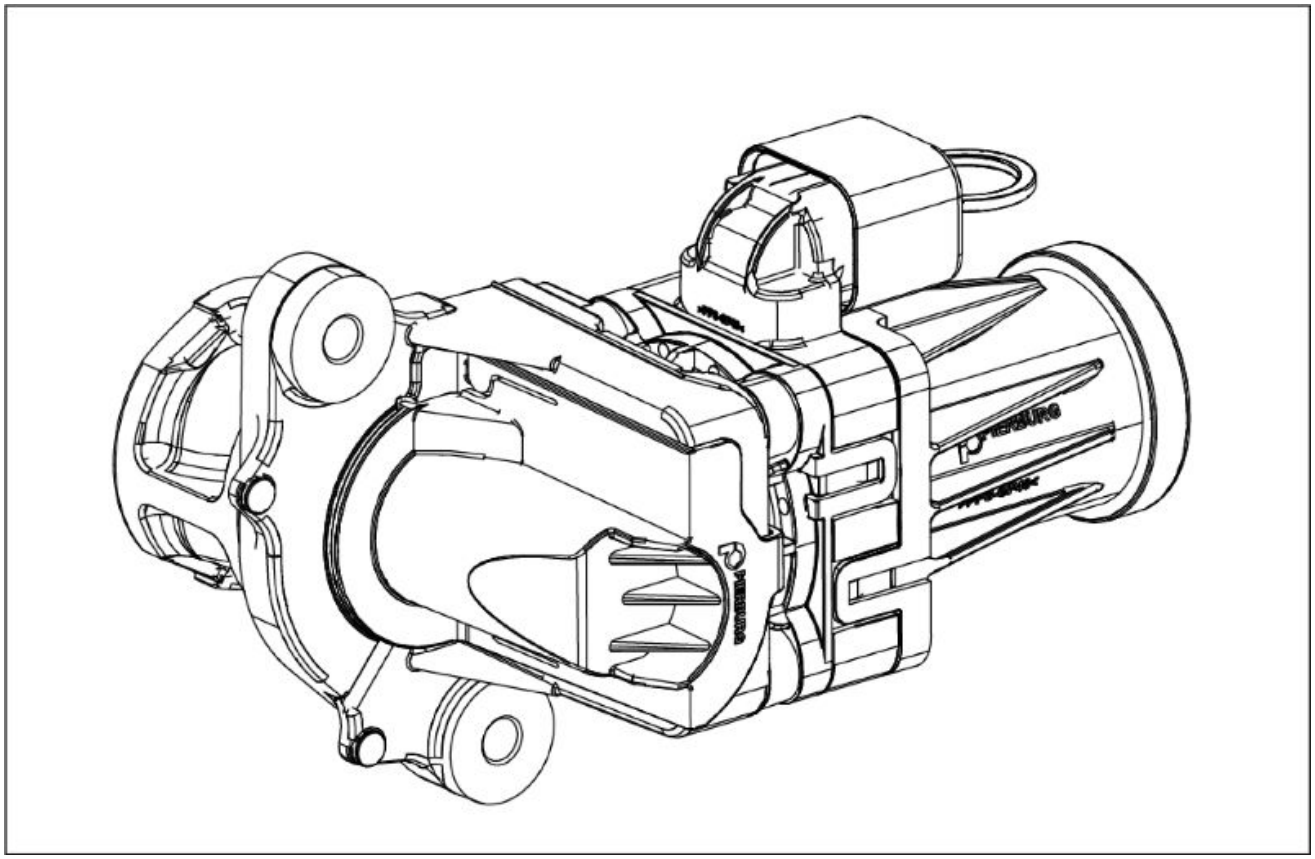
Fit between the EGR system and the exhaust manifold, this is a motorised valve that regulates the quantity of exhaust gas to recirculate in the cylinders at each cycle.

Contains a position sensor and an actuator for the electric valve motor.

The sensor is powered at **5 V**.

## Sensor-actuator pin-out

| Pin | Description |
|---|---|
| 1 | EGR valve DC motor actuator positive |
| 2 | EGR valve position sensor signal output |
| 3 | Not connected |
| 4 | EGR valve position sensor ground |
| 5 | EGR valve DC motor actuator negative |
| 6 | EGR valve position sensor power supply |



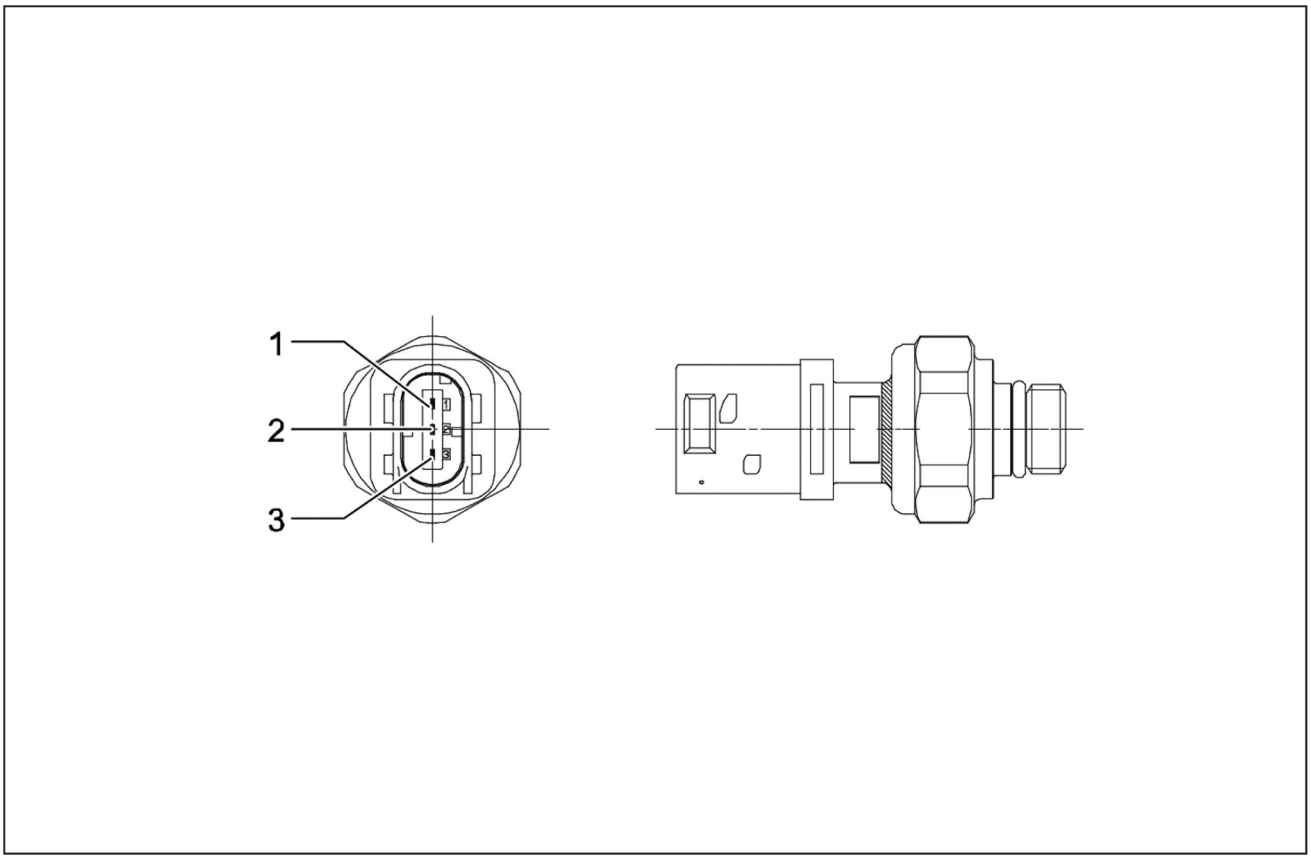
NHIL25ENG0261FA 1

# Exhaust Gas Recirculation (EGR) valve - Overview - Absolute pressure sensor [113427276 - V1 - 04 March 2025]

Fit on a return pipe from the exhaust manifold, it is a sensor that measures the pressure of the exhaust gas, which the engine control unit uses to accurately calculate the quantity of exhaust gas to recirculate in the intake and therefore to control the EGR system throttle valve.

It is fed at **5 V** tension.

Voltage at the output is proportional to the pressure detected by the sensor.




NHIL25ENG0262FA 1

## Sensor pin-out

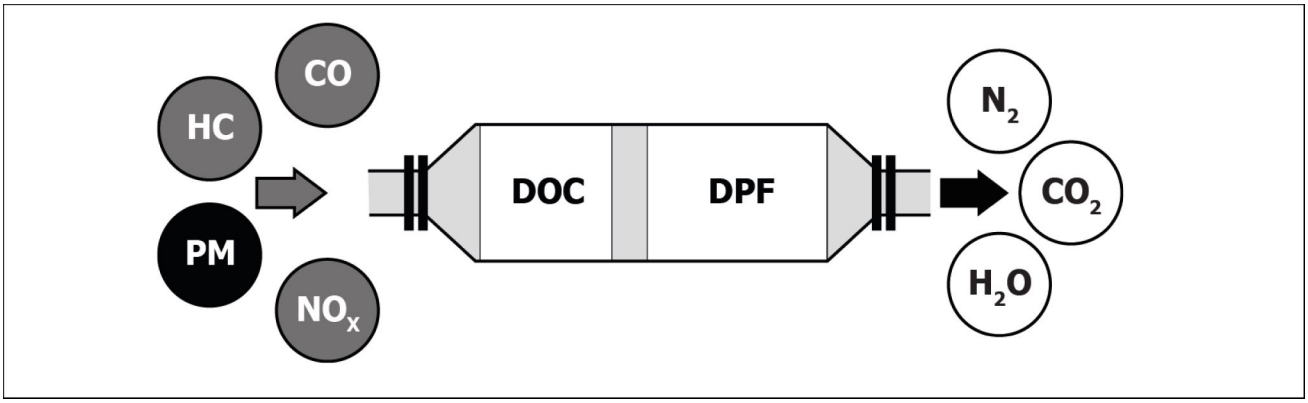
| Pin | Description |
|---|---|
| 1 | Feeding |
| 2 | Ground |
| 3 | Signal |

# Exhaust Gas Recirculation (EGR) valve - Overview - Exhaust pipes and silencer [113437882 - V1 - 06 March 2025]

## Exhaust gas post-treatment system (ATS)

The Stage V regulations, which require a limit on the number of particulate particles (PN) (compared to the previous regulations which set a limit to the mass of particulate), has made mandatory the implementation of DPF filter (Diesel Particulate Filter).

## ATS configuration



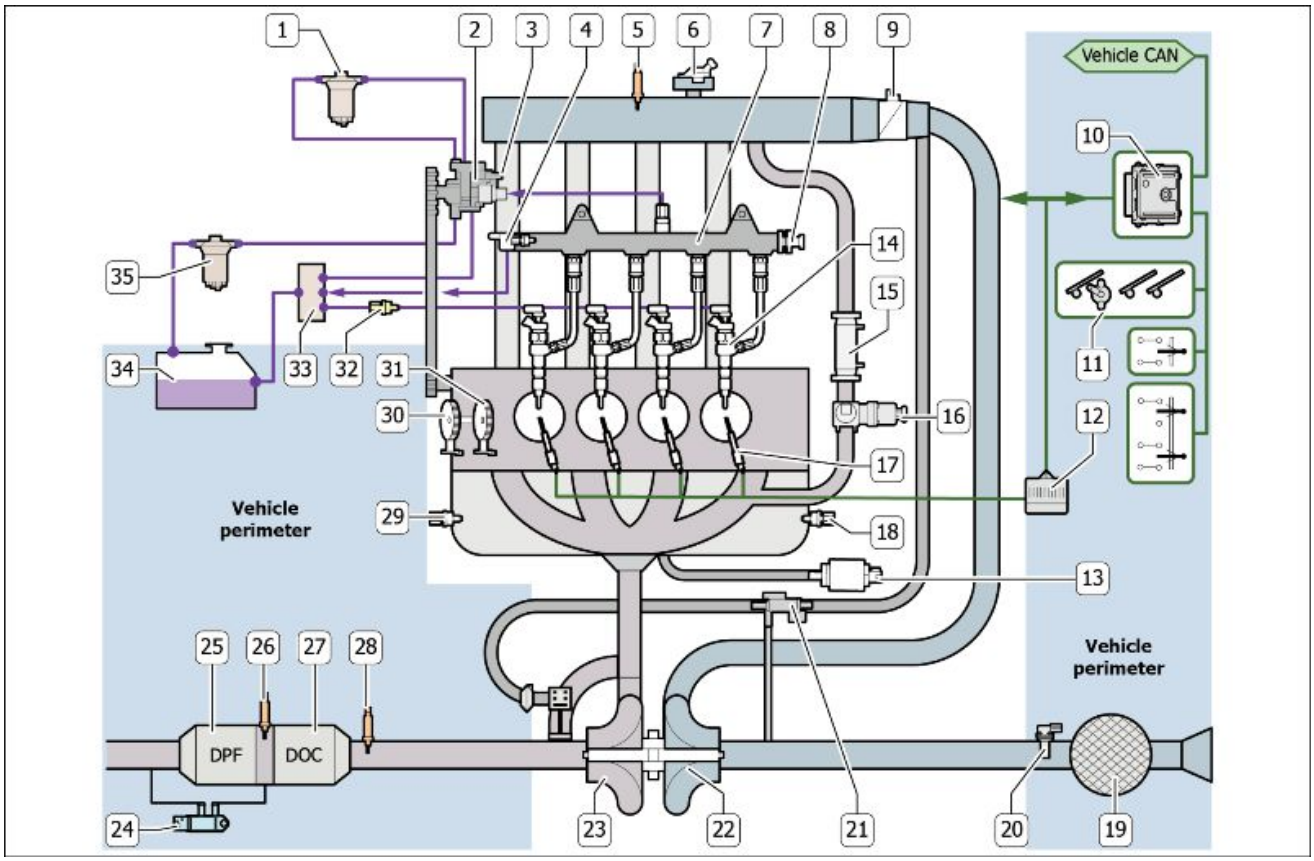

NHIL25ENG0410EA 1

- A DOC (Diesel Oxidation Catalyst) catalytic converter.
- A DPF (Diesel Particulate Filter).

To reduce exhaust gas emissions within the limits required by current standards, it is necessary to implement the exhaust gas post-treatment system (ATS) which combines more devices:

- A DOC catalytic converter that, via a series of oxidation reactions allows the treatment of HC (unburned hydrocarbons) and CO (carbon monoxide) using the residual oxygen $O_2$ at the exhaust by transforming it into carbon dioxide ($CO_2$) and water ($H_2O$) through oxidation reactions. The oxidation of CO and HC are obtained through the use of noble metals such as platinum and palladium.
- The EGR system (EGR valve and heat exchanger) reduces NOx emissions. Once the EGR valve is open, the exhaust gas flows through the EGR heat exchanger where the combustion temperature is reduced in order to reduce the quantity of NOx, then the exhaust gas enters the intake pipe.
- The diesel particulate filter DPF to remove NOx and PM from the diesel exhaust, by oxidising simultaneously CO and HC.

## SCRoF configuration diagram




NHIL25ENG0411FA 2

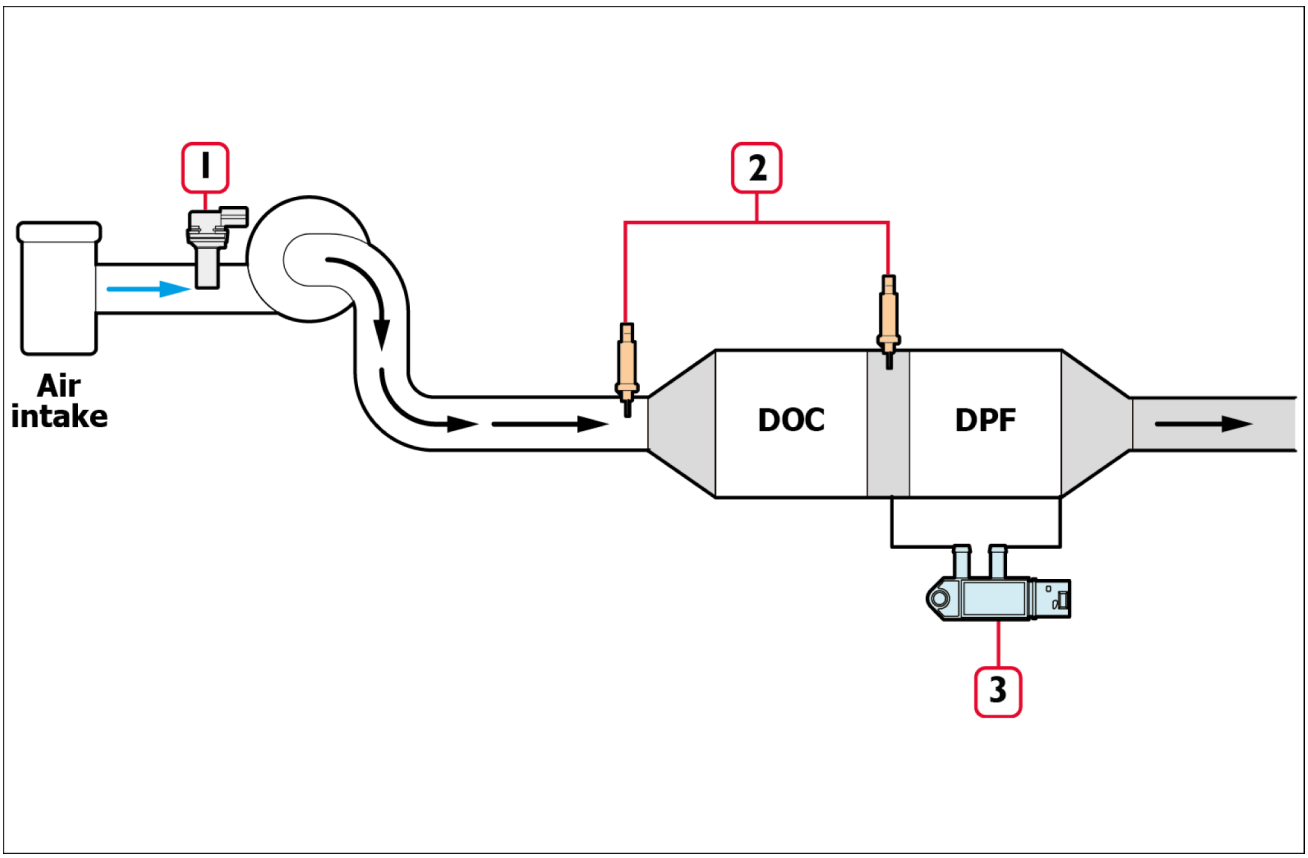
| Item | Description |
|---|---|
| 1 | Fuel filter with temperature sensor |
| 2 | High pressure fuel pump |
| 3 | Fuel high pressure pump dosing valve |
| 4 | Rail pressure sensor |
| 5 | Air temperature sensor (intake manifold) |
| 6 | Boost pressure and air temperature sensor (intake manifold) |
| 7 | Rail |
| 8 | Overpressure valve |
| 9 | Throttle valve (TVA) |
| 10 | Engine control unit |
| 11 | Machine interface (pedal, power take-off,…) |
| 12 | Glow plug connector |
| 13 | Exhaust gas absolute pressure sensor |
| 14 | Injectors |
| 15 | EGR heat exchanger |
| 16 | EGR valve |
| 17 | Glow plugs |
| 18 | Oil pressure sensor |
| 19 | Air filter |
| 20 | Intake air temperature and humidity sensor |
| 21 | Waste-gate pressure modulator |
| 22 | Compressor |
| 23 | Turbine |
| 24 | Pressure differential sensor |
| 25 | DPF particulate filter |
| 26 | Temperature sensor downstream of DOC |
| 27 | DOC catalytic converter |

| Item | Description |
|---|---|
| 28 | Temperature sensor upstream of DOC |
| 29 | Engine coolant temperature sensor |
| 30 | Crankshaft incremental speed sensor |
| 31 | Phasing segmental speed sensor (camshaft) |
| 32 | Check valve (on fuel return line on injector) |
| 33 | - |
| 34 | Fuel return damper |
| 35 | Fuel pre-filter with heater and water sensor in the filter |

The ATS system is managed by the engine control unit via a series of sensors:

- Two exhaust gas temperature sensors.
- One humidity sensor fitted on the engine air intake pipe downstream of the air filter.
- One pressure differential sensor.

## Electronic management of the ATS

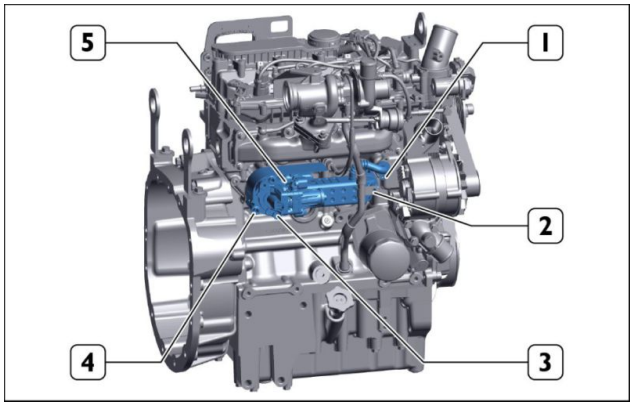



NHIL25ENG0412FA 3

| Item | Description |
|---|---|
| 1 | Inlet air temperature and humidity sensor |
| 2 | Exhaust gas temperature sensor upstream and downstream of the DOC |
| 3 | Pressure differential sensor. |

# Exhaust Gas Recirculation (EGR) exhaust treatment - Remove - EGR Assembly [113427400 - V1 - 04 March 2025]

1. Unscrew the fastening screw **(2)** and move the oil return pipe from the turbocharger in order to ease the removal of the EGR.
2. Unscrew the fastening screws **(3)** and remove the EGR valve.
3. Unscrew the fastening screws **(1)** and nuts **(4)** and remove the EGR heat exchanger **(5)** together with the relevant gaskets.
4. Remove the studs from the cylinder block.

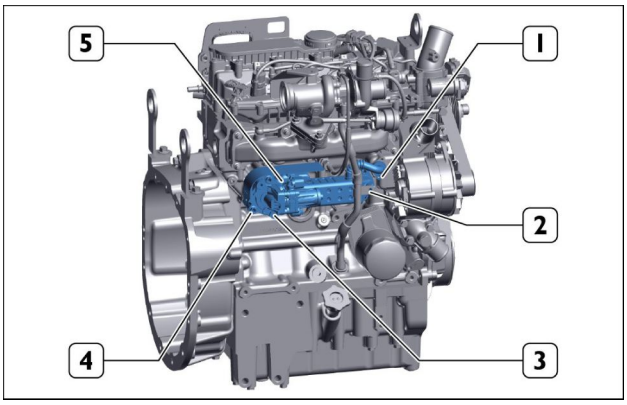



NHIL25ENG0274FA 1

# Exhaust Gas Recirculation (EGR) exhaust treatment - Install - EGR assembly [113427401 - V1 - 04 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| EGR heat exchanger | | 5 nuts M8 x1.25 | **23 +/- 2.3 N·m** |
| | | 1 screw M6 x 1 x 14 | **10 +/- 1 N·m** |
| EGR valve | 2 screws M6 | | **10 +/- 1 N·m** |
| Lubricant oil return pipe from turbocharger bracket | 1 screw M6 x 1 x 10 | | **10 +/- 1 N·m** |

1. Install the studs on the crankcase and tighten them to the prescribed torque.




NHIL25ENG0275FA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| EGR heat exchanger | 5 studs M8 x 1.25 x 80 | | **23 +/- 2.3 N·m** |

2. Install the EGR heat exchanger **(5)** , inserting the gaskets, and tighten the fastening screws **(1)** and the nuts **(4)** to the prescribed torque.

| Description | Quantity | Value |
|---|---|---|
| EGR heat exchanger | 5 nuts M8 x1.25 | **23 +/- 2.3 N·m** |
| | 1 screw M6 x 1 x 14 | **10 +/- 1 N·m N·m** |

3. Fit the EGR valve and tighten the fastening screws **(3)** to the prescribed torque

| Description | Quantity | Value |
|---|---|---|
| EGR valve | 2 screws M6 x 1 x 20 | **10+/- 1 N·m** |

4. Correctly position the oil return pipe from the turbocharger and tighten the fastening screw **(2)**.

| Description | Quantity | Step | Value |
|---|---|---|---|
| Lubricant oil return pipe from turbocharger bracket | 1 screw M6 x 1 x 10 | | **10+/- 1 N·m** |

# Exhaust Gas Recirculation (EGR) valve - Prepare - EGR valve actuator [113387705 - V1 - 21 February 2025]

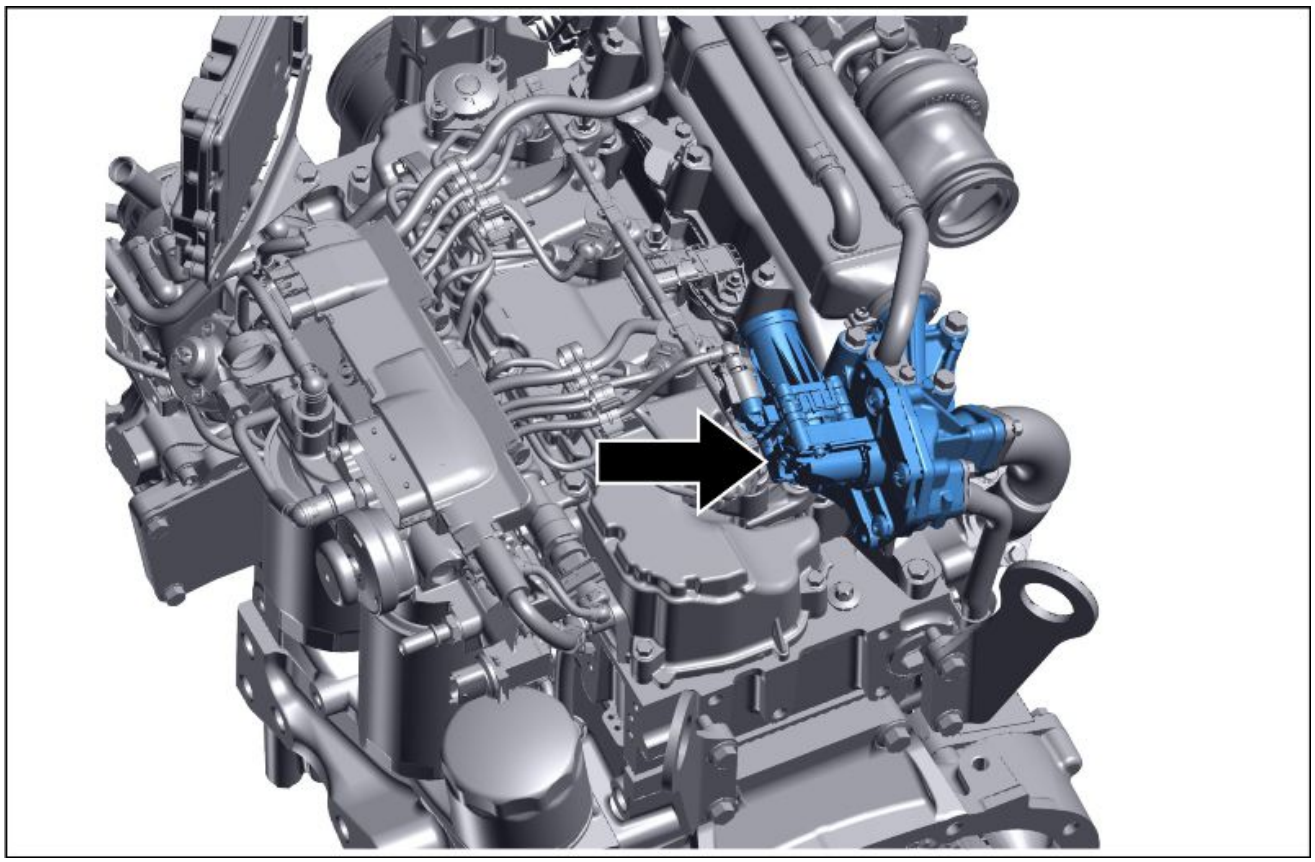
## Preparation

General checks

- Ignition switch set to OFF position.

# Exhaust Gas Recirculation (EGR) valve - Check - EGR valve actuator [113387706 - V1 - 21 February 2025]

1. Check the EGR system
   - Visually check for damage or leaks in the fittings and in the pipes of the EGR valve.
   - Remove the pipes to allow a visual check of the EGR valve.
   - Manually check that the EGR valve is working correctly.
   - Refer to the figure **1** for the location of the EGR valve, then go to step **2**.



NHIL25ENG0461TA 1

**EGR valve location**

2. Check the EGR valve
   A. Fittings, flanges and pipes correctly fastened.
   B. No sticking or damage to the EGR valve.
   C. If the EGR valve is working correctly, refer to **Exhaust Gas Recirculation (EGR) valve - Check - EGR valve actuator (10.501)**.
   D. If the EGR valve is NOT working correctly, go to step **3**.
3. Possible root cause
   - Fittings, flanges and pipes not fastened correctly.
   - EGR valve blocked or damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

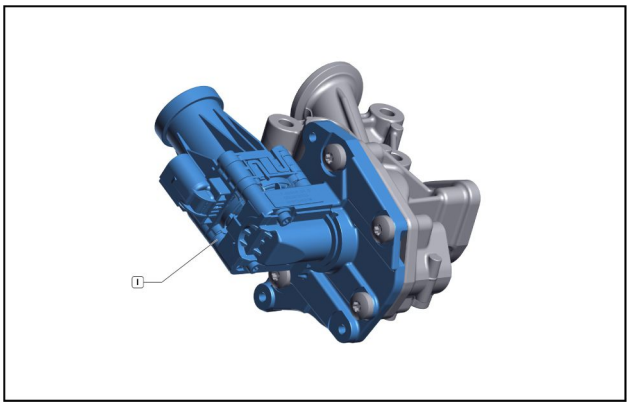
# Exhaust Gas Recirculation (EGR) valve - Check - EGR valve actuator [113387707 - V1 - 21 February 2025]

## Check operation of the EGR valve

1. Check operation of the EGR valve
   - Remove the EGR valve from the engine.
   - Operate the EGR valve by powering it with battery voltage.
   - Use a dial gauge to check that the stroke completed by the EGR valve corresponds to the nominal value of **6.0 mm** (**0.2 in**).
   - Refer to the figure **1** and go to step **2**.

**EGR valve actuator**

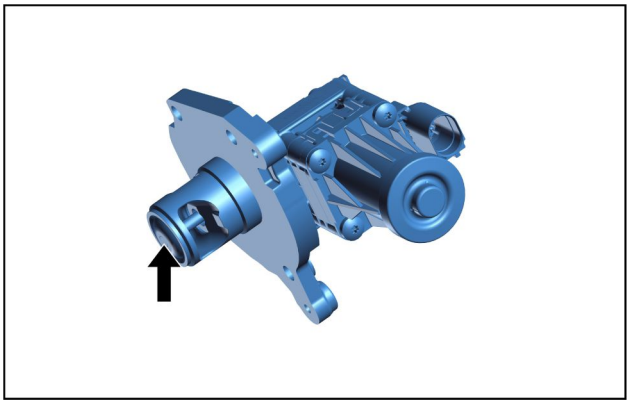
| Item | Description |
|---|---|
| 1 | EGR valve actuator module |




NHIL25ENG0462TA 1

## Location of EGR valve throttle

2. Check operation of the EGR valve
   A. No sticking or damage to the EGR valve throttle.
   B. No faults or damage to the EGR valve actuator module.
   C. Complete opening of the EGR valve ( **6.0 mm** (**0.2 in**)).
   D. If the EGR valve is operating correctly, go to step **4**.
   E. If the EGR valve is NOT operating correctly, go to step **3**.



NHIL25ENG0463TA 2

3. Possible root cause
   - EGR valve throttle blocked or damaged.
   - Actuator module of the EGR valve faulty or damaged.
   - Electrical fault in the component. Check the wiring and the component electrically.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The EGR valve is working correctly.

# Exhaust Gas Recirculation (EGR) valve - Service instruction - Forced regeneration procedure [113437907 - V1 - 07 March 2025]

***NOTE:*** *Risk of damage The forced regeneration of the exhaust gas posttreatment device is a procedure which must always be carried out by Service Centres and can only be activated via a diagnostics tool. Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty*

## ⚠ WARNING

**Personal Protective Equipment (PPE) required. When assembling, operating, or servicing the tractor, wear protective clothing and PPE necessary for the particular procedure. Some PPE that may be necessary includes protective shoes, eye and/or face protection, hard hat, heavy gloves, filter mask, and hearing protection.**
**Failure to comply could result in death or serious injury.**

**W1749A**

Before starting the forced regeneration, follow the indications shown in the warnings.

## General warnings

- During forced regeneration the surfaces of the unit components, in particular the components of the ATS system and of the engine, reach extremely high temperatures.
- Check that the unit is in a safe area, that is appropriately isolated from other equipment and vehicles.
- Carry out the forced regeneration only in an open space.
- Make sure that there are no flammable materials in the area.

***NOTE:*** *Risk of burns The area around the assembly must be cordoned off to prevent any unauthorized persons from coming into contact with the high temperature exhaust gases, which could cause serious personal injury. Failure to comply with these prescriptions can result in the risk of serious injury*

- Hang special safety signs on the unit warning that maintenance is being performed, according to the specific national directives.
- Wear PPE required by national regulations.
- The forced regeneration of the exhaust gas post treatment device is a procedure which must always be carried out by the Assistance Network and may be activated through the diagnostics tool ( PT-Box/ VCI) or through the dedicated CAN message ( CMBC1).
- The regeneration phase includes an automatic warm up phase
- At the end of the regeneration the engine will have a cold down phase at approximately **1500 RPM**.

  ***NOTE:*** *Risk of damage The procedure can last a maximum of **50 min** including the heating phase. Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle*
- In case of doubts, refer to the parent company before proceeding.

## Off-road and on-road warnings

### ⚠ WARNING

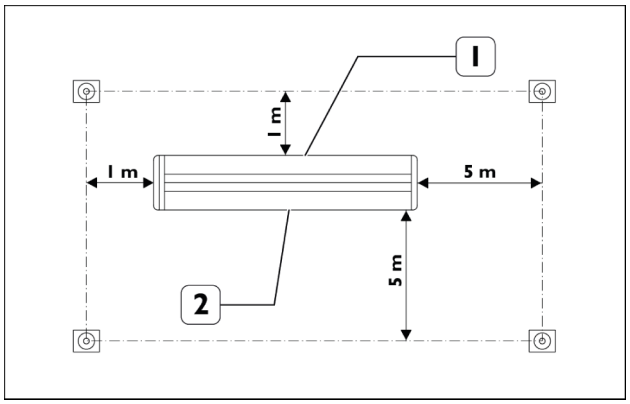
**Fire hazard!**
**During the particulate matter catalyst forced regeneration process the exhaust stack and fixed hood area becomes extremely hot. Park the machine outside and away from combustible or highly flammable material.**
**Failure to comply could result in death or serious injury.**

**W1346A**

***NOTE:*** *General risk, general prescriptions No other vehicle must be in the direction of the exhaust pipe at a distance of less than **5 m** (**197 in**). This precaution must be strictly observed, because during the forced regeneration the released heat in the silencer zone is very high. Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle*

1. - Park the machine away from flammable elements (hay bales, dry leaves).
   - Make sure that the exhaust line is clean and not covered by flammable work residuals.
   - Before starting the procedure mark the area around the vehicle with barrier signs as indicated in the figure.

***NOTE:*** *1) Vehicle – 2) Exhaust gas terminal side and its position on the vehicle.*




NHIL25ENG0415AA 1

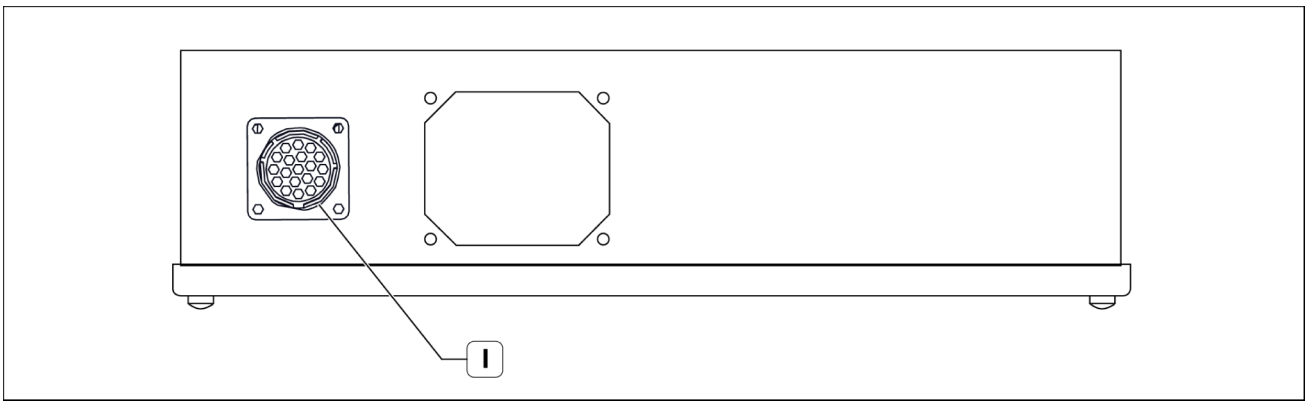
## Specific warnings for generator units

- Isolate the generator unit from the electric distribution line by acting on the phase disconnecting switches – main current contactors.
- Open the access doors on the soundproof unit to ease the ventilation of the engine compartment.
- Delimit the area around the generator; reserving a space of at least **2.00 m** (**78.74 in**) around the unit, paying particular attention of the exhaust gas discharge into the atmosphere.

## Off-road and on-road connections

2. To carry out the forced regeneration of the ATS system, connect the diagnostic tool ( PT-Box o VCI) to the OBD diagnosis socket.
   1. PT-Box ( **Diagnostic connector - Overview - PT-BOX diagnostic tool and connection to the engine (55.100)**)
   2. VCI ( **Diagnostic connector - Overview - VCI diagnostic tool and connection to the engine (55.100)**)
3. Make sure that the unit is switched of from the switchboard. Unit power supply switch set to “OFF” and/or control panel switched OFF.
   - Current generator units: isolate the unit from the three-phase system of the distribution network using the disconnecting switches. Apply special mechanical stops to the disconnecting switches in compliance with applicable national directives.
   - Hang on the switchboard the signs required by applicable national regulations; signs warning that maintenance is being carried out on the unit.

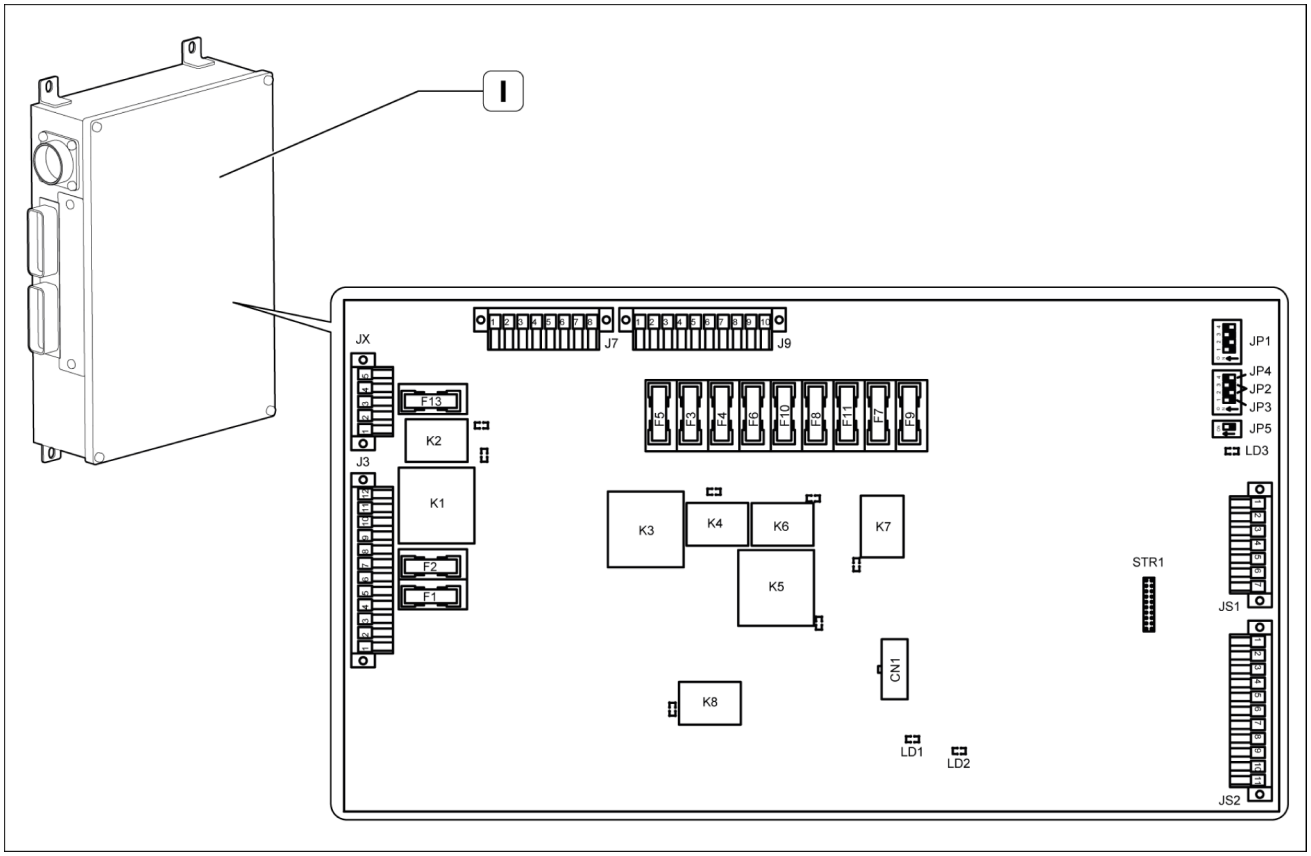
   To perform the forced regeneration of the ATS system, connect the PT-Box o VCI diagnostic tool to the interface housing as described below.
   - PT-Box ( **Diagnostic connector - Overview - PT-BOX diagnostic tool and connection to the engine (55.100)**)
   - VCI ( **Diagnostic connector - Overview - VCI diagnostic tool and connection to the engine (55.100)**)




NHIL25ENG0416EA 2

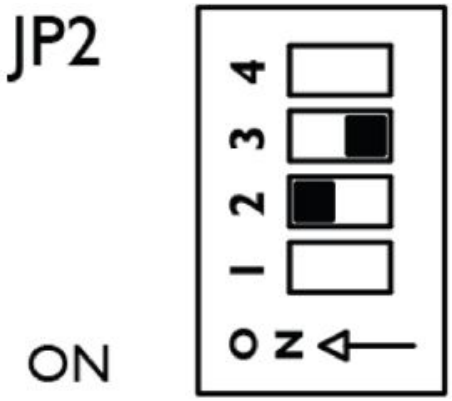
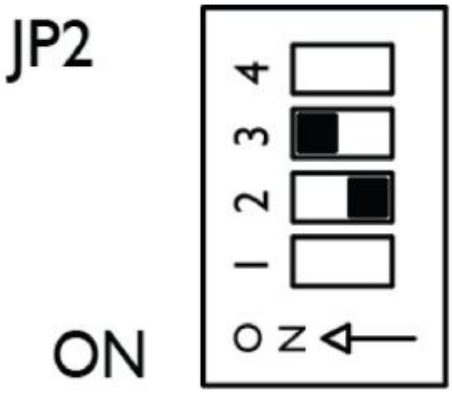
**(1) – 19 pin engine diagnostics socket**

4. Remove the front cover **(1)** of the interface housing to access the internal board.




NHIL25ENG0417FA 3

Set the unit in diagnostic mode by acting on the microswitches JP2.

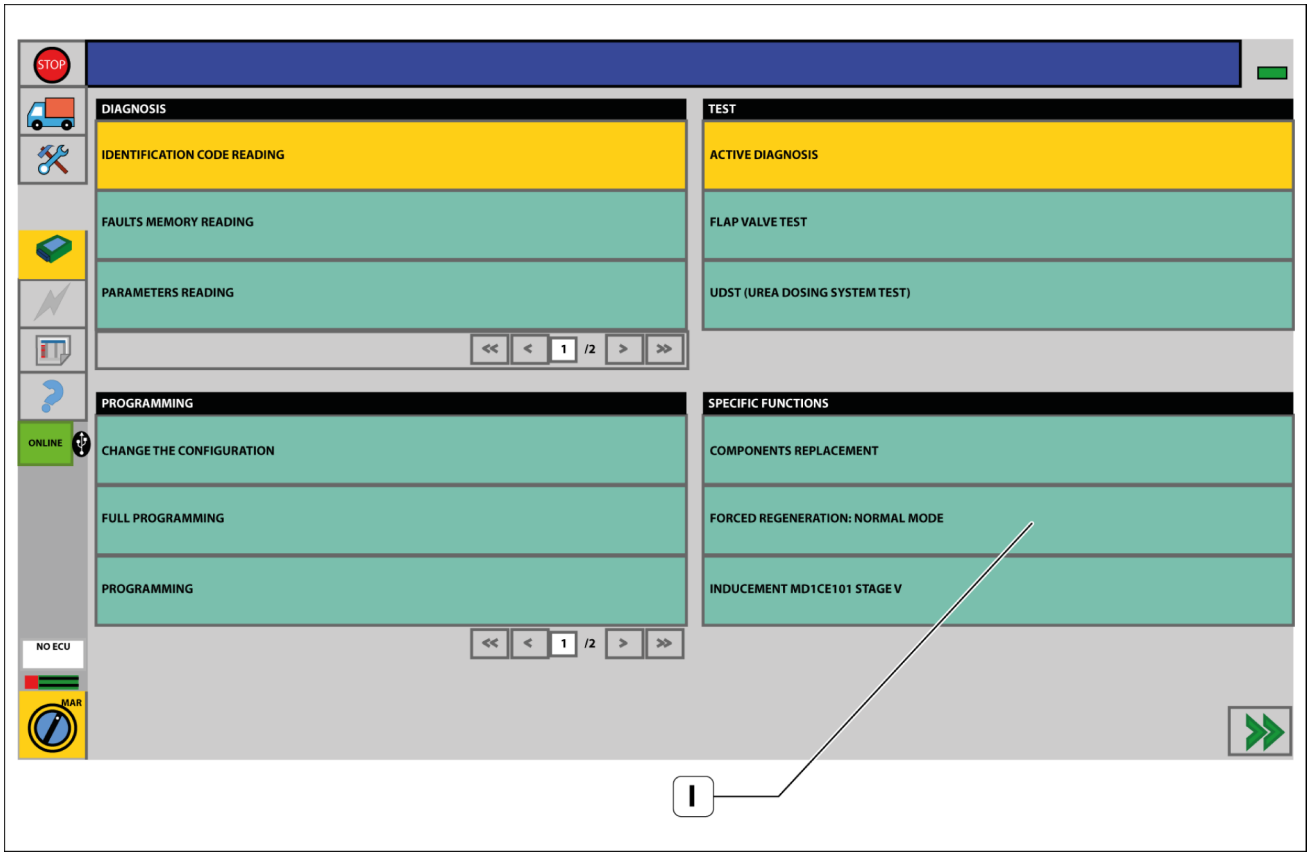
| | |
|---|---|
| Diagnostics position |  |
| Operational position (default) |  |

## Starting the forced regeneration procedures through the diagnostic tool

5. Start the diagnostic tool ( PT-Box o VCI) and follow the step-by-step instructions to select the forced regeneration procedure for the ATS system.

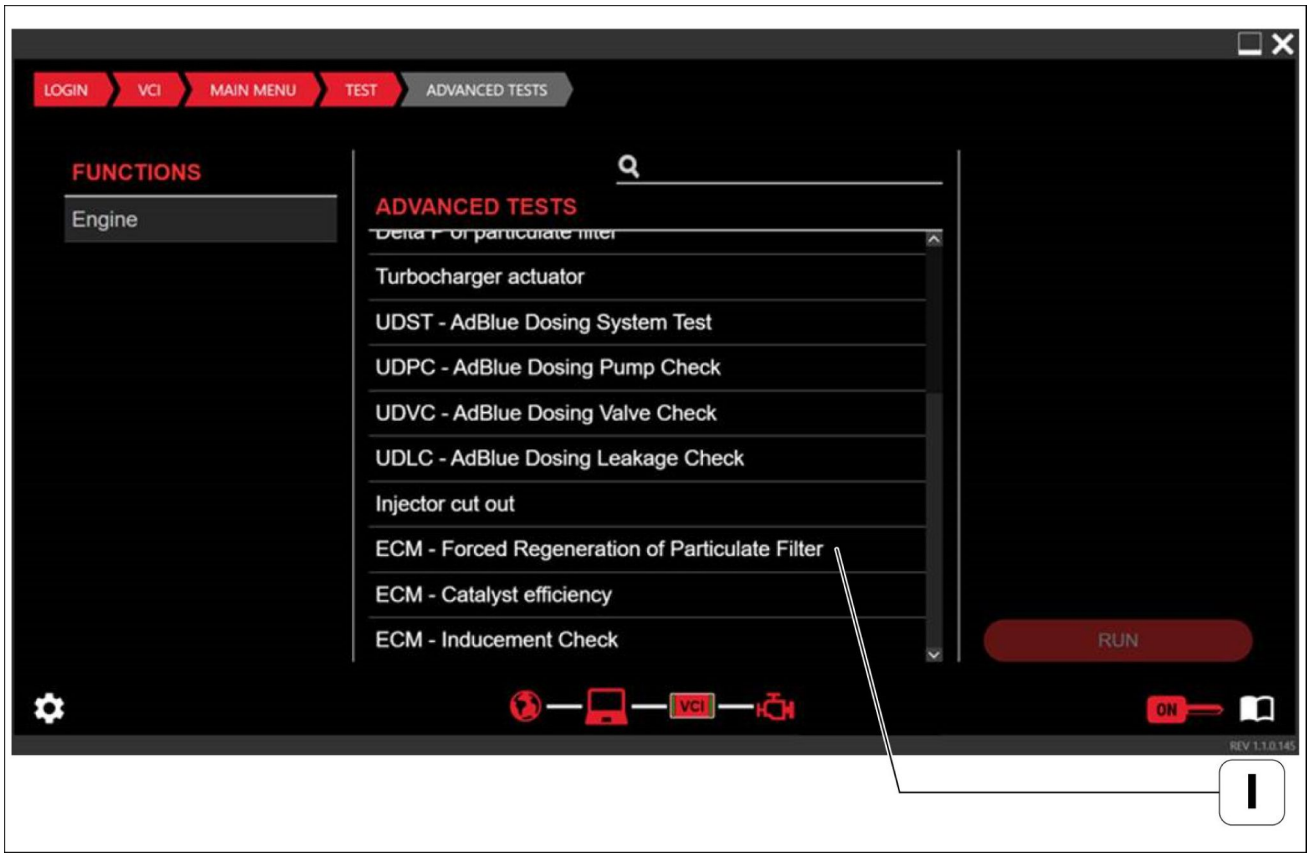
   The functions of the diagnostic tool are contained in four sub-menus.

   - “Diagnostic” menu
   - “Programming” menu
   - “Test” menu
   - “Specific functions” menu




NHIL25ENG0420FA 6

**Screen regarding the diagnostic tool with PT-Box**




NHIL25ENG0421TA 7

**Screen regarding the diagnostic tool with VCI**

To start the forced regeneration select the function **(1)** highlighted in the figure and follow the step-by-step instructions proposed by the diagnostic tool.

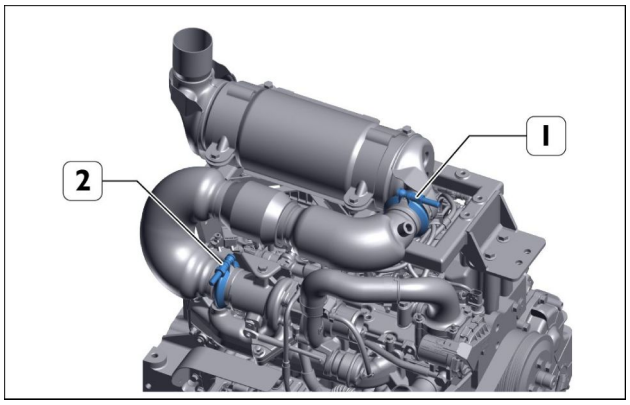
***NOTICE:*** *The procedure is managed by the diagnostic tool: do not carry out any operation until the instrument indicates that the procedure is completed. The procedure is fully automatic and it is not necessary to check the vehicle during the regeneration phase.*

# Exhaust Gas Recirculation (EGR) valve - Remove - Catalyzer [113437908 - V1 - 21 February 2025]

## ATS unit removal

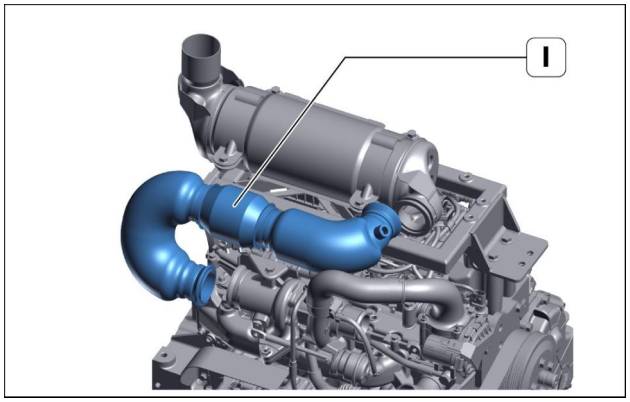
***NOTE:*** *The engines documented in this manual may differ in the layout of some components.*

1. Loosen the collars **(1)** and **(2)** from the exhaust manifold **(3)**.



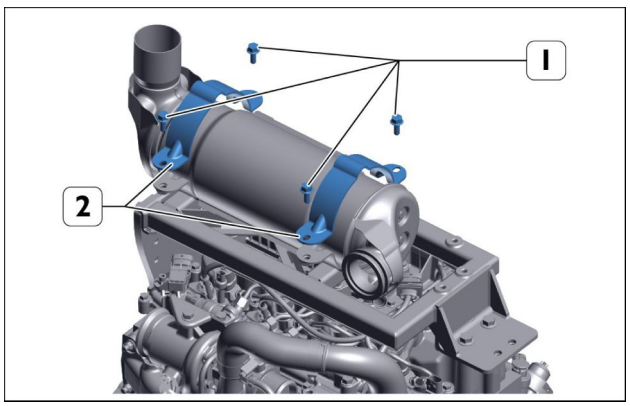

NHIL25ENG0422FA 1

2. Remove the exhaust pipe **(1)**.



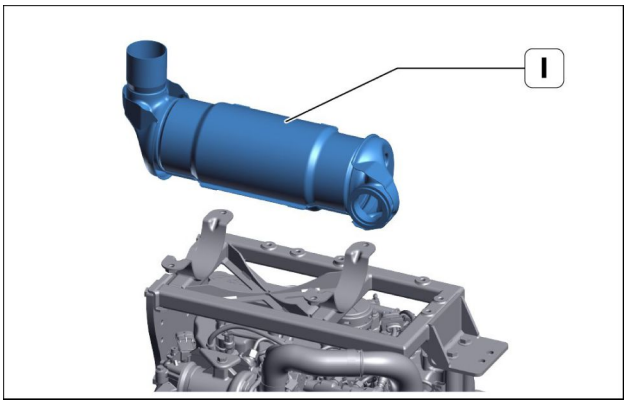

NHIL25ENG0423FA 2

3. Remove the 4 screws M8 X 1.25 X 20 **(1)** and extract the brackets **(2)**.



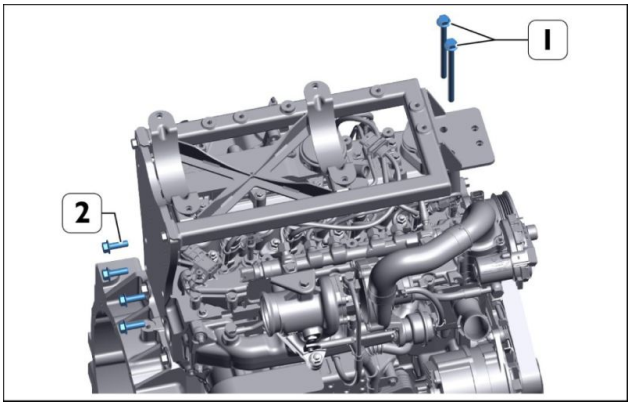

NHIL25ENG0424FA 3

4. Remove the catalyst **(1)** from the ATS supporting frame.




NHIL25ENG0425FA 4

5. Remove the 2 screws M10 X 130 (1) and the 4 screws M10 X 30 **(2)** and remove the ATS supporting frame.



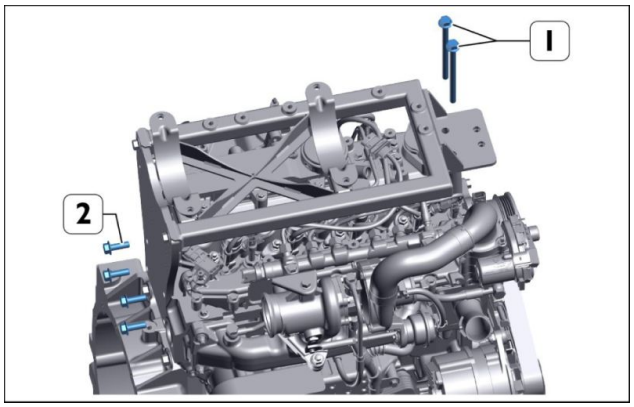

NHIL25ENG0426FA 5

# Exhaust Gas Recirculation (EGR) valve - Install - Catalyzer [113437909 - V1 - 07 March 2025]

## Assembly of the ATS unit

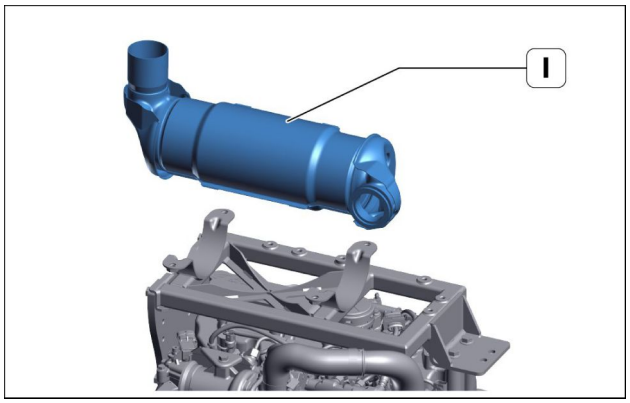
***NOTE:*** *The engines documented in this manual may differ in the layout of some components.*

1. Correctly position the ATS frame and screw down the 2 screws M10 X 130 **(1)** to a torque of **65 +/- 5 N·m** . Tighten the 4 screws M10 X 30 **(2)** to a torque of **65 +/- 5 N·m** securing the ATS supporting frame.



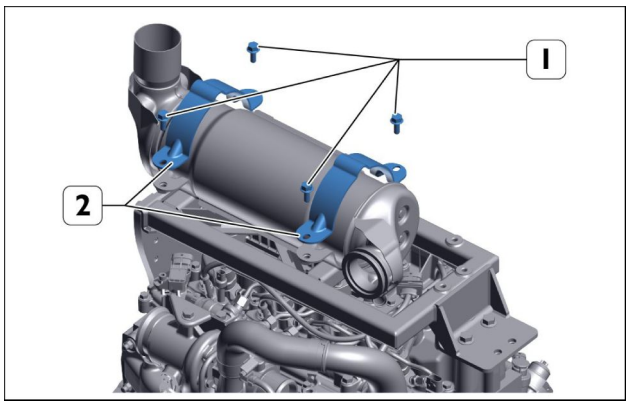

NHIL25ENG0427FA 1

2. Correctly position the catalyst in its seat on the ATS frame **(1)**.



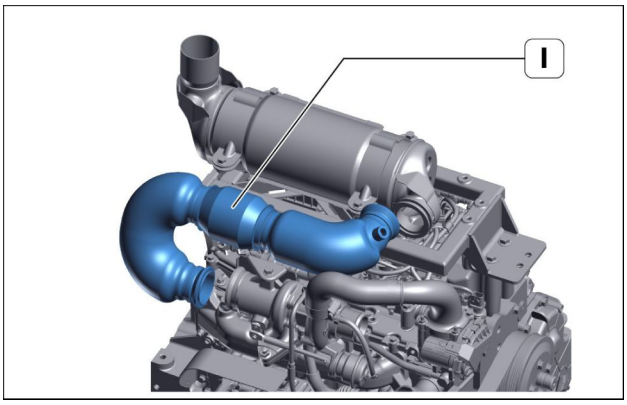

NHIL25ENG0428FA 2

3. Correctly position the brackets tightening them with the 4 screws M8 X 1.25 X 20 **(1)** to a torque of **25 +/- 3 N·m**.



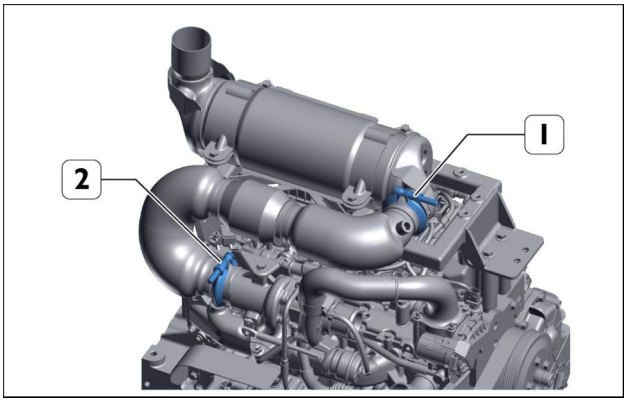

NHIL25ENG0429FA 3

4. Correctly position the exhaust pipe **(1)**.




NHIL25ENG0430FA 4

5. Tighten the collars **(1)** and **(2)** from the exhaust manifold **(3)** to a torque of **25 +/- 15% N·m**.

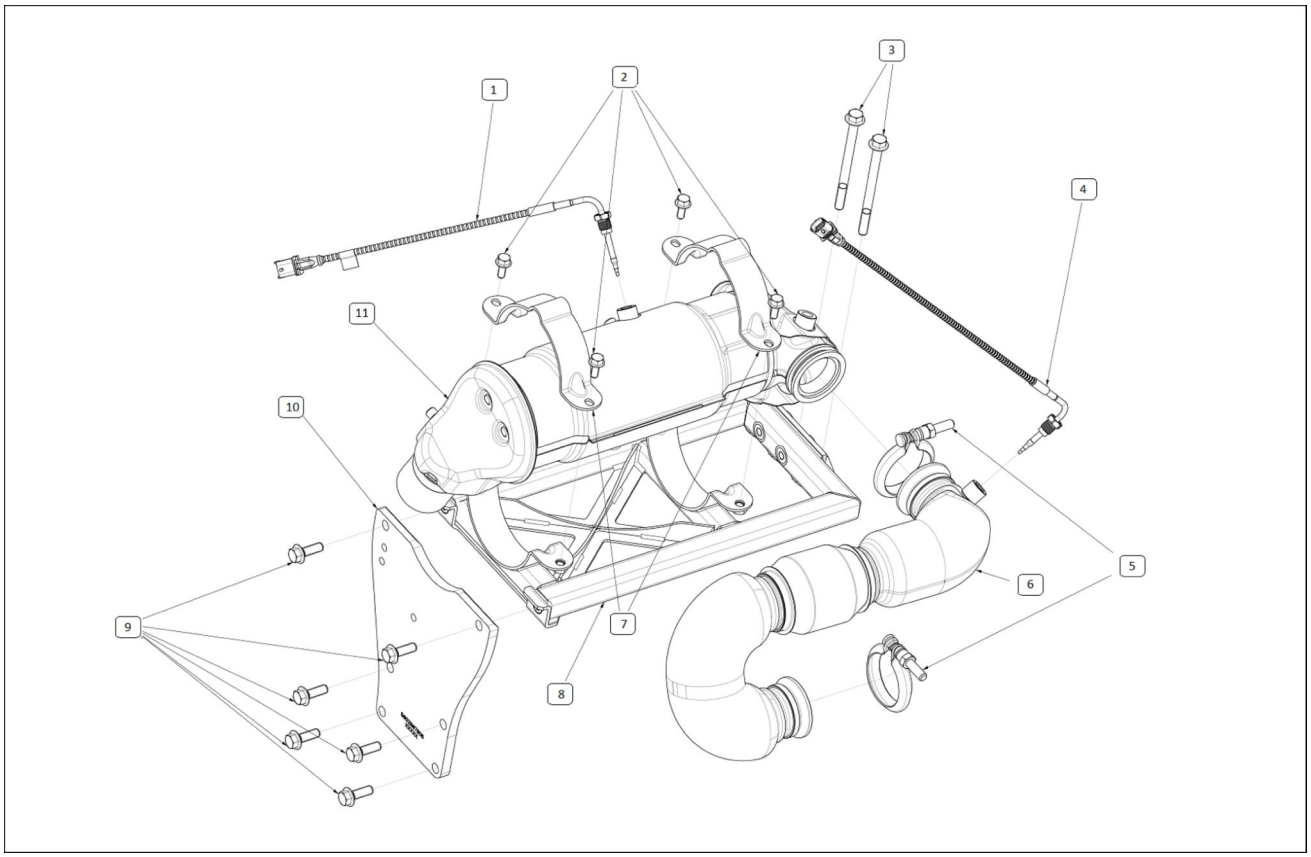



NHIL25ENG0431FA 5

# Exhaust Gas Recirculation (EGR) valve - Assemble - Catalyzer [113437910 - V1 - 07 March 2025]

## Assembly of the ATS unit

***NOTE:*** *Below are the assembly diagrams of the ATS unit which can be supplied as individual parts, as a separate group to be mounted or already mounted on the engine depending on the versions of the engines covered in this manual.*




NHIL25ENG0432TA 1

| Component number | Description | Tightening torque |
|---|---|---|
| **(1)** and **(4)** | 2 temperature sensors M14 X 1.5 X 12 | **45 N·m** (**398 lb in**) |
| **(2)** | 4 screws M8 X 1.25 X 20 | **25 N·m** (**221 lb in**) |
| **(3)** | 2 screws M10 X 130 | **65 N·m** (**575 lb in**) |
| **(5)** | 2 collars | **25 N·m** (**221 lb in**) |
| **(6)** | Pipe | - |
| **(7)** | DPF - DOC module mounting brackets | - |
| **(8)** | DPF supporting frame | - |
| **(9)** | 6 screws M10 X 30 | **65 N·m** (**575 lb in**) |
| **(10)** | DPF supporting frame bracket | |
| **(11)** | DOC + DPF | |

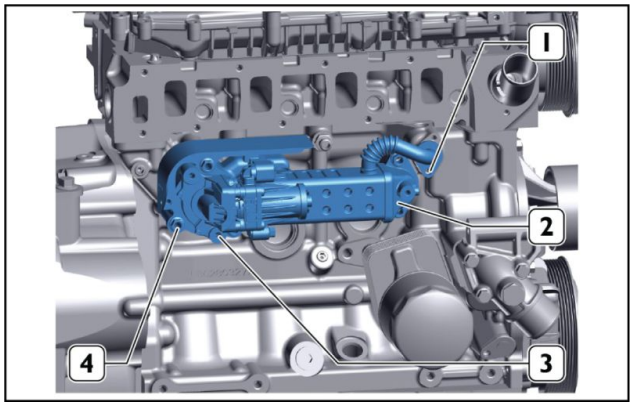
# Exhaust Gas Recirculation (EGR) valve - Visual inspection - Exhaust pipes [113437940 - V1 - 27 February 2025]

## Check the condition of the exhaust duct(s)

1. Visually check the coolant level in the expansion tank.
2. Visually check that the exhaust gas system is not obstructed or damaged.
3. Make sure there are no hazardous fumes in the machine, Contact the Manufacturer if necessary.

# Exhaust Gas Recirculation (EGR) valve - Remove - EGR heat exchanger [113469165 - V1 - 07 March 2025]

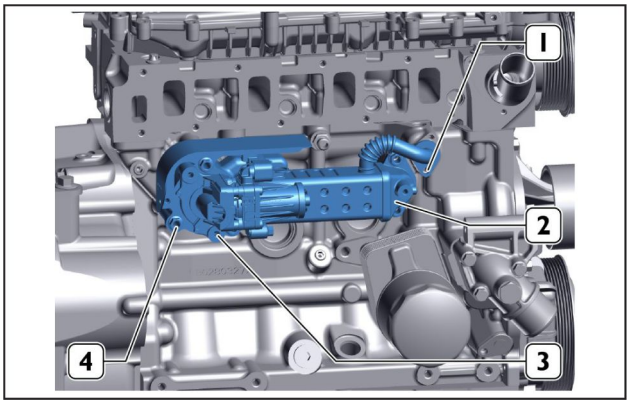
1. Unscrew the fastening screws **(3)** and remove the EGR valve.
2. Unscrew the fastening screws **(1)** and the nuts **(4)** and remove the EGR heat exchanger **(2)** , together with the relevant gaskets.
3. Remove the studs from the crankcase.




NHIL25ENG0108TA 1

# Exhaust Gas Recirculation (EGR) valve - Assemble - EGR heat exchanger [113471249 - V1 - 06 March 2025]

1. Install the studs on the crankcase and tighten them to the specified torque.




NHIL25ENG0200TA 1

| Description | Step | Value |
|---|---|---|
| EGR heat exchanger | 5 nuts M8 x 1.25 | **23 +/- 2.3 N·m** |
| | 1 screw M6 x 1 x 14 | **10 +/- 1 N·m** |

2. Install the EGR heat exchanger **(2)**, inserting the gaskets, and tighten the fastening screws **(1)** and the nuts **(4)** to the prescribed torque.

| Description | Quantity | Step | Value |
|---|---|---|---|
| EGR heat exchanger | 5 studs M8 x 1.25 x 80 | | **23 +/- 2.3 N·m** |

3. Fit the EGR valve and tighten the fastening screws **(3)** to the prescribed torque.

| Description | Quantity | Value |
|---|---|---|
| EGR valve | 2 screws M6 x 1 x 20 | **10 +/- 1 N·m** |

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# Engine - 10

## Engine cooling system - 400

**F6AFL413A*U001**

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## Engine cooling system - 400

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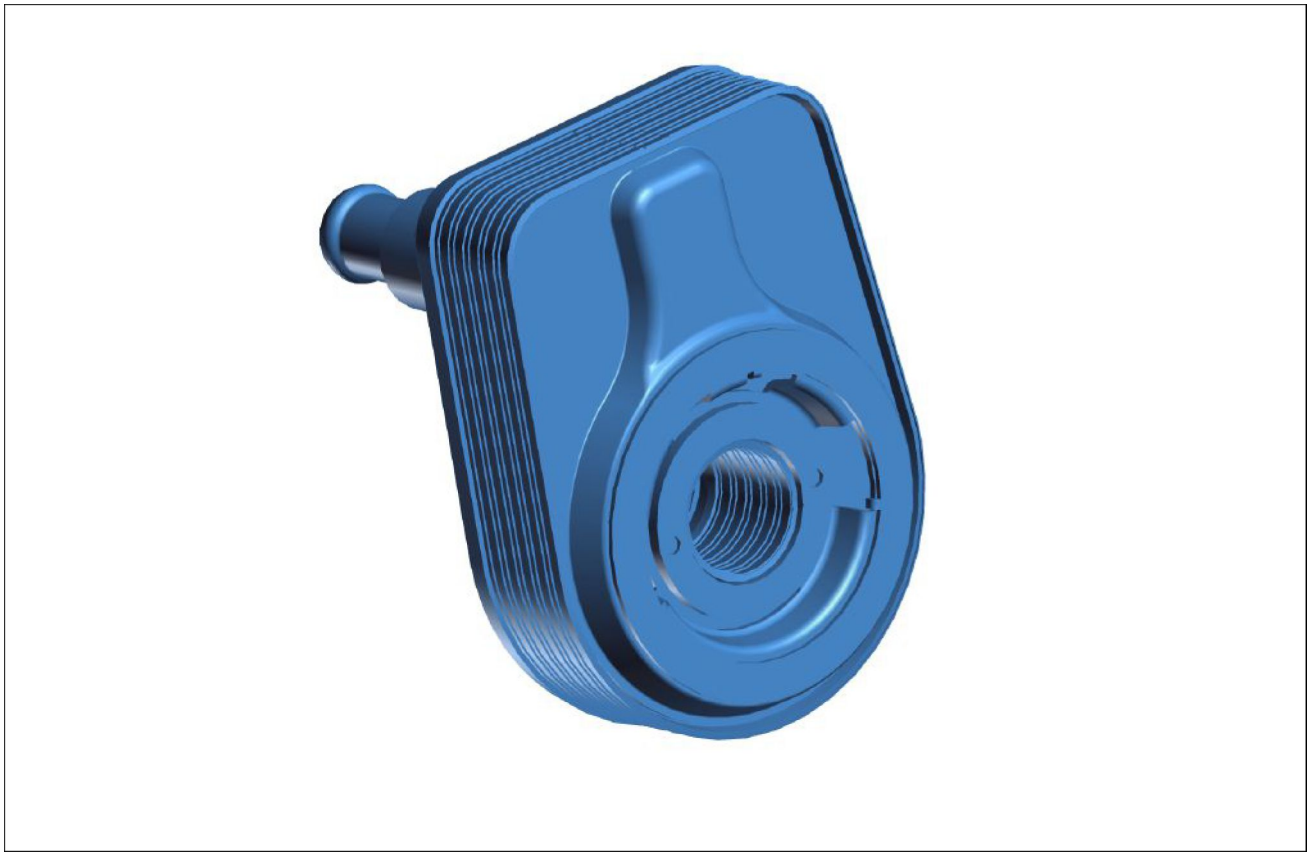
# Engine cooling system - Overview - Heat exchanger [113434725 - V1 - 20 February 2025]

The heat exchanger inside the engine cooling system serves to reduce the temperature of the engine oil by absorbing heat via the engine coolant.



NHIL25ENG0377TA 1

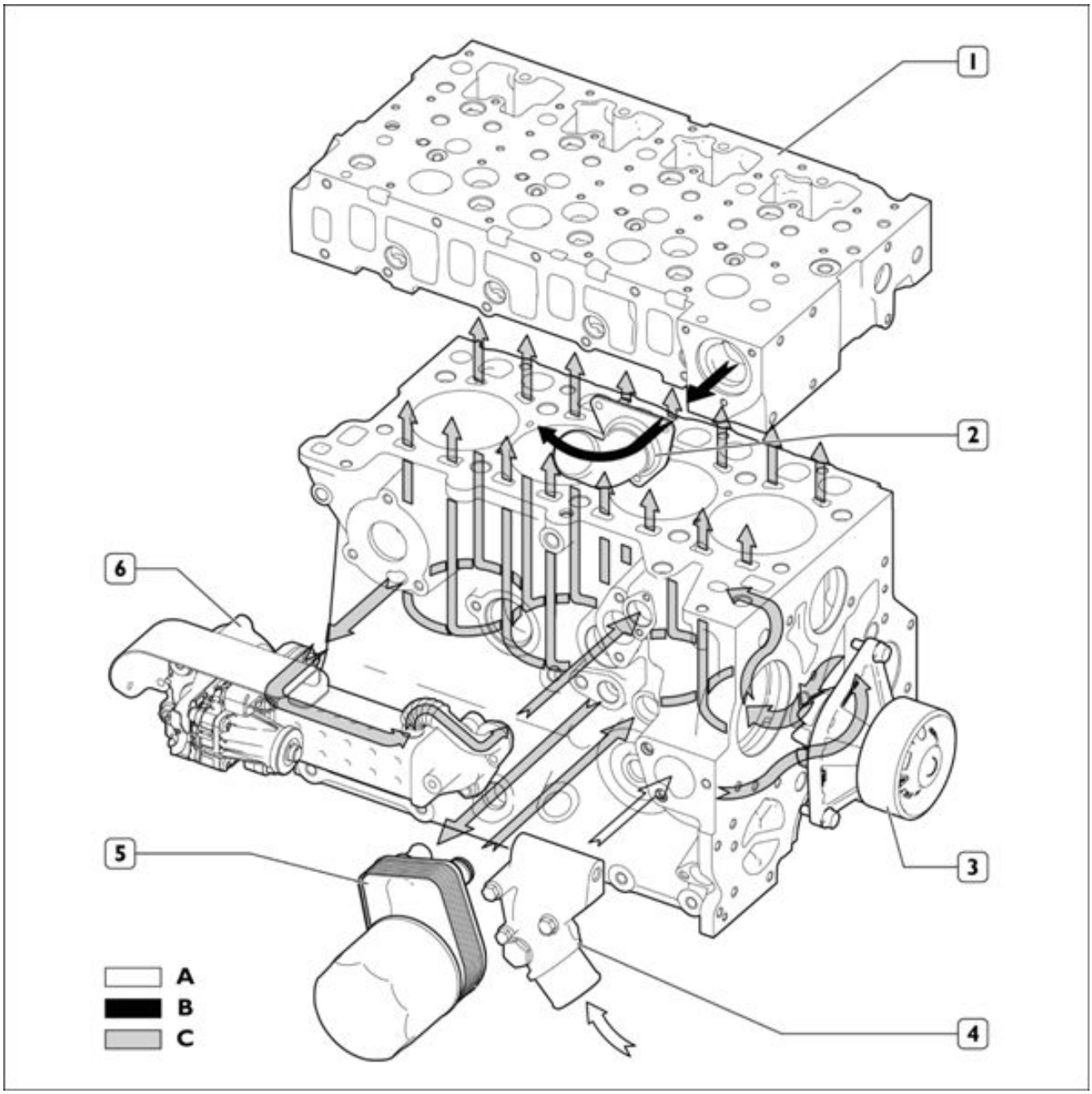
# Engine cooling system - Overview - Water cooling [113434739 - V1 - 06 March 2025]

## Cooling circuit

The engine cooling system, of the closed-loop forced-circulation type, is generally composed of the following components:

- Expansion tank: the position, shape and dimensions can change depending on the engine outfitting.
- Radiator: it dissipates the heat taken from the engine by the coolant. Its position and dimensions can change depending on the version.
- Fan: it increases the dissipating radiator power: also it is part of the specific engine version.
- Heat exchanger: it allows cooling down the lubricant oil and is installed in the cylinder block.
- Water pump: it is a centrifugal pump positioned in the front part of the crankcase.
- Thermostat: it regulates the temperature of the coolant circulating in the engine.
- The circuit can also extend to the compressor if the construction provides for its presence.

## Cooling system diagram with flow of water




NHIL25ENG0378GA 1

| Item | Description |
|---|---|
| A | Coolant inlet to the water pump (from the radiator). |
| B | Coolant outlet from the cylinder head (to the radiator) |
| C | Coolant circulating in the engine |
| 1 | Cylinder Head |
| 2 | Engine coolant outlet pipe (to the radiator) / Thermostat cover |
| 3 | Water pump |
| 4 | Engine coolant inlet pipe (from the radiator) |
| 5 | EGR heat exchanger exhaust gas/coolant |
| 6 | Heat exchanger lubricant oil/coolant |

# Water pump - Overview - Water pump assembly [113434743 - V1 - 06 March 2025]

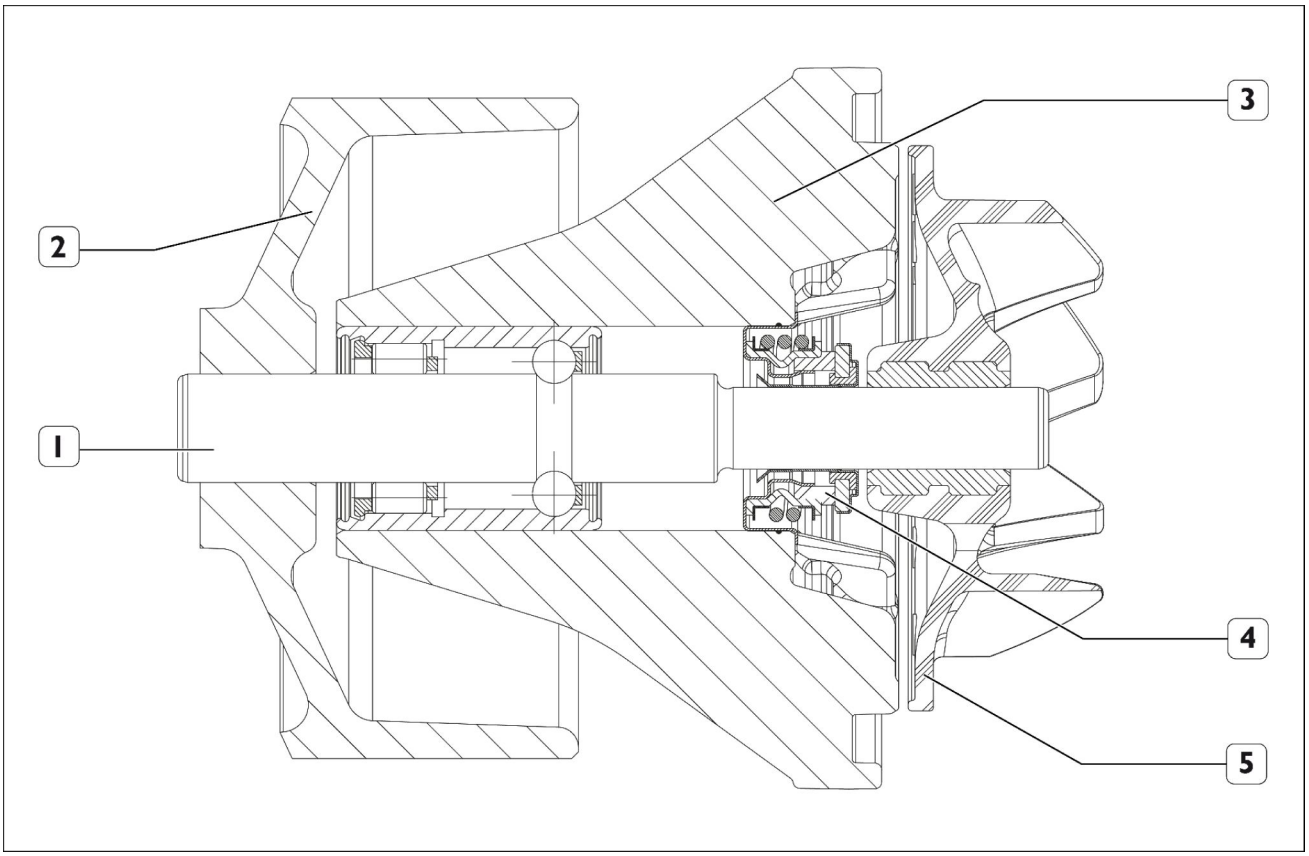
## Section on water pump

The water pump, located in a housing obtained in the crankcase, is controlled by a poly-V belt.

A manual tensioner keeps the belt tension.

The water pump is of the vane centrifugal type.

The water tightness between the pump body and the shaft is obtained by means of a gasket.




NHIL25ENG0379FA 1

| Item | Description |
|---|---|
| 1 | Shaft with bearing |
| 2 | Control pulley |
| 3 | Pump unit |
| 4 | sheath |
| 5 | Impeller |

| Water pump technical data | |
|---|---|
| Coolant temperature | **100 +/- 5 °C** |
| Concentration of antifreeze | **50%** |

| Pump speed | Capacity | Pressure [bar] |
|---|---|---|
| **5000 RPM** | **210 L/min (7 cfm)** | **2.00 – 2.45 bar (29.00 – 35.53 psi)** |
| **2500 RPM** | **110 L/min (4 cfm)** | **0.50 – 0.65 bar (7.25 – 9.43 psi)** |

# Coolant thermostat - Overview - Thermostat [113434806 - V1 - 06 March 2025]

The thermostat, located in the cylinder head, is of the by-pass type and doesn't need regulations.

If there are doubts as to its proper functioning, replace it.

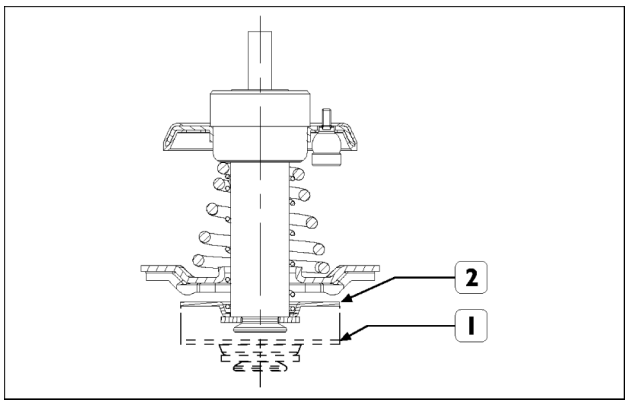
The main components of a thermostat are: thermal motor, including a valve fastened to a piston integrated in a special wax, flange, spring and chassis.

The thermostat has a pin that permits the air trapped in the cooling system to pass in the thermostat and be released from the system.

The thermostat has two important functions:

- It heats the engine faster, blocking the circulation of the coolant between the engine and the radiator until the engine reaches its predefined temperature.
- It controls the operating temperature of the engine by opening and closing in response to specific changes in the coolant temperature in order to maintain the engine temperature within the desired range.

## Thermostat operating diagram




NHIL25ENG0380AA 1

1. Maximum stroke at the temperature of full opening.
2. Minimum stroke at the initial opening temperature.

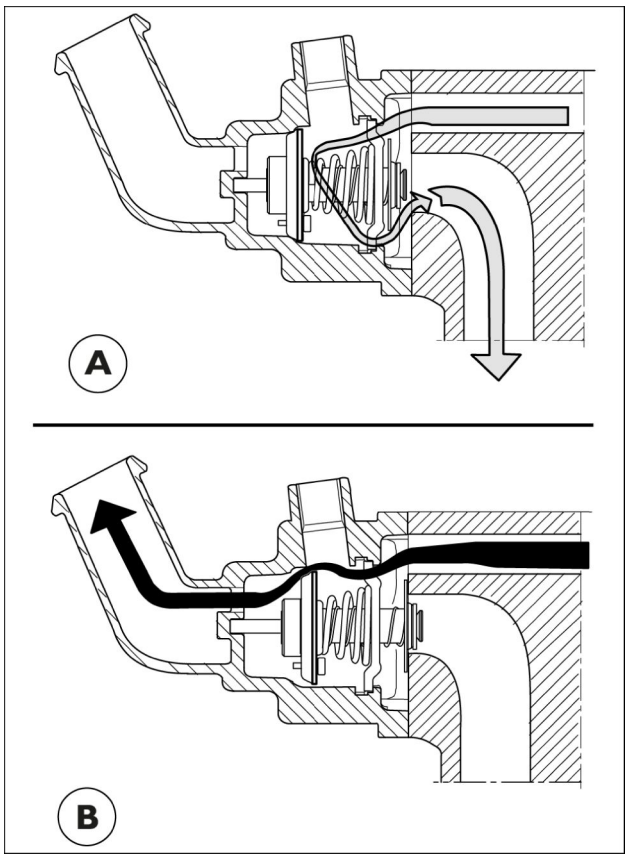
| Technical data | |
|---|---|
| Maximum permitted operating temperature | **130 +/- 2 °C** |
| Maximum stroke at the maximum permitted operating temperature | **11.5 mm** (**0.5 in**) |
| Initial opening temperature | **79 +/- 2 °C** |
| Stroke at the initial opening temperature | **0.3 mm** (**0.0 in**) |
| Complete opening temperature | **94+/- 2 °C** |
| Minimum stroke at the temperature of full opening | **8 mm** (**0 in**) |

## Operation

- With the engine cold, the thermostat is normally closed; the restriction of the flow to the radiator makes it possible to heat the engine;
- When heating the engine, the increase in heat causes the wax to melt, which expands and acts against a piston inside a rubber bellows;
- This lifts the piston, which opens the thermostat so that the coolant can start to circulate between the engine and the radiator;
- With the increase in heat, the thermostat continues to open until the engine is cooled sufficiently;

- If the temperature of the circulating coolant starts to decrease, the wax element will contract, permitting the closure of the thermostat due to the effect of the spring's action and reducing the flow of the coolant towards the radiator.

## Functional diagram




NHIL25ENG0381BA 2

A. Closed thermostat (coolant recirculation to the water pump via the by-pass duct)

B. Thermostat open (coolant outlet from the cylinder head to the radiator)

# Engine cooling system - Prepare - Cooling system [113387771 - V1 - 13 February 2025]

## Preparation

- Ignition switch set OFF position.
- Sufficient coolant liquid available at coolant reservoir.

# Engine cooling system - Check - Cooling system [113387772 - V1 - 21 February 2025]

## Check coolant reservoir

1. Static pressure test with engine OFF
   - Turn the engine OFF and make sure that the engine is not hot.
   - Carefully remove the coolant cap from the expansion coolant bottle, be aware of any trapped/ hot coolant.
   - Make sure that coolant is at the recommended level in the expansion coolant bottle.
   - Select a suitable cap adapter, wet its rubber gasket with water/ coolant and fit it carefully to the expansion coolant bottle, make sure that the adapter cap properly seals the expansion coolant bottle.
   - Install the pressure pump onto the adapter using the quick-connect.
   - Using the pump, pressurise the system to the customer specified value.
   - When the pressure reach the determined pressure value, stop pumping and watch the pump pressure gauge. If the pressure start to decrease, this indicate a leak in the system.
   - With the system kept pressurised, check the radiator and housing for external leak and also check engine oil cooler for internal leakage.
   - After the test is completed, depressurised the coolant system and fill the coolant to the correct level, refit the coolant cap.
   - If static pressure test with engine OFF is OK, go to step **2**.
   - If static pressure test with engine OFF is not OK, go to step **3**.

2. Dynamic pressure test with engine ON
   - Turn the engine ON at idle and make sure that the engine is not hot.
   - Carefully remove the coolant cap from the expansion coolant bottle, be aware of the any trapped/ hot coolant.
   - Make sure that coolant is at the recommended level in the expansion coolant bottle.
   - Select a suitable cap adapter, wet its rubber gasket with water/ coolant and fit it carefully to the expansion coolant bottle, make sure that the adapter cap properly seals the expansion coolant bottle.
   - Install the pressure gauge onto the adapter using the quick-connect.
   - Start the engine and monitor the pressure gauge.After the test is completed, stop the engine and depressurised the coolant system and fill the coolant to the correct level, refit the coolant cap.
   - After the test is completed, stop the engine and depressurised the coolant system and fill the coolant to the correct level, refit the coolant cap.
   - Refer to **1** for aid and go to step **3**.

***NOTE:*** *The pressure pump, the adapter and the quick-connect are included in the coolant system pressure testing tool and they should useful for both cooling pressure test procedures.*

NHIL25ENG0484FA 1

**Location of coolant tank**

3. Check coolant reservoir
   A. No coolant leakage recognizable during static check.
   B. No indication of damaged cylinder head gasket during dynamic check.
   C. If coolant reservoir is not damaged, refer to **Engine cooling system - Check - Cooling system (10.400)**.
   D. If coolant reservoir is damaged, go to step **4**.
4. Possible root cause
   - Coolant leakage.
   - Damaged cylinder head gasket.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

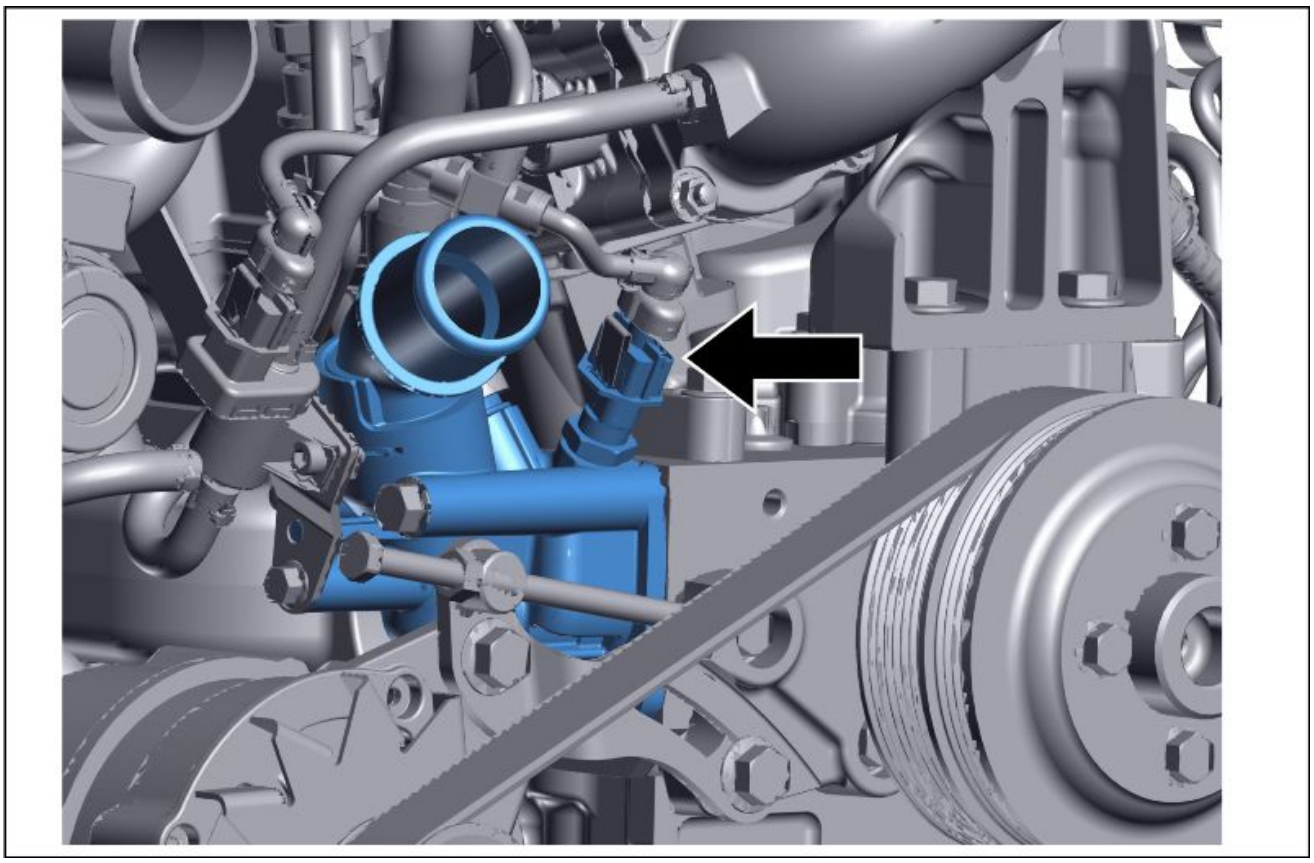
# Engine cooling system - Check - Cooling system [113387773 - V1 - 21 February 2025]

## Visually check coolant temperature sensor

5. Check coolant temperature sensor
   - Visually check the connector of the sensor.
   - Check if the sensor is installed correctly.
   - Check the sensor assembly to the engine body.
   - refer to **1** for aid and go to step **6**.

NHIL25ENG0485BA 1

**Engine coolant temperature sensor location**



NHIL25ENG0486TA 2

**Engine coolant temperature sensor**

6. Check coolant temperature sensor.
   A. Connector of the sensor not damaged and not contaminated.
   B. The sensor is mounted in the correct orientation.
   C. The sensor is correctly fitted to the engine body.
   D. If connector of the sensor is not damaged, go to step **Engine cooling system - Check - Cooling system (10.400)**.
   E. If connector of the sensor is damaged, refer to **6**.
7. Possible root cause
   - Connector of the sensor damaged and/or contaminated.
   - The sensor is not mounted in the correct orientation.
   - The sensor is loosely fitted to the engine body.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Engine cooling system - Check - Cooling system [113387774 - V1 - 21 February 2025]

## Read out coolant temperature sensor value

## Preparation

1. • Cold engine.
   • Diagnosis tester connected to vehicle.
   • Ignition ON.
   • Engine OFF.
   • Offboard tool Diagnosis tester.
2. • Read out coolant temperature value with diagnostic tester.
   • Go to step **3**.
3. Read out coolant temperature sensor value.
   A. Coolant temperature sensor value equal environment temperature.
   B. If coolant temperature sensor is not damaged, refer to **Engine cooling system - Check - Cooling system (10.400)**.
   C. If coolant temperature sensor is damaged, go to step **4**.
4. Possible root cause
   • Offset error coolant temperature sensor.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Engine cooling system - Check - Cooling system [113387775 - V1 - 21 February 2025]

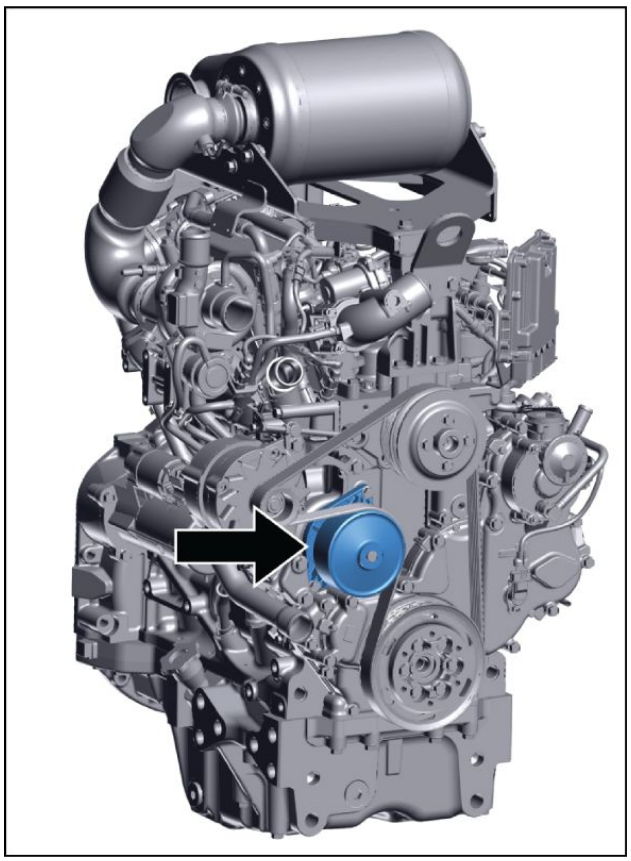
1. Check fan
   - Start the engine and check if the fan is working correctly.
   - Check the fan for damage and pollution.
   - Go to step **2**.
2. Visually check cooling system
   A. Drive belt not damaged, if present.
   B. No leaks from actuating hydraulic circuit, if present.
   C. If cooling system is not damaged, refer to **Engine cooling system - Check (10.400)**.
   D. If cooling system is damaged, go to step **3**.
3. Possible root cause
   - Drive belt could be damaged.
   - Actuating hydraulic circuit (if present) could be damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify*

# Engine cooling system - Check - Cooling system [113387776 - V1 - 22 February 2025]

## Mechanically check water pump

1. Check water pump
   - Set ignition OFF.
   - Check water pump for tightness.
   - Ignition switch set to ON position and start engine.
   - Check the water pump mechanical sounds.
   - Refer to image **1** for aid and go to step **2**.



NHIL25ENG0546TA 1

**Location of water pump**

2. Check water pump
   A. Water pump not damaged or leak.
   B. If water pump is not damaged, Refer to **Engine cooling system - Check - Cooling system (10.400)**.
   C. If water pump is damaged, go to step **3**.
3. Possible root cause
   - Water pump damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Engine cooling system - Check - Cooling system [113387777 - V1 - 22 February 2025]

## FAN activation check

1. General checks
   - Battery voltage is sufficient.
   - Vehicle fuses are OK.
   - Connectors/plugs OK. No loose contact or corrosion.
   - Offboard tool Diagnosis tester.

## Preparation

2. - Connect the diagnostic tester.
   - Start the engine and keep in idle.
3. - Activate the fan and change its speed.
   - Set successive the three activation modes: Full, Medium and Idle.
   - Check for modified fan speed for each activation mode.
   - Go to step **4**.
4. FAN activation check
   A. The FAN speed is respectively Full, Medium and Idle speed.
   B. If Fan is not damaged, Refer to **Engine cooling system - Check - Cooling system (10.400)**
   C. If Fan is damaged, go to step **5**.
5. Possible root cause
   - Communication loss with diagnosis tester.
   - Electrical connection could be damaged.
   - FAN could be defective or damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Engine cooling system - Check - Cooling system [113387778 - V1 - 22 February 2025]

## Visco FAN activation check

1. General checks
   - Battery voltage is sufficient.
   - Vehicle fuses are OK.
   - Connectors/plugs OK. No loose contact or corrosion.
   - Offboard tool Diagnosis tester.

## Preparation

2. - Connect the diagnostic tester.
   - Start the engine and keep in idle.
3. - Activate the fan and change its speed.
   - Check for visco FAN speed on different settings: it can be varied from **10%** to **90%**.
   - Check for modified visco FAN speed.
   - Go to step **4**.
4. Visco FAN activation check
   A. The visco FAN speed can be ranged from **10%** to **90%** of its maximum speed.
   B. If the visco fan is not damaged, go to step **3**.
   C. If the visco fan is damaged, go to step **5**.
5. Possible root cause
   - Communication loss with diagnosis tester.
   - Electrical connection could be damaged.
   - Visco FAN could be defective or damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Engine cooling system - Check - Cooling system [113387779 - V1 - 22 February 2025]

## Engine temperature adjustment check

1. General checks
   - Battery voltage is sufficient.
   - Vehicle fuses are OK.
   - Connectors/plugs OK. No loose contact or corrosion.
   - Offboard tool Diagnosis tester.

## Preparation

2. - Set the key to ON.
   - Connect the diagnostic tester.
3. - Through diagnosis tester simulate the change of coolant temperature.
   - Adjustment is possible in the range from **-40.0 – -110.0 °C** (**-40.0 – -166.0 °F**).
   - Go to step **4**.
4. This coolant temperature modification could have the following feedbacks:
   A. Increasing/decreasing of temperature indicator on cluster.
   B. Pop up of excessive temperature
   C. At high temperatures: activation of fan at max speed.
   D. If the coolant temperature have this feedbacks, go to step **6**.
   E. If the coolant temperature do not have this feedbacks, go to step **5**.
5. Possible root cause
   - Communication loss with diagnosis tester.
   - Electrical connection could be damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

6. The cooling system works properly.

# Engine cooling system - Remove [113434726 - V1 - 20 February 2025]

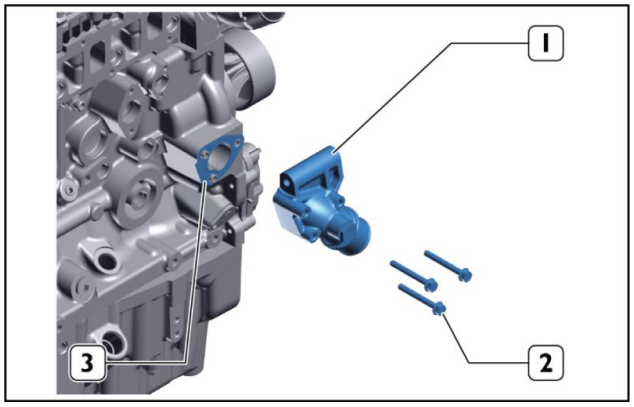
1. To remove the heat exchanger refer to the following procedure **Engine oil filter - Remove - Filter support (10.304)**

# Engine cooling system - Install - Heat exchanger [113434727 - V1 - 20 February 2025]

1. To install the heat exchanger refer to the following procedure **Engine oil filter - Install - Filter support (10.304)**.

# Engine cooling system - Remove - Coolant intake pipe [113469171 - V1 - 07 March 2025]

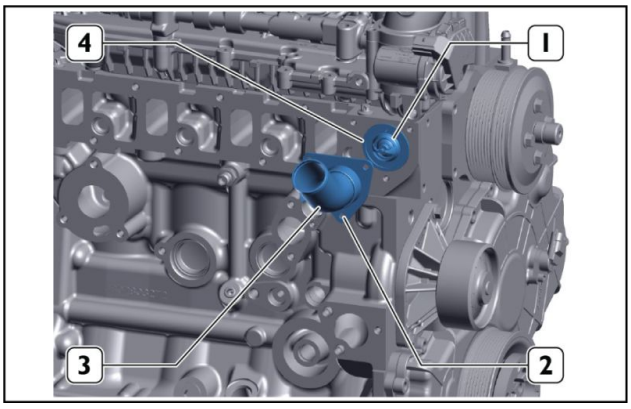
1. Unscrew the screws **(2)** and remove the coolant intake pipe **(1)**, together with the gasket **(3)**.




NHIL25ENG0112FA 1

# Engine cooling system - Remove - Thermostat [113469172 - V1 - 07 March 2025]

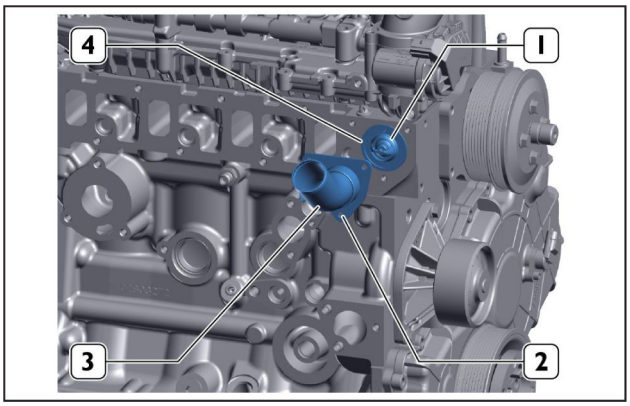
1. Unscrew the fastening screws **(2)** and disconnect the thermostat unit **(3)** complete with the gasket **(4)** from the seat on the cylinder head.
2. Remove the thermostat **(1)** from its housing.




NHIL25ENG0113TA 1

# Engine cooling system - Assemble - Thermostat [113471237 - V1 - 28 February 2025]

1. Install the thermostat **(1)** in its housing.
2. Fit the thermostat body **(3)**, complete with the gasket **(4)** in the seat of the cylinder head, and tighten the fastening screws **(2)** to the specified torque.

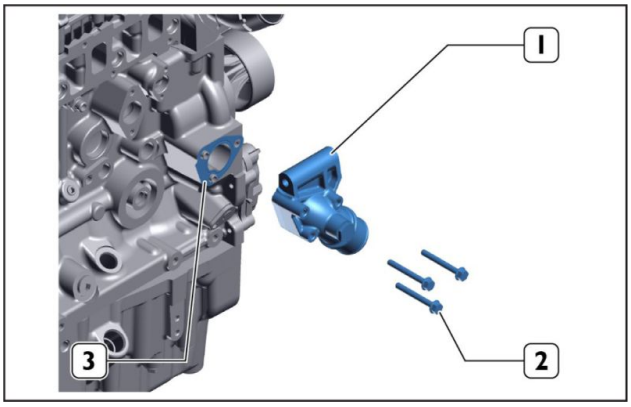



NHIL25ENG0196TA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Thermostat cover | 3 screws M6 x 1 x 12 | | **10 +/- 1 N·m** |

# Engine cooling system - Assemble - Coolant filler pipe [113471241 - V1 - 28 February 2025]

1. Fit the coolant filler pipe **(1)** together with the gasket **(3)** and tighten the fastening screws **(2)**.




NHIL25ENG0197FA 1

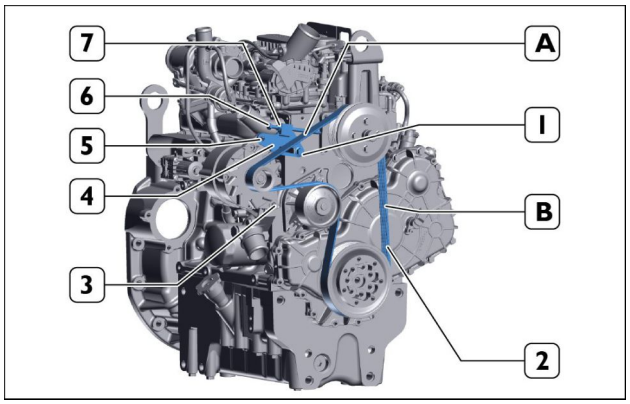
| Description | Step | Value |
|---|---|---|
| Engine coolant input pipe | 3 screws M8 x 1.25 x 65 | **23 +/- 2.3 N·m** |
| | 1 screw M8 x 1,25 x 14 | **25 +/- 2.5 N·m** |

# Radiator to water pump hoses - Check - Water pump drive belt [113434959 - V1 - 06 March 2025]

**Prior operation:**
**Radiator to water pump hoses - Replace - Water pump drive belt (10.400)**

## Main activity

1. Visually check that the alternator belt is not worn or damaged; if it is, replace it as described in the procedure.
2. Wait at least **15.0 mm** (**0.6 in**) with the engine idling, then with the engine off and the temperature of the belt at stabilised at **23 +/- 5°**, use a suitable tool to check the tension of the new auxiliary unit drive belt. The correct tension value of the auxiliary unit drive belt **(2)** must lie within the interval indicated in the table:




NHIL25ENG0384FA 1

## Ancillary belt tension

| Ratio | Control frequency (A) (140 ± 20 N/rib) | Control frequency (B) (140 ± 20 N/rib) |
|---|---|---|
| RT 1.29 Belt **280.0 mm** (**11.0 in**) | **198 +/- 14 Hz** | **173 +/- 12 Hz** |
| RT 1.29 Belt **320.0 mm** (**12.6 in**) | **190 +/- 14 Hz** | **151 +/- 11 Hz** |
| RT 1.40 Belt **280.0 mm** (**11.0 in**) | **197 +/- 14 Hz** | **173 +/- 12 Hz** |
| RT 1.40 Belt **320.0 mm** (**12.6 in**) | **189 +/- 14 Hz** | **151 +/- 11 Hz** |
| RT 1.40 Belt **356.0 mm** (**14.0 in**) | **179 +/- 13 Hz** | **136 +/- 10 Hz** |

***NOTE:*** *The belt tension is measured in the intermediate point **(A)** of the branch between the crankshaft pulley and the fan drive pulley and in point **(B)** between the alternator pulley and the fan drive pulley. Use the designated tool 99395849 to check the correct belt tension.*

3. If necessary, adjust the belt tension **(2)** as described below.
4. Loosen the bolt **(3)** anchoring the alternator to its lower mount and the screw **(5)** fastening the tensioning bracket to the crankcase.
5. Tension the auxiliary unit drive belt **(2)** by tightening the adjusting screw **(5)** until the tensioning bracket **(4)** reaches the maximum extension position of the available adjustment, as shown in the figure.
6. Make the crankshaft perform two complete rotations to settle the auxiliary unit drive belt **(2)**.
7. Tighten the screw **(1)** fastening the tensioning bracket **(4)** to the crankcase to the prescribed torque.

| Description | Step | Value |
|---|---|---|
| Alternator tensioning bracket | 2 screws M10 x 1.5 x 25 + 2 nuts M10 x 1.5 | **45 +/- 4.5 Hz** |

8. Tighten the bolt **(3)** anchoring the alternator to its lower mount to the prescribed torque.

| Description | Step | Value |
|---|---|---|
| Alternator | 1 screw M10 x1.5 x 130 + 1 nut M10 x 1.5 | **45 +/- 4.5 Hz** |

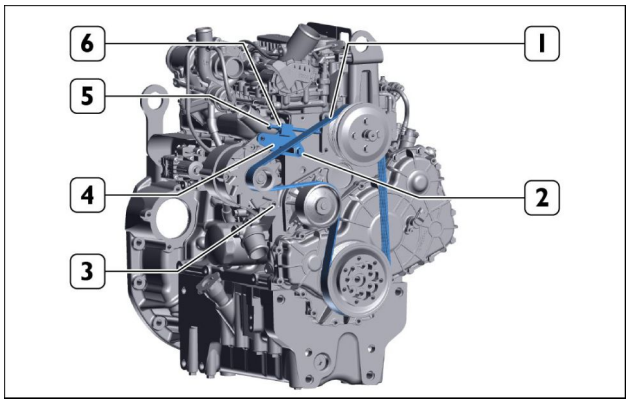
9. Turn the adjusting screw **(5)** two complete revolutions anticlockwise, then tighten the relative lock nut **(6)** to the prescribed torque.

| Description | Step | Value |
|---|---|---|
| Belt adjusting screw | 1 screw M8 x 1.25 | **20.5 +/- 2.5 Hz** |
| | 1 nut M8 x 1.25 | **20.5 +/- 2.5 Hz** |

# Radiator to water pump hoses - Replace - Water pump drive belt [113434960 - V1 - 06 March 2025]

## Replacing the ancillary belt

1. Loosen the bolt **(3)** anchoring the alternator to its lower mount and the screw **(2)** fastening the tensioning bracket **(4)** to the crankcase.
2. Loosen the lock nut **(6)** and unscrew the adjusting screw **(5)** on the tensioning bracket **(4)** to loosen and remove the auxiliary unit drive belt **(1)** .
3. Replace the auxiliary unit drive belt **(1)** with a new one.
4. Make sure that all the components of the pulleys and the guide rollers are clean and free of wear and damage. If necessary, replace the worn or damaged components.
5. Make sure that the pulleys and guide rollers are free of dirt and accumulation of the old belt.
6. Fit the new auxiliary unit drive belt **(1)** inside the shoulders of all the pulleys, in the following order: crankshaft pulley, fan control pulley, alternator, water pump. Make sure that the belt is centred on all pulleys.



NHIL25ENG0385FA 1

***NOTE:*** *The ribs on the auxiliary unit drive belt **(1)** must be positioned in the grooves of each pulley.*

7. Tension the auxiliary unit drive belt **(1)** by tightening the adjusting screw **(5)** until the tensioning bracket **(4)** reaches the maximum extension position of the available adjustment, as shown in the figure.

***NOTE:*** *The belt tension is measured as described in the procedure **Radiator to water pump hoses - Check - Water pump drive belt (10.400)** using the designated tool 99395849.*

8. Make the crankshaft perform two complete rotations to settle the auxiliary unit drive belt **(1)**.
9. Tighten the screw **(2)** fastening the tensioning bracket **(4)** to the crankcase to the prescribed torque.

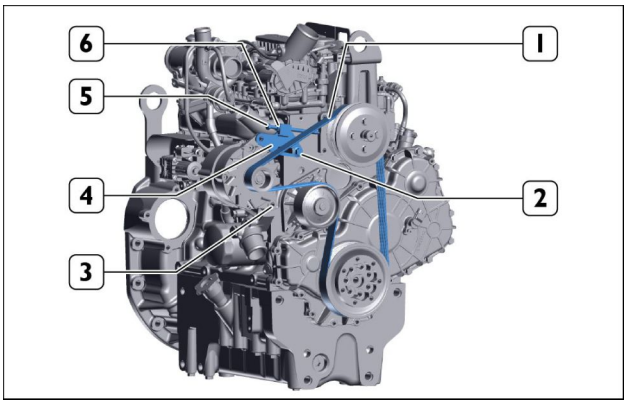
| Description | Step | Value |
|---|---|---|
| Alternator | 1 screw M10 x1.5 x 130 + 1 nut M10 x 1.5 | **45 +/- 4.5 Hz** |

10. Tighten the bolt **(3)** anchoring the alternator to its lower mount to the prescribed torque.
11. Turn the adjusting screw **(5)** two complete revolutions anticlockwise, then tighten the relative lock nut **(6)** to the prescribed torque.

| Description | Step | Value |
|---|---|---|
| Belt adjusting screw | 1 screw M8 x 1.25 | **20.5 +/- 2.5 Hz** |
| | 1 nut M8 x 1.25 | **20.5 +/- 2.5 Hz** |

# Radiator to water pump hoses - Remove - Water pump drive belt [113434961 - V1 - 20 February 2025]

1. Loosen the bolt **(3)** anchoring the alternator to its lower mount and the screw **(2)** fastening the tensioning bracket **(4)** to the crankcase.
2. Loosen the locking nut **(6)** and unscrew the screw **(5)** adjusting the tensioning bracket **(4)** to loosen and remove the auxiliary drive belt **(1)**.




NHIL25ENG0385FA 1

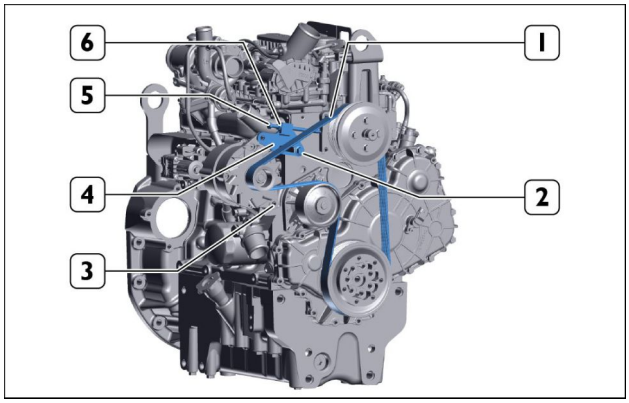
# Radiator to water pump hoses - Install - Water pump drive belt [113434962 - V1 - 06 March 2025]

| Description | Step | Value |
|---|---|---|
| Alternator | 1 screw M10 x1.5 x 130 + 1 nut M10 x 1.5 | **45 +/- 4.5 N·m** |
| Alternator tensioning bracket | 2 screws M10 x 1.5 x 25 + 2 nuts M10 x 1.5 | **45 +/- 4.5 N·m** |
| Belt adjusting screw | 1 screw M8 x 1.25 | **20.5 +/- 2.5 N·m** |
| | 1 nut M8 x 1.25 | **20.5 +/- 2.5 N·m** |

1. Make sure that all the components of the pulleys and the guide rollers are clean and free of wear and damage. If necessary, replace the worn or damaged components.
2. Make sure that the pulleys and guide rollers are free of dirt and accumulation of the old belt.
3. Fit the new auxiliary unit drive belt **(1)** inside the shoulders of all the pulleys, in the following order: crankshaft pulley, fan control pulley, alternator, water pump. Make sure that the belt is centred on all pulleys.

***NOTE:*** *The ribs on the auxiliary unit drive belt **(1)** must be positioned in the grooves of each pulley.*

4. Tension the auxiliary unit drive belt **(1)** by tightening the adjusting screw **(5)** until the tensioning bracket **(4)** reaches the maximum extension position of the available adjustment, as shown in the figure.




NHIL25ENG0385FA 1

***NOTE:*** *The belt tension is measured as described in the procedure **Radiator to water pump hoses - Check - Water pump drive belt (10.400)** using the designated tool 99395849.*

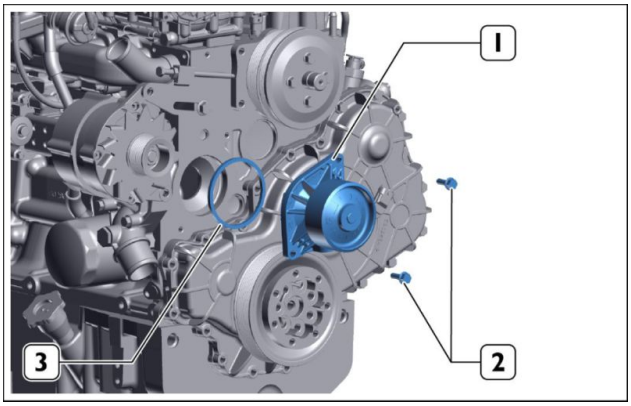
5. Make the crankshaft perform two complete rotations to settle the auxiliary unit drive belt **(1)**.
6. Tighten the screw **(2)** fastening the tensioning bracket **(4)** to the crankcase to the prescribed torque.
7. Tighten the bolt **(3)** anchoring the alternator to its lower mount to the prescribed torque.
8. Turn the adjusting screw **(5)** two complete revolutions anticlockwise, then tighten the relative lock nut **(6)** to the prescribed torque.

# Water pump - Remove - Water pump assembly [113434929 - V1 - 06 March 2025]

**Prior operation:**
Remove the water pump drive belt as described in the procedure **Radiator to water pump hoses - Remove - Water pump drive belt (10.400)**

## Removal

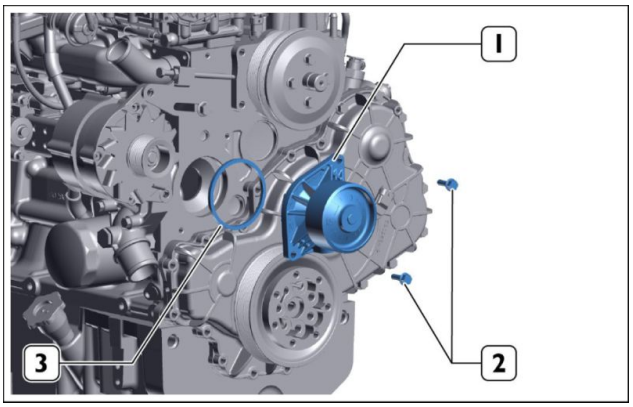
1. Position a suitable container to collect any coolant which may leak out.
2. Unscrew the fastening screws **(2)** and remove the water pump **(1)** recovering the gasket **(3)**.




NHIL25ENG0382FA 1

# Water pump - Install - Water pump assembly [113434930 - V1 - 06 March 2025]

1. Apply a new sealing ring **(3)** to the water pump **(1)**.
2. Position the water pump **(1)** in its seat and tighten the fastening screws **(2)** to the prescribed torque.




NHIL25ENG0382FA 1

| Description | Quantity | Value |
|---|---|---|
| Water pump | 2 screws M8 x 1.25 x 25 | **23 +/- 2.3 N·m** |

**Next operation:**
Install the water pump drive belt as described in the procedure **Radiator to water pump hoses - Install - Water pump drive belt (10.400)**

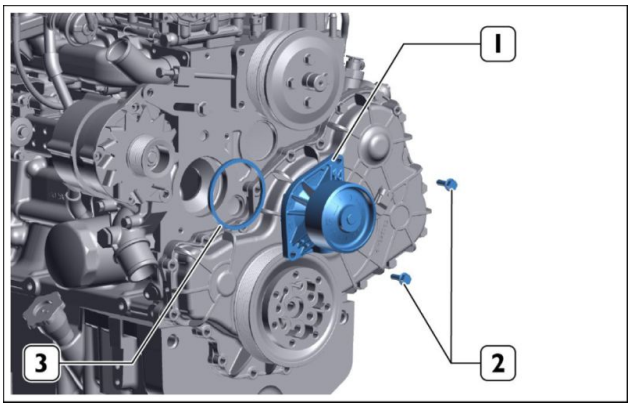
# Water pump - Check - Water pump assembly [113434931 - V1 - 06 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Water pump | 2 screws M8 x 1.25 x 25 | **23 +/- 2.3 N·m** |

| Tool / Material | |
|---|---|
| Belt tension control device (frequency from **10 – 600 Hz**) | 99395849 |

## Water pump

1. Proceed only with the engine off. The water pump is controlled by the belt and housed in the front of the engine. A rotor in the pump pushes the water through the circuit. The rotor is fit on a shaft that is supported by the pump body with bearings and seals.
2. Make sure there are no coolant leaks while the engine is operating.
3. Check that the rotor in the pump is not broken or loosened and that the blades are not worn.
4. Replace the water pump, if necessary, proceeding as follows.
5. Drain the engine coolant from the radiator: open the drain valve on the bottom of the radiator or loosen the lower radiator flexible pipe.
6. Remove the ancillary belt.
7. Loosen the fastening screws **(2)** and remove the water pump **(1)**.
8. Clean and dry the assembly surface and remove all traces of the old gaskets.
9. Position a new gasket **(3)** on the water pump **(1)**, position the pump in its seat and tighten the fastening screws **(2)** to the prescribed torque.
10. Fill the cooling circuit and bleed the air.



NHIL25ENG0382FA 1

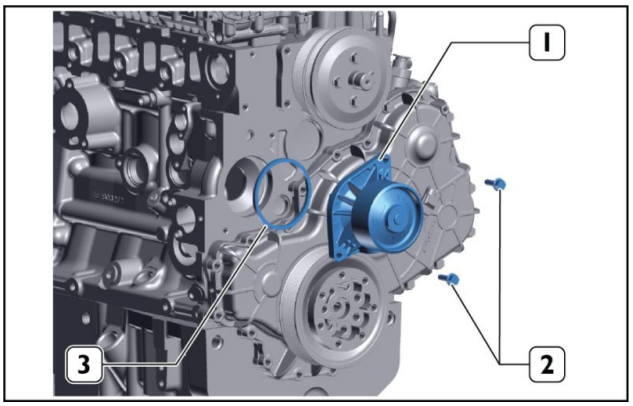
***ATTENTION:*** *When a water pump stars to leak, the cooling system will lose coolant. If the problem is not located, the coolant leak will lead to the engine overheating.*

***ATTENTION:*** *If the engine is overheated, the entire cooling system (radiator, flexible pipes, water pump and engine) must be fully inspected to check for coolant leaks. If the coolant leaks from the shaft or from the water pump breather hole, the water pump must be replaced.*

11. Use the designated tool to check the belt tension.

# Water pump - Remove [113469189 - V1 - 26 February 2025]

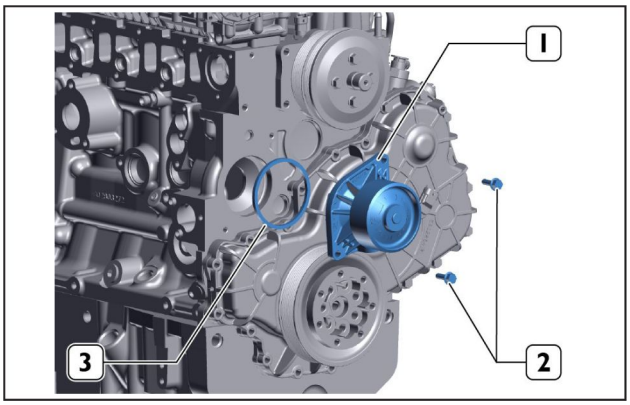
1. Position a suitable container to collect any coolant which may leak out.
2. Unscrew the fastening screws **(2)** and remove the water pump **(1)**, recovering the gasket **(3)**.




NHIL25ENG0114FA 1

# Water pump - Assemble [113471236 - V1 - 28 February 2025]

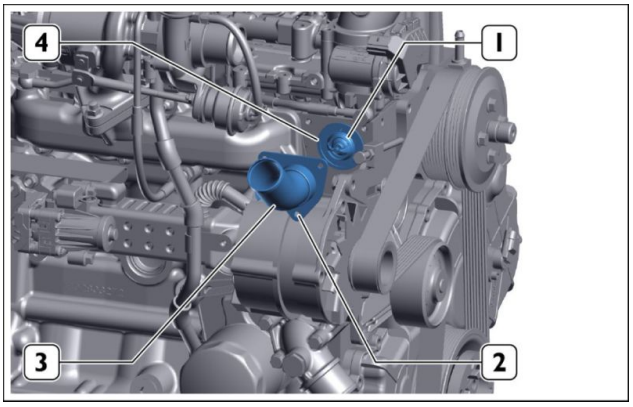
1. Apply a new sealing ring **(3)** to the water pump **(1)**.
2. Position the water pump **(1)** in its seat and tighten the fastening screws **(2)** to the prescribed torque.




NHIL25ENG0195TA 1

# Coolant thermostat - Remove - Thermostat [113434952 - V1 - 20 February 2025]

1. Unscrew the fastening screws **(2)** and remove the thermostat assembly **(3)**, complete with the gasket **(4)**, from the seat on the cylinder head.
2. Remove the thermostat **(1)** from its housing.

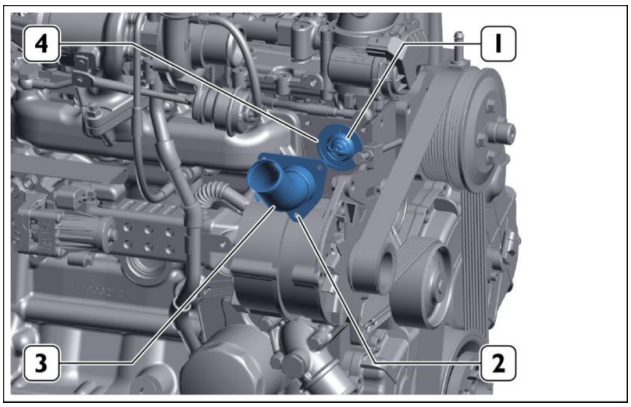



NHIL25ENG0383TA 1

# Coolant thermostat - Install - Thermostat [113434953 - V1 - 06 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Thermostat cover | 3 screws M6 x 1 x 12 | | **10 +/- 1 N·m** |

1. Install the thermostat **(1)** in its housing.
2. Fit the thermostat assembly **(3)**, complete with the gasket **(4)** in its seat in the cylinder head, and tighten the fastening screws **(2)** to the prescribed torque.




NHIL25ENG0383TA 1

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# Engine - 10

## Fan and drive - 414

**F6AFL413A*U001**

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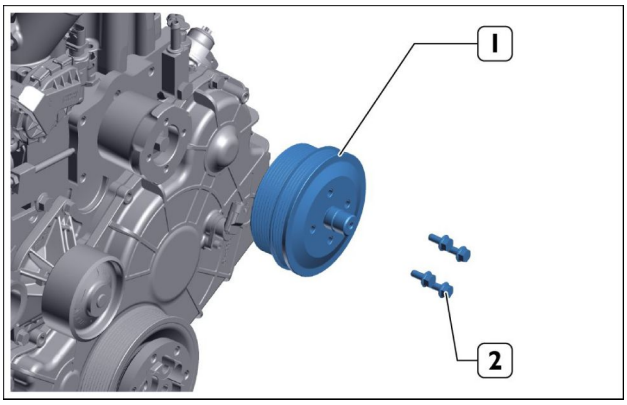
# Fan and drive - Remove - Fan control pulley [113434973 - V1 - 20 February 2025]

**Prior operation:**
Remove the auxiliary unit drive belt as described in the procedure **Radiator to water pump hoses - Remove - Water pump drive belt (10.400)**.

1. Unscrew the screws **(2)** and remove the fan drive pulley **(1)**.

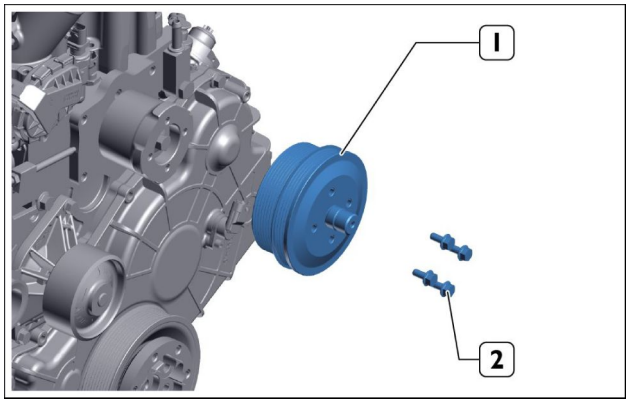



NHIL25ENG0386FA 1

# Fan and drive - Install - Fan control pulley [113434974 - V1 - 07 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Fan control pulley | 4 screws M8 x 1.25 x 18 | **23 +/- 2.3 N·m** |

1. Position the fan control pulley **(1)** on its mount and tighten the screws **(2)** to the prescribed torque.

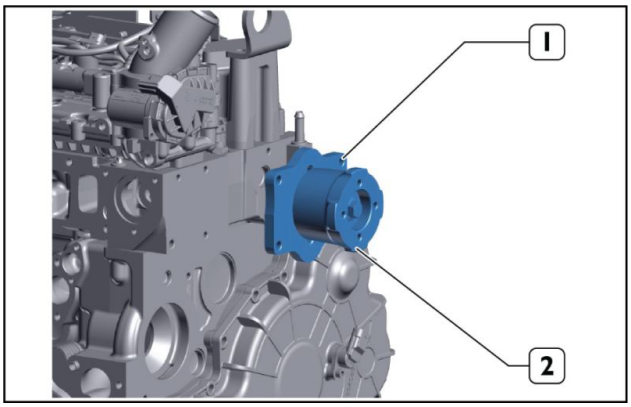



NHIL25ENG0386FA 1

**Next operation:**
Fit the auxiliary unit drive belt as described in the procedure **Fan and drive - Install - Fan control pulley (10.414)**

# Fan and drive - Remove - Fan drive pulley mount [113469192 - V1 - 07 March 2025]

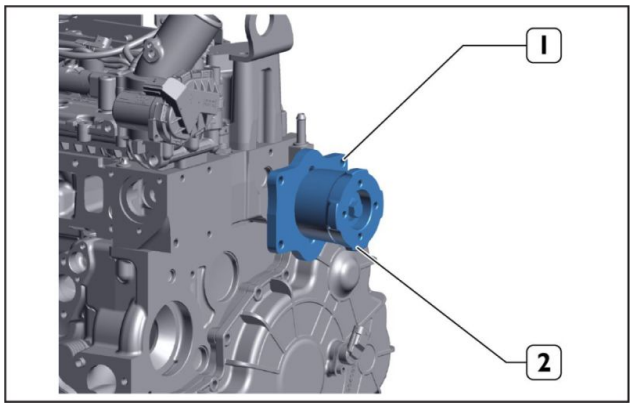
1. Unscrew the screws **(1)** and remove the fan drive pulley mount **(2)**.




NHIL25ENG0116FA 1

# Fan and drive - Assemble - Fan drive pulley mount [113471233 - V1 - 06 March 2025]

1. Correctly position the fan drive pulley mount **(2)** on the crankcase and tighten the screws **(1)** to the specified torque.

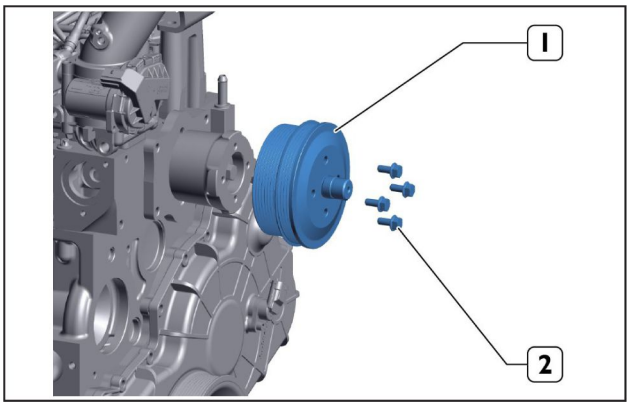



NHIL25ENG0193FA 1

| Description | Quantity | Value |
|---|---|---|
| Fan pulley control mount | 4 screws M8 x 1.25 x 25 | **23 +/- 2.3 N·m** |

# Fan and drive - Assemble - Fan drive pulley [113471234 - V1 - 28 February 2025]

1. Correctly position the fan drive pulley **(1)** on its mount and tighten the fastening screws **(2)** to the specified torque.



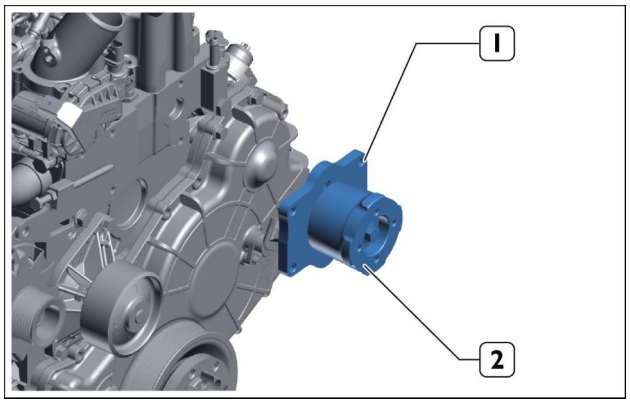

NHIL25ENG0194FA 1

| Description | Quantity | Value |
|---|---|---|
| Fan control pulley | 4 screws M8 x 1.25 x 18 | **23 +/- 2.3 N·m** |

# Fan - Remove - Fan hub mount [113434977 - V1 - 21 February 2025]

**Prior operation:**
Remove the fan drive pulley as described in the procedure **Fan and drive - Remove - Fan control pulley (10.414)**

1. Unscrew the screws **(1)** and remove the fan drive pulley mount **(2)**.

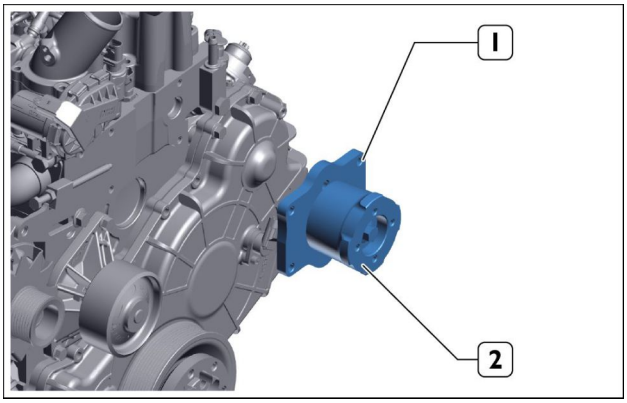



NHIL25ENG0387FA 1

# Fan - Install - Fan hub mount [113434978 - V1 - 06 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Fan pulley control mount | 4 screwsM8 x 1.25 x 18 | **23 +/- 2.3 N·m** |

1. Position the fan drive pulley mount **(2)** on the crankcase and tighten the screws **(1)** to the prescribed torque.

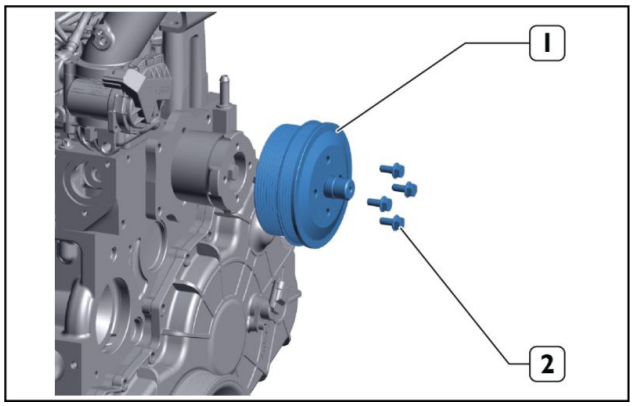



NHIL25ENG0387FA 1

**Next operation:**
Fit the auxiliary unit drive belt as described in the procedure **Fan and drive - Install - Fan control pulley (10.414)**

# Fan - Remove - Fan control pulley [113469191 - V1 - 07 March 2025]

1. Unscrew the screws **(2)** and remove the fan drive pulley **(1)**.




NHIL25ENG0115FA 1

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# Engine - 10

## Engine lubrication system - 304

**F6AFL413A*U001**

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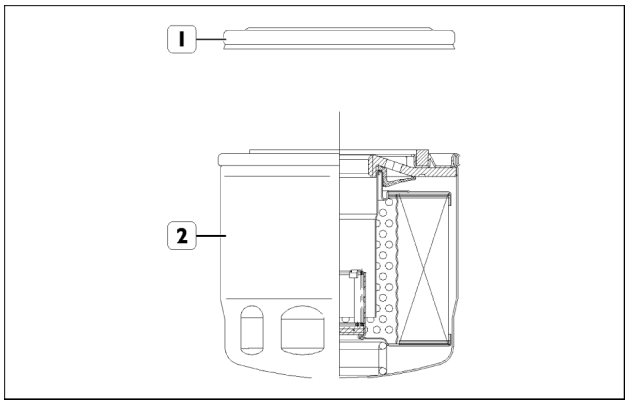
# Engine oil filter - Overview - Engine oil filter cartridge [113434672 - V1 - 06 March 2025]

Its function is to collect the metal residuals from the engine oil.



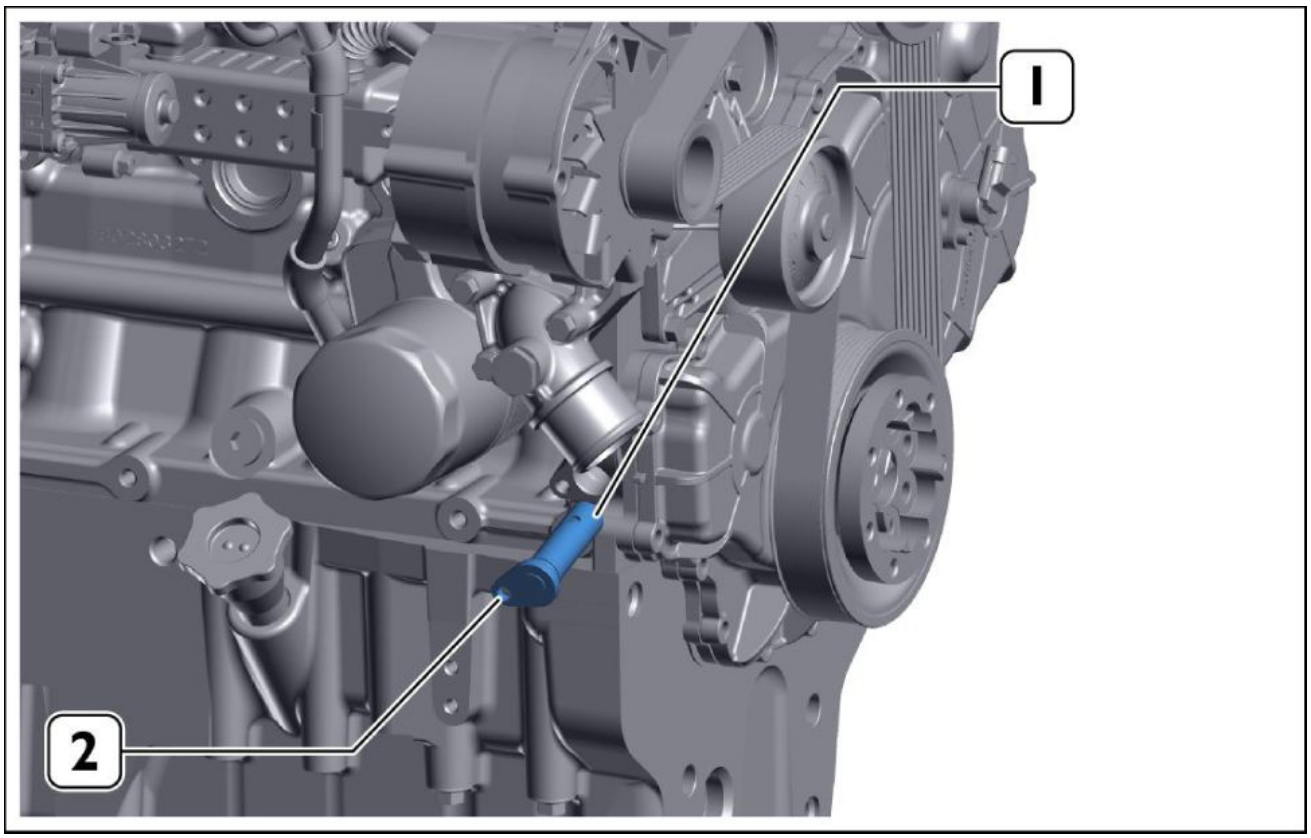

NHIL25ENG0368AA 1

| Item | Description |
|---|---|
| 1 | Protection cover |
| 2 | Cartridge |

| Technical data | |
|---|---|
| Filtering surface | **1350 +/- 100 cm²** |
| Filter collapse (ISO 4548/3) | > **10 bar** (**145 psi**) |
| Burst pressure (ISO 4548/3) | > **20 bar** (**290 psi**) |
| Pressure pulses **1 Hz** >50,000 cycles (ISO 4548/5) | **0 – 15 bar** (**0 – 218 psi**) |
| Operating temperature | **-40 – 120 °C** (**-40 – 248 °F**) |
| Tightening torque | **30 N·m** (**266 lb in**) + 5 |
| Maximum load | **50 L/min** (**2 cfm**) |
| Loss of load (at the end of the life cycle) | > **2.5 bar** (**36.2 psi**) |
| Filtering capacity with loss of load of **2.5 bar** (**36.2 psi**) (ISO 16889) | > **15 g** (**1 oz**) |

# Oil pressure valve - Overview - Oil pressure adjustment valve [113434674 - V1 - 06 March 2025]

## Oil pressure regulating valves 4 – 10 bar (58 – 145 psi)




NHIL25ENG0369FA 1

| Item | Description |
|---|---|
| 1 | Control valve |
| 2 | Control valve fastening screw |

## Oil pressure regulating valves 4 bar (58 psi)

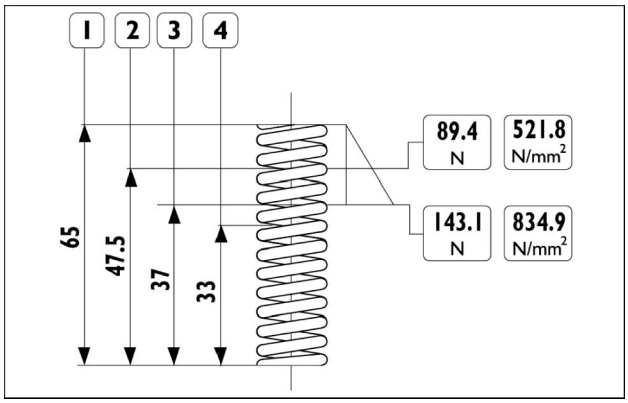
The oil pressure regulating valve is located on the right side of the crankcase near the coolant / lubricant oil heat exchanger and guarantees the correct level of pressure in the main lubrication duct inside the crankcase when the oil is cold.

Unscrew the plug , remove the spring and the control valve from the support .

Check whether the valve is not scored and is sliding smoothly into its seat. The spring shall not be broken or yielded.

Start of opening pressure **4 bar** (**58 psi**).

Main data to check the oil pressure relief valve spring.



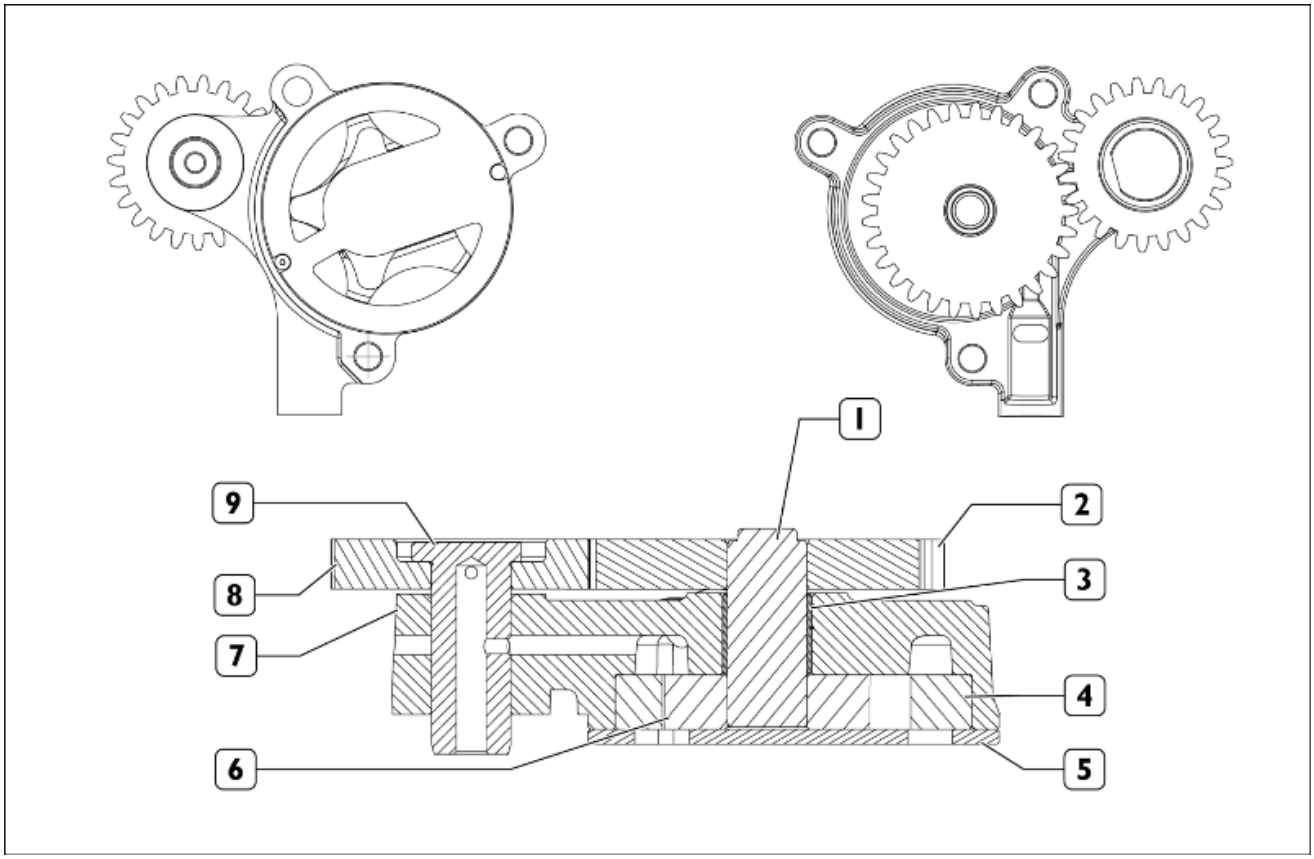

NHIL25ENG0370AA 2

# Engine oil pump - Overview - Oil pump [113434661 - V1 - 06 March 2025]

Housed in the front of the crankcase, the oil pump is a rotary pump commanded by a spur gear fitted to the stub of the crankshaft.

***NOTE:*** *The oil pump cannot be overhauled. If any faults are detected, it must be replaced.*

## Oil pump cross-section




NHIL25ENG0367FA 1

| Item | Description |
|---|---|
| 1 | Control rod |
| 2 | Drive gear |
| 3 | Bush |
| 4 | External rotor |
| 5 | Cover |
| 6 | Inner rotor |
| 7 | Oil pump body |
| 8 | Idle gear |
| 9 | Guide pin |

## Oil pump performance

| Pump performance | |
|---|---|
| Pump speed | **1050 – 3250 RPM** |
| Delivery pressure | **2 – 5 bar** (**29 – 72 psi**) |
| Rated flow | **10.5 – 35.0 L/min** (**0.4 – 1.2 cfm**) |
| Oil temperature | **120 °C** (**248 °F**) |
| Oil used | SAE 15W40 |

# Crankcase ventilation system - Overview - Lubrication [113434656 - V1 - 06 March 2025]

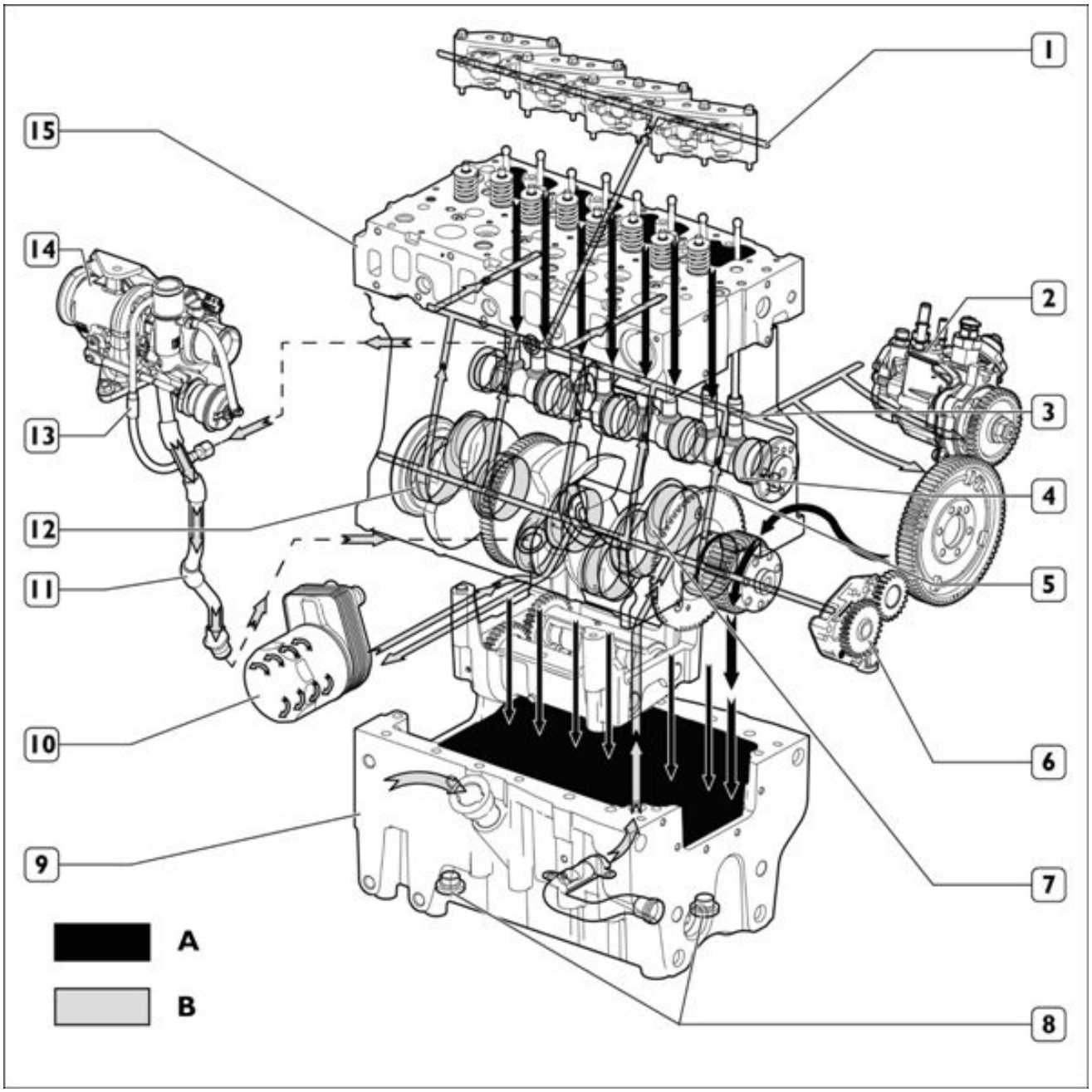
## Lubrication circuit

Forced-circulation lubrication is provided by the rotor oil pump, housed in the front part of the crankcase and controlled by the straight-tooth gear splined to the crankshaft tang.

From the sump, the lubrication oil is sent to the crankshaft, the camshaft and the valve control.

Lubrication also includes the heat exchanger and turbocharger.

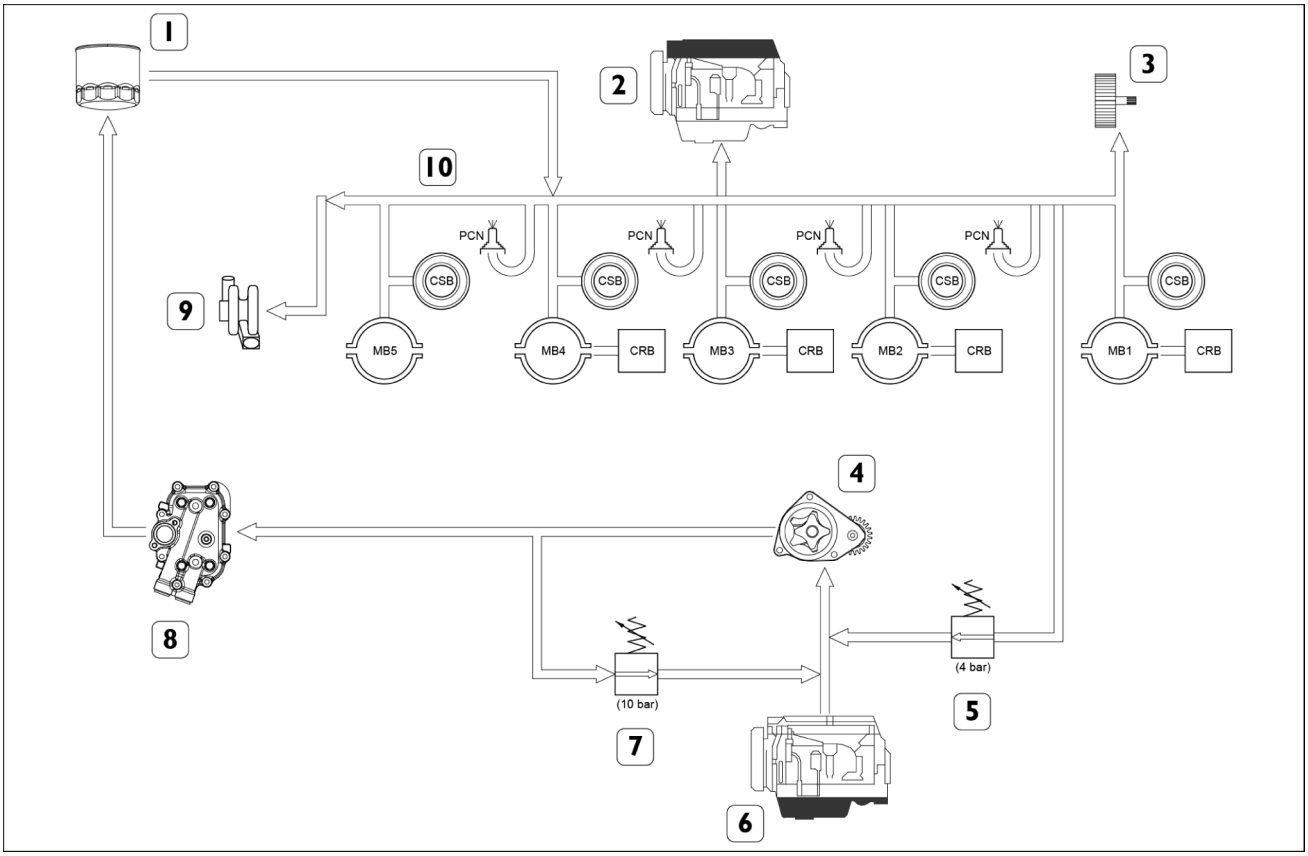
## Lubrication system diagram




NHIL25ENG0365GA 1

| Item | Description |
|---|---|
| 1 | Rocker arm shaft lubrication |
| 2 | High-pressure pump |
| 3 | Tappet cover and push rods lubrication |
| 4 | Camshaft bushing |
| 5 | Piston cooling nozzles |
| 6 | Rotary oil pump |
| 7 | Big end half-bearing lubrication |
| 8 | Lubricant oil drain plug |
| 9 | Oil sump |
| 10 | Engine oil filter |
| 11 | Turbocharger lubricant oil drain pipe |
| 12 | Main half-bearing lubrication |
| 13 | Turbocharger lubricant oil delivery pipe |
| 14 | Turbocharger |
| 15 | Cylinder Head |

## Lubrication circuit




NHIL25ENG0366FA 2

| Item | Description |
|---|---|
| 1 | Oil filter |
| 2 | Cylinder Head |
| 3 | Power take-off |
| 4 | Oil pump |
| 5 | Oil pressure regulating valve **4 bar** (**58 psi**) |
| 6 | Oil sump |
| 7 | Vent valve **10 bar** (**145 psi**) |
| 8 | Heat exchanger |
| 9 | Turbochargers |
| 10 | Main duct |

| Item | Description |
|---|---|
| MB | Main bearings |
| CRB | Big-end bearings |
| PCN | Jets for cooling the pistons |
| CSB | Camshaft bearings |

# Engine oil filter - Check - Engine oil filter cartridge [113434704 - V1 - 20 February 2025]

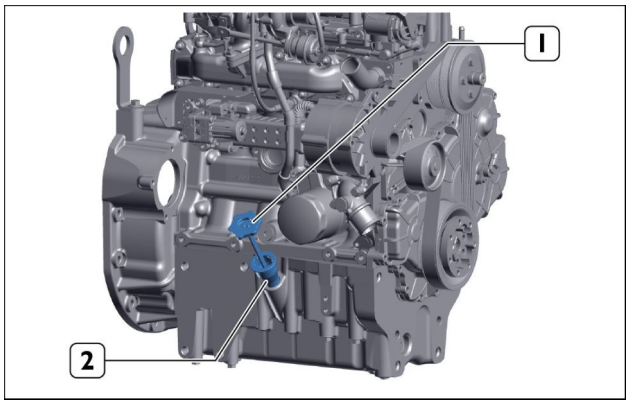
## Engine lubricant oil level check

***NOTE:*** *Depending on the engine version, the oil cap / dipstick, may be on the RIGHT or LEFT side of the engine*

1. The check must be carried out with the engine stopped and possibly cold.
2. Make sure that the engine or the machine on which it is installed is on a flat surface.
3. Use the oil dipstick **(1)** to check that the lubricant oil level falls between the "Min" and "Max" markings.
4. If it is difficult to perform the measurement, clean the oil dipstick **(1)** using a clean cloth without any loose threads, and re-fit the dipstick into its housing **(2)**. Remove it again and check the level.

***NOTE:*** *General prescriptions The engine oil is highly pollutant and harmful. In case of contact with the skin, wash thoroughly with soap and water. Protect skin and eyes appropriately; work in accordance with accident prevention regulations. Dispose of the residue in full compliance with legal regulations. Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty*

5. If the level is too low, top-off using lubricant oil compliant to the specifications in the table "General specifications - REFILLING".
6. To top-off, remove the lubricant oil filling cap **(1)** and pour engine lubricant oil into the sump through the inlet pipe **(2)**.
7. Always make sure to add oil that has the same characteristics of the one contained in the sump. Mixtures are not permitted that cannot guarantee the correct lubrication of the engine parts.
8. Make sure that the dipstick **(1)** is inserted completely and that the oil filler cap is completely tightened.



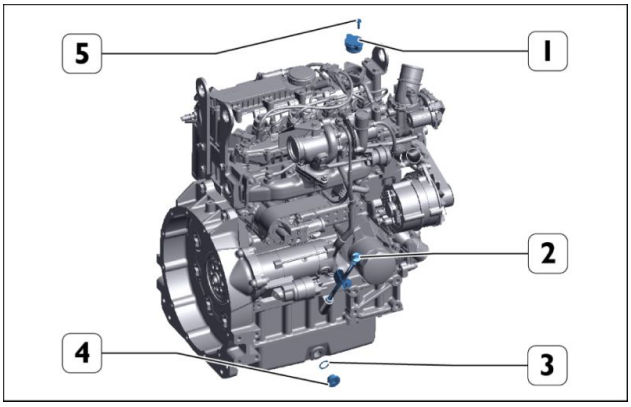

NHIL25ENG0371FA 1

# Engine oil filter - Replace - Engine oil filter cartridge [113434705 - V1 - 06 March 2025]

Only proceed when the engine is not running and is at low temperature in order to avoid the risk of burns.

1. Place a suitable container for collecting the spent oil under the oil sump in line with the lubricant oil drain plugs **(3)**.
2. Unscrew the 2 lubricant oil drain plugs **(4)** (on both sides of the oil sump), recovering the relative gaskets **(3)**. Remove the oil level dipstick **(2)** to help the engine lubricant oil drain out. Wait until the oil sump is completely drained, then re-tighten the lubricant oil drain plugs **(4)** complete with new gaskets **(3)** to the torque of **50 +/- 5 N·m**.
3. Proceed with the filling operation through the filler plug **(1)** after putting the screw **(5)** back on and using lubricant oil which meets the requirements of international standards, as indicated in the section General specification ().
4. Use the dipstick **(2)** to check that the level of lubricant oil is between the "Min" and "Max" limits.
5. If it is difficult to take the reading, clean the oil dipstick **(2)** with a clean, lint-free cloth and put it back in its seat. Remove it again and check the level.
6. Insert the dipstick **(2)** and close the lubricating oil filler cap.

   ***NOTE:*** *General prescriptions Dispose of consumable materials and the parts in contact with them (for example filters) in accordance with the law. The workshops of the FPT Service Network are equipped for this purpose. Correct behavior will ensure that vehicle is used as environmentally friendly as possible.*

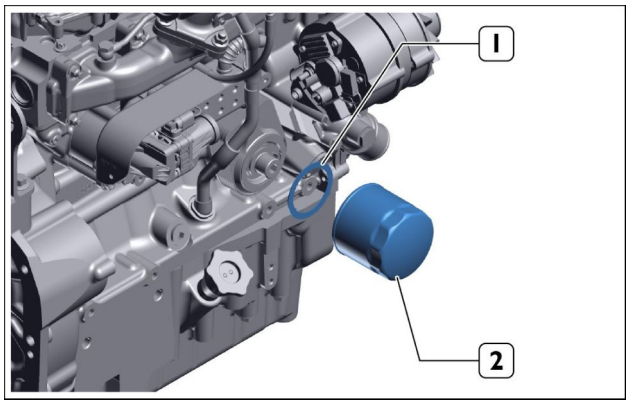



NHIL25ENG0372FA 1

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

***NOTE:*** *Depending on the model, the oil filter may be on the right or left side of the engine*

1. The filter must also be replaced when the lubricant oil is changed.
2. Only use filters with a degree of filtration equal to the original filter.
3. Proceed only when the engine is not rotating and at a low temperature to prevent the risk of burns.
4. Position a suitable container to collect the exhaust oil under the filter bracket.
5. Use the special tool to unscrew and remove the oil filter **(2)** from the filter bracket and recover the gasket **(1)**.
6. Replace the oil filter **(2)** and the gasket **(1)**.
7. Moisten the sealing gasket **(1)** with a thin layer of oil and place it in its seat on the oil filter **(2)**.
8. Tighten the oil filter **(2)** manually on the bracket until the sealing gasket **(1)** adheres.
9. Use the special tool to further tighten the oil filter **(2)** to torque:




NHIL25ENG0373FA 2

| Description | Quantity | Value |
|---|---|---|
| Oil filter | 1 cartridge M27 x 2 | **18 +/- 2.5 N·m** |

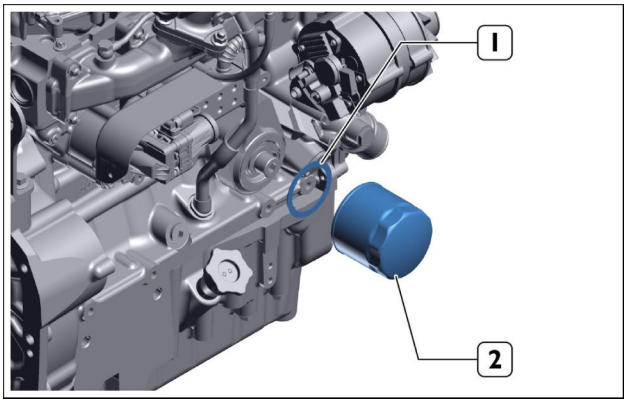
10. Run the engine for a few minutes and then check the level using the dipstick. If necessary, top up to compensate for the oil quantity used to fill the filter cartridge.

# Engine oil filter - Remove - Engine oil filter cartridge [113434706 - V1 - 06 March 2025]

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

***NOTE:*** *Depending on the model, the oil filter may be on the right or left side of the engine.*

1. Position a suitable container to collect the exhaust oil under the filter bracket.
2. Proceed only when the engine is not rotating and at a low temperature to prevent the risk of burns.
3. Use the special tool to unscrew and remove the oil filter **(2)** from the filter bracket and recover the gasket **(1)**.




NHIL25ENG0374FA 1

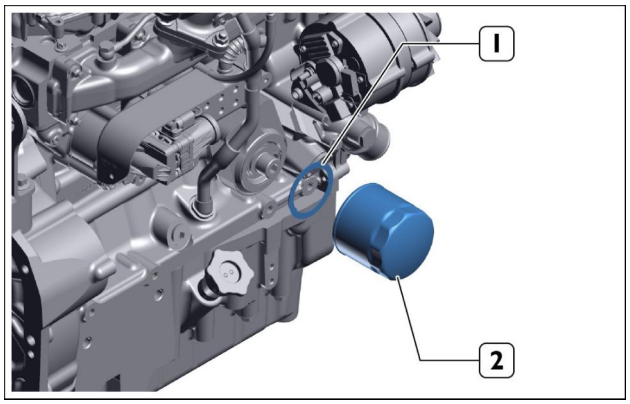
# Engine oil filter - Install - Engine oil filter cartridge [113434708 - V1 - 06 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Oil filter | 1 cartridge M27 x 2 | **18 +/- 2.5 N·m** |

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

***NOTE:*** *Depending on the model, the oil filter may be on the right or left side of the engine.*

1. Moisten the sealing gasket **(1)** with a thin layer of oil and place it in its seat on the oil filter **(2)**.
2. Tighten the oil filter **(2)** manually on the bracket until the sealing gasket **(1)** adheres.
3. Use the special tool to further tighten the oil filter **(2)** to torque:
4. Run the engine for a few minutes and then check the level using the dipstick. If necessary, top up to compensate for the oil quantity used to fill the filter cartridge.



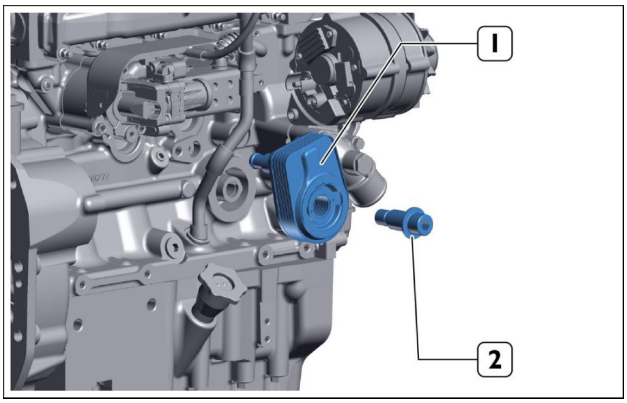

NHIL25ENG0375FA 1

# Engine oil filter - Remove - Filter support [113434723 - V1 - 20 February 2025]

**Prior operation:**
Remove the oil filter as described in procedure **Engine oil filter - Remove - Engine oil filter cartridge (10.304)**

***NOTE:*** *For engines with the oil filter on the RIGHT.*

1. Position a container to collect the used oil below the oil filter mount **(1)**.
2. Unscrew the fastening screws **(2)** and remove the oil filter mount **(1)** recovering the gasket.



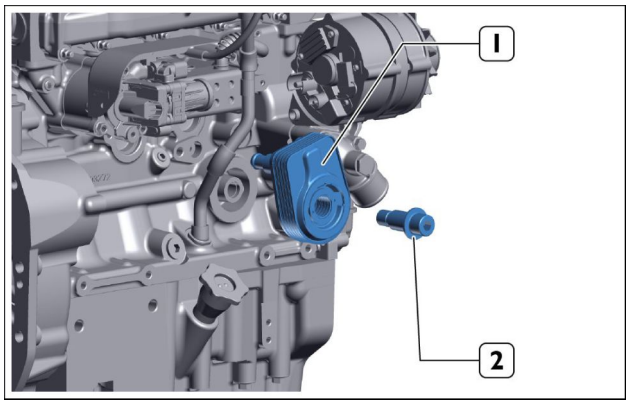

NHIL25ENG0376FA 1

# Engine oil filter - Install - Filter support [113434724 - V1 - 06 March 2025]

| Description | Step | Value |
|---|---|---|
| Oil filter bracket | 1 fitting M20 x 1.5 x 18 | **35 +/- 5 N·m** |
| | 1 fitting (if present) M24 x 1.5 | **45 +/- 4.5 N·m** |
| | 1 plug (if present) M27 x 2 | **18 +/- 2.5 N·m** |

***NOTE:*** *For engines with the oil filter on the right*

1. Position the sealing gasket on the oil filter bracket **(1)**.
2. Fit the oil filter bracket **(1)** and tighten the fastening screw **(2)** to the prescribed torque.



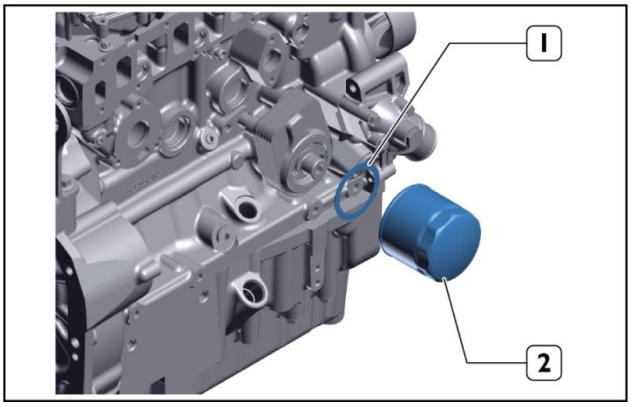

NHIL25ENG0376FA 1

**Next operation:**
Fit the oil filter, as described in the procedure **Engine oil filter - Install - Engine oil filter cartridge (10.304)**

# Engine oil filter - Remove [113469166 - V1 - 26 February 2025]

***NOTE:*** *Depending on the engine model, the oil filter may be on the LEFT or RIGHT side*

1. Position a suitable container to collect the exhaust oil under the filter bracket.
2. Use the special tool to unscrew and remove the oil filter **(2)** from the filter bracket and recover the gasket **(1)**.



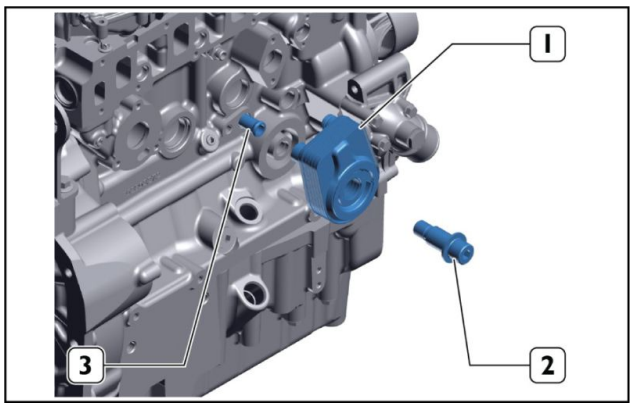

NHIL25ENG0109FA 1

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

# Engine oil filter - Remove - Oil filter mount [113469167 - V1 - 07 March 2025]

***NOTE:*** *Engine with oil filter on the RIGHT*

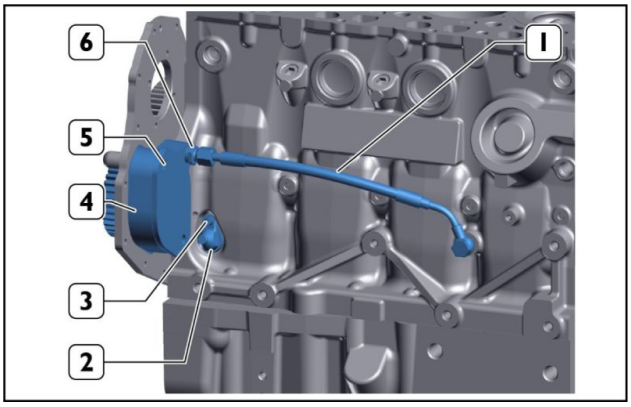
1. Unscrew the fastening screw **(2)** and remove the oil filter bracket **(1)** recovering the gasket and the connection pipe **(3)**.




NHIL25ENG0110FA 1

# Engine oil filter - Remove - Control socket [113469596 - V1 - 06 March 2025]

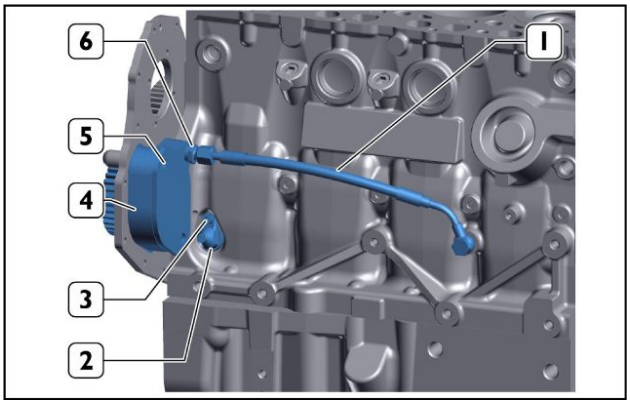
1. Unscrew the fitting and the screw and remove the lubrication pipe **(1)** of the control socket **(4)**.
2. Unscrew the fitting **(6)** on the control socket.
3. Unscrew the screws **(5)** and remove the control socket **(4)** together with the gasket.
4. Unscrew the screw **(3)** and remove the engine speed sensor **(2)**.




NHIL25ENG0138FA 1

# Engine oil filter - Install - Control socket [113469597 - V1 - 06 March 2025]

1. Install the engine speed sensor **(2)** and tighten the fastening screw **(3)** to the specified torque.




NHIL25ENG0166FA 1

| Description | Quantity | Value |
|---|---|---|
| Crankshaft rpm sensor | 1 screw M6 x 1 x 16 | **9 +/- 0.9 N·m** |

2. Install the control socket **(4)** in its seat, inserting a new gasket and making sure that the gear couples correctly with the timing gear, and tighten the fastening screws **(5)** to the specified torque.

| Description | Quantity | Value |
|---|---|---|
| Socket for the service air compressor control | 2 screws M10 x 1.5 x 20 | **45 +/- 4.5 N·m** |

3. Screw the fitting **(6)** onto the control socket.

| Description | Quantity | Value |
|---|---|---|
| Control socket coupling | M12 x 1.5 | **14 +/- 1.4 N·m** |

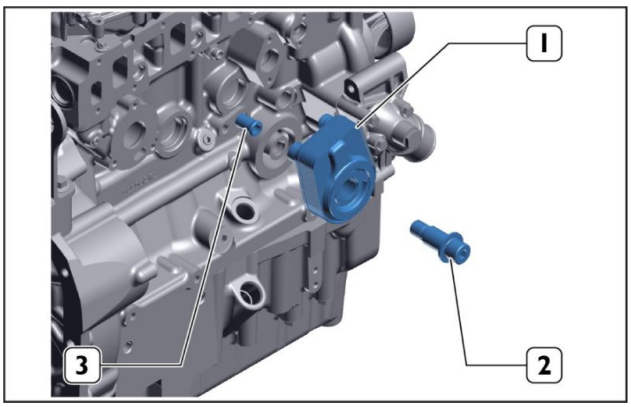
4. Install the lubricant pipe **(1)** of the control socket **(4)** and tighten the fitting and the fastening screw to the specified torque.

| Description | Step | Value |
|---|---|---|
| Control socket lubrication pipe | 1 screw M12 x 1.5 | **40 +/- 4 N·m** |
| | 1 fitting M14 x 1.5 | **40 +/- 4 N·m** |

# Engine oil filter - Assemble - Oil filter mount [113471246 - V1 - 28 February 2025]

***NOTE:*** *Engine with oil filter on the right.*

1. Install the pipe connection **(3)** and the oil filter support **(1)**, inserting a new gasket and tightening the fastening screw **(2)** to the specified torque.



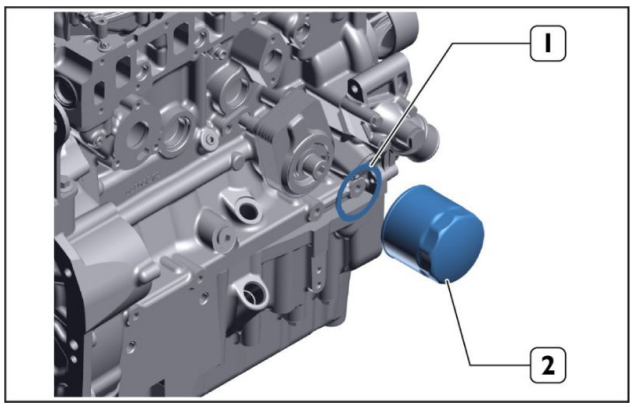

NHIL25ENG0198FA 1

| Description | Step | Value |
|---|---|---|
| Oil filter bracket | 1 fitting M20 x 1.5 x 18 | **35 +/- 5 N·m** |
| | 1 fitting (if present) M24 x 1.5 | **45 +/- 4.5 N·m** |
| | 1 plug (if present) M27 x 2 | **18 +/- 2.5 N·m** |

# Engine oil filter - Assemble - Oil filter [113471247 - V1 - 28 February 2025]

***NOTE:*** *Depending on the engine model, the oil filter may be on the left or right side*

1. Moisten the sealing gasket **(1)** with a thin layer of oil and place it in its seat on the oil filter **(2)**.
2. Tighten the oil filter **(2)** manually on the bracket until the sealing gasket **(1)** adheres.
3. Use the special tool to further tighten the oil filter **(2)** to torque:




NHIL25ENG0199FA 1

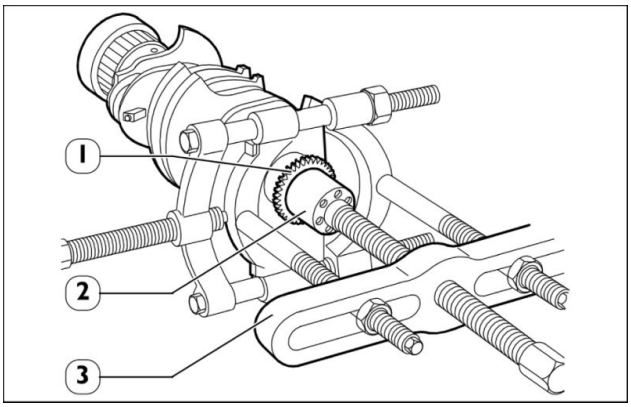
| Description | Quantity | Value |
|---|---|---|
| Oil filter | 1 cartridge M27 x 2 | **18 +/- 2.5 N·m** |

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

# Engine oil pump - Replace - Oil pump control pinion gear [113427680 - V1 - 04 March 2025]

## Oil pump drive gear replacement

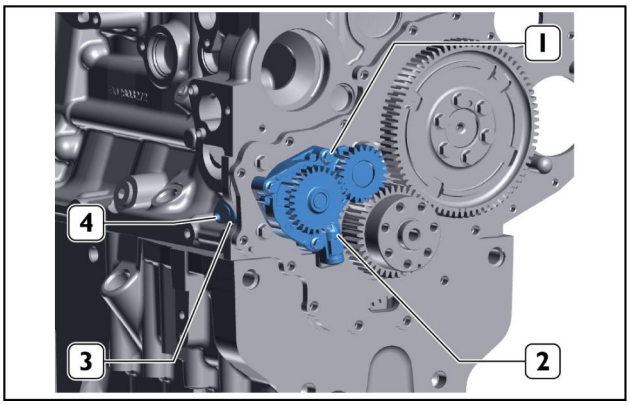
1. Check that gear toothing **(1)** is not damaged or worn, otherwise remove using the proper puller **(3)**.
2. After fitting the new gear, it must be heated for **10 min** in an oven at a temperature of **180.0 °C** (**356.0 °F**) and keyed to the engine by interposing the key.




NHIL25ENG0298AA 1

# Engine oil pump - Remove [113469602 - V1 - 27 February 2025]

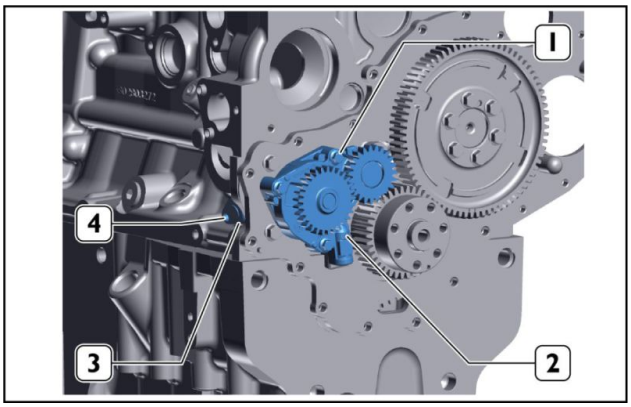
1. Unscrew the screw **(4)** and remove the oil pressure adjustment valve **(3)**.
2. Unscrew the screws **(1)** and remove the oil pump **(2)**.




NHIL25ENG0139TA 1

# Engine oil pump - Install - Oil pump [113469603 - V1 - 06 March 2025]

1. Fit the oil pump **(2)** and tighten the fastening **(1)**screws to the specified torque.




NHIL25ENG0165FA 1

| Description | Quantity | Value |
|---|---|---|
| Oil pump | 3 screws M8 x 1.25 x 36 | **33 +/- 3.3 N·m** |

2. Fit the oil pressure control valve **(3)** and tighten the fastening screw **(4)** to the specified torque.

| Description | Quantity | Value |
|---|---|---|
| Oil pressure regulator valve | 1 screw M8 x 1.25 x 36 | **33 +/- 3.3 N·m** |

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# SERVICE MANUAL

## Electrical systems

### F6AFL413A*U001

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# Electrical components - ECU description [113351867 - V2 - 19 August 2025]

***A-F02 - Centralina controllo motore (ECU)***

| | |
|---|---|
| Component Type | ECU |
| Wiring frames | **SHEET 01 SH01 - ECU engine side**<br>**SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F02V (Receptacle)** - Engine control unit [A-F02]<br>**X-F02E (Receptacle)** - Engine control unit [A-F02] (5802805180) |

***A-F02 - Engine control unit (ECU)***

| | |
|---|---|
| Component Type | ECU |
| Wiring frames | **SHEET 01 SH01 - ECU engine side**<br>**SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F02V (Receptacle)** - Engine control unit [A-F02]<br>**X-F02E (Receptacle)** - Engine control unit [A-F02] (5802805180) |

***A-F222 - Centralina controllo avviamento (ECU)***

| | |
|---|---|
| Component Type | ECU |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F222A** - Starting control unit [A-F222] |

***A-F222 - Starting control unit (ECU)***

| | |
|---|---|
| Component Type | ECU |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F222A** - Starting control unit [A-F222] |

***A-F251 - Centralina candelette preriscaldo (ECU)***

| | |
|---|---|
| Component Type | ECU |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F251 (Receptacle)** - Preheating glow-plugs control unit [A-F251] (84356962) |

***A-F251 - Preheating glow-plugs control unit (ECU)***

| | |
|---|---|
| Component Type | ECU |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F251 (Receptacle)** - Preheating glow-plugs control unit [A-F251] (84356962) |

# Electrical components - Sensor description [113351869 - V2 - 19 August 2025]

***B-F09 - Sensore di pressione sul rail (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F09** - Pressure sensor on the rail [B-F09] |

***B-F09 - Pressure sensor on the rail (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F09** - Pressure sensor on the rail [B-F09] |

***B-F19 - Sensore di fase (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F19** - Timing sensor [B-F19] |

***B-F19 - Timing sensor (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F19** - Timing sensor [B-F19] |

***B-F21 - Sensore temperatura liquido raffreddamento motore (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F21** - Engine coolant temperature sensor [B-F21] |

***B-F217 - Sensore presenza acqua nel combustibile (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F217 (Receptacle)** - Water in fuel sensor [B-F217] (87747172) |

***B-F217 - Water in fuel sensor (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F217 (Receptacle)** - Water in fuel sensor [B-F217] (87747172) |

***B-F219 - Sensore temperatura turbo (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F219** - Turbo temperature sensor [B-F219] |

***B-F219 - Turbo temperature sensor (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F219** - Turbo temperature sensor [B-F219] |

***B-F23 - Sensore di giri (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |

| | |
|---|---|
| Connectors | **X-F23 (Receptacle)** - Rpm sensor [B-F23] |

***B-F23 - Rpm sensor (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F23 (Receptacle)** - Rpm sensor [B-F23] |

***B-F290 - Sensore temperatura combustibile (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F290** - Fuel temperature sensor [B-F290] |

***B-F290 - Fuel temperature sensor (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F290** - Fuel temperature sensor [B-F290] |

***B-F32 - Sensore di temperatura gas di scarico a monte del DOC (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F32** - Exhaust gas temperature sensor upstream of the DOC [B-F32] |

***B-F32 - Exhaust gas temperature sensor upstream of the DOC (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F32** - Exhaust gas temperature sensor upstream of the DOC [B-F32] |

***B-F33 - Sensore di temperatura gas di scarico a monte del DPF (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F33** - Exhaust gas temperature sensor upstream of the DPF [B-F33] |

***B-F33 - Exhaust gas temperature sensor upstream of the DPF (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F33** - Exhaust gas temperature sensor upstream of the DPF [B-F33] |

***B-F34 - Sensore di pressione differenziale sul DPF (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F34** - Differential pressure sensor on the DPF [B-F34] |

***B-F34 - Differential pressure sensor on the DPF (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F34** - Differential pressure sensor on the DPF [B-F34] |

***B-F48 - Sensore pressione e temperatura aria di sovrapressione (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F48 (Receptacle)** - Overpressure air temperature pressure sensor [B-F48] |

***B-F48 - Overpressure air temperature pressure sensor (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F48 (Receptacle)** - Overpressure air temperature pressure sensor [B-F48] |

***B-F53 - Sensore pressione gas di scarico (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F53** - Exhaust gas pressure sensor [B-F53] |

***B-F53 - Exhaust gas pressure sensor (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F53** - Exhaust gas pressure sensor [B-F53] |

***B-F65 - Sensore di temperatura dell'aria aspirata (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F65** - Intake air temperature sensor [B-F65] |

***B-F65 - Intake air temperature sensor (Sensor)***

| | |
|---|---|
| Component Type | Sensor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F65** - Intake air temperature sensor [B-F65] |

# Electrical components - Fuse description [113351871 - V2 - 19 August 2025]

***F-F200 - Fusibile (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F200 - Fuse (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F201 - Fusibile (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F201 - Fuse (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F215 - Fusibile (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F215 - Fuse (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F230 - Fusibile (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F230A - Fusibile (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F230A - Fuse (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F245 - Fusibile (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F245A - Fusibile (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F245A - Fuse (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F245B - Fusibile (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F245B - Fuse (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F272 - Fusibile (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F272 - Fuse (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F303 - Fusibile (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***F-F303 - Fuse (Fuse)***

| | |
|---|---|
| Component Type | Fuse |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

# Electrical components - Voltage source description [113351873 - V2 - 19 August 2025]

***G-F271 - Batteria (Voltage source)***

| Component Type | Voltage source |
|---|---|
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***G-F271 - Battery (Voltage source)***

| Component Type | Voltage source |
|---|---|
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

# Electrical components - Ground description [113351875 - V2 - 19 August 2025]

***GND-02 - (Ground)***

| | |
|---|---|
| Component Type | Ground |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |

***GND-02 - (Ground)***

| | |
|---|---|
| Component Type | Ground |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |

# Electrical components - Relay description [113351877 - V2 - 19 August 2025]

***K-F220 - Teleruttore avviamento (Relay)***

| | |
|---|---|
| Component Type | Relay |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F220** - Starter contactor [K-F220] |

***K-F220 - Starter contactor (Relay)***

| | |
|---|---|
| Component Type | Relay |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F220** - Starter contactor [K-F220] |

***K-F222 - Teleruttore controllo avviamento da Body Controller (Relay)***

| | |
|---|---|
| Component Type | Relay |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F222** - Contactor for start-up control from Body Controller [K-F222] |

***K-F222 - Contactor for start-up control from Body Controller (Relay)***

| | |
|---|---|
| Component Type | Relay |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F222** - Contactor for start-up control from Body Controller [K-F222] |

***K-F223 - Teleruttore controllo avviamento (Relay)***

| | |
|---|---|
| Component Type | Relay |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F223** - Starter control contactor [K-F223] |

***K-F223 - Starter control contactor (Relay)***

| | |
|---|---|
| Component Type | Relay |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F223** - Starter control contactor [K-F223] |

***K-F230 - Teleruttore riscaldamento filtro combustibile (Relay)***

| | |
|---|---|
| Component Type | Relay |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F230** - Fuel filter heating contactor [K-F230] |

***K-F230 - Fuel filter heating contactor (Relay)***

| | |
|---|---|
| Component Type | Relay |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F230** - Fuel filter heating contactor [K-F230] |

***K-F245 - Teleruttore principale (Relay)***

| | |
|---|---|
| Component Type | Relay |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F245** - Main contactor [K-F245] |

***K-F245 - Main contactor (Relay)***

| | |
|---|---|
| Component Type | Relay |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F245** - Main contactor [K-F245] |

# Electrical components - Load description [113351879 - V2 - 19 August 2025]

***L-F96_1 - Candeletta di preriscaldo (Load)***

| | |
|---|---|
| Component Type | Load |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***L-F96_1 - Pre-heating glow plug (Load)***

| | |
|---|---|
| Component Type | Load |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***L-F96_2 - Candeletta di preriscaldo (Load)***

| | |
|---|---|
| Component Type | Load |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***L-F96_2 - Pre-heating glow plug (Load)***

| | |
|---|---|
| Component Type | Load |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***L-F96_3 - Candeletta di preriscaldo (Load)***

| | |
|---|---|
| Component Type | Load |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***L-F96_3 - Pre-heating glow plug (Load)***

| | |
|---|---|
| Component Type | Load |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***L-F96_4 - Candeletta di preriscaldo (Load)***

| | |
|---|---|
| Component Type | Load |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***L-F96_4 - Pre-heating glow plug (Load)***

| | |
|---|---|
| Component Type | Load |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

# Electrical components - Motor description [113351881 - V2 - 19 August 2025]

***M-F272 - Motorino d'avviamento (Motor)***

| | |
|---|---|
| Component Type | Motor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F272** - Starter motor [M-F272] |

***M-F272 - Starter motor (Motor)***

| | |
|---|---|
| Component Type | Motor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F272** - Starter motor [M-F272] |

# Electrical components - Resistor description [113351883 - V2 - 19 August 2025]

***R-F230A - Resistenza filtro combustibile (Resistor)***

| | |
|---|---|
| Component Type | Resistor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

***R-F230A - Fuel filter resistor (Resistor)***

| | |
|---|---|
| Component Type | Resistor |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |

# Electrical components - Switch description [113351885 - V2 - 19 August 2025]

***S-F200 - Commutatore di avviamento (Switch)***

| | |
|---|---|
| Component Type | Switch |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F200** - Ignition switch [S-F200] |

***S-F200 - Ignition switch (Switch)***

| | |
|---|---|
| Component Type | Switch |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F200** - Ignition switch [S-F200] |

***S-F55 - Interruttore allarme basso livello olio motore (Switch)***

| | |
|---|---|
| Component Type | Switch |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F55** - Low engine oil level alarm switch [S-F55] |

***S-F55 - Low engine oil level alarm switch (Switch)***

| | |
|---|---|
| Component Type | Switch |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F55** - Low engine oil level alarm switch [S-F55] |

***SW-F215 - Interruttore staccabatteria (BDS) (Switch)***

| | |
|---|---|
| Component Type | Switch |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F215** - Battery disconnect switch (BDS) [SW-F215] |

***SW-F215 - Battery disconnect switch (BDS) (Switch)***

| | |
|---|---|
| Component Type | Switch |
| Wiring frames | **SHEET 02 SH02 - ECU vehicle side** |
| Connectors | **X-F215** - Battery disconnect switch (BDS) [SW-F215] |

# Electrical components - Solenoid description [113351887 - V2 - 19 August 2025]

***Y-F07 - Elettrovalvola per regolazione pressione combustibile (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F07 (Receptacle)** - Fuel pressure regulating solenoid valve [Y-F07] |

***Y-F07 - Fuel pressure regulating solenoid valve (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F07 (Receptacle)** - Fuel pressure regulating solenoid valve [Y-F07] |

***Y-F102 - Elettrovalvola a farfalla (TVA) (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F102** - Throttle solenoid valve (TVA) [Y-F102] |

***Y-F102 - Throttle solenoid valve (TVA) (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F102** - Throttle solenoid valve (TVA) [Y-F102] |

***Y-F11_1 - Iniettore 1 (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F11_1** - Injector 1 [Y-F11_1] |

***Y-F11_1 - Injector 1 (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F11_1** - Injector 1 [Y-F11_1] |

***Y-F11_2 - Iniettore 2 (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F11_2** - Injector 2 [Y-F11_2] |

***Y-F11_2 - Injector 2 (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F11_2** - Injector 2 [Y-F11_2] |

***Y-F11_3 - Iniettore 3 (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F11_3** - Injector 3 [Y-F11_3] |

***Y-F11_3 - Injector 3 (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F11_3** - Injector 3 [Y-F11_3] |

***Y-F11_4 - Iniettore 4 (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F11_4** - Injector 4 [Y-F11_4] |

***Y-F11_4 - Injector 4 (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F11_4** - Injector 4 [Y-F11_4] |

***Y-F24A - Elettrovalvola EGR (Pierburg) (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F24A** - EGR solenoid valve (Pierburg) [Y-F24A] |

***Y-F24A - EGR solenoid valve (Pierburg) (Solenoid)***

| | |
|---|---|
| Component Type | Solenoid |
| Wiring frames | **SHEET 01 SH01 - ECU engine side** |
| Connectors | **X-F24A** - EGR solenoid valve (Pierburg) [Y-F24A] |

# Wire connectors - Component diagram 00 Connector X-000 to X-009 [113351831 - V2 - 19 August 2025]

***X-F02E - Engine control unit [ A-F02] (5802805180) (Receptacle)***

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 6 | **X-F12-1 (Receptacle) pin 2** - Connector SEC.2 F | CB | Fuel pressure regulating solenoid valve | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 7 | **X-F12-1 (Receptacle) pin 1** - Connector SEC.2 F | ZB | Fuel pressure regulating solenoid valve | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 8 | **X-F12-1 (Receptacle) pin 37** - Connector SEC.2 F | CV | Throttle solenoid valve (TVA) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 9 | **X-F12-1 (Receptacle) pin 38** - Connector SEC.2 F | LC | Throttle solenoid valve (TVA) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 11 | **X-F12-1 (Receptacle) pin 3** - Connector SEC.2 F | HL | Low engine oil level alarm switch | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 16 | **X-F12-1 (Receptacle) pin 41** - Connector SEC.2 F | ML | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 20 | **X-F12-1 (Receptacle) pin 9** - Connector SEC.2 F | L(2) | Rpm sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 21 | **X-F12-1 (Receptacle) pin 10** - Connector SEC.2 F | Z(2) | Rpm sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 22 | **X-F11-2 (Receptacle) pin 8** - Connector SEC.1 F | GC | Injector 2 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 24 | **X-F11-2 (Receptacle) pin 4** - Connector SEC.1 F | Z | Injector 3 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 35 | **X-F12-1 (Receptacle) pin 15** - Connector SEC.2 F | S | Fuel temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 36 | **X-F12-1 (Receptacle) pin 16** - Connector SEC.2 F | MB | Fuel temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 37 | **X-F12-1 (Receptacle) pin 12** - Connector SEC.2 F | B(2) | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 38 | **X-F12-1 (Receptacle) pin 17** - Connector SEC.2 F | ZC | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 40 | **X-F12-1 (Receptacle) pin 33** - Connector SEC.2 F | L(4) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 42 | **X-F12-1 (Receptacle) pin 7** - Connector SEC.2 F | HV | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 43 | **X-F11-2 (Receptacle) pin 7** - Connector SEC.1 F | H | Injector 2 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 45 | **X-F11-2 (Receptacle) pin 3** - Connector SEC.1 F | B | Injector 3 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 51 | **X-F12-1 (Receptacle) pin 8** - Connector SEC.2 F | ZV | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 52 | **X-F12-1 (Receptacle) pin 4** - Connector SEC.2 F | H(2) | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 61 | **X-F12-1 (Receptacle) pin 20** - Connector SEC.2 F | V(3) | Turbo temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 62 | **X-F12-1 (Receptacle) pin 6** - Connector SEC.2 F | GL | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 63 | **X-F12-1 (Receptacle) pin 5** - Connector SEC.2 F | VC | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 64 | **X-F11-2 (Receptacle) pin 1** - Connector SEC.1 F | L | Injector 1 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 66 | **X-F11-2 (Receptacle) pin 5** - Connector SEC.1 F | CL | Injector 4 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 67 | **X-F12-1 (Receptacle) pin 29** - Connector SEC.2 F | BC(2) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 78 | **X-F12-1 (Receptacle) pin 35** - Connector SEC.2 F | Z(4) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 79 | **X-F12-1 (Receptacle) pin 34** - Connector SEC.2 F | LB | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 85 | **X-F11-2 (Receptacle) pin 2** - Connector SEC.1 F | M | Injector 1 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 87 | **X-F11-2 (Receptacle) pin 6** - Connector SEC.1 F | VZ | Injector 4 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 88 | **X-F12-1 (Receptacle) pin 30** - Connector SEC.2 F | HC | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 95 | **X-F12-1 (Receptacle) pin 19** - Connector SEC.2 F | MZ | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 96 | **X-F12-1 (Receptacle) pin 18** - Connector SEC.2 F | LM | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 97 | **X-F12-1 (Receptacle) pin 43** - Connector SEC.2 F | BC | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 98 | **X-F12-1 (Receptacle) pin 42** - Connector SEC.2 F | LH | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 99 | **X-F12-1 (Receptacle) pin 13** - Connector SEC.2 F | V | Turbo temperature sensor / Engine coolant temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 100 | **X-F12-1 (Receptacle) pin 14** - Connector SEC.2 F | G | Engine coolant temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F02V - Engine control unit [ A-F02] (Receptacle)*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | F-F245A-P-1 | EN-003S | Main contactor | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | SP-S03-P-PIN1 | WIRE6790 | Battery | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 3 | SP-S02-P-PIN1 | EN-006 | Main contactor | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 4 | SP-S03-P-PIN1 | WIRE6791 | Battery | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 5 | SP-S02-P-PIN1 | EN-004 | Main contactor | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 6 | SP-S03-P-PIN1 | WIRE6788 | Battery | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 7 | | | Not Used | | |
| 8 | | | Not Used | | |
| 9 | | | Not Used | | |
| 10 | | | Not Used | | |
| 11 | | | Not Used | | |
| 12 | | | Not Used | | |
| 13 | SP3303-P-PIN1 | H(4) | CONTROLLER AREA NETWORK Interface 1 connector for interface with CONTROLLER AREA NETWORK network / Diagnostics connector | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 14 | SP3304-P-PIN1 | L(7) | CONTROLLER AREA NETWORK Interface 1 connector for interface with CONTROLLER AREA NETWORK network / Diagnostics connector | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 15 | **X-F34 pin 2** - Differential pressure sensor on the DPF [B-F34] | WIRE31207 | Differential pressure sensor on the DIESEL PARTICULATE FILTER | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 16 | **X-F34 pin 3** - Differential pressure sensor on the DPF [B-F34] | WIRE31206 | Differential pressure sensor on the DIESEL PARTICULATE FILTER | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 17 | | | Not Used | | |
| 18 | | | Not Used | | |
| 19 | | | Not Used | | |
| 20 | **X-F230 pin 85** - Fuel filter heating contactor [K-F230] | WIRE30598 | Fuel filter heating contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 21 | | | Not Used | | |
| 22 | | | Not Used | | |
| 23 | | | Not Used | | |
| 24 | | | Not Used | | |
| 25 | | | Not Used | | |
| 26 | SP-S1-P-PIN1 | WIRE6815 | Preheating glow-plugs control unit | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 27 | SP-S11-P-PIN1 | WIRE31202 | Exhaust gas temperature sensor upstream of the DIESEL PARTICULATE FILTER / Exhaust gas temperature sensor upstream of the DIESEL OXIDATION CATALYST | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 28 | **X-F33 pin 1** - Exhaust gas temperature sensor upstream of the DPF [B-F33] | WIRE31204 | Exhaust gas temperature sensor upstream of the DIESEL PARTICULATE FILTER | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 29 | | | Not Used | | |
| 30 | **X-F32 pin 1** - Exhaust gas temperature sensor upstream of the DOC [B-F32] | WIRE31201 | Exhaust gas temperature sensor upstream of the DIESEL OXIDATION CATALYST | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 31 | | | Not Used | | |
| 32 | | | Not Used | | |
| 33 | | | Not Used | | |
| 34 | | | Not Used | | |
| 35 | | | Not Used | | |
| 36 | **X-F12-1 (Receptacle) pin 22** - Connector SEC.2 F | BL(1) | Exhaust gas pressure sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 37 | | | Not Used | | |
| 38 | | | Not Used | | |
| 39 | | | Not Used | | |
| 40 | | | Not Used | | |
| 41 | | | Not Used | | |
| 42 | SP-S09-P-PIN1 | HG(1) | Exhaust gas pressure sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 43 | | | Not Used | | |
| 44 | | | Not Used | | |
| 45 | | | Not Used | | |
| 46 | | | Not Used | | |
| 47 | | | Not Used | | |
| 48 | | | Not Used | | |
| 49 | | | Not Used | | |
| 50 | | | Not Used | | |
| 51 | | | Not Used | | |
| 52 | | | Not Used | | |
| 53 | **X-F251 (Receptacle) pin 3** - Preheating glow-plugs control unit [A-F251] (84356962) | WIRE6819 | Preheating glow-plugs control unit | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 54 | | | Not Used | | |
| 55 | **X-F223 pin 85** - Starter control contactor [K-F223] | WIRE6837 | Starter control contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 56 | | | Not Used | | |
| 57 | **X-F251 (Receptacle) pin 8** - Preheating glow-plugs control unit [A-F251] (84356962) | WIRE6818 | Preheating glow-plugs control unit | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 58 | | | Not Used | | |
| 59 | | | Not Used | | |
| 60 | | | Not Used | | |
| 61 | | | Not Used | | |
| 62 | | | Not Used | | |
| 63 | **X-F12-1 (Receptacle) pin 23** - Connector SEC.2 F | M(3) | Exhaust gas pressure sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 64 | | | Not Used | | |
| 65 | | | Not Used | | |
| 66 | | | Not Used | | |
| 67 | | | Not Used | | |
| 68 | | | Not Used | | |
| 69 | | | Not Used | | |
| 70 | **X-F217 (Receptacle) pin 1** - Water in fuel sensor [B-F217] (87747172) | WIRE6751 | Water in fuel sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 71 | | | Not Used | | |
| 72 | **X-F223 pin 86** - Starter control contactor [K-F223] | WIRE6836 | Starter control contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 73 | | | Not Used | | |
| 74 | | | Not Used | | |
| 75 | SP-S05-P-PIN1 | WIRE6795 | Ignition switch / Water in fuel sensor | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |
| 76 | **X-F65 pin 1** - Intake air temperature sensor [B-F65] | WIRE6756 | Intake air temperature sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 77 | | | Not Used | | |
| 78 | | | Not Used | | |
| 79 | | | Not Used | | |
| 80 | | | Not Used | | |
| 81 | | | Not Used | | |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 82 | | | Not Used | | |
| 83 | | | Not Used | | |
| 84 | SP-S06-P-PIN1 | WIRE6820 | Contactor for start-up control from Body Controller / Ignition switch | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |
| 85 | | | Not Used | | |
| 86 | | | Not Used | | |
| 87 | **X-F65 pin 2** - Intake air temperature sensor [B-F65] | WIRE6755 | Intake air temperature sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 88 | **X-F245 pin 85** - Main contactor [K-F245] | EN-020 | Main contactor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F07 - Fuel pressure regulating solenoid valve [ Y-F07] (Receptacle)*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 1** - Connector SEC.2 M | ZB(1) | Fuel pressure regulating solenoid valve | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F12-2 (Plug) pin 2** - Connector SEC.2 M | CB(1) | Fuel pressure regulating solenoid valve | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |

### *X-F09 - Pressure sensor on the rail [ B-F09]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 5** - Connector SEC.2 M | VC(1) | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F12-2 (Plug) pin 6** - Connector SEC.2 M | GL(1) | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 3 | **X-F12-2 (Plug) pin 7** - Connector SEC.2 M | HV(1) | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F11_1 - Injector 1 [ Y-F11_1]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F11-1 (Plug) pin 1** - Connector SEC.1 M | L(1) | Injector 1 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F11-1 (Plug) pin 2** - Connector SEC.1 M | M(1) | Injector 1 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F11_2 - Injector 2 [ Y-F11_2]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F11-1 (Plug) pin 8** - Connector SEC.1 M | GC(1) | Injector 2 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F11-1 (Plug) pin 7** - Connector SEC.1 M | H(1) | Injector 2 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F11_3 - Injector 3 [ Y-F11_3]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F11-1 (Plug) pin 4** - Connector SEC.1 M | Z(1) | Injector 3 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F11-1 (Plug) pin 3** - Connector SEC.1 M | B(1) | Injector 3 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F11_4 - Injector 4 [ Y-F11_4]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F11-1 (Plug) pin 5** - Connector SEC.1 M | CL(1) | Injector 4 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F11-1 (Plug) pin 6** - Connector SEC.1 M | VZ(1) | Injector 4 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F3YH - CAN Interface 1 connector for interface with CAN network*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| PIN1 | SP3304-P-PIN1 | L(8) | CONTROLLER AREA NETWORK Interface 1 connector for interface with CONTROLLER AREA NETWORK network | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| PIN2 | SP3303-P-PIN1 | H(5) | CONTROLLER AREA NETWORK Interface 1 connector for interface with CONTROLLER AREA NETWORK network | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

# Wire connectors - Component diagram 01 Connector X-010 to X-019 [113351833 - V2 - 19 August 2025]

### *X-F11-1 - Connector SEC.1 M (Plug)*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F11_1 pin 1** - Injector 1 [Y-F11_1] | L(1) | Injector 1 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F11_1 pin 2** - Injector 1 [Y-F11_1] | M(1) | Injector 1 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 3 | **X-F11_3 pin 2** - Injector 3 [Y-F11_3] | B(1) | Injector 3 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 4 | **X-F11_3 pin 1** - Injector 3 [Y-F11_3] | Z(1) | Injector 3 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 5 | **X-F11_4 pin 1** - Injector 4 [Y-F11_4] | CL(1) | Injector 4 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 6 | **X-F11_4 pin 2** - Injector 4 [Y-F11_4] | VZ(1) | Injector 4 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 7 | **X-F11_2 pin 2** - Injector 2 [Y-F11_2] | H(1) | Injector 2 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 8 | **X-F11_2 pin 1** - Injector 2 [Y-F11_2] | GC(1) | Injector 2 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F11-2 - Connector SEC.1 F (Receptacle)*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F02E (Receptacle) pin 64** - Engine control unit [A-F02] (5802805180) | L | Injector 1 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F02E (Receptacle) pin 85** - Engine control unit [A-F02] (5802805180) | M | Injector 1 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 3 | **X-F02E (Receptacle) pin 45** - Engine control unit [A-F02] (5802805180) | B | Injector 3 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 4 | **X-F02E (Receptacle) pin 24** - Engine control unit [A-F02] (5802805180) | Z | Injector 3 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 5 | **X-F02E (Receptacle) pin 66** - Engine control unit [A-F02] (5802805180) | CL | Injector 4 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 6 | **X-F02E (Receptacle) pin 87** - Engine control unit [A-F02] (5802805180) | VZ | Injector 4 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 7 | **X-F02E (Receptacle) pin 43** - Engine control unit [A-F02] (5802805180) | H | Injector 2 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |
| 8 | **X-F02E (Receptacle) pin 22** - Engine control unit [A-F02] (5802805180) | GC | Injector 2 | none - 1.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F12-1 - Connector SEC.2 F (Receptacle)*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F02E (Receptacle) pin 7** - Engine control unit [A-F02] (5802805180) | ZB | Fuel pressure regulating solenoid valve | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F02E (Receptacle) pin 6** - Engine control unit [A-F02] (5802805180) | CB | Fuel pressure regulating solenoid valve | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 3 | **X-F02E (Receptacle) pin 11** - Engine control unit [A-F02] (5802805180) | HL | Low engine oil level alarm switch | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 4 | **X-F02E (Receptacle) pin 52** - Engine control unit [A-F02] (5802805180) | H(2) | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 5 | **X-F02E (Receptacle) pin 63** - Engine control unit [A-F02] (5802805180) | VC | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 6 | **X-F02E (Receptacle) pin 62** - Engine control unit [A-F02] (5802805180) | GL | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 7 | **X-F02E (Receptacle) pin 42** - Engine control unit [A-F02] (5802805180) | HV | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 8 | **X-F02E (Receptacle) pin 51** - Engine control unit [A-F02] (5802805180) | ZV | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 9 | **X-F02E (Receptacle) pin 20** - Engine control unit [A-F02] (5802805180) | L(2) | Rpm sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 10 | **X-F02E (Receptacle) pin 21** - Engine control unit [A-F02] (5802805180) | Z(2) | Rpm sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 11 | | | Not Used | | |
| 12 | **X-F02E (Receptacle) pin 37** - Engine control unit [A-F02] (5802805180) | B(2) | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 13 | **X-F02E (Receptacle) pin 99** - Engine control unit [A-F02] (5802805180) | V | Turbo temperature sensor / Engine coolant temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 14 | **X-F02E (Receptacle) pin 100** - Engine control unit [A-F02] (5802805180) | G | Engine coolant temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 15 | **X-F02E (Receptacle) pin 35** - Engine control unit [A-F02] (5802805180) | S | Fuel temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 16 | **X-F02E (Receptacle) pin 36** - Engine control unit [A-F02] (5802805180) | MB | Fuel temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 17 | **X-F02E (Receptacle) pin 38** - Engine control unit [A-F02] (5802805180) | ZC | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 18 | **X-F02E (Receptacle) pin 96** - Engine control unit [A-F02] (5802805180) | LM | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 19 | **X-F02E (Receptacle) pin 95** - Engine control unit [A-F02] (5802805180) | MZ | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 20 | **X-F02E (Receptacle) pin 61** - Engine control unit [A-F02] (5802805180) | V(3) | Turbo temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 21 | SP-S09-P-PIN1 | HG(2) | Exhaust gas pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 22 | **X-F02V (Receptacle) pin 36** - Engine control unit [A-F02] | BL(1) | Exhaust gas pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 23 | **X-F02V (Receptacle) pin 63** - Engine control unit [A-F02] | M(3) | Exhaust gas pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 24 | | | Not Used | | |
| 25 | | | Not Used | | |
| 26 | | | Not Used | | |
| 27 | | | Not Used | | |
| 28 | | | Not Used | | |
| 29 | **X-F02E (Receptacle) pin 67** - Engine control unit [A-F02] (5802805180) | BC(2) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 30 | **X-F02E (Receptacle) pin 88** - Engine control unit [A-F02] (5802805180) | HC | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 31 | | | Not Used | | |
| 32 | | | Not Used | | |
| 33 | **X-F02E (Receptacle) pin 40** - Engine control unit [A-F02] (5802805180) | L(4) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 34 | **X-F02E (Receptacle) pin 79** - Engine control unit [A-F02] (5802805180) | LB | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 35 | **X-F02E (Receptacle) pin 78** - Engine control unit [A-F02] (5802805180) | Z(4) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 36 | | | Not Used | | |
| 37 | **X-F02E (Receptacle) pin 8** - Engine control unit [A-F02] (5802805180) | CV | Throttle solenoid valve (TVA) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 38 | **X-F02E (Receptacle) pin 9** - Engine control unit [A-F02] (5802805180) | LC | Throttle solenoid valve (TVA) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 39 | | | Not Used | | |
| 40 | | | Not Used | | |
| 41 | **X-F02E (Receptacle) pin 16** - Engine control unit [A-F02] (5802805180) | ML | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 42 | **X-F02E (Receptacle) pin 98** - Engine control unit [A-F02] (5802805180) | LH | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 43 | **X-F02E (Receptacle) pin 97** - Engine control unit [A-F02] (5802805180) | BC | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 44 | | | Not Used | | |
| 45 | | | Not Used | | |
| 46 | | | Not Used | | |
| 47 | | | Not Used | | |
| 48 | | | Not Used | | |
| 49 | | | Not Used | | |
| 50 | | | Not Used | | |
| 51 | | | Not Used | | |
| 52 | | | Not Used | | |
| 53 | | | Not Used | | |
| 54 | | | Not Used | | |
| 55 | | | Not Used | | |
| 56 | | | Not Used | | |
| 57 | **X-F251 (Receptacle) pin 6** - Preheating glow-plugs control unit [A-F251] (84356962) | WIRE31210 | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 58 | **X-F251 (Receptacle) pin 1** - Preheating glow-plugs control unit [A-F251] (84356962) | WIRE31211 | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 59 | | | Not Used | | |
| 60 | **X-F251 (Receptacle) pin 7** - Preheating glow-plugs control unit [A-F251] (84356962) | WIRE31212 | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 61 | **X-F251 (Receptacle) pin 2** - Preheating glow-plugs control unit [A-F251] (84356962) | WIRE31213 | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F12-2 - Connector SEC.2 M (Plug)*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F07 (Receptacle) pin 1** - Fuel pressure regulating solenoid valve [Y-F07] | ZB(1) | Fuel pressure regulating solenoid valve | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F07 (Receptacle) pin 2** - Fuel pressure regulating solenoid valve [Y-F07] | CB(1) | Fuel pressure regulating solenoid valve | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 3 | **X-F55 pin 1** - Low engine oil level alarm switch [S-F55] | HL(1) | Low engine oil level alarm switch | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 4 | **X-F19 pin 2** - Timing sensor [B-F19] | H(3) | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 5 | **X-F09 pin 1** - Pressure sensor on the rail [B-F09] | VC(1) | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 6 | **X-F09 pin 2** - Pressure sensor on the rail [B-F09] | GL(1) | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 7 | **X-F09 pin 3** - Pressure sensor on the rail [B-F09] | HV(1) | Pressure sensor on the rail | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 8 | **X-F19 pin 1** - Timing sensor [B-F19] | ZV(1) | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 9 | **X-F23 (Receptacle) pin 1** - Rpm sensor [B-F23] | L(3) | Rpm sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 10 | **X-F23 (Receptacle) pin 2** - Rpm sensor [B-F23] | Z(3) | Rpm sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 11 | | | Not Used | | |
| 12 | **X-F19 pin 3** - Timing sensor [B-F19] | B(3) | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 13 | SP-S06(1)-P-PIN1 | V(1) | Turbo temperature sensor / Engine coolant temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 14 | **X-F21 pin 1** - Engine coolant temperature sensor [B-F21] | G(1) | Engine coolant temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 15 | **X-F290 pin 2** - Fuel temperature sensor [B-F290] | S(1) | Fuel temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 16 | **X-F290 pin 1** - Fuel temperature sensor [B-F290] | MB(1) | Fuel temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 17 | **X-F48 (Receptacle) pin 3** - Overpressure air temperature pressure sensor [B-F48] | ZC(1) | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 18 | **X-F48 (Receptacle) pin 4** - Overpressure air temperature pressure sensor [B-F48] | LM(1) | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 19 | **X-F48 (Receptacle) pin 1** - Overpressure air temperature pressure sensor [B-F48] | MZ(1) | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 20 | **X-F219 pin 1** - Turbo temperature sensor [B-F219] | V(4) | Turbo temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 21 | **X-F53 pin 1** - Exhaust gas pressure sensor [B-F53] | HG | Exhaust gas pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 22 | **X-F53 pin 2** - Exhaust gas pressure sensor [B-F53] | BL | Exhaust gas pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 23 | **X-F53 pin 3** - Exhaust gas pressure sensor [B-F53] | M(2) | Exhaust gas pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 24 | | | Not Used | | |
| 25 | | | Not Used | | |
| 26 | | | Not Used | | |
| 27 | | | Not Used | | |
| 28 | | | Not Used | | |
| 29 | **X-F24A pin 1** - EGR solenoid valve (Pierburg) [Y-F24A] | BC(3) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 30 | **X-F24A pin 5** - EGR solenoid valve (Pierburg) [Y-F24A] | HC(1) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 31 | | | Not Used | | |
| 32 | | | Not Used | | |
| 33 | **X-F24A pin 6** - EGR solenoid valve (Pierburg) [Y-F24A] | L(5) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 34 | **X-F24A pin 2** - EGR solenoid valve (Pierburg) [Y-F24A] | LB(1) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 35 | **X-F24A pin 4** - EGR solenoid valve (Pierburg) [Y-F24A] | Z(5) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 36 | | | Not Used | | |
| 37 | **X-F102 pin 6** - Throttle solenoid valve (TVA) [Y-F102] | CV(1) | Throttle solenoid valve (TVA) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 38 | **X-F102 pin 2** - Throttle solenoid valve (TVA) [Y-F102] | LC(1) | Throttle solenoid valve (TVA) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 39 | | | Not Used | | |
| 40 | | | Not Used | | |
| 41 | **X-F102 pin 1** - Throttle solenoid valve (TVA) [Y-F102] | ML(1) | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 42 | **X-F102 pin 5** - Throttle solenoid valve (TVA) [Y-F102] | LH(1) | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 43 | **X-F102 pin 3** - Throttle solenoid valve (TVA) [Y-F102] | BC(1) | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 44 | | | Not Used | | |
| 45 | | | Not Used | | |
| 46 | | | Not Used | | |
| 47 | | | Not Used | | |
| 48 | | | Not Used | | |
| 49 | | | Not Used | | |
| 50 | | | Not Used | | |
| 51 | | | Not Used | | |
| 52 | | | Not Used | | |
| 53 | | | Not Used | | |
| 54 | | | Not Used | | |
| 55 | | | Not Used | | |
| 56 | | | Not Used | | |
| 57 | **X-F96-1 pin 1** - Connector SEC.GP | L(11) | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 58 | **X-F96-1 pin 2** - Connector SEC.GP | Z(6) | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 59 | | | Not Used | | |
| 60 | **X-F96-1 pin 3** - Connector SEC.GP | G(2) | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 61 | **X-F96-1 pin 4** - Connector SEC.GP | VB | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F19 - Timing sensor [ B-F19]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 8** - Connector SEC.2 M | ZV(1) | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F12-2 (Plug) pin 4** - Connector SEC.2 M | H(3) | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 3 | **X-F12-2 (Plug) pin 12** - Connector SEC.2 M | B(3) | Timing sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

# Wire connectors - Component diagram 02 Connector X-020 to X-029 [113351835 - V2 - 19 August 2025]

### *X-F21 - Engine coolant temperature sensor [ B-F21]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 14** - Connector SEC.2 M | G(1) | Engine coolant temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | SP-S06(1)-P-PIN1 | V(2) | Engine coolant temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F23 - Rpm sensor [ B-F23] (Receptacle)*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 9** - Connector SEC.2 M | L(3) | Rpm sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F12-2 (Plug) pin 10** - Connector SEC.2 M | Z(3) | Rpm sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F24A - EGR solenoid valve (Pierburg) [ Y-F24A]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 29** - Connector SEC.2 M | BC(3) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F12-2 (Plug) pin 34** - Connector SEC.2 M | LB(1) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 3 | | | Not Used | | |
| 4 | **X-F12-2 (Plug) pin 35** - Connector SEC.2 M | Z(5) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 5 | **X-F12-2 (Plug) pin 30** - Connector SEC.2 M | HC(1) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 6 | **X-F12-2 (Plug) pin 33** - Connector SEC.2 M | L(5) | EXHAUST GAS RECIRCULATION (EGR) solenoid valve (Pierburg) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

# Wire connectors - Component diagram 03 Connector X-030 to X-039 [113351837 - V2 - 19 August 2025]

### *X-F32 - Exhaust gas temperature sensor upstream of the DOC [ B-F32]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F02V (Receptacle) pin 30** - Engine control unit [A-F02] | WIRE31201 | Exhaust gas temperature sensor upstream of the DIESEL OXIDATION CATALYST | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | SP-S11-P-PIN1 | WIRE31200 | Exhaust gas temperature sensor upstream of the DIESEL OXIDATION CATALYST | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F33 - Exhaust gas temperature sensor upstream of the DPF [ B-F33]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F02V (Receptacle) pin 28** - Engine control unit [A-F02] | WIRE31204 | Exhaust gas temperature sensor upstream of the DIESEL PARTICULATE FILTER | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | SP-S11-P-PIN1 | WIRE31203 | Exhaust gas temperature sensor upstream of the DIESEL PARTICULATE FILTER | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F34 - Differential pressure sensor on the DPF [ B-F34]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | SP-S09-P-PIN1 | WIRE31208 | Differential pressure sensor on the DIESEL PARTICULATE FILTER | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | **X-F02V (Receptacle) pin 15** - Engine control unit [A-F02] | WIRE31207 | Differential pressure sensor on the DIESEL PARTICULATE FILTER | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 3 | **X-F02V (Receptacle) pin 16** - Engine control unit [A-F02] | WIRE31206 | Differential pressure sensor on the DIESEL PARTICULATE FILTER | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

# Wire connectors - Component diagram 04 Connector X-040 to X-049 [113351839 - V2 - 19 August 2025]

***X-F48 - Overpressure air temperature pressure sensor [ B-F48] (Receptacle)***

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 19** - Connector SEC.2 M | MZ(1) | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | | | Not Used | | |
| 3 | **X-F12-2 (Plug) pin 17** - Connector SEC.2 M | ZC(1) | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 4 | **X-F12-2 (Plug) pin 18** - Connector SEC.2 M | LM(1) | Overpressure air temperature pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

# Wire connectors - Component diagram 05 Connector X-050 to X-059 [113351841 - V2 - 19 August 2025]

### *X-F53 - Exhaust gas pressure sensor [ B-F53]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 21** - Connector SEC.2 M | HG | Exhaust gas pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F12-2 (Plug) pin 22** - Connector SEC.2 M | BL | Exhaust gas pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 3 | **X-F12-2 (Plug) pin 23** - Connector SEC.2 M | M(2) | Exhaust gas pressure sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

### *X-F55 - Low engine oil level alarm switch [ S-F55]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 3** - Connector SEC.2 M | HL(1) | Low engine oil level alarm switch | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | GND-02-P-1 | WIRE4457 | Low engine oil level alarm switch | none - 0.0 | **SHEET 01 SH01 - ECU engine side** |

# Wire connectors - Component diagram 06 Connector X-060 to X-069 [113351843 - V2 - 19 August 2025]

***X-F65 - Intake air temperature sensor [ B-F65]***

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F02V (Receptacle) pin 76** - Engine control unit [A-F02] | WIRE6756 | Intake air temperature sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | **X-F02V (Receptacle) pin 87** - Engine control unit [A-F02] | WIRE6755 | Intake air temperature sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

# Wire connectors - Component diagram 09 Connector X-090 to X-099 [113351845 - V2 - 19 August 2025]

### *X-F96-1 - Connector SEC.GP*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 57** - Connector SEC.2 M | L(11) | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | **X-F12-2 (Plug) pin 58** - Connector SEC.2 M | Z(6) | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 3 | **X-F12-2 (Plug) pin 60** - Connector SEC.2 M | G(2) | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 4 | **X-F12-2 (Plug) pin 61** - Connector SEC.2 M | VB | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F96-2 - Connector SEC.EH*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | L-F96_4-P-PIN1 | L(10) | Pre-heating glow plug | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | L-F96_3-P-PIN1 | Z(8) | Pre-heating glow plug | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 3 | L-F96_2-P-PIN1 | G(4) | Pre-heating glow plug | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 4 | L-F96_1-P-PIN1 | VB(2) | Pre-heating glow plug | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |

# Wire connectors - Component diagram 10 Connector X-100 to X-109 [113351847 - V2 - 19 August 2025]

***X-F102 - Throttle solenoid valve (TVA) [ Y-F102]***

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 41** - Connector SEC.2 M | ML(1) | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F12-2 (Plug) pin 38** - Connector SEC.2 M | LC(1) | Throttle solenoid valve (TVA) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |
| 3 | **X-F12-2 (Plug) pin 43** - Connector SEC.2 M | BC(1) | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 4 | | | Not Used | | |
| 5 | **X-F12-2 (Plug) pin 42** - Connector SEC.2 M | LH(1) | Throttle solenoid valve (TVA) | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 6 | **X-F12-2 (Plug) pin 37** - Connector SEC.2 M | CV(1) | Throttle solenoid valve (TVA) | none - 0.75 | **SHEET 01 SH01 - ECU engine side** |

# Wire connectors - Component diagram 20 Connector X-200 to X-209 [113351849 - V2 - 19 August 2025]

***X-F200 - Ignition switch [ S-F200]***

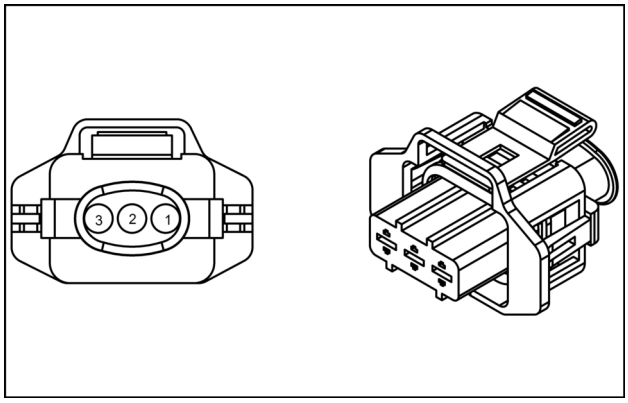
| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | SP-S06-P-PIN1 | WIRE30605 | Ignition switch | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | F-F201-P-1 | WIRE30607 | Ignition switch | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |
| 3 | SP-S05-P-PIN1 | WIRE30603 | Ignition switch | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 4 | F-F200-P-1 | WIRE30606 | Ignition switch | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |

# Wire connectors - Component diagram 21 Connector X-210 to X-219 [113351851 - V2 - 19 August 2025]

### *X-F215 - Battery disconnect switch (BDS) [ SW-F215]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | SP-S04-P-PIN1 | WIRE30600 | Battery disconnect switch (BDS) | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | G-F271-P-POS | WIRE30601 | Battery disconnect switch (BDS) | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F217 - Water in fuel sensor [ B-F217] (87747172) (Receptacle)*




87747172 1

**87747172**

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F02V (Receptacle) pin 70** - Engine control unit [A-F02] | WIRE6751 | Water in fuel sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | SP-S10-P-PIN1 | WIRE6757 | Water in fuel sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 3 | SP-S05-P-PIN1 | WIRE6796 | Water in fuel sensor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F219 - Turbo temperature sensor [ B-F219]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 20** - Connector SEC.2 M | V(4) | Turbo temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | SP-S06(1)-P-PIN1 | L(6) | Turbo temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

# Wire connectors - Component diagram 22 Connector X-220 to X-229 [113351853 - V2 - 19 August 2025]

***X-F220 - Starter contactor [ K-F220]***

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | | | Not Used | | |
| 2 | | | Not Used | | |
| 3 | | | Not Used | | |
| 4 | | | Not Used | | |
| 5 | | | Not Used | | |
| 6 | | | Not Used | | |
| 7 | | | Not Used | | |
| 8 | | | Not Used | | |
| 9 | | | Not Used | | |
| 10 | | | Not Used | | |
| 11 | | | Not Used | | |
| 12 | | | Not Used | | |
| 13 | | | Not Used | | |
| 14 | | | Not Used | | |
| 15 | | | Not Used | | |
| 16 | | | Not Used | | |
| 17 | | | Not Used | | |
| 18 | | | Not Used | | |
| 19 | | | Not Used | | |
| 20 | | | Not Used | | |
| 21 | | | Not Used | | |
| 22 | | | Not Used | | |
| 23 | | | Not Used | | |
| 24 | | | Not Used | | |
| 25 | | | Not Used | | |
| 26 | | | Not Used | | |
| 27 | | | Not Used | | |
| 28 | | | Not Used | | |
| 29 | | | Not Used | | |
| 30 | F-F272-P-1 | WIRE6829 | Starter contactor | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |
| 31 | | | Not Used | | |
| 32 | | | Not Used | | |
| 33 | | | Not Used | | |
| 34 | | | Not Used | | |
| 35 | | | Not Used | | |
| 36 | | | Not Used | | |
| 37 | | | Not Used | | |
| 38 | | | Not Used | | |
| 39 | | | Not Used | | |
| 40 | | | Not Used | | |
| 41 | | | Not Used | | |
| 42 | | | Not Used | | |
| 43 | | | Not Used | | |
| 44 | | | Not Used | | |
| 45 | | | Not Used | | |
| 46 | | | Not Used | | |
| 47 | | | Not Used | | |
| 48 | | | Not Used | | |
| 49 | | | Not Used | | |
| 50 | | | Not Used | | |
| 51 | | | Not Used | | |
| 52 | | | Not Used | | |
| 53 | | | Not Used | | |
| 54 | | | Not Used | | |
| 55 | | | Not Used | | |
| 56 | | | Not Used | | |
| 57 | | | Not Used | | |
| 58 | | | Not Used | | |
| 59 | | | Not Used | | |
| 60 | | | Not Used | | |
| 61 | | | Not Used | | |
| 62 | | | Not Used | | |
| 63 | | | Not Used | | |
| 64 | | | Not Used | | |
| 65 | | | Not Used | | |
| 66 | | | Not Used | | |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 67 | | | Not Used | | |
| 68 | | | Not Used | | |
| 69 | | | Not Used | | |
| 70 | | | Not Used | | |
| 71 | | | Not Used | | |
| 72 | | | Not Used | | |
| 73 | | | Not Used | | |
| 74 | | | Not Used | | |
| 75 | | | Not Used | | |
| 76 | | | Not Used | | |
| 77 | | | Not Used | | |
| 78 | | | Not Used | | |
| 79 | | | Not Used | | |
| 80 | | | Not Used | | |
| 81 | | | Not Used | | |
| 82 | | | Not Used | | |
| 83 | | | Not Used | | |
| 84 | | | Not Used | | |
| 85 | **X-F223 pin 87** - Starter control contactor [K-F223] | WIRE6839 | Starter control contactor / Starter contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 86 | GND5-P-1 | WIRE6838 | Starter contactor | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |
| 87 | **X-F272 pin 2** - Starter motor [M-F272] | WIRE6840 | Starter contactor / Starter motor | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F222 - Contactor for start-up control from Body Controller [ K-F222]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 30 | **X-F223 pin 30** - Starter control contactor [K-F223] | WIRE6835 | Contactor for start-up control from Body Controller / Starter control contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 85 | **X-F222A pin PIN1** - Starting control unit [A-F222] | WIRE6833 | Contactor for start-up control from Body Controller / Starting control unit | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 86 | **X-F222A pin PIN2** - Starting control unit [A-F222] | WIRE6834 | Contactor for start-up control from Body Controller / Starting control unit | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 87 | SP-S06-P-PIN1 | WIRE6822 | Contactor for start-up control from Body Controller | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 87A | GND4-P-1 | WIRE6832 | Contactor for start-up control from Body Controller | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F222A - Starting control unit [ A-F222]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| PIN1 | **X-F222 pin 85** - Contactor for start-up control from Body Controller [K-F222] | WIRE6833 | Contactor for start-up control from Body Controller / Starting control unit | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| PIN2 | **X-F222 pin 86** - Contactor for start-up control from Body Controller [K-F222] | WIRE6834 | Contactor for start-up control from Body Controller / Starting control unit | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

### *X-F223 - Starter control contactor [ K-F223]*

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | | | Not Used | | |
| 2 | | | Not Used | | |
| 3 | | | Not Used | | |
| 4 | | | Not Used | | |
| 5 | | | Not Used | | |
| 6 | | | Not Used | | |
| 7 | | | Not Used | | |
| 8 | | | Not Used | | |
| 9 | | | Not Used | | |
| 10 | | | Not Used | | |
| 11 | | | Not Used | | |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 12 | | | Not Used | | |
| 13 | | | Not Used | | |
| 14 | | | Not Used | | |
| 15 | | | Not Used | | |
| 16 | | | Not Used | | |
| 17 | | | Not Used | | |
| 18 | | | Not Used | | |
| 19 | | | Not Used | | |
| 20 | | | Not Used | | |
| 21 | | | Not Used | | |
| 22 | | | Not Used | | |
| 23 | | | Not Used | | |
| 24 | | | Not Used | | |
| 25 | | | Not Used | | |
| 26 | | | Not Used | | |
| 27 | | | Not Used | | |
| 28 | | | Not Used | | |
| 29 | | | Not Used | | |
| 30 | **X-F222 pin 30** - Contactor for start-up control from Body Controller [K-F222] | WIRE6835 | Contactor for start-up control from Body Controller / Starter control contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 31 | | | Not Used | | |
| 32 | | | Not Used | | |
| 33 | | | Not Used | | |
| 34 | | | Not Used | | |
| 35 | | | Not Used | | |
| 36 | | | Not Used | | |
| 37 | | | Not Used | | |
| 38 | | | Not Used | | |
| 39 | | | Not Used | | |
| 40 | | | Not Used | | |
| 41 | | | Not Used | | |
| 42 | | | Not Used | | |
| 43 | | | Not Used | | |
| 44 | | | Not Used | | |
| 45 | | | Not Used | | |
| 46 | | | Not Used | | |
| 47 | | | Not Used | | |
| 48 | | | Not Used | | |
| 49 | | | Not Used | | |
| 50 | | | Not Used | | |
| 51 | | | Not Used | | |
| 52 | | | Not Used | | |
| 53 | | | Not Used | | |
| 54 | | | Not Used | | |
| 55 | | | Not Used | | |
| 56 | | | Not Used | | |
| 57 | | | Not Used | | |
| 58 | | | Not Used | | |
| 59 | | | Not Used | | |
| 60 | | | Not Used | | |
| 61 | | | Not Used | | |
| 62 | | | Not Used | | |
| 63 | | | Not Used | | |
| 64 | | | Not Used | | |
| 65 | | | Not Used | | |
| 66 | | | Not Used | | |
| 67 | | | Not Used | | |
| 68 | | | Not Used | | |
| 69 | | | Not Used | | |
| 70 | | | Not Used | | |
| 71 | | | Not Used | | |
| 72 | | | Not Used | | |
| 73 | | | Not Used | | |
| 74 | | | Not Used | | |
| 75 | | | Not Used | | |
| 76 | | | Not Used | | |
| 77 | | | Not Used | | |
| 78 | | | Not Used | | |
| 79 | | | Not Used | | |
| 80 | | | Not Used | | |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 81 | | | Not Used | | |
| 82 | | | Not Used | | |
| 83 | | | Not Used | | |
| 84 | | | Not Used | | |
| 85 | **X-F02V (Receptacle) pin 55** - Engine control unit [A-F02] | WIRE6837 | Starter control contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 86 | **X-F02V (Receptacle) pin 72** - Engine control unit [A-F02] | WIRE6836 | Starter control contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 87 | **X-F220 pin 85** - Starter contactor [K-F220] | WIRE6839 | Starter control contactor / Starter contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |

# Wire connectors - Component diagram 23 Connector X-230 to X-239 [113351855 - V2 - 19 August 2025]

***X-F230 - Fuel filter heating contactor [ K-F230]***

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | | | Not Used | | |
| 2 | | | Not Used | | |
| 3 | | | Not Used | | |
| 4 | | | Not Used | | |
| 5 | | | Not Used | | |
| 6 | | | Not Used | | |
| 7 | | | Not Used | | |
| 8 | | | Not Used | | |
| 9 | | | Not Used | | |
| 10 | | | Not Used | | |
| 11 | | | Not Used | | |
| 12 | | | Not Used | | |
| 13 | | | Not Used | | |
| 14 | | | Not Used | | |
| 15 | | | Not Used | | |
| 16 | | | Not Used | | |
| 17 | | | Not Used | | |
| 18 | | | Not Used | | |
| 19 | | | Not Used | | |
| 20 | | | Not Used | | |
| 21 | | | Not Used | | |
| 22 | | | Not Used | | |
| 23 | | | Not Used | | |
| 24 | | | Not Used | | |
| 25 | | | Not Used | | |
| 26 | | | Not Used | | |
| 27 | | | Not Used | | |
| 28 | | | Not Used | | |
| 29 | | | Not Used | | |
| 30 | F-F230-P-2 | WIRE6814 | Fuel filter heating contactor | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 31 | | | Not Used | | |
| 32 | | | Not Used | | |
| 33 | | | Not Used | | |
| 34 | | | Not Used | | |
| 35 | | | Not Used | | |
| 36 | | | Not Used | | |
| 37 | | | Not Used | | |
| 38 | | | Not Used | | |
| 39 | | | Not Used | | |
| 40 | | | Not Used | | |
| 41 | | | Not Used | | |
| 42 | | | Not Used | | |
| 43 | | | Not Used | | |
| 44 | | | Not Used | | |
| 45 | | | Not Used | | |
| 46 | | | Not Used | | |
| 47 | | | Not Used | | |
| 48 | | | Not Used | | |
| 49 | | | Not Used | | |
| 50 | | | Not Used | | |
| 51 | | | Not Used | | |
| 52 | | | Not Used | | |
| 53 | | | Not Used | | |
| 54 | | | Not Used | | |
| 55 | | | Not Used | | |
| 56 | | | Not Used | | |
| 57 | | | Not Used | | |
| 58 | | | Not Used | | |
| 59 | | | Not Used | | |
| 60 | | | Not Used | | |
| 61 | | | Not Used | | |
| 62 | | | Not Used | | |
| 63 | | | Not Used | | |
| 64 | | | Not Used | | |
| 65 | | | Not Used | | |
| 66 | | | Not Used | | |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 67 | | | Not Used | | |
| 68 | | | Not Used | | |
| 69 | | | Not Used | | |
| 70 | | | Not Used | | |
| 71 | | | Not Used | | |
| 72 | | | Not Used | | |
| 73 | | | Not Used | | |
| 74 | | | Not Used | | |
| 75 | | | Not Used | | |
| 76 | | | Not Used | | |
| 77 | | | Not Used | | |
| 78 | | | Not Used | | |
| 79 | | | Not Used | | |
| 80 | | | Not Used | | |
| 81 | | | Not Used | | |
| 82 | | | Not Used | | |
| 83 | | | Not Used | | |
| 84 | | | Not Used | | |
| 85 | **X-F02V (Receptacle) pin 20** - Engine control unit [A-F02] | WIRE30598 | Fuel filter heating contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 86 | SP-S7-P-PIN1 | WIRE30599 | Fuel filter heating contactor | none - 0.75 | **SHEET 02 SH02 - ECU vehicle side** |
| 87 | R-F230A-P-PIN2 | WIRE30597 | Fuel filter heating contactor | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |

# Wire connectors - Component diagram 24 Connector X-240 to X-249 [113351857 - V2 - 19 August 2025]

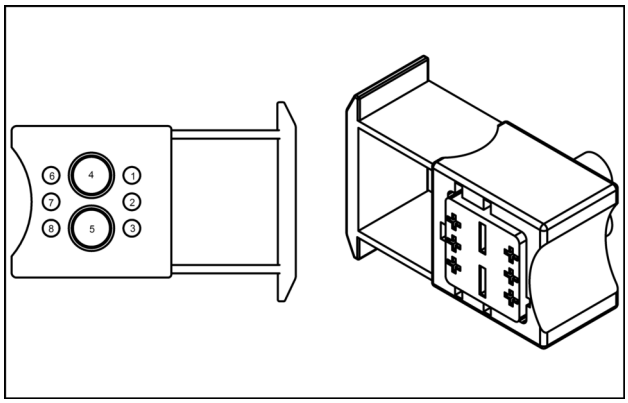
***X-F245 - Main contactor [ K-F245]***

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | | | Not Used | | |
| 2 | | | Not Used | | |
| 3 | | | Not Used | | |
| 4 | | | Not Used | | |
| 5 | | | Not Used | | |
| 6 | | | Not Used | | |
| 7 | | | Not Used | | |
| 8 | | | Not Used | | |
| 9 | | | Not Used | | |
| 10 | | | Not Used | | |
| 11 | | | Not Used | | |
| 12 | | | Not Used | | |
| 13 | | | Not Used | | |
| 14 | | | Not Used | | |
| 15 | | | Not Used | | |
| 16 | | | Not Used | | |
| 17 | | | Not Used | | |
| 18 | | | Not Used | | |
| 19 | | | Not Used | | |
| 20 | | | Not Used | | |
| 21 | | | Not Used | | |
| 22 | | | Not Used | | |
| 23 | | | Not Used | | |
| 24 | | | Not Used | | |
| 25 | | | Not Used | | |
| 26 | | | Not Used | | |
| 27 | | | Not Used | | |
| 28 | | | Not Used | | |
| 29 | | | Not Used | | |
| 30 | SP-S04-P-PIN1 | EN-691B | Main contactor | none - 6.0 | **SHEET 02 SH02 - ECU vehicle side** |
| 31 | | | Not Used | | |
| 32 | | | Not Used | | |
| 33 | | | Not Used | | |
| 34 | | | Not Used | | |
| 35 | | | Not Used | | |
| 36 | | | Not Used | | |
| 37 | | | Not Used | | |
| 38 | | | Not Used | | |
| 39 | | | Not Used | | |
| 40 | | | Not Used | | |
| 41 | | | Not Used | | |
| 42 | | | Not Used | | |
| 43 | | | Not Used | | |
| 44 | | | Not Used | | |
| 45 | | | Not Used | | |
| 46 | | | Not Used | | |
| 47 | | | Not Used | | |
| 48 | | | Not Used | | |
| 49 | | | Not Used | | |
| 50 | | | Not Used | | |
| 51 | | | Not Used | | |
| 52 | | | Not Used | | |
| 53 | | | Not Used | | |
| 54 | | | Not Used | | |
| 55 | | | Not Used | | |
| 56 | | | Not Used | | |
| 57 | | | Not Used | | |
| 58 | | | Not Used | | |
| 59 | | | Not Used | | |
| 60 | | | Not Used | | |
| 61 | | | Not Used | | |
| 62 | | | Not Used | | |
| 63 | | | Not Used | | |
| 64 | | | Not Used | | |
| 65 | | | Not Used | | |
| 66 | | | Not Used | | |

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 67 | | | Not Used | | |
| 68 | | | Not Used | | |
| 69 | | | Not Used | | |
| 70 | | | Not Used | | |
| 71 | | | Not Used | | |
| 72 | | | Not Used | | |
| 73 | | | Not Used | | |
| 74 | | | Not Used | | |
| 75 | | | Not Used | | |
| 76 | | | Not Used | | |
| 77 | | | Not Used | | |
| 78 | | | Not Used | | |
| 79 | | | Not Used | | |
| 80 | | | Not Used | | |
| 81 | | | Not Used | | |
| 82 | | | Not Used | | |
| 83 | | | Not Used | | |
| 84 | | | Not Used | | |
| 85 | **X-F02V (Receptacle) pin 88** - Engine control unit [A-F02] | EN-020 | Main contactor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 86 | F-F245-P-2 | WIRE6749 | Main contactor | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 87 | SP-S01-P-PIN1 | EN-030 | Main contactor | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |

# Wire connectors - Component diagram 25 Connector X-250 to X-259 [113351859 - V2 - 19 August 2025]

***X-F251 - Preheating glow-plugs control unit [ A-F251] (84356962) (Receptacle)***




84356962 1

**84356962**

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-1 (Receptacle) pin 58** - Connector SEC.2 F | WIRE31211 | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | **X-F12-1 (Receptacle) pin 61** - Connector SEC.2 F | WIRE31213 | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 3 | **X-F02V (Receptacle) pin 53** - Engine control unit [A-F02] | WIRE6819 | Preheating glow-plugs control unit | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 4 | F-F215-P-1 | WIRE31209 | Preheating glow-plugs control unit | none - 6.0 | **SHEET 02 SH02 - ECU vehicle side** |
| 5 | SP-S1-P-PIN1 | WIRE6817 | Preheating glow-plugs control unit | none - 3.0 | **SHEET 02 SH02 - ECU vehicle side** |
| 6 | **X-F12-1 (Receptacle) pin 57** - Connector SEC.2 F | WIRE31210 | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 7 | **X-F12-1 (Receptacle) pin 60** - Connector SEC.2 F | WIRE31212 | Preheating glow-plugs control unit | none - 2.5 | **SHEET 02 SH02 - ECU vehicle side** |
| 8 | **X-F02V (Receptacle) pin 57** - Engine control unit [A-F02] | WIRE6818 | Preheating glow-plugs control unit | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

# Wire connectors - Component diagram 27 Connector X-270 to X-279 [113351861 - V2 - 19 August 2025]

***X-F272 - Starter motor [ M-F272]***

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | GND3-P-1 | WIRE6830 | Starter motor | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |
| 2 | **X-F220 pin 87** - Starter contactor [K-F220] | WIRE6840 | Starter contactor / Starter motor | none - 0.0 | **SHEET 02 SH02 - ECU vehicle side** |

# Wire connectors - Component diagram 29 Connector X-290 to X-299 [113351863 - V2 - 19 August 2025]

***X-F290 - Fuel temperature sensor [ B-F290]***

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| 1 | **X-F12-2 (Plug) pin 16** - Connector SEC.2 M | MB(1) | Fuel temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |
| 2 | **X-F12-2 (Plug) pin 15** - Connector SEC.2 M | S(1) | Fuel temperature sensor | none - 0.5 | **SHEET 01 SH01 - ECU engine side** |

# Wire connectors - Component diagram 30 Connector X-300 to X-309 [113351865 - V2 - 19 August 2025]

***X-F301 - Diagnostics connector***

| Pin | From | Wire | Description | Color-Size | Frame |
|---|---|---|---|---|---|
| A | GND6-P-1 | WIRE6849 | Diagnostics connector | none - 1.0 | **SHEET 02 SH02 - ECU vehicle side** |
| B | F-F303-P-1 | WIRE6848 | Diagnostics connector | none - 1.0 | **SHEET 02 SH02 - ECU vehicle side** |
| C | SP3303-P-PIN1 | H(6) | Diagnostics connector | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |
| D | SP3304-P-PIN1 | L(9) | Diagnostics connector | none - 0.5 | **SHEET 02 SH02 - ECU vehicle side** |

# Diagnostic connector - Overview - PT-BOX diagnostic tool and connection to the engine [113439266 - V1 - 07 March 2025]

## Introduction

Good diagnostic skills are achieved from the expertise acquired from years of experience and from attending training courses.

When poor performance or operating faults arise, the user's description of the problem should be considered since it may provide us with useful diagnostic information.

Using computerised instruments FPT, it is also possible to establish bi-directional communication with the central unit, thus allowing us to determine the error codes, as well as to access its memory in order to obtain any additional information that may be useful for determining the cause of the fault.

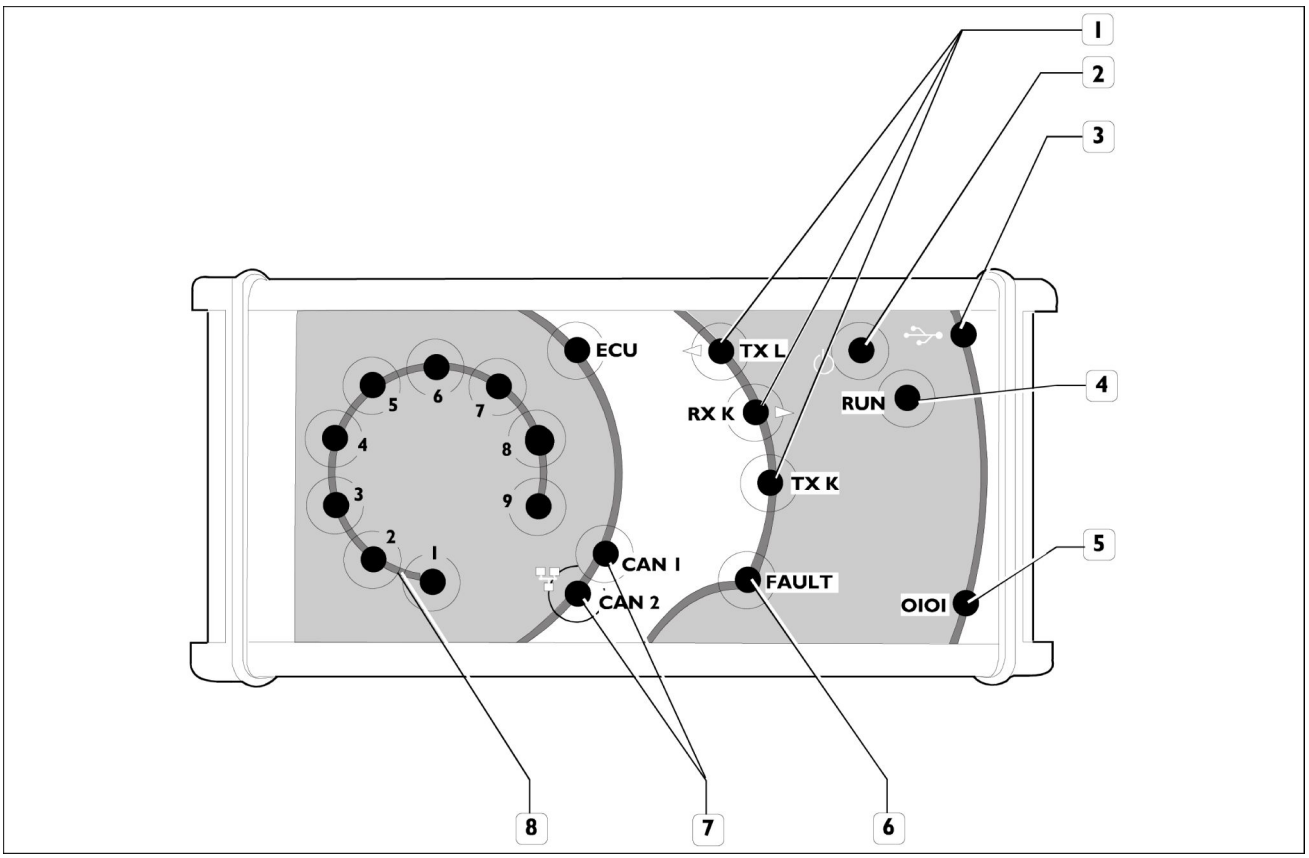
Each time a problem arises and is confirmed, the electronic control unit should be consulted using one of the methods indicated. The diagnostic investigation can then be carried out using the available evidence and measurements, in order to obtain an overview of the operating conditions, after which the actual cause of the fault can be determined.

If the electronic control unit fails to provide any indications, you should proceed by relying on your experience with traditional diagnostic methods.

***NOTE:*** *Any type of intervention on the control unit must be carried out by specialized personnel and duly authorized by FPT.*
*Any unauthorized tampering shall invalidate the assistance warranty.*

## PT-BOX

The PT - BOX is a diagnostic tool from a connector to a Personal Computer.



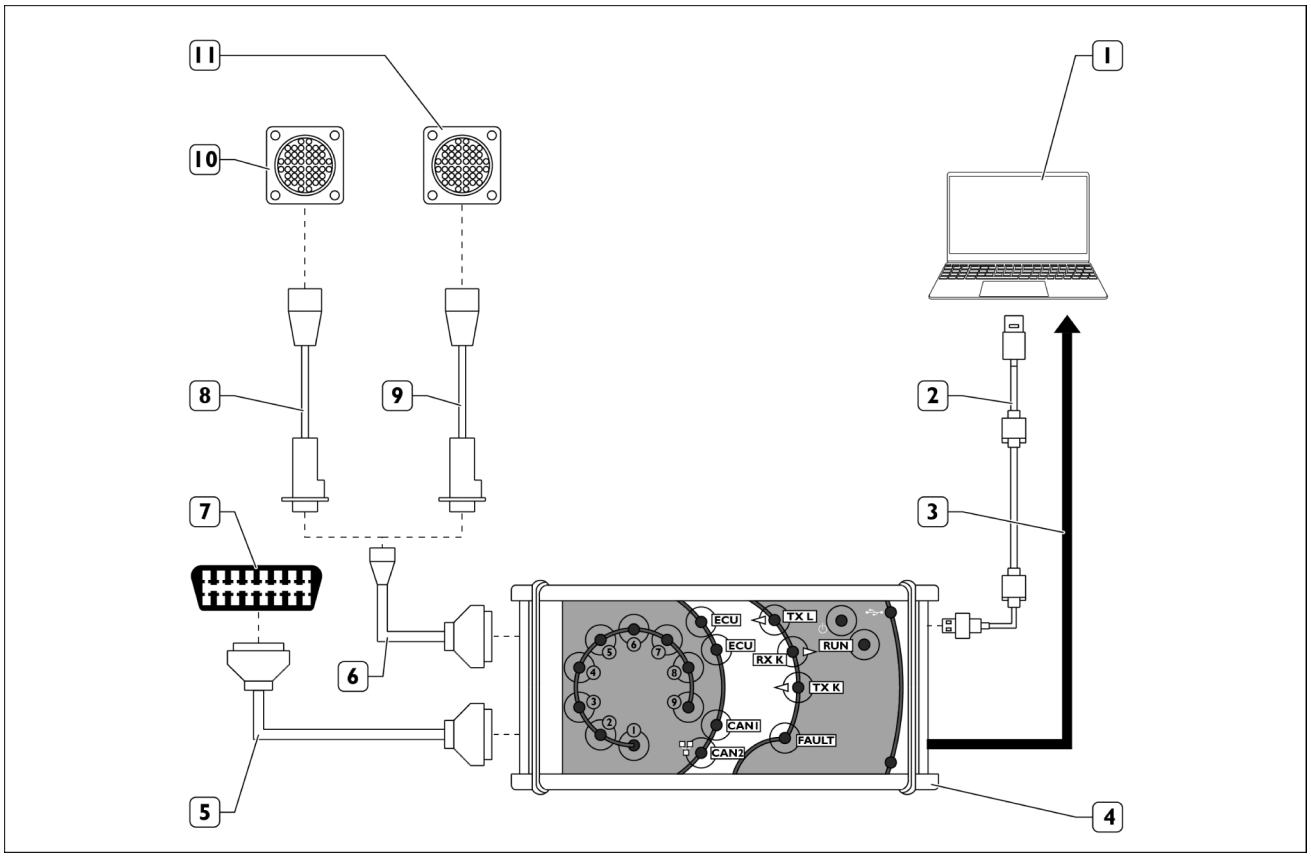

NHIL25ENG0452FA 1

| Item | Description |
|---|---|
| 1 | Data transfer warning light (flashing) |
| 2 | Ignition warning light |
| 3 | USB warning light |
| 4 | Operating warning light |
| 5 | Serial port warning light |
| 6 | "Error" warning light |
| 7 | CAN line warning light |
| 8 | Warning light for automatically controlled K lines |

The PT-BOX can be used to do the following:

- Basic diagnostics: reading the control unit's identification code, reading faulty memories, reading parameters, wiping faulty memories and reading the "Flight Recorder" memory.
- Active diagnostics: functional tests upon the main components (actuators, contactors, etc.).
- Reading the "Flight Recorder".
- Recognition of the replaced electronic components in the control unit.
- 2nd level and PTO programming.
- Acquisition of parameters during functional tests.

## Connection of PT-BOX diagnostic tool to the connector for engine diagnostics




NHIL25ENG0453FA 2

| No. | Component | Tool code |
|---|---|---|
| 1 | Computer | |
| 2 | USB connection cable PT-BOX | **1.8 mm** (**0.1 in**) 99327018<br>**1.8 mm** (**0.1 in**) 99327019 |
| 3 | Bluetooth dongle | 99327085 |
| 4 | PT-BOX | 99327282 |
| 5 | ODB Led | 99331070 |
| 6 | 30 pin cable PT-BOX | 99327017 |
| 7 | Vehicle OBD engine diagnostic socket | |
| 8 | 30 - 19 pin adapter cable | 99368555 |
| 9 | 30 - 9 pin adapter cable | 99331000 |
| 10 | 19-pin engine diagnostic socket | |
| 11 | 9-pin engine diagnostic socket | |

***NOTE:*** *Images are for illustrative purposes.*

# Diagnostic connector - Overview - VCI diagnostic tool and connection to the engine [113439339 - V1 - 07 March 2025]

## Introduction

Good diagnostic skills are achieved from the expertise acquired from years of experience and from attending training courses.

When poor performance or operating faults arise, the user's description of the problem should be considered since it may provide us with useful diagnostic information.

Using computerised instruments FPT, it is also possible to establish bi-directional communication with the central unit, thus allowing us to determine the error codes, as well as to access its memory in order to obtain any additional information that may be useful for determining the cause of the fault.

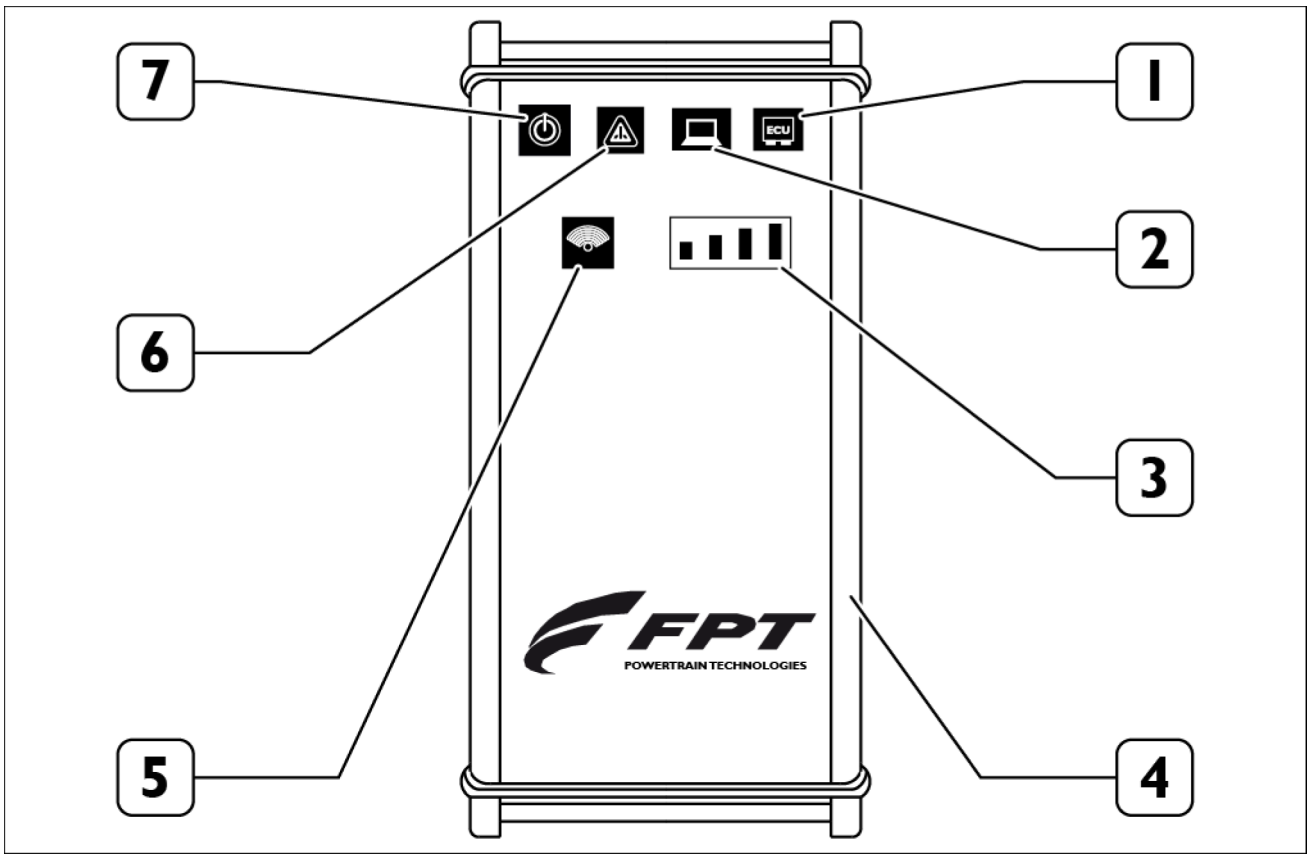
Each time a problem arises and is confirmed, the electronic control unit should be consulted using one of the methods indicated. The diagnostic investigation can then be carried out using the available evidence and measurements, in order to obtain an overview of the operating conditions, after which the actual cause of the fault can be determined.

If the electronic control unit fails to provide any indications, you should proceed by relying on your experience with traditional diagnostic methods.

***NOTE:*** *Any type of intervention on the control unit must be carried out by specialized personnel and duly authorized by FPT.*
*Any unauthorized tampering shall invalidate the assistance warranty.*

## VCI (Vehicle Comuncation Interface)

The VCI ( Vehicle Comuncation Interface) is a diagnostic tool to be connected to a Personal Computer.



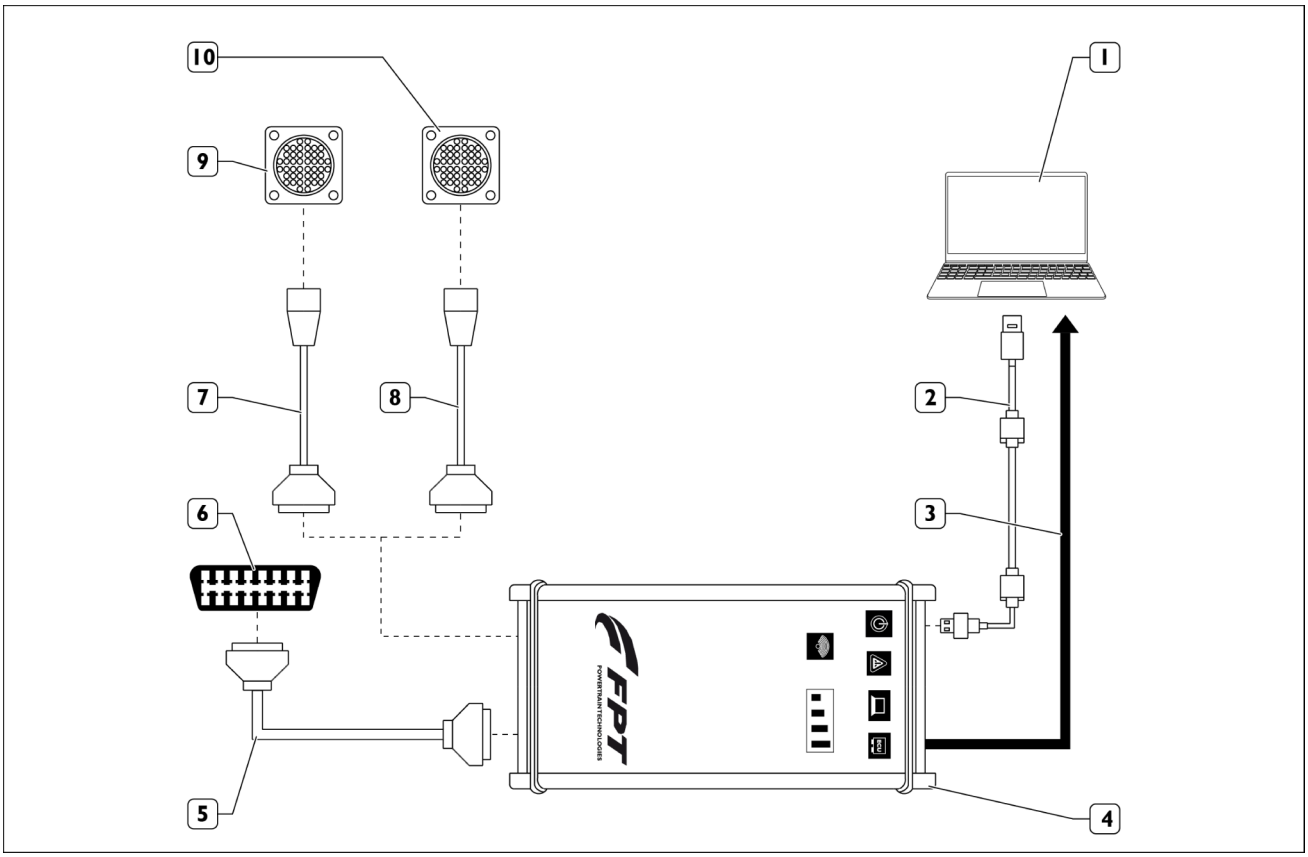

NHIL25ENG0454FA 1

| Item | Description |
|---|---|
| 1 | Status of the control unit connection |
| 2 | Power warning light |
| 3 | Strength of the WiFi / Bluetooth connection |
| 4 | Operation warning light |
| 5 | Bluetooth / WiFi connection signal |
| 6 | "Error" warning light |
| 7 | Power supply status |

With the VCI it is possible to carry out:

- Basic diagnostics: reading the control unit's identification code, reading faulty memories, reading parameters, wiping faulty memories and reading the "Flight Recorder" memory.
- Active diagnostics: functional tests upon the main components (actuators, contactors, etc.).
- Reading the "Flight Recorder".
- Recognition of the replaced electronic components in the control unit.
- 2nd level and PTO programming.
- Acquisition of parameters during functional tests.

## Connection of PT-BOX diagnostic tool to the connector for engine diagnostics

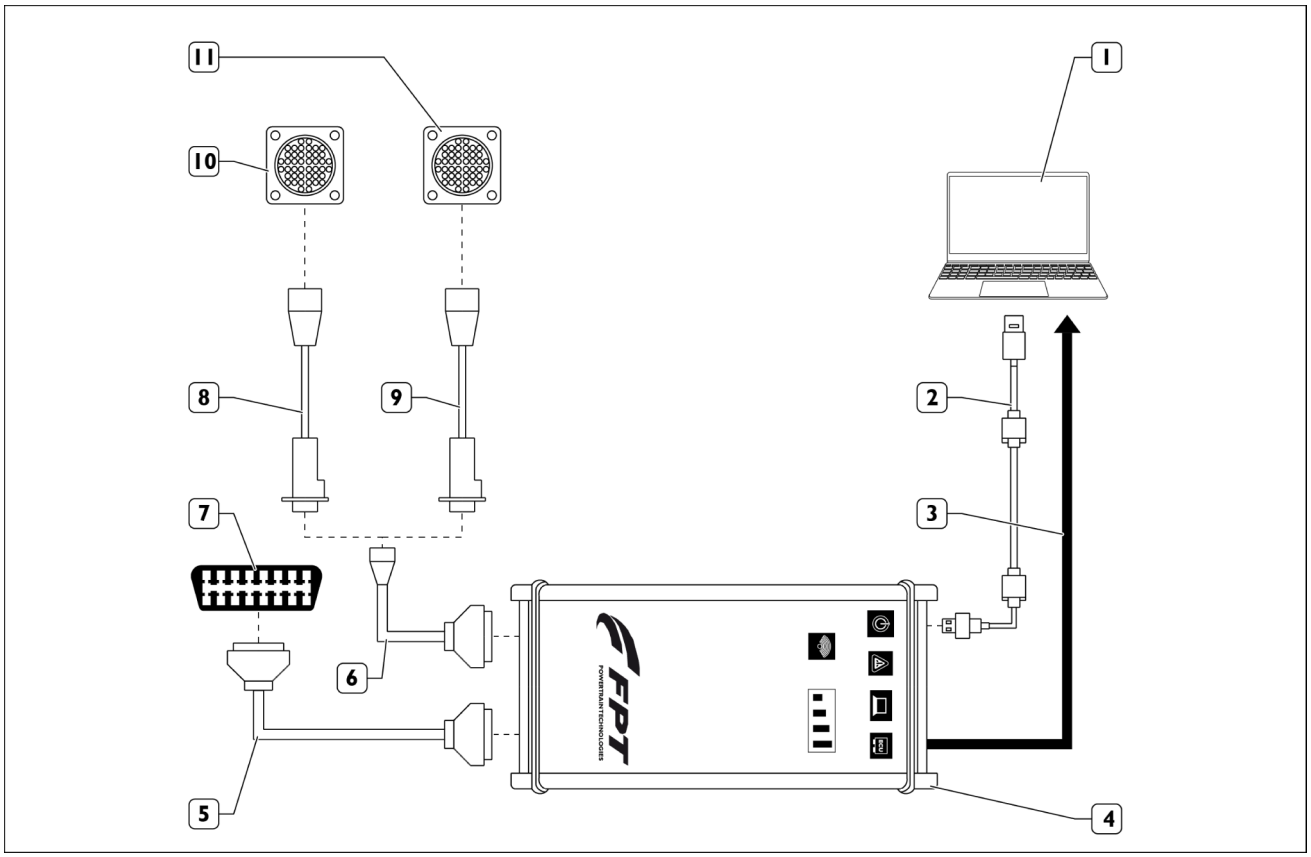



NHIL25ENG0455FA 2

***NOTE:*** *Images are for illustrative purposes.*

| No. | Component | Tool code |
|---|---|---|
| 1 | Computer | |
| 2 | USB connection cable VCI | 99327152 — **3.0 mm** (**0.1 in**) cable |
| 3 | Bluetooth dongle | 99327162 |
| 4 | VCI | 99327169 |
| 5 | ODB Led | 99327155 |
| 6 | Vehicle OBD engine diagnostic socket | |
| 7 | 19-pin cable | 99327157 |
| 8 | 9-pin cable | 99327159 |
| 9 | 19-pin engine diagnostic socket | |
| 10 | 9-pin engine diagnostic socket | |

## Connection of VCI diagnostic tool to the connector for engine diagnostics using the cables of the PT-BOX




NHIL25ENG0456FA 3

***NOTE:*** *Images are for illustrative purposes.*

| No. | Component | Tool code |
|---|---|---|
| 1 | Computer | |
| 2 | USB connection cable PT-BOX | 99327018 – Cable **1.8 mm** (**0.1 in**)<br>99327019 – **4.5 mm** (**0.2 in**) cable |
| 3 | Bluetooth dongle | 99327085 |
| 4 | PT-BOX | 99327282 |
| 5 | ODB Led | 99331070 |
| 6 | 30 pin cable PT-BOX | 99327017 |
| 7 | Vehicle OBD engine diagnostic socke | |
| 8 | 30 - 19 pin adapter cable | 99368555 |
| 9 | 30 - 9 pin adapter cable | 99331000 |
| 10 | 19-pin engine diagnostic socket | |
| 11 | 9-pin engine diagnostic socket | |

# Diagnostic connector - Check -PT-BOX diagnostic tool and accessories [113439306 - V1 - 20 February 2025]

| Tool / Material | |
|---|---|
| 30-pin to 19-pin adapter (component of 99327282) | 99368555 |
| 30-pin to 9-pin adapter (use with 99327017) | 99331000 |
| Adapter for new EOBD connector (use with E.A.SY.) | 99331070 |
| Cap for autodiagnosis for ECI (replacement for E.A.SY.) | 99327037 |
| Connector 99327037 power supply cable with cigarette lighter socket (EASY Light spare part) | 99327046 |
| Diagnostic interface with prepaid card ((compose of: 99327017, 99327018, 99327019, 99327037, 99327046, 99327301, 99368555) | 99327282 |
| E.A.SY. Bluetooth | 99327085 |
| Prepaid card (component of 99327282) | 99327301 |
| USB cable with EMI filter ( **1.80 m** (**70.87 in**) ) for ECI (replacement for E.A.SY.) | 99327018 |
| USB cable with EMI filter ( **4.50 m** (**177.17 in**) ) for ECI (replacement for E.A.SY.) | 99327019 |
| Vehicle communication cable with 32-pin socket ( **0.42 m** (**16.54 in**) ) for ECI (replacement for E.A.SY.) | 99327017 |

The table below provides the codes of the PT-BOX (Diagnostic interface) and its accessories.

| Tool / Material | |
|---|---|
| Vehicle communication cable with 32-pin socket ( **0.42 m** (**16.54 in**) ) for ECI (replacement for E.A.SY.) | 99327017 |
| USB cable with EMI filter ( **1.80 m** (**70.87 in**) ) for ECI (replacement for E.A.SY.) | 99327018 |
| USB cable with EMI filter ( **4.50 m** (**177.17 in**) ) for ECI (replacement for E.A.SY.) | 99327019 |
| Cap for autodiagnosis for ECI (replacement for E.A.SY.) | 99327037 |
| Connector 99327037 power supply cable with cigarette lighter socket (EASY Light spare part) | 99327046 |
| E.A.SY. Bluetooth | 99327085 |
| Diagnostic interface with prepaid card ((compose of: 99327017, 99327018, 99327019, 99327037, 99327046, 99327301, 99368555) | 99327282 |
| Prepaid card (component of 99327282) | 99327301 |
| 30-pin to 9-pin adapter (use with 99327017) | 99331000 |
| Adapter for new EOBD connector (use with E.A.SY.) | 99331070 |
| 30-pin to 19-pin adapter (component of 99327282) | 99368555 |

# Diagnostic connector - Check VCI diagnostic tool and accessories [113439307 - V1 - 20 February 2025]

| Tool / Material | |
|---|---|
| 30-pin to 19-pin adapter (component of 99327282) | 99368555 |
| 30-pin to 9-pin adapter (use with 99327017) | 99331000 |
| Adapter for self-diagnostics for new VCI (Replacement part for 99327170-99327175) | 99327154 |
| Bluetooth key for new VCI (Replacement for 99327170-99327175) | 99327162 |
| Case with FPT logo (Replacement for 99327175) | 99327153 |
| Diagnostic cable kit (4) for FPT (composed of 99327155-99327156-99327157-99327159 | 99327167 |
| Kit VCI for FPT (compose of: 99327152-99327153-99327154-99327162-99327169) | 99327175 |
| New VCI-OBD cable (Replacement part for 99327170-99327167) | 99327155 |
| New Vehicle Communication Interface for FPT (Replacement for 99327175) | 99327169 |
| Prepaid card (component of 99327282) | 99327301 |
| USB cable for new VCI (Replacement part for 99327170-99327175) | 99327152 |
| VCI Protection Bumper-PC side (Replacement part for 9327169-99327170-99327171-99327175) | 99327172 |
| VCI Protection Bumper-Vehicle side (Replacement part for 99327169-99327170-99327171-99327175) | 9327173 |
| Vehicle communication cable with 19-pin socket (Replacement for 99327167) | 99327157 |
| Vehicle communication cable with 30-pin socket (Replacement for 99327167) | 99327156 |
| Vehicle communication cable with 9-pin socket (Replacement for 99327167) | 99327159 |

The table below provides the codes of the VCI (Diagnostic interface) and its accessories.

| Tool / Material | |
|---|---|
| USB cable for new VCI (Replacement part for 99327170-99327175) | 99327152 |
| Case with FPT logo (Replacement for 99327175) | 99327153 |
| Adapter for self-diagnostics for new VCI (Replacement part for 99327170-99327175) | 99327154 |
| New VCI-OBD cable (Replacement part for 99327170-99327167) | 99327155 |
| Vehicle communication cable with 30-pin socket (Replacement for 99327167) | 99327156 |
| Vehicle communication cable with 19-pin socket (Replacement for 99327167) | 99327157 |
| Vehicle communication cable with 9-pin socket (Replacement for 99327167) | 99327159 |
| Bluetooth key for new VCI (Replacement for 99327170-99327175) | 99327162 |
| Diagnostic cable kit (4) for FPT (composed of 99327155-99327156-99327157-99327159) | 99327167 |
| New Vehicle Communication Interface for FPT (Replacement for 99327175) | 99327169 |
| VCI Protection Bumper-PC side (Replacement part for 9327169-99327170-99327171-99327175) | 99327172 |
| VCI Protection Bumper-Vehicle side (Replacement part for 99327169-99327170-99327171-99327175) | 99327173 |
| Kit VCI for FPT (compose of: 99327152-99327153-99327154- 99327162-99327169) | 99327175 |
| Prepaid card (component of 99327282) | 99327301 |
| 30-pin to 9-pin adapter (use with 99327017) | 99331000 |
| 30-pin to 19-pin adapter (component of 99327282) | 99368555 |

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# Electrical systems - 55

## Engine control system - 015

**F6AFL413A*U001**

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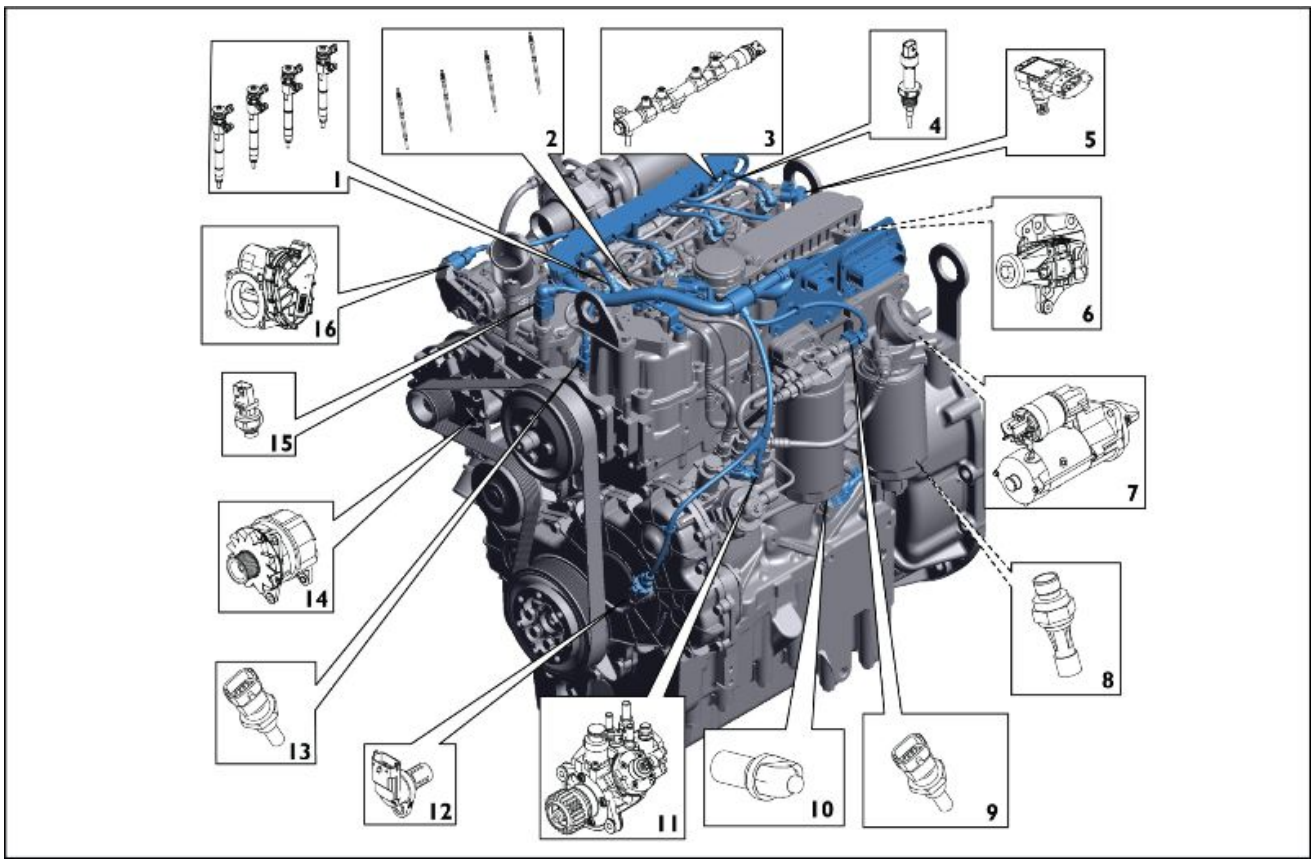
# Engine control system - Component localization - Engine [113474426 - V2 - 06 March 2025]

## Location of engine electrical components

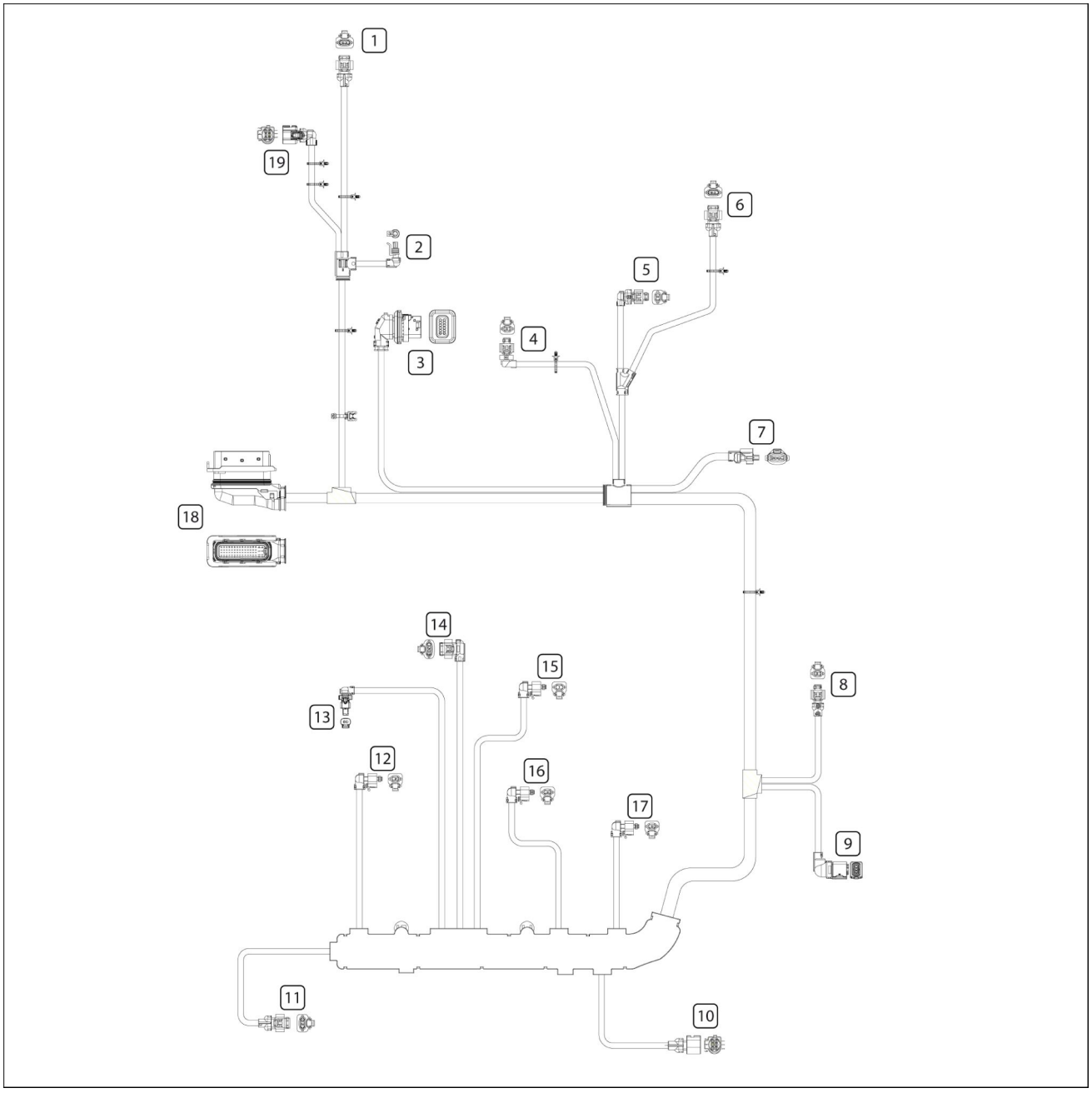



NHIL25ENG0096FA 1

| Item | Description |
|---|---|
| 1 | Electro-injectors |
| 2 | Preheating glow plugs |
| 3 | Rail pressure sensor |
| 4 | Temperature sensor for exhaust gas |
| 5 | Supercharging pressure and air temperature sensor |
| 6 | Valve EGR |
| 7 | Electric starter motor (component not supplied by FPT) |
| 8 | Low oil pressure valve |
| 9 | Fuel temperature sensor |
| 10 | Crankshaft speed sensor (incremental speed) |
| 11 | High pressure fuel pump dosing unit |
| 12 | Camshaft timing sensor (segmental speed) |
| 13 | Coolant temperature sensor |
| 14 | Alternator |
| 15 | Exhaust gas absolute pressure sensor |
| 16 | Throttle body |

# Engine wiring harness - Overview - Engine cables [113439216 - V1 - 20 February 2025]

## Cable on engine




NHIL25ENG0450GA 1

1. Crankshaft speed sensor (incremental speed)— X-F23
2. Low oil pressure valve — X-F55
3. Cylinder disconnection connector — X-X-1
4. Fuel temperature sensor — X-F290
5. Fuel high pressure pump metering unit — X-F07
6. Camshaft timing sensor (segmental speed) — X-F19
7. Heating glow plug connector — X-X-1
8. Coolant temperature sensor — X-F21

9. Exhaust gas absolute pressure sensor — X-F53
10. Throttle valve sensor — X-F102
11. Pressure sensor Common Rail — X-F09
12. Cylinder 4 injector solenoid valve — X-F11_4
13. Air temperature sensor — X-F219
14. Air temperature and boost pressure sensor — X-F48
15. Cylinder 3 injector solenoid valve — X-F11_3
16. Cylinder 2 injector solenoid valve — X-F11_2
17. Cylinder 1 injector solenoid valve — X-F11_1
18. Vehicle wiring connector — X-X-2
19. Valve EGR Pieburg — X-F24A

# Engine timing sensors - Overview - Rev.counter sender [113438036 - V1 - 07 March 2025]

## Crankshaft speed sensor (incremental speed)

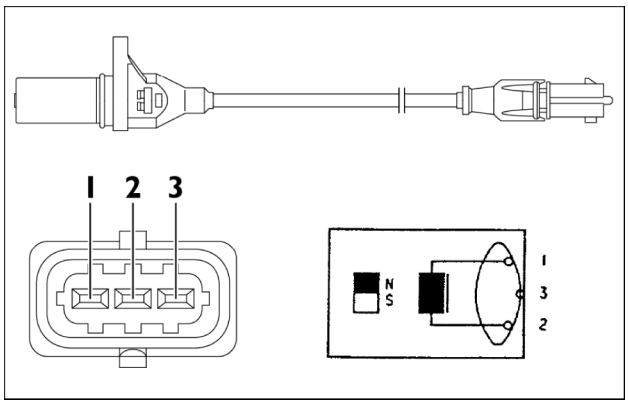
It is an inductive sensor. It generates signals obtained from changes in magnetic flux created by spaces between the teeth on the phonic wheel fitted to the crankshaft.

The sensor resistance value is:

| Technical data | |
|---|---|
| Resistance | = **900 Ω** |

## Sensor pin-out

| Item | Description |
|---|---|
| 1 | Signal |
| 2 | Signal |
| 3 | Signal |




NHIL25ENG0448AA 1

# Engine timing sensors - Overview - Timing gear speed sender [113438037 - V1 - 07 March 2025]

## Camshaft timing sensor (segmental speed)

It is an inductive sensor. It generates signals obtained from magnetic flux lines which close through the holes situated in gears force fit on the camshaft. The signal this sensor generates is used by the electronic control unit as an injector timing signal.

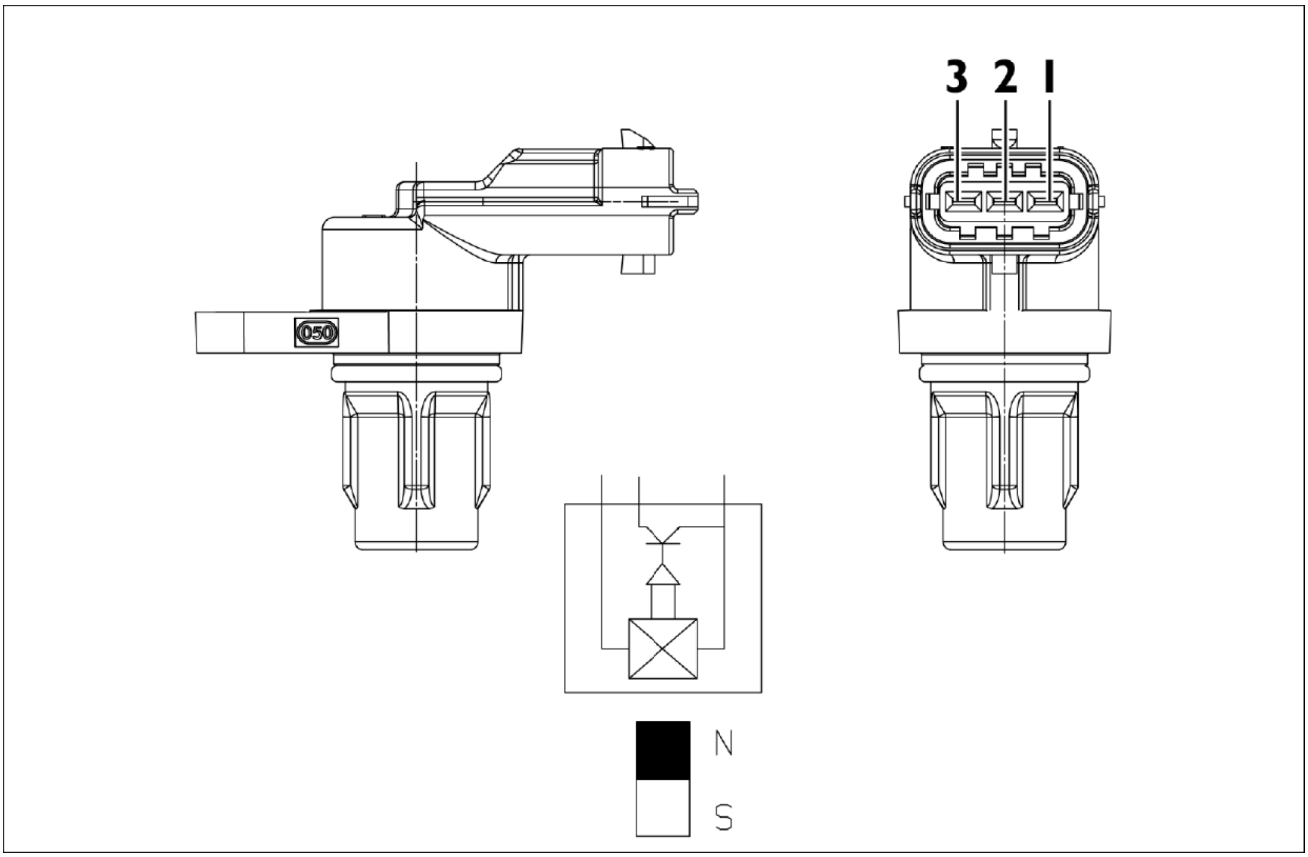
Though it is similar to the engine speed sensor, it is NOT interchangeable as it has a different shape.

The sensor resistance value is:

| Technical data | |
|---|---|
| Resistance | **900 Ω** |

## Sensor pin-out

| Item | Description |
|---|---|
| 1 | Ground |
| 2 | Signal |
| 3 | Feeding |




NHIL25ENG0449FA 1

# Engine Control Unit (ECU) - Prepare - ECU power supply [113408046 - V1 - 27 February 2025]

## Preparation

- Ignition switch set to OFF position.
- Disconnect the wiring harness connector from the required ECU.

# Engine Control Unit (ECU) - Prepare - MIL activation check [113408047 - V1 - 27 February 2025]

## Preparation

General checks

- Battery voltage is sufficient.
- Vehicle fuses are OK.
- Connectors/plugs OK. No loose contact or corrosion.
- Offboard tool Diagnosis tester.

# Engine Control Unit (ECU) - Prepare - Read parameter check [113408048 - V1 - 13 February 2025]

## Preparation

General checks

- Battery voltage is sufficient.
- Vehicle fuses are OK.
- Connectors/plugs OK. No loose contact or corrosion.
- Off-board tool: Diagnosis tester.

# Engine Control Unit (ECU) - Check - ECU power supply [113408049 - V1 - 27 February 2025]

## Check power supply of indicated Electronic Control Unit (ECU)

1. Check power supply of Electronic Control Unit (ECU)
   - Measure the voltage between the required ECU wiring harness connector and ground point in accordance with the following table and go to step **2**.

| Ignition switch set OFF position | | | | | |
|---|---|---|---|---|---|
| **Component [Connector]** | **PIN** | **Via [fuse, relay]** | **Destination [Connector]** | **PIN** | **Typical Value** |
| ECU | 1 | Fuse F 7.5A | Vehicle ground point | - | From **11 – 14.8 V**. |
| ECU | 3 | Fuse F-20A | Vehicle ground point | - | From **11 – 14.8 V**. |
| ECU | 5 | Fuse F-20A | Vehicle ground point | - | From **11 – 14.8 V**. |

***NOTE:*** *Please consider internal resistance of measurement equipment and breakout box used.*

2. Check power supply of indicated Electronic Control Unit (ECU).
   - If all values within specified range or similar to typical value, go to step **Engine Control Unit (ECU) - Check - ECU power supply (55.015)**.
   - If not all values within specified range or similar to typical value, go to step **3**.
3. Possible root cause
   - Wiring harness damaged.
   - Wiring harness connector damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Engine Control Unit (ECU) - Check - ECU power supply [113408050 - V1 - 27 February 2025]

## Check ECU Wiring Harness – Open Circuit check

1. Preparation
   - Ignition switch set to OFF position.
   - Disconnect the controller connectors and fuses or relays linked to the inspected terminals/cables.
   - Disconnect the wiring harness connector from the required ECU.
2. Open circuit check of indicated Electronic Control Unit (ECU).
   - Measure the resistance between the required ECU wiring harness connector and indicated connector/ destination point in accordance with the following table and go to step **3**.

| Component [Connector] | PIN | Destination [Connector] | PIN | Typical Value |
|---|---|---|---|---|
| ECU | 1 | Battery pole (+) via Fuse F **7.5 A**. | Not applicable | From **0 – 0.2 Ω**. |
| ECU | 3 | Battery pole (+) via Fuse F **20 A**. | Not applicable | From **0 – 0.2 Ω**. |
| ECU | 5 | Battery pole (+) via Fuse F **20 A**. | Not applicable | From **0 – 0.2 Ω**. |
| ECU | 2 | Battery pole (-) | Not applicable | From **0 – 0.2 Ω**. |
| ECU | 4 | Battery pole (-) | Not applicable | From **0 – 0.2 Ω**. |
| ECU | 6 | Battery pole (-) | Not applicable | From **0 – 0.2 Ω**. |

3. Open circuit check of indicated Electronic Control Unit (ECU).
   A. If all values within specified range, go to step **5**.
   B. If not all values within specified range, go to step **4**.
4. Possible root cause
   - Wiring harness damaged.
   - Wiring harness connector damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

5. The ECU Power Supply works properly.

# Engine Control Unit (ECU) - Check - MIL activation check [113408051 - V1 - 27 February 2025]

## Preparation

- Connect the diagnostic tester.
- Turn the key to ON position.
- Select MIL activation light item on diagnosis tester.

## Check

1. 
   - Pressing the star button, you can verify the activation of MIL light on cluster.
   - MIL is activated 3 times and you will get a visual feedback.
   - Go to step **2**.
2. MIL Activation check
   - The diagnosis tester output shows the MIL providing a visual feedback. If the MIL Activation is not OK, go to step **3**.
   - If the MIL Activation is OK, go to step **4** .
3. Possible root cause
   - Defect cluster

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The MIL light on cluster works properly.

# Engine Control Unit (ECU) - Check - Read parameter check [113408052 - V1 - 27 February 2025]

## Preparation

- Set the key to ON.
- Connect the diagnostic tester.

## Check

***NOTE:*** *This procedure is used to modify and maintain the engine rpm and analyse the performance of a number of pressure and injector parameters. Adjustment is possible in the range from idle to nominal speed. Tools for modifying the following parameters are arranged on the screen page (click on the instrument to visualize the name of the measurement channel).*

1. Procedure
   - Check and modify the boost air temperature: air temperature in intake manifold.
   - Check and modify the relative boost air temperature: difference between absolute supercharging pressure and ambient pressure.
   - Check and modify the target fuel pressure: target fuel pressure value to be reached by the ECU.
   - Check and modify the fuel pressure: pressure in the rail.
   - Check and modify the pre-injection fuel delivery: quantity of the fuel injected per cycle during pre-injection (certain rpm only).
   - Check and modify the main fuel delivery: main fuel quantity injected per cycle.
   - Check and modify the total fuel delivery: quantity of fuel injected per cycle, including pre-injection and main injection.
   - Check and modify the coolant temperature: temperature of coolant to obtain engine cooling effect.
   - Go to step **2**.
2. - The following table shows the indicative reading parameters obtained by means of the diagnostics tool.
   - See the table below.
   - If the parameters are OK, go to step **4**.
   - If the parameters are NOT OK, go to step **3**.

***NOTE:*** *The values shown in the table are purely indicative and do not refer to the current application.*

| Description | Value | | | Unit |
|---|---|---|---|---|
| | IGN_On **0 RPM** | ENG_On **900 RPM** | ENG_On **1500 RPM** | |
| Engine Revolutions | 0 | 90 | 1500 | Rpm |
| Injection Advance | 0 | 2.33 | 3.43 | ° |
| Battery Voltage | 12 | 14 | 14 | Volt |
| Turbocharger Actuator | 99 | 81 | 53 | % |
| Boost Pressure | 1016 | 1031 | 1097 | mBar |
| Oil Pressure | 30 | 4311 | 4898 | mBar |
| Coolant Temperature | 32 | 71 | 80 | °C |
| Fuel temperature sensor | 26 | 25 | 26 | °C |
| Oil Temperature | 32 | 53 | 68 | °C |
| Main Fuel Quantity | 0 | 37 | 39 | mg/str |
| Fuel Introduced Pre-Injection | 0 | 1.5 | 1.5 | mg/str |
| Total Fuel Introduced | 0 | 35 | 37 | mg/str |
| Current Injection Quantity | 0 | 35 | 37 | mg/str |
| Cylinder Air Mass | 0 | 1600 | 1660 | mg/str |
| Fuel Pressure | 2 | 500 | 877 | Bar |
| Fuel Pressure Setpoint | 323 | 500 | 875 | Bar |
| Intake Air Quantity | 0 | 1576 | 1662 | mg/str |
| Humidity sensor (if present) | 33 | 43 | 43 | % |
| Humidity sensor voltage (if present) | 1847 | 2097 | 2097 | mV |

3. Possible root cause
   - Electrical defect of fuel and/or air system's components check wiring harness and component electrically.
   - Mechanical defect of fuel and/or air system's components.
   - Engine mechanical defect.

***NOTE:*** *After having eliminated the cause of the error, delete the fault memory and repeat the reading.*

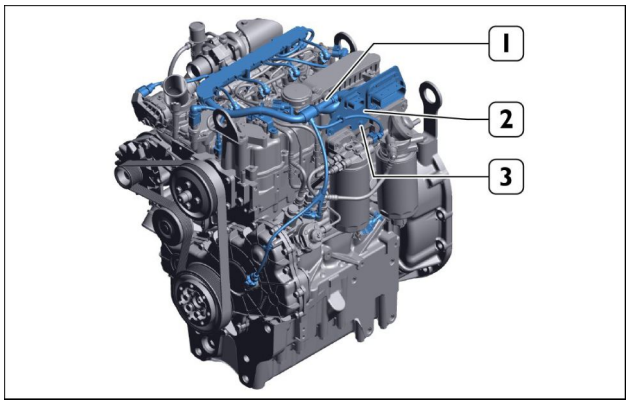
4. The engine control unit works properly.

# Engine wiring harness - Remove - Engine cables [113439219 - V1 - 20 February 2025]

1. Disconnect the engine cable **(1)** from the control unit, from the electro-injectors and from all the sensors and transmitters to which it is connected.

***NOTE:*** *Suitably cover all the connectors to prevent oxidation or any damage.*

2. To ease the removal, loosen the screws **(2)** from the fixing bracket **(3)** of the engine wiring.
3. Remove the clips fastening the engine cable **(1)** and remove the cable.

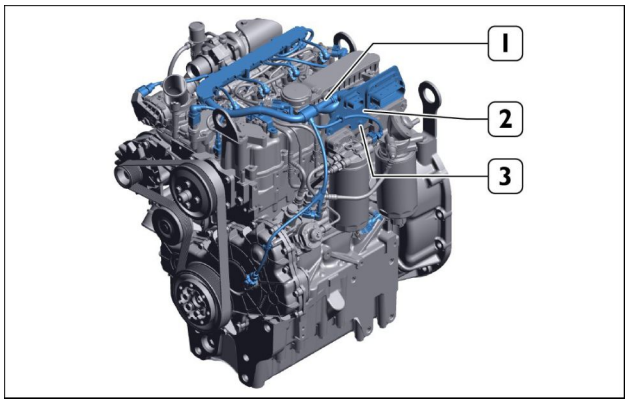



NHIL25ENG0451FA 1

# Engine wiring harness - Install - Engine cables [113439220 - V1 - 07 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Engine cable fixing bracket | 3 screws M8 x 1.25 x 20 | **23 +/- 2.3 N·m** |

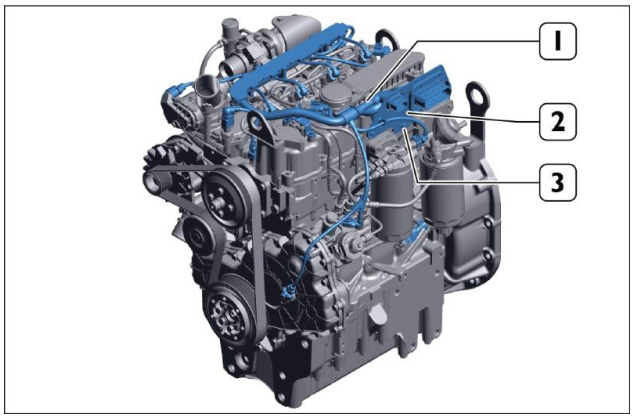
1. Position the engine cable **(1)** correctly and fasten all the engine cable retaining clips. Connect the engine cable to the control unit and all the sensors and transmitters shown in the figure.
2. Tighten the screws **(2)** of the bracket **(3)** fixing the engine wiring to the prescribed torque.




NHIL25ENG0451FA 1

# Engine wiring harness - Install - Fitting the engine cable [113471383 - V1 - 06 March 2025]

1. Correctly position the engine cable **(1)** and fasten all clips securing the engine cable. Connect the engine cable to the control unit and to all the sensors and senders indicated in the figure **1**.
2. Tighten the fastening screws **(2)** of the bracket **(3)** securing the engine wiring to the specified torque.




NHIL25ENG0212FA 1

| Description | Quantity | Value |
|---|---|---|
| Engine cable fixing bracket | 3 screws M8 x 1.25 x 20 | **23 +/- 2.3 N·m** |

# Engine timing sensors - Prepare - Engine speed adjustment check [113408036 - V1 - 26 February 2025]

## Preparation

General checks

- Battery voltage is sufficient.
- Vehicle fuses are OK.
- Connectors/plugs OK. No loose contact or corrosion.
- Offboard tool: Diagnosis tester.

# Engine timing sensors - Check - Engine speed adjustment check [113408037 - V1 - 26 February 2025]

## Preparation

This procedure is used to modify and maintain the engine rpm. Adjustment is possible in the range from idle to **2300 RPM**.

- Turn the key to ON position and start the engine at idle speed.
- Connect the diagnostic tester.
- Select Engine Speed item on diagnostic tester.

## Check

1. - Modify and maintain the engine rpm.
   - Adjust the engine speed from idle to **2300 RPM**.
   - Go to step **2**.
2. Engine speed adjustment check
   - The actual engine speed is into specified rpm range.
   - If the engine speed adjustment check is OK, go to step **4**.
   - If the engine speed adjustment check is NOT OK, go to step **3**.
3. Possible root cause
   - Engine air system fault, e.g. air leak, faulty turbocharger etc.
   - Engine fuel system fault, e.g. leaking injector, faulty fuel pump etc.
   - Engine/transmission fault, e.g. head cylinder pressure leaking, wrong cam crank timing etc.

***NOTE:*** *Minimum speed should be engine idle speed.*

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The engine speed adjustment check works properly.

# Engine timing sensors - Prepare - Camshaft and crankshaft synchronization [113408042 - V1 - 26 February 2025]

## Preparation

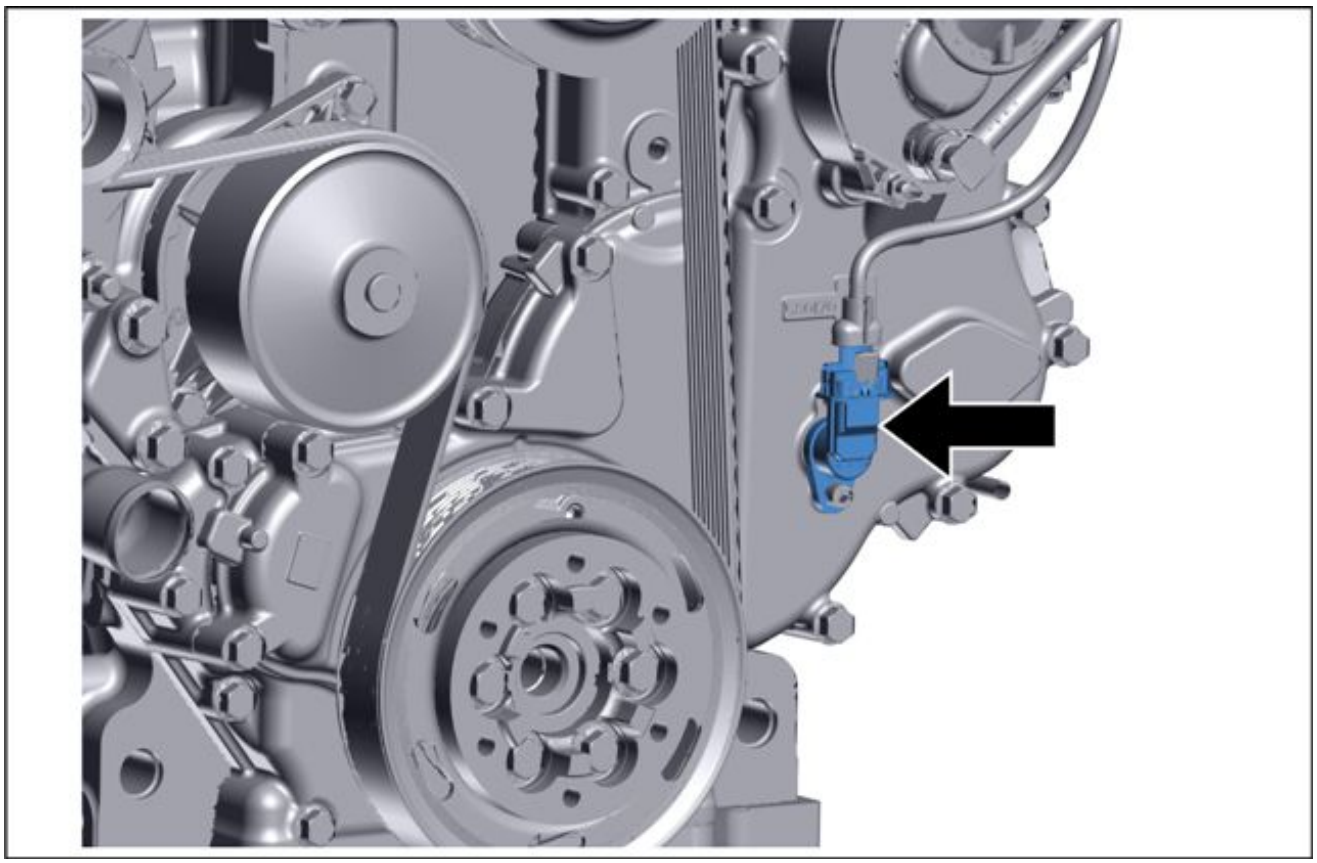
General checks

- Battery voltage is sufficient.
- Electrical circuit is OK, like fuses, connectors, wiring harness, relays.
- Offboard tool: oscilloscope.

# Engine timing sensors - Check - Camshaft and crankshaft synchronization [113408043 - V1 - 26 February 2025]

## Visual check the camshaft sensor

1. Visual check the camshaft sensor
   - Visually check the connector of the sensor.
   - Check if the sensor is installed correctly.
   - Check if the screw of the sensor is tight.
   - Check the sensor assembly to the engine body.
   - See the figure below for indications and go to step **2**.



NHIL25ENG0528FA 1

**Camshaft speed sensor**

2. A. Connector of the sensor not damaged and not contaminated.
   B. The sensor is mounted in the correct orientation.
   C. The sensor is correctly fitted to the engine body, no gap between the sensor and the engine body.
   D. The screw is not loose.
   E. If the camshaft sensor is OK, go to step **Engine timing sensors - Check - Camshaft and crankshaft synchronization (55.015)**.
   F. If the camshaft sensor is NOT OK, go to step **3**.

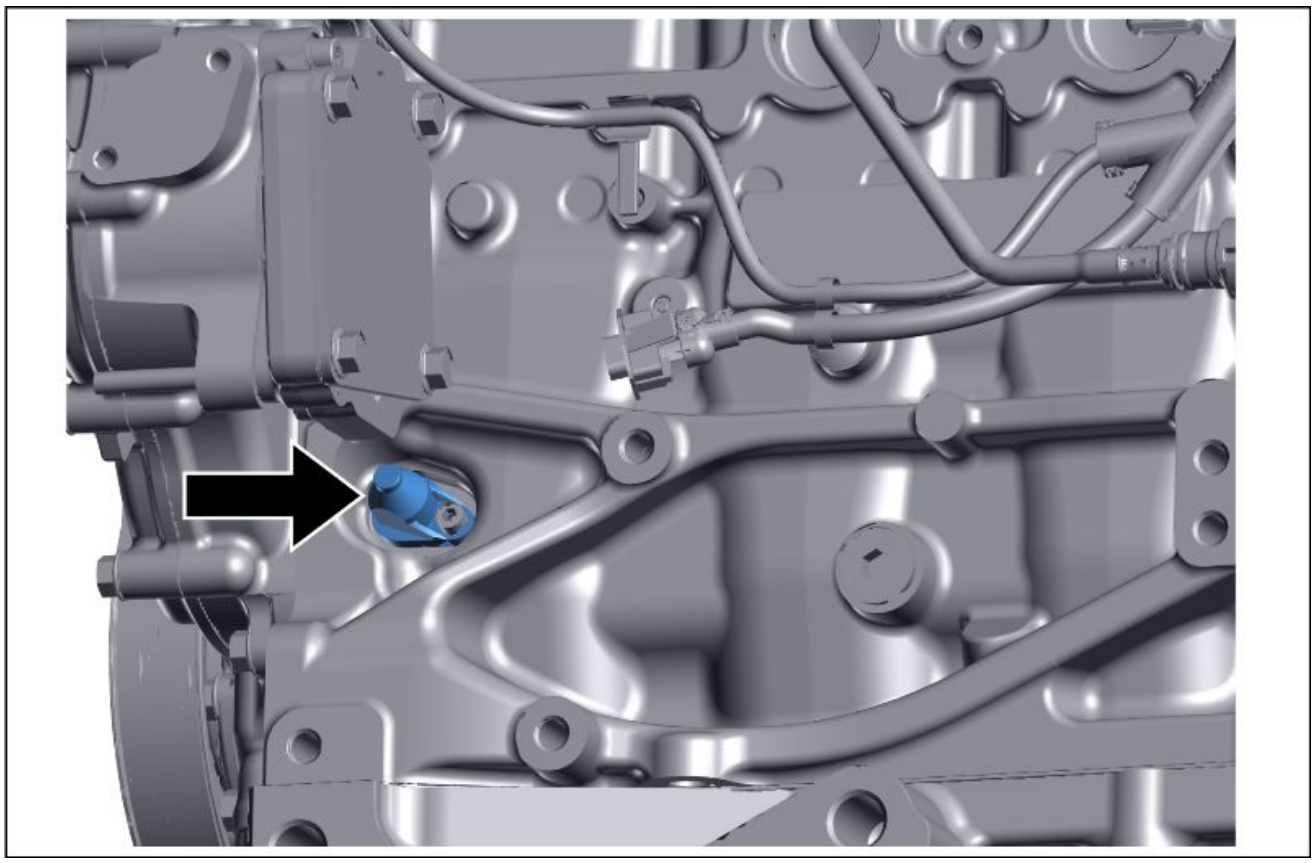
3. Possible root cause
   - Connector of the sensor damaged and/or contaminated.
   - The sensor is not mounted in the correct orientation.
   - The sensor is loosely fitted to the engine body.
   - Tighten the screw.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Engine timing sensors - Check - Camshaft and crankshaft synchronization [113408044 - V1 - 26 February 2025]

## Visual check the crankshaft sensor

1. Visual check the crankshaft sensor
   - Visually check the connector of the sensor.
   - Check if the sensor is installed correctly.
   - Check if the screw of the sensor is tight
   - Check the sensor assembly to the engine body.
   - See the figure below for indications and go to step **2**.



NHIL25ENG0529FA 1

**Crankshaft speed sensor**

2. Check the crankshaft sensor
   A. Connector of the sensor not damaged and not contaminated.
   B. The sensor is mounted in the correct orientation.
   C. The sensor is correctly fitted to the engine body, no gap between the sensor and the engine body.
   D. The screw is not loose.
   E. If the crankshaft sensor is OK, go to step **Engine timing sensors - Check - Camshaft and crankshaft synchronization (55.015)**.
   F. If the crankshaft sensor is NOT OK, go to step **3**.

3. Possible root cause
   - Connector of the sensor damaged and/or contaminated.
   - The sensor is not mounted in the correct orientation.
   - The sensor is loosely fitted to the engine body.
   - Tighten the screw.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Engine timing sensors - Check - Camshaft and crankshaft synchronization [113408045 - V1 - 27 February 2025]

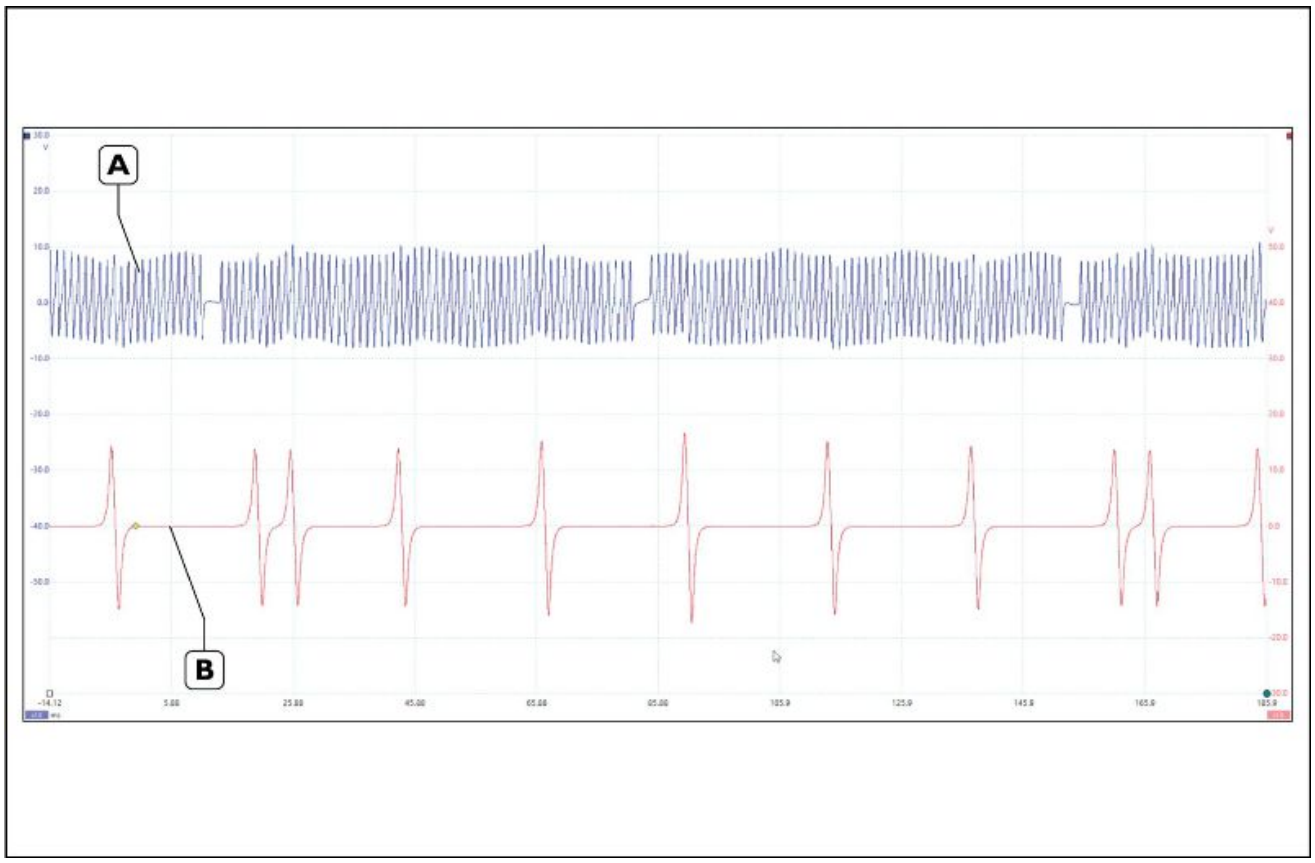
1. Check camshaft and crankshaft signals
   - Use an oscilloscope to check and compare the electrical signal of the camshaft and crankshaft sensor, go to step **2**.
2. Signal check of Camshaft Speed Sensor ( CmSpdSens) by oscilloscope
   - Capture indicated CmSpdSens signal.
   - Keep engine in low idle at least **1 min**.
   - Go to step **3**.

| Component [Controller connector] | PIN | Component [Controller connector] | PIN |
|---|---|---|---|
| CmSpdSens ECU Connector 2 | 68 | CmSpdSens ECU Connector 2 | 67 |

3. Signal check of Crankshaft Speed Sensor ( CrSpdSens) by oscilloscope
   - Capture indicated CrSpdSens signal
   - Keep engine in low idle at least **1 min**.
   - Go to step **4**.

| Component [Controller connector] | PIN | Component [Controller connector] | PIN |
|---|---|---|---|
| CmSpdSens ECU Connector 2 | 66 | CmSpdSens ECU Connector 2 | 65 |

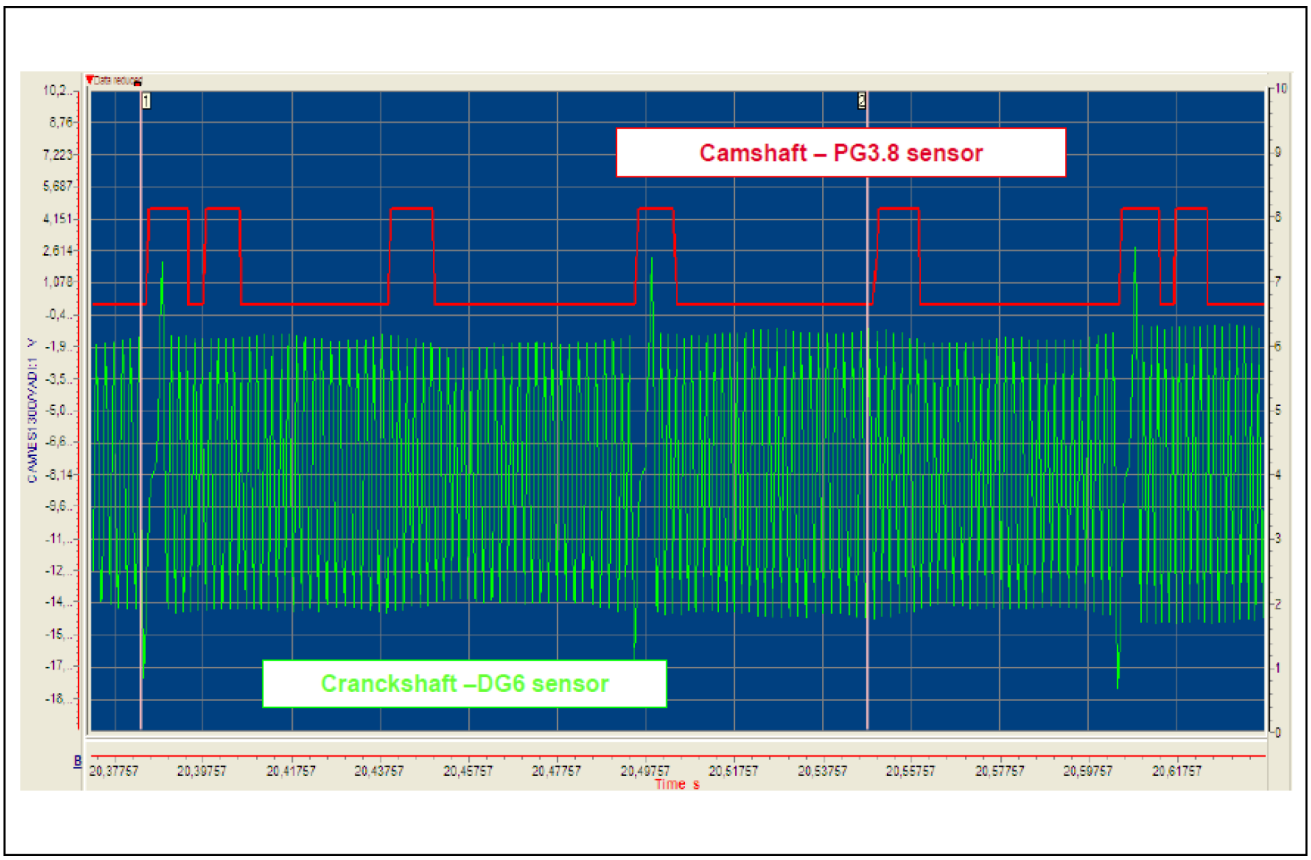
4. Check the synchronisation of the camshaft and crankshaft, following the correct graph according to the sensor fitted.
   A. The Camshaft and Crankshaft speed sensors' outputs should have a similar wave shape to the figure below:
   B. If the synchronization is OK, go to step **6**.
   C. If the synchronization is NOT OK, go to step **5**.




NHIL25ENG0530FA 1

***NOTE:*** *the graph shows the purpose of the signal Camshaft and crankshaft sensors output signals comparison (sync in low idle speed).*

| Item | Description |
|---|---|
| A | Crankshaft speed sensor |
| B | Camshaft speed sensor |




NHIL25ENG0531FA 2

***NOTE:*** *the graph shows the purpose of the signal Comparison of camshaft and crankshaft sensor output signals with Hall effect sensor (synchronisation at low idle speed).*

| Item | Description |
|---|---|
| A | Camshaft speed sensor |
| B | Crankshaft speed sensor |

***NOTE:*** *The maximum allowed output voltage peaks for the speed sensor is according to the control unit interface definition: V "out" less than* ***100 V*** *and exceeding* ***–100 V****.*

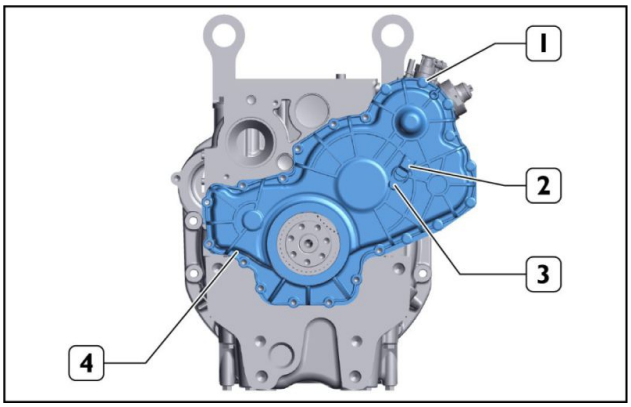
5. Possible root cause
   - Wrong mechanical trimming.
   - The sensor is loosely fitted to the engine.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

6. The camshaft and crankshaft synchronization works properly.

# Engine timing sensors - Disassemble - Timing gear cover [113469254 - V1 - 07 March 2025]

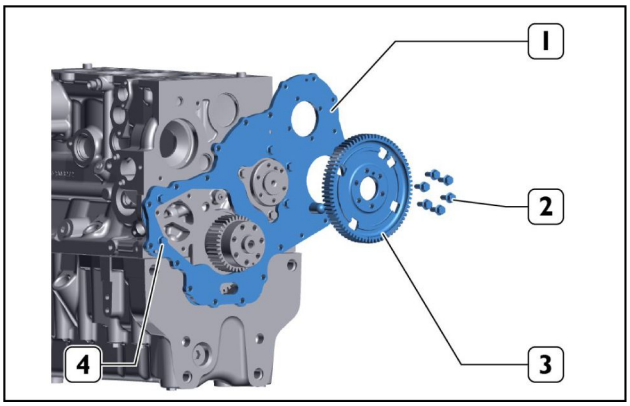
1. Unscrew the screw **(3)** and remove the camshaft timing sensor **(2)**.
2. Unscrew the screws **(1)** and remove the timing gear case **(4)** , recovering the relevant gasket.




NHIL25ENG0136FA 1

# Engine timing sensors - Remove - Timing gear removal [113469255 - V1 - 27 February 2025]

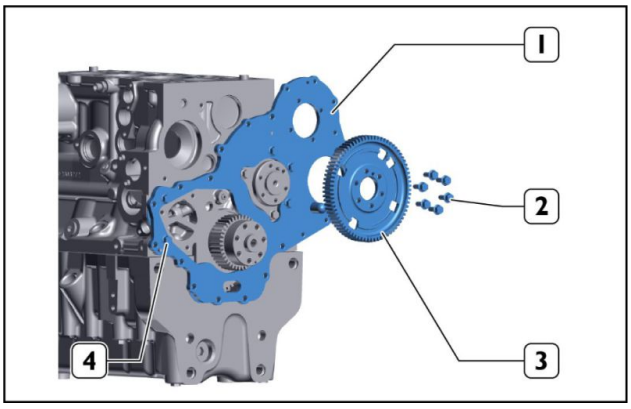
1. Unscrew the screws **(2)** and remove the timing gear **(3)**.
2. Unscrew the screws **(4)** and remove the spacer **(1)** recovering the relevant gasket.




NHIL25ENG0140FA 1

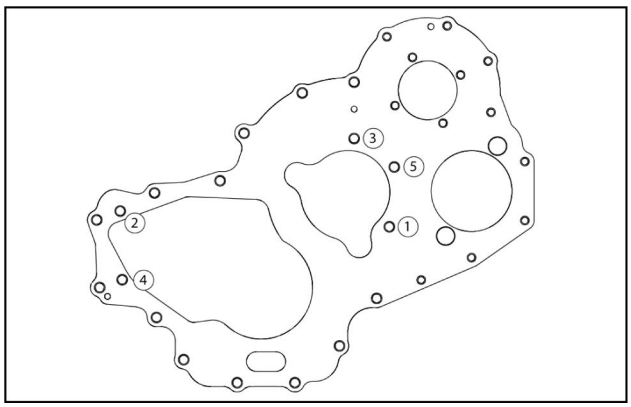
# Engine timing sensors - Assemble - Timing gear [113469256 - V1 - 06 March 2025]

1. Fit the spacer **(1)** on the crankcase, inserting a new gasket and tightening the fastening screws **(4)** to the specified torque.




NHIL25ENG0162FA 1

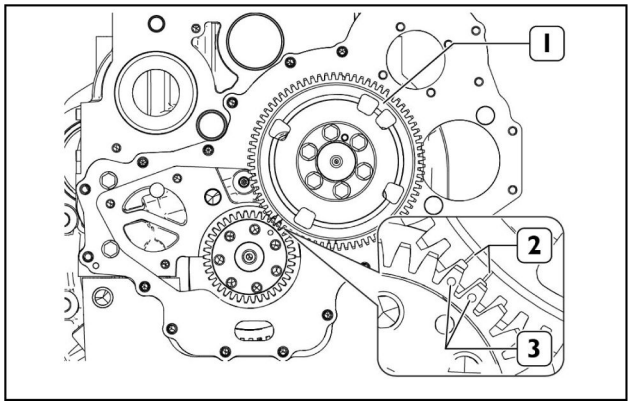
2. Tighten the fastening screws **(4)** in the sequence shown in the figure.
3. Install the timing gear **(3)** tighten the fastening screws **(2)** to the specified torque.




NHIL25ENG0163AA 2

| Description | Quantity | Step | Value |
|---|---|---|---|
| Timing gear | 6 screws M8 x 1.25 x 20 | | **34 +/- 3.4 N·m** |

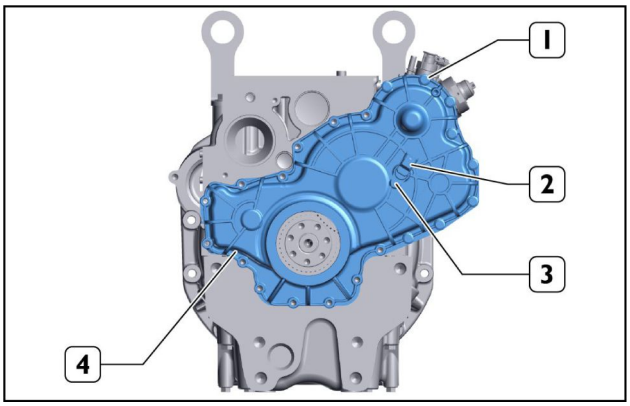
4. In order for the engine to be timed, you must position the camshaft gear **(1)** so that its notches **(2)** correspond with the notches **(3)** on the crankshaft.




NHIL25ENG0164FA 3

# Engine timing sensors - Assemble - Timing gear assembly cover mounting [113469257 - V1 - 07 March 2025]

1. Correctly position a new gasket and install the timing gear case **(4)** tightening the fastening screws **(1)** to the specified torque and according to the sequence shown in the figure.

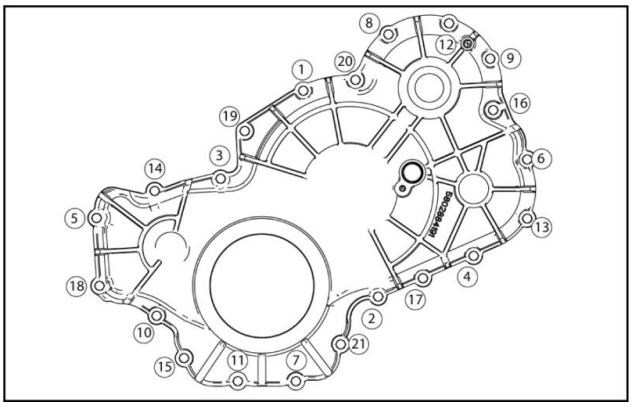



NHIL25ENG0169FA 1

| Description | Step | Value |
|---|---|---|
| Timing gearbox | 13 screws M8 x 1.25 x 25 | **23 +/- 2.3 N·m** |
| | 13 screws M8 x 1.25 x 35 | **23 +/- 2.3 N·m** |

2. Install the camshaft timing sensor **(2)** and tighten the fastening screw **(3)** to the specified torque.

| Description | Quantity | Value |
|---|---|---|
| Camshaft timing sensor | 1 screw M6 x 1 x 16 | **9 +/- 0.9 N·m** |




NHIL25ENG0170AA 2

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## Engine starting system - 201

**F6AFL413A*U001**

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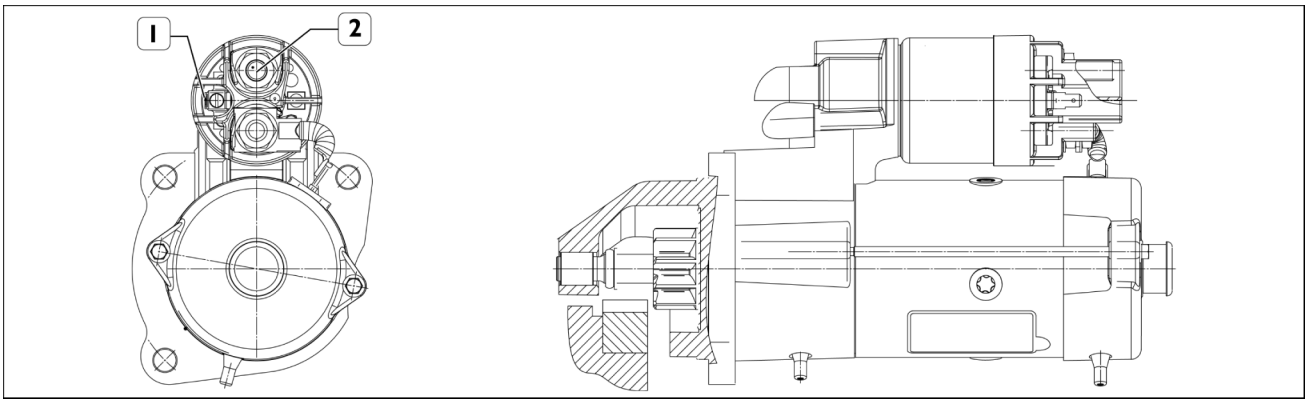
# Engine starter - Overview - Starter motor [113437958 - V1 - 07 March 2025]

## Technical view



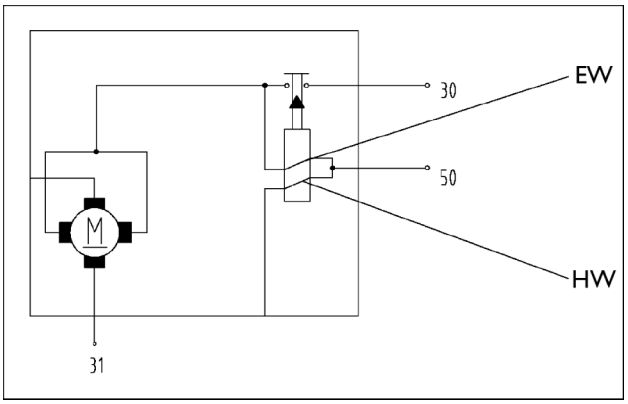

NHIL25ENG0436EA 1

| Item | Description |
|---|---|
| 1 | Terminal 50 |
| 2 | Terminal 30 |
| 3 | Terminal 31 |

## Electric diagram

EW: PULL-IN WINDING

HW: HOLD-ON WINDING

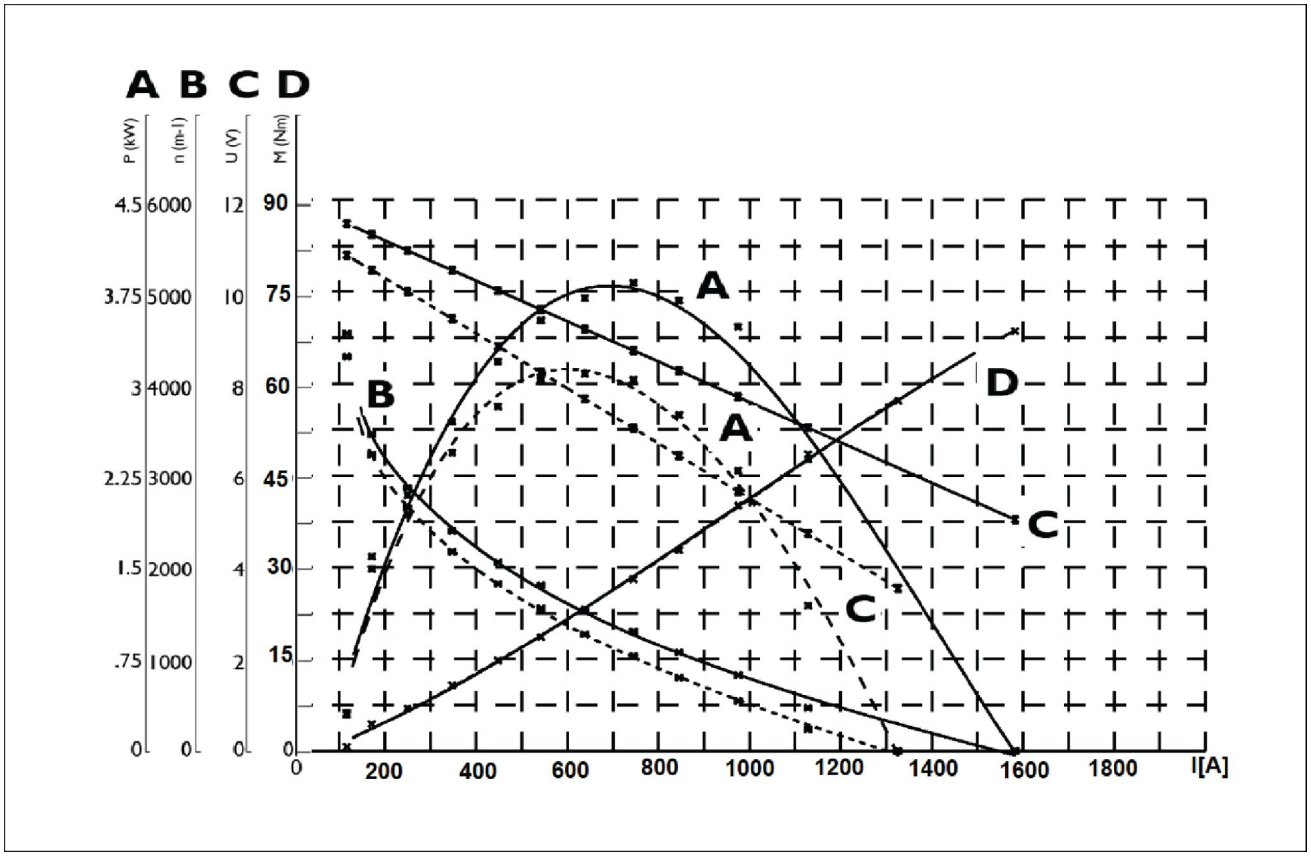



NHIL25ENG0437AA 2

## Tightening torques

| Technical data | |
|---|---|
| M10 nut (terminal 30) | 15 ±3 |
| M10 nut (terminal 50) | **5.8 ± 1 N·m** |
| M10 nut (terminal 31) | **12 ± 1 N·m** |

## Characteristic curves

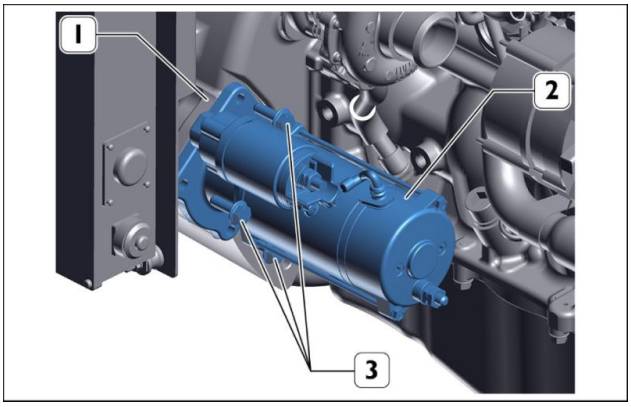



NHIL25ENG0438FA 3

| Technical data | |
|---|---|
| Rated Voltage | **12 V** |
| Power | **3.2 kW** (**4.4 hp**) |

# Engine starter - Remove - Complete starter motor [113437959 - V1 - 20 February 2025]

1. . Make sure that the electric starter motor **(3)** is suitably supported.
2. Unscrew the fastening screws **(2)** and remove the electric starter motor **(3)** from the flywheel housing **(1)**.

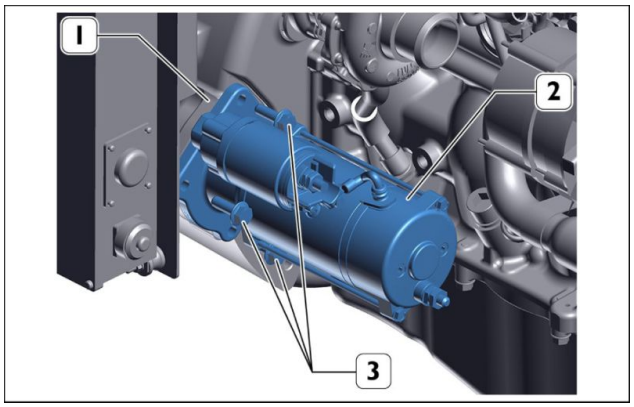



NHIL25ENG0439FA 1

# Engine starter - Install - Complete starter motor [113437960 - V1 - 07 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Starter motor | 3 screws M10 x 1.5 | **45 +/- 4.5 N·m** |

1. Fit the electric starter motor **(3)** in the flywheel housing **(1)**.
2. Tighten the fastening screws **(2)** to the specified torque.




NHIL25ENG0439FA 1

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# Electrical systems - 55

## Alternator - 301

**F6AFL413A*U001**

# Contents

## Electrical systems - 55

### Alternator - 301


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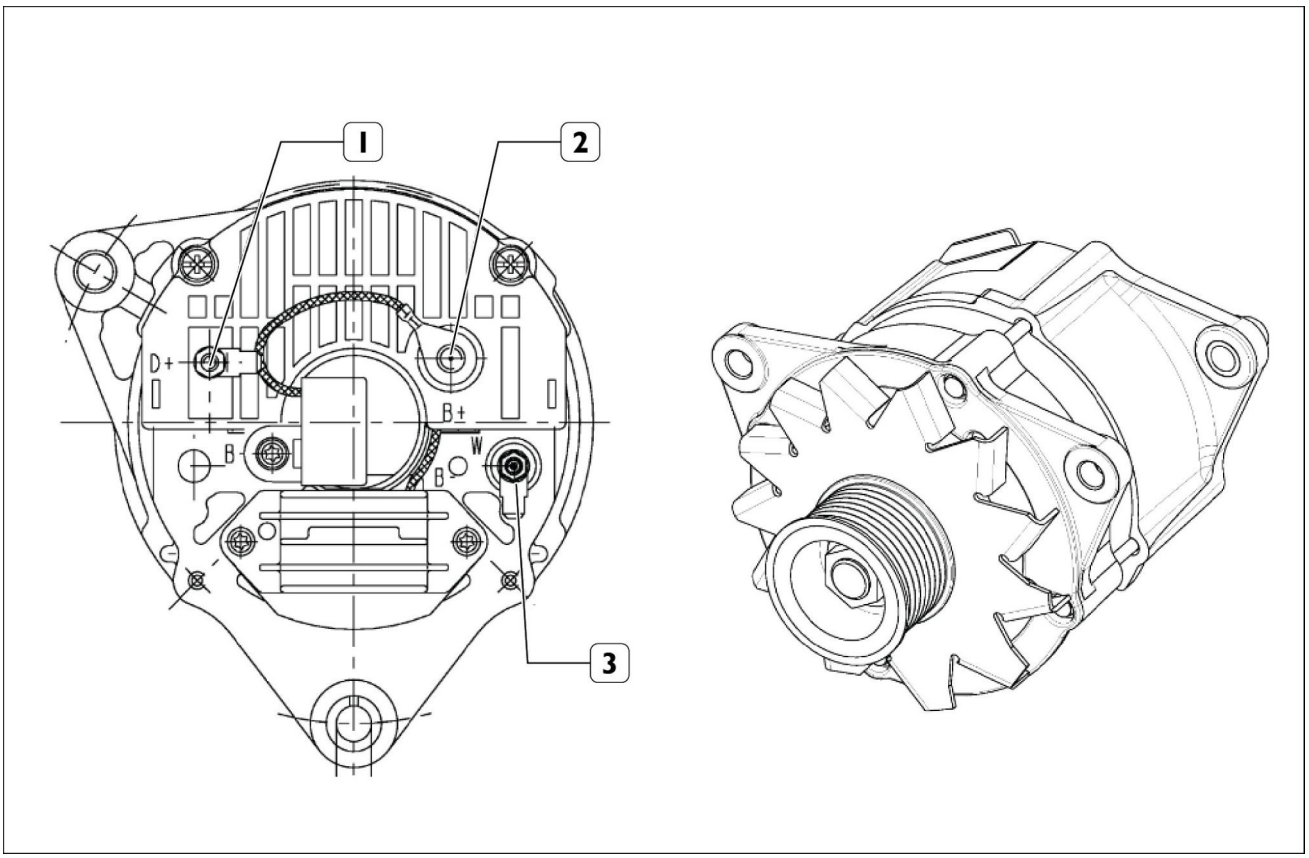
# Alternator - Overview [113437942 - V1 - 07 March 2025]

It is located at the front on the right-hand side of the engine and is driven by the ancillary belt.

## Technical view

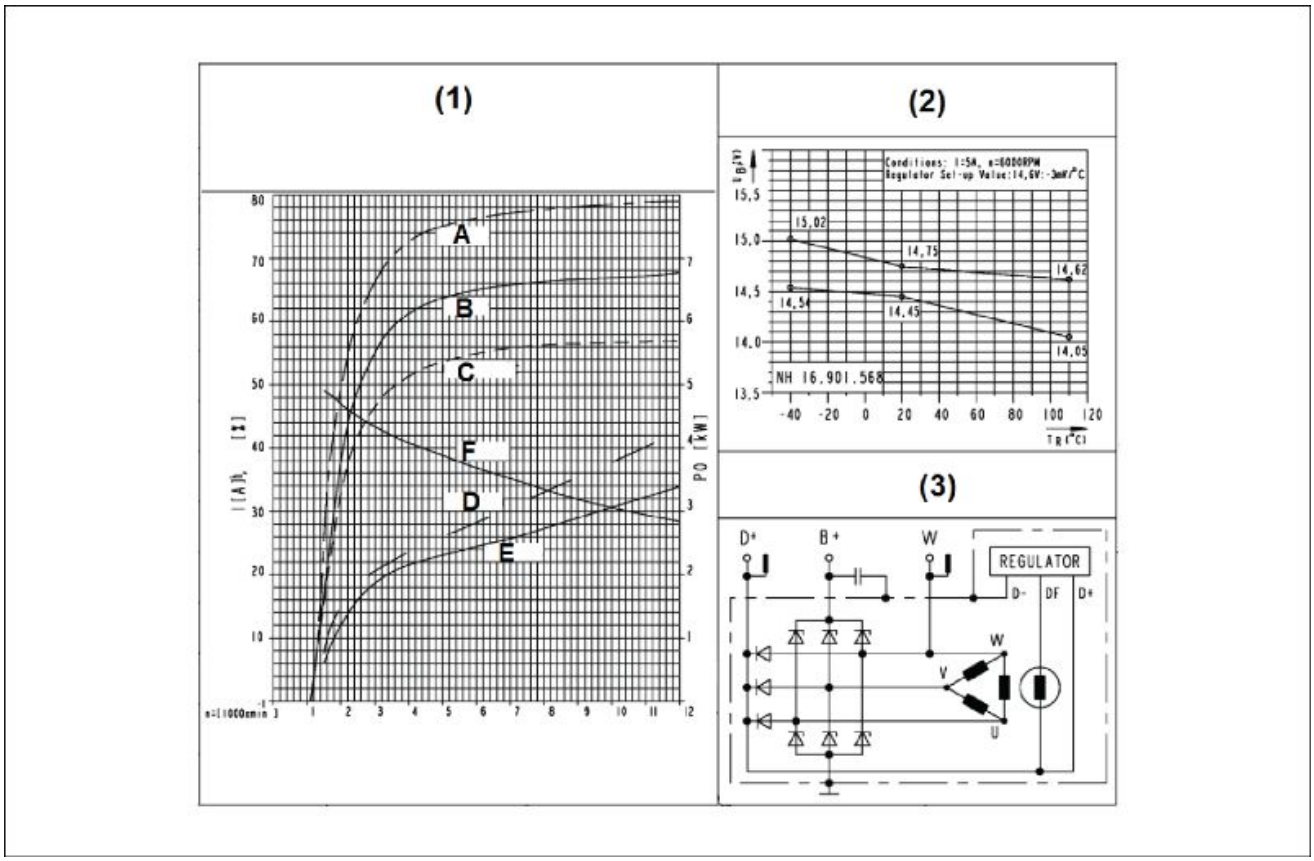



NHIL25ENG0433TA 1

**Terminals available**

1. Terminal **(D+)**
2. Terminal **(B+)**
3. Terminal **(W)**

## Characteristic curves, adjustment curve and wiring diagram




NHIL25ENG0434FA 2

| Item | Description |
|---|---|
| 1 | Characteristic curve; |
| 2 | Adjustment curve; |
| 3 | Wiring diagram |

Characteristic curves

A. Current curve **(A)** when cold.
B. Current curve **(A)** when hot.
C. Current curve **(A)** when hot **110 °C** (**230 °F**).
D. Power curve **(kW)** when cold.
E. Power curve **(kW)** when hot.
F. Efficiency curve **(%)**.

## Characteristics

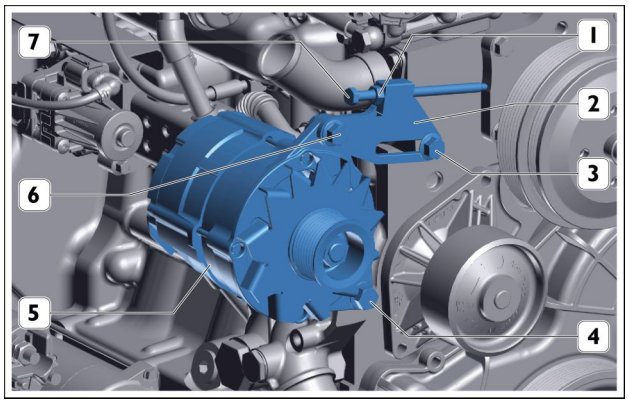
Sense of rotation: clockwise

| Technical data | |
|---|---|
| Rated voltage | **14 V** |
| Nominal current supply | **65 A** |
| Maximum continuous speed | **≤ 15.000 RPM** |
| Operating temperature range | **-40 – 110 °C** (**-40 – 230 °F**) |

# Alternator - Remove [113437943 - V1 - 07 March 2025]

**Prior operation:**
**Radiator to water pump hoses - Remove - Water pump drive belt (10.400)**.

1. Unscrew the fastening screws **(3)** and **(6)** and remove the tensioning bracket **(2)** from the crankcase.
2. Unscrew the anchoring bolt **(4)** and remove the alternator **(5)** from its lower support mount.

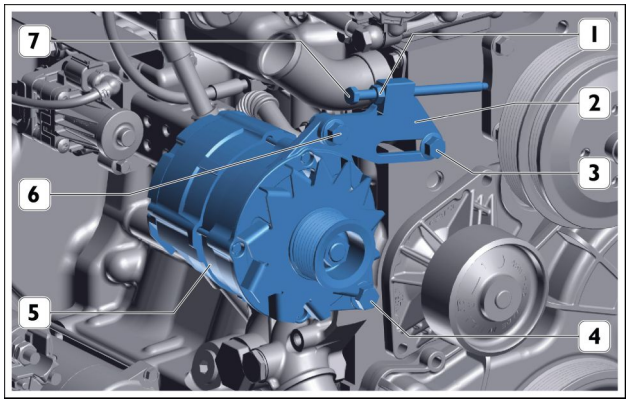



NHIL25ENG0435TA 1

# Alternator - Install [113437944 - V1 - 07 March 2025]

| Description | Step | Value |
|---|---|---|
| Alternator | 1 screw M10 x 1.5 x 130 + 1 nut M10 x 1.5 | **45 +/- 4.5 N·m** |
| Alternator tensioning bracket | 2 screws M10 x 1.5 x 25 + 2 nuts M10 x 1.5 | **45 +/- 4.5 N·m** |

1. Position the alternator **(5)** in its seat and anchor it with the bolt **(4)** to its lower mount.
2. Fix the tensioning bracket **(2)** to the crankcase, tightening the fastening screws **(3)** and **(6)** to the prescribed torque.




NHIL25ENG0435TA 1

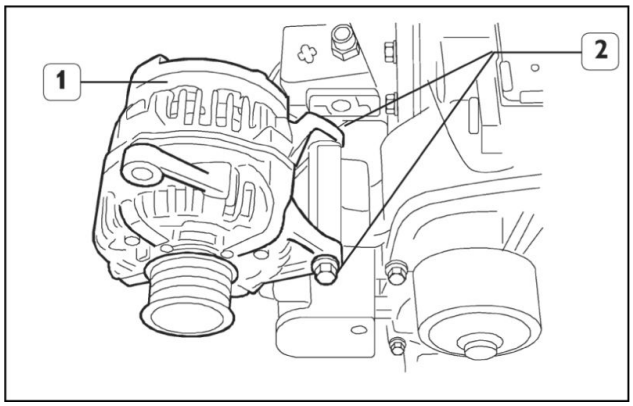
**Next operation:**
**Radiator to water pump hoses - Install - Water pump drive belt (10.400)**

# Alternator - Visual inspection [113437945 - V1 - 07 March 2025]

1. Only continue with the engine switched off.
2. Visually check that the alternator is not damaged, in which case it must be replaced.
3. Check there are no unusual noises while the engine is running.
4. Check that the alternator fastening bolts are correctly tightened.
5. Inspect the connection of the battery cable on the rear side of the alternator. Make sure it is clean and correctly tightened.

# Alternator - Remove [113469160 - V1 - 26 February 2025]

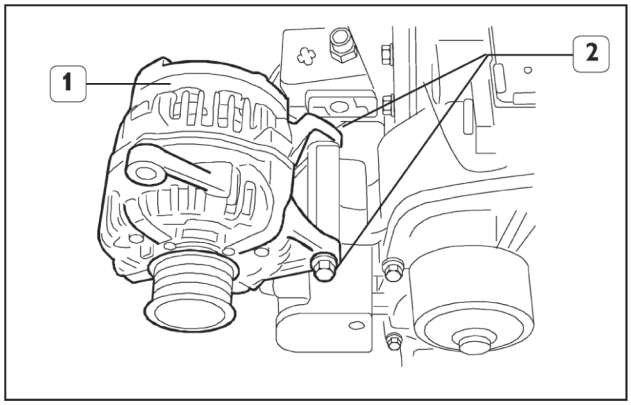
1. Firmly hold the alternator **(1)** and remove it from the relevant mount by loosening the screw **(2)**: recover the nut and the washer.




NHIL25ENG0105AA 1

# Alternator - Assemble [113471299 - V1 - 03 March 2025]

1. Put the alternator **(1)** back into its original position.
2. Screw in but do not tighten **(2)**.




NHIL25ENG0204AA 1

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## Cold start aid - 202

**F6AFL413A*U001**

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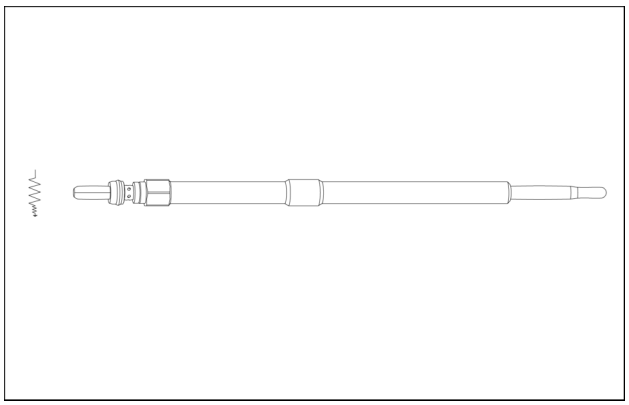
Assemble - Glow plug wiring . . . . . 16

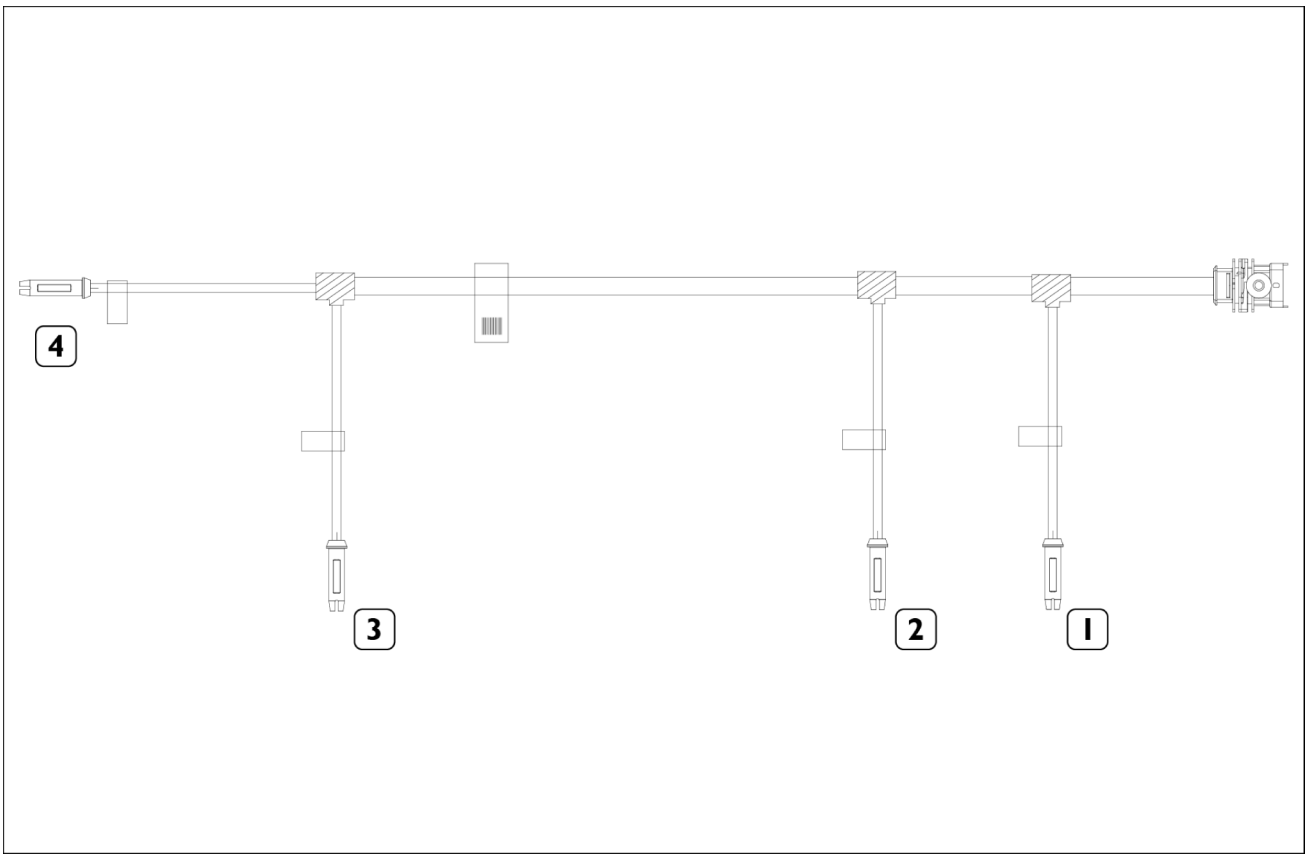
# Glow plug system - Overview - Preheater plugs [113437965 - V1 - 07 March 2025]

## Pre-heating glow plugs



NHIL25ENG0440AA 1

**Incandescent elements used to reach the conditions for triggering combustion when the engine is cold.**




NHIL25ENG0441FA 2

| Item | Description |
|---|---|
| 1 | Glow plug 1 |
| 2 | Glow plug 2 |
| 3 | Glow plug 3 |
| 4 | Glow plug 4 |

The glow plug bridle connects the pre-heating glow plugs to the engine control unit.

# Glow plug system - Prepare - Spark plug heater [113408027 - V1 - 26 February 2025]

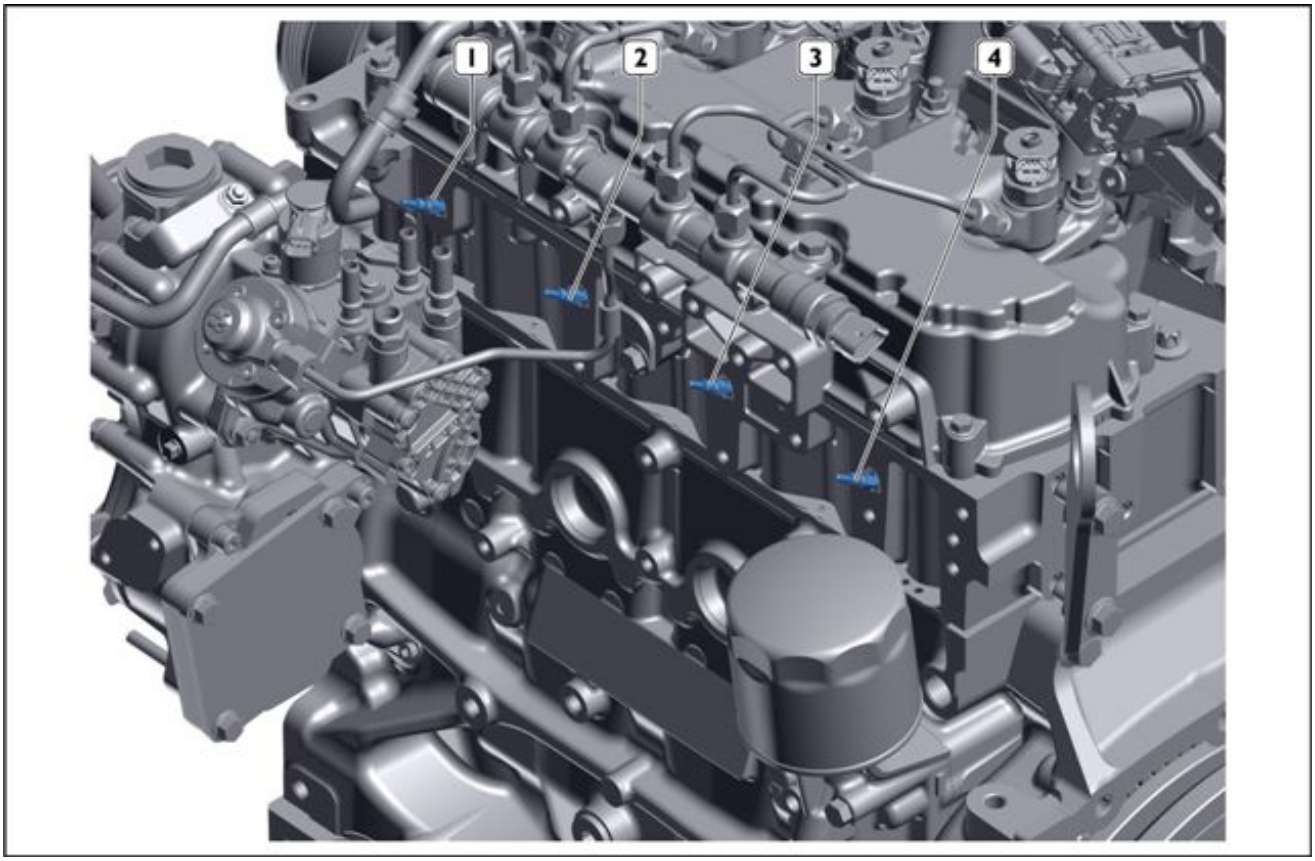
## Preparation

- Ignition switch set OFF position

# Glow plug system - Check - Spark plug heater [113408029 - V1 - 12 February 2025]

## Visual check of glow plugs

1. Visual check of glow plugs
   - Check if the glow plugs are fitted correctly.
   - Remove the glow plugs from their housing.
   - Check there is no damage to the glow plug.
   - See figure below for explanation and go to step **2**.




NHIL25ENG0527FA 1

**Location of the glow plug**

| Item | Description |
|---|---|
| 1–4 | Pre-heating glow plug |

2. Glow plugs check.
   A. Glow plugs fitted correctly.
   B. Glow plugs neither faulty nor damaged.
   C. If the glow plugs are efficient, go to step **Glow plug system - Check - Spark plug heater (55.202)**.
   D. If the glow plugs are NOT efficient, go to step **3**.
3. Possible root cause
   - The electrical connection from the relay to the glow plugs could be damaged.
   - Glow plugs faulty or damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Glow plug system - Check - Spark plug heater [113408035 - V1 - 26 February 2025]

1. General checks
   - Battery voltage is sufficient.
   - Component related fuses are OK.
   - Connectors/plugs OK. No loose contact or corrosion.
   - Offboard tool Diagnosis tester.

## Preparation

2. - Connect the diagnostic tester.
   - Start the engine.
   - Carry out the run up test as per the instructions from the diagnostic tester.
3. - Press the start button.
   - Check and verify activation of the glow plug (measure the current flow on the wiring with a current clamp).
   - Go to step **4**.
4. Glow plug activation check
   A. Measurable current flow during activation
   B. Increase in temperature of the glow plugs.
   C. If the glow plugs are efficient, go to step **6**.
   D. If the glow plugs are NOT efficient, go to step **5**.
5. Possible root cause
   - Communication loss with diagnosis tester.
   - The electrical connection from the relay to the glow plugs could be damaged.
   - Glow plug faulty or damaged.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

6. The glow plugs are working correctly.

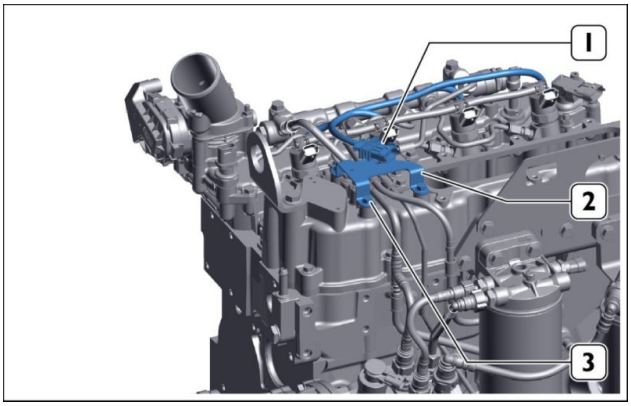
# Glow plug system - Remove - Pipes [113434483 - V1 - 05 March 2025]

**Prior operation:**
Disconnect the engine cable as described in the procedure **Engine wiring harness - Remove - Engine cables (55.015)**.

## Removal of fuel pipes

## Glow plug wiring removal

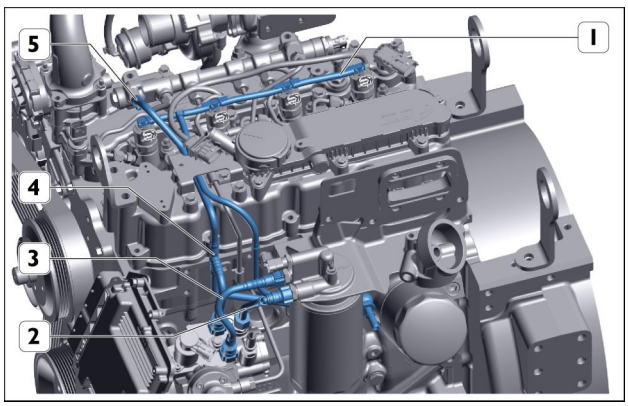
1. Disconnect the glow plug wiring **(1)**, paying attention to the special stop.
2. Unscrew the screws **(3)** and remove the glow plug wiring retain bracket **(2)**.




NHIL25ENG0347FA 1

## Low pressure fuel pipes removal

3. Disconnect the low pressure fittings and remove the fuel pipes from the filter to the high pressure pump **(3)** and from the high pressure pump to the filter **(2)**.
4. Unscrew the fastening screws and remove the retaining brackets of the fuel return pipes **(5)** and **(4)** from the common rail and from the high pressure pump. Disconnect the low pressure fittings. Remove the pipes.
5. Unscrew the fastening screws and remove the retaining brackets of the fuel return pipe from the injectors **(1)**. Disconnect the low pressure fittings and remove the pipe **(1)**.

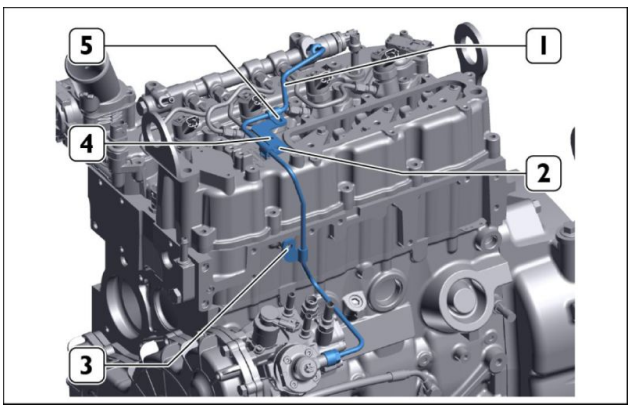



NHIL25ENG0348TA 2

## Removal of delivery fuel pipe to rail

6. Unscrew the fastening screws **(2)**, **(3)**, **(4)** and **(5)** and remove the retainer brackets of the fuel delivery pie **(1)**.
7. Unscrew the fittings and remove the fuel delivery pipe **(1)** from the high pressure pump to the rail.

***NOTE:*** *The high pressure fuel delivery pipe must always be replaced each time it is removed.*

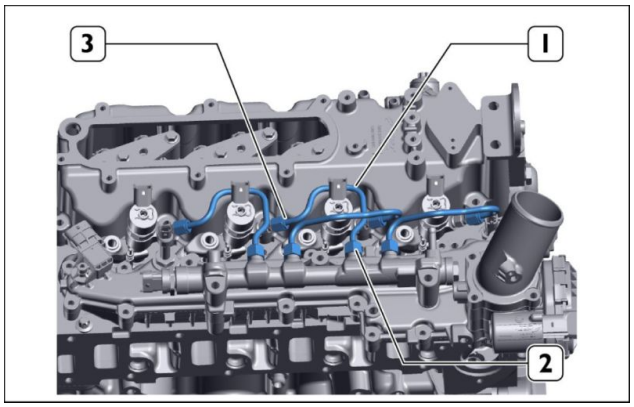



NHIL25ENG0349TA 3

## Removing the fuel delivery pipe from rail to injectors

8. Remove the high pressure fuel delivery pipes **(1)** by loosening first the nuts on injector side **(3)** and then the nuts on Common Rail side **(2)**.

***NOTE:*** *The high pressure fuel delivery pipes must be replaced with new ones whenever they are removed.*




NHIL25ENG0350FA 4

# Glow plug system - Install - Pipes [113434484 - V1 - 05 March 2025]

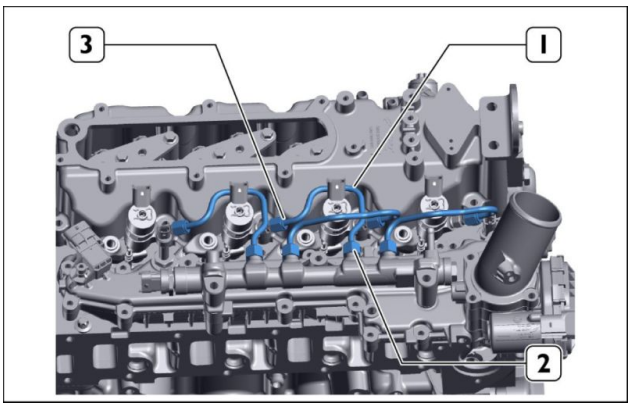
| Description | Quantity | Step | Value |
|---|---|---|---|
| Bracket retaining the delivery fuel pipe from the pump to the rail | 3 screws M6 x 1 x 10 | | **10 +/- 1 N·m** |
| Bracket retaining the fuel return pump from the rail and from the high pressure pump | | 1 screw M6 x 1 x 16 | **10 +/- 1 N·m** |
| Delivery fuel pipe from the pump to the rail | | 1 high pressure fuel pump-side coupling M16 x 1 | **45 +/- 2.25 N·m** |
| | | 1 rail-side coupling M14 x 1.5 | **35 +/- 1.75 N·m** |
| Fuel delivery pipes to the electro-injectors | 4 rail-side couplings M14 x1.5 | | **35 +/- 1.75 N·m** |
| Fuel pipe fittings between the pump and filter | M10 x 1.5 x 18 | | **25 +/- 2.5 N·m** |
| Glow plug harness mount | 3 screws M6 x 1 x 14 | | **10 +/- 1 N·m** |
| Injector fuel return pipe brackets | | 1 screw M8 x 1.25 x 18 | **23 +/- 2.3 N·m** |

## Refitting the fuel pipes

## Fuel delivery pipe assembly rail to the injectors

1. Fit the high pressure fuel delivery pipes **(1)** and manually position first the common rail side nuts **(2)** and then the injector side nuts **(1)** up near then.
2. First tighten the common rail side nuts **(2)** and then the injector side nuts **(3)** in two steps to the prescribed torque.

***NOTE:*** *The high pressure fuel delivery pipes must be replaced each time they are disconnected.*



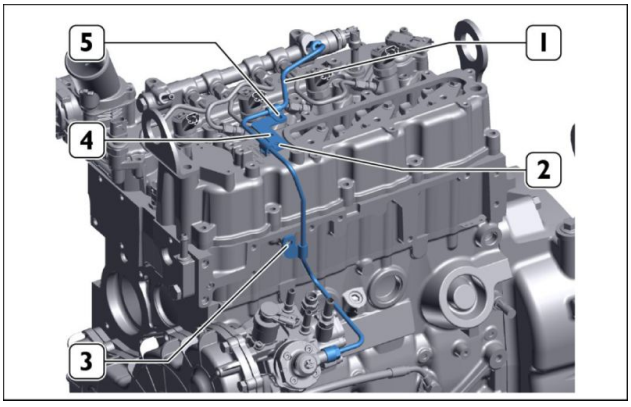

NHIL25ENG0350FA 1

## Fuel delivery pipe assembly

3. Fit the fuel delivery pipe **(1)** from the high pressure pump to the rail and tighten the couplings to the prescribed torque.

***NOTE:*** *The high pressure fuel delivery pipe must always be replaced each time it is removed.*

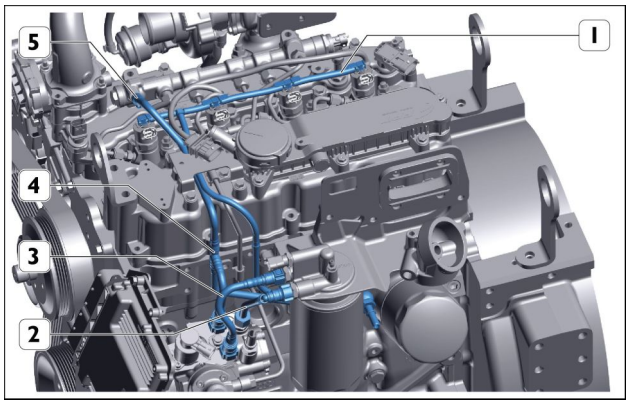
4. Install the fuel delivery pipe retaining brackets **(1)** and tighten the fastening screws **(2)**, **(3)**, **(4)** and **(5)** to the specified torque.




NHIL25ENG0349TA 2

## Assembly of the low-pressure fuel pipes

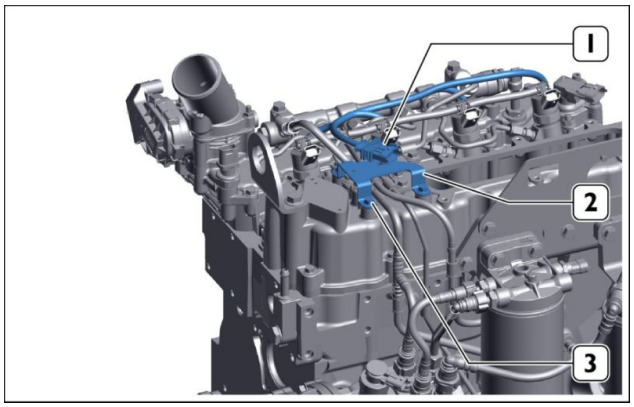
5. Connect the low pressure fittings and fit the fuel pipes from the filter to the high pressure pump **(3)** and from the high pressure pump to the filter **(2)**.
6. Connect the low pressure fittings of the fuel return pipes **(5)** and **(4)** from the common rail and from the high pressure pump. Tighten the fastening screws and fit the retaining brackets.
7. Connect the low pressure fittings and fit the fuel return pipe from the injectors **(1)**. Mount the retaining brackets of the fuel return pipe from the injectors **(1)** and tighten the fastening screws.




NHIL25ENG0348TA 3

## Glow plug wiring assembly

8. Fit the bracket **(2)** retaining the glow plug wiring and tighten the screws **(3)** to the prescribed torque.
9. Install the glow plug wiring **(1)** and fix it using the retaining clip.



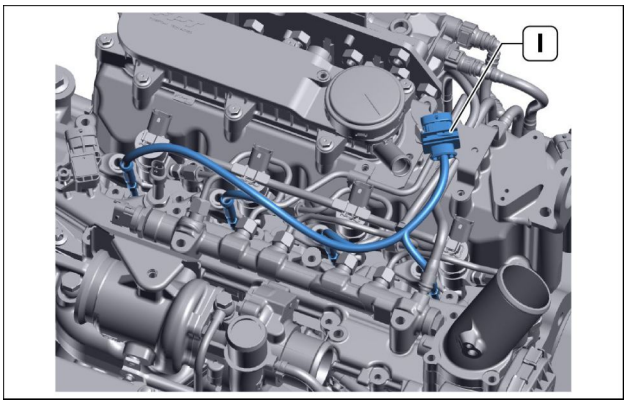

NHIL25ENG0347FA 4

**Next operation:**
Connect the engine cable as described in the procedure **Engine wiring harness - Install - Engine cables (55.015)**.

# Glow plug system - Remove - PREHEATER PLUGS [113437967 - V1 - 07 March 2025]

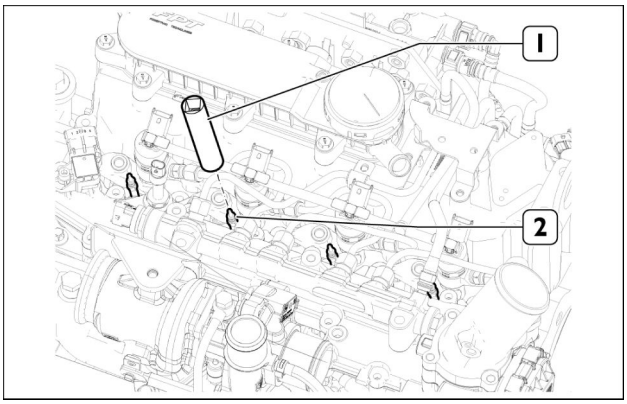
| Tool / Material | |
|---|---|
| Socket wrench ( **8.0 mm** (**0.3 in**) ) for removing and refitting glow plugs | SP2275 |

1. Remove the glow plug wiring **(1)**.




NHIL25ENG0442TA 1

2. Unscrew the glow plug **(2)** using the tool **(1)**.



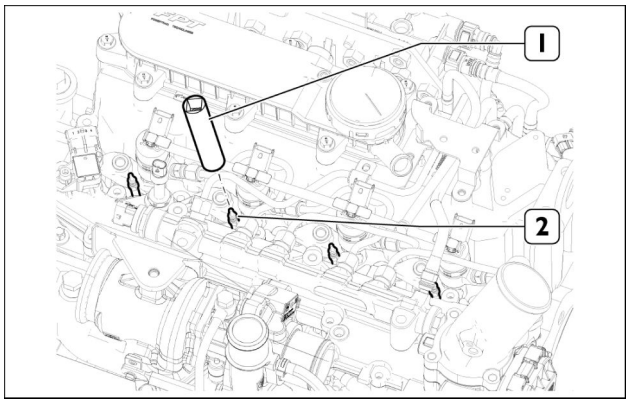

NHIL25ENG0443FA 2

# Glow plug system - Install - Preheater plugs [113437968 - V1 - 07 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Pre-heating glow plugs | 4 glow plugs M8 x 1 | **9 +/- 1 N·m** |

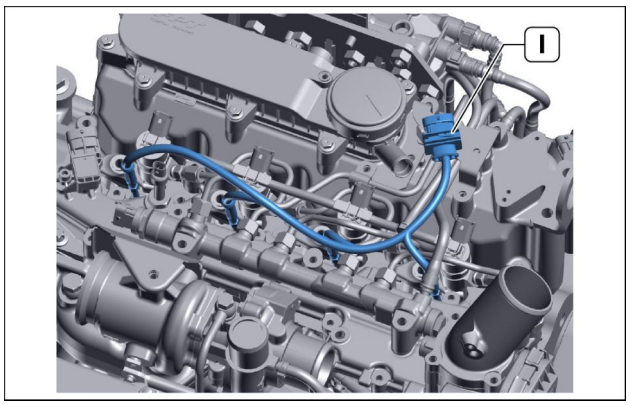
| Tool / Material | |
|---|---|
| Socket wrench ( **8.0 mm** (**0.3 in**)) for removing and refitting glow plugs | SP2275 |

1. Tighten the glow plug **(1)** with the tool **(2)** , to the prescribed torque.




NHIL25ENG0443FA 1

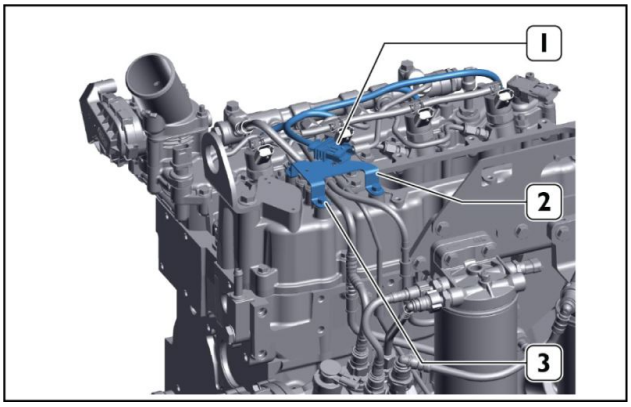
2. Install the wiring **(1)** for the glow plugs.




NHIL25ENG0442TA 2

# Glow plug system - Remove - Glow plug wiring [113469195 - V1 - 07 March 2025]

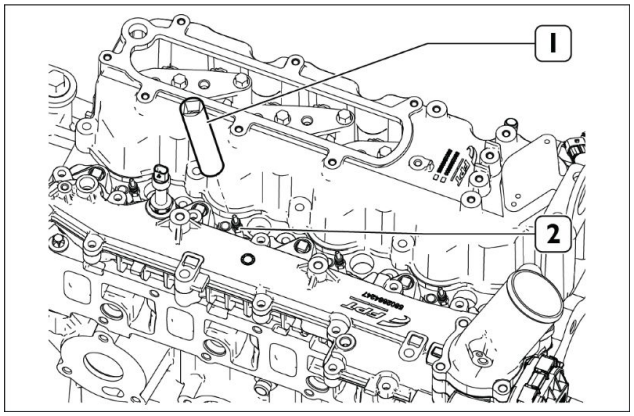
1. Disconnect the glow plug wiring **(1)** , paying attention to the special stop.
2. Unscrew the screws **(3)** and remove the glow plug wiring retain bracket **(2)**.




NHIL25ENG0118FA 1

# Glow plug system - Remove - Pre-heating plugs [113469205 - V1 - 07 March 2025]

1. Unscrew the glow plug **(2)** using the tool **(1)**.

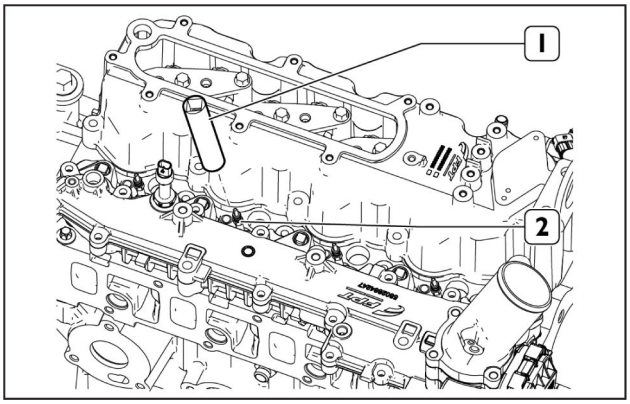



NHIL25ENG0128FA 1

| Tool / Material | |
|---|---|
| Socket wrench ( **8.0 mm** (**0.3 in**)) for removing and refitting glow plugs | SP2275 |

# Glow plug system - Assemble - Pre-heating glow plug [113470135 - V1 - 28 February 2025]

1. Tighten the glow plug **(2)** using the tool **(1)**, to the specified torque.



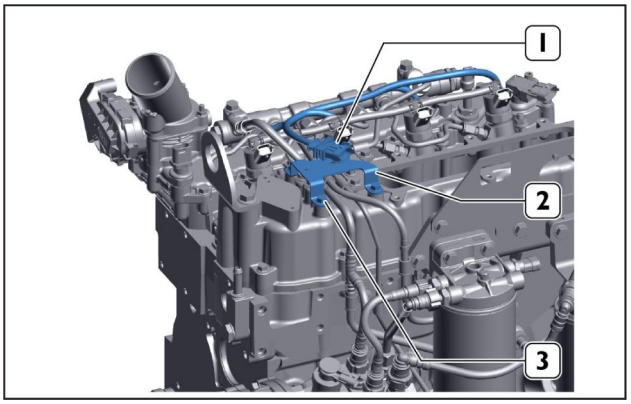

NHIL25ENG0181FA 1

| Tool / Material | |
|---|---|
| Socket wrench (8 mm) for removing and refitting glow plugs | SP2275 |

| Description | Quantity | Value |
|---|---|---|
| Pre-heating glow plugs | 4 glow plugs M8 x 1 | **9 +/- 1 N·m** |

# Glow plug system - Assemble - Glow plug wiring [113470136 - V1 - 28 February 2025]

1. Fit the bracket **(2)** retaining the glow plug wiring and tighten the screws **(3)** to the prescribed torque.




NHIL25ENG0191TA 1

| Description | Step | Value |
|---|---|---|
| Glow plug harness mount | 3 screws M6 x 1 x 14 | **10 +/- 1 N·m** |

2. Install the glow plug wiring **(1)** and fix it using the retaining clip.

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## Fuel injection system - 010

**F6AFL413A*U001**

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# Fuel temperature sensor - Overview - Fuel temperature sensor [113435237 - V1 - 06 March 2025]

It is a variable resistance sensor. It detects the fuel temperature thus enabling the ECU to determine the fuel density and volume and adjust the delivery.

Its resistance is:

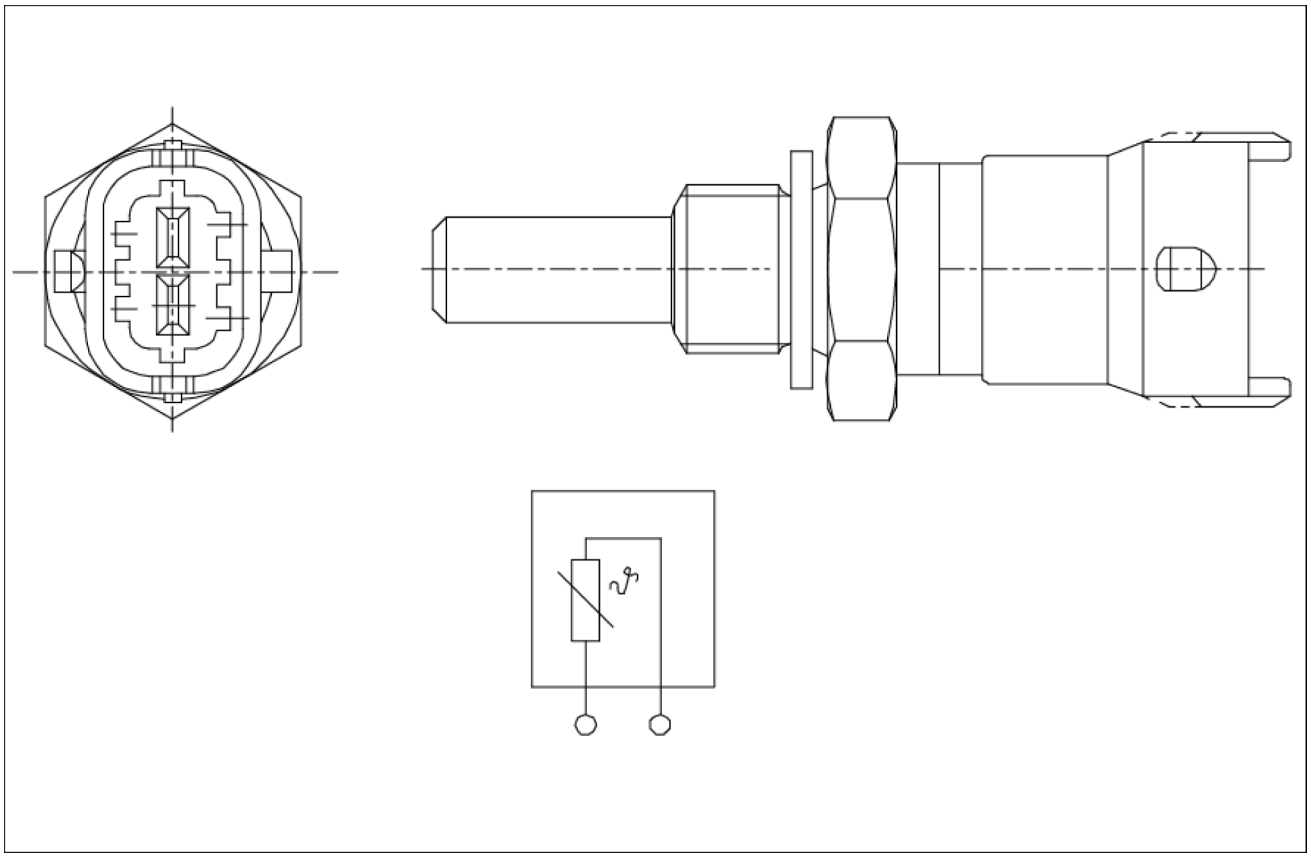
| Resistance | |
|---|---|
| Conditions: Temperature **20 °C** (**68 °F**) | **2.5 kΩ** |

The ECU controls the control contactor to heat the filter to the fuel temperature:

| Resistance | |
|---|---|
| Fuel temperature: ≤ | **5 °C** (**41 °F**) |

## Sensor pin-out

| Item | Description |
|---|---|
| 1 | Signal |
| 2 | Ground |



NHIL25ENG0399FA 1

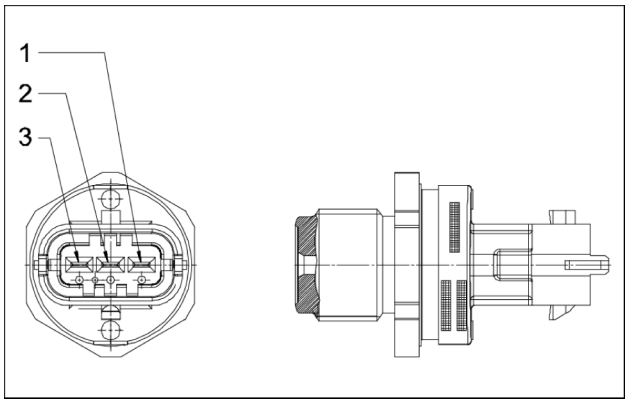
# Fuel pressure sensor - Overview - Pressure sensor [113435531 - V1 - 06 March 2025]

## Fuel pressure sensor on rail

Assembled on one end of the rail, it measures the existing fuel pressure and informs the control unit (feed - back).

The value of injection pressure is used to keep the pressure level under control and to determine the time duration of the injection electronic command.

It is powered at **5 V**.

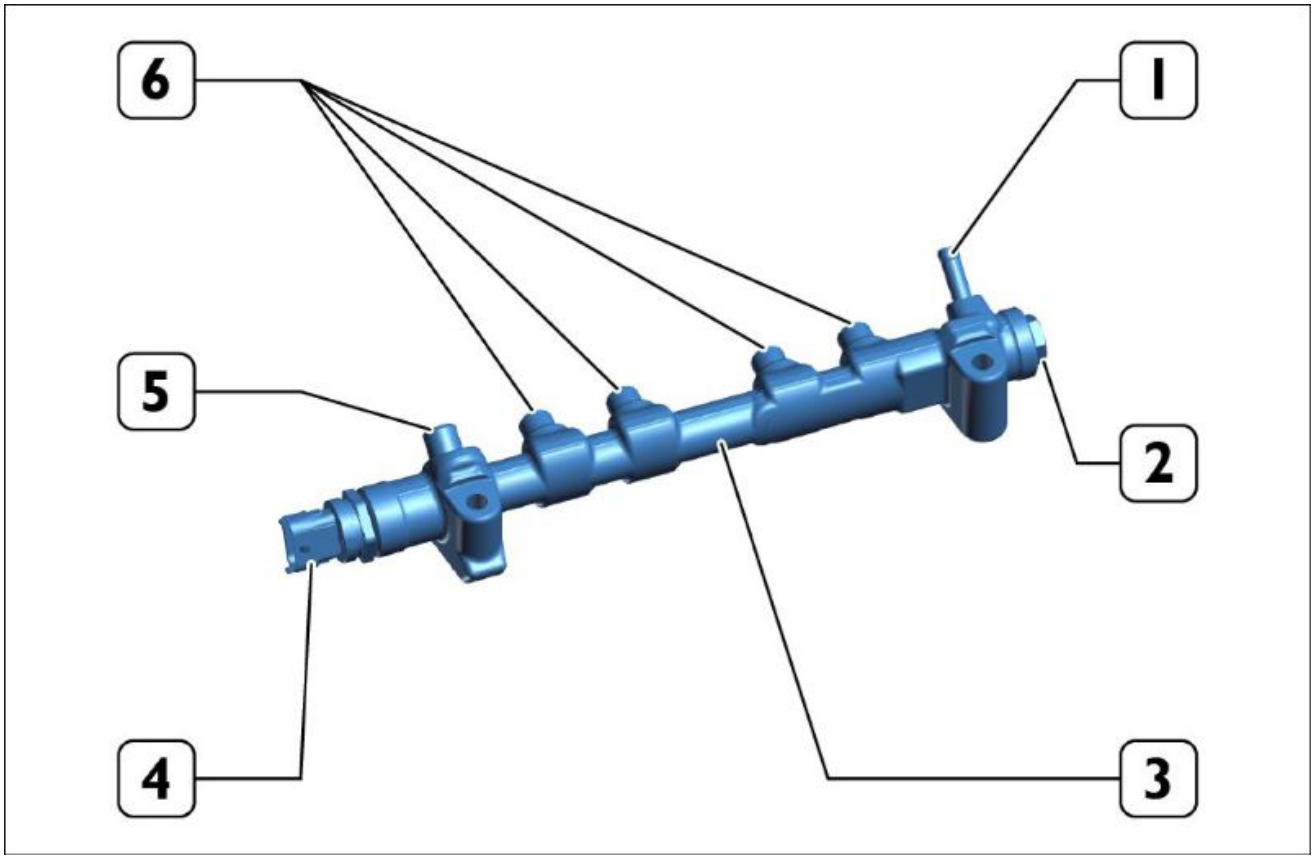



NHIL25ENG0404AA 1

| Pin | Description |
|---|---|
| 1 | Ground |
| 2 | Signal |
| 3 | Feeding |

# Common rail pressure sensor - Overview - High pressure accumulator [113435336 - V1 - 06 March 2025]

## Rail (pressure accumulator)




NHIL25ENG0403FA 1

| Item | Description |
|---|---|
| 1 | Fuel outlet towards tank |
| 2 | Overpressure valve |
| 3 | Rail |
| 4 | Pressure sensor |
| 5 | Fuel inlet from high-pressure pump |
| 6 | Fuel outlet towards the injectors |

The rail **(3)** volume is of reduced size to allow a quick pressurisation at start-up, at idle and in case of high flow-rates.

It anyway has enough volume as to minimise pulsations caused by injectors openings and closings and by the high-pressure pump operation.

This function is further enabled by a calibrated hole being set downstream of the high-pressure pump.

The throttle valves or control bushes have been fitted to the fuel delivery couplings, which control the fuel pressure waves generated by the high pressure pump.

A fuel pressure sensor **(4)** is screwed to the rail.

The signal sent by this sensor to the electronic control unit represents feed-back data, based on which the rail pressure value is checked and corrected if necessary.

## Overpressure valve

This is installed at one rail end and it protects system components should a fault in either the rail pressure sensor or the pump pressure regulator causes an excessive increase of pressure in the high pressure system.

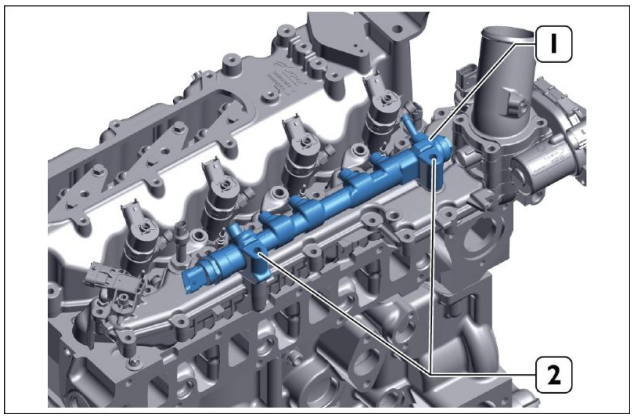
When the pressure in the rail reaches **1750.0 bar** (**25375.0 psi**), the valve initially trips to run fuel off and accordingly reduce the pressure to safe levels. It then mechanically regulates the pressure in the rail.

This valve enables to have the engine operated for long time with limited performance and inhibits fuel excessive overheating, so preserving the pipes returning from the tank.

| | |
|---|---|
| Rated pressure rail | **1600.0 bar** (**23200.0 psi**) |
| Overpressure valve opening start | **1750.0 bar** (**25375.0 psi**) |
| Complete opening of overpressure valve | **1950.0 bar** (**28275.0 psi**) |

# Fuel injection system - Remove - Rail [113469203 - V1 - 07 March 2025]

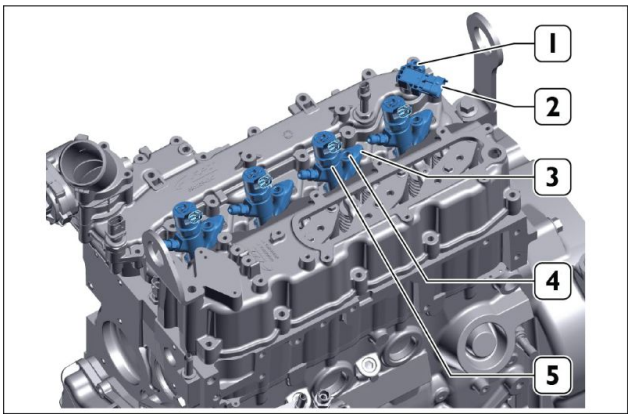
1. Unscrew the fastening screws **(2)** of the common rail **(1)**.
2. Remove the common rail **(1)**, with the rail pressure sensor and pressure limiting valve, from the intake manifold.




NHIL25ENG0126TA 1

# Fuel injection system - Remove - Injector [113469204 - V1 - 07 March 2025]

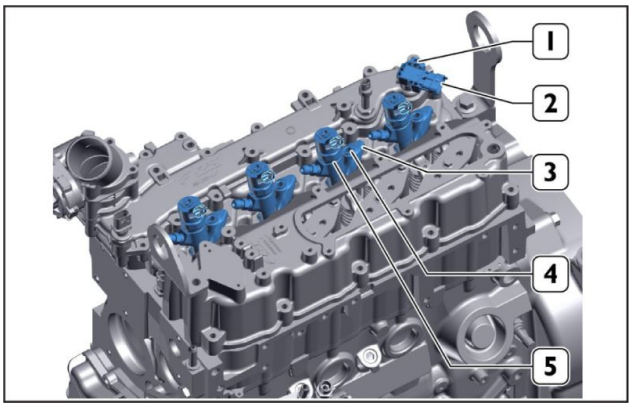
1. Unscrew the screw **(1)** and remove the air temperature and supercharging pressure sensor **(2)**.
2. Unscrew the nuts **(4)**, recovering the washers, and remove the injector **(5)**, together with the fastening bracket **(3)**, from the head and mark it with the cylinders to which it belongs.
3. Unscrew the studs housed on the head.




NHIL25ENG0127TA 1

# Fuel injection system - Assemble [113470138 - V1 - 28 February 2025]

1. Fit the studs and tighten them to the specified torque.




NHIL25ENG0182FA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Electro-injector brackets | 4 nuts M8 x1.25 | | **18 +/- 1.8 N·m** |

2. Fit the electro-injector **(5)** on the head together with the fixing bracket **(3)** and tighten the nuts **(4)**, together with their washers, to the prescribed torque.

| Description | Quantity | Step | Value |
|---|---|---|---|
| Electro-injector brackets | 4 studs M8 x 1.25 x 65 | | **28 +/- 1.4 N·m** |

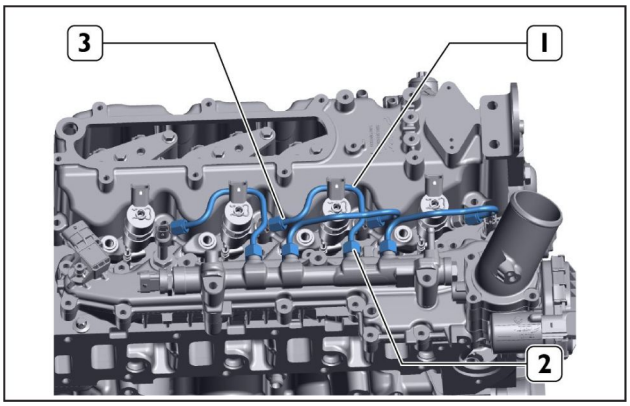
3. Fit the air temperature and boost pressure sensor **(2)** and tighten the fastening screw **(1)** to the specified torque.

| Description | Quantity | Value |
|---|---|---|
| Air temperature and pressure sensor | 1 screw M6 x 1 x 16 | **9 +/- 0.9 N·m** |

# Fuel injection system - Assemble - Fuel delivery pipe aasembly rail to the injectors [113470139 - V1 - 06 March 2025]

1. Fit the high pressure fuel delivery pipes **(1)** and manually position first the common rail side nuts **(2)** and then the injector side nuts **(1)** up near then.
2. First tighten the common rail side nuts **(2)** and then the injector side nuts **(3)** in two steps to the prescribed torque.

***NOTE:*** *The high pressure fuel delivery pipes must be replaced each time they are disconnected.*

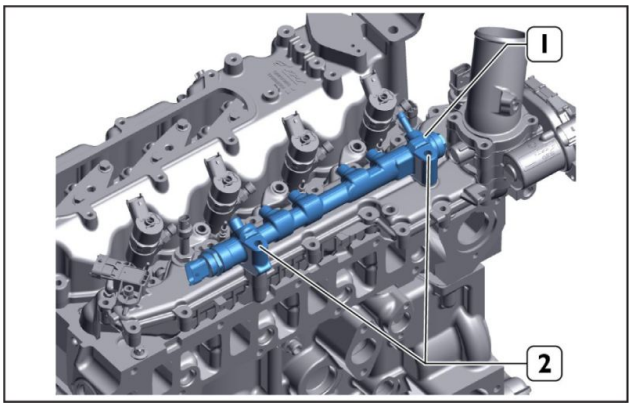



NHIL25ENG0184TA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Fuel delivery pipes to the electro-injectors | 4 railside couplings M14 x 1.5 | | **35 +/- 1.75 N·m** |

# Fuel injection system - Install - Rail Installation [113470140 - V1 - 28 February 2025]

1. Fit the common rail **(1)** together with the rail pressure sensor and the pressure relief valve, on the intake manifold.
2. Tighten the fastening screws **(2)** to the specified torque.



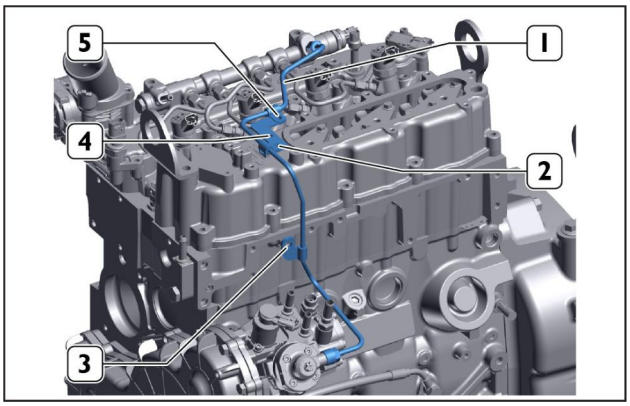

NHIL25ENG0183TA 1

| Description | Quantity | Step | Value |
|---|---|---|---|
| Common Rail | 2 screws M8 x 1.25 x 55 | | **23 +/- 2.3 N·m** |

# Fuel injection system - Assemble - Fuel delivery pipe [113470143 - V1 - 28 February 2025]

1. Fit the fuel delivery pipe **(1)** from the high pressure pump to the rail and tighten the couplings to the prescribed torque.

***NOTE:*** *The high pressure fuel delivery pipe must always be replaced each time it is removed.*




NHIL25ENG0185TA 1

| Description | Step | Value |
|---|---|---|
| Delivery fuel pipe from the pump to the rail | 1 high pressure fuel pump-side coupling M16 x 1 | **45 +/- 2.25 N·m** |
| | 1 rail-side coupling M14 x 1.5 | **35 +/- 1.75 N·m** |

2. Install the fuel delivery pipe retaining brackets **(1)** and tighten the fastening screws **(2)**, **(3)**, **(4)** and **(5)** to the specified torque.

| Description | Step | Value |
|---|---|---|
| Bracket retaining the delivery fuel pipe from the pump to the rail | 3 screws M6 x 1 x 10 | **10 +/- 1 N·m** |

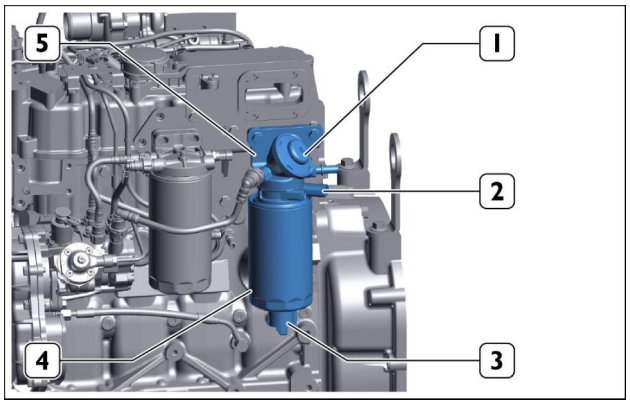
# Fuel filter sensor - Remove - Fuel pre - filter [113435286 - V1 - 06 March 2025]

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

1. Disconnect the electrical connection of the sensor **(3)** detecting water in the fuel pre-filter and the electrical connection of the fuel electric heater **(2)**.
2. Position a container to collect the diesel oil below the fuel pre-filter **(4)**.
3. Use the specific tool to unscrew and remove the fuel pre-filter **(4)** from the relative pre-filter mount **(5)** and recover the gasket.

***NOTE:*** *Pay attention to the sensor **(3)** detecting the presence of water in the fuel pre-filter and to the electrical connections of the engine cable.*

***NOTE:*** *Pay careful attention to the electric fuel heater **(2)** and the relative electrical connection.*




NHIL25ENG0400FA 1

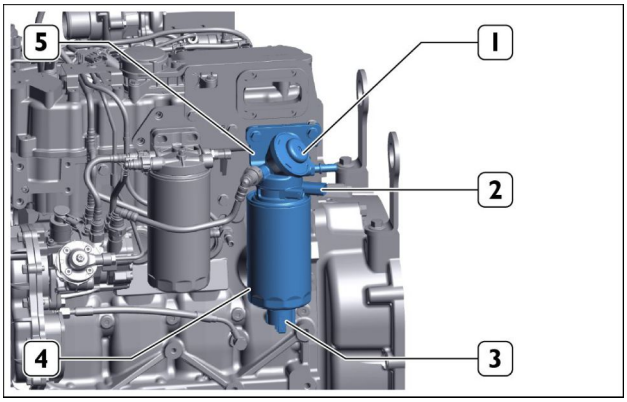
# Fuel filter sensor - Install - Fuel pre-filter [113435287 - V1 - 06 March 2025]

1. Moisten the fuel pre-filter sealing gasket **(4)** with a film of engine oil.
2. Manually tighten the fuel pre-filter **(4)** on the bracket **(5)** until it adheres to the gasket.

***NOTE:*** *Pay attention to the water in the fuel pre-filter sensor **(3)** and to the electrical connections of the engine cable.*

***NOTE:*** *Pay attention to the electric fuel heater **(2)** and the relative electrical connection.*

3. Use the special tool to further tighten the fuel pre-filter **(4)** to a torque of:




NHIL25ENG0400FA 1

| Description | Quantity | Value |
|---|---|---|
| Fuel Pre-filter | 1 cartridge — | **20 +/- 3 N·m** |

4. Connect the electrical connection for the water in fuel pre-filter sensor **(3)** and the electrical connection of the electric fuel heater **(2)**.
5. After replacing the fuel pre-filter **(4)**, there can be air bubbles in the fuel circuit.
6. Bleed the residual air from the fuel pre-filter **(4)** by loosening the breather cap and connecting it to a suitable container with a transparent flexible pipe.
7. Start the manual pump **(1)** for the fuel pre-filter **(4)** until the fuel exiting the breather cap is completely free of air bubbles.
8. Tighten the bleeder plug to the specified torque.

| Description | Quantity | Value |
|---|---|---|
| Air bleeding on the fuel filter bracket | 1 screw M10 | **4 +/- 0.5 N·m** |

9. Start the engine and let it idle for a few minutes to eliminate all residual air.

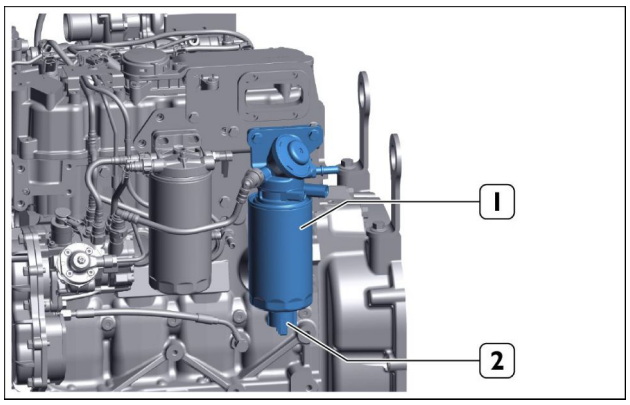
# Fuel filter sensor - Check - Water in fuel pre-filter/filter [113435288 - V1 - 06 March 2025]

***NOTE:*** *For engines equipped with the fuel pre-filter*

1. Proceed with the engine off and at a low temperature.
2. Place a container below the pre-filter **(1)** to collect the fluid.
3. Visually check for water in fuel pre-filter **(1)**.
4. Disconnect the electrical connection and unscrew the sensor **(2)** to detect the presence of water in the fuel in the lower part of the fuel pre-filter **(1)**.
5. Drain the fluid until only fuel exits.

***ATTENTION:*** *The disposal of all liquids and fluids must be in full compliance with current legislation.*

6. When draining is completed, retighten the sensor **(2)** at the base of the fuel pre-filter **(1)** and reconnect the electrical connections.
7. Check that the water presence sensor **(2)** is working correctly.




NHIL25ENG0401FA 1

# Fuel filter sensor - Replace - Fuel pre-filter [113435289 - V1 - 06 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Air bleeding on the fuel filter bracket | 1 screw M10 | **4 +/- 0.5 N·m** |
| Fuel Pre-filter | 1 cartridge — | **20 +/- 3 N·m** |

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

***NOTE:*** *For engines equipped with the fuel pre-filter*

1. Disconnect the electrical connection for the water in fuel pre-filter sensor **(3)** and the electrical connection for the electric fuel heater **(2)**.
2. Position a container to collect the diesel oil below the fuel pre-filter **(4)**.
3. Use the special tool to loosen and remove the fuel pre-filter **(4)** from the relative pre-filter bracket **(5)** and retrieve the gasket.

***NOTE:*** *Pay attention to the water in the fuel pre-filter sensor **(3)** and to the electrical connections of the engine cable.*

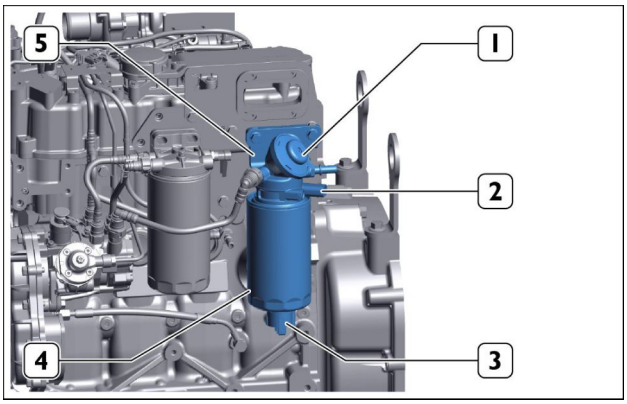
***NOTE:*** *Pay attention to the electric fuel heater **(2)** and the relative electrical connection.*

4. Replace the fuel pre-filter.
5. Moisten the fuel pre-filter sealing gasket **(4)** with a film of engine oil.
6. Manually tighten the fuel pre-filter **(4)** on the bracket **(5)** until it adheres to the gasket.

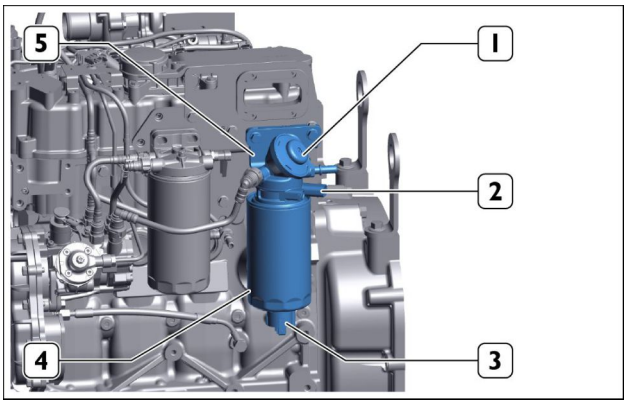
***NOTE:*** *Pay attention to the water in the fuel pre-filter sensor **(3)** and to the electrical connections of the engine cable.*

***NOTE:*** *Pay attention to the electric fuel heater **(2)** and the relative electrical connection.*

7. Use the special tool to further tighten the fuel pre-filter **(4)** to a torque of:
8. Connect the electrical connection for the water in fuel pre-filter sensor **(3)** and the electrical connection of the electric fuel heater **(2)**.
9. After replacing the fuel pre-filter **(4)**, there can be air bubbles in the fuel circuit.
10. Bleed the residual air from the fuel pre-filter **(4)** by loosening the breather cap and connecting it to a suitable container with a transparent flexible pipe.
11. Start the manual pump **(1)** for the fuel pre-filter **(4)** until the fuel exiting the breather cap is completely free of air bubbles.
12. Tighten the bleeder plug to the specified torque.
13. Start the engine and let it run at idle for a few minutes to expel any remaining air.



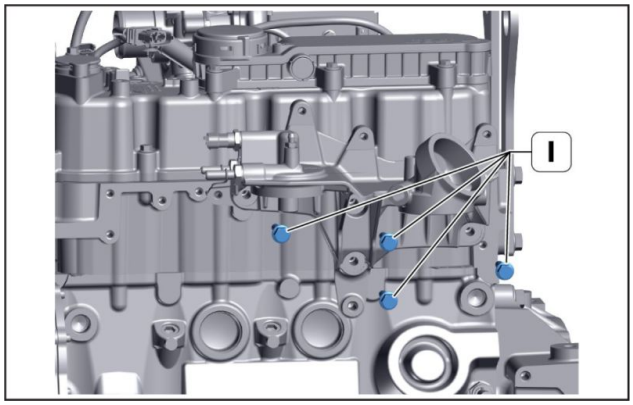

NHIL25ENG0402FA 1




NHIL25ENG0402FA 2

# Fuel filter sensor - Assemble - Assembly of filter and fuel pre-filter support bracket - Versions with and without pre-filter [113470937 - V1 - 06 March 2025]

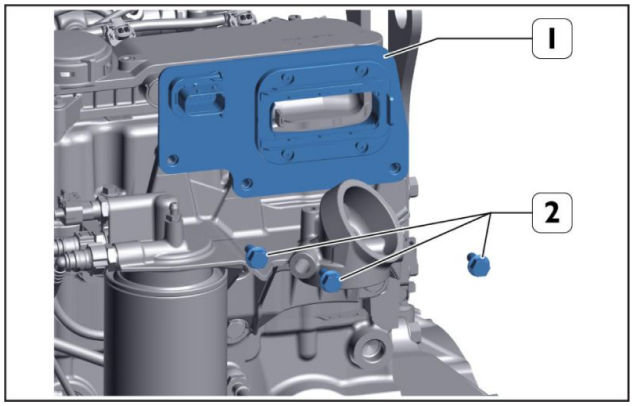
1. Attach the filter and fuel pre-filter support bracket by tightening the screws **(1)** to the specified torque.




NHIL25ENG0186FA 1

| Description | Step | Value |
|---|---|---|
| Fuel filter mount - version with pre-filter | 4 screws M8 x 1.25 x 20 | **23 +/- 2.3 N·m** |
| Fuel filter mount - version without pre-filter | 4 screws M8 x 1.25 x 40 | **23 +/- 2.3 N·m** |

2. Tighten the screws **(2)** and secure the support bracket **(1)** of the engine wiring connectors.




NHIL25ENG0187FA 2

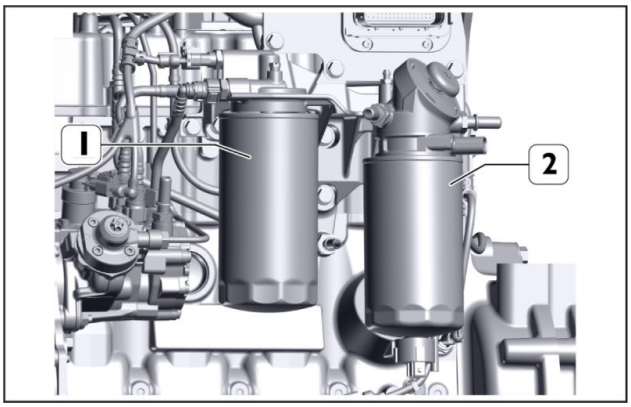
| Description | Step | Value |
|---|---|---|
| Engine cable fixing bracket | 3 screws M8 x 1.25 x 20 | **23 +/- 2.3 N·m** |

# Fuel filter sensor - Assemble [113470938 - V1 - 06 March 2025]

1. Moisten the sealing gasket of the fuel filter **(2)** with a thin layer of engine oil.
2. Manually screw the fuel filter **(2)** onto the support until it comes into contact with the gasket.

***NOTE:*** *Pay attention to the fuel temperature sensor and to the electric connections of the engine cable.*

3. With the specific tool, tighten the fuel filter **(2)** further to a torque of:




NHIL25ENG0188FA 1

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

| Description | Quantity | Value |
|---|---|---|
| Fuel filter | 1 cartridge M20 x 1.5 | **22 +/- 3 N·m** |

4. After the fuel filter **(2)** has been replaced it is possible that air bubbles may become trapped inside the fuel supply circuit.
5. Bleed residual air from the fuel filter **(2)** by loosing the breather plug connecting it to a suitable container using a transparent flexible hose.
6. Operate the fuel pre-filter hand pump until the fuel coming out through the breather plug is completely free of air bubbles.
7. Tighten the bleeder plug to the specified torque.

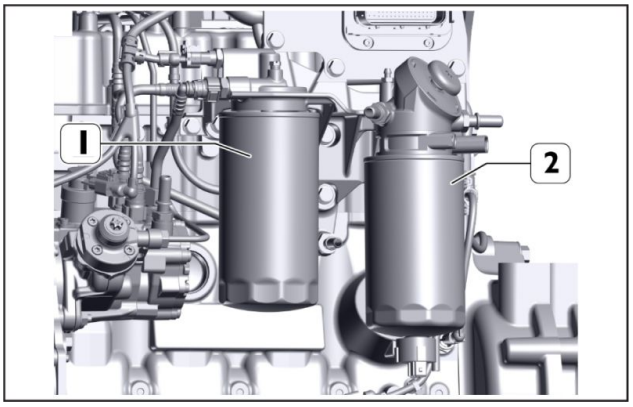
| Description | Quantity | Value |
|---|---|---|
| Air bleeding on the fuel filter bracket | 1 screw M10 | **4 +/- 0.5 N·m** |

# Fuel filter sensor - Pre-assemble - Fuel pre-filter [113470939 - V1 - 06 March 2025]

1. Moisten the fuel pre-filter sealing gasket **(2)** with a film of engine oil.
2. Manually screw the fuel pre-filter **(2)** onto the support until it adheres to the gasket.

***NOTE:*** *Pay attention to the fuel pre-filter water presence sensor , to the fuel electric heater and the relevant connection.*

3. Use the special tool to further tighten the fuel pre-filter **(3)** to a torque of:



NHIL25ENG0189FA 1

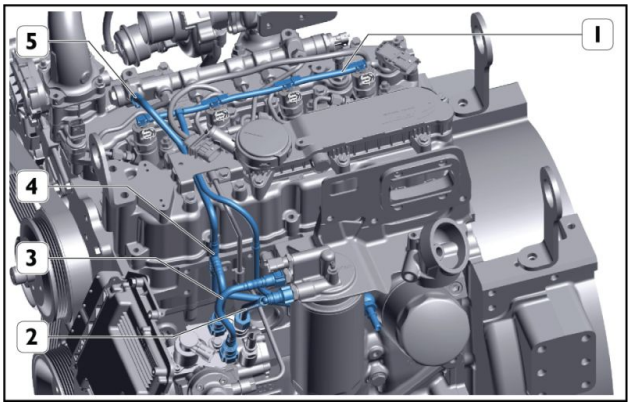
| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

| Description | Quantity | Value |
|---|---|---|
| Fuel Pre-filter | 1 cartridge — | **20 +/- 3 N·m N·m** |

4. Then connect the electrical connection of the sensor detecting water in the fuel pre-filter and the electrical connection of the electric fuel heater.

# Fuel filter sensor - Remove - Low pressure fuel pipes [113469196 - V1 - 07 March 2025]

1. Disconnect the low pressure fittings and remove the fuel pipes from the filter to the high pressure pump **(3)** and from the high pressure pump to the filter **(2)**.
2. Unscrew the fastening screws and remove the retaining brackets of the fuel return pipes **(5)** and **(4)** from the common rail and from the high pressure pump. Disconnect the low pressure fittings. Remove the pipes
3. Unscrew the fastening screws and remove the retaining brackets of the fuel return pipe from the injectors **(1)** . Disconnect the low pressure fittings and remove the pipe **(1)**.



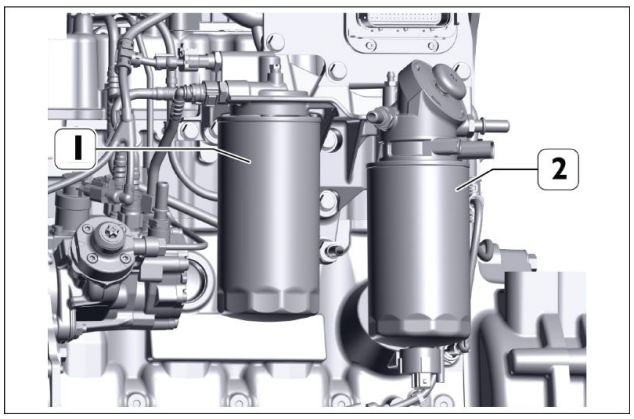

NHIL25ENG0119TA 1

# Fuel filter sensor - Remove - fuel pre-filter (if present) [113469197 - V1 - 07 March 2025]

***NOTE:*** *If present*

1. Position a container to collect the diesel oil under the fuel pre-filter **(3)**.
2. Use the special tool to unscrew and remove the fuel pre-filter **(2)** from the relevant pre-filter bracket and recover the gasket.

***NOTE:*** *Pay attention to the sensor **(4)** detecting water in the fuel pre-filter, the electric fuel heater **(2)** and the relevant connection.*



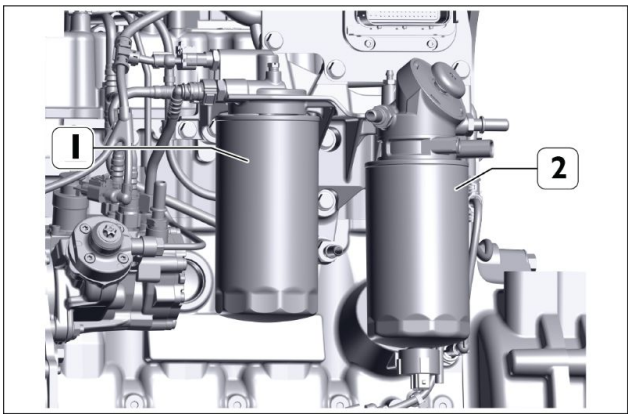

NHIL25ENG0120FA 1

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

# Fuel filter sensor - Remove [113469198 - V1 - 26 February 2025]

1. Position a container to collect the diesel oil under the fuel filter **(2)**.
2. Use the specific tool to unscrew and remove the fuel filter **(1)** from the relative filter bracket and recover the gasket.

***NOTE:*** *Pay attention to the fuel temperature sensor and to the electric connections of the engine cable.*

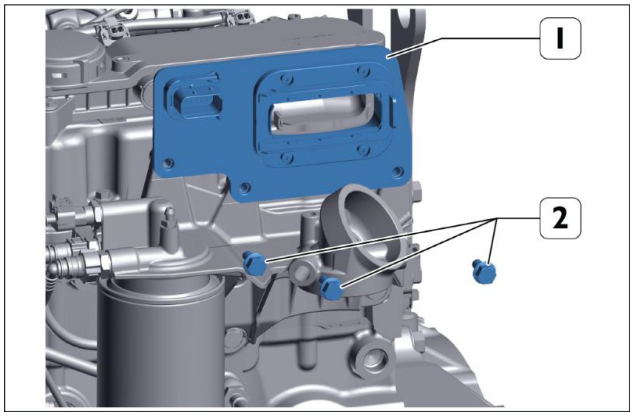



NHIL25ENG0121FA 1

| Tool / Material | |
|---|---|
| Remover,cartridge filter | 99360076 |

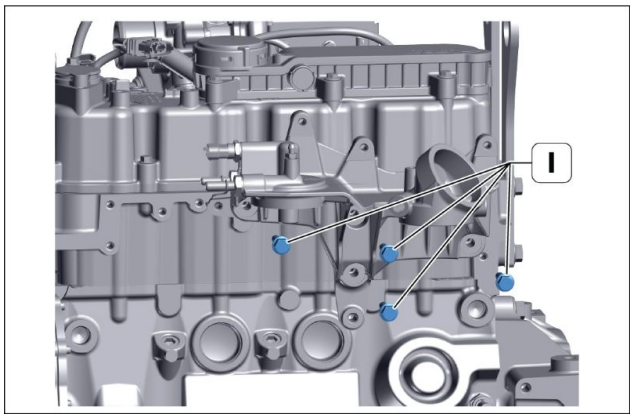
# Fuel filter sensor - Remove - filter and fuel pre-filter support bracket - Versions with and without pre-filter [113469199 - V1 - 07 March 2025]

1. Unscrew the screws **(2)** and remove the engine wiring connectors support yoke **(1)**.




NHIL25ENG0122FA 1

2. Unscrew the screws **(1)** and remove the fuel filter and pre-filter support yoke .

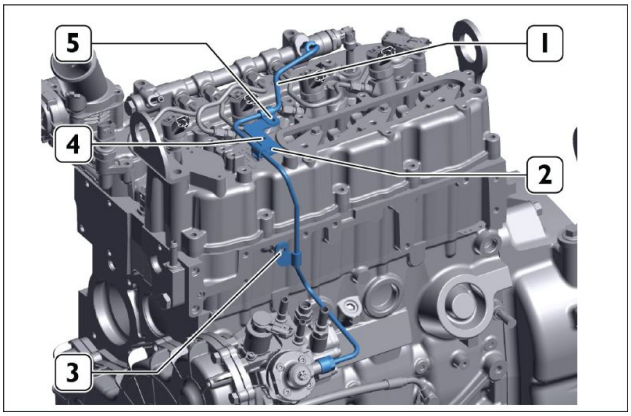



NHIL25ENG0123FA 2

# Fuel filter sensor - Remove - delivery fuel pipe to [113469200 - V1 - 07 March 2025]

1. Unscrew the fastening screws **(2)**, **(3)**, **(4)** and **(5)** and remove the retainer brackets of the fuel delivery pie **(1)**.
2. Unscrew the fittings and remove the fuel delivery pipe **(1)** from the high pressure pump to the rail.

***NOTE:*** *The high pressure fuel delivery pipe must always be replaced each time it is removed.*

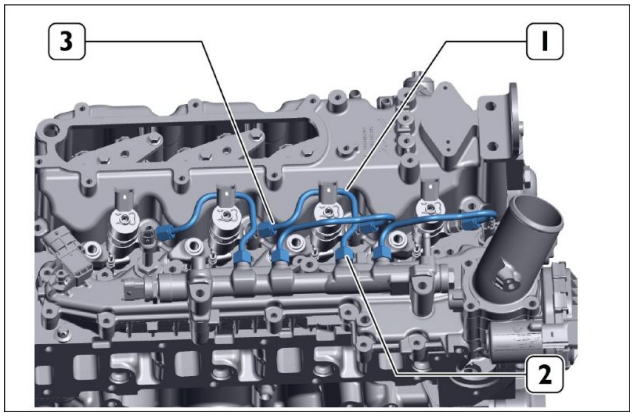



NHIL25ENG0124TA 1

# Fuel filter sensor - Remove - fuel delivery pipe from rail to injectors [113469201 - V1 - 07 March 2025]

1. Remove the high pressure fuel delivery pipes **(1)** by loosening first the nuts on injector side **(3)** and then the nuts on Common Rail side **(2)**.

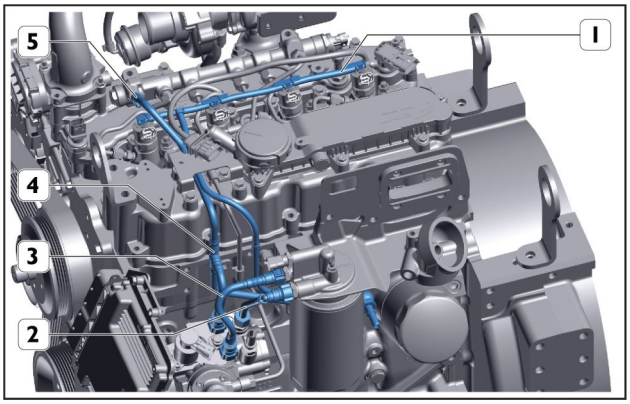
***NOTE:*** *The high pressure fuel delivery pipes must be replaced with new ones whenever they are removed.*




NHIL25ENG0125TA 1

# Fuel filter sensor - Assemble - Low-pressure fuel pipes [113471050 - V1 - 06 March 2025]

1. Connect the low pressure fittings and fit the fuel pipes from the filter to the high pressure pump **(3)** and from the high pressure pump to the filter **(2)**.




NHIL25ENG0190TA 1

| Description | Quantity | Value |
|---|---|---|
| Fuel pipe fittings between the pump and filter | M10 x 1.5 x 18 | **25 +/- 2.5 N·m** |

2. Connect the low pressure fittings of the fuel return pipes **(5)** and **(4)** from the common rail and from the high pressure pump.Tighten the fastening screws and fit the retaining brackets.

| Description | Quantity | Value |
|---|---|---|
| Bracket retaining the fuel return pump from the rail and from the high pressure pump | 1 screw M6 x 1 x 16 | **10 +/- 1 N·m** |

3. Connect the low pressure fittings and fit the fuel return pipe from the injectors **(1)**.Mount the retaining brackets of the fuel return pipe from the injectors **(1)** and tighten the fastening screws.

| Description | Quantity | Value |
|---|---|---|
| Injector fuel return pipe brackets | 1 screw M8 x 1.25 x 18 | **23 +/- 2.3 N·m** |

# Fuel pressure sensor - Disassemble [113435637 - V1 - 25 February 2025]

1. Loosen the pressure sensor using the wrench or unscrew the rail by hand.
2. If present, remove the O-ring gasket.
3. Clean the sensor thread and the contact surface of the rail.
4. Plug the seat of the sensor on the rail using a plastic cap to prevent contamination.

# Fuel pressure sensor - Assemble - Pressure sensor [113435638 - V1 - 06 March 2025]

| Description | Quantity | Value |
|---|---|---|
| Pressure sensor on rail RDS4.2 | 1 sensor M18 x 1.5 | **70 +/- 5 N·m** |

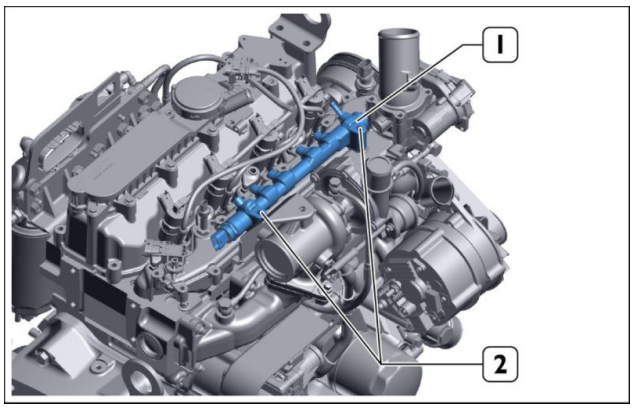
1. Remove the plastic cap from its seat in the sensor on the rail.
2. Inspect the thread and the contact surfaces of the pressure sensor and the rail.
3. If damage or wear is found, replace the concerned parts.
4. If fitted, install a new eyelet gasket.
5. Prior to assembly, lubricate the thread and the clamp on the sensor.
6. Manually tighten the pressure sensor on the rail and tighten to a torque of:

# Common rail pressure sensor - Remove - High pressure accumulator [113435576 - V1 - 06 March 2025]

**Prior operation:**
Disconnect the engine cable as described in the procedure **Engine wiring harness - Remove - Engine cables (55.015)**.
**Prior operation:**
Remove the fuel delivery and return pipes from the rail and from the high pressure pump, as described in the procedure **Glow plug system - Remove - Pipes (55.202)**.

## Common Rail removal

1. Loosen the screws **(2)** fastening the common rail **(1)**.
2. Remove the common rail **(1)**, together with the rail pressure sensor and the pressure relief valve, from the intake manifold.

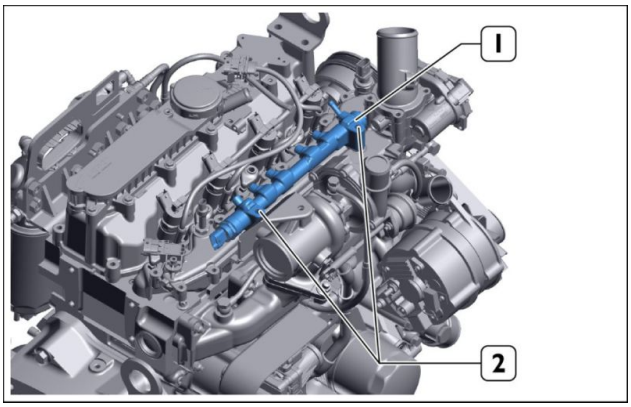


NHIL25ENG0405TA 1

# Common rail pressure sensor - Install - High pressure accumulator [113435577 - V1 - 06 March 2025]

| Description | Quantity | Step | Value |
|---|---|---|---|
| Common Rail | 2 screws M8 x 1.25 x 55 | | **23 +/- 2.3 N·m** |

1. Fit the common rail **(1)**, complete with the rail pressure sensor and the pressure relief valve, on the intake manifold.
2. Tighten the fastening screws **(2)** to the specified torque.




NHIL25ENG0405TA 1

**Next operation:**
Fit the fuel delivery and return pipes from the rail and from the high pressure pump, as described in the procedure **Glow plug system - Install - Pipes (55.202)**.
**Next operation:**
Connect the engine cable as described in the procedure **Engine wiring harness - Install - Engine cables (55.015)**.

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## Engine intake and exhaust system - 014

**F6AFL413A*U001**

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### Engine intake and exhaust system - 014


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# Intake air pressure and temperature sensor - Overview - Air pressure sensor [113435173 - V1 - 06 March 2025]

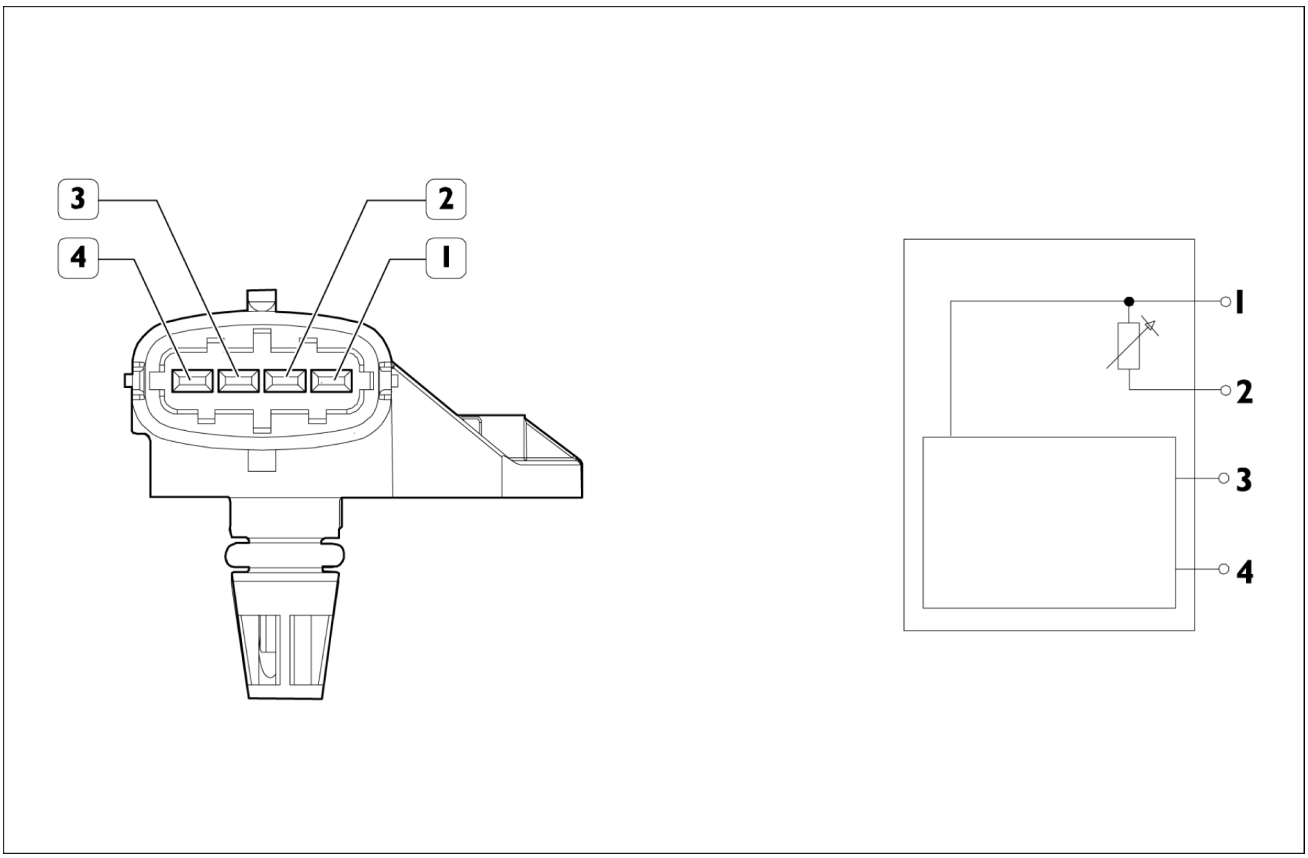
## Boost pressure and air temperature sensor

This component incorporates a temperature sensor and a pressure sensor.

It is fitted to the intake manifold so that, by measuring the maximum quantity of air taken in, it makes it possible to determine the exact amount of fuel to be injected at each cycle.

It is powered at **5 V**.

The output voltage is proportional to the pressure (or temperature) measured by the sensor.




NHIL25ENG0398FA 1

## Sensor pin-out

| Item | Description |
|---|---|
| 1 | Ground |
| 2 | Temperature signal |
| 3 | Feeding |
| 4 | Pressure signal |

# Engine air heater supply cable - Cleaning - Engine supply air filter [113437873 - V1 - 27 February 2025]

1. Remove the filtering element from the filter housing.
2. Blow the filter element from the inside to the outside with compressed air. Do not use detergents or diesel oil.
3. Never use tools to strike the filtering element and check its condition before refitting it.
4. Replace the filter if cleaning with compressed air is not sufficient or if there are breaks or tears.

***NOTE:*** *General prescriptions Make sure that the components are refitted correctly. Incorrect fitting could cause the engine to intake unfiltered air which could lead to serious damage. Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty*

# Intake air pressure and temperature sensor - Prepare - Intake air pressure and temperature sensor [113387920 - V1 - 14 February 2025]

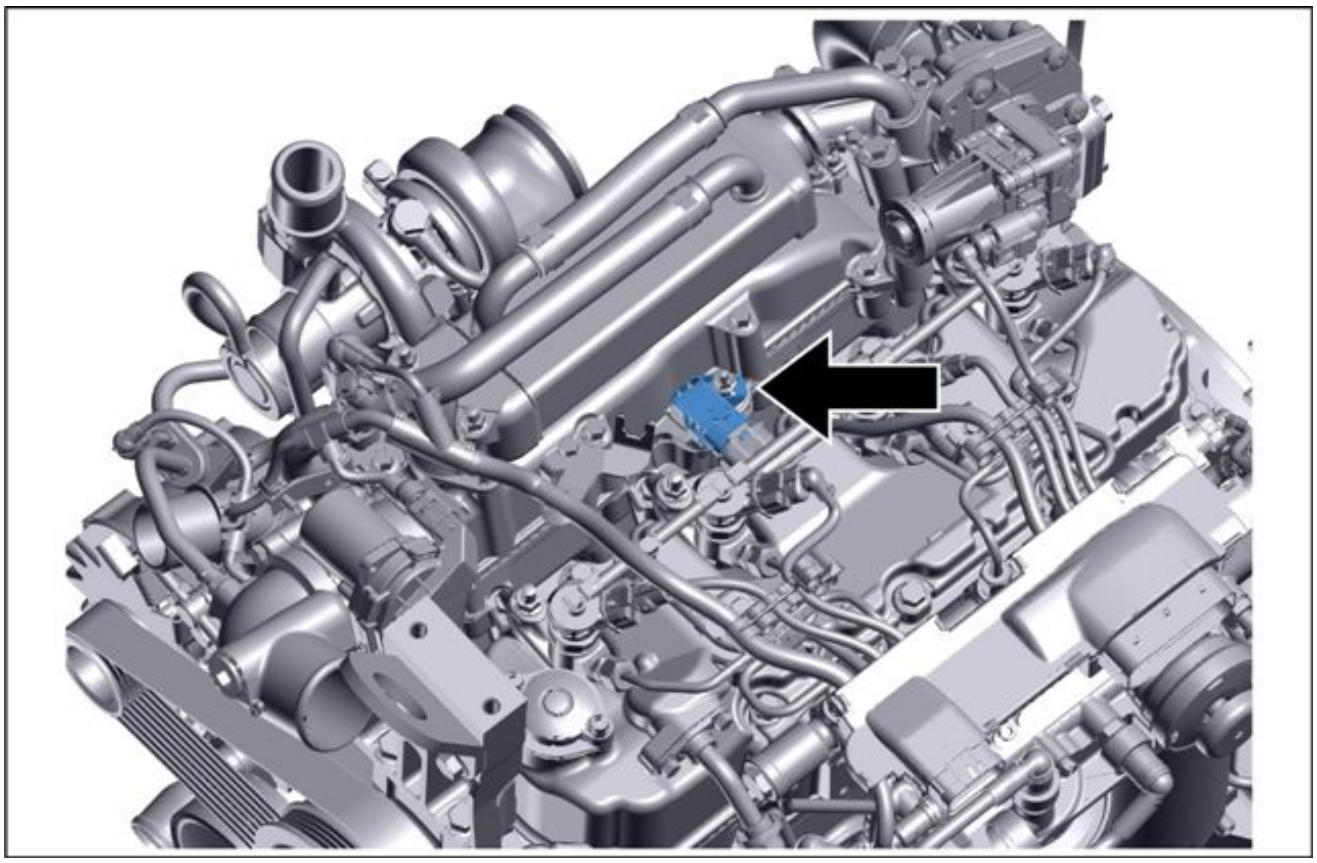
## Preparation

- Ignition switch set to OFF position.

# Intake air pressure and temperature sensor - Check - Intake air pressure and temperature sensor [113387921 - V1 - 22 February 2025]

## Visually check intake air pressure and temperature sensor

1. • Visually check the connector of the sensor.
   • Check if the sensor is installed correctly.
   • Check if the screw of the sensor is tight.
   • Check the sensor assembly to the intake air manifold.
   • Refer to figure **1** for explanation and go to step **2**.



NHIL25ENG0497FA 1

**Location of intake air pressure and temperature sensor**

2. Check the intake manifold pressure and temperature sensor.
   A. Connector of the sensor not damaged and not contaminated.
   B. The sensor is mounted in the correct orientation.
   C. The sensor is correctly fitted to the air intake manifold.
   D. The screw is not loose.
   E. If intake manifold pressure and temperature sensor is OK, Refer to Preparation Diagnosis tester connected to vehicle Ignition On Engine Off.
   F. If intake manifold pressure and temperature sensor is NOT OK, go to step **3**.

3. Possible root cause
   - Connector of the sensor damaged and/or contaminated.
   - The sensor is not mounted in the correct orientation.
   - The sensor is loosely fitted to the air intake pipe.
   - Tighten the screw.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

# Intake air pressure and temperature sensor - Visual inspection [113387922 - V1 - 22 February 2025]

## Read out intake air pressure sensor value

Preparation

- Diagnosis tester connected to vehicle.
- Ignition ON.
- Engine OFF.

## Read out intake air pressure sensor value

1. • Read out boost pressure value with diagnostic tester.
   • Go to step **2**.
2. Read out intake air pressure sensor value
   A. Boost pressure equal environment pressure ( ~ **1000 bar** (**14500 psi**)).
   B. If intake air pressure sensor valve is OK, go to step **4**.
   C. If intake air pressure sensor valve is NOT OK, go to step **3**.
3. Possible root cause
   • Offset error intake manifold pressure and temperature sensor.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The intake manifold pressure and temperature sensor works properly.

# Turbine speed sensor - Prepare - Water in fuel sensor plausibility [113389085 - V1 - 13 February 2025]

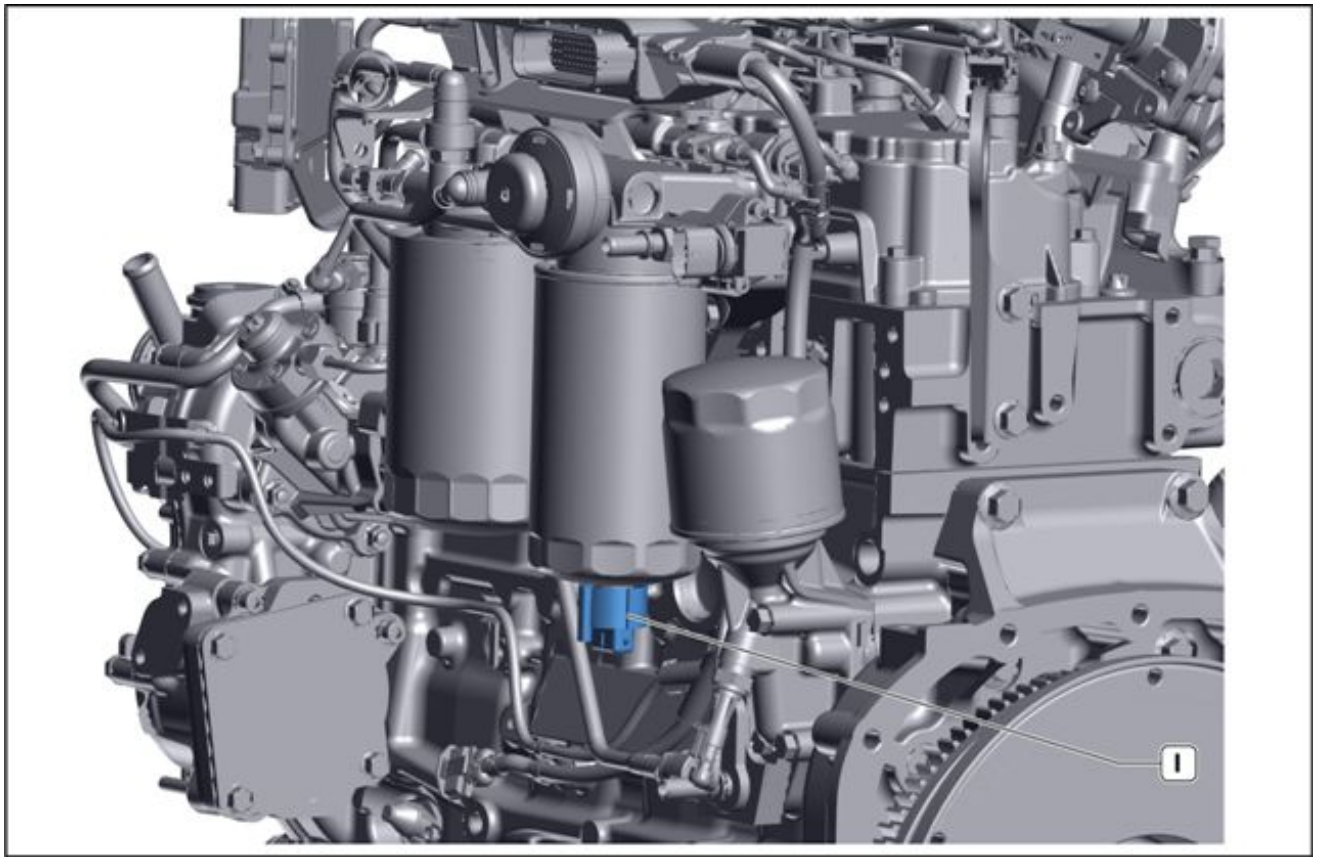
## Preparation

- No visible damage of fuel pre-filter.

# Turbine speed sensor - Check - Water in fuel sensor plausibility [113389086 - V1 - 22 February 2025]

Check water in fuel sensor plausibility

- Read fault code memory from ECU.
- Check amount of water at fuel pre-filter water in fuel sensor.
- Refer to figure **1** and table below for explanation and go to step **1**.




NHIL25ENG0501FA 1

**Water in fuel sensor location at fuel pre-filter**

| Item | Description |
|---|---|
| 1 | Water in fuel sensor |

| Status ( ECM SYSTEM DIAGNOSTICS - Self-engage (29.54) ) | Water visible |
|---|---|
| Active | the |
| Not Active | no |

1. Check water in fuel sensor plausibility.
   A. If no water in fuel sensor, go to step **3**.
   B. If there is water in the fuel sensor, go to step **2**.
2. Possible root cause
   - Electrical defect of the water in fuel sensor.
   - Sensor defect, replace component.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

3. The sensor works properly.

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# Electrical systems - 55

## Selective Catalytic Reduction (SCR) electrical system - 988

**F6AFL413A*U001**

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# Selective Catalytic Reduction (SCR) humidity sensor - Prepare - Intake air humidity and temperature sensor [113408015 - V1 - 26 February 2025]

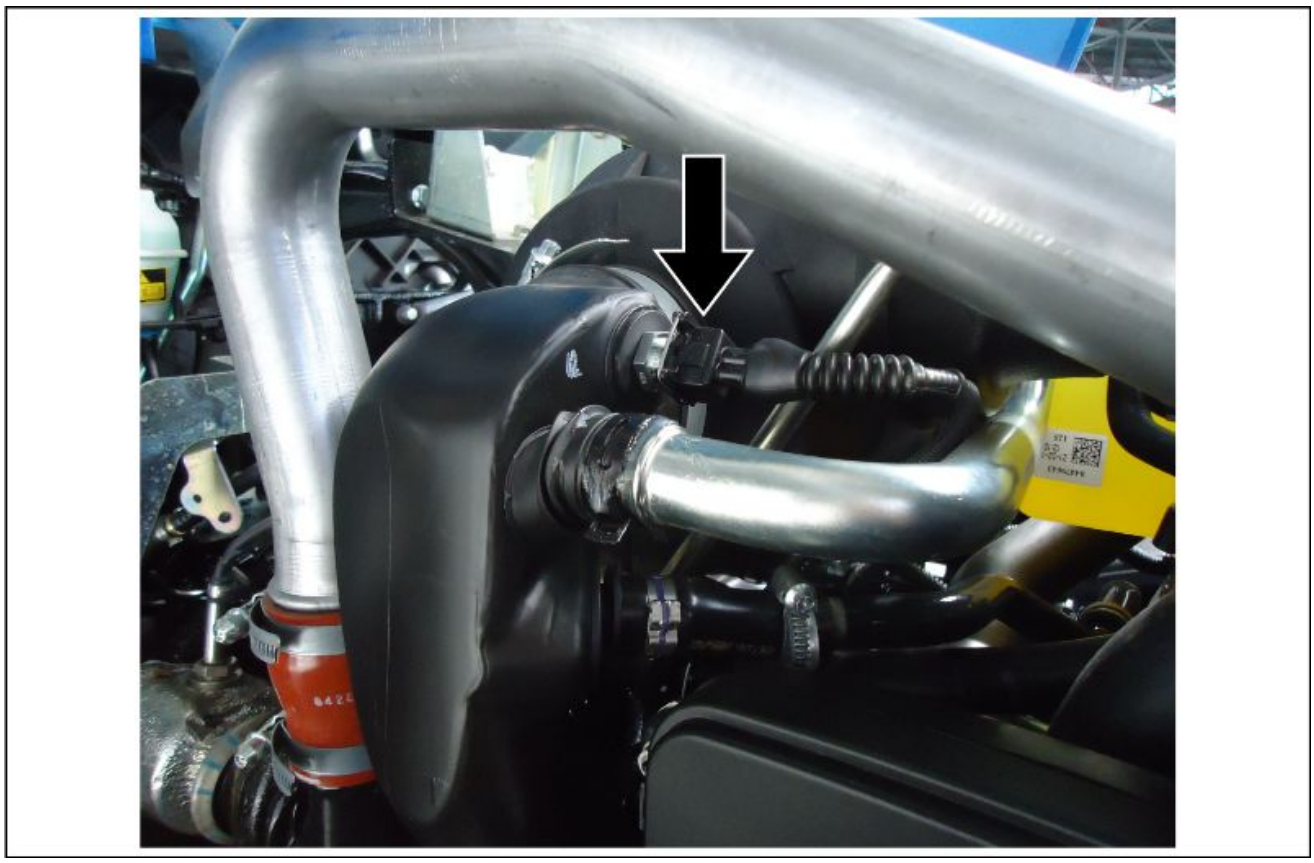
## Preparation

- Ignition switch set to OFF position.

# Selective Catalytic Reduction (SCR) humidity sensor - Check - Intake air humidity and temperature sensor [113408016 - V1 - 26 February 2025]

## Visually check intake air humidity and temperature sensor

1. Visually check intake air humidity and temperature sensor
   - Visually check the connector of the sensor.
   - Check if the sensor is installed correctly.
   - Check if the screw of the sensor is tight.
   - Check the sensor assembly to the intake air pipe.
   - See figure below for explanation and go to step **2**.



NHIL25ENG0526TA 1

**Location of intake air humidity and temperature sensor**

2. Check the intake air humidity and temperature sensor.
   A. Connector of the sensor not damaged and not contaminated.
   B. The sensor is mounted in the correct orientation.
   C. The sensor is correctly fitted to the air intake pipe.
   D. The screws are not loose.
   E. If intake air humidity and temperature sensor is OK, go to step **4**.
   F. If intake air humidity and temperature sensor is NOT OK, go to step **3**.

3. Possible root cause
   - Connector of the sensor damaged and/or contaminated.
   - The sensor is not mounted in the correct orientation.
   - The sensor is loosely fitted to the air intake pipe.
   - Tighten the screws.

***NOTE:*** *After fixing the error cause, please clear up fault memory and read again to verify.*

4. The intake air humidity and temperature sensor works properly.

# Selective Catalytic Reduction (SCR) temperature sensors - Test - Exhaust gas temperature sensor downstream of the SCR [113407991 - V1 - 26 February 2025]

## Description

The exhaust gas temperature sensor downstream of the SCR B-F39 is present in the exhaust gas after-treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)** and measures the outlet temperature at the catalyst. The exhaust gas temperature sensor downstream of the SCR B-F39 is positioned in the after-treatment system downstream of the SCR catalyst. It consists of an internal platinum resistance crossed by a **5 V** voltage which allows indirect measurement of the resistance as the temperature changes. The sensor allows the electronic engine control unit (ECU) **A-F02** to constantly adjust the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid input according to the emissions.

To refer to the technical data relating to the exhaust gas temperature sensor downstream of SCR B-F39, refer to **Exhaust Gas Recirculation (EGR) temperature sensors - Overview - Temperature sensor (55.989)**.

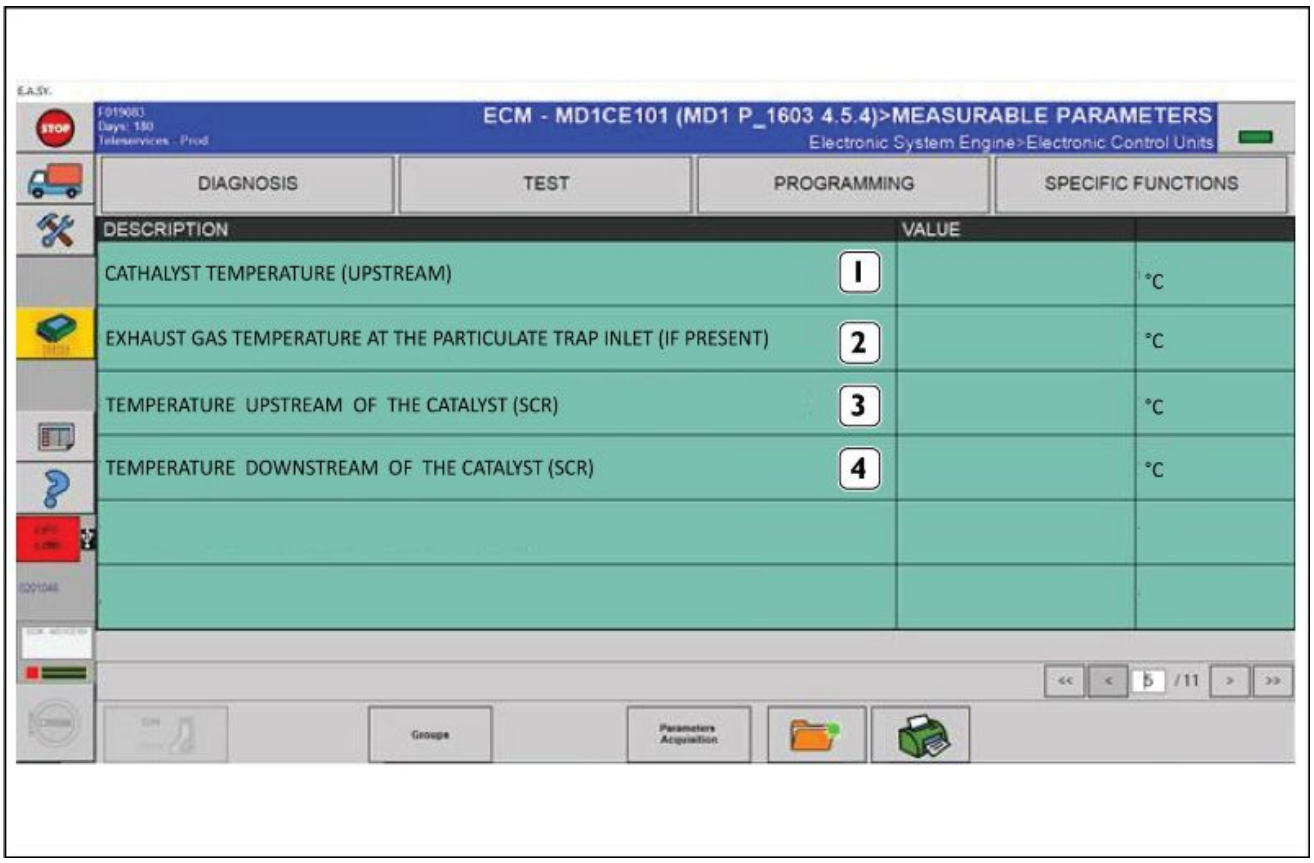
***NOTE:*** *The error codes relating to the exhaust gas temperature sensor downstream of the SCR B-F39 immediately become inactive when the SCR outlet temperature drops below the threshold value. With the vehicle in the workshop it is likely that the error code will be inactive.*

## Diagnostics procedure

1. Check that the temperature sensors on the exhaust gas treatment system (ATS) are installed correctly and in the specified positions.
2. Use the diagnostic instrument to check that when the engine is cold, the values of the temperature sensors on the ATS system are all aligned and coincide with the ambient temperature.

   The sensors to be checked are the following:

   1. Exhaust gas temperature sensor upstream of DOC **B-F32**.
   2. Exhaust gas temperature sensor downstream of DOC B-F113.
   3. Exhaust gas temperature sensor upstream of SCR B-F38.
   4. Exhaust gas temperature sensor downstream of SCR B-F39.




NHIL25ENG0512FA 1

Any misalignment of the temperature value can indicate a fault in a sensor or in the relative electrical circuit.

A. If the temperature values corresponding to the sensors detected are in-line, adjust the temperature of the engine by following the instructions in step **3** and then go to step **4**.

B. If the temperature values relating to the sensors in question are not aligned, identify the sensor with the fault and continue with step **8**.

3. Adjust the temperature of the engine as follows:
   1. Keep the ignition switch in the “ON” position for **15 s**.
   2. Start the engine and maintain idle speed for **15 s**.
   3. Keep the engine at **2000 RPM** for **30 s**.
   4. Keep the engine at **1600 RPM** for **30 s** with the exhaust choking valve closed at **90%**.
   5. Keep the engine at idle speed for **15 s**.
4. 1. Use the diagnostic instrument to check that the temperature sensors on the exhaust gas after-treatment system (ATS) show a decreasing temperature, starting from the sensor closest to the engine and moving towards the one furthest away in the exhaust.
   2. The test should last approx. **300 s** with a sampling frequency of **200 ms**.

***NOTE:*** *When using the diagnostic instrument to detect the parameters, make sure that the vehicle is not in a start-up condition.*

The sensors to be checked with a decreasing temperature sequence are:

1. Exhaust gas temperature sensor upstream of DOC **B-F32**.
2. Exhaust gas temperature sensor downstream of DOC B-F113.
3. Exhaust gas temperature sensor upstream of SCR B-F38.
4. Exhaust gas temperature sensor downstream of SCR B-F39.

5. If the decreasing temperature trend is not observed, this indicates a malfunction of a sensor or the relative electric circuit.
   A. If the temperature values relating to the sensors in question do observe the decreasing temperature trend, continue with step **6**.
   B. If the temperature values relating to the sensors in question do not observe the decreasing temperature trend, this indicates a malfunction in a sensor or the relative electrical circuit. Go to step **8**.
6. Check that the sensors in question return resistance values which are compatible with those listed in the table "Characteristics and correlation of sensor resistance and temperature", refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**.
7. Proceed as follow:
   1. Disconnect sensor from wiring harness.
   2. Remove the sensor from the after-treatment system.
   3. Place the sensor in a pipe which is of the same diameter and material as the one on the vehicle.
   4. Heat the sensor using a digital hot air blower.

## ⚠ WARNING

**Avoid injury!**
**Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.**
**Failure to comply could result in death or serious injury.**

**W1036A**

- Use a thermal probe to check the temperature.
- Use a precision multimeter to read the resistance values between pin 1 and pin 2 of the temperature sensor in question and compare them with those listed in the table "Characteristics and correlation of sensor resistance and temperature", refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**.

A. If the resistance values are correct, the sensor is working correctly. Continue with the fault identification procedure.

B. If the resistance values are incorrect, continue with step **8**.

8. Check the efficiency of the electrical wiring and carry out the fault identification procedure.

# Selective Catalytic Reduction (SCR) temperature sensors - Test - Exhaust gas temperature sensor upstream of the SCR [113407992 - V1 - 26 February 2025]

## Description

The exhaust gas temperature sensor upstream of the SCR B-F38 is present in the exhaust gas post-treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)** and measures the inlet temperature at the catalyst. The exhaust gas temperature sensor upstream of the SCR B-F38 is positioned in the after-treatment system, between the DOC module and the SCR catalyst. It consists of an internal platinum resistor crossed by a voltage **5 V** which allows the indirect measurement of the resistance as the temperature changes. The sensor allows the electronic engine control unit (ECU) **A-F02** to constantly adjust ADBLUE FLUID input according to the emissions.

To refer to the technical data relating to the temperature sensor of the exhaust gas upstream of the SCR B-F38, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**.

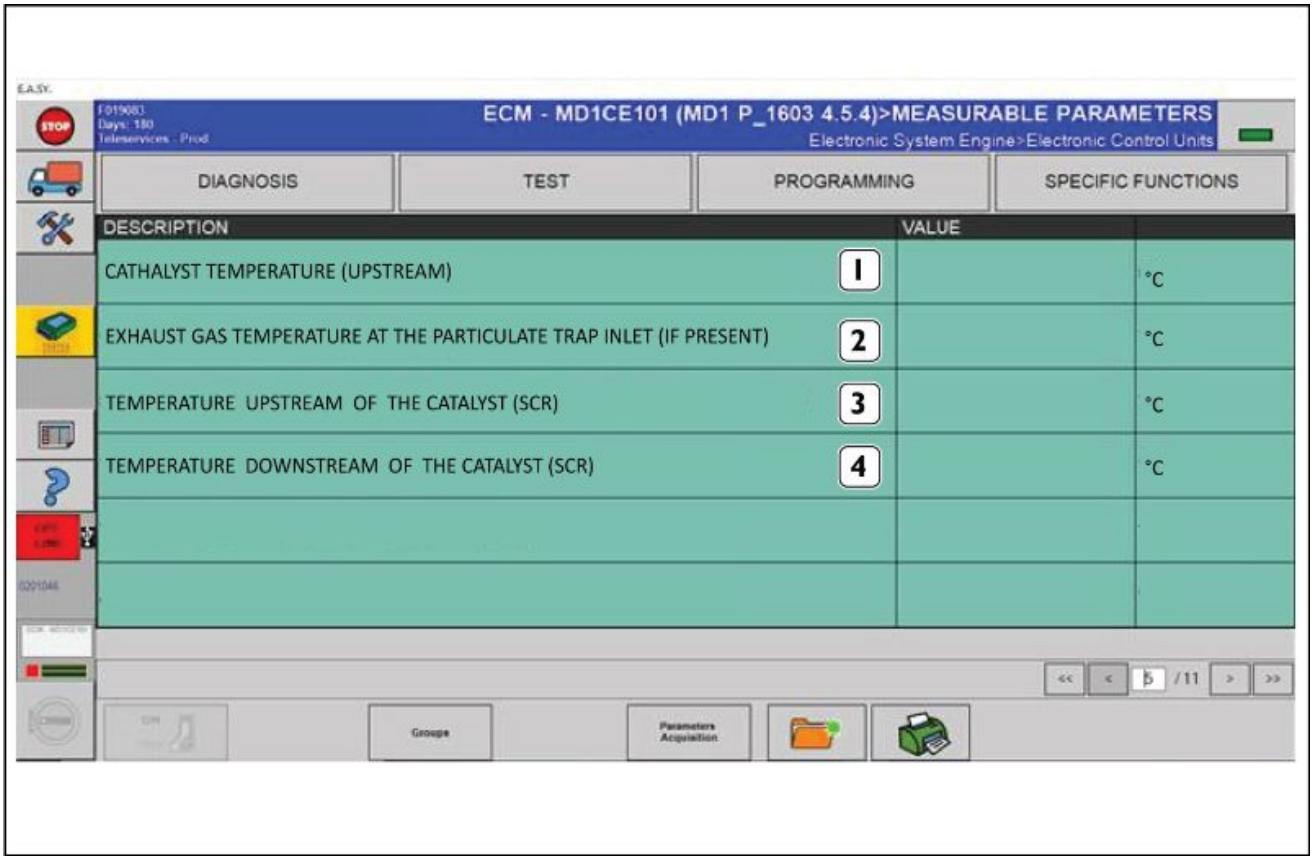
***NOTE:*** *The error codes relating to the exhaust gas temperature sensor upstream of the SCR B-F38 immediately become inactive when the SCR inlet temperature drops below the threshold value. With the vehicle in the workshop it is likely that the error code will be inactive.*

## Diagnostics procedure

1. Check that the temperature sensors on the exhaust gas treatment system (ATS) are installed correctly and in the specified positions.
2. Use the diagnostic instrument to check that when the engine is cold, the values of the temperature sensors on the ATS system are all aligned and coincide with the ambient temperature.

   The sensors to be checked are the following:

   1. Exhaust gas temperature sensor upstream of DOC **B-F32**.
   2. Exhaust gas temperature sensor downstream of DOC B-F113.
   3. Exhaust gas temperature sensor upstream of SCR B-F38.
   4. Exhaust gas temperature sensor downstream of SCR B-F39.




NHIL25ENG0512FA 1

Any misalignment of the temperature value can indicate a fault in a sensor or in the relative electrical circuit.

1. If the temperature values corresponding to the sensors detected are in-line, adjust the temperature of the engine by following the instructions in step **3** and then go to step **4**.
2. If the temperature values relating to the sensors in question are not aligned, identify the sensor with the fault and continue with step **8**.

3. Adjust the temperature of the engine as follows:
   1. Keep the ignition switch in the “ON” position for **15 s**.
   2. Start the engine and maintain idle speed for **15 s**.
   3. Keep the engine at **2000 RPM** for **30 s**.
   4. Keep the engine at **1600 RPM** for **30 s** with the exhaust choking valve closed at **90%**.
   5. Keep the engine at idle speed for **15 s**.
4. 1. Use the diagnostic instrument to check that the temperature sensors on the exhaust gas after-treatment system (ATS) show a decreasing temperature, starting from the sensor closest to the engine and moving towards the one furthest away in the exhaust.
   2. The test should last approx. **300 s** with a sampling frequency of **200 ms**.

***NOTE:*** *When using the diagnostic instrument to detect the parameters, make sure that the vehicle is not in a start-up condition.*

The sensors to be checked with a decreasing temperature sequence are:

1. Exhaust gas temperature sensor upstream of DOC **B-F32**.
2. Exhaust gas temperature sensor downstream of DOC B-F113 .
3. Exhaust gas temperature sensor upstream of SCR B-F38.
4. Exhaust gas temperature sensor downstream of SCR B-F39.

5. If the decreasing temperature trend is not observed, this indicates a malfunction of a sensor or the relative electric circuit.
   A. If the temperature values relating to the sensors in question do observe the decreasing temperature trend, continue with step **6**.
   B. If the temperature values relating to the sensors in question do not observe the decreasing temperature trend, this indicates a malfunction in a sensor or the relative electrical circuit. Go to step **8**.
6. Check that the sensors in question return resistance values which are compatible with those listed in the table "Characteristics and correlation of sensor resistance and temperature", refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**.
7. Proceed as follow:
   1. Disconnect sensor from wiring harness.
   2. Remove the sensor from the after-treatment system.
   3. Place the sensor in a pipe which is of the same diameter and material as the one on the vehicle.
   4. Heat the sensor using a digital hot air blower.

## ⚠ WARNING

**Avoid injury!**
**Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.**
**Failure to comply could result in death or serious injury.**

**W1036A**

- Use a thermal probe to check the temperature.
- Use a precision multimeter to read the resistance values between pin 1 and pin 2 of the temperature sensor in question and compare them with those listed in the table "Characteristics and correlation of sensor resistance and temperature", refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**.

A. If the resistance values are correct, the sensor is working correctly. Continue with the fault identification procedure.

B. If the resistance values are incorrect, continue with step **8**.

8. Check the efficiency of the electrical wiring and carry out the fault identification procedure.

# Nitrogen Oxide (NOx) sensor - Test - NOx sensor downstream of the SCR [113408013 - V1 - 26 February 2025]

## Description

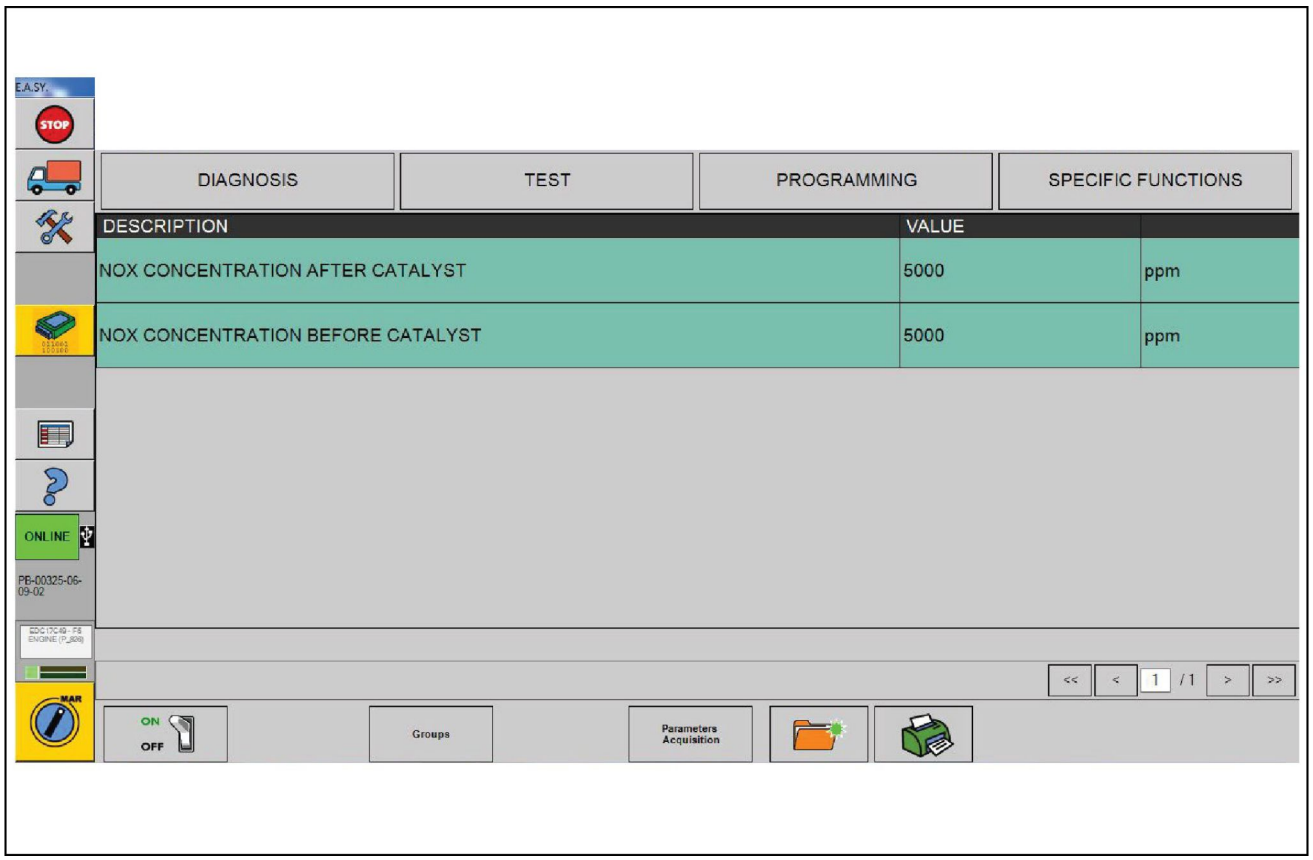
The NOx sensor B-F49 is downstream of the Selective Catalytic Reduction (SCR) and is present in the exhaust gas after-treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**. The NOx sensor B-F49 is made up of two parts: an electronic module connected via wiring to the sensor body. The two components cannot be separated. The NOx outlet sensor B-F49 detects the amount of nitrogen oxide leaving the SCR system and, via the CAN network, it allows the Engine Control Unit **A-F02** to constantly adjust the introduction of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid on the basis of the emissions.The NOx sensor B-F49 is downstream of the Selective Catalytic Reduction (SCR) and is present in the exhaust gas after-treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**. The NOx sensor B-F49 is made up of two parts: an electronic module connected via wiring to the sensor body. The two components cannot be separated. The NOx outlet sensor B-F49 detects the amount of nitrogen oxide leaving the SCR system and, via the CAN network, it allows the Engine Control Unit **A-F02** to constantly adjust the introduction of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid on the basis of the emissions.

To refer to the technical data relating to the NOx sensor B-F49.

***NOTE:*** *The electronic control unit activates the sensor only when the temperature inside the exhaust duct is sufficiently high to prevent the presence of condensate, otherwise the sensor could be damaged.*

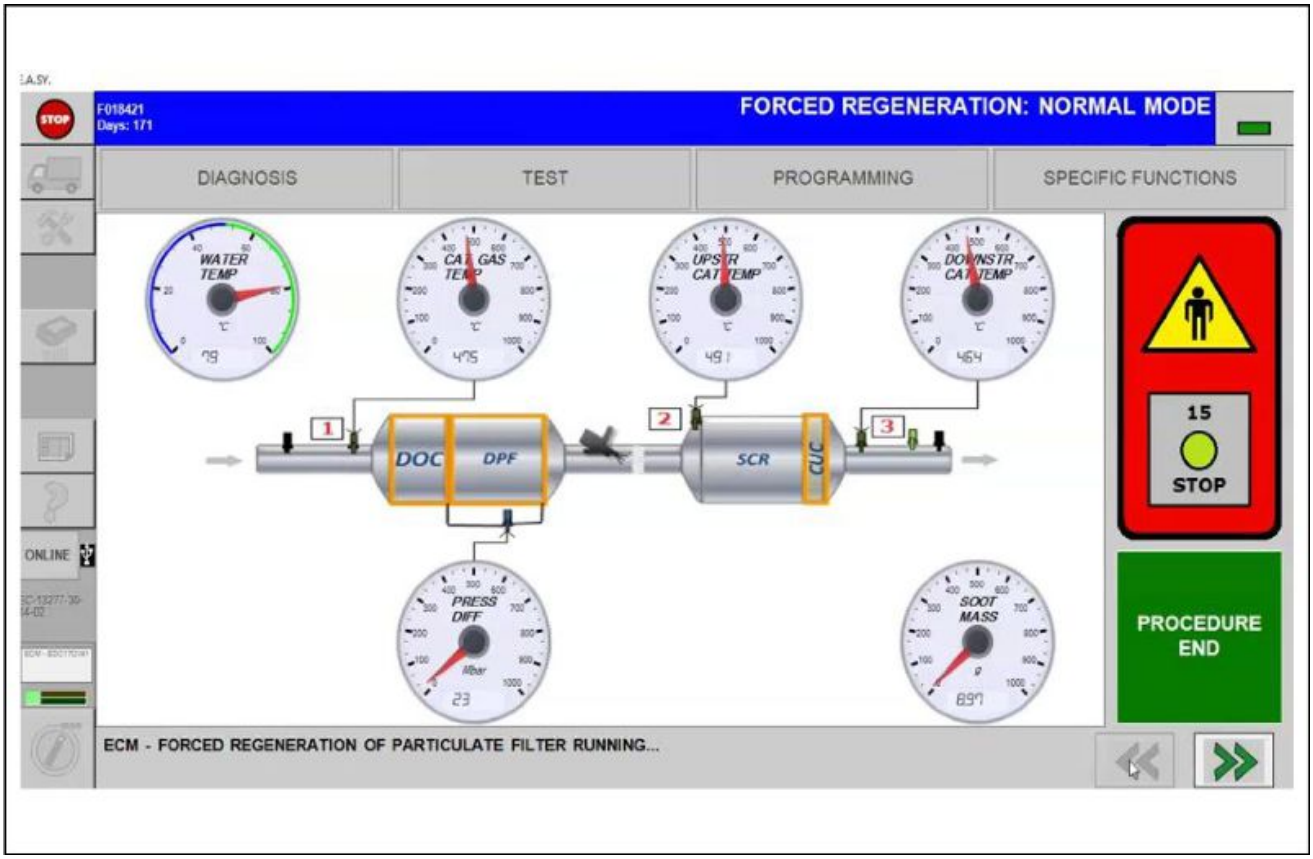
## Diagnostics procedure

1. Use the diagnostic instrument to monitor the values relating to the following sensors:
   - NOx sensor upstream B-F67 of the Selective Catalytic Reduction catalyst (SCR).
   - NOx sensor downstream B-F49 of the Selective Catalytic Reduction catalyst (SCR).



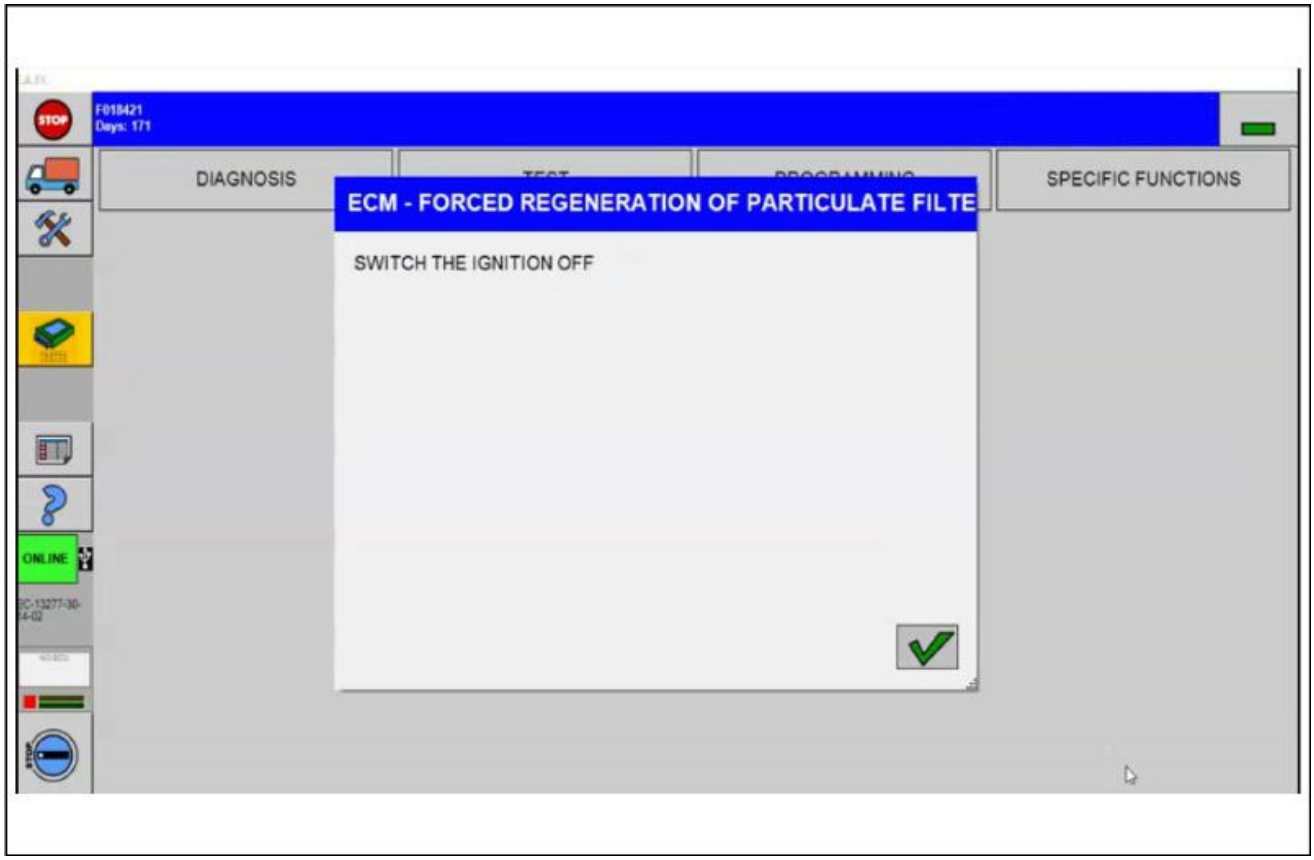

NHIL25ENG0513TA 1

2. Using the diagnostic tool, start the forced regeneration procedure of the DPF filter.




NHIL25ENG0514FA 2

3. Stop the forced regeneration procedure of the DPF filter before the cooling phase in order to obtain high temperatures in the exhaust gas after treatment system.

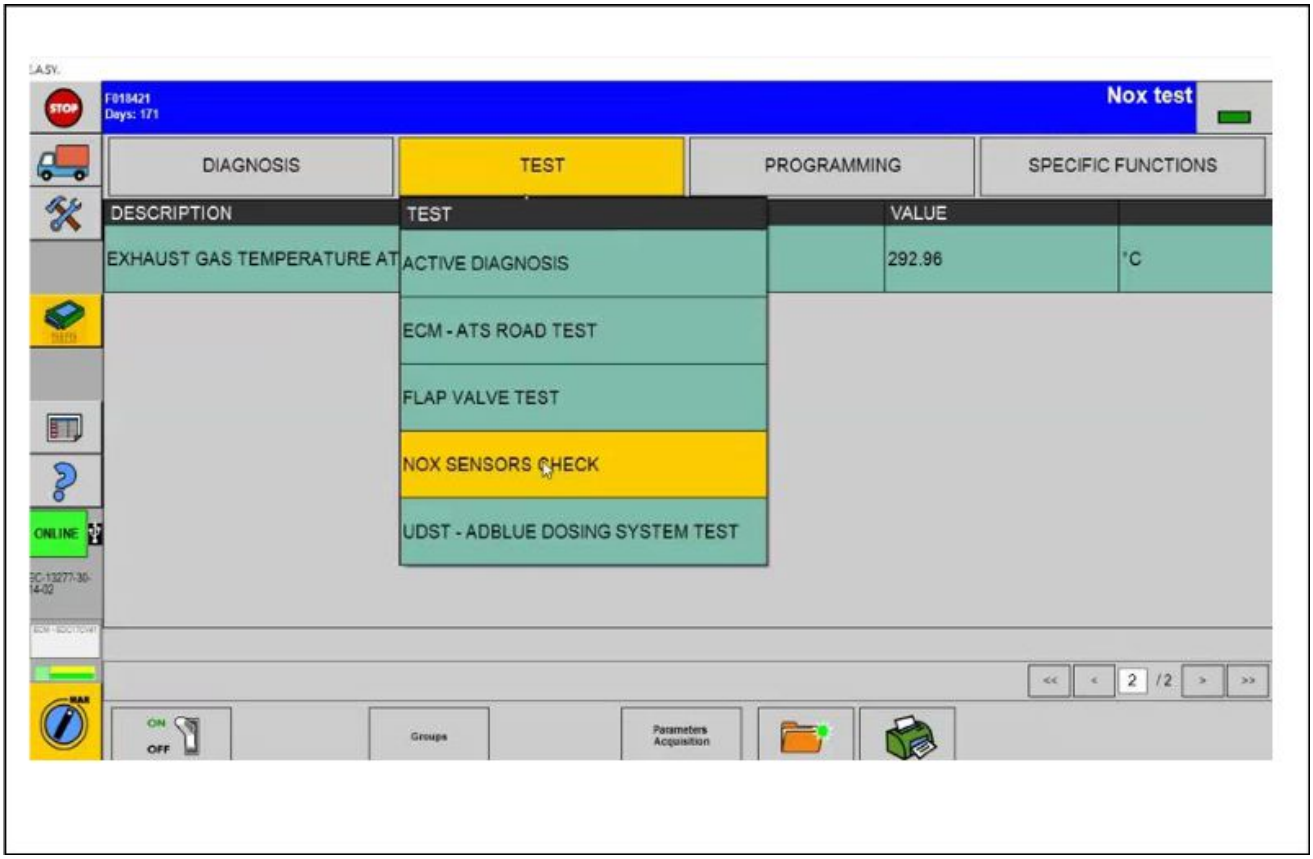



NHIL25ENG0515FA 3

4. The interruption of the forced regeneration procedure of the DPF filter will automatically stop the engine.

NHIL25ENG0516FA 4

5. Using the diagnostic tool, start the active diagnosis of the NOx sensors.




NHIL25ENG0517FA 5

6. Manually disconnect the connector of the dosing module X-F44 / X-F44A.

## ⚠ WARNING

**Avoid injury!**
**Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.**
**Failure to comply could result in death or serious injury.**

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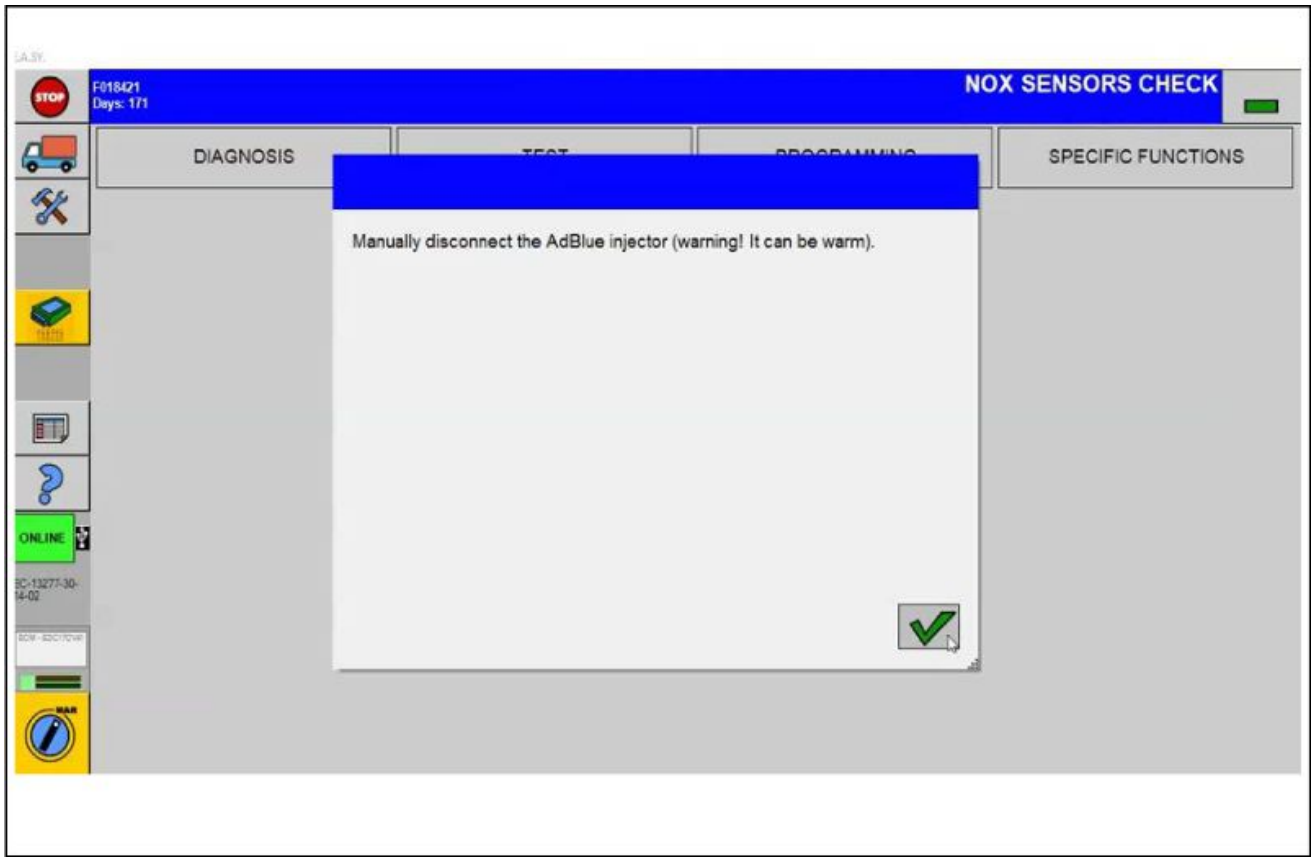
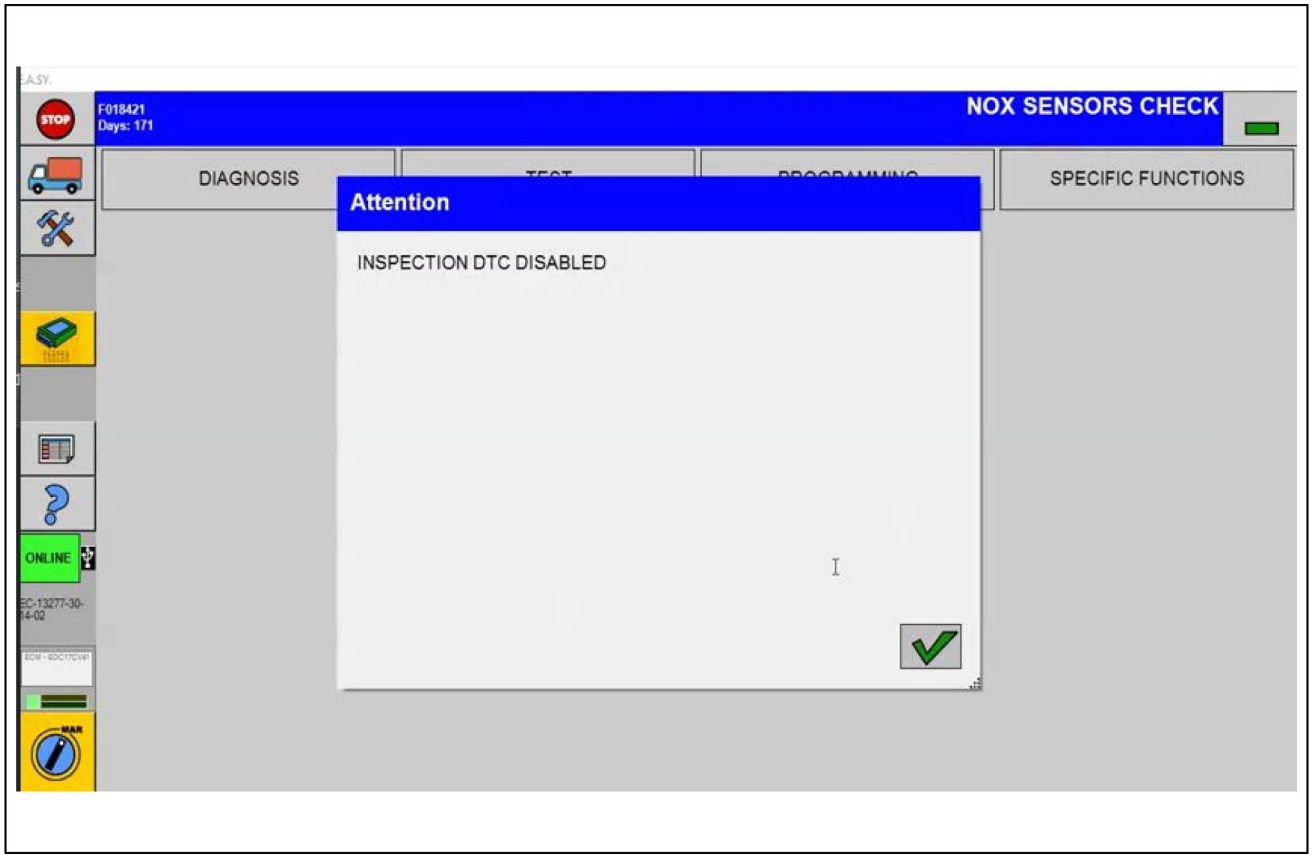


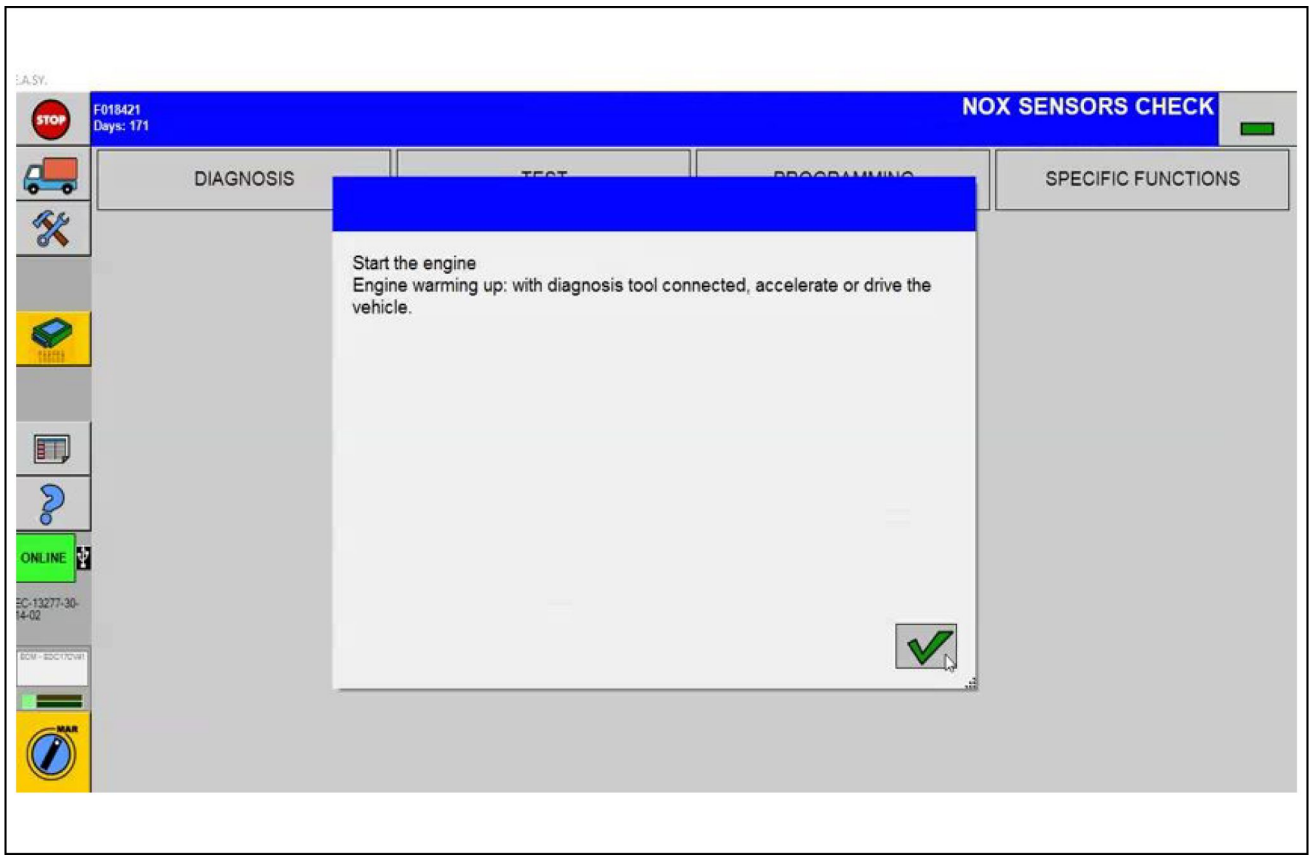

NHIL25ENG0518FA 6

7. Active diagnosis relating to NOx sensors will inhibit the errors setting.



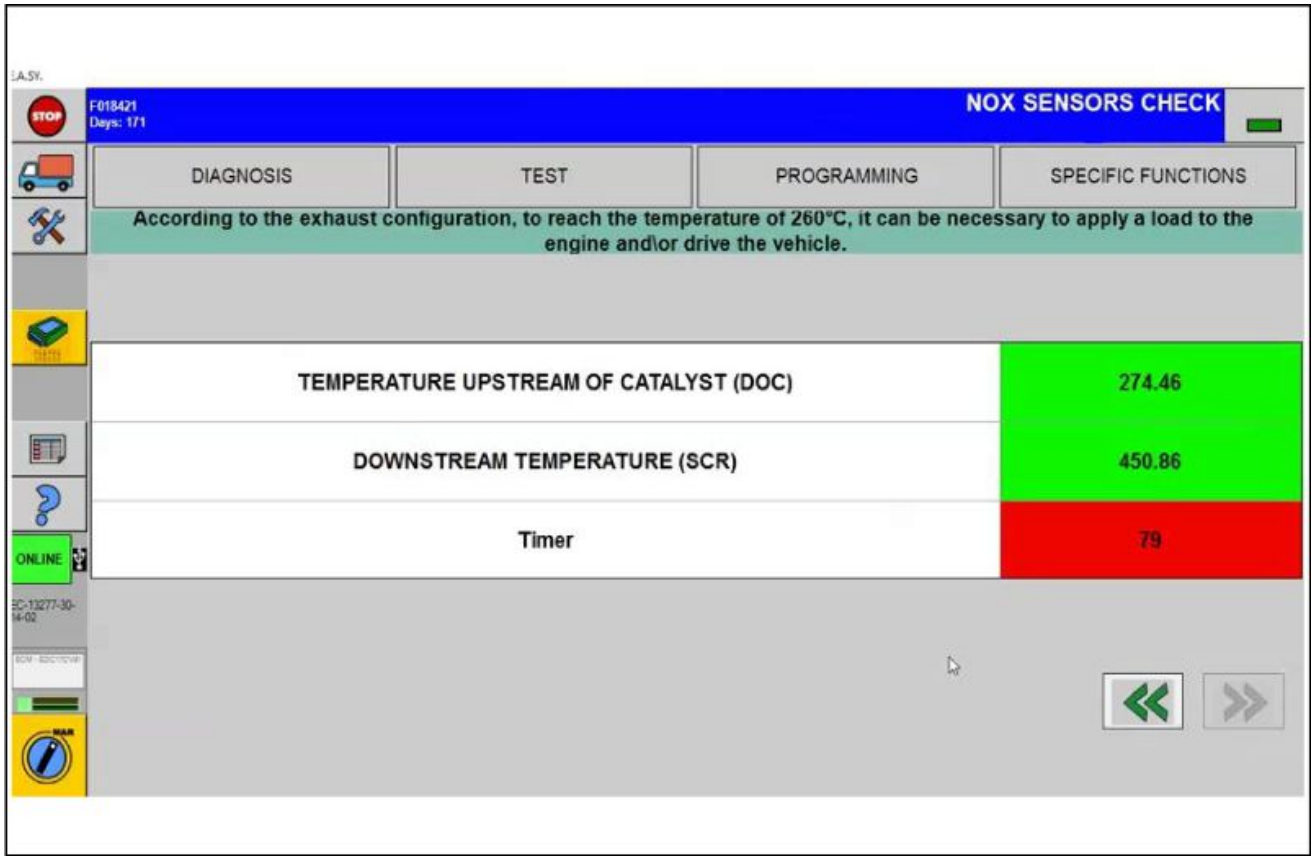

NHIL25ENG0519TA 7

8. Start the engine again and run it at a speed close to **1600 RPM** in order to maintain high temperatures in the exhaust gas after treatment system.



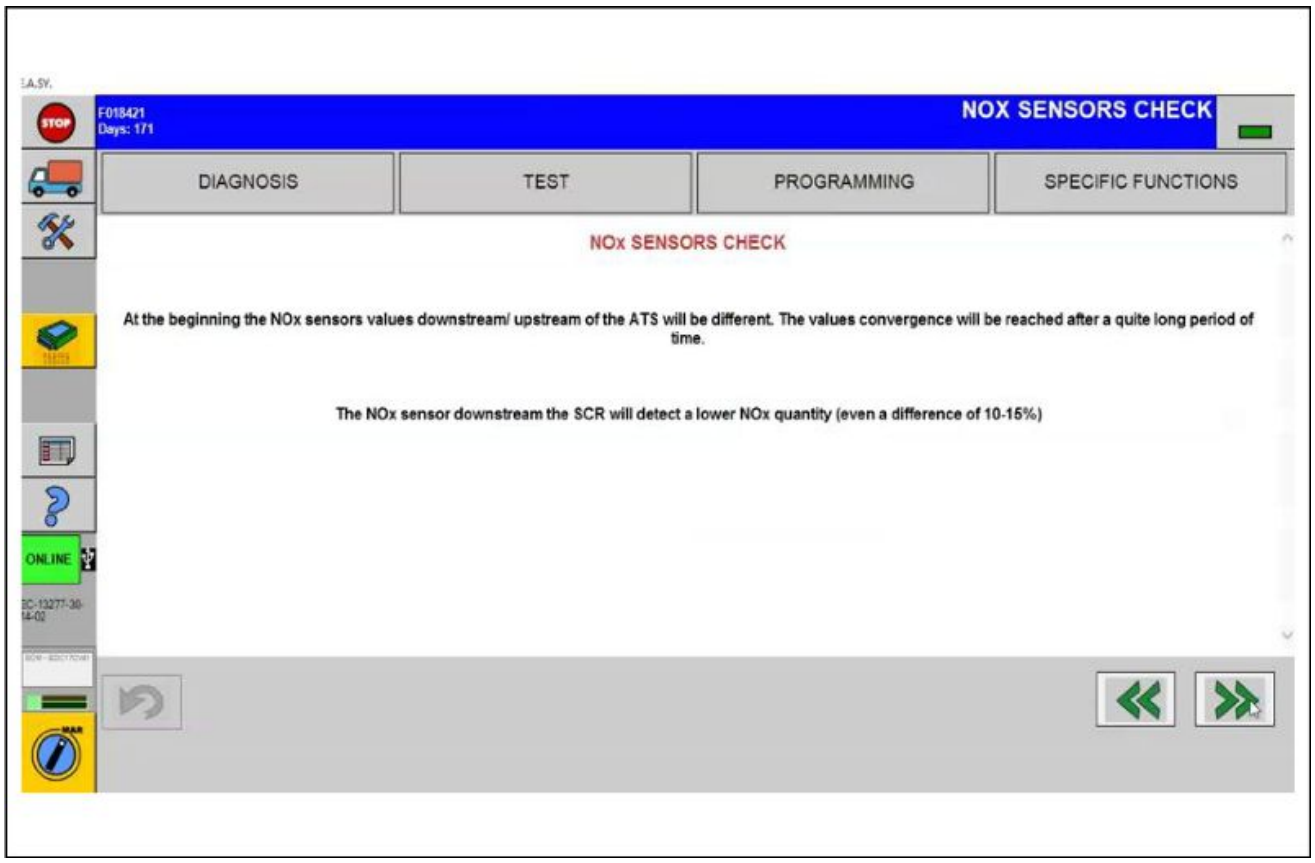

NHIL25ENG0520TA 8

9. Wait for the temperature to reach the indicated threshold and for the timer to finish the count.



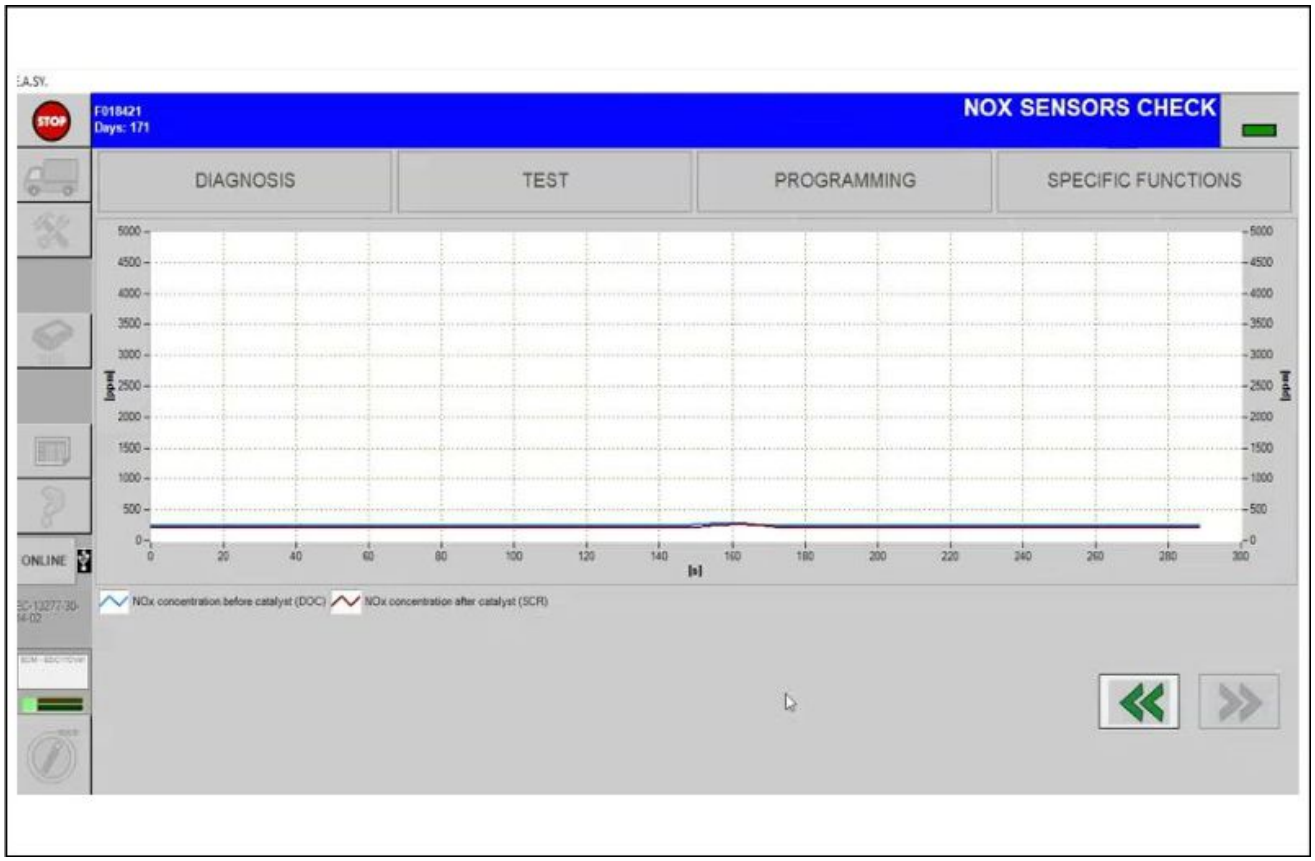

NHIL25ENG0521FA 9

10. Wait for the sensor values B-F67 and B-F49 to converge. In this phase, the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid residues inside the pipes of the exhaust system are gradually spent.




NHIL25ENG0522FA 10

11. continue by selecting the “>>” key to wait for the graph to be completed.




NHIL25ENG0523FA 11

12. Reconnect the connector of the dosing module X-F44/ X-F44A.

## ⚠ WARNING

**Avoid injury!**
**Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.**
**Failure to comply could result in death or serious injury.**

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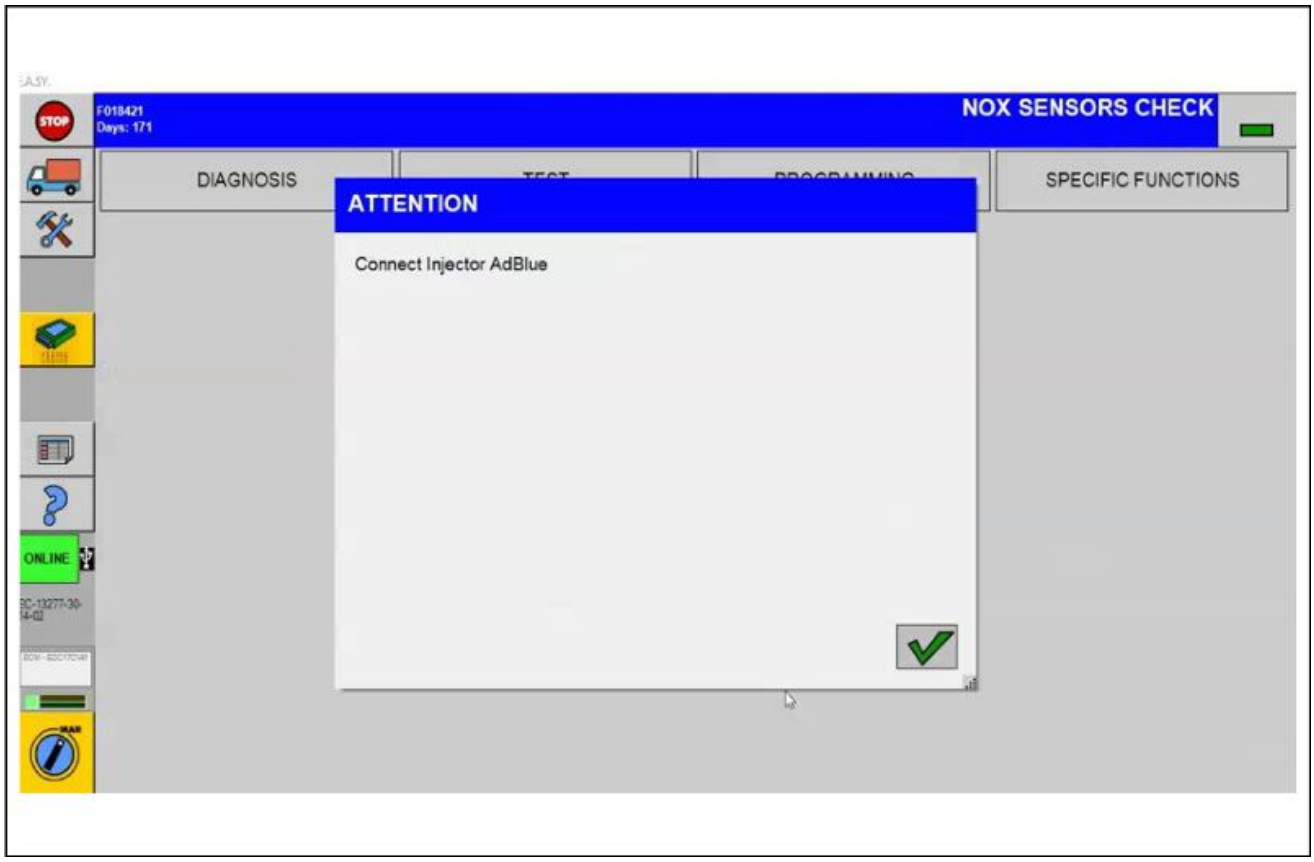
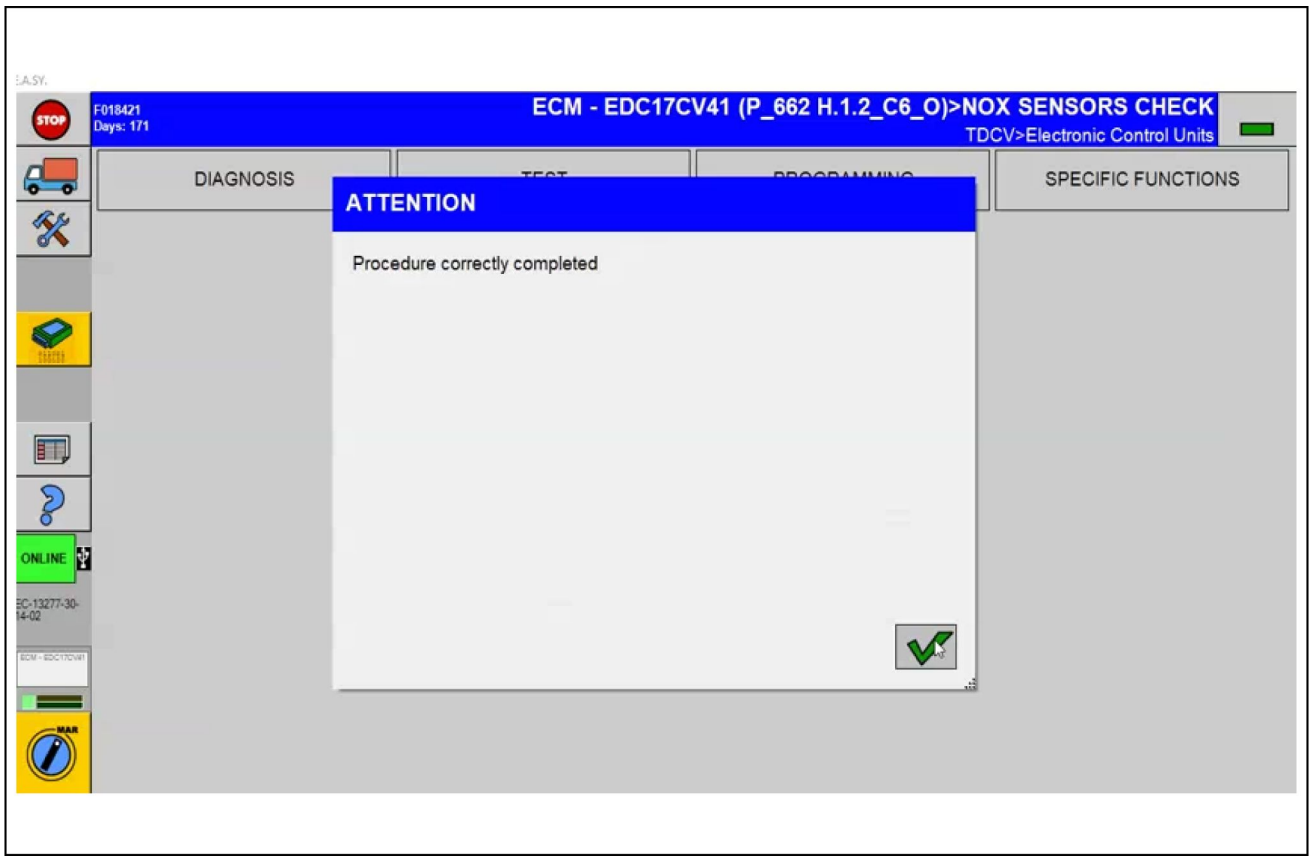



NHIL25ENG0524FA 12

13. The procedure is complete, clear the fault memory and go to the step **14**.




NHIL25ENG0525TA 13

14. The procedure allows correct operation and plausibility of the sensors to be checked upstream and downstream of the Selective Catalytic Reduction (SCR).

    A. If both sensors return a similar value to each other, then the procedure is verified. Return to the troubleshooting procedure.

    B. If the sensors do not return similar values, there could be a malfunction on one of the two components. Return to the fault identification procedure.

# Nitrogen Oxide (NOx) sensor - Test - NOx sensor upstream of the SCR [113408014 - V1 - 26 February 2025]

## Description

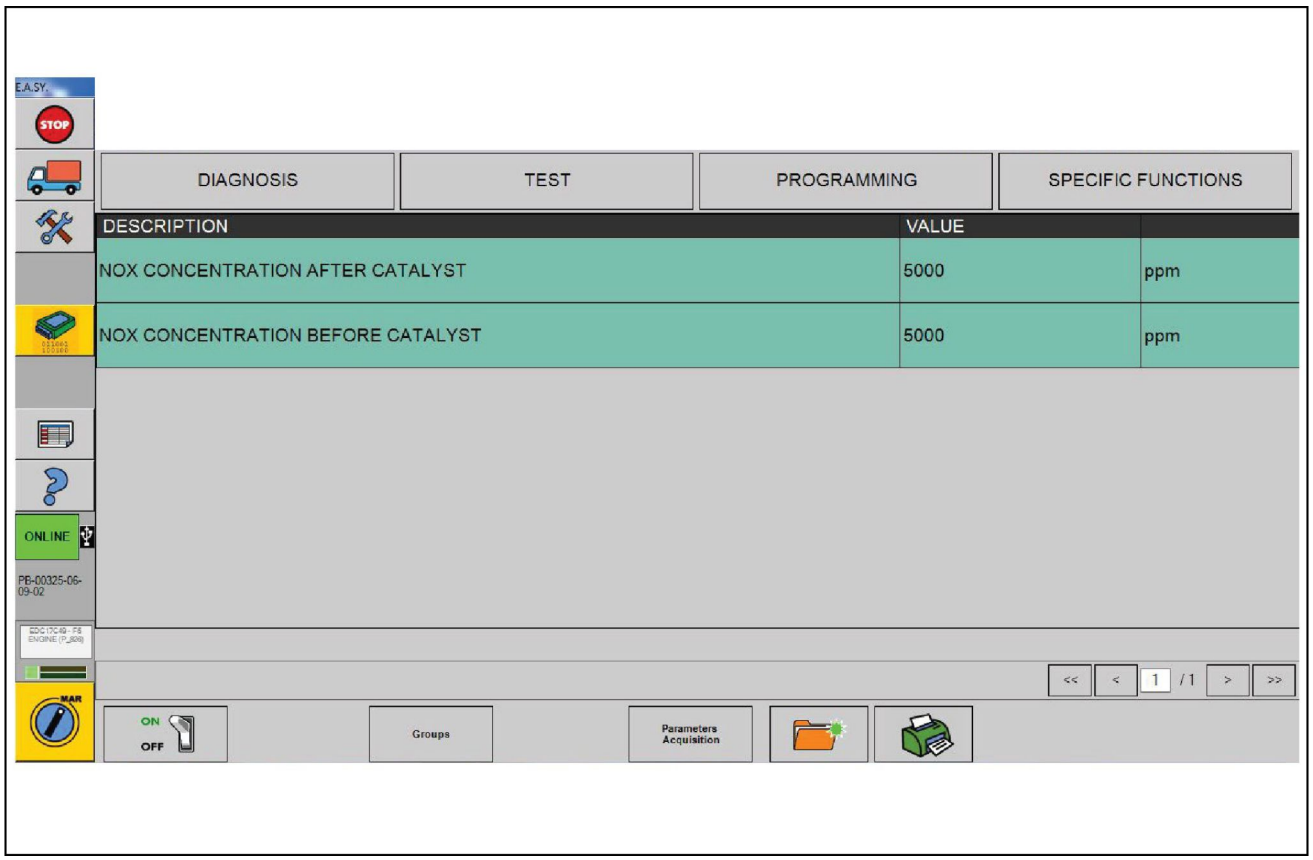
The NOx sensor B-F67 is present in the exhaust gas after- treatment system **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)** and is located after the turbocharger at the inlet of the Diesel Oxidation Catalyst (DOC). The NOx sensor B-F67 is made up of two parts: an electronic module connected via wiring to the sensor body. The two components cannot be separated. The NOx inlet sensor B-F67 detects the amount of nitrogen oxide entering the DOC and, via the CAN network, it allows the Engine Control Unit **A-F02** to constantly adjust the introduction of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid on the basis of the emissions.

To refer to the technical data relating to the NOx sensor B-F67.

***NOTE:*** *The electronic control unit activates the sensor only when the temperature inside the exhaust duct is sufficiently high to prevent the presence of condensate, otherwise the sensor could be damaged.*

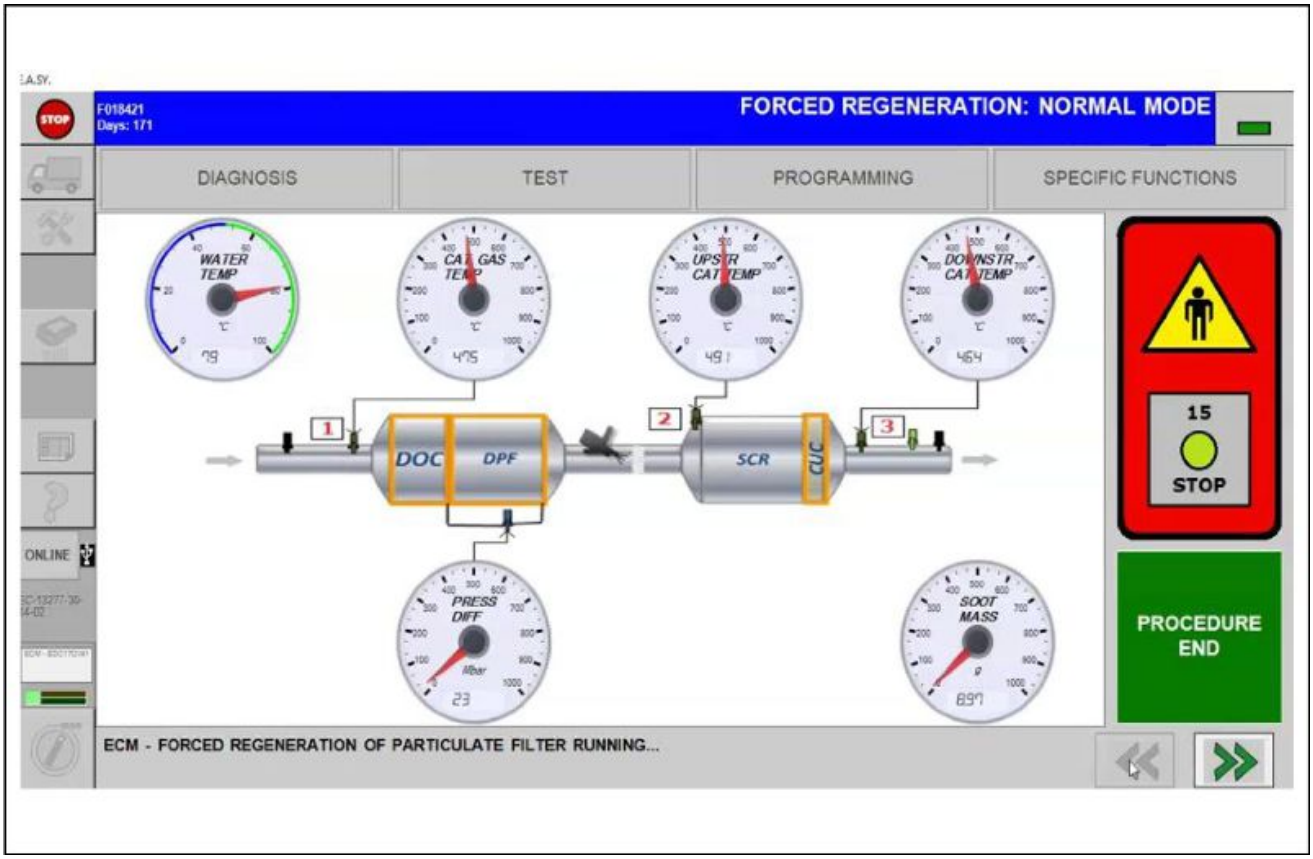
## Diagnostics procedure

1. Use the diagnostic instrument to monitor the values relating to the following sensors:
   - NOx sensor upstream B-F67 of the Selective Catalytic Reduction catalyst (SCR).
   - NOx sensor downstream B-F49 of the Selective Catalytic Reduction catalyst (SCR).



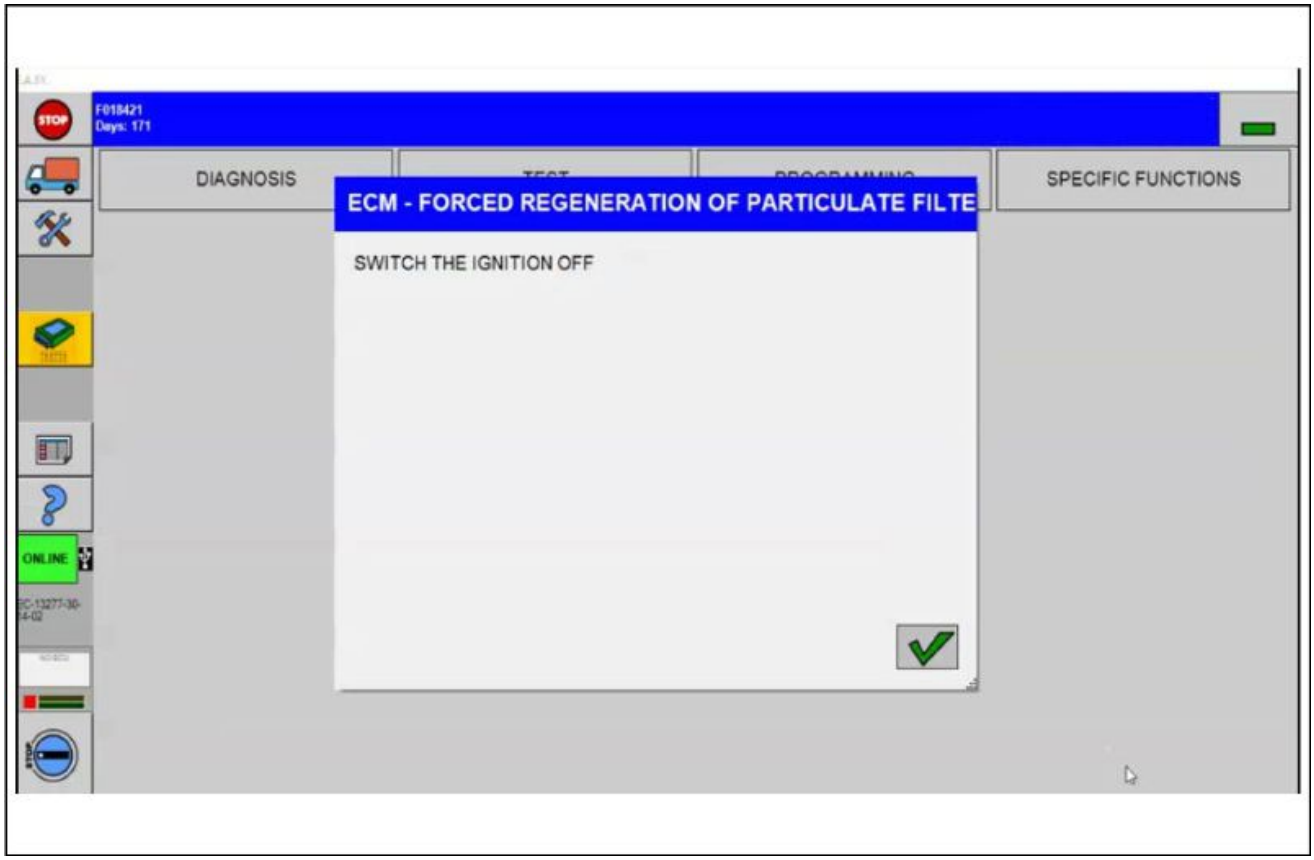

NHIL25ENG0513TA 1

2. Using the diagnostic tool, start the forced regeneration procedure of the DPF filter.




NHIL25ENG0514FA 2

3. Stop the forced regeneration procedure of the DPF filter before the cooling phase in order to obtain high temperatures in the exhaust gas after treatment system.

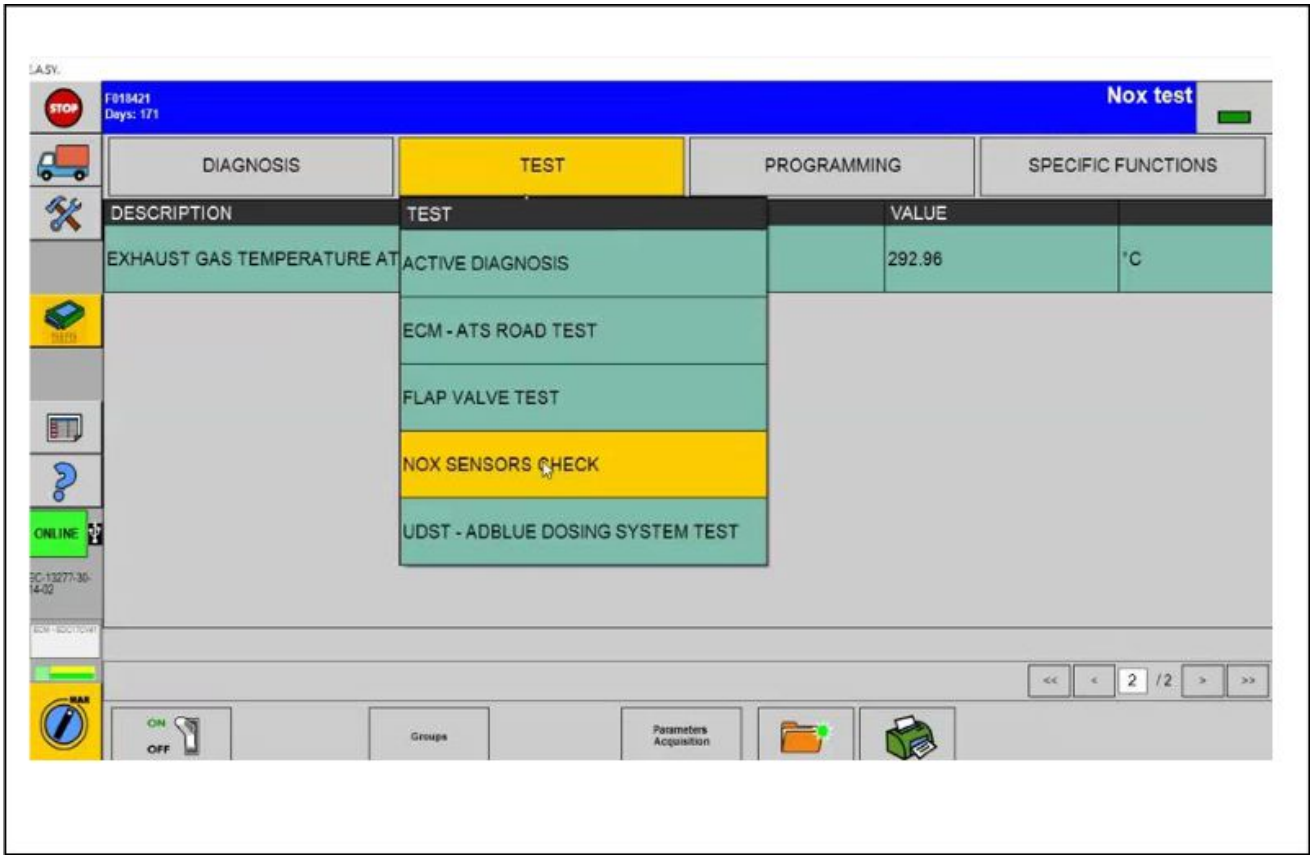



NHIL25ENG0515FA 3

4. The interruption of the forced regeneration procedure of the DPF filter will automatically stop the engine.

NHIL25ENG0516FA 4

5. Using the diagnostic tool, start the active diagnosis of the NOx sensors.




NHIL25ENG0517FA 5

6. Manually disconnect the connector of the dosing module X-F44 / X-F44A .

## ⚠ WARNING

**Avoid injury!**
**Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.**
**Failure to comply could result in death or serious injury.**

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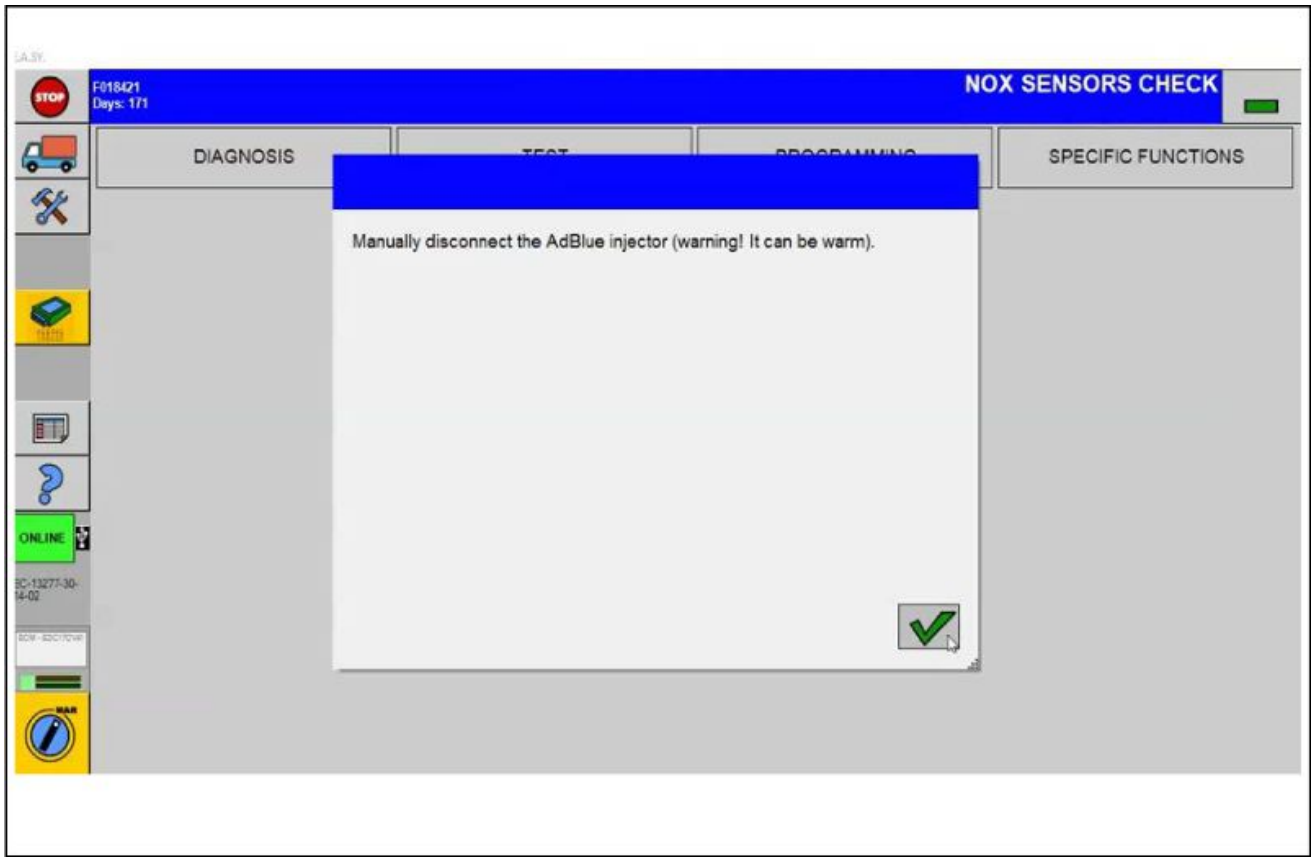
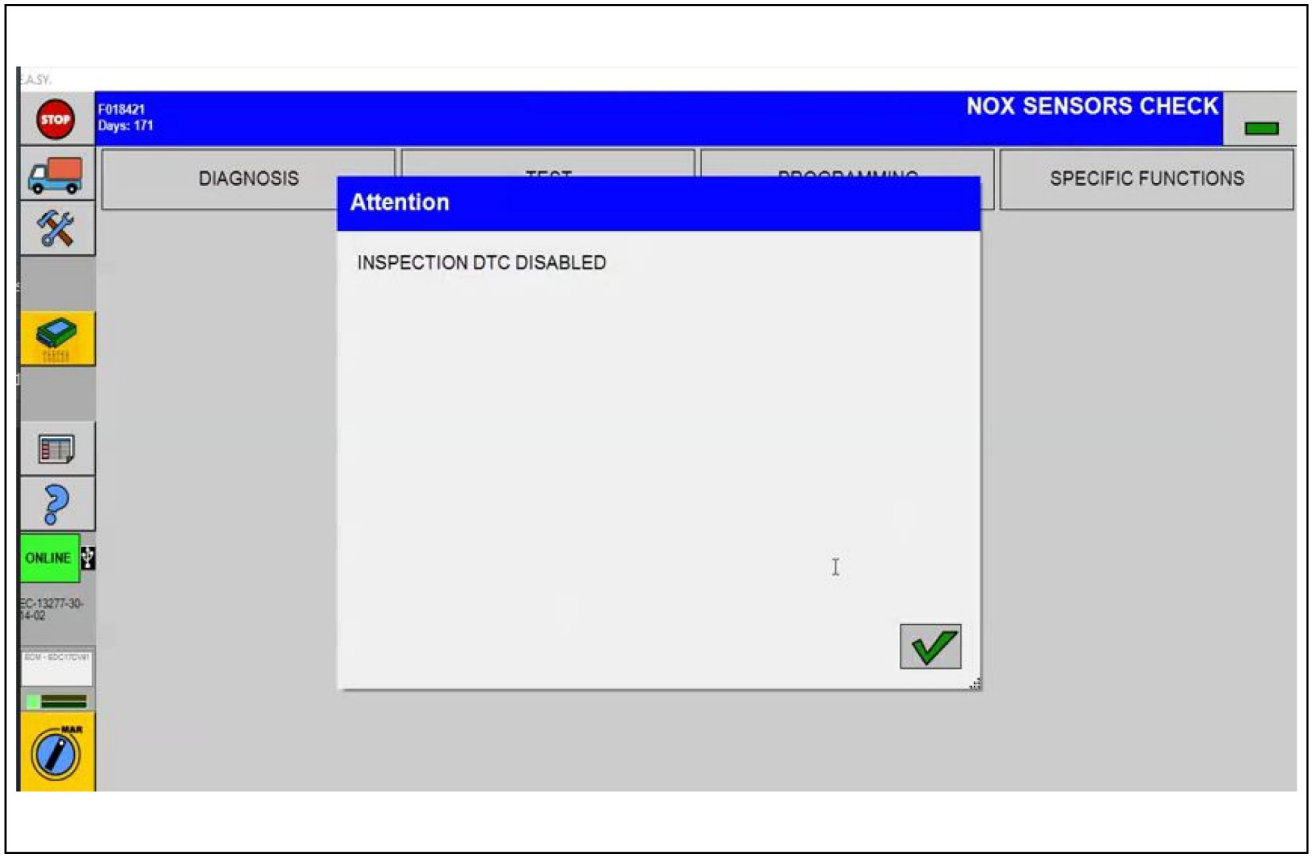


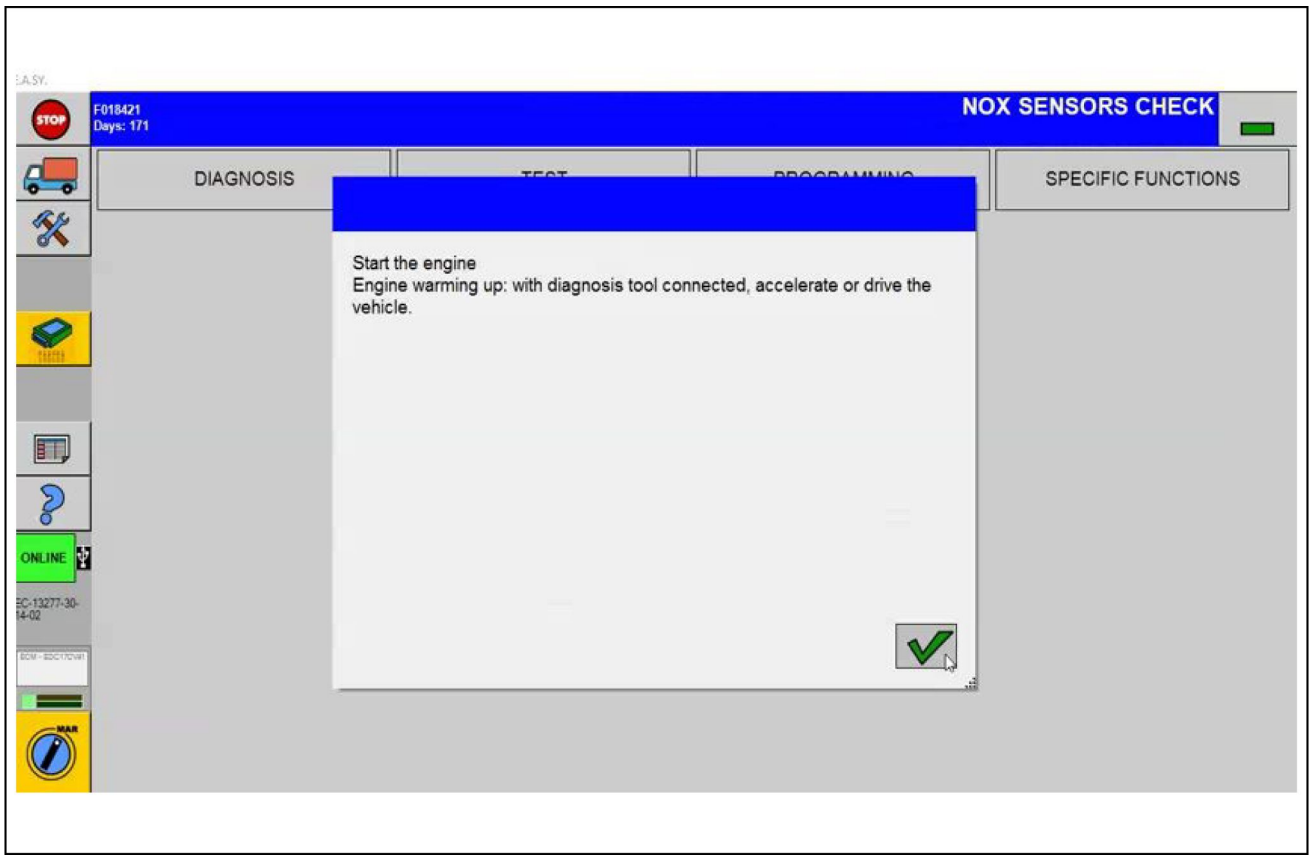

NHIL25ENG0518FA 6

7. Active diagnosis relating to NOx sensors will inhibit the errors setting.



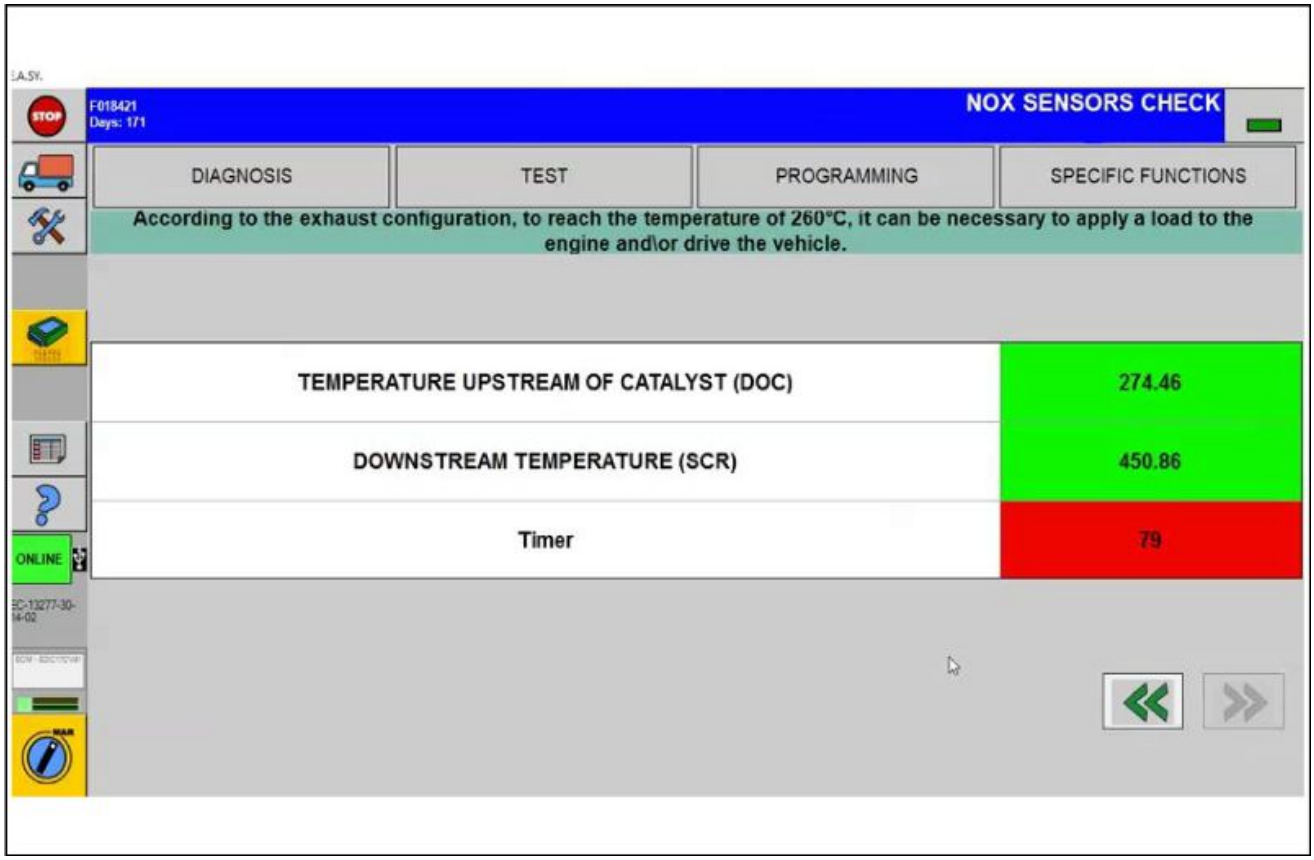

NHIL25ENG0519TA 7

8. Start the engine again and run it at a speed close to **1600 RPM** in order to maintain high temperatures in the exhaust gas after treatment system.



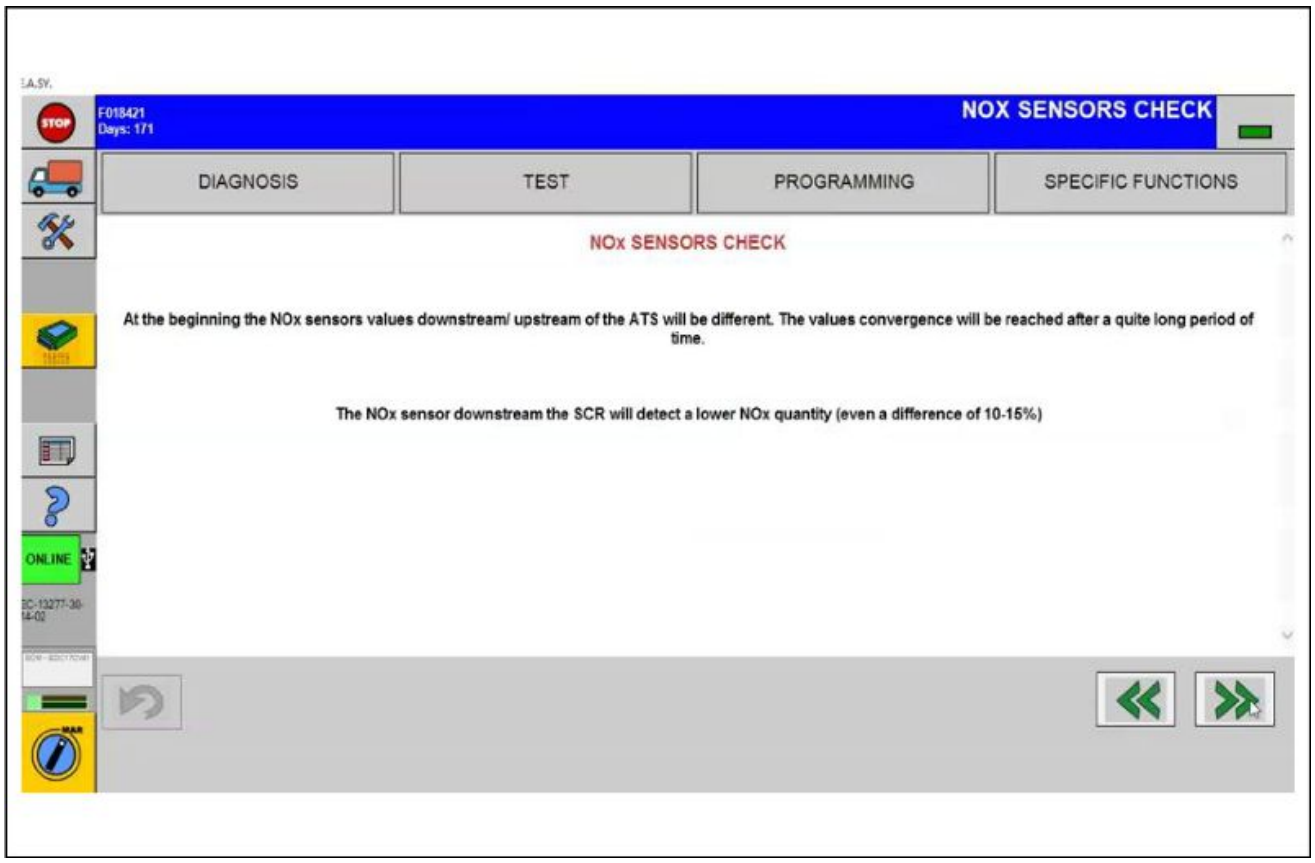

NHIL25ENG0520TA 8

9. Wait for the temperature to reach the indicated threshold and for the timer to finish the count.



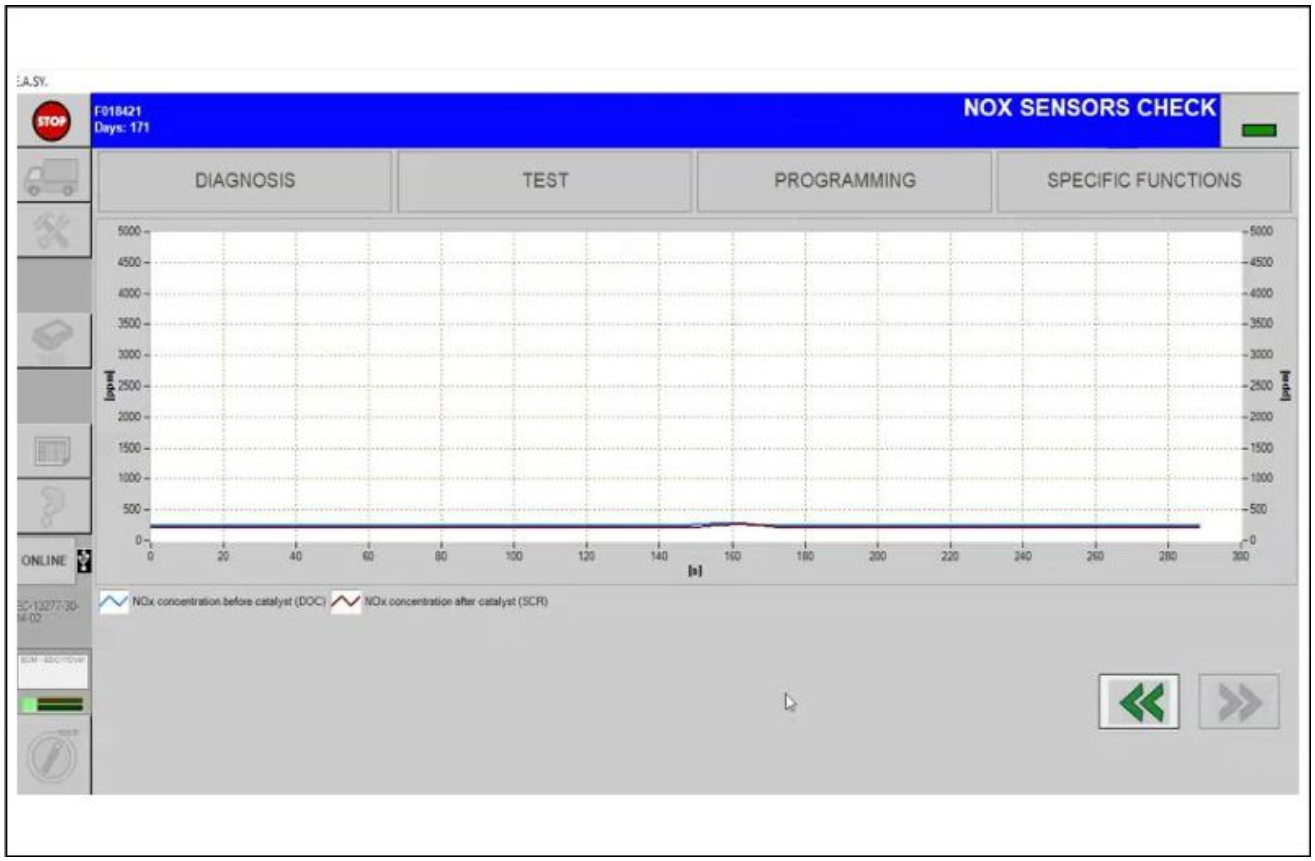

NHIL25ENG0521FA 9

10. Wait for the sensor values B-F67 and B-F49 to converge. In this phase, the **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid residues inside the pipes of the exhaust system are gradually spent.




NHIL25ENG0522FA 10

11. continue by selecting the “>>” key to wait for the graph to be completed.



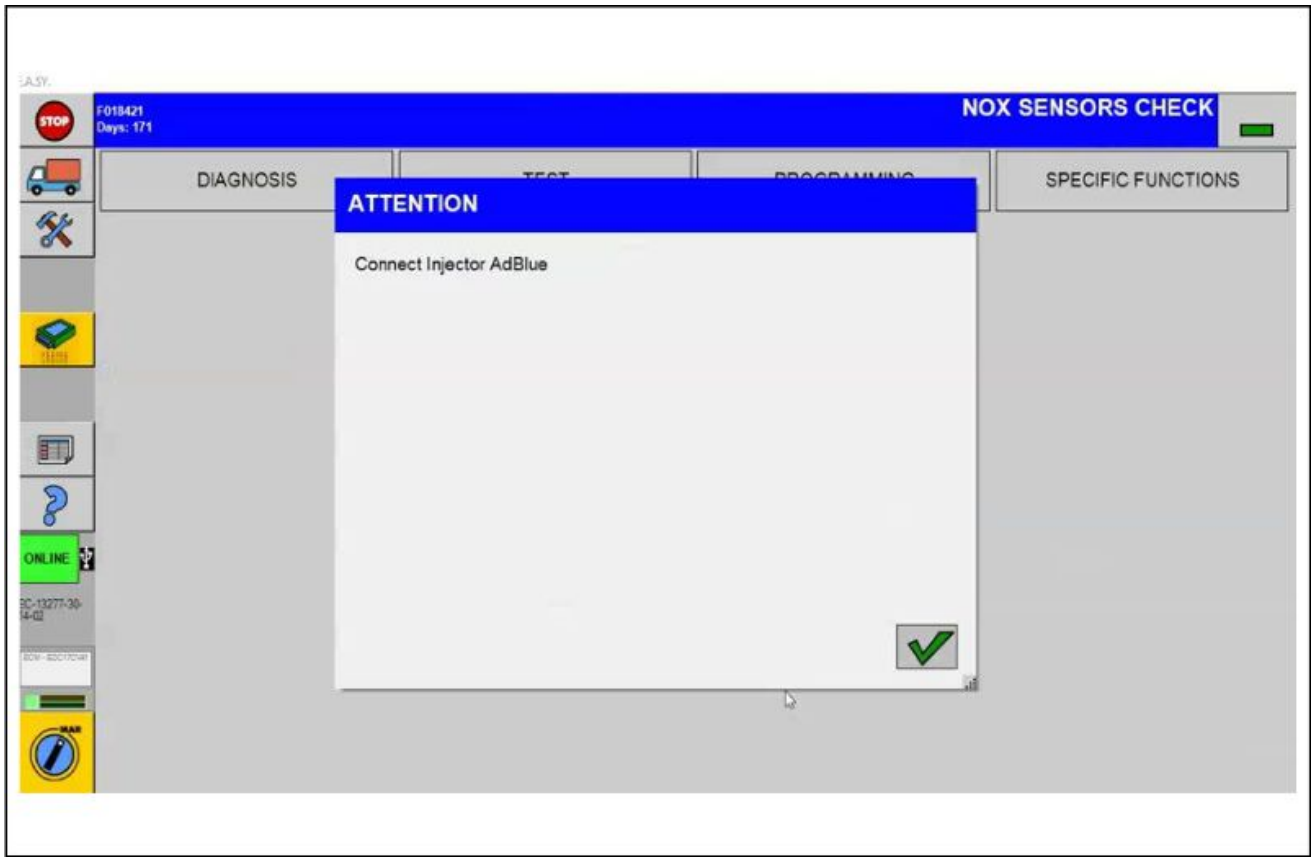

NHIL25ENG0523FA 11

12. Reconnect the connector of the dosing module X-F44/ X-F44A.

## ⚠ WARNING

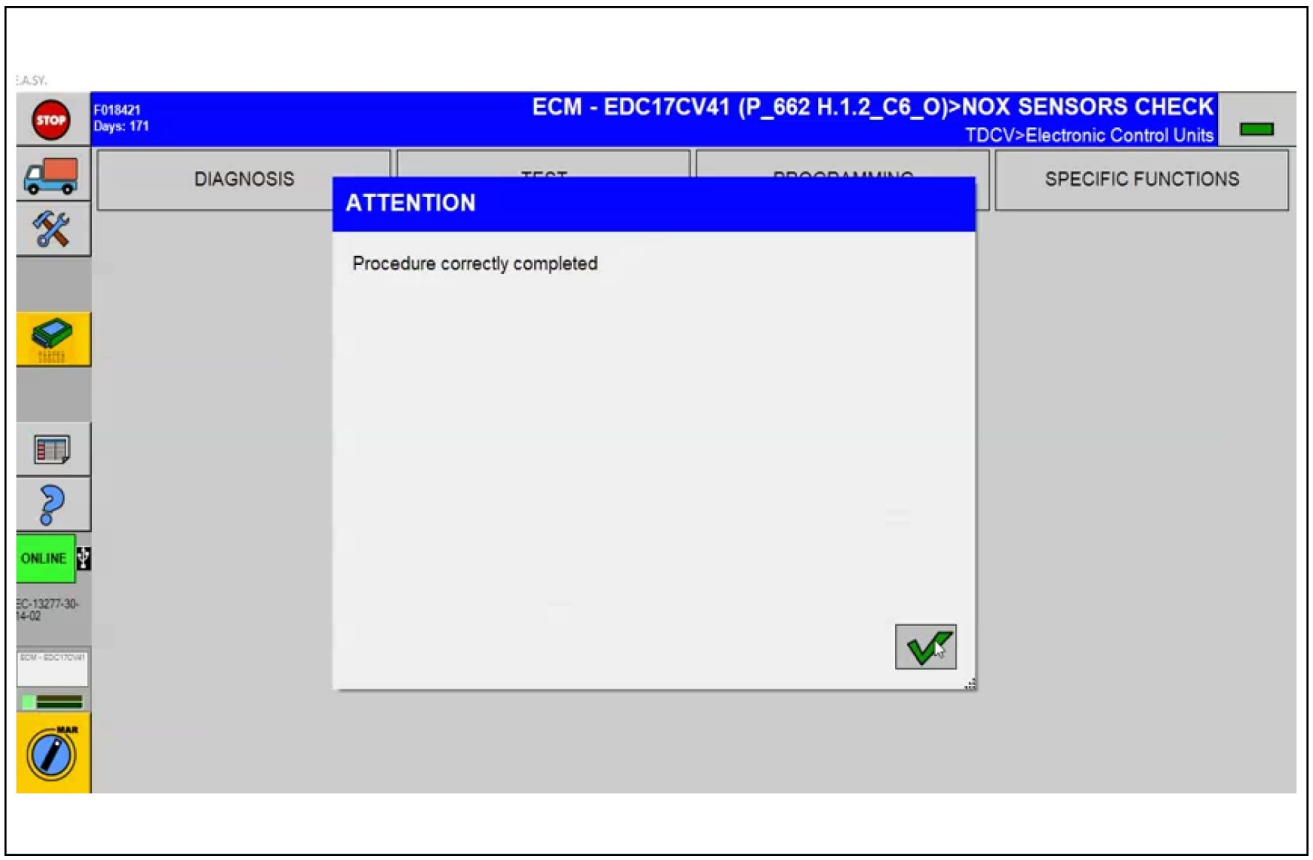
**Avoid injury!**
**Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.**
**Failure to comply could result in death or serious injury.**

W1036A




NHIL25ENG0524FA 12

13. The procedure is complete, clear the fault memory and go to the step **14**.




NHIL25ENG0525TA 13

14. The procedure allows correct operation and plausibility of the sensors to be checked upstream and downstream of the Selective Catalytic Reduction (SCR).

    A. If both sensors return a similar value to each other, then the procedure is verified. Return to the troubleshooting procedure.

    B. If the sensors do not return similar values, there could be a malfunction on one of the two components. Return to the fault identification procedure.

# Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA quality sensor - Test - AdBlue quality, level and temperature SUN-A sensor [113408017 - V1 - 26 February 2025]

The AdBlue quality, level and temperature sensor is present in the exhaust gas after treatment system **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)** and measures the AdBlue temperature, level and quality inside the tank.

To refer to the technical data relating to the AdBlue temperature, level, and quality sensor, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA quality sensor - Test - AdBlue quality, level and temperature SUN-A sensor (55.988)**.

## Diagnostics procedure

1. Check that the AdBlue fluid is not contaminated and that the concentration is correct ( **32.5%**). Proceed as follows:

***NOTE:*** *Do not add water or any liquid other than the one specified into the AdBlue tank. This would cause serious damage to the after-treatment system.*

- AdBlue concentration must be **32.5%** +/- **0.7%**. If the concentration is not within the specified value, the tank must be drained, washed with distilled water and refilled with the quality of fluid indicated.
- AdBlue concentration must be verified in the following cases:
  - The vehicle has been stationary for an extended period.
  - There is the possibility that water might have been added to the AdBlue tank.
  - There is the possibility that water might have evaporated from the AdBlue tank.
  - The AdBlue filler cap has been removed from the tank for an extended period of time.
  - There is the possibility of a fault in the heating system in the AdBlue tank.
  - There is the possibility of incorrect refilling having been carried out.
- Checking of the AdBlue concentration is carried out using a refractometer. The refractometer consists of two prisms and a light source. The indication of concentration is read on a graded scale created by the curvature of the light beam that passes through the liquid. Proceed as follows:
  - Place a few droplets of the liquid to be analysed on the lens.
  - Go to a well lit area and look at the lens.
  - The quadrant will divide into two colours.
  - The line separating the two colours will indicate the percentage of concentration.

- Refractometer calibration, proceed as follows:
  - Take a solvent for parenteral use to wash the light source and the lens cover.
  - Place three droplets of the solvent for parenteral use on the lens and lower the lens cover.
  - Look through the eyepiece and bring the droplets into focus.
  - Rotate the calibration screw until the instrument is calibrated to "0".
- AdBlue tank contamination: If the AdBlue tank has been contaminated, proceed as follows:
  - Remove the filter from the AdBlue dosing module.
  - Check that the filter does not show any sign of contaminated liquid having passed through it.
  - Drain the tank.
  - Wash it with distilled water.
  - Check and replace all line filters. Follow the procedure AD-BLUE FILTER - Replace (50.74).
  - Refill with liquid of the specified quality.

If the filter from the AdBlue dosing module shows signs of contamination, proceed as follows:

- Drain the tank.
- Wash it with distilled water.
- Replace all line filters. Follow the procedure AD-BLUE FILTER - Replace (50.74).
- Replace the dosing module filter.
- Disconnect all the lines and wash them with distilled water.
- Fill the tank with distilled water.
- Use the diagnostic tool to activate the pump module and repeat the test on the dosing module until clear liquid is obtained.
- Drain the distilled water from the tank and refill with liquid of the specified quality.

A. If the AdBlue concentration is correct, go to step **2**.

B. If the AdBlue concentration is not correct, repeat the verification.

2. Use the diagnostic tool to acquire the data relating to the temperature of the fluid in the AdBlue tank. Use a digital thermometer with a probe to measure the temperature relating to the fluid in the AdBlue tank. Compare the data provided by the diagnostic tool with the data measured directly using the digital thermometer.

   A. If the temperature values match, this indicates that the temperature read by the sensor is correct. Go to step **3**.

   B. If the temperature values do not coincide, this indicates that the sensor might not be working correctly. Go back to the fault identification procedure and then go to step **4**.

3. Use the diagnostic tool to acquire the data relating to the level of liquid present in the AdBlue® tank in the following conditions:
   - AdBlue tank completely empty ( **0%**).
   - AdBlue tank **50%** full, use the capacity data to determine the exact amount of fluid to be introduced.
   - AdBlue tank completely full ( **100%**).

   Analyse the three sets of data provided by the diagnostic instrument, checking that they are consistent with the three different test conditions.

   A. If the values relating to the level sensor are consistent, go to step **4**.

   B. If the temperature values are not consistent, this indicates that the sensor might not be working correctly. Go back to the fault identification procedure and then go to step **4**.

4. Use the diagnostic instrument to disable and delete the fault code. Restore vehicle operating conditions and check that the fault code relating to the quality, temperature, and level sensor AdBlue does not activate.

   A. If the fault code relating to the quality, temperature, and level sensor AdBlue is not active, the sensor is working correctly. Continue with the fault identification procedure.

   B. If the fault code relating to the AdBlue temperature, level and quality sensor is active, check the efficiency of the electrical wiring and continue with the fault identification procedure.

# Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA quality sensor - Test - AdBlue quality, level and temperature Wema sensor [113408018 - V1 - 26 February 2025]

The AdBlue quality, level and temperature sensor is present in the exhaust gas after treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)** and measures the AdBlue temperature, level and quality inside the tank.

To refer to the technical data relating to the AdBlue temperature, level, and quality sensor, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA quality sensor - Test - AdBlue quality, level and temperature SUN-A sensor (55.988)** .

## Diagnostics procedure

1. Check that the AdBlue fluid is not contaminated and that the concentration is correct ( **32.5%**). Proceed as follows:

***NOTE:*** *Do not add water or any liquid other than the one specified into the AdBlue tank. This would cause serious damage to the after-treatment system.*

- AdBlue concentration must be **32.5%** +/- **0.7%**. If the concentration is not within the specified value, the tank must be drained, washed with distilled water and refilled with the quality of fluid indicated.
- AdBlue concentration must be verified in the following cases:
  - The vehicle has been stationary for an extended period.
  - There is the possibility that water might have been added to the AdBlue tank.
  - There is the possibility that water might have evaporated from the AdBlue tank.
  - The AdBlue filler cap has been removed from the tank for an extended period of time.
  - There is the possibility of a fault in the heating system in the AdBlue tank.
  - There is the possibility of incorrect refilling having been carried out.
- Checking of the AdBlue concentration is carried out using a refractometer. The refractometer consists of two prisms and a light source. The indication of concentration is read on a graded scale created by the curvature of the light beam that passes through the liquid. Proceed as follows:
  - Place a few droplets of the liquid to be analysed on the lens.
  - Go to a well lit area and look at the lens.
  - The quadrant will divide into two colours.
  - The line separating the two colours will indicate the percentage of concentration.

- Refractometer calibration, proceed as follows:
  - Take a solvent for parenteral use to wash the light source and the lens cover.
  - Place three droplets of the solvent for parenteral use on the lens and lower the lens cover.
  - Look through the eyepiece and bring the droplets into focus.
  - Rotate the calibration screw until the instrument is calibrated to "0".
- AdBlue tank contamination: If the AdBlue tank has been contaminated, proceed as follows:
  - Remove the filter from the AdBlue dosing module.
  - Check that the filter does not show any sign of contaminated liquid having passed through it.
  - Drain the tank.
  - Wash it with distilled water.
  - Check and replace (if necessary) all the filters in the line.
  - Refill with liquid of the specified quality.

If the filter from the AdBlue dosing module shows signs of contamination, proceed as follows:

- Drain the tank.
- Wash it with distilled water.
- Replace all the filters in the line.
- Replace the dosing module filter.
- Disconnect all the lines and wash them with distilled water.
- Fill the tank with distilled water.
- Use the diagnostic tool to activate the pump module and repeat the test on the dosing module until clear liquid is obtained.
- Drain the distilled water from the tank and refill with liquid of the specified quality.

A. If the AdBlue concentration is correct, go to step **2**.

B. If the AdBlue concentration is not correct, repeat the verification.

2. Use the diagnostic tool to measure the temperature of the fluid in the AdBlue tank. Use a digital thermometer with a probe to measure the temperature of the fluid in the AdBlue tank. Compare the data provided by the diagnostic tool with the value measured using the digital thermometer.

   A. If the temperature values match, this indicates that the temperature read by the sensor is correct. Go to step **3**.

   B. If the temperature values do not coincide, this indicates that the sensor might not be working correctly. Go back to the fault identification procedure and then go to step **4**.

3. Use the diagnostic tool to acquire the data relating to the level of liquid present in the **DEF/ADBLUE®** tank in the following conditions:
   - AdBlue tank completely empty ( **0%**).
   - AdBlue tank **50%** full, use the capacity data to determine the exact amount of fluid to be introduced.
   - AdBlue tank completely full ( **100%**).

   Analyse the three sets of data provided by the diagnostic instrument, checking that they are consistent with the three different test conditions.

   A. If the values relating to the level sensor are consistent, go to step **4**.

   B. If the temperature values are not consistent, this indicates that the sensor might not be working correctly. Go back to the fault identification procedure and then go to step **4**.

4. Use the diagnostic tool to disable and delete the fault code. Restore vehicle operating conditions and check that the fault code relating to the quality, temperature, and level sensor does not activate.

   A. If the fault code relating to the quality, temperature, and level sensor AdBlue is not active, the sensor is working correctly. Continue with the fault identification procedure.

   B. If the fault code relating to the AdBlue temperature, level and quality sensor is active, check the efficiency of the electrical wiring and continue with the fault identification procedure.

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**F6AFL413A*U001**

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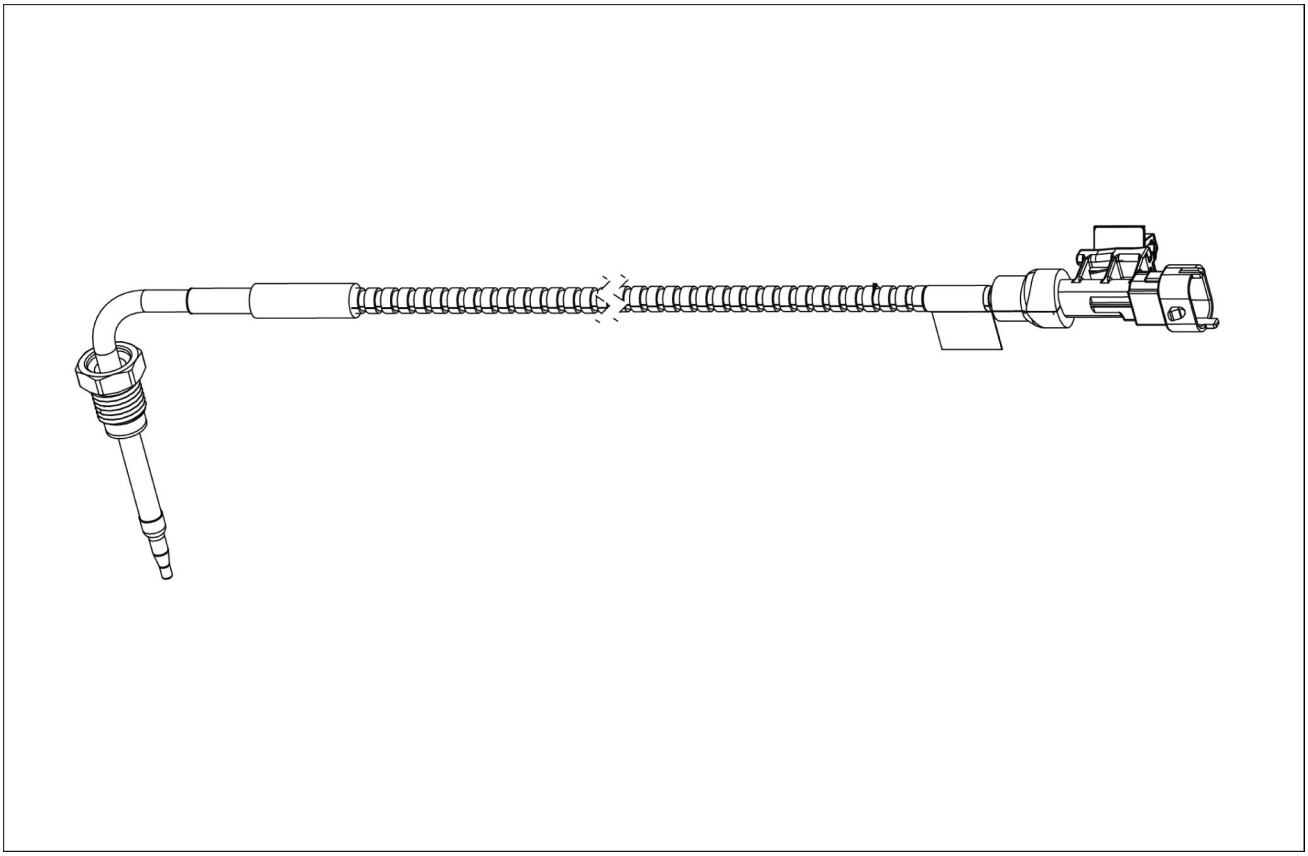
# Exhaust Gas Recirculation (EGR) temperature sensors - Overview - Temperature sensor [113437902 - V1 - 06 March 2025]

## Exhaust gas temperature sensor



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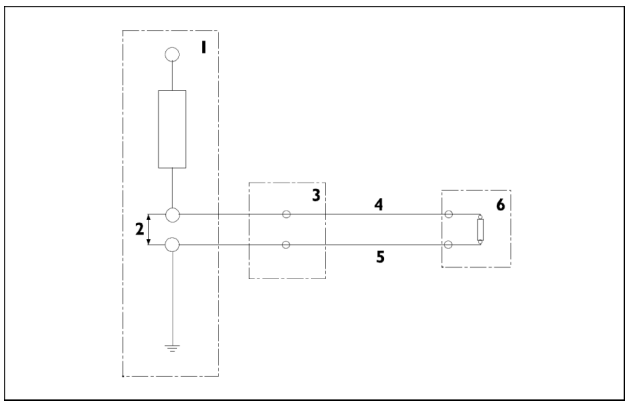
## Functional wiring diagram

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| Item | Description |
|---|---|
| 1 | Power supply voltage |
| 2 | Variable output voltage |
| 3 | Connector |
| 4 | Signal cable (grey) |
| 5 | Ground cable (white) |
| 6 | Sensor |

The function of this sensor is to send to the control unit the exhaust gas temperature measured in various points of the ATS:

- At the DOC inlet, signal used to protect the DOC against overheating.
- At the DOC outlet, signal used to protect the DOC against overheating.

| CHARACTERISTICS OF THE EXHAUST GAS TEMPERATURE SENSOR | NOMINAL |
|---|---|
| Power supply | **+ 5 +/- 0.1% V** |
| Output resistance at temperature of - 40 – 800 °C | **170.2 – 738.7 V** |
| Pull-up resistance | **1.000 +/- 0.1% Ω** |
| Cable resistance | **1 Ω** |
| Tightening torque | **45 +/- 4.5 N·m** |

| (T) | (RS) | (V0) |
|---|---|---|
| **-40.0 °C** (**-40.0 °F**) | **170.2 Ω** | **0.727 V** |
| **-20.0 °C** (**-4.0 °F**) | **185.6 Ω** | **0.783 V** |
| **0.0 °C** (**0.0 °F**) | **201.1 Ω** | **0.837 V** |
| **25.0 °C** (**77.0 °F**) | **220.1 Ω** | **0.902 V** |
| **50.0 °C** (**122.0 °F**) | **239.0 Ω** | **0.964 V** |
| **100.0 °C** (**212.0 °F**) | **276.4 Ω** | **1.083 V** |
| **150.0 °C** (**302.0 °F**) | **313.2 Ω** | **1.193 V** |
| **200.0 °C** (**392.0 °F**) | **349.5 Ω** | **1.295 V** |
| **250.0 °C** (**482.0 °F**) | **385.1 Ω** | **1.390 V** |
| **300.0 °C** (**572.0 °F**) | **420.2 Ω** | **1.479 V** |
| **350.0 °C** (**662.0 °F**) | **454.7 Ω** | **1.563 V** |
| **400.0 °C** (**752.0 °F**) | **488.6 Ω** | **1.641 V** |
| **450.0 °C** (**842.0 °F**) | **521.9 Ω** | **1.715 V** |
| **500.0 °C** (**932.0 °F**) | **554.6 Ω** | **1.784 V** |
| **600.0 °C** (**1112.0 °F**) | **618.3 Ω** | **1.910 V** |
| **700.0 °C** (**1292.0 °F**) | **679.7 Ω** | **2.023 V** |
| **800.0 °C** (**1472.0 °F**) | **738.7 Ω** | **2.124 V** |

# Exhaust Gas Recirculation (EGR) temperature sensors - Test - DOC catalyst exhaust gas temperature sensors [113407987 - V1 - 26 February 2025]

## Description

Temperature sensors for the diesel oxidation catalyst (DOC) module **B-F32** and **B-F33** are in the exhaust gas after-treatment system, refer to **Engine control system - Component localization - Engine (55.015)** and measure the temperature entering and leaving the catalyst. The sensor consists of an internal platinum resistor through which a voltage of **5 V** passes, allowing the indirect measurement of the resistor as the temperature changes. The sensor allows the **A-F02** engine electronic control unit (ECU) to constantly adjust fuel injection in order to reduce emissions. The catalyst temperature is monitored in order to prevent overheating and reduce deterioration.

To refer to the technical data relating to the temperature sensors for the diesel oxidation catalyst (DOC) module **B-F32** and **B-F33**, refer to **Exhaust Gas Recirculation (EGR) temperature sensors - Overview - Temperature sensor (55.989)**.

## Troubleshooting

1. Check that the temperature sensors for the exhaust gas treatment system are correctly installed in the specified positions.
2. Using the diagnostic tool and when the engine is cold, check that the exhaust gas treatment system temperature sensor values are all aligned and correspond to the ambient temperature.

   The sensors to be checked are the following:

   1. Exhaust gas temperature sensor upstream of DOC **B-F32**.
   2. Exhaust gas temperature sensor upstream of the DPF **B-F33**.

   Any misalignment of the temperature value can indicate a fault in a sensor or in the relative electrical circuit.

   A. If the temperature values relating to the sensors in question are aligned, continue with step **3**.

   B. If the temperature values relating to the sensors in question are not aligned, identify the sensor with the fault and continue with step **7**.
3. Start the engine and keep it running at idle to bring the engine to the correct operating temperature. Use the diagnostic tool to check that the temperature sensors for the exhaust gas after-treatment system show a decreasing temperature, starting from the sensor closest to the engine and moving towards the one furthest away in the exhaust.

   The test should last approx. **300 s** with a sampling frequency of **200 ms**.

***NOTE:*** *When using the diagnostic instrument to detect the parameters, make sure that the vehicle is not in a start-up condition.*

The sensors to be checked with a decreasing temperature sequence are:

1. Exhaust gas temperature sensor upstream of DOC **B-F32**.
2. Exhaust gas temperature sensor upstream of the DPF **B-F33**.

4. If the decreasing temperature trend is not observed, this indicates a malfunction of a sensor or the relative electric circuit.
   A. If the temperature values relating to the sensors in question do observe the decreasing temperature trend, continue with step **5**.
   B. If the temperature values relating to the sensors in question do not observe the decreasing temperature trend, this indicates a malfunction in a sensor or the relative electrical circuit. Go to step **7**.
5. Check that the sensors in question return resistance values which are compatible with those listed in the table "Characteristics and correlation of sensor resistance and temperature", refer to **Exhaust Gas Recirculation (EGR) temperature sensors - Overview - Temperature sensor (55.989)**.
6. Proceed as follow:
   1. Disconnect sensor from wiring harness.
   2. Remove the sensor from the after-treatment system.
   3. Place the sensor in a pipe which is of the same diameter and material as the one on the vehicle.
   4. Heat the sensor using a digital hot air blower.

## ⚠ WARNING

**Avoid injury!**
**Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.**
**Failure to comply could result in death or serious injury.**

**W1036A**

- Use a thermal probe to check the temperature.
- Use a precision multimeter to read the resistance values between pin 1 and pin 2 of the temperature sensor in question and compare them with those listed in the table "Characteristics and correlation of sensor resistance and temperature", refer to **Exhaust Gas Recirculation (EGR) temperature sensors - Overview - Temperature sensor (55.989)**.

A. If the resistance values are correct, the sensor is working correctly. Continue with the fault identification procedure.
B. If the resistance values are incorrect, continue with step **7**.

7. Check the efficiency of the electrical wiring and carry out the fault identification procedure.

# Exhaust Gas Recirculation (EGR) temperature sensors - Test - Intake air temperature sensor [113407988 - V1 - 13 February 2025]

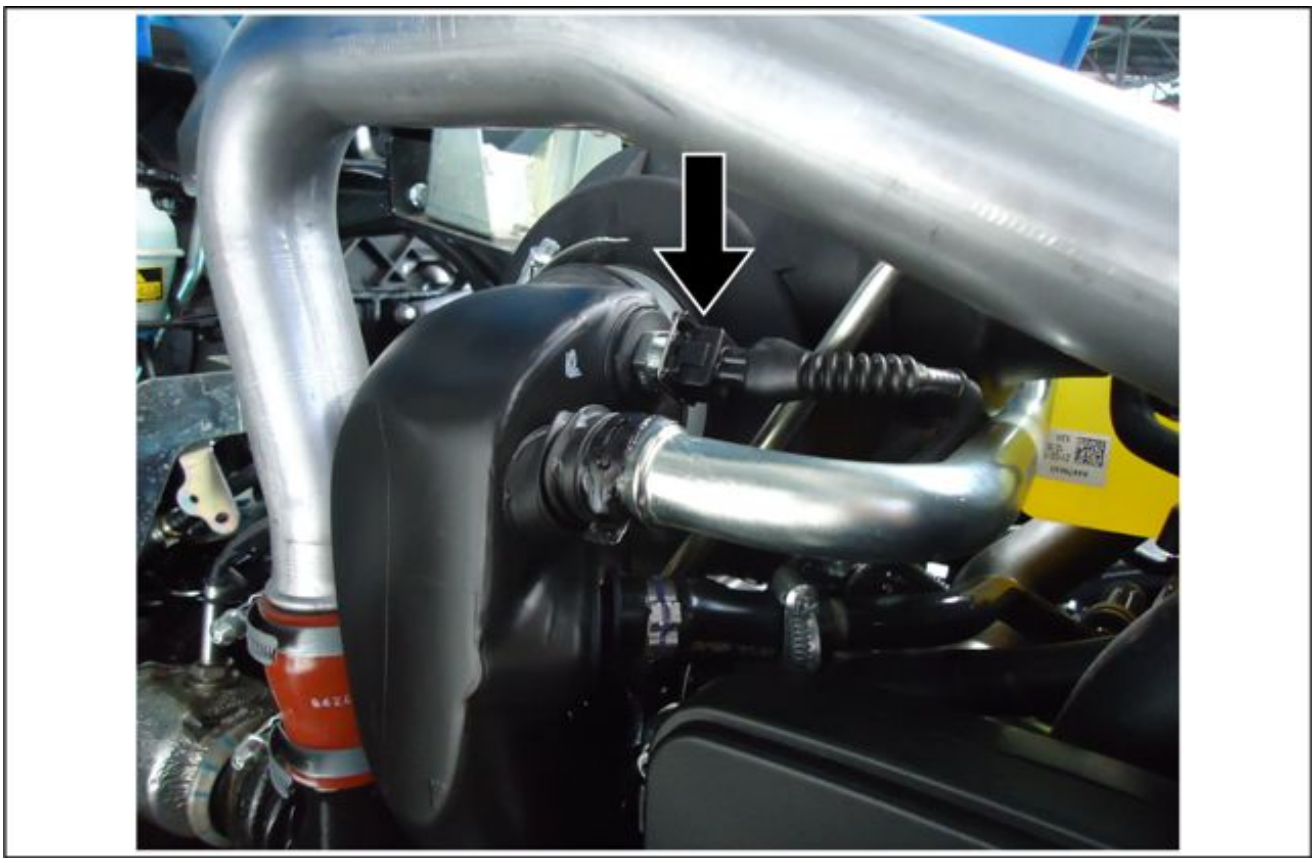
## Preparation

- Set the ignition switch to OFF.

# Exhaust Gas Recirculation (EGR) temperature sensors - Check - Intake air temperature sensor [113407989 - V1 - 22 February 2025]

## Visually check the intake air temperature sensor

1. Visually check the intake air temperature sensor
   - Visually check the connector of the sensor.
   - Check if the sensor is installed correctly.
   - Check if the screw of the sensor is tight.
   - Check the sensor assembly to the intake air pipe.
   - Refer to figure **1** for explanation and go to step **2**.



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**Location of the intake air temperature sensor**

2. Check the intake air temperature sensor.
   - Connector of the sensor not damaged and not contaminated
   - The sensor is mounted in the correct orientation.
   - The sensor is correctly fitted to the air intake pipe.
   - The screws are not loose.
   - If the intake air temperature sensor is OK, go to step **4**.
   - If the intake air temperature sensor is NOT OK, go to step **3**.

3. Possible root cause
   - Connector of the sensor damaged and/or contaminated.
   - The sensor is not mounted in the correct orientation.
   - The sensor is loosely fitted to the air intake pipe
   - Tighten the screws.

***NOTE:*** *After having eliminated the cause of the error, delete the fault memory and repeat the reading.*

4. The intake air temperature sensor is operating correctly.

# Exhaust Gas Recirculation (EGR) temperature sensors - Test - Exhaust gas temperature sensor upstream of the DOC [113408011 - V1 - 24 February 2025]

## Description

The temperature sensor relating to the Diesel Oxidation Catalyst (DOC) **B-F32** is present in the exhaust gas after treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)** and measures the temperature entering and leaving the catalyst. The sensor consists of an internal platinum resistor through which a **5 V** voltage passes allowing the indirect measurement of the resistor as the temperature changes. The sensor allows the Engine Control Unit (ECU) **A-F02** to constantly adjust the introduction of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid at engine load conditions.

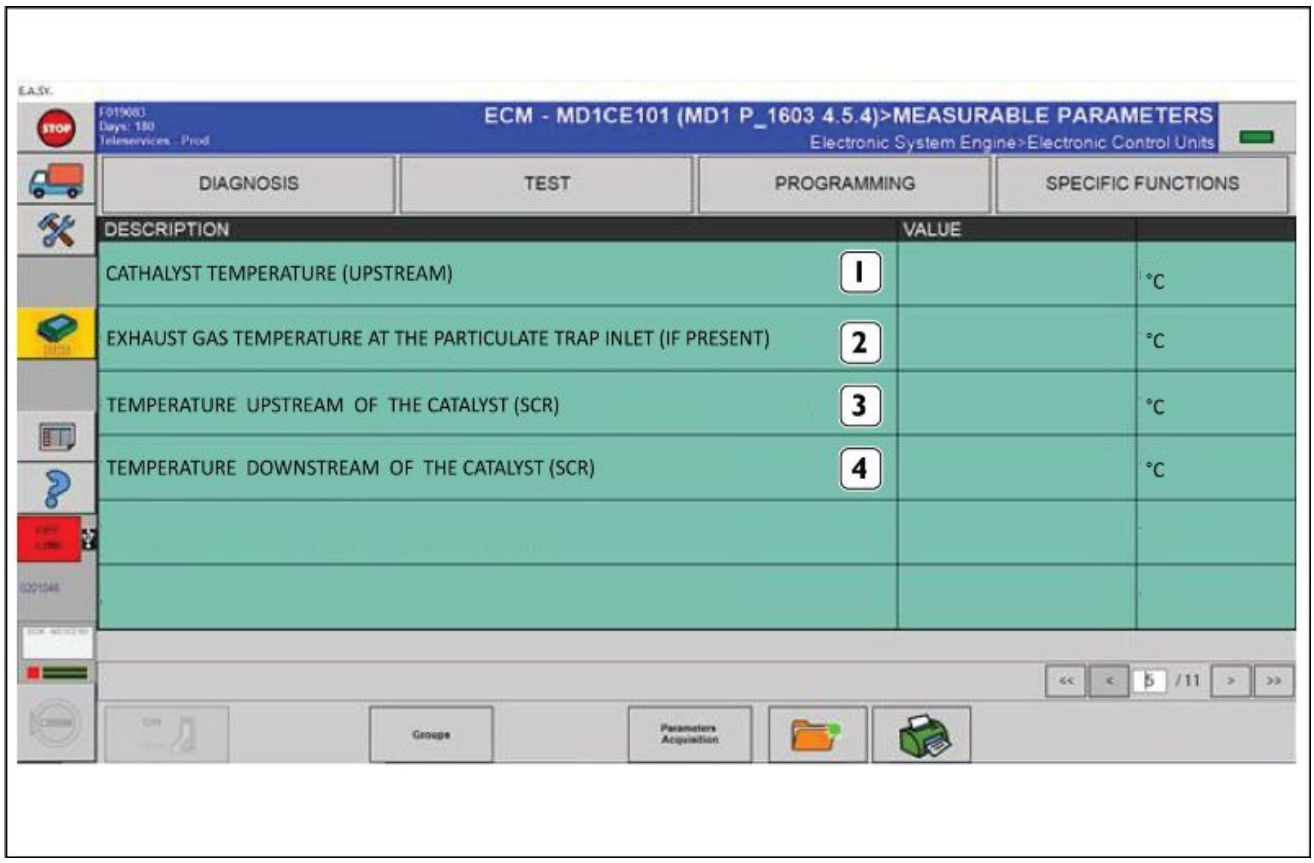
To refer to the technical data relating to the Diesel Oxidation Catalyst (DOC) module **B-F32** temperature sensor, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**.

## Diagnostics procedure

1. Check that the temperature sensors on the exhaust gas treatment system (ATS) are installed correctly and in the specified positions.
2. Use the diagnostic instrument to check that when the engine is cold, the values of the temperature sensors on the ATS system are all aligned and coincide with the ambient temperature.

   The sensors to be checked are the following:

   1. Exhaust gas temperature sensor upstream of DOC **B-F32**.
   2. Exhaust gas temperature sensor downstream of DOC B-F113.
   3. Exhaust gas temperature sensor upstream of SCR B-F38.
   4. Exhaust gas temperature sensor downstream of SCR B-F39.

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Any misalignment of the temperature value can indicate a fault in a sensor or in the relative electrical circuit.

1. If the temperature values corresponding to the sensors detected are in-line, adjust the temperature of the engine by following the instructions in step **3** and then go to step **4**.
2. If the temperature values relating to the sensors in question are not aligned, identify the sensor with the fault and continue with step **8**.

3. Adjust the temperature of the engine as follows:
   1. Keep the ignition switch in the “ON” position for **15 s**.
   2. Start the engine and maintain idle speed for **15 s**.
   3. Keep the engine at **2000 RPM** for **30 s**.
   4. Keep the engine at **1600 RPM** for **30 s** with the exhaust choking valve closed at **90%**.
   5. Keep the engine at idle speed for **15 s**.
4. 1. Use the diagnostic instrument to check that the temperature sensors on the exhaust gas after-treatment system (ATS) show a decreasing temperature, starting from the sensor closest to the engine and moving towards the one furthest away in the exhaust.
   2. The test should last approx. **300 s** with a sampling frequency of **200 ms** .

***NOTE:*** *When using the diagnostic instrument to detect the parameters, make sure that the vehicle is not in a start-up condition.*

The sensors to be checked with a decreasing temperature sequence are:

1. Exhaust gas temperature sensor upstream of DOC **B-F32**.
2. Exhaust gas temperature sensor downstream of DOC B-F113.
3. Exhaust gas temperature sensor upstream of SCR B-F38.
4. Exhaust gas temperature sensor downstream of SCR B-F39.

5. If the decreasing temperature trend is not observed, this indicates a malfunction of a sensor or the relative electric circuit.
   A. If the temperature values relating to the sensors in question do observe the decreasing temperature trend, continue with step **6**.
   B. If the temperature values relating to the sensors in question do not observe the decreasing temperature trend, this indicates a malfunction in a sensor or the relative electrical circuit. Go to step **8**.
6. Check that the sensors in question return resistance values which are compatible with those listed in the table "Characteristics and correlation of sensor resistance and temperature", refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**.
7. Proceed as follow:
   1. Disconnect sensor from wiring harness.
   2. Remove the sensor from the after-treatment system.
   3. Place the sensor in a pipe which is of the same diameter and material as the one on the vehicle.
   4. Heat the sensor using a digital hot air blower.

## ⚠ WARNING

**Avoid injury!**
**Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.**
**Failure to comply could result in death or serious injury.**

**W1036A**

- Use a thermal probe to check the temperature.
- Use a precision multimeter to read the resistance values between pin 1 and pin 2 of the temperature sensor in question and compare them with those listed in the table "Characteristics and correlation of sensor resistance and temperature", refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)**.

A. If the resistance values are correct, the sensor is working correctly. Continue with the fault identification procedure.

B. If the resistance values are incorrect, continue with step **8**.

8. Check the efficiency of the electrical wiring and carry out the fault identification procedure.

# Exhaust Gas Recirculation (EGR) temperature sensors - Test - Exhaust gas temperature sensor downstream of the DOC [113408012 - V1 - 25 February 2025]

## Description

The temperature sensor relating to the Diesel Oxidation Catalyst (DOC) B-F113 is in the exhaust gas after treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)** and measures the temperature leaving the catalyst. The sensor consists of an internal platinum resistor through which a **5 V** voltage passes allowing the indirect measurement of the resistor as the temperature changes. The sensor allows the Engine Control Unit (ECU) **A-F02** to constantly adjust the introduction of **DIESEL EXHAUST FLUID (DEF)/ADBLUE®** fluid at engine load conditions.

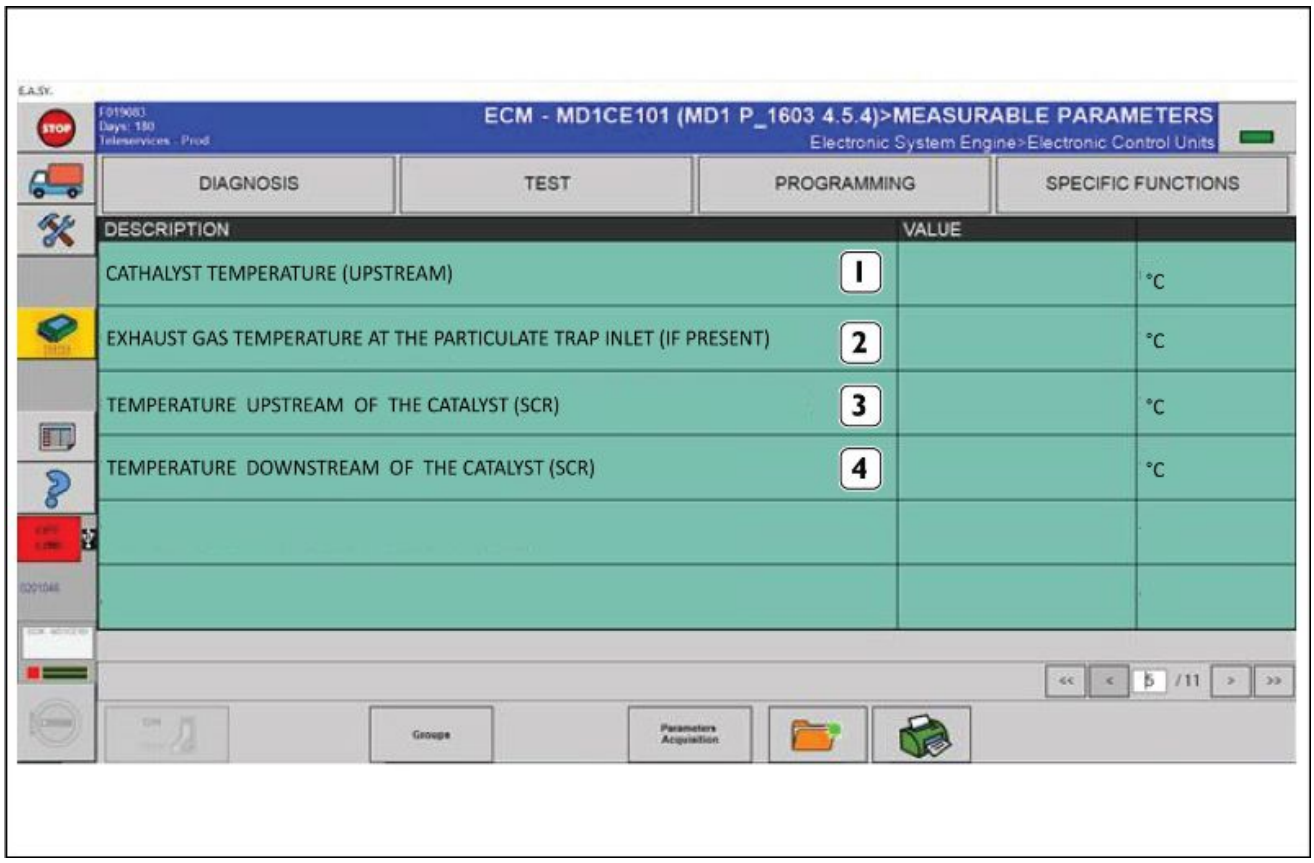
To refer to the technical data relating to the Diesel Oxidation Catalyst (DOC) module B-F113 temperature sensor, refer to **Exhaust Gas Recirculation (EGR) temperature sensors - Overview - Temperature sensor (55.989)**.

## Diagnostics procedure

1. Check that the temperature sensors on the exhaust gas treatment system (ATS) are installed correctly and in the specified positions.
2. Use the diagnostic instrument to check that when the engine is cold, the values of the temperature sensors on the ATS system are all aligned and coincide with the ambient temperature.

   The sensors to be checked are the following:

   1. Exhaust gas temperature sensor upstream of DOC **B-F32**.
   2. Exhaust gas temperature sensor downstream of DOC B-F113 .
   3. Exhaust gas temperature sensor upstream of SCR B-F38 .
   4. Exhaust gas temperature sensor downstream of SCR B-F39 .

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Any misalignment of the temperature value can indicate a fault in a sensor or in the relative electrical circuit.

A. If the temperature values corresponding to the sensors detected are in-line, adjust the temperature of the engine by following the instructions in step **3** and then go to step **4**.

B. If the temperature values relating to the sensors in question are not aligned, identify the sensor with the fault and continue with step **8**.

3. Adjust the temperature of the engine as follows:
   1. Keep the ignition switch in the “ON” position for **15 s**.
   2. Start the engine and maintain idle speed for **15 s**.
   3. Keep the engine at **2000 RPM** for **30 s**.
   4. Keep the engine at **1600 RPM** for **30 s** with the exhaust choking valve closed at **90%**.
   5. Keep the engine at idle speed for **15 s**.
4. 1. Use the diagnostic instrument to check that the temperature sensors on the exhaust gas after-treatment system (ATS) show a decreasing temperature, starting from the sensor closest to the engine and moving towards the one furthest away in the exhaust.
   2. The test should last approx. **300 s** with a sampling frequency of **200 ms**.

***NOTE:*** *When using the diagnostic instrument to detect the parameters, make sure that the vehicle is not in a start-up condition.*

The sensors to be checked with a decreasing temperature sequence are:

1. Exhaust gas temperature sensor upstream of DOC **B-F32**.
2. Exhaust gas temperature sensor downstream of DOC B-F113.
3. Exhaust gas temperature sensor upstream of SCR B-F38.
4. Exhaust gas temperature sensor downstream of SCR B-F39.

5. If the decreasing temperature trend is not observed, this indicates a malfunction of a sensor or the relative electric circuit.
   A. If the temperature values relating to the sensors in question do observe the decreasing temperature trend, continue with step **6**.
   B. If the temperature values relating to the sensors in question do not observe the decreasing temperature trend, this indicates a malfunction in a sensor or the relative electrical circuit. Go to step **8**.
6. Check that the sensors in question return resistance values which are compatible with those listed in the table "Characteristics and correlation of sensor resistance and temperature", refer to **Exhaust Gas Recirculation (EGR) temperature sensors - Overview - Temperature sensor (55.989)**.
7. Proceed as follow:
   1. Disconnect sensor from wiring harness.
   2. Remove the sensor from the after-treatment system.
   3. Place the sensor in a pipe which is of the same diameter and material as the one on the vehicle.
   4. Heat the sensor using a digital hot air blower.

## ⚠ WARNING

**Avoid injury!**
**Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.**
**Failure to comply could result in death or serious injury.**

**W1036A**

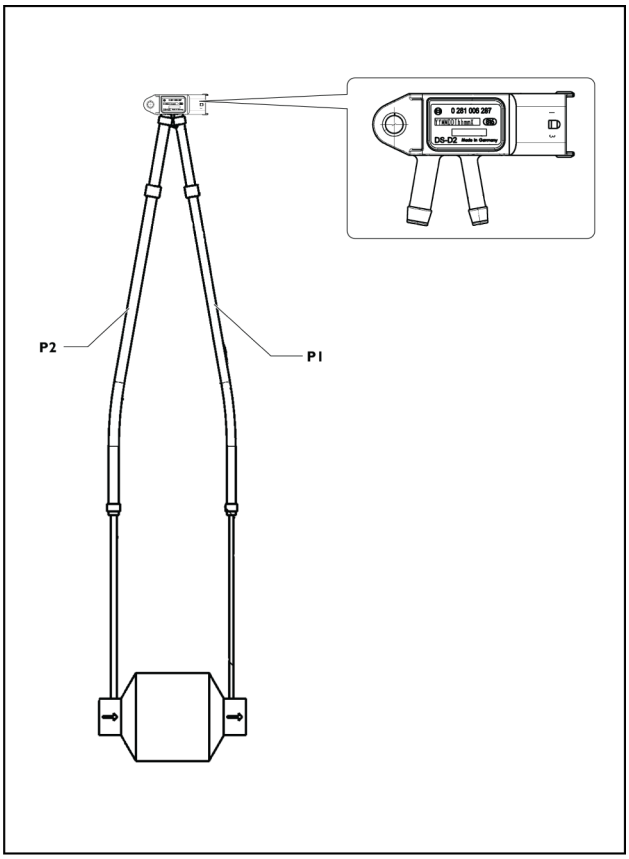
- Use a thermal probe to check the temperature.
- Use a precision multimeter to read the resistance values between pin 1 and pin 2 of the temperature sensor in question and compare them with those listed in the table "Characteristics and correlation of sensor resistance and temperature", refer to **Exhaust Gas Recirculation (EGR) temperature sensors - Overview - Temperature sensor (55.989)**.

A. If the resistance values are correct, the sensor is working correctly. Continue with the fault identification procedure.

B. If the resistance values are incorrect, continue with step **8**.

8. Check the efficiency of the electrical wiring and carry out the fault identification procedure.

# Differential pressure sensor - Test - Particulate matter catalyst differential pressure sensor [113389224 - V1 - 26 February 2025]

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| Item | Description |
|---|---|
| P1 | Pressure downstream of particulate catalyst |
| P2 | Pressure upstream of particulate catalyst |

## Description

The differential pressure sensor **B-F34** is present in the exhaust gas post-treatment system, refer to **Engine control system - Component localization - Engine (55.015)** and measures the difference in pressure between the particulate catalyst inlet and outlet. The differential pressure sensor consists of a piezo-resistive pressure sensor connected to a signal amplification circuit with integrated temperature compensation on a silicon chip. Pressure **(P1)** acts on the underside of the silicon diaphragm which is resistant to corrosion. The diaphragm is protected by a gel film which prevents any damage due to ice as well as possible signal errors due to accumulation of impurities. Pressure **(P2)** acts on the upper side of the silicon diaphragm. The top surface of the chip and the connection of the wire to the ceramic substrate are protected against corrosion by the anti-corrosive gel.

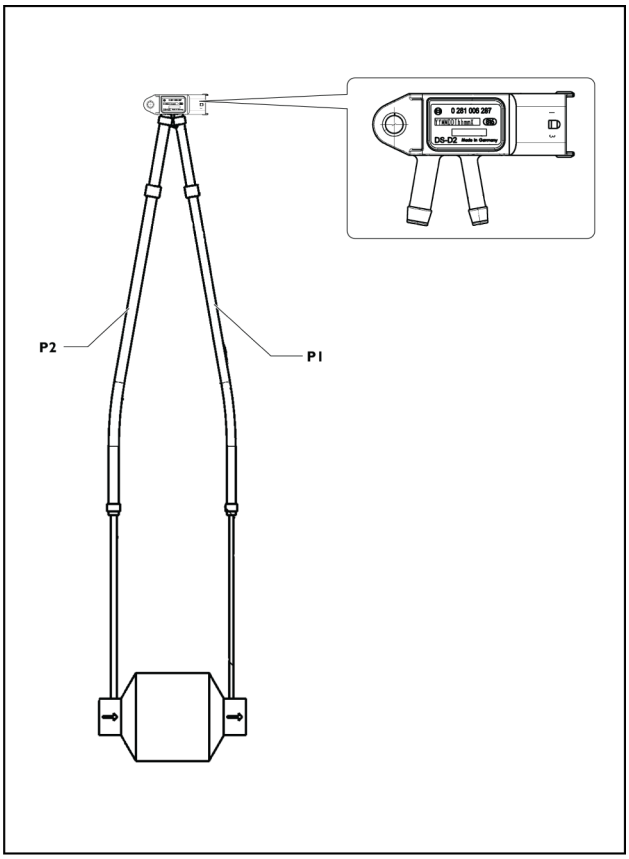
To refer to the technical data relating to the differential pressure sensor **B-F34**, refer to **Fuel pressure sensor - Assemble - Pressure sensor (55.010)**.

## Troubleshooting

1. Visually check that the pipes connected to the differential pressure sensor **B-F34** show no sign of restrictions and are not damaged.
   A. If the pipes are restricted and/or damaged, replace them and continue with step **4**.
   B. If the pipes are not restricted and/or damaged, continue with step **2**.
2. Visually check that the pipes connected to the differential pressure sensor **B-F34** show no sign of obstructions due to dust or other impurities.
   A. If the pipes are obstructed, clean them and continue with step **3**.
   B. If the pipes are not obstructed, continue with step **3**.
3. Visually check that the wiring harness is intact and that the connector of the differential pressure sensor **B-F34** shows no sign of oxidation.
   A. If any damage to the wiring harness or oxidation on the contacts of the connector is detected, replace the wiring harness and continue with step **4**.
   B. If you find no damage to the wiring harness or oxidation on the contacts of the connector, continue with step **4**.
4. Use a diagnostics instrument to check the parameters relating to the differential pressure sensor **B-F34** in the following conditions:
   - Start the engine and maintain idle speed for **15 s**.
   - Accelerate to maximum speed for **15 s**.
   - Go back to idle speed from **15 s**.

   Analyse the graph relating to the pressure differential.
   A. If the pressure differential is positive, this indicates that the sensor is working correctly. Go to step **5**.
   B. If the pressure differential is negative, this indicates that the pipes are not connected correctly. Check the connection layout and repeat the test.
   C. If the pressure differential remains unchanged, it is possible that the component is not working correctly. Return to the fault identification procedure and then go to step **5**.
5. Use the diagnostic instrument to carry out a regeneration cycle of the particulate catalyst, disable and clear the fault codes, and check whether the error returns.
   A. If the fault code relating to the differential pressure sensor is not active, carry out a functional test to check correct vehicle operation. Diagnostics can be considered terminated if there are no faults relating to the differential pressure sensor.
   B. If the fault code relating to the differential pressure sensor is active, go back to the fault identification procedure.

# Differential pressure sensor - Test - Particulate matter catalyst differential pressure sensor [113389225 - V1 - 26 February 2025]

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| Item | Description |
|---|---|
| P1 | Pressure downstream of particulate catalyst |
| P2 | Pressure upstream of particulate catalyst |

## Description

The differential pressure sensor **B-F34** is present in the exhaust gas post-treatment system, refer to **Diesel Exhaust Fluid (DEF)/AdBlue®/ARLA tank - Test - Bosch 6.5 supply module and Bosch 3.3 dosing module (10.500)** and measures the difference in pressure between the particulate catalyst inlet and outlet. The differential pressure sensor consists of a piezo-resistive pressure sensor connected to a signal amplification circuit with integrated temperature compensation on a silicon chip. Pressure **(P1)** acts on the underside of the silicon diaphragm which is resistant to corrosion. The diaphragm is protected by a gel film which prevents any damage due to ice as well as possible signal errors due to accumulation of impurities. Pressure **(P2)** acts on the upper side of the silicon diaphragm. The top surface of the chip and the connection of the wire to the ceramic substrate are protected against corrosion by the anti-corrosive gel.

To refer to the technical data relating to the differential pressure sensor **B-F34**, refer to **Fuel pressure sensor - Assemble - Pressure sensor (55.010)**.

## Diagnostics procedure

1. Visually check that the pipes connected to the differential pressure sensor **B-F34** show no sign of restrictions and are not damaged.
   A. If the pipes are restricted and/or damaged, replace them and continue with step **4**.
   B. If the pipes are not restricted and/or damaged, continue with step **2**.
2. Visually check that the pipes connected to the differential pressure sensor **B-F34** show no sign of obstructions due to dust or other impurities.
   A. If the pipes are obstructed, clean them and continue with step **3**.
   B. If the pipes are not obstructed, continue with step **3**.
3. Visually check that the wiring harness is intact and that the connector of the differential pressure sensor **B-F34** shows no sign of oxidation.
   A. If any damage to the wiring harness or oxidation on the contacts of the connector is detected, replace the wiring harness and continue with step **4**.
   B. If you find no damage to the wiring harness or oxidation on the contacts of the connector, continue with step **4**.
4. Use a diagnostics instrument to check the parameters relating to the differential pressure sensor **B-F34** in the following conditions:
   - Start the engine and maintain idle speed for **15 s**.
   - Accelerate to maximum speed for **15 s**.
   - Go back to idle speed from **15 s**.

   Analyse the graph relating to the pressure differential.
   A. If the pressure differential is positive, this indicates that the sensor is working correctly.Go to step **5**.
   B. If the pressure differential is negative, this indicates that the pipes are not connected correctly. Check the connection layout and repeat the test.
   C. If the pressure differential remains unchanged, it is possible that the component is not working correctly. Return to the fault identification procedure and then go to step **5**.
5. Use the diagnostic instrument to carry out a regeneration cycle of the particulate catalyst, disable and clear the fault codes, and check whether the error returns.
   A. If the fault code relating to the differential pressure sensor is not active, carry out a functional test to check correct vehicle operation. Diagnostics can be considered terminated if there are no faults relating to the differential pressure sensor.
   B. If the fault code relating to the differential pressure sensor is active, go back to the fault identification procedure.

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## Engine cooling system - 012

**F6AFL413A*U001**

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# Engine coolant temperature sensor and switch - Overview - Engine water temperature sender [113437985 - V1 - 07 March 2025]

## Coolant temperature sensor

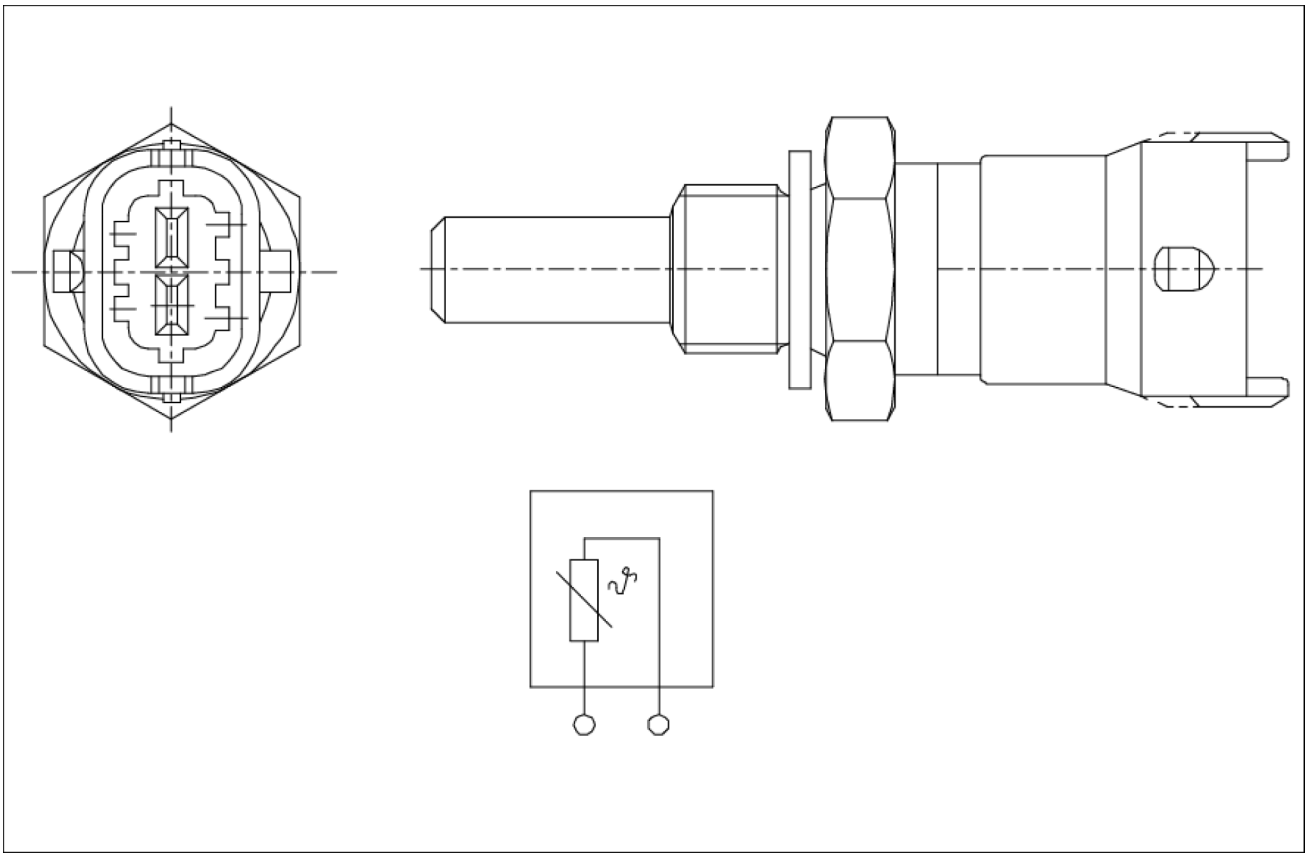
It is an N.T.C. sensor and is positioned near the water outlet manifold from the head on the thermostat casing from the right side of the engine. It determines the coolant temperature for the various control logics of operation of the engine when hot or cold and identifies the need to enrich the mixture when the engine is cold or reduce fuel injection when it is hot.

Its resistance is:

| Resistance | |
|---|---|
| Conditions: Temperature **20 °C** (**68 °F**) | **2.50 kΩ** |

## Sensor pin-out

| Pin | Description |
|---|---|
| 1 | Signal |
| 2 | Ground |



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# Engine cooling system - Check - Radiator [113437877 - V1 - 27 February 2025]

## Engine coolant level

1. Only proceed when the engine is not turning, and is at low temperature, so as not to run the risk of burns.
2. Remove the pressurisation cap from the expansion tank.
3. Check that the coolant in the expansion tank is above the minimum level.
4. If necessary, top up the expansion tank with a mixture of **50%%** water and Actifull OT concentrate, as indicated in the refillingtable. Do not fill the expansion tank to the brim.
5. When the engine is cold, check that the level of coolant is a few centimetres below the filling hole.
6. If there is a level indicator outside of the heat exchangers, proceed with the top up operation by making sure that the coolant does not overfill the internal volume of the exchanger in order to allow the expansion of coolant volume due to an increase in temperature.

# Engine cooling system - Check - Radiator [113437878 - V1 - 06 March 2025]

## Liquid density

1. Remove the expansion tank plug and remove a sample of coolant with a normal densimeter used to check the density of the anti-freeze fluid.

### ⚠ WARNING

**Hot liquid under pressure!**
**Never remove the filler cap or the recovery tank cap while the engine is running or the coolant is hot. Let the system cool. Loosen the recovery tank cap slowly to allow any pressure to escape.**
**Failure to comply could result in death or serious injury.**

**W1300A**

2. Depending on the temperature of the fluid, check the percentage of antifreeze in the fluid on the reading scale of the instrument.

   The percentage must exceed **40%** but must not exceed **50%**.

3. If necessary, restore the percentage of antifreeze, bearing in mind that the fluid needs to be replaced every 2 to.

   The density of the coolant must however be checked every year before the winter and it must be changed every two years.

# Engine cooling system - Change fluid - Radiator [113437879 - V1 - 06 March 2025]

## Engine coolant replacement

1. Only proceed when the engine is not turning, and is at low temperature, so as not to run the risk of burns.
2. Place a container for collecting coolant under the heat exchanger (radiator).
3. Remove the pressurisation cap from the expansion tank.
4. Loosen the retaining elements and remove the sleeves connecting the engine cooling circuit to the heat exchanger.
5. Drain the coolant from the heat exchanger (radiator) and wait until it is completely empty.
6. Once emptied, refit the cooling circuit making sure the sleeves are perfectly sealed.
7. Refill the engine and the heat exchanger until completely filling the cooling circuit with a mixture of **50%** water and Actifull OT CONCENTRATE, as indicated in the REFILLING table. Do not fill the expansion tank to the brim.
8. With the coolant cap open, start the engine and let it idle for approx. **1 min**. This helps to completely bleed the air contained in the cooling circuit.
9. Stop the engine and if necessary top up with more coolant, if necessary.
10. When the engine is cold, make sure that the coolant in the expansion tank is a few centimetres below the filling hole.
11. If there is a level indicator outside of the heat exchangers, proceed with the top up operation by making sure that the coolant does not overfill the internal volume of the exchanger in order to allow the expansion of coolant volume due to an increase in temperature.

***NOTE:*** *General prescriptions Failure to observe the procedure described above will not guarantee the presence of the correct quantity of coolant in the engine. Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty*

### ⚠ WARNING

**Hot liquid under pressure!**
**Never remove the filler cap or the recovery tank cap while the engine is running or the coolant is hot. Let the system cool. Loosen the recovery tank cap slowly to allow any pressure to escape.**
**Failure to comply could result in death or serious injury.**

**W1300A**

## ⚠ WARNING

**Burn hazard!**
**Always remove the recovery tank cap BEFORE you remove the filler cap. Never remove either cap while the engine is running or the coolant is hot. Stop the engine and let the system cool. Using a thick cloth, loosen the cap slowly and allow the pressure to escape.**
**Failure to comply could result in death or serious injury.**

**W0361A**

# Engine cooling system - Cleaning - Radiator [113437880 - V1 - 06 March 2025]

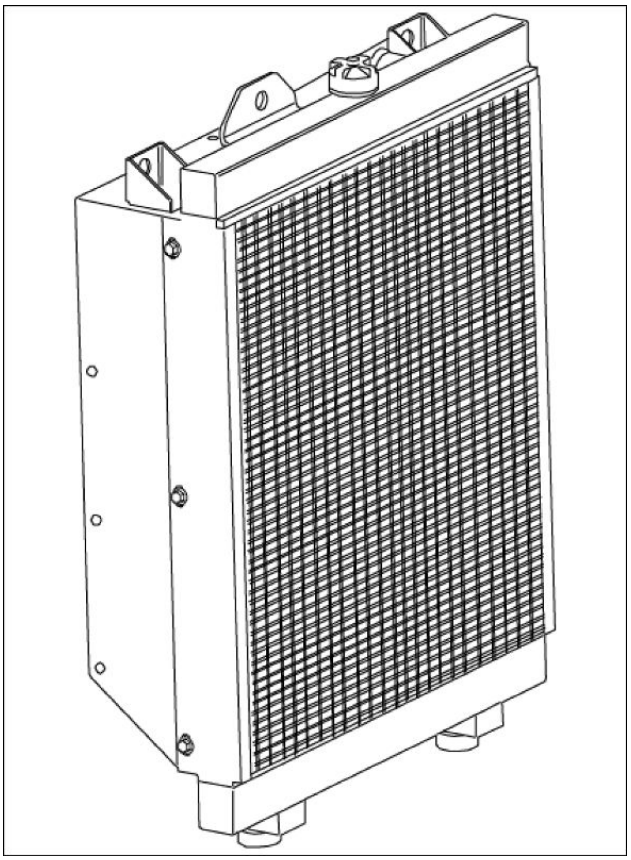
## Clean the heat exchanger (radiator)

1. Check that the radiator air inlets are free from dirt (dust, mud, straw, etc.).
2. Clean them if necessary using compressed air or steam.

**⚠ CAUTION**

**Cutting hazard!**
**Use care handling sharp components. Always wear appropriate Personal Protective Equipment (PPE), including heavy gloves.**
**Failure to comply could result in minor or moderate injury.**

**C0139A**



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**F6AFL413A*U001**

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# Engine oil pressure sensor and switch - Overview - Engine oil pressure gauge sender [113437982 - V2 - 07 March 2025]

## Engine oil low pressure valve

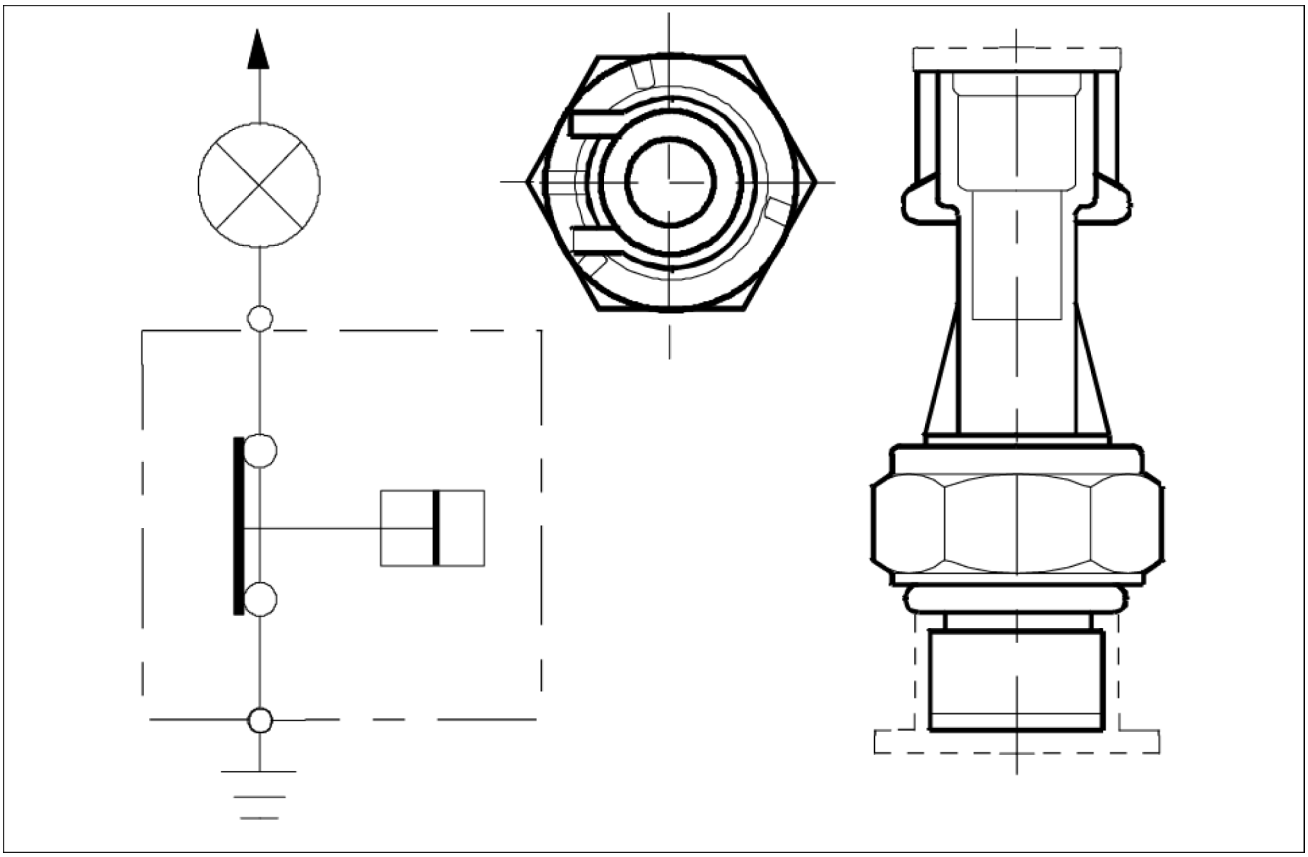
It is fit on the oil filter mount.

It only measures the engine oil pressure

It is powered at **5 V**.

The signal detected is transmitted to the engine control unit, which in turn controls the indicator on the instrument panel (oil low pressure warning light and indicator).

The engine oil temperature is not detected by a sensor and therefore is not used by the Engine Control Unit.



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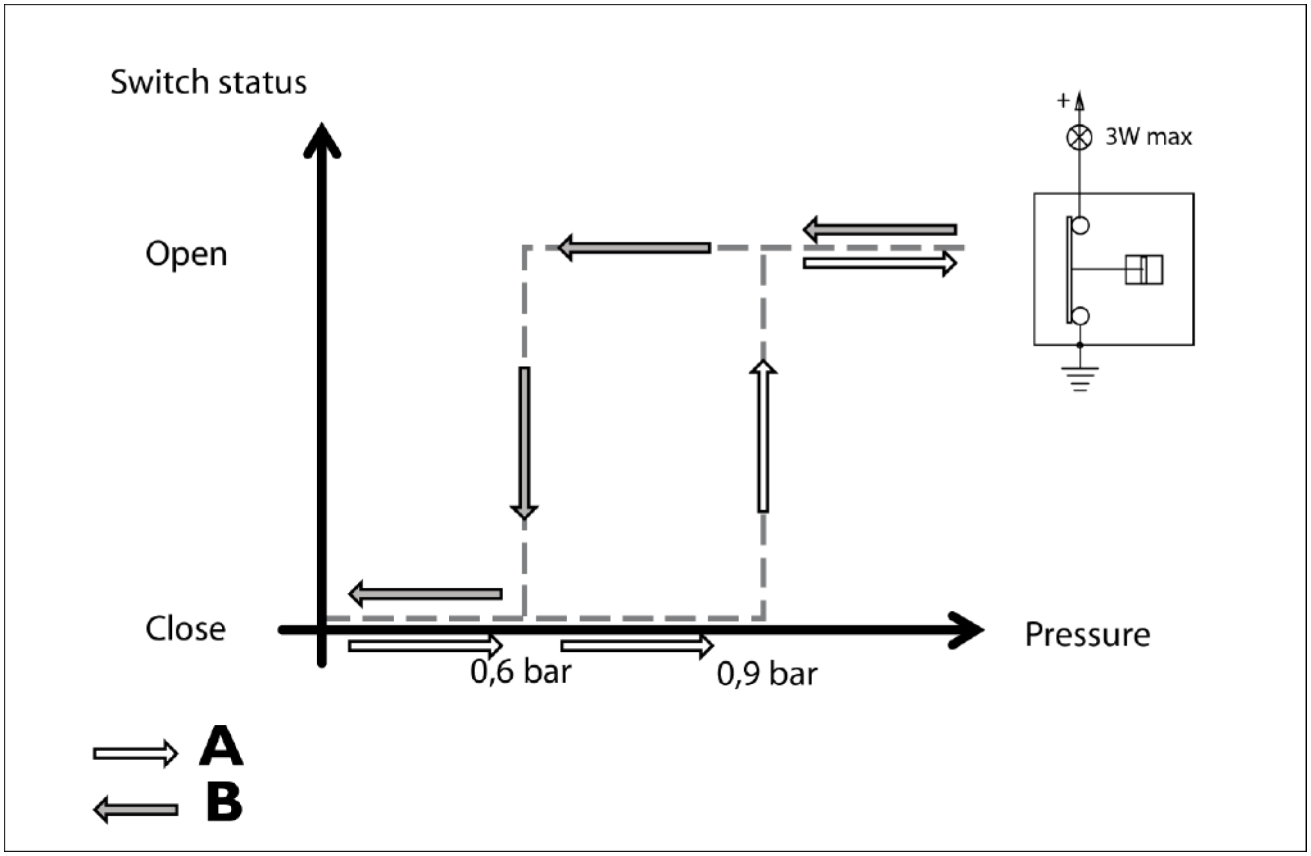
## Pin - Out

| Item | Description |
|---|---|
| 1 | Pressure signal |




NHIL25ENG0446FA 2

A. Path followed by the valve switch when the pressure increases from **0 bar** (**0 psi**) to P≥1.
B. Path followed by the valve switch when the pressure decreases from P≥1 to **0 bar** (**0 psi**).

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# 3007 (F-4076-00) - Engine Coolant Temperature Sensor Voltage is Higher than Expected [113270395 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the engine coolant temperature sensor **B-9003**. The engine coolant temperature sensor **B-9003** shares the coolant temperature signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage greater than **4.94 V** for more than **500 ms** on the engine coolant temperature sensor **B-9003** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the engine coolant temperature sensor **B-9003** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty engine coolant temperature sensor **B-9003**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the engine coolant temperature sensor **B-9003**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the engine coolant temperature sensor **B-9003** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the engine coolant temperature sensor **B-9003** at connector **X-9006**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 100** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **3**.

   B. If there is voltage, continue with Step **4**.
3. Check the engine coolant temperature sensor **B-9003** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 100** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity, continue with Step **6**.

   B. If there is continuity, continue with Step **4**.
4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 14** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **5**.

B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9006** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 14** | All other pins on **X-9138B** | There should be no continuity |
| **X-9006 (Receptacle) pin 1** | All other pins on **X-9006** | There should be no continuity |

A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9006** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the engine coolant temperature sensor **B-9003** signal circuit for an open circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 99** | **X-9006 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 100** | **X-9006 (Receptacle) pin 1** | There should be continuity |

A. If there is continuity on either check, continue with Step **8**.

B. If there is no continuity on both checks, continue with Step **7**.

7. Locate the circuit for an open circuit.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 99** | **X-470 (Receptacle) pin 13** | There should be continuity |
| **X-EC1 (Receptacle) pin 100** | **X-470 (Receptacle) pin 14** | There should be continuity |

A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9006** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Check the coolant temperature sensor **B-9003**.

With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9006 (Receptacle) pin 1** | **X-9006 (Receptacle) pin 2** | The resistance should be between **100 – 50,000 Ω**. |

A. If the measured resistance value is correct, continue with Step **9**.

B. If the measured resistance value is incorrect, the coolant temperature sensor **B-9003** has failed internally. Replace the coolant temperature sensor **B-9003**.

9. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3008 (F-4076-04) - Engine Coolant Temperature Sensor Voltage is Lower than Expected [113270346 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the engine coolant temperature sensor **B-9003**. The engine coolant temperature sensor **B-9003** shares the coolant temperature signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage less than **174 mV** for more than **500 ms** on the engine coolant temperature sensor **B-9003** temperature signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the engine coolant temperature sensor **B-9003** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground
2. Faulty engine coolant temperature sensor **B-9003**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the engine coolant temperature sensor **B-9003**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the engine coolant temperature sensor **B-9003** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the engine coolant temperature sensor **B-9003** at connector **X-9006**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 99** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 100** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 99** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 100** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Check the engine coolant temperature sensor **B-9003** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 13** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 14** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 13** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 14** | All other pins on **X-9138B** | There should be no continuity |

| From | To | Value |
|---|---|---|
| **X-9006 (Receptacle) pin 1** | All other pins on **X-9006** | There should be no continuity |
| **X-9006 (Receptacle) pin 2** | All other pins on **X-9006** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9006** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the coolant temperature sensor **B-9003**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9006 (Receptacle) pin 1** | **X-9006 (Receptacle) pin 2** | The resistance should be between **100 – 50,000 Ω** |

A. If the measured resistance value is correct, continue with Step **5**.

B. If the measured resistance value is incorrect, the coolant temperature sensor **B-9003** has failed internally. Replace the coolant temperature sensor **B-9003**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3010 (F-105-04) - Intake Manifold Temperature Sensor Voltage is Lower than Expected [113270821 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the overpressure air temperature and pressure sensor **B-9001**. The overpressure air temperature and pressure sensor **B-9001** shares the intake manifold air temperature signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage less than **153 mV** for more than **500 ms** on the overpressure air temperature and pressure sensor **B-9001** temperature signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the overpressure air temperature and pressure sensor **B-9001** temperature signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the overpressure air temperature and pressure sensor **B-9001** circuit for a short to ground.

   Disconnect the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 96** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 38** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 96** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.

3. Check the overpressure air temperature and pressure sensor **B-9001** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 17** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 18** | Chassis ground | There should be no continuity |

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 17** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 18** | All other pins on **X-9138B** | There should be no continuity |
| **X-9003 pin 3** | All other pins on **X-9003** | There should be no continuity |
| **X-9003 pin 4** | All other pins on **X-9003** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9003** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the overpressure air temperature and pressure sensor **B-9001**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3015 (F-174-03) - Fuel Temperature Sensor Voltage is Higher than Expected [113270414 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the fuel temperature sensor **B-9002**. The fuel temperature sensor **B-9002** shares the fuel temperature signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage greater than **4.94 V** for more than **300 ms** on the fuel temperature sensor **B-9002** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the fuel temperature sensor **B-9002** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty fuel temperature sensor **B-9002**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the fuel temperature sensor **B-9002**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the fuel temperature sensor **B-9002** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the fuel temperature sensor **B-9002** at connector **X-9005**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 36** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **3**.

   B. If there is voltage, continue with Step **4**.
3. Check the fuel temperature sensor **B-9002** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 36** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity, continue with Step **6**.

   B. If there is continuity, continue with Step **4**.
4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 16** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **5**.

B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9005** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 16** | All other pins on **X-9138B** | There should be no continuity |
| **X-9005 (Receptacle) pin 1** | All other pins on **X-9005** | There should be no continuity |

A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9005** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the fuel temperature sensor **B-9002** circuit for an open circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 36** | **X-9005 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 35** | **X-9005 (Receptacle) pin 1** | There should be continuity |

A. If there is continuity on both checks, continue with Step **8**.

B. If there is no continuity on either check, continue with Step **7**.

7. Locate the circuit for an open circuit.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 36** | **X-470 (Receptacle) pin 16** | There should be continuity |
| **X-EC1 (Receptacle) pin 35** | **X-470 (Receptacle) pin 15** | There should be continuity |

A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9005** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Replace the fuel temperature sensor **B-9002**, reconnect the connectors, then recheck the status of this fault.

A. Fault is active. Continue with Step **9**.

B. Fault is not active. Return the machine to normal operation.

9. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3016 (F-174-04) - Fuel Temperature Sensor Voltage is Lower than Expected [113270356 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the fuel temperature sensor **B-9002**. The fuel temperature sensor **B-9002** shares the fuel temperature signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage lower than **174 mV** for more than **300 ms** on the fuel temperature sensor **B-9002** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the fuel temperature sensor **B-9002** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground
2. Faulty fuel temperature sensor **B-9002**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the fuel temperature sensor **B-9002**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the fuel temperature sensor **B-9002** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the fuel temperature sensor **B-9002** at connector **X-9005**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 35** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 36** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 35** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 36** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Check the fuel temperature sensor **B-9002** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 15** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 16** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 15** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 16** | All other pins on **X-9138B** | There should be no continuity |

| From | To | Value |
|---|---|---|
| **X-9005 (Receptacle) pin 1** | All other pins on **X-9005** | There should be no continuity |
| **X-9005 (Receptacle) pin 2** | All other pins on **X-9005** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9005** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the fuel temperature sensor **B-9002**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3019 (F-102-03) - Intake Manifold Pressure Sensor Voltage is Higher than Expected [113270429 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the overpressure air temperature and pressure sensor **B-9001**. The overpressure air temperature and pressure sensor **B-9001** shares the intake manifold air pressure signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage greater than **4.92 V** for more than **500 ms** on the overpressure air temperature and pressure sensor **B-9001** pressure signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the overpressure air temperature and pressure sensor **B-9001** pressure signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the overpressure air temperature and pressure sensor **B-9001** supply circuit.

   Using a multimeter back probe the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9003 pin 3** | Chassis ground | There should be approximately **5 V** |

   A. If there is approximately **5 V**, continue with Step **3**.

   B. If there is not approximately **5 V**, check the circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the connectors, recheck the voltage, then return the machine to normal operation.

3. Check the overpressure air temperature and pressure sensor **B-9001** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 96** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **4**.

B. If there is voltage, continue with Step **5**.

4. Check the overpressure air temperature and pressure sensor **B-9001** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 96** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity, continue with Step **7**.

   B. If there is continuity, continue with Step **5**.

5. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 18** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **6**.

   B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

6. Locate the circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 18** | All other pins on **X-9138B** | There should be no continuity |
| **X-9003 pin 4** | All other pins on **X-9003** | There should be no continuity |

   A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

7. Check the overpressure air temperature and pressure sensor **B-9001** signal circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | **X-9003 pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 95** | **X-9003 pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 96** | **X-9003 pin 4** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **9**.

   B. If there is no continuity on any of the checks, continue with Step **8**.

8. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | **X-470 (Receptacle) pin 17** | There should be continuity |
| **X-EC1 (Receptacle) pin 95** | **X-470 (Receptacle) pin 19** | There should be continuity |

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 96** | **X-470 (Receptacle) pin 18** | There should be continuity |

A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

9. Replace the overpressure air temperature and pressure sensor **B-9001**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **10**.

   B. Fault is not active. Return the machine to normal operation.

10. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3024 (F-108-03) - ECU Internal Failure - Ambient Air Pressure Sensor Voltage is Higher than Expected [113270769 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** analyses the measured signal of the ambient air pressure sensor for implausible values by means of diverse criteria. In fault cases the signals will be set invalid and a defect is reported. The measured pressure is checked for plausibility. The ambient pressure sensor is located inside ECU **A-001**. When the ECU **A-001** senses a diagnosis information of the Serial Processor Interface (SPI) continuously reports the "value too high" status, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3025 (F-108-04) - ECU Internal Failure - Ambient Air Pressure Sensor Voltage is Lower than Expected [113270771 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** analyses the measured signal of the ambient air pressure sensor for implausible values by means of diverse criteria. In fault cases the signals will be set invalid and a defect is reported. The measured pressure is checked for plausibility. The ambient pressure sensor is located inside ECU **A-001**. When the ECU **A-001** senses a diagnosis information of the Serial Processor Interface (SPI) continuously reports the "value too low" status, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3027 (100-02) - Defect Fault Check for Plausibility from Digital Sensor [113270863 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the engine oil pressure value for plausibility. The oil pressure signal is acquired from the connected oil pressure sensor. When the engine is running, the pressure must be lower than a defined maximum value, detected by the low engine oil level alarm switch **S-9016**. When the ECU **A-001** senses the oil pressure signal or the digital oil pressure switch is active, this fault will occur.

**Cause:**
The ECU **A-001** has detected a fault in low engine oil level alarm switch **S-9016**.

**Possible failure modes:**

1. Faulty low engine oil level alarm switch **S-9016**, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the low engine oil level alarm switch **S-9016**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the correct operation of the low engine oil level alarm switch **S-9016**.

   Use the Electronic Service Tool (EST) to check the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Replace the low engine oil level alarm switch **S-9016** then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3037 (F-102-04) - Intake Manifold Pressure Sensor Voltage is Lower than Expected [113270369 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the overpressure air temperature and pressure sensor **B-9001**. The overpressure air temperature and pressure sensor **B-9001** shares the intake manifold air pressure signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage less than **185.60 mV** for more than **500 ms** on the overpressure air temperature and pressure sensor **B-9001** pressure signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the overpressure air temperature and pressure sensor **B-9001** pressure signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the overpressure air temperature and pressure sensor **B-9001** circuit for a short to ground.

   Disconnect the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 96** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 38** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 96** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.

3. Check the overpressure air temperature and pressure sensor **B-9001** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 17** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 18** | Chassis ground | There should be no continuity |

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 17** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 18** | All other pins on **X-9138B** | There should be no continuity |
| **X-9003 pin 3** | All other pins on **X-9003** | There should be no continuity |
| **X-9003 pin 4** | All other pins on **X-9003** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9003** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the overpressure air temperature and pressure sensor **B-9001**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3059 (F-1485-07) - Main Relay Stuck Error [113270813 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** controls the main relay and provides the actual state and main relay diagnosis. When the ECU **A-001** senses a sticky main relay, this fault will occur.

**Cause:**
The ECU **A-001** has detected a sticky main relay.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3088 (F-637-09) - Crankshaft Speed Sensor Values are Not Plausible [113270481 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** assesses the signal received by the camshaft and crankshaft speed sensors. The angle and speed, the quality and plausibility of the signal are determined. When the ECU **A-001** senses that the Revolutions Per Minute (RPM) sensor **B-9007** signal is not detected for more than four times during engine revolutions, this fault will occur.

**Cause:**
The ECU **A-001** has not detected a RPM sensor **B-9007** signal for more than four times.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty RPM sensor, incorrectly aligned or mounted.
3. Faulty RPM sensor **B-9007**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the RPM sensor **B-9007**, the fuse (if applicable) and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the RPM sensor **B-9007** integrity.

   Verify the RPM sensor **B-9007** is correctly mounted and the sensor is not loose or moving.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the RPM sensor **B-9007** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the RPM sensor **B-9007** at connector **X-9021**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 20** | **X-9021 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 21** | **X-9021 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **5**.

   B. If there is no continuity on either check, continue with Step **4**.
4. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 20** | **X-470 (Receptacle) pin 9** | There should be continuity |
| **X-EC1 (Receptacle) pin 21** | **X-470 (Receptacle) pin 10** | There should be continuity |

A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9021** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Replace the RPM sensor **B-9007** then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3089 (F-637-02) - Crankshaft Speed Sensor Pattern is Not Plausible [113270354 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Revolutions Per Minute (RPM) sensor **B-9007** to control the machine operations. The ECU **A-001** is responsible for evaluating the signals received from the RPM sensor **B-9007**. Angle and speed determination, signal plausibility and quality are all evaluated. When the ECU **A-001** senses that the crank shaft signal is not plausible for more than eighty times, the crank shaft signal is considered disturbed while the engine is running at a speed greater than **650 RPM**, this fault will occur.

**Cause:**
The ECU **A-001** has detected that a disturbed RPM sensor **B-9007** signal exists.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty RPM sensor **B-9007**, incorrectly aligned or mounted.
3. Faulty RPM sensor **B-9007**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the RPM sensor **B-9007**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the RPM sensor **B-9007** integrity.

   Verify the RPM sensor **B-9007** is correctly mounted and the sensor is not loose or moving.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.

3. Check the RPM sensor **B-9007** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the RPM sensor **B-9007** at connector **X-9021**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 20** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 21** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **4**.

   B. If there is voltage on either check, continue with Step **5**.

4. Check the RPM sensor **B-9007** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 20** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 21** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 20** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 21** | All other pins on **X-EC1** | There should be no continuity |

A. If there is no continuity on all the checks, continue with Step **7**.

B. If there is continuity on any of the check, continue with Step **5**.

5. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 9** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 10** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **6**.

   B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9021** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

6. Locate the circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 9** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 10** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 9** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 10** | All other pins on **X-9138B** | There should be no continuity |
| **X-9021 (Receptacle) pin 1** | All other pins on **X-9021** | There should be no continuity |
| **X-9021 (Receptacle) pin 2** | All other pins on **X-9021** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9138B** and **X-9021** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

7. Check the RPM sensor **B-9007** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 20** | **X-9021 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 21** | **X-9021 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **9**.

   B. If there is no continuity on either check, continue with Step **8**.

8. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 20** | **X-470 (Receptacle) pin 9** | There should be continuity |
| **X-EC1 (Receptacle) pin 21** | **X-470 (Receptacle) pin 10** | There should be continuity |

A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9021** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

9. Replace the RPM sensor **B-9007** then recheck the status of this fault.

   A. Fault is active. continue with Step **10**.

   B. Fault is not active. Return the machine to normal operation.

10. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3090 (F-636-09) - Camshaft Speed Sensor Values are Not Plausible [113270479 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** assesses the signal received by the camshaft and crankshaft speed sensors. The angle and speed, the quality and plausibility of the signal are determined. When the ECU **A-001** senses that the timing sensor **B-9017** signal is not detected for more than four times during engine revolutions, this fault will occur. The ECU **A-001** uses various monitoring strategies during engine start-up and the normal operation of the engine. If the problem is detected at engine start-up, a redundant synchronisation of the angular system is carried out using only the crankshaft increment signal and the test injections to determine the engine phase. If this procedure is not carried out correctly, the injection is interrupted and the system waits for a restart.

**Cause:**
The ECU **A-001** has not detected a timing sensor **B-9017** signal for more than four times.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty timing sensor **B-9017**, improperly aligned or mounted.
3. Faulty timing sensor **B-9017**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the timing sensor **B-9017**, the fuse (if applicable) and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the timing sensor **B-9017** integrity.

   Verify the correct timing sensor **B-9017** is aligned or mounted properly, and the sensor is not loose or moving.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the timing sensor **B-9017** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the timing sensor **B-9017** at connector **X-9008**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 51** | **X-9008 pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 52** | **X-9008 pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 37** | **X-9008 pin 3** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **5**.

   B. If there is no continuity on any of the checks, continue with Step **4**.

4. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 51** | **X-470 (Receptacle) pin 8** | There should be continuity |
| **X-EC1 (Receptacle) pin 52** | **X-470 (Receptacle) pin 4** | There should be continuity |
| **X-EC1 (Receptacle) pin 37** | **X-470 (Receptacle) pin 10** | There should be continuity |

   A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9008** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Replace the timing sensor **B-9017** then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3091 (F-636-02) - Camshaft Speed Sensor Pattern is Not Plausible [113270352 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** assesses the signal received by the camshaft and crankshaft speed sensors. The angle and speed, the quality and plausibility of the signal are determined. When the ECU **A-001** senses that the camshaft signal does not match the correct model (edge distance, level) or all camshafts edges required during the engine revolutions are not detected for more than six times, this fault occurs. The ECU **A-001** uses various monitoring strategies during engine start-up and the normal operation of the engine. If the problem is detected at engine start-up, a redundant synchronisation of the angular system is carried out using only the crankshaft increment signal and the test injections to determine the engine phase. If this procedure is not carried out correctly, the injection is interrupted and the system waits for a restart. When the ECU **A-001** senses the timing sensor **B-9017** signal is implausible, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the timing sensor **B-9017** signal implausibility for more than six times.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty timing sensor gear plate (phonic wheel), timing.
3. Faulty timing sensor **B-9017**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the timing sensor **B-9017**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the timing sensor **B-9017** integrity.

   Verify the correct timing sensor **B-9017** is installed and is properly secured, and the sensor is not loose or moving.

   Verify the timing sensor gear plate (phonic wheel) alignment.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.

3. Check the timing sensor **B-9017** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the timing sensor **B-9017** at connector **X-9008**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 51** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 52** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **4**.

B. If there is voltage on either check, continue with Step **5**.

4. Check the timing sensor **B-9017** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 51** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 52** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 51** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 52** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **7**.

   B. If there is continuity on any of the check, continue with Step **5**.

5. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 8** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 4** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **6**.

   B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9008** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

6. Locate the circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 8** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 4** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 8** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 4** | All other pins on **X-9138B** | There should be no continuity |
| **X-9008 pin 1** | All other pins on **X-9008** | There should be no continuity |
| **X-9008 pin 2** | All other pins on **X-9008** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9138B** and **X-9008** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

7. Check the timing sensor **B-9017** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 51** | **X-9008 pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 52** | **X-9008 pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 37** | **X-9008 pin 3** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **9**.

   B. If there is no continuity on any of the checks, continue with Step **8**.

8. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 51** | **X-470 (Receptacle) pin 8** | There should be continuity |
| **X-EC1 (Receptacle) pin 52** | **X-470 (Receptacle) pin 4** | There should be continuity |
| **X-EC1 (Receptacle) pin 37** | **X-470 (Receptacle) pin 10** | There should be continuity |

   A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9008** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

9. Replace the timing sensor **B-9017** then recheck the status of this fault.

   A. Fault is active. continue with Step **10**.

   B. Fault is not active. Return the machine to normal operation.

10. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3093 (F-636-31) - Compared Camshaft and Crankshaft Speed Sensor Values are Not Plausible [113270410 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the camshaft position sensor **B-9017** and the crankshaft sensor **B-9007** characteristics for angle, speed determination, signal plausibility, and quality. When the ECU **A-001** senses that the offset between crankshaft signal and expected camshaft first edge less than **10°**CrS or greater than **10°**CrS for more than four consecutive cycles, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the offset between the crankshaft signal and the first expected camshaft end is lower than or greater than the correct value for more than four consecutive cycles.

**Possible failure modes:**

1. Faulty engine timing, incorrectly timed.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the camshaft position sensor **B-9017**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the engine verifying the correct phasing of the camshaft.

   Use the Electronic Service Tool (EST) to check the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3102 (F-157-04) - Fuel Rail Pressure Sensor Voltage is Lower than Expected [113270379 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** to control the engine operations. When the ECU **A-001** senses a voltage less than **310.40 mV** for more than **0.14 s** on the pressure sensor on the rail **B-9004** signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the pressure sensor on the rail **B-9004** signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty pressure sensor on the rail **B-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pressure sensor on the rail **B-9004**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the pressure sensor on the rail **B-9004** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the pressure sensor on the rail **B-9004** at connector **X-9026**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 42** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 62** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 42** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.

3. Check the pressure sensor on the rail **B-9004** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 7** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 6** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 7** | All other pins on **X-9138B** | There should be no continuity |
| **X-9026 (Receptacle) pin 2** | All other pins on **X-9026** | There should be no continuity |
| **X-9026 (Receptacle) pin 3** | All other pins on **X-9026** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9026** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the pressure sensor on the rail **B-9004**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3105 (F-5571-14) - Fuel Pressure Relief Valve is Forced to Open, Perform Pressure Increase [113270371 - V4 - 27 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** to control the machine's operations. To determine the mechanical component wear out or to send the system into limp home mode, the ECU **A-001** can force the fuel pressure relief valve to open. This action consists of two steps, waiting for the rail pressure to build up and then performing the pressure shock. When the ECU **A-001** commands this operation, this fault will occur. Once the pressure sensor on the rail **B-9004** failure is detected or maximum rail pressure is exceeded, the system will go into a limp home mode. When this fault will occur, other fuel related system faults can also occur due to the increase in fuel pressure, diagnose those codes as required.

**Cause:**
The ECU **A-001** has detected that the pressure sensor on the rail **B-9004** failure or the maximum rail pressure is exceeded.

**Possible failure modes:**

1. Faulty pressure sensor on the rail **B-9004**, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pressure sensor on the rail **B-9004**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the pressure sensor on the rail **B-9004**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3106 (F-5571-15) - Fuel Pressure Relief Valve Reached Maximum Allowed Opening Count [113270499 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Pressure Relief Valve (PRV) which is integral to the fuel rail to control the engine operations. The ECU **A-001** counts the sudden reductions on the rail pressure whenever the PRV opens. When the ECU **A-001** senses sudden reductions on the rail pressure for more than 50 counts, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the PRV opening counter has exceeded 50 counts.

**Possible failure modes:**

1. Faulty PRV, tightness and opening pressure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the fuel pressure.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Replace the PRV.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3110 (F-157-20) - Rail Pressure Sensor Value is Above Maximum Offset [113270541 - V4 - 28 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** to control the engine operations. The ECU **A-001** also monitors the fuel rail pressure against the offset drift at engine stand still after a waiting period. This allows the rail pressure to drop to ambient pressure, which is approximately **1 bar** (**14.5 psi**). When the ECU **A-001** senses that the voltage is more than **609 mV** for 8 measurements on the pressure sensor on the rail **B-9004**, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the pressure sensor on the rail **B-9004** is above the maximum offset.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty pressure sensor on the rail **B-9004**, improper mounting.
3. Faulty pressure sensor on the rail **B-9004**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pressure sensor on the rail **B-9004**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the pressure sensor on the rail **B-9004**.

   Then recheck the status of this fault.

   A. Fault is active. Continue to Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check that the pressure sensor on the rail **B-9004** is properly mounted and secured.

   A. If the pressure sensor on the rail **B-9004** is properly mounted and secured, continue to Step **4**.

   B. If the pressure sensor on the rail **B-9004** is loose or incorrectly mounted, repair or replace as required.
4. Replace the pressure sensor on the rail **B-9004**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3111 (F-157-21) - Rail Pressure Sensor Value is Below Minimum Offset [113270377 - V4 - 28 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** to control the engine operations. The ECU **A-001** also monitors the fuel rail pressure against the offset drift at engine stand still after a waiting period. This allows the rail pressure to drop to ambient pressure, which is approximately **1 bar** (**14.5 psi**). When the ECU **A-001** senses that the voltage is below than **424 mV** for 3 measurements on the pressure sensor on the rail **B-9004**, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the pressure sensor on the rail **B-9004** is below the minimum offset.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty pressure sensor on the rail **B-9004**, improper mounting.
3. Faulty pressure sensor on the rail **B-9004**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pressure sensor on the rail **B-9004**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the pressure sensor on the rail **B-9004**.

   Then recheck the status of this fault.

   A. Fault is active. Continue to Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check that the pressure sensor on the rail **B-9004** is properly mounted and secured.

   A. If the pressure sensor on the rail **B-9004** is properly mounted and secured, continue to Step **4**.

   B. If the pressure sensor on the rail **B-9004** is loose or incorrectly mounted, repair or replace as required.
4. Replace the pressure sensor on the rail **B-9004**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3112 (F-157-11) - Fuel Rail Pressure Sensor Voltage is Higher than Expected [113270447 - V5 - 28 February 2025]

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004**. The pressure sensor on the rail **B-9004** shares the fuel rail pressure signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage greater than **4.74 V** for more than **140 ms** on the pressure sensor on the rail **B-9004** pressure signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the pressure sensor on the rail **B-9004** pressure signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty pressure sensor on the rail **B-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pressure sensor on the rail **B-9004**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the pressure sensor on the rail **B-9004** supply circuit.

   Using a multimeter back probe the harness from the pressure sensor on the rail **B-9004** at connector **X-9026**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9026 (Receptacle) pin 3** | Chassis ground | There should be approximately **5 V** |

   A. If there is approximately **5 V**, continue with Step **3**.

   B. If there is not approximately **5 V**, check the circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the connectors, recheck the voltage, then return the machine to normal operation.

3. Check the pressure sensor on the rail **B-9004** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the pressure sensor on the rail **B-9004** at connector **X-9026**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **4**.

   B. If there is voltage, continue with Step **5**.

4. Check the pressure sensor on the rail **B-9004** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | All other pins on **X-EC1** | There should be no continuity |

A. If there is no continuity, continue with Step **7**.

B. If there is continuity, continue with Step **5**.

5. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **6**.

B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

6. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | All other pins on **X-9138B** | There should be no continuity |
| **X-9026 (Receptacle) pin 2** | All other pins on **X-9026** | There should be no continuity |

A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

7. Check the pressure sensor on the rail **B-9004** signal circuit for an open circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | **X-9026 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-9026 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 42** | **X-9026 (Receptacle) pin 3** | There should be continuity |

A. If there is continuity on all the checks, continue with Step **9**.

B. If there is no continuity on any of the checks, continue with Step **8**.

8. Locate the circuit for an open circuit.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | **X-470 (Receptacle) pin 6** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-470 (Receptacle) pin 5** | There should be continuity |
| **X-EC1 (Receptacle) pin 42** | **X-470 (Receptacle) pin 7** | There should be continuity |

A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

9. Replace the pressure sensor on the rail **B-9004**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **10**.

   B. Fault is not active. Return the machine to normal operation.

10. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3137 (F-5380-05) - Fuel Metering Unit has an Open Load Error [113270493 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the fuel metering unit **Y-9000** to control the engine operations. When the ECU **A-001** senses an open circuit on the fuel metering unit **Y-9000** circuit, this fault will occur. When the fuel metering unit **Y-9000** is not operating, fuel pressure will be at maximum.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the fuel metering unit **Y-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty fuel metering unit **Y-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the fuel metering unit **Y-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the fuel metering unit **Y-9000** for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the fuel metering unit **Y-9000** at connector **X-9007**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9007 pin 1** | **X-EC1 (Receptacle) pin 7** | There should be continuity |
| **X-9007 pin 2** | **X-EC1 (Receptacle) pin 6** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **4**.

   B. If there is no continuity on either check, continue with Step **3**.

3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 7** | **X-470 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 6** | **X-470 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on both the checks, there is an open circuit in the connector harness (between **X-9007** and **X-9138B** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the fuel metering unit **Y-9000**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9007 pin 1** | **X-9007 pin 2** | The resistance should be **2.8 – 3.2 Ω** |

   A. If the measured resistance value is within the limit, continue with Step **5**.

   B. If the measured resistance value is not within the limit, the fuel metering unit **Y-9000** has failed internally. Replace the fuel metering unit **Y-9000**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3141 (F-1240-31) - Fuel pump pressure has exceeded desired pressure limits [113270437 - V4 - 13 February 2025]

## Control Module: ECU

**Fault Description:**
The Fuel Metering Unit (FMU) **Y-9000** controls the required fuel flow on the common rail. The unit is regulated via feedback control from the Engine Control Unit (ECU) **A-001**. If the ECU **A-001** determines that the required fuel pressure cannot be obtained, this indicates the probable presence of a leak and this fault occurs.

**Cause:**
Fuel pressure is unable to reach the desired pressure.

**Possible failure modes:**
Faulty low pressure fuel system, leakage or blockage (40% - 60 min)
Faulty fuel injectors (20% - 20 min)
Faulty high pressure pump (10% - 45 min)
Faulty Pressure Relief Valve (PRV) or common rail assembly (10% - 30 min)
Faulty fuel metering unit (FMU). Component ID : Y-F07 (10% - 20 min)
Faulty rail pressure sensor. Component ID : B-F09 (5% - 5 min)
Fuel tank level, too low (5% - 5 min)

### Faulty low pressure fuel system, leakage or blockage

**Solution:**

1. Check if the service interval for the fuel filter is close. If so, replace the fuel filter and check for fault reoccurrence. Fuel filter replacement can be performed by the customer if the machine is still in the field and a fuel filter is available.

   A. The fault is no longer active. Return the machine to service.

   B. The fault is still active. Go to Step **2**.

2. Measure restriction on the suction side of the fuel system.

   Install the pressure gauges from Fuel Test Kit **380003437** and the F5 and VM Engine Fuel Test Adapters **380003438** . See **Fuel injection system - Test (10.218-F.40.C.01)** under the heading “Connections” for the proper procedure.

   Start the engine.

   Run the engine to normal operating temperature.

   Run the engine slow through the RPM range while monitoring Gauge **(A)**.

   ***NOTE:*** *It may be necessary to run the engine under load or in similar working conditions to reproduce the fault while monitoring Gauge **(A)**.*

   Record the highest value seen on Gauge **(A)** - suction side (before pre-filter).

   ***NOTE:*** *For values less than one, be sure to enter with a leading zero before the decimal point.*

   A. The measured vacuum on Gauge **(A)** is greater than **-0.3 bar**, A vacuum measurement greater than **-0.3 bar** indicates restriction in the suction side of the fuel system. Go to Step **6**.

   B. The measured vacuum on Gauge **(A)** is less than **-0.3 bar**, Leave all gauges connected and go to Step **3**.

3. During the test, were any air bubbles visible in the clear test lines?

   A. Large air bubbles were observed. Large air bubbles in the suction line indicate air ingress. Go to Step **7**.

B. No or very small random air bubbles were observed. Leave all gauges connected and go to Step **4**.

4. Run engine at **1500 RPM** and measure low side fuel pressure before the main filter.

   Record the values for Gauge **(B)** - Low pressure side (before main filter).

   A. The measured value is greater than **4.5 bar** (**65 psi**). Leave all gauges connected and go to Step **5**.

   B. The measured value is lower than **4.5 bar** (**65 psi**). The low pressure gear pump is weak or damaged. Replace low pressure gear pump (if available). Replace the complete high pressure pump if low pressure gear pump is not available.

5. Run engine at **1500 RPM** and measure low side fuel pressure after the main filter.

   Record the values for Gauge **(C)** - low pressure side (after main filter).

   A. The measured value is greater than **4.5 bar** (**65 psi**). Leave all gauges connected and go to possible failure modes list.

   B. The measured value is less than **4.5 bar** (**65 psi**). Filter differential pressure is greater than specification. Go to Step **8**.

6. Inspect the following components to determine the root cause of a high vacuum measurement on Gauge **(A)**.

   - Fuel water separator/filter
   - Suction screen in the tank
   - Fuel line from the tank or pickup in the tank
   - Fuel tank vent

   A. Fuel water separator/filter is clogged. Clean or replace the fuel water separator/filter.

   B. Suction screen in the tank is clogged. Clean or replace the suction screen.

   C. Fuel line from the tank or pickup in the tank is clogged or restricted. Clean or replace the line.

   D. Fuel tank vent is clogged or restricted. Clean or replace the fuel tank vent line.

7. Inspect the following components to determine the root cause of air ingress on the suction side of the fuel system.

   - Fuel level in the tank
   - Air leak at test fitting or test quick coupler
   - Leak in the fuel lines/fittings
   - Diaphragm in primer pump
   - Seal between the ECU and fuel cooler base (if equipped)
   - Fuel fitting O-rings

   A. Unit low in fuel. Fill tank with fuel.

   B. Air leak at test fitting or test quick coupler. Reset, repair, or replace the test fittings or couplers.

   C. Leak in the fuel lines/fittings. Tighten loose fittings, replace deteriorated/ damaged fuel lines.

   D. Diaphragm in primer pump cracked / damaged. Replace the primer pump.

   E. Deteriorated/damaged fuel fitting O-rings. Replace deteriorated / damaged O-rings.

8. Inspect the following components to determine the root cause of pressure drop across the main filter.

   - Main fuel filter
   - Main fuel filter base

   A. Main fuel filter is clogged. Replace main fuel filter.

B. Restriction / blockage in main fuel filter base. Clear / remove restriction from the fuel filter base. Replace the filter base if necessary.

### Faulty fuel injectors

**Solution:**

1. Measure the individual return flow for each fuel injector at low idle.

   Use the test fittings, hoses and graduated cylinder from Fuel Test Kit **380003437** and the F5 and VM Engine Fuel Test Adapters **380003438** to collect the return fuel for **60 s**. See **Fuel injectors - Leakage test (10.218.AF-F.40.A.40)** for the proper procedure.

   Enter the value from the injector that had the highest return flow into the field below.

   A. The individual return flow value is greater than **24 mL** in **60 s**. Indicate the values obtained for each injector in the comment field. Then, replace the injector(s) that have a return flow greater than **24 mL**.

   B. The individual return flow value is less than **24 mL** in **60 s**. Indicate the values obtained for each injector in the comment field. Go to possible failure mode list..

### Faulty high pressure pump

**Solution:**

1. Measure the return flow from the high pressure pump.

   Use the test fittings, hoses and graduated container from Fuel Test Kit **380003437** and the F5 and VM Engine Fuel Test Adapters **380003438** to collect the return fuel for one minute. See **High pressure pump - Flow test (10.218.AT-F.40.A.45)** for the proper procedure.

   A. The measured return flow value is greater than **750 mL** / **60 s**.The internal components are worn or damaged. Replace the high pressure pump.

   B. The measured return flow value is less than **750 mL** / **60 s**.Go to possible failure modes list.

### Faulty pressure relief valve

**Solution:**

1. Measure leakage from the common rail pressure relief valve.

   Use the test fittings, hoses and suitable container from Fuel Test Kit **380003437** and the F5 and VM Engine Fuel Test Adapters **380003438**. See **Common rail Relief valve - Leakage test (10.218.AA.01-F.40.A.40)** for the proper procedure.

   A. There is visible fuel leakage from the common rail pressure relief valve. Replace the common rail assembly. Then use EST to configure the replacement of the rail Pressure Relief Valve (PRV).

   B. There is no visible fuel leakage from the common rail pressure relief valve. Go to possible failure modes list.

### Faulty fuel metering unit (FMU) Y-F07

**Solution:**

1. Remove and inspect Fuel Metering Unit (FMU) **Y-F07** for sticking/binding and contamination.

   A. Sticking/binding or contamination found. Clean or replace FMU **Y-F07** as necessary.

B. No issues found, functions normally. Connect the EST to the machine. Download and attach the following files: Data Stored and Fault Memory Reading from EASy, Software versions (.ver) file from EST, Fault Code list (.flt) from EST, Machine Statistical Data Log (vehicle & transmission file). Then, submit a Technical Help Desk (THD) request. Include the list of part numbers for the components replaced.

## Faulty rail pressure sensor B-F09

**Solution:**

1. Use the Electronic Service Tool (EST) to check for the following related faults that may have caused this fault to occur. If any of the listed faults are active, diagnose them.

   A. **3102 (F-157-04) – Fuel rail pressure sensor voltage is lower than expected** is present. Use the troubleshooting available for the active fault to find the root cause of this fault.

   B. **3112 (F-157-11) – Fuel rail pressure sensor voltage is higher than expected** is present. Use the troubleshooting available for the active fault to find the root cause of this fault.

   C. **3810 (F-157-02) – Rail pressure sensor value is intermittent** is present. Use the troubleshooting available for the active fault to find the root cause of this fault.

   D. None of the faults in the list are currently active. Go to possible failure mode list.

## Fuel tank level, too low

**Solution:**

1. This fault code can occur if the fuel tank level is too low. You can contact the customer to check the fuel level if the machine is still in the field.

   A. The fuel level in the tank is low. Fill the fuel tank and bleed the air from the fuel system. Inform the customer that running the engine with the fuel level too low can result in damage to fuel system components.

   B. The fuel level in the tank is acceptable. Go to possible failure modes.

# 3146 (F-97-31) - Water in Fuel Detected or Water in Fuel Circuit Failure [113270412 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Water In Fuel (WIF) sensor **B-007** to control the machine operations. The ECU **A-001** monitors the voltage output from the WIF sensor **B-007** to determine if water is present in the fuel supply. If water is detected in the fuel, warnings will be displayed to alert the operator of potential engine damage if operation continues. When the ECU **A-001** senses that the ground signal is "active" longer than **60 s** on the WIF sensor **B-007** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected the excess water on the fuel system or a fault on the WIF sensor **B-007** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty WIF sensor **B-007**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the WIF sensor **B-007** and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check fuel for water contamination.

   Check the fuel for water contamination.

   A. If there is water contamination, continue with Step **3**.

   B. If there is no water contamination, return the machine to normal operation.
3. Verify proper WIF sensor **B-007** operation.

   Purge fuel supply system, replace fuel filters and refill with fuel that is free of water contamination.

   Start and run the engine for **5 min**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the WIF sensor **B-007** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the WIF sensor **B-007** at connector **X-463**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 70** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 75** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-EC2** and **X-463** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Check the WIF sensor **B-007** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 70** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 75** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 70** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 75** | All other pins on **X-EC2** | There should be no continuity |
| **X-463 pin 1** | All other pins on **X-463** | There should be no continuity |
| **X-463 pin 3** | All other pins on **X-463** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-EC2** and **X-463** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the WIF sensor **B-007** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 70** | **X-463 pin 1** | There should be continuity |
| **X-EC2 (Receptacle) pin 75** | **X-463 pin 3** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **7**.

   B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-EC2** and **X-463** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

7. Replace the WIF sensor **B-007**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **8**.

   B. Fault is not active. Return the machine to normal operation.

8. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3166 (4009-03) - Fuel Filter Heater Actuator is Shorted to Battery Voltage [113271849 - V4 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-F02** monitors the fuel filter heating contactor **K-F230** to control the fuel filter resistor **R-F230A** operations. When the ECU **A-F02** senses a voltage above normal on the fuel filter heating contactor **K-F230** control circuit, this fault will occur.

**Cause:**
The ECU **A-F02** has detected a short to power condition on the fuel filter heating contactor **K-F230** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty fuel filter heating contactor **K-F230** internal failure.
3. Faulty ECU **A-F02** ,software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-F02** to the fuel filter heating contactor **K-F230**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the fuel filter heating contactor **K-F230** supply circuit.

   Using a multimeter back probe the harness from the fuel filter heating contactor **K-F230** at connector **X-F230**.

   With the keyswitch in the ON position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-F230 pin 30** | Chassis ground | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is greater than **12 V**, check the circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the connector, recheck the voltage, then return the machine to normal operation.

3. Check the fuel filter heating contactor **K-F230** circuit for a short to power.

   Disconnect the harness from ECU **A-F02** at connector **X-F02V**.

   Disconnect the harness from the fuel filter heating contactor **K-F230** at connector **X-F230**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-F02V (Receptacle) pin 20** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **4**.

   B. If there is voltage, continue with Step **5**.

4. Check the fuel filter heating contactor **K-F230** circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-F02V (Receptacle) pin 20** | All other pins on **X-F02V** | There should be no continuity |
| **X-F230 pin 85** | All other pins on **X-F230** | There should be no continuity |

A. If there is no continuity on both checks, continue with Step **5**.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-F02V** and **X-F230** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Check the fuel filter heating contactor **K-F230**.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the component side:

| From | To | Value |
|---|---|---|
| **X-F230 pin 30** | **X-F230 pin 87** | There should be no continuity |

A. If there is no continuity, continue with Step **6**.

B. If there is continuity, the fuel filter heating contactor **K-F230** has failed internally. Replace the fuel filter heating contactor **K-F230**.

6. Check the ECU **A-F02** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-F02**.

# 3167 (4009-04) - Fuel Filter Heater Actuator is Shorted to Ground [113271983 - V4 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-F02** monitors the fuel filter heating contactor **K-F230** circuit to control the fuel filter resistor **R-F230A** operations. When the ECU **A-F02** senses a voltage below normal on the fuel filter heating contactor **K-F230** control circuit, this fault will occur.

**Cause:**
The ECU **A-F02** has detected a short to ground condition on the fuel filter heating contactor **K-F230** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty fuel filter heating contactor **K-F230**, internal failure.
3. Faulty ECU **A-F02**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-F02** to the fuel filter heating contactor **K-F230**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the voltage on the fuel filter heating contactor **K-F230** supply circuit.

   Using a multimeter back probe the harness from the fuel filter heating contactor **K-F230** at connector **X-F230**.

   With the keyswitch in the ON position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-F230 pin 30** | Chassis ground | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is greater than **12 V**, check the circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the connector, recheck the voltage, then return the machine to normal operation.

3. Check the ECU **A-F02** circuit for a short to ground.

   Disconnect the harness from the ECU **A-F02** at connector **X-F02V**.

   Disconnect the harness from the fuel filter heating contactor **K-F230** at connector **X-F230**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-F02V (Receptacle) pin 20** | Chassis ground | There should be no continuity |
| **X-F02V (Receptacle) pin 20** | All other pins on **X-F02V** | There should be no continuity |
| **X-F230 pin 85** | All other pins on **X-F230** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

B. If there is continuity on any of the checks, there is a short to ground in the engine (EN) harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the fuel filter heating contactor **K-F230**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the component side:

| From | To | Value |
|---|---|---|
| **X-F230 pin 30** | **X-F230 pin 87** | There should be no continuity |

   A. If there is no continuity, continue with Step **5**.

   B. If there is continuity, the fuel filter heating contactor **K-F230** has failed internally. Replace the fuel filter heating contactor **K-F230**.

5. Check the ECU **A-F02** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-F02**.

# 3168 (4009-05) - Fuel Filter Heater: No Load Error in Power Stage of Fuel Filter Heating [113271986 - V4 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-F02** monitors the fuel filter heating contactor **K-F230** to control the fuel filter resistor **R-F230A** operations. When the ECU **A-F02** fails to receive a signal on the fuel filter heating contactor **K-F230** control circuit, this fault will occur.

**Cause:**
The ECU **A-F02** has detected an open circuit condition on the fuel filter heating contactor **K-F230** control circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty fuel filter heating contactor **K-F230**, internal failure.
3. Faulty ECU **A-F02**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-F02** to the fuel filter heating contactor **K-F230**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the fuel filter heating contactor **K-F230** supply circuit.

   Using a multimeter back probe the harness from the fuel filter heating contactor **K-F230** at connector **X-F230**.

   With the keyswitch in the ON position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-F230 pin 30** | Chassis ground | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is greater than **12 V**, check the circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harness, recheck the voltage, then return the machine to normal operation.

3. Check the fuel filter heating contactor **K-F230** ground circuit.

   Disconnect the harness from the fuel filter heating contactor **K-F230** at connector **X-F230**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-F230 pin 87** | Chassis ground | There should be continuity |

   A. If there is continuity, continue with Step **4**.

   B. If there is no continuity, there is an open circuit in the ground circuit harness or the fuel filter resistor **R-F230A**. Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the fuel filter heating contactor **K-F230** circuit for an open circuit.

Disconnect the harness from the ECU **A-F02** at connector **X-F02V**.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-F230 pin 85** | **X-F02V (Receptacle) pin 20** | There should be continuity |
| **X-F230 pin 86** | **X-F02V (Receptacle) pin 1** | There should be continuity |

A. If there is continuity on both checks, continue with Step **5**.

B. If there is no continuity on either check, there is an open circuit in the engine (EN) harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Check the fuel filter heating contactor **K-F230**.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the component side:

| From | To | Value |
|---|---|---|
| **X-F230 pin 30** | **X-F230 pin 87** | There should be no continuity |

A. If there is no continuity, continue with Step **6**.

B. If there is continuity, the fuel filter heating contactor **K-F230** has failed internally. Replace the fuel filter heating contactor **K-F230**.

6. Check the ECU **A-F02** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-F02**.

# 3169 (4009-06) - Fuel Filter Heater ECU Driver has an Over Temperature Error [113271988 - V4 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-F02** monitors the fuel filter heating contactor **K-F230** to control the fuel filter resistor **R-F230A** operations. When the ECU **A-F02** senses an over temperature on the fuel filter heating contactor **K-F230** control circuit, this fault will occur.

**Cause:**
The ECU **A-F02** has detected a short circuit condition on the fuel filter heating contactor **K-F230** control circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short circuit.
2. Faulty fuel filter heating contactor **K-F230**, internal failure.
3. Faulty ECU **A-F02**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-F02** to the fuel filter heating contactor **K-F230**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the fuel filter heating contactor **K-F230** supply circuit.

   Using a multimeter back probe the harness from the fuel filter heating contactor **K-F230** at connector **X-F230**.

   With the keyswitch in the ON position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-F230 pin 30** | Chassis ground | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is greater than **12 V**, check the circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harness, recheck the voltage, then return the machine to normal operation.

3. Check the fuel filter heating contactor **K-F230** circuit for a short to power.

   Disconnect the harness from the ECU **A-F02** at connector **X-F02V**.

   Disconnect the harness from the fuel filter heating contactor **K-F230** at connector **X-F230**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-F02V (Receptacle) pin 20** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **4**.

   B. If there is voltage, there is a short to power in the engine (EN) harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

4. Check the fuel filter heating contactor **K-F230** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-F02V (Receptacle) pin 20** | Chassis ground | There should be no continuity |
| **X-F02V (Receptacle) pin 20** | All other pins on **X-F02V** | There should be no continuity |
| **X-F230 pin 85** | All other pins on **X-F230** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **5**.

   B. If there is continuity on any of the checks, there is a short to power in the engine (EN) harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Check the fuel filter heating contactor **K-F230**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the component side:

| From | To | Value |
|---|---|---|
| **X-F230 pin 30** | **X-F230 pin 87** | There should be no continuity |

   A. If there is no continuity, continue with Step **6**.

   B. If there is continuity, the fuel filter heating contactor **K-F230** has failed internally. Replace the fuel filter heating contactor **K-F230**.

6. Check the ECU **A-F02** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-F02**.

# 3172 (F-110-16) - Engine Coolant Temperature has Exceeded the Pre-warning Threshold [113270401 - V4 - 20 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the coolant temperature sensor **B-9003**. The coolant temperature sensor **B-9003** shares the coolant temperature signal with the ECU **A-001** to control the engine operations. Two engine temperature thresholds are available to signal high engine temperature. A pre-warning is set when the engine coolant temperature exceeds **105.96 °C** (**222.73 °F**). When the ECU **A-001** senses that the pre-warning threshold is exceeded, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the engine coolant temperature pre-warning threshold has been exceeded.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty use, engine temperature too high (heavy use or high environmental temperature).
3. Faulty engine cooling system, low coolant, thermostat stuck closed, restricted cooling package etc.
4. Faulty coolant temperature sensor **B-9003**, internal failure.
5. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the coolant temperature sensor **B-9003**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check whether the environmental temperature is high or heavy usage.

   If the environmental temperature is high or the heavy usage of machine, resolve the issue.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the condition of the thermostat valve.

   If the thermostat is corroded or damaged, resolve the issue.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check to confirm if other fault codes are active.

   Resolve them first and then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. Check the coolant temperature sensor **B-9003**.

Disconnect the harness from the coolant temperature sensor **B-9003** at connector **X-9006**.

With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9006** | **X-9006** | The resistance should be between **100 – 50,000 Ω** |

A. If the measured resistance value is within the limit, continue with Step **6**.

B. If the measured resistance value is not within the limit, the coolant temperature sensor **B-9003** has failed internally. Replace the coolant temperature sensor **B-9003**.

6. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3173 (F-110-00) - Engine Coolant Temperature has Exceeded the Warning Threshold [113270403 - V4 - 20 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the engine coolant temperature sensor **B-9003**. The engine coolant temperature sensor **B-9003** shares the coolant temperature signal with the ECU **A-001** to control the engine operations. Two engine temperature thresholds are available to signal high engine temperature. A pre-warning is set when the engine coolant temperature exceeds **105.96 °C** (**222.73 °F**) and a warning is set when the engine coolant temperature exceeds **109.96 °C** (**229.93 °F**). When the ECU **A-001** senses that the warning threshold is exceeded, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the engine coolant temperature warning threshold has been exceeded.

**Possible failure modes:**

1. Faulty use, engine temperature too high (heavy use or high environmental temperature).
2. Faulty engine cooling system, low coolant, thermostat stuck closed, restricted cooling package etc.
3. Faulty engine coolant temperature sensor **B-9003**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the engine coolant temperature sensor **B-9003**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check whether the environmental temperature is high or heavy usage.

   If the environmental temperature is high or the heavy usage of machine, resolve the issue.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the condition of the thermostat valve.

   If the thermostat is corroded or damaged, resolve the issue.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check to confirm if other fault codes are active.

   Resolve them first then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. Check the engine coolant temperature sensor **B-9003**.

Disconnect the harness from the engine coolant temperature sensor **B-9003** at connector **X-9006**.

With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9006** | **X-9006** | There should be approximately **100 – 50,000 Ω** |

A. If the measured resistance value is correct, continue with Step **6**.

B. If the measured resistance value is incorrect, the engine coolant temperature sensor **B-9003** has failed internally. Replace the engine coolant temperature sensor **B-9003**.

6. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3176 (F-1240-11) - High Pressure Pump Fuel Delivery Quantity in Over Run Exceeds a Maximum Threshold [113270443 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the fuel rail pressure control is executed by the fuel pressure regulation solenoid valve **Y-9000** as feeding quantity control. High pressure system leakage is checked at overrun. The ECU **A-001** monitors the presence of any high pressure leakage in overspeed conditions. When the ECU **A-001** senses a high pressure fuel delivery quantity exceeds a maximum threshold in over run and the desired fuel pressure can not be reached, leakage in the system is assumed and this fault will occur.

**Cause:**
The ECU **A-001** has determined that the desired fuel rail pressure is lower than expected in overspeed.

**Possible failure modes:**

1. Faulty fuel injectors, internal leakage or stuck open.
2. Faulty pressure relief valve leaking.
3. Faulty fuel pressure regulation solenoid valve **Y-9000**, internal failure.
4. Faulty high pressure pump.
5. Faulty fuel filter, clogged.
6. Faulty low pressure fuel pipes, leaking (air entrance).
7. Faulty low-pressure gear pump.
8. Faulty electric intake pump (if applicable).
9. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the fuel pressure regulation solenoid valve **Y-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active. Resolve them first then recheck the status of this fault.
   A. Fault is active. Continue with Step **3**.
   B. Fault is not active. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3177 (F-190-00) - Engine Over Speed Condition Detected [113270823 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the engine speed and in the case of overspeed detection a failure is reported. Unacceptably high engine speed may arise in the event of an error in the ECU **A-001** or under certain operating states like downhill travel. In the case of downhill travel the failure does not indicate an error but simply informs about a "misuse" of the engine. When the ECU **A-001** senses that the engine speed exceeds the threshold of **3100 RPM**, this fault will occur. No reaction is necessary unless this fault or information status reoccurs frequently. In that case check driving conditions of the vehicle, engine speed acquisition and injection system for quantity set point and actual value during fault recognition. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3213 (F-2797-04) - Short Circuit to Ground Monitoring Test in Bank 1 [113270361 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the cylinder bank 1 injectors (injector 1 **Y-9001**, and injector 3 **Y-9003**) to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors in the cylinder bank 1 (injector 1 **Y-9001**, and injector 3 **Y-9003**). When the ECU **A-001** senses an expected combination of errors is detected, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the cylinder bank 1 injectors circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty injector 1 **Y-9001**, internal failure.
3. Faulty injector 3 **Y-9003**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 1 **Y-9001**, and the injector 3 **Y-9003**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 1 **Y-9001** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 1 **Y-9001** at connectors **X-9030**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 64** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 64** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **4**.

   B. If there is continuity on either check, continue with Step **3**.
3. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-9030** from the harness connector **X-9033**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9030 (Receptacle) pin 1** | Chassis ground | There should be no continuity |
| **X-9030 (Receptacle) pin 1** | All other pins on **X-9030** | There should be no continuity |
| **X-9030 (Receptacle) pin 1** | All other pins on **X-9030** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9030** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the injector 3 **Y-9003** for a short to ground.

   Disconnect the harness from the injector 3 **Y-9003** at connectors **X-9031**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 24** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 24** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **5**.

5. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 4** | Chassis ground | There should be no continuity |
| **X-9139B pin 4** | All other pins on **X-9139B** | There should be no continuity |
| **X-9031 (Receptacle) pin 1** | All other pins on **X-9031** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9031** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the injector 1 **Y-9001**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9030 (Receptacle) pin 1** | **X-9030 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **7**.

   B. If the measured resistance value is incorrect, the injector 1 **Y-9001** has failed internally. Replace the injector 1 **Y-9001**.

7. Check the injector 3 **Y-9003**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9031 (Receptacle) pin 1** | **X-9031 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **8**.

   B. If the measured resistance value is incorrect, the injector 3 **Y-9003** has failed internally. Replace the injector 3 **Y-9003**.

8. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3221 (F-2798-04) - Short Circuit to Ground Monitoring Test in Bank 2 [113270363 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the cylinder bank 2 injectors (injector 2 **Y-9002**, and injector 4 **Y-9004**) to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors in the cylinder bank 1 (injector 2 **Y-9002**, and injector 4 **Y-9004**). When the ECU **A-001** senses an expected combination of errors is detected, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the cylinder bank 2 injectors circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty injector 2 **Y-9002**, internal failure.
3. Faulty injector 4 **Y-9004**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 2 **Y-9002**, and the injector 4 **Y-9004**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 2 **Y-9002** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 2 **Y-9002** at connector **X-9033**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 22** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 22** | All other pins in **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **4**.

   B. If there is continuity on either check, continue with Step **3**.
3. Check the injector 2 **Y-9002** circuit for a short to ground.

   Disconnect the harness connector **X-9030** from the harness connector **X-9033**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 8** | Chassis ground | There should be no continuity |
| **X-9139B pin 8** | All other pins on **X-9139B** | There should be no continuity |
| **X-9033 (Receptacle) pin 1** | All other pins on **X-9033** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9033** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the injector 4 **Y-9004** circuit for a short to ground.

   Disconnect the harness from the injector 4 **Y-9004** at connector **X-9032**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 66** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 66** | All other pins in **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **5**.

5. Check the injector 4 **Y-9004** circuit for a short to ground.

   Disconnect the harness connector **X-9030** from the harness connector **X-9033**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 5** | Chassis ground | There should be no continuity |
| **X-9139B pin 5** | All other pins on **X-9139B** | There should be no continuity |
| **X-9032 (Receptacle) pin 1** | All other pins on **X-9032** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-9033** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9032** and **X-9030** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the injector 2 **Y-9002**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9033 (Receptacle) pin 1** | **X-9033 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **7**.

   B. If the measured resistance value is incorrect, the injector 2 **Y-9002** has failed internally. Replace the injector 2 **Y-9002**.

7. Check the injector 4 **Y-9004**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9032 (Receptacle) pin 1** | **X-9032 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **8**.

   B. If the measured resistance value is incorrect, the injector 4 **Y-9004** has failed internally. Replace the injector 4 **Y-9004**.

8. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3255 (F-5572-31) - ECU Internal Failure - ADC Test [113270495 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the efficiency of the Analog to Digital Converter (ADC). A fixed incoming test voltage (from the accelerator pedal) is sent to the ADC and converted. The ECU **A-001** monitors this test, the value must be between **4.73 V** and **4.83 V** and the ECU **A-001** counts all the times in which the value is not recorded within the specified range. When the ECU **A-001** senses that the counter exceeds 15 times, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the ADC test voltage is out of range.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3256 (F-5572-14) - ECU Internal Failure - NTP Error in ADC Monitoring [113270596 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** uses a No-load Test Pulse (NTP) operation to check the efficiency of the Analog to Digital Converter (ADC). When the ECU **A-001** senses an error during this test, this fault will occur.

**Cause:**
The ECU **A-001** has detected an NTP error on the ADC.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3258 (F-677-03) - Starter Relay High Side Driver Circuit Short to Battery Failure [113270842 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the voltage to the ignition control contactor **K-103** to control the engine operations. The battery equalizer PDM controls the voltage to the ignition control contactor **K-103**. When the ECU **A-001** senses a voltage above normal on the ignition control contactor **K-103** high side control circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the ignition control contactor **K-103** high side circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty ignition control contactor **K-103**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the ignition control contactor **K-103**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ignition control contactor **K-103** supply circuit.

   Using a multimeter back probe the harness from the ignition control contactor **K-103** at connector **X-101**.

   With the keyswitch in the ON position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-101 (Power Distribution) pin 1** | Chassis ground | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is greater than **12 V**, check the circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the connector, recheck the voltage, then return the machine to normal operation.
3. Check the ignition control contactor **K-103** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the ignition control contactor **K-103** at connector **X-101**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 72** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **4**.

   B. If there is voltage, continue with Step **5**.
4. Check the ignition control contactor **K-103** circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 72** | All other pins on **X-EC2** | There should be no continuity |
| **X-101 (Power Distribution) pin 3** | All other pins on **X-101** | There should be no continuity |

A. If there is no continuity on both checks, continue with Step **5**.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-EC2** and **X-101** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Check the ignition control contactor **K-103**.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the component side:

| From | To | Value |
|---|---|---|
| **X-101 (Power Distribution) pin 1** | **X-101 (Power Distribution) pin 9** | There should be no continuity |

A. If there is no continuity, continue with Step **6**.

B. If there is continuity, the ignition control contactor **K-103** has failed internally. Replace the ignition control contactor **K-103**.

6. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3259 (F-677-04) - Starter Relay High Side Driver Circuit Short to Ground Failure [113270835 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the voltage to the ignition control contactor **K-103** to control the engine operations. The battery equalizer PDM controls the voltage to the ignition control contactor **K-103**. When the ECU **A-001** senses a voltage below normal on the ignition control contactor **K-103** high side control circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the ignition control contactor **K-103** high side circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty ignition control contactor **K-103**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the ignition control contactor **K-103**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the ignition control contactor **K-103** supply circuit.

   Using a multimeter back probe the harness from the ignition control contactor **K-103** at connector **X-101**.

   With the keyswitch in the ON position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-101 (Power Distribution) pin 1** | Chassis ground | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is greater than **12 V**, check the circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the connector, recheck the voltage, then return the machine to normal operation.

3. Check the ignition control contactor **K-103** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the ignition control contactor **K-103** at connector **X-101**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 72** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 72** | All other pins on **X-EC2** | There should be no continuity |
| **X-101 (Power Distribution) pin 3** | All other pins on **X-101** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-EC2** and **X-101** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the ignition control contactor **K-103**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the component side:

| From | To | Value |
|---|---|---|
| **X-101 (Power Distribution) pin 1** | **X-101 (Power Distribution) pin 9** | There should be no continuity |

   A. If there is no continuity, continue with Step **5**.

   B. If there is continuity, the ignition control contactor **K-103** has failed internally. Replace the ignition control contactor **K-103**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3261 (F-1321-03) - Starter Relay Low Side Driver Circuit Short to Battery Failure [113270845 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the ignition control contactor relay **K-103**. When the ECU **A-001** senses a voltage above normal on the ignition control contactor relay **K-103** low side circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the ignition control contactor relay **K-103** low side circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty ignition control contactor relay **K-103**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the ignition control contactor relay **K-103**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the ignition control contactor relay **K-103** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from ignition control contactor relay **K-103** at connector **X-101**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 72** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 55** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, there is a short to power in the connector harness (between **X-EC2** and **X-101** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

3. Check the ignition control contactor relay **K-103** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 72** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 55** | All other pins on **X-EC2** | There should be no continuity |
| **X-101 (Power Distribution) pin 3** | All other pins on **X-101** | There should be no continuity |
| **X-101 (Power Distribution) pin 7** | All other pins on **X-101** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the check, there is a short to power in the connector harness (between **X-EC2** and **X-101** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. As there is no method for field testing, replace the ignition control contactor relay **K-103**, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3262 (F-1321-04) - Starter Relay Low Side Driver Circuit Short to Ground Failure [113270838 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the ignition control contactor relay **K-103**. When the ECU **A-001** senses a voltage below normal on the ignition control contactor relay **K-103** low side circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the ignition control contactor relay **K-103** low side circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty ignition control contactor relay **K-103**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the ignition control contactor relay **K-103**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ignition control contactor relay **K-103** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from ignition control contactor relay **K-103** at connector **X-101**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 72** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 55** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 72** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 55** | All other pins on **X-EC2** | There should be no continuity |
| **X-101 (Power Distribution) pin 3** | All other pins on **X-101** | There should be no continuity |
| **X-101 (Power Distribution) pin 7** | All other pins on **X-101** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **3**.

   B. If there is continuity on any of the check, there is a short to ground in the connector harness (between **X-EC2** and **X-101** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.
3. As there is no method for field testing, replace the ignition control contactor relay **K-103**, then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3283 (F-3510-12) - ECU 5 Volt Sensor Supply 2 Out of Range Failure [113270449 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides six independent **5 V** supplies for the sensors. These voltages are monitored by hardware within the ECU **A-001** to make sure they are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses a sensor supply 2 reference voltage is out of range, this fault will occur.

**Cause:**
The ECU **A-001** has detected a sensor supply 2 reference voltage is out of range.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Cycle the power or reset the ECU **A-001** then recheck the status of this fault.
   A. Fault is active. Continue with Step **2**.
   B. Fault is not active. Return the machine to normal operation.
2. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **3**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3285 (F-3511-12) - ECU 5 Volt Sensor Supply 3 Out of Range Failure [113270451 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides the **5 V** supplies to the sensors. These voltages are monitored by hardware within the ECU **A-001** to ensure the voltages are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses a sensor supply 3 reference voltage is out of range, this fault will occur.

**Cause:**
The ECU **A-001** has detected the sensor supply 3 reference voltage is out of range.

**Possible failure modes:**

1. Faulty wiring or connections, short circuit.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty pressure sensor on the rail **B-9004**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, the pressure sensor on the rail **B-9004**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the overpressure air temperature and pressure sensor **B-9001** supply circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **3**.

   B. If there is voltage, continue with Step **4**.
3. Check the overpressure air temperature and pressure sensor **B-9001** supply circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 38** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **4**.
4. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 17** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **5**.

B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 17** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 17** | All other pins on **X-9138B** | There should be no continuity |
| **X-9003 pin 3** | All other pins on **X-9003** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the check, there is a short circuit in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the pressure sensor on the rail **B-9004** supply circuit for a short to power.

Disconnect the harness from the pressure sensor on the rail **B-9004** at connector **X-9026**.

With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **7**.

B. If there is voltage, continue with Step **8**.

7. Check the pressure sensor on the rail **B-9004** supply circuit for a short circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 62** | All other pins on **X-EC1** | There should be no continuity |

A. If there is no continuity on both checks, continue with Step **10**.

B. If there is continuity on either check, continue with Step **8**.

8. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **9**.

B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

9. Locate the circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 6** | All other pins on **X-9138B** | There should be no continuity |
| **X-9026 (Receptacle) pin 2** | All other pins on **X-9026** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

10. Replace the overpressure air temperature and pressure sensor **B-9001** and then recheck the status of this fault.

    A. Fault is active. Continue with Step **11**.

    B. Fault is not active. Return the machine to normal operation.

11. Replace the pressure sensor on the rail **B-9004** and then recheck the status of this fault.

    A. Fault is active. Continue with Step **12**.

    B. Fault is not active. Return the machine to normal operation.

12. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3293 (F-519744-18) - Fuel Rail Pressure has Exceeded Maximum Positive Deviation Limits [113270435 - V3 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-F02** monitors the fuel pressure control. Fuel pressure is controlled by the solenoid valve for fuel pressure regulation. When the ECU **A-F02** senses a rail pressure is lower than the expected value for the engine speed based on the threshold value, this indicates that fuel pressure in the rail has exceeded the maximum positive deviation limits, this fault will occur.

**Cause:**
The ECU **A-F02** has detected that the measured rail pressure is lower than the commanded pressure according to engine speed dependant threshold.

**Possible failure modes:**

1. Fault in the low pressure system, clogging.
2. Fault in the fuel filter controlled by the relay **K-F230**.
3. Fault in the pipes.
4. Fault in the high pressure valve.
5. Fault in the injector seal.
6. Faulty solenoid valve for fuel pressure regulation **Y-F07**, internal failure.
7. Faulty ECU **A-F02**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-F02** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check that the low pressure system (and the fuel filter controlled by the fuel filter heating contactor **K-F230**) are not clogged.
   A. If the system is not clogged. Continue with Step **3**.
   B. If the system is clogged, Bleed the system.
3. Check that the pipes between the pre-supply and the solenoid valve for fuel pressure regulation **Y-F07** do not show any sign of malfunctions.
   A. If no malfunctions are present. Continue with Step **4**.
   B. If any malfunctions are present, repair or replace as required.
4. Check the supply (this may be low due to clogging of the pipes ate the tank outlet) of the pre-supply pump.
   A. If the supply is not too low. Continue with Step **5**.
   B. If the supply is too low, repair or replace as required.
5. Check the high pressure system to check for leaks.
   A. If the system does not have any leaks. Continue with Step **6**.
   B. If the system has leaks, repair or replace as required.

6. Check the correct operation of the high pressure pump.
   A. If the pump is working correctly. Continue with Step **7**.
   B. If the pump is not working correctly, repair or replace the high pressure pump.
7. Check none of the injectors are tightened more than normal.
   A. If one or more of the injectors are not too tight, continue with Step **8**.
   B. If one or more of the injectors are too tight, repair or replace one or more injectors.
8. Replace the solenoid valve for fuel pressure regulation **Y-F07**, reconnect the harness, then recheck the status of this fault.
   A. Fault is active. Continue with Step **9**.
   B. Fault is not active. Return the machine to normal operation.
9. Check the ECU **A-F02** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-F02**.

# 3301 (F-519744-15) - Fuel Rail Pressure has Exceeded Maximum Negative Deviation Limits [113270439 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the solenoid valve for fuel pressure regulation **Y-9000** to control the machine's operations. The monitoring is active when the fuel tank is not empty and the engine speed is greater than **5500 RPM**, the desired fuel flow of the solenoid valve for fuel pressure regulation **Y-9000**. When the ECU **A-001** senses the actual fuel pressure has exceeded the desired fuel pressure with the solenoid valve for fuel pressure regulation **Y-9000** fully closed based on an engine speed dependent curve, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the actual fuel pressure has exceeded the desired fuel pressure by an engine speed dependent curve with the solenoid valve for fuel pressure regulation **Y-9000** commanded closed.

**Possible failure modes:**

1. Faulty gear pump pressure.
2. Faulty low pressure fuel lines from high pressure pump to tank, clogged or damaged.
3. Faulty solenoid valve for fuel pressure regulation **Y-9000**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the solenoid valve for fuel pressure regulation **Y-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the solenoid valve for fuel pressure regulation **Y-9000**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the low pressure fuel lines from high pressure pump to the tank for damage or clogging. Also check for proper gear pump pressure.

   A. If the lines are free of damage and clogging and the gear pump pressure is within the specified range, continue with Step **4**.

   B. If the lines show damage or signs of clogging, there may be blockage that is not allowing excess fuel to be returned to the fuel tank. If gear pump pressure is excessive, a fuel rail pressure maximum negative deviation condition may be present. Repair the fuel system as necessary.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3305 (F-519745-17) - Fuel Rail Pressure has Dropped Below the Minimum Limit [113270441 - V4 - 30 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** to control the engine operations. When the ECU **A-001** senses that the fuel pressure is less than **280 bar** (**4060 psi**) on the pressure sensor on the rail **B-9004** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the minimal desired fuel pressure is not reached.

**Possible failure modes:**

1. Faulty injectors, internal leakage or stuck open.
2. Faulty high pressure pump.
3. Fault in the fuel filter, clogged.
4. Faulty Pressure Relief Valve (PRV), leaking or stuck open.
5. Faulty electronic suction pump (if present).
6. Faulty gear pump pressure too low.
7. Faulty pressure sensor on the rail **B-9004**, internal failure.
8. Faulty solenoid valve for fuel pressure regulation **Y-9000**, internal failure.
9. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the solenoid valve for fuel pressure regulation **Y-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the solenoid valve for fuel pressure regulation **Y-9000**.

   Then recheck the status of this fault.

   A. Fault is active. Continue to Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Replace the solenoid valve for fuel pressure regulation **Y-9000**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3309 (F-1442-00) - Fuel Rail Pressure has Exceeded Maximum Limit [113270825 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** and the duty cycle of the solenoid valve for fuel pressure regulation **Y-9000** to control the fuel supply operations. When the ECU **A-001** senses that the fuel pressure is greater than **1700 bar** (**24650 psi**) for a period greater than **1 s**, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the fuel rail pressure has exceeded the maximum limit.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty fuel return line, damaged or clogged.
3. Faulty solenoid valve for fuel pressure regulation **Y-9000**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the solenoid valve for fuel pressure regulation **Y-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the solenoid valve for fuel pressure regulation **Y-9000**.

   Then recheck the status of this fault.

   A. Fault is active. Continue to Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Inspect the high pressure pump fuel return line for damage or blockage.

   A. If there is no damage or blockage, continue to Step **4**.

   B. If there is any damage or blockage, repair or replace the fuel line as required.
4. Replace the solenoid valve for fuel pressure regulation **Y-9000**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3334 (518495-09) - CAN communication failure between vehicle controller and ECU controller - TSC1_PE message [108520210 - V4 - 19 April 2021]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** can connect and ensure communication between two distinct CAN (Controller Area Network) networks. The correct configuration and monitoring of the two networks configured with pairs of twisted wires is also a function of the ECU **A-001**. Node 1 of the CAN BUS is the main vehicle interface bus. The ECU **A-001** supplies a CAN termination resistor for node 1 of the CAN BUS inside the ECU **A-001**. The ECU **A-001** receives the CAN message TSC1PE containing the information regarding torque/speed requested by the power take-off. If the ECU **A-001** detects a timeout error for message TSC1PE and the fault condition occurs continuously for more than **10 ms**, this error occurs.

**Cause:**
The ECU **A-001** has detected a timeout error of message TSC1PE for more than **10 ms**.

**Possible failure modes:**

1. Fault in the vehicle system, associated CAN faulty.
2. Fault in the power supply voltage or ground, missing.
3. Faulty CAN circuit wiring, open circuit, short circuit, short circuit to ground, or short circuit towards a high voltage source.
4. Fault in the power take-off.
5. Faulty ECU **A-001**, software.

**Solution:**

1. Verify that the fault code is present and active.

   Use the diagnostic tool to check the status of this fault.

   A. If the fault is present and active, go to step **2**.

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Go to step **10**.
2. Check for other vehicle CAN faults.

   Use the diagnostic instrument to determine if CAN network faults exist related to the vehicle.

   A. If other vehicle CAN faults do exist, resolve the vehicle CAN faults, then check to see that this fault is also resolved.

   B. If other vehicle CAN faults do not exist, go to **3**.
3. Check the power supply voltage of the ECU **A-001**.

   Disconnect the vehicle wiring from the ECU **A-001** at connector **X-EC2**.

   With the key switch in the ON position, use a multimeter to check for voltage on the wiring harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 1** | chassis ground | There should be a voltage of **12.0 V**. |
| **X-EC2 (Receptacle) pin 3** | chassis ground | There should be a voltage of **12.0 V**. |
| **X-EC2 (Receptacle) pin 5** | chassis ground | There should be a voltage of **12.0 V**. |

   A. If there is no voltage in one or more checks, Identify and restore power supply to ECU **A-001**.

B. If voltage is present in all the checks, go to **4**.

4. Check the ECU **A-001** grounding.

   Disconnect the vehicle wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch set to OFF, use a multimeter to check for continuity on the vehicle wiring harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 2** | Frame ground | There should be continuity. |
| **X-EC2 (Receptacle) pin 4** | Frame ground | There should be continuity. |
| **X-EC2 (Receptacle) pin 6** | Frame ground | There should be continuity. |

   A. If no continuity is detected in one or more checks, identify and restore the ground circuit to the ECU **A-001**.

   B. If continuity is detected on all of the checks, go to **5**.

5. Check the terminating resistor inside the ECU **A-001**.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch in the OFF position, use a multimeter to perform the following resistance check on the component side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | **X-EC2 (Receptacle) pin 14** | The resistance should be **120 Ω**. |

   A. If the measured resistance is incorrect, there is a fault inside the ECU **A-001**. Check the ECU **A-001** for the appropriate software and update if necessary.

   B. If the measured resistance is correct, go to step **6**.

6. Check the CAN circuit of the ECU **A-001** for a short circuit towards a high voltage source.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the key switch in the ON position, use a multimeter to check for voltage on the engine wiring harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | Frame ground | There should be **0 V** voltage. |
| **X-EC2 (Receptacle) pin 14** | Frame ground | There should be **0 V** voltage. |

   A. If the value is greater than **0 V**, there is a short circuit towards a high voltage source in the CAN circuit of the ECU **A-001**.Locate and repair the shorted conductor.

   B. In the absence of voltage, go to step **7**.

7. Check the CAN circuit of the ECU **A-001** to check for a short circuit to ground.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch in the OFF position, use a multimeter to check for continuity of the engine wiring side phase:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | Frame ground | There should be no continuity. |
| **X-EC2 (Receptacle) pin 14** | Frame ground | There should be no continuity. |
| **X-EC2 (Receptacle) pin 13** | **X-EC2** all other pins | There should be no continuity. |
| **X-EC2 (Receptacle) pin 14** | **X-EC2** all other pins | There should be no continuity. |

   A. If there is continuity, there is a short circuit to ground in the CAN circuit of the ECU **A-001**.Locate and repair the shorted conductor.

   B. If no continuity is detected, go to step **9**.

8. Check the ECU CAN circuit **A-001** for an open circuit condition.

Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

Disconnect the wiring from the PTO.

With the ignition switch set to “ON”, use a multimeter to perform the following continuity check:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | Vehicle CAN H | There should be continuity |
| **X-EC2 (Receptacle) pin 14** | Vehicle CAN L | There should be continuity |

A. If there is no continuity, there is an interruption in the CAN circuit of the ECU **A-001**.Locate and repair the broken conductor.

B. If continuity is detected, go to **9**

9. Check the correct operation of the PTO.

   A. If it is not working correctly, replace it and return the vehicle to service.

   B. If it is working correctly, check the ECU **A-001** for the appropriate software and update if necessary.

10. Visually check the wiring and main connectors looking for any faults, bent or incorrectly positioned pins, corroded terminals, or broken wires. Make sure that the connectors are fully mounted. Bend the involved wiring to check for any intermittent faults or short circuits in the involved cables. Operate the machine and observe the display.

    A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

    B. If there is no damage and the display indicates normal values, delete the fault code.

# 3334 (518496-09) - CAN communication failure between vehicle controller and ECU controller - TSC1_PE message [110422791 - V4 - 19 October 2022]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** can connect and ensure communication between two distinct CAN networks. The correct configuration and monitoring of the two networks configured with pairs of twisted wires is also a function of the ECU **A-001**. Node 1 of the CAN BUS is the main vehicle interface bus. The ECU **A-001** supplies a CAN termination resistor for node 1 of the CAN BUS inside the ECU control unit **A-001**. The ECU **A-001** receives the TSC1PE CAN message providing information regarding torque/speed from the PTO. If the ECU **A-001** detects a timeout error of the TSC1PE message, and the defect condition fulfills for more than **20 ms**, this fault occurs. Monitoring is active if the ECU **A-001** initialized since at least **6.00 s** while engine isn't running yet, while engine is not in cranking mode, **6.00 s** after startup if engine is running, if battery voltage is higher than **10.00 V** since at least **2.00 s**, while none of the CAN controllers is in bus-off state, while none of the CAN controllers is in bus-off state since at least **6.00 s**, if ECU **A-001** is not in afterrun and if terminal 15 is ON.

**Cause:**
The ECU **A-001** has detected a TSC1PE message timeout error.

**Possible failure modes:**

1. Fault in the vehicle system, associated CAN faulty.
2. Fault in the power supply voltage or ground, missing.
3. Faulty CAN circuit wiring, open circuit, short circuit, short circuit to ground, or short circuit towards a high voltage source.
4. Fault in the power take-off.
5. Faulty ECU **A-001**, software.

**Solution:**

1. Verify that the fault code is present and active.

   Use the diagnostic tool to check the status of this fault.

   A. If the fault is present and active, go to step **2**.

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Go to step **10**.
2. Check for other vehicle CAN faults.

   Use the diagnostic instrument to determine if CAN network faults exist related to the vehicle.

   A. If other vehicle CAN faults do exist, resolve the vehicle CAN faults, then check to see that this fault is also resolved.

   B. If other vehicle CAN faults do not exist, go to **3**.
3. Check the power supply voltage of the ECU **A-001**.

   Disconnect the vehicle wiring from the ECU **A-001** at connector **X-EC2**.

   With the key switch in the ON position, use a multimeter to check for voltage on the wiring harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 1** | chassis ground | There should be a voltage of **12.0 V**. |
| **X-EC2 (Receptacle) pin 3** | chassis ground | There should be a voltage of **12.0 V**. |
| **X-EC2 (Receptacle) pin 5** | chassis ground | There should be a voltage of **12.0 V**. |

A. If there is no voltage in one or more checks, Identify and restore power supply to ECU **A-001**.

B. If voltage is present in all the checks, go to **4**.

4. Check the ECU **A-001** grounding.

   Disconnect the vehicle wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch set to OFF, use a multimeter to check for continuity on the vehicle wiring harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 2** | Frame ground | There should be continuity. |
| **X-EC2 (Receptacle) pin 4** | Frame ground | There should be continuity. |
| **X-EC2 (Receptacle) pin 6** | Frame ground | There should be continuity. |

   A. If no continuity is detected in one or more checks, identify and restore the ground circuit to the ECU **A-001**.

   B. If continuity is detected on all of the checks, go to **5**.

5. Check the terminating resistor inside the ECU **A-001**.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch in the OFF position, use a multimeter to perform the following resistance check on the component side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | **X-EC2 (Receptacle) pin 14** | The resistance should be **120 Ω**. |

   A. If the measured resistance is incorrect, there is a fault inside the ECU **A-001**. Check the ECU **A-001** for the appropriate software and update if necessary.

   B. If the measured resistance is correct, go to step **6**.

6. Check the CAN circuit of the ECU **A-001** for a short circuit towards a high voltage source.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the key switch in the ON position, use a multimeter to check for voltage on the engine wiring harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | Frame ground | There should be **0 V** voltage. |
| **X-EC2 (Receptacle) pin 14** | Frame ground | There should be **0 V** voltage. |

   A. If the value is greater than **0 V**, there is a short circuit towards a high voltage source in the CAN circuit of the ECU **A-001**.Locate and repair the shorted conductor.

   B. In the absence of voltage, go to step **7**.

7. Check the CAN circuit of the ECU **A-001** to check for a short circuit to ground.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch in the OFF position, use a multimeter to check for continuity of the engine wiring side phase:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | Frame ground | There should be no continuity. |
| **X-EC2 (Receptacle) pin 14** | Frame ground | There should be no continuity. |
| **X-EC2 (Receptacle) pin 13** | **X-EC2** all other pins | There should be no continuity. |
| **X-EC2 (Receptacle) pin 14** | **X-EC2** all other pins | There should be no continuity. |

   A. If there is continuity, there is a short circuit to ground in the CAN circuit of the ECU **A-001**.Locate and repair the shorted conductor.

   B. If no continuity is detected, go to step **9**.

8. Check the ECU CAN circuit **A-001** for an open circuit condition.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   Disconnect the wiring from the PTO.

   With the ignition switch set to “ON”, use a multimeter to perform the following continuity check:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | Vehicle CAN H | There should be continuity |
| **X-EC2 (Receptacle) pin 14** | Vehicle CAN L | There should be continuity |

   A. If there is no continuity, there is an interruption in the CAN circuit of the ECU **A-001**.Locate and repair the broken conductor.

   B. If continuity is detected, go to **9**

9. Check the correct operation of the PTO.

   A. If it is not working correctly, replace it and return the vehicle to service.

   B. If it is working correctly, check the ECU **A-001** for the appropriate software and update if necessary.

10. Visually check the wiring and main connectors looking for any faults, bent or incorrectly positioned pins, corroded terminals, or broken wires. Make sure that the connectors are fully mounted. Bend the involved wiring to check for any intermittent faults or short circuits in the involved cables. Operate the machine and observe the display.

    A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

    B. If there is no damage and the display indicates normal values, delete the fault code.

# 3338 (518256-09) - CAN communication failure between vehicle controller and ECU controller - TSC1_VE message [108520213 - V4 - 19 April 2021]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001**can connect and ensure communication between two distinct CAN networks. The correct configuration and monitoring of the two networks configured with pairs of twisted wires is also a function of the ECU **A-001**. Node 1 of the CAN BUS is the main vehicle interface bus. The ECU **A-001** supplies a CAN termination resistor for node 1 of the CAN BUS inside the ECU control unit **A-001**. The ECU **A-001** receives the TSC1VE CAN message containing the information regarding the torque/speed request from the vehicle control unit.

**Cause:**
The ECU **A-001** has sensed a TSC1VE message timeout.

**Possible failure modes:**

1. fault in the vehicle system, associated CAN faulty.
2. fault in the power supply voltage or ground, missing.
3. Faulty CAN circuit wiring, open circuit, short circuit, short circuit to ground, or short circuit towards a high voltage source.
4. Faulty ECU **A-001**, software.

**Solution:**

1. Verify that the fault code is present and active.

   Use the diagnostic tool to check the status of this fault.

   A. If the fault is present and active, go to step **2**.

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Go to step **10**.
2. Check for other vehicle CAN faults.

   Use the diagnostic instrument to determine if CAN network faults exist related to the vehicle.

   A. If other vehicle CAN faults do exist, resolve the vehicle CAN faults, then check to see that this fault is also resolved.

   B. If other vehicle CAN faults do not exist, go to **3**.
3. Check the power supply voltage of the ECU **A-001**.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch in the OFF position, use a multimeter to check the voltage on the engine wiring side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 1** | chassis ground | It must be **12.0 V**. |
| **X-EC2 (Receptacle) pin 3** | chassis ground | It must be **12.0 V**. |
| **X-EC2 (Receptacle) pin 5** | chassis ground | It must be **12.0 V**. |

   A. If there is no voltage in one or more checks, Identify and restore power supply to ECU **A-001**.

   B. If voltage is present in all the checks, go to **4**.
4. Check the ECU **A-001** grounding.

Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

With the ignition switch in the OFF position, use a multimeter to check for continuity of the engine wiring side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 2** | Chassis ground | There should be continuity. |
| **X-EC2 (Receptacle) pin 4** | Chassis ground | There should be continuity. |
| **X-EC2 (Receptacle) pin 6** | Chassis ground | There should be continuity. |

A. If no continuity is detected in one or more checks, identify and restore the ground circuit to the ECU **A-001**.

B. If continuity is detected on all of the checks, go to **5**.

5. Check the terminating resistor inside the ECU **A-001**.

Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

With the ignition switch in the OFF position, use a multimeter to perform the following resistance check on the component side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | **X-EC2 (Receptacle) pin 14** | There should be **120 Ω**. |

A. If the measured resistance is incorrect, there is a fault inside the ECU **A-001**. Check the ECU **A-001** for the appropriate software and update if necessary.

B. If the measured resistance is correct, go to step **6**.

6. Check the CAN circuit of the ECU **A-001** for a short circuit towards a high voltage source.

Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

With the key switch in the ON position, use a multimeter to check for voltage on the engine wiring harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | Frame ground | There should be **0 V** voltage. |
| **X-EC2 (Receptacle) pin 14** | Frame ground | There should be **0 V** voltage. |

A. If the value is greater than **0 V**, there is a short circuit towards a high voltage source in the CAN circuit of the ECU **A-001**.Locate and repair the shorted conductor.

B. In the absence of voltage, go to step **7**.

7. Check the CAN circuit of the ECU **A-001** to check for a short circuit to ground.

Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

With the ignition switch in the OFF position, use a multimeter to check for continuity of the engine wiring side phase:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | Frame ground | There should be no continuity. |
| **X-EC2 (Receptacle) pin 14** | Frame ground | There should be no continuity. |
| **X-EC2 (Receptacle) pin 13** | **X-EC2** all other pins | There should be no continuity. |
| **X-EC2 (Receptacle) pin 14** | **X-EC2** all other pins | There should be no continuity. |

A. If there is continuity, there is a short circuit to ground in the CAN circuit of the ECU **A-001**.Locate and repair the shorted conductor.

B. If no continuity is detected, go to step **8**.

8. Check the CAN circuit of the ECU **A-001** for an open circuit.

Disconnect the wiring harness from the ECU **A-001** at connector **X-EC2**.

With the ignition switch in the OFF position, use a multimeter to check the continuity:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | To the pin of CAN H of chassis control module control unit | There should be continuity. |
| **X-EC2 (Receptacle) pin 14** | To the pin of CAN L of chassis control module control unit | There should be continuity. |

A. If there is no continuity, there is an open circuit on the CAN network of the ECU **A-001**. Locate and repair the broken conductor.

B. If continuity is detected, check the ECU **A-001** for the appropriate software and update if necessary.

9. Visually check the wiring and main connectors looking for any faults, bent or incorrectly positioned pins, corroded terminals, or broken wires. Make sure that the connectors are fully mounted. Bend the involved wiring to check for any intermittent faults or short circuits in the involved cables. Operate the machine and observe the display.

   A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

   B. If there is no damage and the display indicates normal values, delete the fault code.

# 3338 (518257-09) - CAN communication failure between vehicle controller and ECU controller - TSC1_VE message [110422949 - V4 - 19 October 2022]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** can connect and ensure communication between two distinct CAN networks. The correct configuration and monitoring of the two networks configured with pairs of twisted wires is also a function of the ECU **A-001**. Node 1 of the CAN BUS is the main vehicle interface bus. The ECU **A-001** supplies a CAN termination resistor for node 1 of the CAN BUS inside the ECU control unit **A-001**. The ECU **A-001** receives the TSC1VE CAN message containing the information regarding the torque/speed request from the vehicle control unit. If the ECU **A-001** detects a timeout error for the TSC1VE message, and the defect condition fulfills for more than **20 ms**, this fault occurs. Monitoring is active if the ECU **A-001** initialized since at least **6.00 s** while engine isn't running yet, while engine is not in cranking mode, **6.00 s** after startup if engine is running, if battery voltage is higher than **10.00 V** since at least **2.00 s**, while none of the CAN controllers is in bus-off state, while none of the CAN controllers is in bus-off state since at least **6.00 s**, if ECU **A-001** is not in afterrun and if terminal 15 is ON.

**Cause:**
The ECU **A-001** has sensed a TSC1VE message timeout.

**Possible failure modes:**

1. fault in the vehicle system, associated CAN faulty.
2. fault in the power supply voltage or ground, missing.
3. Faulty CAN circuit wiring, open circuit, short circuit, short circuit to ground, or short circuit towards a high voltage source.
4. Faulty ECU **A-001**, software.

**Solution:**

1. Verify that the fault code is present and active.

   Use the diagnostic tool to check the status of this fault.

   A. If the fault is present and active, go to step **2**.

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Go to **10**.
2. Check for other vehicle CAN faults.

   Use the diagnostic instrument to determine if CAN network faults exist related to the vehicle.

   A. If other vehicle CAN faults do exist, resolve the vehicle CAN faults, then check to see that this fault is also resolved.

   B. If other vehicle CAN faults do not exist, go to **3**.
3. Check the power supply voltage of the ECU **A-001**.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch in the OFF position, use a multimeter to check the voltage on the engine wiring side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 1** | chassis ground | It must be **12.0 V**. |
| **X-EC2 (Receptacle) pin 3** | chassis ground | It must be **12.0 V**. |
| **X-EC2 (Receptacle) pin 5** | chassis ground | It must be **12.0 V**. |

A. If there is no voltage in one or more checks, Identify and restore power supply to ECU **A-001**.

B. If voltage is present in all the checks, go to **4**.

4. Check the ECU **A-001** grounding.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch in the OFF position, use a multimeter to check for continuity of the engine wiring side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 2** | Chassis ground | There should be continuity. |
| **X-EC2 (Receptacle) pin 4** | Chassis ground | There should be continuity. |
| **X-EC2 (Receptacle) pin 6** | Chassis ground | There should be continuity. |

   A. If no continuity is detected in one or more checks, identify and restore the ground circuit to the ECU **A-001**.

   B. If continuity is detected on all of the checks, go to **5**.

5. Check the terminating resistor inside the ECU **A-001**.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch in the OFF position, use a multimeter to perform the following resistance check on the component side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | **X-EC2 (Receptacle) pin 14** | There should be **120 Ω**. |

   A. If the measured resistance is incorrect, there is a fault inside the ECU **A-001**. Check the ECU **A-001** for the appropriate software and update if necessary.

   B. If the measured resistance is correct, go to step **6**.

6. Check the CAN circuit of the ECU **A-001** for a short circuit towards a high voltage source.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the key switch in the ON position, use a multimeter to check for voltage on the engine wiring harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | Frame ground | There should be **0 V** voltage. |
| **X-EC2 (Receptacle) pin 14** | Frame ground | There should be **0 V** voltage. |

   A. If the value is greater than **0 V**, there is a short circuit towards a high voltage source in the CAN circuit of the ECU **A-001**.Locate and repair the shorted conductor.

   B. In the absence of voltage, go to step **7**.

7. Check the CAN circuit of the ECU **A-001** to check for a short circuit to ground.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch in the OFF position, use a multimeter to check for continuity of the engine wiring side phase 5 (S5):

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | Frame ground | There should be no continuity. |
| **X-EC2 (Receptacle) pin 14** | Frame ground | There should be no continuity. |
| **X-EC2 (Receptacle) pin 13** | **X-EC2** all other pins | There should be no continuity. |
| **X-EC2 (Receptacle) pin 14** | **X-EC2** all other pins | There should be no continuity. |

   A. If there is continuity, there is a short circuit to ground in the CAN circuit of the ECU **A-001**.Locate and repair the shorted conductor.

   B. If no continuity is detected, go to step **8**.

8. Check the CAN circuit of the ECU **A-001** for a short circuit.

   Disconnect the engine wiring from the ECU **A-001** at connector **X-EC2**.

   With the ignition switch in the OFF position, use a multimeter to check for continuity of the engine wiring side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 13** | **X-EC2 (Receptacle) pin 14** | There should be no continuity. |
| **X-EC2 (Receptacle) pin 13** | **X-EC2** all other pins | There should be no continuity. |
| **X-EC2 (Receptacle) pin 14** | **X-EC2** all other pins | There should be no continuity. |

   A. If there is continuity, there is a short circuit condition in the CAN circuit of the ECU **A-001**.Locate and repair the shorted conductor.

   B. If no continuity is detected, check the ECU **A-001** for the appropriate software and update if necessary.

9. Visually check the wiring and main connectors looking for any faults, bent or incorrectly positioned pins, corroded terminals, or broken wires. Make sure that the connectors are fully mounted. Bend the involved wiring to check for any intermittent faults or short circuits in the involved cables. Operate the machine and observe the display.

   A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

   B. If there is no damage and the display indicates normal values, delete the fault code.

# 3363 (F-3555-02) - ECU Internal Failure - Ambient Air Pressure Failure [113270773 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** analyses the measured signal of the ambient air pressure sensor for implausible values by means of diverse criteria. In fault cases the signals will be set invalid and a defect is reported. The measured pressure is checked for plausibility. The ambient pressure sensor is located inside ECU **A-001**. When the ECU **A-001** senses an internal ambient pressure sensor reports an implausible status consistently for a set time, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3367 (110-02) - Engine Coolant Temeprature Absolute Plausibility Test Error Detected [113334021 - V4 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the engine coolant temperature sensor **B-9003**. The engine coolant temperature sensor **B-9003** shares the coolant temperature signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses that the engine coolant temperature sensor **B-9003** value is out of range, this fault will occur.

**Cause:**
The ECU **A-001** has detected a non plausible engine coolant temperature sensor **B-9003** operating range value.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty wiring or connections, short or open circuit.
3. Faulty engine coolant temperature sensor **B-9003**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the engine coolant temperature sensor **B-9003**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active.

   Resolve them first, then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the engine coolant temperature sensor **B-9003** for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the engine coolant temperature sensor **B-9003** at connector **X-9006**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 99** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 100** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **4**.

   B. If there is voltage on either check, continue with Step **5**.
4. Check the engine coolant temperature sensor **B-9003** for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 99** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 100** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 99** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 100** | All other pins on **X-EC1** | There should be no continuity |

A. If there is no continuity on all the checks, continue with Step **7**.

B. If there is continuity on any of the checks, continue with Step **5**.

5. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 13** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 14** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **6**.

   B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9006** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

6. Locate the circuit for a short circuit.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 13** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 14** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 13** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 14** | All other pins on **X-9138B** | There should be no continuity |
| **X-9006** | All other pins on **X-9006** | There should be no continuity |
| **X-9006** | All other pins on **X-9006** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9138B** and **X-9006** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

7. Check the engine coolant temperature sensor **B-9003** signal circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 99** | **X-9006** | There should be continuity |
| **X-EC1 (Receptacle) pin 100** | **X-9006** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **9**.

   B. If there is no continuity on either check, continue with Step **8**.

8. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 99** | **X-470 (Receptacle) pin 13** | There should be continuity |
| **X-EC1 (Receptacle) pin 100** | **X-470 (Receptacle) pin 14** | There should be continuity |

A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9006** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

9. Replace the engine coolant temperature sensor **B-9003**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **10**.

   B. Fault is not active. Return the machine to normal operation.

10. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3370 (F-519845-31) - Strong Torque Limitation from Engine Protection Active [113270567 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The engine is protected against too high temperature in the air intake gas, against too high temperature of the coolant, against too high temperature of the oil, and against too high temperature of the fuel, by means of a torque reduction. If one of the temperature values exceeds the limit set by the dedicated parameters programmed in the engine control unit (ECU) **A-001**. If the power reduction exceeds the set value, a fault is saved as a confirmation that a performance limitation has been activated. This is not caused by a faulty component or system, but by extreme operating conditions. This fault is a confirmation of the temporary power limitation. This fault requires no corrective actions except for checking the presence of other faults relating to the engine speed / engine protection that could be present in the relevant memory. If only this fault has been generated, no corrective actions are required. If the power reduction has been caused by an effective fault, also the fault that activated the torque limitation must be present in the fault memory. Follow the troubleshooting procedure for the actual fault.

# 3371 (F-519846-31) - Strong Torque Limitation from Injection System Active [113270569 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
This fault has been generated following performance limitation to protect the high-pressure fuel pump from high temperatures. This fault is stored when a power reduction occurs. It is not caused by a component or system fault. This fault code is generated for information purposes only and does not require any further action. If there are other fault codes present which could affect high-pressure fuel pump temperatures, these faults may indicate an actual fault. Follow the troubleshooting procedure for the other fault.

# 3409 (100-01) - Engine Oil Pressure Too Low [113270856 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the engine oil pressure value for plausibility. The oil pressure signal is acquired from the connected oil pressure sensor. When the engine is running, the pressure must be higher than a defined minimum value, detected by the low engine oil level alarm switch **S-9016**. When the ECU **A-001** senses that there is no oil pressure signal or the digital oil pressure switch is not active, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the engine oil pressure is low or the low engine oil level alarm switch **S-9016** is blocked.

**Possible failure modes:**

1. Faulty oil level, too low.
2. Faulty low engine oil level alarm switch **S-9016**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the low engine oil level alarm switch **S-9016**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the engine oil level and top up if necessary.

   Check the oil quality for any contamination or sludge and oil paths for blockage.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Replace the low engine oil level alarm switch **S-9016** then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3449 (F-518144-14) - ECU Internal Failure - Calculated Engine Speed [113270423 - V4 - 23 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the engine speed in 3 levels. A redundant check for engine speed is performed for function monitoring at software level 2. Level 1 is the functions level (engine control, component monitoring), Level 2 is the function monitoring level (detects the faulty processes of the level 1 functions), and Level 3 is the controller monitoring level (check corrects processing of ECU **A-001** program commands). When the ECU **A-001** senses that the difference between the calculated engine speed from Level 1 and engine speed from Level 2 is greater than the threshold of **400 RPM** or there is a debounce signal error, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3457 (F-105-03) - Intake Manifold Temperature Sensor Voltage is Higher than Expected [113270827 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the overpressure air temperature and pressure sensor **B-9001**. The overpressure air temperature and pressure sensor **B-9001** shares the intake manifold air temperature signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage greater than **4.93 V** for more than **500 ms** on the overpressure air temperature and pressure sensor **B-9001** temperature signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the overpressure air temperature and pressure sensor **B-9001** temperature signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the overpressure air temperature and pressure sensor **B-9001** supply circuit.

   Using a multimeter back probe the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9003 pin 3** | Chassis ground | There should be approximately **5 V** |

   A. If there is approximately **5 V**, continue with Step **3**.

   B. If there is not approximately **5 V**, check the circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the connectors, recheck the voltage, then return the machine to normal operation.

3. Check the overpressure air temperature and pressure sensor **B-9001** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 96** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **4**.

B. If there is voltage, continue with Step **5**.

4. Check the overpressure air temperature and pressure sensor **B-9001** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 96** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity, continue with Step **7**.

   B. If there is continuity, continue with Step **5**.

5. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 18** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **6**.

   B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

6. Locate the circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 18** | All other pins on **X-9138B** | There should be no continuity |
| **X-9003 pin 4** | All other pins on **X-9003** | There should be no continuity |

   A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

7. Check the overpressure air temperature and pressure sensor **B-9001** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | **X-9003 pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 95** | **X-9003 pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 96** | **X-9003 pin 4** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **9**.

   B. If there is no continuity on any of the checks, continue with Step **8**.

8. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | **X-470 (Receptacle) pin 17** | There should be continuity |
| **X-EC1 (Receptacle) pin 95** | **X-470 (Receptacle) pin 19** | There should be continuity |

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 96** | **X-470 (Receptacle) pin 18** | There should be continuity |

A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

9. Replace the overpressure air temperature and pressure sensor **B-9001**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **10**.

   B. Fault is not active. Return the machine to normal operation.

10. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3501 (F-152-14) - ECU Internal Failure – Software Resets in DSM 0 [113270791 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the presence of possible errors in the software inside the ECU **A-001**. When the ECU **A-001** senses an error in the software, the software undergoes a complete reset and this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure that has lead to a software reset.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3502 (518148-31) - Visibility of Software Resets in DSM1 [113270793 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors for a possible error to the ECU **A-001** internal software. When the ECU **A-001** senses a software failure, a software reset will be performed and this fault will occur. During a software reset, all instrument panel lights could flash (power on test) and the instruments could shortly read zero.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3503 (152-02) - ECU Internal Failure - Software Resets in DSM [113270573 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the internal software to control the machine's operations. When the ECU **A-001** senses an internal software failure, this fault will occur. The evaluation of the reason for the reset is performed after each reset, the reset is activated by the application software.

**Cause:**
The ECU **A-001** has detected an internal software failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check for sources of electromagnetic disturbance on the ECU **A-001**.

   A. There are no sources of electromagnetic disturbance, continue with Step **3**.

   B. There are sources of electromagnetic disturbance, eliminate the sources of electromagnetic disturbance.
3. Check the voltage on the ECU **A-001** supply circuit.

   Using a multimeter back probe the harness from the **A-001** at connector **X-EC2**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 1** | Chassis ground | There should be approximately **12.0 V** |
| **X-EC2 (Receptacle) pin 3** | Chassis ground | There should be approximately **12.0 V** |
| **X-EC2 (Receptacle) pin 5** | Chassis ground | There should be approximately **12.0 V** |

   A. If there is approximately **12 V** on all the checks, continue with Step **4**.

   B. If there is not approximately **12 V** on any of the checks, check the fuse and circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reinstall the fuse, recheck the voltage, then return the machine to normal operation.
4. Check the ECU **A-001** ground circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 2** | Chassis ground | There should be continuity |
| **X-EC2 (Receptacle) pin 4** | Chassis ground | There should be continuity |
| **X-EC2 (Receptacle) pin 6** | Chassis ground | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **5**.

B. If there is no continuity on any of the checks, there is an open circuit in the ground circuit harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Use the Electronic Service Tool (EST) to recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3507 (F-1675-31) - Engine Cranked for Too Long or Key Switch Failure [113270849 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors correct operation of the ignition switch **S-001**. When the ECU **A-001** senses that the crank signal input has been high for too long on the ignition switch **S-001** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the crank signal input has been high for too long indicating that the engine has been cranked for too long or there is a failure in the ignition switch **S-001** circuit.

**Possible failure modes:**

1. Engine cranked for an excessive period of time.
2. Faulty ignition switch **S-001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the ignition switch **S-001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the ignition switch **S-001**. Resolve them first then recheck the status of this fault.
   A. Fault is active. Continue with Step **3**.
   B. Fault is not active. Return the machine to normal operation.
3. Replace the ignition switch **S-001** then recheck the status of this fault.
   A. Fault is active. Continue with Step **4**.
   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3517 (F-171-03) - Ambient Temperature Sensor Voltage is Higher than Expected [113270408 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the intake air temperature sensor **B-010**. The intake air temperature sensor **B-010** shares the intake air temperature signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage greater than **4.89 V** on the intake air temperature sensor **B-010** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the intake air temperature sensor **B-010** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty intake air temperature sensor **B-010**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the intake air temperature sensor **B-010**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the intake air temperature sensor **B-010** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the intake air temperature sensor **B-010** at connector **X-474**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 76** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **3**.

   B. If there is voltage, there is a short to power in the connector harness (between **X-474** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

3. Check the intake air temperature sensor **B-010** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 76** | All other pins on **X-EC2** | There should be no continuity |
| **X-474 (Receptacle) pin 1** | All other pins on **X-474** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **4**.

   B. If there is continuity on either check, there is a short to power in the connector harness (between **X-474** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the intake air temperature sensor **B-010** circuit for an open circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-474 (Receptacle) pin 1** | **X-EC2 (Receptacle) pin 76** | There should be continuity |
| **X-474 (Receptacle) pin 2** | **X-EC2 (Receptacle) pin 87** | There should be continuity |

A. If there is continuity on both checks, continue with Step **5**.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-474** and **X-EC2** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Replace the intake air temperature sensor **B-010**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3518 (F-171-04) - Ambient Temperature Sensor Voltage is Lower than Expected [113270350 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the intake air temperature sensor **B-010**. The intake air temperature sensor **B-010** shares the intake air temperature signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage less than **195 mV** on the intake air temperature sensor **B-010** temperature circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground or an open circuit condition on the intake air temperature sensor **B-010** temperature circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground or open circuit.
2. Faulty intake air temperature sensor **B-010**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **B-010** to the intake air temperature sensor **B-010**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the intake air temperature sensor **B-010** circuit for a short to ground.

   Disconnect the harness from ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the intake air temperature sensor **B-010** at connector **X-474**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 76** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 87** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 76** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 87** | All other pins on **X-EC2** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **3**.

   B. If there is continuity on any of the checks, there is a short to ground in the engine (EN) harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.
3. Check the intake air temperature sensor **B-010** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-474 (Receptacle) pin 2** | **X-EC2 (Receptacle) pin 87** | There should be continuity |
| **X-474 (Receptacle) pin 1** | **X-EC2 (Receptacle) pin 76** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **4**.

B. If there is no continuity on either check, there is an open circuit in the engine (EN) harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the intake air temperature sensor **B-010**, reconnect the harness,

   then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3581 (F-519859-00) - Torque Limitation is Active [113270797 - V4 - 27 January 2025]

## Control Module: ECU

**Fault Description:**
This fault is only for informational purposes and requires no action other than the resolution of the active fault causing this fault to occur. When the Engine Control Unit (ECU) **A-001** senses any one of many Selective Catalytic Reduction (SCR) not displayed faults that remain active for a predetermined length of time, this fault will occur.

# 3616 (F-519844-31) - Torque Limitation Caused by Turbo Charger Protection [113270565 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
This failure path is only for information. This failure does not require any further action except to check if another failure related to turbocharger is stored in fault memory. If there is a failure present, follow the troubleshooting procedure for that fault. This failure confirms there was a temporary torque limitation present.

# 3647 (1127-00) - Turbocharger Control: Boost Pressure Value Above Highest Threshold [113334012 - V1 - 13 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-F02** monitors the plausibility of boost pressure under low speed and load conditions. The boost pressure is compared with environmental pressure after the ECU **A-F02** initialization and before the engine start as long as the overpressure air temperature and pressure sensor **B-F48** and the Electronic Variable Geometry Turbocharger (eVGT) controller **A-F14** is deemed reliable. When the ECU **A-F02** senses that the boost pressure value is above the upper threshold value, this fault will occur.

**Cause:**
The ECU **A-F02** has detected the boost pressure value is above the upper threshold value.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty overpressure air temperature and pressure sensor **B-F48**, internal failure.
3. Faulty eVGT controller **A-F14**, internal failure.
4. Faulty ECU **A-F02**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-F02** to the overpressure air temperature and pressure sensor **B-F48**, the eVGT controller **A-F14**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes related to the intake manifold or boost pressure are active.

   Resolve them first and then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the mechanical linkage for blockage and proper connections on the eVGT controller **A-F14**.

   Check for damage or incorrect connections.

   A. If the linkage and connections are correct, continue with Step **4**.

   B. If the linkage is damaged or incorrect connection found, repair or replace as required.
4. Replace the overpressure air temperature and pressure sensor **B-F48**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. As there is no method for field testing or re-flashing the actuator controller, replace the eVGT controller **A-F14**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-F02** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-F02**.

# 3680 (F-3607-14) - ECU Internal Failure - Engine Speed Limitation via Fuel injection Cut Off is Active [113270406 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
This is only an informative fault and no corrective actions are required; this fault has been generated by another active fault. The Engine Control Unit (ECU) **A-001** performs fuel injection cut off in order to limit the engine speed at a controllable range. This procedure is activated whenever the engine speed exceeds the threshold limit and if certain faults are found inside the ECU **A-001** regarding the reliability of the accelerator pedal signal, fuel injection parameters, or engine speed. When the ECU **A-001** senses the fuel injection cut off procedure is active, this fault will occur.

# 3686 (F-4765-14) - DOC Upstream Temperature Sensor Signal Drift at Cold Start [113270483 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the signal detected by the exhaust gas temperature sensor upstream of the Diesel Oxidation Catalyst (DOC) **B-011** and compares its values with those measure by other 3 temperature sensors at the exhaust. If the value measured by the exhaust gas temperature sensor upstream of the DOC **B-011** differs by more than the maximum permitted limit defined by the ECU **A-001**, this fault will occur. Monitoring is active once in a driving cycle if the following conditions are true: monitoring not disabled due to another failure, not in high altitude (ambient pressure higher than **0.74 bar** (**10.73 psi**)), the engine running time of last driving cycle was higher than **5.00 s** with engine speed higher than **10.00 RPM** and the engine coolant temperature higher than **69.96 °C** (**157.93 °F**) at least once, engine cold start detected at actual start, the absolute difference between the engine coolant temperature to the intake temperature lower than 5.00K and to the environmental temperature lower than 5.00K at actual start. If all conditions are fulfilled, the temperatures are measured for at least **2.00 s** but it is interrupted **2.00 s** after the engine speed has exceeded **10.00 RPM**. If the measuring time was lower than **2.00 s** before interruption, no test result is taken during this driving cycle.

**Cause:**
The ECU **A-001** has detected that the signal of the exhaust gas temperature sensor upstream of the DOC **B-011** has drifted during a cold start.

**Possible failure modes:**

1. Sudden change in ambient temperature surrounding the exhaust gas temperature sensor upstream of the DOC **B-011**.
2. Faulty exhaust gas temperature sensor upstream of the DOC **B-011**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DOC **B-011**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check for other active fault codes related to exhaust gas temperature sensor upstream of the DOC **B-011**.

   And then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Use the Electronic Service Tool (EST) to compare the exhaust gas temperature sensor upstream of the DOC **B-011** with the values measured by the exhaust gas temperature sensor upstream of the DPF **B-012**, the Selective Catalytic Reduction (SCR) downstream temperature sensor, and the SCR upstream temperature sensor temperature values.

   Monitor for possible signal drift due to a rapid change in ambient temperature. The sensors should have similar characteristics.

   Monitoring must be done after a cold soak condition to avoid any residual heat.

   And then recheck the status of this fault.

A. Fault is active. Continue with Step **4**.

B. Fault is not active. Return the machine to normal operation.

4. Replace the exhaust gas temperature sensor upstream of the DOC **B-011**.

   Perform an engine cold start and then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3687 (F-4766-02) - SCR Upstream Temperature Sensor Signal Drift at Cold Start [113270485 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas temperature sensor upstream of the Diesel Particulate Filter (DPF) **B-012**. When the ECU **A-001** senses that this fault has not been deactivated due to another fault, not at high altitudes and that the last driving cycle was not cold, and the temperature measured by the exhaust gas temperature sensor upstream of the DPF **B-012** differs from the value measured by the exhaust gas temperature sensor upstream of the Diesel Oxidation Catalyst (DOC) **B-011**, this fault will occur. Monitoring is active once in a driving cycle if the following conditions are true: monitoring not disabled due to another failure, not in high altitude (ambient pressure higher than **0.74 bar** (**10.73 psi**)), the engine running time of last driving cycle was higher than **5.00 s** with engine speed higher than **10.00 RPM** and the engine coolant temperature higher than **69.96 °C** (**157.93 °F**) at least once, engine cold start detected at actual start, the absolute difference between the engine coolant temperature to the intake temperature lower than 5.00K and to the environmental temperature lower than 5.00K at actual start. If all conditions are fulfilled, the temperatures are measured for at least **2.00 s** but it is interrupted **2.00 s** after the engine speed has exceeded **10.00 RPM**. If the measuring time was lower than **2.00 s** before interruption, no test result is taken during this driving cycle.

**Cause:**
The ECU **A-001** has detected that the signal of the exhaust gas temperature sensor upstream of the DPF **B-012** has drifted during a cold start.

**Possible failure modes:**

1. Sudden change in ambient temperature surrounding the exhaust gas temperature sensor upstream of the DPF **B-012**.
2. Faulty exhaust gas temperature sensor upstream of the DPF **B-012**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DPF **B-012**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check for other active fault codes related to exhaust gas temperature sensor upstream of the DPF **B-012**.

   And then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Use the Electronic Service Tool (EST) to compare the exhaust gas temperature sensor upstream of the DPF **B-012** with the values measured by the exhaust gas temperature sensor upstream of the DOC **B-011**, the Selective Catalytic Reduction (SCR) downstream temperature sensor, and the SCR upstream temperature sensor temperature values.

   Monitor for possible signal drift due to a rapid change in ambient temperature. The sensors should have similar characteristics.

   Monitoring must be done after a cold soak condition to avoid any residual heat.

   And then recheck the status of this fault.

A. Fault is active. Continue with Step **4**.

B. Fault is not active. Return the machine to normal operation.

4. Replace the exhaust gas temperature sensor upstream of the DPF **B-012**.

   Perform an engine cold start and then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3688 (20245, 97-12) - Water in Fuel Sensor or Sensor Circuit Failure [113270487 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Water In Fuel (WIF) sensor **B-007** to control the machine operations. The ECU **A-001** monitors the voltage output from the WIF sensor **B-007** to determine if water is present in the fuel supply. If water is detected in the fuel, warnings will be displayed to alert the operator of potential engine damage if operation continues. When the ECU **A-001** senses that the ground signal from the WIF sensor **B-007** indicates water is present, this fault will occur.

**Cause:**
The ECU **A-001** has detected the excess water on the fuel system or a fault on the WIF sensor **B-007** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty WIF sensor **B-007**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the WIF sensor **B-007** and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check fuel for water contamination.

   Check the fuel for water contamination.

   A. If there is water contamination, continue with Step **3**.

   B. If there is no water contamination, return the machine to normal operation.
3. Verify proper WIF sensor **B-007** operation.

   Purge fuel supply system, replace fuel filters and refill with fuel that is free of water contamination.

   Start and run the engine for **5 min**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the WIF sensor **B-007** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the WIF sensor **B-007** at connector **X-463**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 70** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 75** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-EC2** and **X-463** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Check the WIF sensor **B-007** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 70** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 75** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 70** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 75** | All other pins on **X-EC2** | There should be no continuity |
| **X-463 pin 1** | All other pins on **X-463** | There should be no continuity |
| **X-463 pin 3** | All other pins on **X-463** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-EC2** and **X-463** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the WIF sensor **B-007** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 70** | **X-463 pin 1** | There should be continuity |
| **X-EC2 (Receptacle) pin 75** | **X-463 pin 3** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **7**.

   B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-EC2** and **X-463** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

7. Replace the WIF sensor **B-007**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **8**.

   B. Fault is not active. Return the machine to normal operation.

8. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3735 (1442-06) - Fuel Metering Unit has an Over-Temperature Error [113270594 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the solenoid valve for fuel pressure regulation **Y-9000** to control the engine operations. When the ECU **A-001** senses an over-temperature condition on the solenoid valve for fuel pressure regulation **Y-9000** control circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short circuit condition on the solenoid valve for fuel pressure regulation **Y-9000** control circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short circuit.
2. Faulty solenoid valve for fuel pressure regulation **Y-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the solenoid valve for fuel pressure regulation **Y-9000**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the solenoid valve for fuel pressure regulation **Y-9000** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the solenoid valve for fuel pressure regulation **Y-9000** at connector **X-9007**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 6** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 7** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, there is a short to power in the engine (EN) harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

3. Check the solenoid valve for fuel pressure regulation **Y-9000** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 6** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 7** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 6** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 7** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

B. If there is continuity on any of the checks, continue with Step **4**.

4. Check the solenoid valve for fuel pressure regulation **Y-9000** circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 1** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 2** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **5**.

   B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9007** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Check the solenoid valve for fuel pressure regulation **Y-9000** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 1** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 2** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 1** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 2** | All other pins on **X-9138B** | There should be no continuity |
| **X-9007 pin 1** | All other pins on **X-9007** | There should be no continuity |
| **X-9007 pin 2** | All other pins on **X-9007** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9007** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the solenoid valve for fuel pressure regulation **Y-9000**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **7**.

   B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3750 (F-5441-02) - ECU Internal Failure - Fuel Injection Energizing Time is Not Plausible [113270531 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the energizing time request plausibility for the injectors by the monitoring software (level 2). The ECU **A-001** level 2 monitors the ECU **A-001** level 1 software, an implausible injection energizing time for either the pilot main or the post-injection is determined. When the ECU **A-001** senses that the difference between measured and programmed injection duration is greater than **0.09 ms** with the engine speed greater than **1000 RPM** and the rail pressure greater than **208 bar**, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3751 (F-5441-31) - ECU Internal Failure - Fuel Injection Energizing Phase is Not Plausible [113270511 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the start of energizing time for the injectors for plausibility by the monitoring software (level 2). The ECU **A-001** level 2 monitors the ECU **A-001** level 1 software (functional software). When the ECU **A-001** senses an implausible start of energizing of either a main or a pilot or a post-injection is detected and the detection is not inhibited by another failure, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3753 (F-1116-31) - ECU internal failure - Injection quantity correction [113270425 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine performance is assisted by the addition of pilot injections, main injections and three post injections. The Engine Control Unit (ECU) **A-001** monitors the efficiency of these injections and provides injection quantity corrections, if necessary. When the ECU **A-001** senses an excessive corrections to injection quantity are being made, there is a calibration error and this fault will occur. Replacement of the ECU **A-001** is necessary. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3754 (F-5313-02) - ECU Internal Failure - Rail Pressure Plausibility [113270367 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors fuel rail pressure for proper engine performance as well as safety concerns. Fuel rail pressure is monitored by the ECU **A-001** to check if the ECU **A-001** is functioning properly. When the ECU **A-001** detects an implausible rail pressure during monitoring, the ECU **A-001** is not functioning correctly and this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3757 (F-518150-31) - ECU Internal Failure - Post Injection Shut-off Failure [113270604 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
Engine performance is assisted by the addition of pilot injections, main injections and three post injections. The Engine Control Unit (ECU) **A-001** monitors the post injection 2 shut off quantity in normal mode. When the ECU **A-001** senses that the post injection 2 shut off quantity has exceeded **655.34 mg**/hub in normal mode and engine speed is greater than **10,200 RPM**, this fault will occur. Replacement of the ECU **A-001** is necessary. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3758 (F-518151-31) - ECU Internal Failure - Post Injection Efficiency Failure [113270606 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
Engine performance is assisted by the addition of pilot injections, main injections and three post injections. The Engine Control Unit (ECU) **A-001** monitors the post injection 3 quantity in normal mode. When the ECU **A-001** senses that the post injection 2 shut off quantity has exceeded **655.34 mg** in normal mode and engine speed is greater than **10,200 RPM**, this fault will occur. Replacement of the ECU **A-001** is necessary. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3766 (F-3251-02) - Fault Check for the Pressure Sensor Plausibility [113270535 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the differential pressure sensor on the Diesel Particulate Filter (DPF) **B-018** to control the emission operations. During the ECU **A-001** after-run, **5 s** after key-OFF, monitoring is not disabled by another fault, when the ECU **A-001** senses that the differential pressure sensor on the DPF **B-018** signal is below **0.018 bar** (**0.261 psi**) for more than **3 s**, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the differential pressure sensor on the DPF **B-018** signal is below the allowable tolerance.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty differential pressure sensor on the DPF **B-018**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the differential pressure sensor on the DPF **B-018**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Replace the differential pressure sensor on the DPF **B-018**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3767 (F-1648-12) - ECU Internal Failure - 'WDA Active' Reported Due to Errors in Query/Response Communication [113270497 - V5 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the communication, internal to the ECU **A-001**, between the power stages and the power stage voltage supplier. When the ECU **A-001** an unexpected communication (a wire is active when it should not be) error during this monitoring, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3769 (F-1648-03) - ECU Internal Failure - 'ABE Active' Reported Due to Overvoltage Detection [113270427 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the communication, internal to the ECU **A-001**, between the power stages and the power stage voltage supplier. When the ECU **A-001** senses the WDA/ABE communication wire becomes active, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3771 (F-4765-31) - Diesel Oxidation Catalyst Up and Down Stream Temperature Sensors are Swapped [113270877 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas temperature sensor upstream of the Diesel Oxidation Catalyst (DOC) **B-011** and the exhaust gas temperature sensor upstream of the Diesel Particulate Filter (DPF) **B-012** to control the emission operations. When the ECU **A-001** senses that these two sensor positions have been swapped, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the position of the exhaust gas temperature sensor upstream of the DOC **B-011** and the exhaust gas temperature sensor upstream of the DPF **B-012** have been swapped.

**Possible failure modes:**

1. Faulty exhaust gas temperature sensor upstream of the DOC **B-011**, internal failure.
2. Faulty exhaust gas temperature sensor upstream of the DPF **B-012**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DOC **B-011** and the exhaust gas temperature sensor upstream of the DPF **B-012**, and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Verify the location of the exhaust gas temperature sensor upstream of the DOC **B-011**.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DOC **B-011** at connector **X-617**.

   Inspect the relevant harness and connector to verify the proper placement of the exhaust gas temperature sensor upstream of the DOC **B-011**.

   A. If the sensor installation is correct, continue with Step **3**.

   B. If the sensor installation is incorrect, the exhaust gas temperature sensor upstream of the DOC **B-011** have installed wrongly. Reinstall the exhaust gas temperature sensor upstream of the DOC **B-011** at correct position.
3. Verify the location of the exhaust gas temperature sensor upstream of the DPF **B-012**.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DPF **B-012** at connector **X-303**.

   Inspect the relevant harness and connector to verify the proper placement of the exhaust gas temperature sensor upstream of the DPF **B-012**.

   A. If the sensor installation is correct, continue with Step **4**.

   B. If the sensor installation is incorrect, the exhaust gas temperature sensor upstream of the DPF **B-012** have installed wrongly. Reinstall the exhaust gas temperature sensor upstream of the DPF **B-012** at correct position.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3773 (F-1128-18) - Turbo Charger Speed Signal Period has Exceeded a Limit [113271755 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the overpressure air temperature and pressure sensor **B-9001** to control the engine operation. The overpressure air temperature and pressure sensor **B-9001** sends status and feedback information at regular intervals to the ECU **A-001** relating to the operating status of the turbocharger. When the ECU **A-001** senses the current pressure value of the turbocharger is higher than the set threshold, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the eVGT actuator is clogged or turbocharger efficiency is compromised due to probable leaks.

**Possible failure modes:**

1. Faulty turbocharger.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Use the Electronic Service Tool (EST) to test operation of the turbocharger.

   Check the routing of the turbocharger connection pipes then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Since there are no procedures to perform the on field testing, replace the overpressure air temperature and pressure sensor **B-9001** then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3775 (F-3251-15) - SCR Catalyst Differential Pressure Value is Above the Maximum Value. Dealer Catalyst Service is Required. (Filter Plugged - Level L6) [113270549 - V4 - 03 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the differential pressure sensor on the Diesel Particulate Filter (DPF) **B-018** to control the emission operations. If exhaust gas back pressure reaches too high values due to elevated soot level, the system goes into "Alarm state" and a failure is activated, which has the possibility to reduce power to protect the DPF against damage. The ECU **A-001** monitors exhaust operation as long as the battery voltage is greater than **10 V**, engine speed is greater than **50 RPM**, there is no pending regeneration, the surface temperature of the particulate filter is between **99.96 – 699.96 °C** (**211.93 – 1291.93 °F**), monitoring is not inhibited by another failure and exhaust volume flow is greater than **350.00 m³/hr** (**1541.00 US gpm**). When the ECU **A-001** senses a pressure drop over the filter higher than an exhaust flow dependant limit established by the ECU **A-001** continuously for greater than **85 s** equates to a soot level of **9 g/L** which signifies a severely clogged DPF, this fault will occur. The system is placed in "Limp home mode" and service action is mandatory for Selective Catalytic Reduction on Filter (SCRoF) replacement.

**Cause:**
The ECU **A-001** has detected that the SCR catalyst differential pressure value is above the maximum value.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty SCRoF, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the differential pressure sensor on the DPF **B-018**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Remove the differential pressure pipes and submerge in warm water until the contaminates can be removed.

   Install the cleaned pipes and then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3780 (F-519697-00) - Torque Limitation Due to High Differential Pressure on Particulate Filter [113270537 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the differential pressure sensor on the DPF **B-018**. If the exhaust gas return pressure reaches values which are too high due to a high level of soot, the system switches to an "alarm status" and the fault is activated. This can reduce engine power to protect the Diesel Particulate Filter (DPF) from damage. The ECU **A-001** monitors operation of the exhaust until the battery voltage is above **10 V** and the engine rpm is in standard conditions. A pressure drop on the filter greater than the exhaust flow, based on limits established by the ECU **A-001**, in continuous mode equal to a high level of soot which indicates an obstructed DPF means this fault occurs. Regeneration of the filter is not correctly completed or is not possible, we recommend managing the manual catalyst (MCM) to return the DPF to the correct condition. If the exhaust gas return pressure reaches values which are too high due to the high level of soot, the system switches to an "alarm condition" and the fault is activated.

**Cause:**
The ECU **A-001** has detected a short to power condition on the differential pressure sensor on the DPF **B-018** pressure signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty differential pressure sensor on the DPF **B-018**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the differential pressure sensor on the DPF **B-018** supply circuit.

   Using a multimeter back probe the harness from the differential pressure sensor on the DPF **B-018** at connector **X-331**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-331 (Receptacle) pin 1** | Chassis ground | There should be approximately **5 V** |

   A. If there is approximately **5 V**, continue with Step **3**.

   B. If there is not approximately **5 V**, check the circuit wiring for damage. Repair or replace the harnesses or connectors as required.

3. Check the differential pressure sensor on the DPF **B-018** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the differential pressure sensor on the DPF **B-018** at connector **X-331**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 15** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **4**.

B. If there is voltage, there is a short to power in the engine (EN) harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

4. Check the differential pressure sensor on the DPF **B-018** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 15** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 15** | All other pins on **X-EC2** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **5**.

   B. If there is continuity on either check, there is a short to power in the engine (EN) harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Replace the differential pressure sensor on the DPF **B-018**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3794 (F-102-15) - Boost Pressure Plausability Check Detects that the Boost Pressure is Higher than Expected [113270539 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the plausibility of intake pressure under low speed and load conditions. The intake manifold pressure is compared with environmental pressure after the ECU **A-001** initialization and before the engine start as long as the overpressure air temperature and pressure sensor **B-9001** is deemed reliable. When the ECU **A-001** senses that the pressure signal of the overpressure air temperature and pressure sensor **B-9001** is out of the high range, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the pressure signal of the overpressure air temperature and pressure sensor **B-9001** is out of the high range.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active.

   Resolve them first and then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Replace the overpressure air temperature and pressure sensor **B-9001** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3795 (F-102-17) - Boost Pressure Plausability Check Detects that the Boost Pressure is Lower than Expected [113270515 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the plausibility of intake pressure under low speed and load conditions. The intake manifold pressure is compared with environmental pressure after the ECU **A-001** initialization and before the engine start as long as the overpressure air temperature and pressure sensor **B-9001** is deemed reliable. When the ECU **A-001** senses that the pressure signal of the overpressure air temperature and pressure sensor **B-9001** is out of the low range, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the pressure signal of the overpressure air temperature and pressure sensor **B-9001** is out of the low range.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active.

   Resolve them first and then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Replace the overpressure air temperature and pressure sensor **B-9001** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3797 (F-3251-03) - Differential Pressure Sensor: Signal Range Check is Too High [113270866 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the differential pressure sensor on the Diesel Particulate Filter (DPF) **B-018** to control the engine operations. The differential pressure sensor on the DPF **B-018** is an advanced sensor that uses SENT (Single Edge Nibble Transmission) technology. SENT technology is intended for use in applications where it high-resolution sensor data has to be transmitted from a sensor to an ECU **A-001** unit. The differential pressure sensor on the DPF **B-018** supplies information to the ECU **A-001** using 2 fast channels and a slow channel. Fast channel 1 contains the value of the differential pressure, fast channel 2 contains known values for the validation of sensor information, while the slow channel contains warning messages and the configuration and manufacturer codes. The differential pressure sensor on the DPF **B-018** contains an integrated circuit for specific applications (ASIC) and a digital signal processor (DSP) based on microprocessor technology and automatically monitors the presence of internal faults. When the ECU **A-001** senses a voltage greater than **4.87 V** on the differential pressure sensor on the DPF **B-018** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the differential pressure sensor on the DPF **B-018** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty differential pressure sensor on the DPF **B-018**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the differential pressure sensor on the DPF **B-018** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the differential pressure sensor on the DPF **B-018** at connector **X-331**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 15** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 16** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the check, there is a short to power in the connector harness (between **X-EC2** and **X-331** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.
3. Check the differential pressure sensor on the DPF **B-018** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 15** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 16** | All other pins on **X-EC2** | There should be no continuity |

A. If there is no continuity on all the checks, continue with Step **4**.

B. If there is continuity on any of the check, there is a short to power in the connector harness (between **X-EC2** and **X-331** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the differential pressure sensor on the DPF **B-018**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3798 (F-3251-04) - Differential Pressure Sensor: Signal Range Check is Too Low [113270859 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the differential pressure sensor on the Diesel Particulate Filter (DPF) **B-018** to control the emission operations. The differential pressure sensor on the DPF **B-018** is an advanced sensor using Single Edge Nibble Transmission (SENT) technology. SENT is intended for use in applications where high resolution sensor data needs to be communicated from a sensor to the ECU **A-001**. The differential pressure sensor on the DPF **B-018** provides information to the ECU **A-001** using 2 fast channels (sent every **2 s**) and one slow channel Fast channel 1 contains differential pressure value, fast channel 2 contains secure values for validating sensor information while the slow channel contains errors messages and configuration and manufacturer code. The differential pressure sensor on the DPF **B-018** contains a microprocessor based Application-Specific Integrated Circuit (ASIC) and Digital Signal Processor (DSP) and monitors for internal faults. When the ECU **A-001** senses a voltage less than **185.60 mV** for longer than **1.80 s**, the DPF differential pressure is frozen at the last valid value on preliminary failure and jumps to a default value of **0.10001 bar** (**1.45015 psi**) failure is validated, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the differential pressure sensor on the DPF **B-018** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty differential pressure sensor on the DPF **B-018**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the differential pressure sensor on the DPF **B-018** supply circuit.

   Using a multimeter back probe the harness from the differential pressure sensor on the DPF **B-018** at connector **X-331**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-331 (Receptacle) pin 1** | Chassis ground | There should be approximately **5 V** |

   A. If there is approximately **5 V**, continue with Step **3**.

   B. If there is not approximately **5 V**, check the circuit wiring for damage. Repair or replace the harnesses or connectors as required.
3. Check the differential pressure sensor on the DPF **B-018** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the differential pressure sensor on the DPF **B-018** at connector **X-331**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 15** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 16** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 15** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 16** | All other pins on **X-EC2** | There should be no continuity |

A. If there is no continuity on all the checks, continue with Step **4**.

B. If there is continuity, there is a short to ground in the connector harness (between **X-EC2** and **X-331** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the differential pressure sensor on the DPF **B-018**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3799 (F-5571-10) - Fuel Pressure Relief Valve is Forced to Open, Perform Pressure Shock [113270373 - V4 - 27 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** to control the machine's operations. To determine the mechanical component wear out or to send the system into limp home mode, the ECU **A-001** can force the fuel pressure relief valve to open. This action consists of two steps, waiting for the rail pressure to build up and then performing the pressure shock. When the ECU **A-001** commands this operation, this fault will occur. Once the pressure sensor on the rail **B-9004** failure is detected or maximum rail pressure is exceeded, the system will go into a limp home mode. When this fault will occur, other fuel related system faults can also occur due to the increase in fuel pressure, diagnose those codes as required.

**Cause:**
The ECU **A-001** has detected that a pressure shock has occurred and the fuel pressure relief valve is forced to open.

**Possible failure modes:**

1. Faulty pressure sensor on the rail **B-9004**, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pressure sensor on the rail **B-9004**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the pressure sensor on the rail **B-9004**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3808 (F-1240-14) - High pressure pump fuel delivery quantity at low idle is too high [113270445 - V5 - 13 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** controls fuel delivery by the Fuel Metering Unit (FMU) **Y-9000**. If the ECU **A-001** determines that proper fuel pressure can not be reached at engine idle speed, leakage in the system is assumed and this fault will occur.

**Cause:**
The ECU **A-001** has determined that commanded fuel rail pressure is lower than expected at engine idle speed.

**Possible failure modes:**
Faulty low pressure fuel system, leakage or blockage (40% - 60 min)
Faulty fuel injectors (20% - 20 min)
Faulty high pressure pump (10% - 45 min)
Faulty Pressure Relief Valve (PRV) or common rail assembly (10% - 30 min)
Faulty fuel metering unit (FMU). Component ID : Y-F07 (10% - 20 min)
Fuel tank level, too low (5% - 5 min)
Faulty rail pressure sensor. Component ID : B-F09 (5% - 5 min)

### Faulty low pressure fuel system, leakage or blockage

**Solution:**

1. Check if the service interval for the fuel filter is close. If so, replace the fuel filter and check for fault reoccurrence. Fuel filter replacement can be performed by the customer if the machine is still in the field and a fuel filter is available.

   A. The fault is no longer active. Return the machine to service.

   B. The fault is still active. Go to Step **2**.

2. Measure restriction on the suction side of the fuel system.

   Install the pressure gauges from Fuel Test Kit **380003437** and the F5 and VM Engine Fuel Test Adapters **380003438** . See **Fuel injection system - Test (10.218-F.40.C.01)** under the heading “Connections” for the proper procedure.

   Start the engine.

   Run the engine to normal operating temperature.

   Run the engine slow through the RPM range while monitoring Gauge **(A)**.

   ***NOTE:*** *It may be necessary to run the engine under load or in similar working conditions to reproduce the fault while monitoring Gauge **(A)**.*

   Record the highest value seen on Gauge **(A)** - suction side (before pre-filter).

   ***NOTE:*** *For values less than one, be sure to enter with a leading zero before the decimal point.*

   A. The measured vacuum on Gauge **(A)** is greater than **-0.3 bar**, A vacuum measurement greater than **-0.3 bar** indicates restriction in the suction side of the fuel system. Go to Step **6**.

   B. The measured vacuum on Gauge **(A)** is less than **-0.3 bar**, Leave all gauges connected and go to Step **3**.

3. During the test, were any air bubbles visible in the clear test lines?

   A. Large air bubbles were observed. Large air bubbles in the suction line indicate air ingress. Go to Step **7**.

B. No or very small random air bubbles were observed. Leave all gauges connected and go to Step **4**.

4. Run engine at **1500 RPM** and measure low side fuel pressure before the main filter.

   Record the values for Gauge **(B)** - Low pressure side (before main filter).

   A. The measured value is greater than **4.5 bar** (**65 psi**). Leave all gauges connected and go to Step **5**.

   B. The measured value is lower than **4.5 bar** (**65 psi**). The low pressure gear pump is weak or damaged. Replace low pressure gear pump (if available). Replace the complete high pressure pump if low pressure gear pump is not available.

5. Run engine at **1500 RPM** and measure low side fuel pressure after the main filter.

   Record the values for Gauge **(C)** - low pressure side (after main filter).

   A. The measured value is greater than **4.5 bar** (**65 psi**). Leave all gauges connected and go to possible failure modes list.

   B. The measured value is less than **4.5 bar** (**65 psi**). Filter differential pressure is greater than specification. Go to Step **8**.

6. Inspect the following components to determine the root cause of a high vacuum measurement on Gauge **(A)**.

   - Fuel water separator/filter
   - Suction screen in the tank
   - Fuel line from the tank or pickup in the tank
   - Fuel tank vent

   A. Fuel water separator/filter is clogged. Clean or replace the fuel water separator/filter.

   B. Suction screen in the tank is clogged. Clean or replace the suction screen.

   C. Fuel line from the tank or pickup in the tank is clogged or restricted. Clean or replace the line.

   D. Fuel tank vent is clogged or restricted. Clean or replace the fuel tank vent line.

7. Inspect the following components to determine the root cause of air ingress on the suction side of the fuel system.

   - Fuel level in the tank
   - Air leak at test fitting or test quick coupler
   - Leak in the fuel lines/fittings
   - Diaphragm in primer pump
   - Seal between the ECU and fuel cooler base (if equipped)
   - Fuel fitting O-rings

   A. Unit low in fuel. Fill tank with fuel.

   B. Air leak at test fitting or test quick coupler. Reset, repair, or replace the test fittings or couplers.

   C. Leak in the fuel lines/fittings. Tighten loose fittings, replace deteriorated/ damaged fuel lines.

   D. Diaphragm in primer pump cracked / damaged. Replace the primer pump.

   E. Deteriorated/damaged fuel fitting O-rings. Replace deteriorated / damaged O-rings.

8. Inspect the following components to determine the root cause of pressure drop across the main filter.

   - Main fuel filter
   - Main fuel filter base

   A. Main fuel filter is clogged. Replace main fuel filter.

B. Restriction / blockage in main fuel filter base. Clear / remove restriction from the fuel filter base. Replace the filter base if necessary.

### Faulty fuel injectors

**Solution:**

1. Measure the individual return flow for each fuel injector at low idle.

   Use the test fittings, hoses and graduated cylinder from Fuel Test Kit **380003437** and the F5 and VM Engine Fuel Test Adapters **380003438** to collect the return fuel for **60 s**. See **Fuel injectors - Leakage test (10.218.AF-F.40.A.40)** for the proper procedure.

   Enter the value from the injector that had the highest return flow into the field below.

   A. The individual return flow value is greater than **24 mL** in **60 s**. Indicate the values obtained for each injector in the comment field. Then, replace the injector(s) that have a return flow greater than **24 mL**.

   B. The individual return flow value is less than **24 mL** in **60 s**. Indicate the values obtained for each injector in the comment field. Go to possible failure mode list..

### Faulty high pressure pump

**Solution:**

1. Measure the return flow from the high pressure pump.

   Use the test fittings, hoses and graduated container from Fuel Test Kit **380003437** and the F5 and VM Engine Fuel Test Adapters **380003438** to collect the return fuel for one minute. See **High pressure pump - Flow test (10.218.AT-F.40.A.45)** for the proper procedure.

   A. The measured return flow value is greater than **750 mL** / **60 s**.The internal components are worn or damaged. Replace the high pressure pump.

   B. The measured return flow value is less than **750 mL** / **60 s**.Go to possible failure modes list.

### Faulty pressure relief valve

**Solution:**

1. Measure leakage from the common rail pressure relief valve.

   Use the test fittings, hoses and suitable container from Fuel Test Kit **380003437** and the F5 and VM Engine Fuel Test Adapters **380003438**. See **Common rail Relief valve - Leakage test (10.218.AA.01-F.40.A.40)** for the proper procedure.

   A. There is visible fuel leakage from the common rail pressure relief valve. Replace the common rail assembly. Then use EST to configure the replacement of the rail Pressure Relief Valve (PRV).

   B. There is no visible fuel leakage from the common rail pressure relief valve. Go to possible failure modes list.

### Faulty fuel metering unit (FMU) Y-F07

**Solution:**

1. Remove and inspect Fuel Metering Unit (FMU) **Y-F07** for sticking/binding and contamination.

   A. Sticking/binding or contamination found. Clean or replace FMU **Y-F07** as necessary.

B. No issues found, functions normally. Connect the EST to the machine. Download and attach the following files: Data Stored and Fault Memory Reading from EASy, Software versions (.ver) file from EST, Fault Code list (.flt) from EST, Machine Statistical Data Log (vehicle & transmission file). Then, submit a Technical Help Desk (THD) request. Include the list of part numbers for the components replaced.

## Fuel tank level, too low

**Solution:**

1. This fault code can occur if the fuel tank level is too low. You can contact the customer to check the fuel level if the machine is still in the field.

   A. The fuel level in the tank is low. Fill the fuel tank and bleed the air from the fuel system. Inform the customer that running the engine with the fuel level too low can result in damage to fuel system components.

   B. The fuel level in the tank is acceptable. Go to possible failure modes.

## Faulty rail pressure sensor B-F09

**Solution:**

1. Use the Electronic Service Tool (EST) to check for the following related faults that may have caused this fault to occur. If any of the listed faults are active, diagnose them.

   A. **3102 (F-157-04) – Fuel rail pressure sensor voltage is lower than expected** is present. Use the troubleshooting available for the active fault to find the root cause of this fault.

   B. **3112 (F-157-11) – Fuel rail pressure sensor voltage is higher than expected** is present. Use the troubleshooting available for the active fault to find the root cause of this fault.

   C. **3810 (F-157-02) – Rail pressure sensor value is intermittent** is present. Use the troubleshooting available for the active fault to find the root cause of this fault.

   D. None of the faults in the list are currently active. Go to possible failure mode list.

# 3810 (F-157-02) - Rail Pressure Sensor Value is Intermittent [113270777 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** to control the engine operations. When the ECU **A-001** senses a five or more pressure jumps of greater than **180 bar** (**2610 psi**) within **10.00 ms** and the time between the pressure jumps is less than **300 ms**, this fault will occur. The counter will reset to zero if the time between the pressure jumps is greater than **300 ms**.

**Cause:**
The ECU **A-001** has detected a short or open circuit condition on the pressure sensor on the rail **B-9004** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty pressure sensor on the rail **B-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pressure sensor on the rail **B-9004**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the pressure sensor on the rail **B-9004** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the pressure sensor on the rail **B-9004** at connector **X-9026**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 42** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.

3. Check the pressure sensor on the rail **B-9004** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 42** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 42** | All pins in connector **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 62** | All pins in connector **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, continue with Step **4**.

4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 7** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **5**.

   B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 7** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 6** | All pins in connector **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 7** | All pins in connector **X-9138B** | There should be no continuity |
| **X-9026 (Receptacle) pin 2** | All pins in connector **X-9026** | There should be no continuity |
| **X-9026 (Receptacle) pin 3** | All pins in connector **X-9026** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short to circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the pressure sensor on the rail **B-9004** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | **X-9026 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 42** | **X-9026 (Receptacle) pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-9026 (Receptacle) pin 1** | There should be continuity |

   A. If there is no continuity on all the checks, continue with Step **8**.

   B. If there is continuity on any of the checks, continue with Step **7**.

7. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | **X-9139B pin 6** | There should be continuity |
| **X-EC1 (Receptacle) pin 42** | **X-9139B pin 7** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-9139B pin 5** | There should be continuity |

   A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Replace the pressure sensor on the rail **B-9004**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. continue with Step **9**.

   B. Fault is not active. Return the machine to normal operation.

9. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3811 (F-3509-12) - ECU 5 Volt Sensor Supply 1 Out of Range Failure [113270789 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides the **5 V** supplies to the sensors. These voltages are monitored by hardware within the ECU **A-001** to ensure the voltages are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses a sensor supply 1 reference voltage is out of range, this fault will occur.

**Cause:**
The ECU **A-001** has detected the sensor supply 1 reference voltage is out of range.

**Possible failure modes:**

1. Faulty wiring or connections, short circuit.
2. Faulty differential pressure sensor on the Diesel Particulate Filter (DPF) **B-018**, internal failure.
3. Faulty exhaust gas pressure sensor **B-9005**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, the exhaust gas pressure sensor **B-9005**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the exhaust gas pressure sensor **B-9005** supply circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas pressure sensor **B-9005** at connector **X-9018**.

   Disconnect the harness from the differential pressure sensor on the DPF **B-018** at connector **X-331**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **3**.

   B. If there is voltage, continue with Step **4**.

3. Check the exhaust gas pressure sensor **B-9005** supply circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 42** | All other pins on **X-EC2** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **4**.

4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 21** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **5**.

   B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9018** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 21** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 21** | All other pins on **X-9138B** | There should be no continuity |
| **X-9018 pin 1** | All other pins on **X-9018** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-470** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9138B** and **X-9018** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the differential pressure sensor on the DPF **B-018** supply circuit for a short to power.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **7**.

   B. If there is voltage, there is a short to power in the connector harness (between **X-EC2** and **X-331** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

7. Check the differential pressure sensor on the DPF **B-018** supply circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 42** | All other pins on **X-EC2** | There should be no continuity |
| **X-331 (Receptacle) pin 1** | All other pins on **X-331** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **8**.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-EC2** and **X-331** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Replace the differential pressure sensor on the DPF **B-018** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **9**.

   B. Fault is not active. Return the machine to normal operation.

9. Replace the exhaust gas pressure sensor **B-9005** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **10**.

   B. Fault is not active. Return the machine to normal operation.

10. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3836 (4766-04) - Oxidation Catalyser Downstream Temperature Sensor: Signal Range Check Low (Voltage Low) [113270391 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas temperature sensor upstream Diesel Particulate Filter (DPF) **B-012** to control the emission operations. When the ECU **A-001** senses a voltage less than **409 mV** for longer than **1000 ms** on the exhaust gas temperature sensor upstream DPF **B-012** circuit, this fault will occur. When this fault is active, the temperature value will be frozen by the ECU **A-001** at the last valid value or to a fixed replacement value.

**Cause:**
The ECU **A-001** has detected short to ground condition on the exhaust gas temperature sensor upstream DPF **B-012** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty exhaust gas temperature sensor upstream DPF **B-012**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream DPF **B-012**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the exhaust gas temperature sensor upstream DPF **B-012** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas temperature sensor upstream DPF **B-012** at connector **X-303**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 27** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 28** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 27** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 28** | All other pins on **X-EC2** | There should be no continuity |
| **X-303 (Receptacle) pin 1** | **X-303 (Receptacle) pin 2** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **3**.

   B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-303** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.
3. Replace the exhaust gas temperature sensor upstream DPF **B-012**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

B. Fault is not active. Return the machine to normal operation.

4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3838 (4765-04) - Oxidation Catalyser Upstream Temperature Sensor: Signal Value Below Minimum Limit (Signal Low) [113270312 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas temperature sensor upstream of the Diesel Oxidation Catalyst (DOC) **B-011** to control the engine operations. When the ECU **A-001** senses a voltage less than **409 mV** on the exhaust gas temperature sensor upstream of the DOC **B-011** circuit, this fault occurs. When this fault occurs, the temperature value is locked by the ECU **A-001** on the last valid value detected or on a fixed replacement value, once the fault is validated.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the exhaust gas temperature sensor upstream of the DOC **B-011** circuit.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty wiring or connections, short to ground.
3. Faulty exhaust gas temperature sensor upstream of the DOC **B-011**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DOC **B-011**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check for other active fault codes related to exhaust gas temperature sensor upstream of the DOC **B-011**.

   And then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the exhaust gas temperature sensor upstream of the DOC **B-011** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DOC **B-011** at connector **X-617**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 27** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 30** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 27** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 30** | All other pins on **X-EC2** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-EC2** and **X-617** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the exhaust gas temperature sensor upstream of the DOC **B-011**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-617 (Receptacle) pin 1** | **X-617 (Receptacle) pin 2** | The resistance should be between **169.7 – 738.2 Ω** at the temperature on the exhaust **-40 – 800 °C** (**-40 – 1472 °F**) |

   A. If the resistance is within the limit, continue with Step **5**.

   B. If the resistance is not within the limit, the exhaust gas temperature sensor upstream of the DOC **B-011** has failed internally. Replace the exhaust gas temperature sensor upstream of the DOC **B-011**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3903 (174-16) - Fuel Temperature is Too High [113271844 - V5 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the fuel temperature sensor **B-9002** to control the machine's operations. When the ECU **A-001** senses a fuel temperature higher than **84.96 °C** (**184.9 °F**), this fault will occur.

**Cause:**
The ECU **A-001** has detected a high fuel temperature.

**Possible failure modes:**

1. High ambient temperature.
2. Faulty fuel temperature sensor **B-9002**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the fuel temperature sensor **B-9002**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the actual fuel temperature.

   Use thermometer or thermal reading gun, as close as possible to the fuel temperature sensor **B-9002** to capture the fuel temperature.

   A. If the measured temperature is less than **89.96 °C** (**193.9 °F**), continue with Step **3**.

   B. If the measured temperature is greater than **89.96 °C** (**193.9 °F**), the environmental conditions or engine operation factors such as misuse need to be identified and resolved. Resolve the physical condition causing the fuel to overheat.
3. Check to confirm if other fault codes are active.

   Resolve them first then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the fuel temperature sensor **B-9002**.

   Disconnect the harness from the fuel temperature sensor **B-9002** at connector **X-9005**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side :

| From | To | Value |
|---|---|---|
| **X-9005 (Receptacle) pin 1** | **X-9005 (Receptacle) pin 2** | There should be greater than **250 Ω** |

   A. If the measured resistance is greater than **250 Ω**, continue with Step **5**.

   B. If the measured resistance is less than **250 Ω**, the fuel temperature sensor **B-9002** has failed internally. Replace the fuel temperature sensor **B-9002**.
5. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3915 (5571-02) - Averaged Rail Pressure is Outside the Expected Tolerance Range [113270929 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** to control the engine operations. The ECU **A-001** monitors the rail pressure gradients and the pressure relief valve is classified as open after the positive evaluation. If the mean rail pressure is outside the expected range, the pressure relief valve opening evaluation via the mean rail pressure has failed. When the ECU **A-001** senses the average rail pressure is outside the expected range, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the average rail pressure is outside the expected range on the pressure sensor on the rail **B-9004** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty pressure sensor on the rail **B-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pressure sensor on the rail **B-9004**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the pressure sensor on the rail **B-9004** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the pressure sensor on the rail **B-9004** at connector **X-9026**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 42** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.

3. Check the pressure sensor on the rail **B-9004** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 42** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 42** | All pins in connector **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 62** | All pins in connector **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

B. If there is continuity on any of the checks, continue with Step **4**.

4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 7** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **5**.

   B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 7** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 6** | All pins in connector **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 7** | All pins in connector **X-9138B** | There should be no continuity |
| **X-9026 (Receptacle) pin 2** | All pins in connector **X-9026** | There should be no continuity |
| **X-9026 (Receptacle) pin 3** | All pins in connector **X-9026** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short to circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the pressure sensor on the rail **B-9004** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | **X-9026 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 42** | **X-9026 (Receptacle) pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-9026 (Receptacle) pin 1** | There should be continuity |

   A. If there is no continuity on all the checks, continue with Step **8**.

   B. If there is continuity on any of the checks, continue with Step **7**.

7. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | **X-470 (Receptacle) pin 6** | There should be continuity |
| **X-EC1 (Receptacle) pin 42** | **X-470 (Receptacle) pin 7** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-470 (Receptacle) pin 5** | There should be continuity |

   A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Replace the pressure sensor on the rail **B-9004**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. continue with Step **9**.

   B. Fault is not active. Return the machine to normal operation.

9. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3916 (F-5571-16) - Fuel Pressure Relief Valve has Reached Maximum Allowed Open Time [113270431 - V4 - 31 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** and the duty cycle of the solenoid valve for fuel pressure regulation **Y-9000** to control the fuel supply operations. The Pressure Relief Valve (PRV) which is integrated with the fuel rail, will open in the event of excessive fuel rail pressure. The ECU **A-001** senses the counts and records the number and duration of PRV openings. When the ECU **A-001** senses that the PRV has been open for a duration greater than **5 h**, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the PRV has reached the maximum allowed open time.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty low pressure fuel lines, clogged fuel filter, faulty charge gear pump, faulty lift pump (if equipped).
3. Faulty solenoid valve for fuel pressure regulation **Y-9000**, internal failure.
4. Faulty PRV, internal failure.
5. Faulty pressure sensor on the rail **B-9004**, internal failure.
6. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pressure sensor on the rail **B-9004**, the solenoid valve for fuel pressure regulation **Y-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Use the Electronic Service Tool (EST) to check for other active fault codes related to fuel system, rail pressure or pressure relief valve.

   A. If no other faults are active, continue with Step **3**.

   B. If other faults are active, resolve them first and then return to this fault.
3. Check for any leakage, clogging or damage that would allow air to enter the low pressure side of the fuel system. Visually and tactually inspect the low pressure side of the fuel system for leaks, clogs or air entry damage. Inspect gear pump for appropriate pressure.

   A. If no leakage, clogging, air entry, damage or low gear pump pressure are found, continue with Step **4**.

   B. If any leakage, clogging, air entry, damage or low gear pump pressure are found, repair of replace fittings, filters, lines as needed.
4. Replace the solenoid valve for fuel pressure regulation **Y-9000**.

   Use the EST to check the status of this fault.

   A. Fault is active. Continue to Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. Replace the PRV.

Use the EST to check the status of this fault.

A. Fault is active. Continue to Step **6**.

B. Fault is not active. Return the machine to normal operation.

6. Replace the pressure sensor on the rail **B-9004**.

   Use the EST to check the status of this fault.

   A. Fault is active. Continue to Step **7**.

   B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3959 (5419-03) - Throttle Valve: SRC High for TVA Position [113270461 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle position sensor which is internal inside the throttle solenoid valve **Z-9001**. The throttle solenoid valve **Z-9001** shares the throttle valve position signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage is greater than **4.75 V** for more than **500 ms** on the throttle solenoid valve **Z-9001** signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the throttle solenoid valve **Z-9001** signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the throttle solenoid valve **Z-9001** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 16** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 98** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 8** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the checks, continue with Step **4**.
3. Check the throttle solenoid valve **Z-9001** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 16** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 98** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 8** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, continue with Step **4**.
4. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 41** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 42** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 37** | Chassis ground | There should be no voltage |

A. If there is no voltage on all the checks, continue with Step **5**.

B. If there is voltage on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 41** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 42** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 37** | All other pins on **X-9138B** | There should be no continuity |
| **X-9011 (Receptacle) pin 1** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 5** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 6** | All other pins on **X-9011** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the throttle solenoid valve **Z-9001** signal circuit for an open circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 16** | **X-9011 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 98** | **X-9011 (Receptacle) pin 5** | There should be continuity |
| **X-EC1 (Receptacle) pin 8** | **X-9011 (Receptacle) pin 6** | There should be continuity |

A. If there is continuity on all the checks, continue with Step **8**.

B. If there is no continuity on any of the checks, continue with Step **7**.

7. Locate the circuit for an open circuit.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 16** | **X-470 (Receptacle) pin 41** | There should be continuity |
| **X-EC1 (Receptacle) pin 98** | **X-470 (Receptacle) pin 42** | There should be continuity |
| **X-EC1 (Receptacle) pin 8** | **X-470 (Receptacle) pin 37** | There should be continuity |

A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Replace the throttle solenoid valve **Z-9001**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **9**.

   B. Fault is not active. Return the machine to normal operation.

9. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3960 (5417-04) - Throttle Valve Actuator Position Sensor Voltage is Lower than Expected [113270389 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle position sensor which is internal inside the throttle solenoid valve **Z-9001**. The throttle solenoid valve **Z-9001** shares the throttle valve position signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage is less than **250 mV** for more than **500 ms** on the throttle solenoid valve **Z-9001** signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the throttle solenoid valve **Z-9001** signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the throttle solenoid valve **Z-9001** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 16** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 98** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 8** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 16** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 98** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 8** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.

3. Check the throttle solenoid valve **Z-9001** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 41** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 42** | Chassis ground | There should be no continuity |

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 37** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 41** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 42** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 37** | All other pins on **X-9138B** | There should be no continuity |
| **X-9011 (Receptacle) pin 1** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 5** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 6** | All other pins on **X-9011** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9011** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the throttle solenoid valve **Z-9001**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3985 (1209-03) - Exhaust Gas Pressure Sensor Voltage is Higher than Expected [113270433 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas pressure sensor **B-9005**. The exhaust gas pressure sensor **B-9005** shares the exhaust gas pressure value with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage above normal on the exhaust gas pressure sensor **B-9005** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the exhaust gas pressure sensor **B-9005** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty exhaust gas pressure sensor **B-9005**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas pressure sensor **B-9005**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the exhaust gas pressure sensor **B-9005** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas pressure sensor **B-9005** at connector **X-9018**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 36** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 63** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the checks, continue with Step **4**.
3. Check the exhaust gas pressure sensor **B-9005** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 36** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 63** | All other pins on **X-EC2** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, continue with Step **4**.
4. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 21** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 22** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 23** | Chassis ground | There should be no voltage |

A. If there is no voltage on all the checks, continue with Step **5**.

B. If there is voltage on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9018** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 21** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 22** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 23** | All other pins on **X-9138B** | There should be no continuity |
| **X-9018 pin 1** | All other pins on **X-9018** | There should be no continuity |
| **X-9018 pin 2** | All other pins on **X-9018** | There should be no continuity |
| **X-9018 pin 3** | All other pins on **X-9018** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to power in the connector harness (between **X-470** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9018** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the exhaust gas pressure sensor **B-9005**, reconnect the connectors, then recheck the status of this fault.

A. Fault is active. Continue with Step **7**.

B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 3986 (1209-04) - Exhaust Gas Pressure Sensor Voltage Is Lower Than Expected [113270375 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas pressure sensor **B-9005**. The exhaust gas pressure sensor **B-9005** shares the exhaust gas pressure value with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage below normal on the exhaust gas pressure sensor **B-9005** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the exhaust gas pressure sensor **B-9005** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty exhaust gas pressure sensor **B-9005**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas pressure sensor **B-9005**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the exhaust gas pressure sensor **B-9005** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas pressure sensor **B-9005** at connector **X-9018**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 36** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 63** | All other pins on **X-EC2** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.

3. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 21** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 22** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 23** | All other pins on **X-9138B** | There should be no continuity |
| **X-9018 pin 1** | All other pins on **X-9018** | There should be no continuity |
| **X-9018 pin 2** | All other pins on **X-9018** | There should be no continuity |
| **X-9018 pin 3** | All other pins on **X-9018** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-470** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9138B** and **X-9018** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the exhaust gas pressure sensor **B-9005**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17006 (355-31) - Engine Oil Change Interval Time Expired [113334026 - V3 - 24 January 2025]

## Control Module: ECU

**Fault Description:**
This fault is for information purposes only and no actions are required. When the Engine Control Unit (ECU) **A-001** senses that the engine oil change interval time has expired, this fault will occur. Changing the engine oil at regular intervals of time prevents from the fault code to occur. If the fault code persists again, submit a Technical Help Desk (THD) before replacing the ECU **A-001**.

# 17008 (516396-10) - Rail Pressure Relief Valve Kick-Off Opening Time High [113334019 - V3 - 24 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Pressure Relief Valve (PRV) to control the engine operations. The PRV which is integrated in the fuel line, opens if excessive pressure is present in the rail. The ECU **A-001** detects, counts and records the number and the duration of PRV openings. When the ECU **A-001** senses that the PRV remained open for too long, this fault will occur.

**Cause:**
The ECU **A-001** has recorded a PRV opening for too long.

**Possible failure modes:**

1. Faulty fuel metering unit **Y-9000**, internal failure.
2. Faulty PRV, internal failure.
3. Faulty rail pressure sensor **B-9004**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the fuel metering unit **Y-9000**, the PRV, the rail pressure sensor **B-9004**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active. Resolve them first then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check that there are no leaks, obstructions or damage that could allow air to enter the low pressure side of the fuel system.

   Visually check and inspect the low pressure side of the supply system to check that there are no leaks, obstructions or damage due to air entry.

   Inspect the gear pump to verify that the pressure is correct.

   If any leakage, clogging, air entry, damage or low gear pump pressure is found, repair or replace the fittings, filters, lines as required.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Replace the fuel metering unit **Y-9000**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. Replace the PRV, reconnect the connectors, then recheck the status of this fault.

A. Fault is active. Continue with Step **6**.

B. Fault is not active. Return the machine to normal operation.

6. Replace the rail pressure sensor **B-9004**, reconnect the connectors, then recheck the status of this fault.

A. Fault is active. Continue with Step **7**.

B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17009 (97-16) - Water In Fuel Detected (Moderate Severe) [113334023 - V4 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Water In Fuel (WIF) sensor **B-007** to control the machine's operations. The ECU **A-001** monitors the voltage output from the WIF sensor **B-007** to determine if water is present in the fuel supply. If water is detected in the fuel, warnings will be displayed to alert the operator of potential engine damage if operation continues. When the ECU **A-001** senses that the ground signal is "active" longer than **6 s** from the WIF sensor **B-007** indicates water is present, this fault will occur. .

**Cause:**
The ECU **A-001** has detected the excess water on the fuel system or a fault on the WIF sensor **B-007** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty WIF sensor **B-007**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the WIF sensor **B-007**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the fuel for water contamination.

   A. If there is water contamination, continue with Step **3**.

   B. If there is no water contamination, Return the machine to normal operation.
3. Verify proper WIF sensor **B-007** operation.

   Purge fuel supply system, replace fuel filters and refill with fuel that is free of water contamination.

   Start and run the engine for **5 min**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the WIF sensor **B-007** supply circuit.

   Using a multimeter back probe the harness from the WIF sensor **B-007** at connector **X-463**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-463 pin 3** | Chassis ground | There should be approximately **5 V** |

   A. If there is approximately **5 V**, continue with Step **5**.

B. If there is not approximately **5 V**, check the fuse and circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reinstall the fuse, reconnect the connectors, recheck the voltage, then return the machine to normal operation.

5. Check the WIF sensor **B-007** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the WIF sensor **B-007** at connector **X-463**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 70** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **6**.

   B. If there is voltage, there is a short to power in the connector harness (between **X-EC2** and **X-463** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

6. Check the WIF sensor **B-007** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 70** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 70** | All other pins on **X-EC2** | There should be no continuity |
| **X-463 pin 1** | All other pins on **X-463** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **7**.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-EC2** and **X-463** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

7. Check the WIF sensor **B-007** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 70** | **X-463 pin 1** | There should be continuity |

   A. If there is continuity, continue with Step **8**.

   B. If there is no continuity, there is an open circuit in the connector harness (between **X-EC2** and **X-463** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Check the WIF sensor **B-007** ground circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-463 pin 2** | Chassis ground | There should be continuity |

   A. If there is continuity, continue with Step **9**.

   B. If there is no continuity, there is an open circuit in the ground circuit harness. Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

9. Replace the WIF sensor **B-007**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **10**.

   B. Fault is not active. Return the machine to normal operation.

10. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17010 (5571-20) - Rail Fuel Pressure Relief Valve Open [113334017 - V4 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the rail pressure sensor **B-9004** to control the engine operations. To determine mechanical exhaustion, the pressure relief valve can be forced to open by performing a rail pressure shock defined in two stages: waiting for the rail pressure to rise and performing pressure shocks. The two steps are recorded in the fault memory. Pressure shock is only possible in a defined range of engine speed/injection quantity. The ECU **A-001** reports the error when the pressure shock is rejected because the amount of fuel is outside the predetermined range. When the ECU **A-001** senses a pressure shock request outside of the possible range due to the rail pressure sensor **B-9004** failure, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the rail pressure sensor **B-9004** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty rail pressure sensor **B-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the rail pressure sensor **B-9004**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the rail pressure sensor **B-9004** for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the rail pressure sensor **B-9004** at connector **X-9026**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 42** | **X-9026 (Receptacle) pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 62** | **X-9026 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-9026 (Receptacle) pin 1** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **4**.

   B. If there is no continuity on any of the checks, continue with Step **3**.

3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 42** | **X-470 (Receptacle) pin 7** | There should be continuity |
| **X-EC1 (Receptacle) pin 62** | **X-470 (Receptacle) pin 6** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-470 (Receptacle) pin 5** | There should be continuity |

A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-9026** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the rail pressure sensor **B-9004**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17011 (516396-07) - Rail Pressure Sensor Plausibility Fault Detected at Engine Restart [113334015 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the rail pressure sensor **B-9004** to control the engine operations. When the ECU **A-001** senses a five or more pressure jumps of greater than **0.25 bar** (**3.62 psi**) within **10.00 ms** and the time between the pressure jumps is less than **300 ms**, this fault will occur. The counter will reset to zero if the time between the pressure jumps is greater than **300 ms**.

**Cause:**
The ECU **A-001** has detected a short or open circuit condition on the rail pressure sensor **B-9004** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty rail pressure sensor **B-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the rail pressure sensor **B-9004**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the rail pressure sensor **B-9004** for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the rail pressure sensor **B-9004** at connector **X-9026**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 42** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 63** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the checks, continue with Step **4**.

3. Check the rail pressure sensor **B-9004** for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 42** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 63** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 42** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 62** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 63** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

B. If there is continuity on any of the checks, continue with Step **4**.

4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 5** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 7** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **5**.

   B. If there is voltage on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 5** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 7** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 5** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 6** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 7** | All other pins on **X-9138B** | There should be no continuity |
| **X-9026 (Receptacle) pin 1** | All other pins on **X-9026** | There should be no continuity |
| **X-9026 (Receptacle) pin 2** | All other pins on **X-9026** | There should be no continuity |
| **X-9026 (Receptacle) pin 3** | All other pins on **X-9026** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the rail pressure sensor **B-9004** for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 42** | **X-9026 (Receptacle) pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 62** | **X-9026 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-9026 (Receptacle) pin 1** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **8**.

   B. If there is no continuity on any of the checks, continue with Step **7**.

7. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 42** | **X-470 (Receptacle) pin 7** | There should be continuity |
| **X-EC1 (Receptacle) pin 62** | **X-470 (Receptacle) pin 6** | There should be continuity |

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 63** | **X-470 (Receptacle) pin 5** | There should be continuity |

A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Replace the rail pressure sensor **B-9004**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **9**.

   B. Fault is not active. Return the machine to normal operation.

9. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17296 (2791-31) - EGR Valve DC Motor is Limited at the Maximum Allowed Current [113270284 - V6 - 19 December 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the EGR solenoid valve **Z-9000** to control the engine operations. When the ECU **A-001** senses the current exceeds the limit of **1.76 A** for longer than debounce time on the EGR solenoid valve **Z-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the current has exceeded the set threshold on the EGR solenoid valve **Z-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 88** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 67** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.
3. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 88** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 67** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **4**.
4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 30** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 29** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 30** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 29** | All other pins on **X-9138B** | There should be no continuity |
| **X-9010 (Receptacle) pin 5** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 1** | All other pins on **X-9010** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check for a mechanical block in the EGR solenoid valve **Z-9000** and repair as required.

Use the Electronic Service Tool (EST) to recheck the status of this fault.

A. Fault is active. Continue with Step **7**.

B. Fault is not active. Return the machine to normal operation.

7. Connect the Electronic Service Tool (EST) and perform the "EGR Valve Test".

Click the "START Test" button and follow the on-screen instructions.

A. Test results indicate that the EGR valve is working properly. Continue with Step **8**.

B. Test results indicate that the EGR valve is not working properly. Replace the EGR valve.

8. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17303 (516445-05) - EGR Valve Control Circuit Open [113270475 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) solenoid valve **Z-9000** to control the engine operations. When the ECU **A-001** fails to receive a signal from the EGR solenoid valve **Z-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the EGR solenoid valve **Z-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the EGR solenoid valve **Z-9000** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 88** | **X-9010 (Receptacle) pin 5** | There should be continuity |
| **X-EC1 (Receptacle) pin 67** | **X-9010 (Receptacle) pin 1** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **4**.

   B. If there is no continuity on either check, continue with Step **3**.

3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 88** | **X-470 (Receptacle) pin 30** | There should be continuity |
| **X-EC1 (Receptacle) pin 67** | **X-470 (Receptacle) pin 29** | There should be continuity |

   A. If there is continuity on both check, there is an open circuit in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the EGR solenoid valve **Z-9000**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17304 (519197-06) - EGR Valve H-Bridge Control Circuit Over Current [113270286 - V7 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) solenoid valve **Z-9000** to control the engine operations. The H-Bridge has 2 switches (high side and low side). When the ECU **A-001** senses an overcurrent error on the EGR solenoid valve **Z-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an overcurrent error on the EGR solenoid valve **Z-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 79** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 78** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 88** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the checks, continue with Step **4**.
3. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 79** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 78** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 88** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, continue with Step **4**.
4. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 34** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 35** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 30** | Chassis ground | There should be no voltage |

A. If there is no voltage on all the checks, continue with Step **5**.

B. If there is voltage on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 34** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 35** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 30** | All other pins on **X-9138B** | There should be no continuity |
| **X-9010 (Receptacle) pin 2** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 4** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 5** | All other pins on **X-9010** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the EGR solenoid valve **Z-9000**, reconnect the connectors, then recheck the status of this fault.

A. Fault is active. Continue with Step **7**.

B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17305 (519198-06) - EGR Valve H-Bridge Control Circuit Over Temperature [113270577 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) sensor which is internal inside the EGR solenoid valve **Z-9000**. When the ECU **A-001** senses an overtemperature error on the EGR solenoid valve **Z-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an overtemperature error on the EGR solenoid valve **Z-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, the fuse (if applicable) and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the EGR solenoid valve **Z-9000** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 67** | **X-9010 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 88** | **X-9010 (Receptacle) pin 5** | There should be continuity |
| **X-EC1 (Receptacle) pin 78** | **X-9010 (Receptacle) pin 4** | There should be continuity |
| **X-EC1 (Receptacle) pin 79** | **X-9010 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 40** | **X-9010 (Receptacle) pin 6** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **4**.

   B. If there is no continuity on any of the checks, continue with Step **3**.

3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 67** | **X-470 (Receptacle) pin 29** | There should be continuity |
| **X-EC1 (Receptacle) pin 88** | **X-470 (Receptacle) pin 30** | There should be continuity |
| **X-EC1 (Receptacle) pin 78** | **X-470 (Receptacle) pin 35** | There should be continuity |
| **X-EC1 (Receptacle) pin 79** | **X-470 (Receptacle) pin 34** | There should be continuity |
| **X-EC1 (Receptacle) pin 40** | **X-470 (Receptacle) pin 33** | There should be continuity |

A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the EGR solenoid valve **Z-9000**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17306 (516445-03) - EGR Valve H-Bridge Control Circuit 1 Shorted to Battery [113270525 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) solenoid valve **Z-9000** to control the engine operations. The H-Bridge has 2 switches (high side and low side). Each circuit is monitored separately and a short circuit to battery is signalled on Out1. When the ECU **A-001** senses a voltage above normal on the EGR solenoid valve **Z-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the EGR solenoid valve **Z-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 88** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 67** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.
3. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 88** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 67** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **4**.
4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 30** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 29** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 30** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 29** | All other pins on **X-9138B** | There should be no continuity |
| **X-9010 (Receptacle) pin 5** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 1** | All other pins on **X-9010** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the EGR solenoid valve **Z-9000**, reconnect the connectors, then recheck the status of this fault.

A. Fault is active. Continue with Step **7**.

B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17307 (519198-03) - EGR Valve H-Bridge Control Circuit 2 Shorted to Battery [113270399 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) solenoid valve **Z-9000** to control the engine operations. The H-Bridge has 2 switches (high side and low side). Each circuit is monitored separately and a short circuit to battery is signalled on Out2. When the ECU **A-001** senses a voltage above normal on the EGR solenoid valve **Z-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the EGR solenoid valve **Z-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, the fuse (if applicable) and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 79** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 78** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both the checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.
3. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 79** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 78** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both the checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **4**.
4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 34** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 35** | Chassis ground | There should be no voltage |

A. If there is no voltage on both the checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 34** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 35** | All other pins on **X-9138B** | There should be no continuity |
| **X-9010 (Receptacle) pin 2** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 4** | All other pins on **X-9010** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the EGR solenoid valve **Z-9000**, reconnect the connectors, then recheck the status of this fault.

A. Fault is active. Continue with Step **7**.

B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17308 (516445-04) - EGR Valve H-Bridge Control Circuit 1 Shorted to Ground [113270503 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) solenoid valve **Z-9000** to control the engine operations. The H-Bridge has 2 switches (high side and low side). Each circuit is monitored separately and a short to ground is signalled on Out1. When the ECU **A-001** senses a voltage below normal on the EGR solenoid valve **Z-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the EGR solenoid valve **Z-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the EGR solenoid valve **Z-9000** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 88** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 67** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 88** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 67** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.

3. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 30** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 29** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 30** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 29** | All other pins on **X-9138B** | There should be no continuity |
| **X-9010 (Receptacle) pin 5** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 1** | All other pins on **X-9010** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9010** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the EGR solenoid valve **Z-9000**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17309 (519198-04) - EGR Valve H-Bridge Control Circuit 2 Shorted to Ground [113270348 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) solenoid valve **Z-9000** to control the engine operations. The H-Bridge has 2 switches (high side and low side). Each circuit is monitored separately and a short to ground is signalled on Out2. When the ECU **A-001** senses a voltage below normal on the EGR solenoid valve **Z-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the EGR solenoid valve **Z-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the EGR solenoid valve **Z-9000** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 40** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 79** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 40** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 79** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 33** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 34** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 33** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 34** | All other pins on **X-9138B** | There should be no continuity |
| **X-9010 (Receptacle) pin 6** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 2** | All other pins on **X-9010** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9010** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the EGR solenoid valve **Z-9000**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17310 (519199-06) - EGR Valve Control Circuit Over Load [113270477 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) solenoid valve **Z-9000** to control the engine operations. An overload error is not directly detectable if the wiring length is greater than 1m and the fault occurs close to the actuator. Therefore, a plausibility check is required if a "Short Circuit to Battery" (SCB) or "Short Circuit to Ground" (SCG) fault is detected. Therefore the switch (low side in the case of SCB, high side in the case of SCG) is closed. If the short circuit fault disappears, it is cleared and the short circuit overload fault is activated. In the event of a short circuit to ground fault, the high side switches are closed. If there is no longer a short circuit to ground fault, it is detected as a short circuit overload fault. In the event of a short circuit to battery error, the switches on the lower side are closed. If there is no longer a short circuit to battery error, it is detected as a short circuit overload error. If a short circuit overload fault is detected, the pre-existing SCG / SCB fault is resolved. When the ECU **A-001** senses an overload error on the EGR solenoid valve **Z-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an overload error on the EGR solenoid valve **Z-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short circuit.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 67** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 88** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 78** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 79** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 40** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the checks, continue with Step **4**.
3. Check the EGR solenoid valve **Z-9000** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 67** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 88** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 78** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 79** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 40** | All other pins on **X-EC1** | There should be no continuity |

A. If there is no continuity on all the checks, continue with Step **6**.

B. If there is continuity on any of the checks, continue with Step **4**.

4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 29** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 30** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 35** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 34** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 33** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **5**.

   B. If there is voltage on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 29** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 30** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 35** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 34** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 33** | All other pins on **X-9138B** | There should be no continuity |
| **X-9010 (Receptacle) pin 1** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 5** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 4** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 2** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 6** | All other pins on **X-9010** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the EGR solenoid valve **Z-9000**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **7**.

   B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17312 (519199-05) - EGR Valve Control Circuit Supply Voltage Too Low [113270543 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) sensor which is internal inside the EGR solenoid valve **Z-9000**. When the ECU **A-001** senses the voltage below the permitted threshold on the EGR solenoid valve **Z-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the EGR solenoid valve **Z-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, the fuse (if applicable) and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the EGR solenoid valve **Z-9000** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 67** | **X-9010 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 88** | **X-9010 (Receptacle) pin 5** | There should be continuity |

   A. If there is continuity on both the checks, continue with Step **4**.

   B. If there is no continuity on either check, continue with Step **3**.

3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 67** | **X-470 (Receptacle) pin 29** | There should be continuity |
| **X-EC1 (Receptacle) pin 88** | **X-470 (Receptacle) pin 30** | There should be continuity |

   A. If there is continuity on both the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the EGR solenoid valve **Z-9000**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17322 (2791-00) - EGR Valve Position Sensor Voltage is Higher than Expected [113270527 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) sensor which is internal inside the EGR solenoid valve **Z-9000**. The EGR solenoid valve **Z-9000** shares the EGR valve position signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage greater than **4.86 V** for more than **500 ms** on the EGR solenoid valve **Z-9000** pressure signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the EGR solenoid valve **Z-9000** pressure signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 78** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 79** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 40** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the checks, continue with Step **4**.
3. Check the EGR solenoid valve **Z-9000** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 78** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 79** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 40** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, continue with Step **4**.
4. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 35** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 34** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 33** | Chassis ground | There should be no voltage |

A. If there is no voltage on all the checks, continue with Step **5**.

B. If there is voltage on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 35** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 34** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 33** | All other pins on **X-9138B** | There should be no continuity |
| **X-9010 (Receptacle) pin 2** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 6** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 4** | All other pins on **X-9010** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the EGR solenoid valve **Z-9000** signal circuit for an open circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 78** | **X-9010 (Receptacle) pin 4** | There should be continuity |
| **X-EC1 (Receptacle) pin 79** | **X-9010 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 40** | **X-9010 (Receptacle) pin 6** | There should be continuity |

A. If there is continuity on all the checks, continue with Step **8**.

B. If there is no continuity on any of the checks, continue with Step **7**.

7. Locate the circuit for an open circuit.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 78** | **X-470 (Receptacle) pin 35** | There should be continuity |
| **X-EC1 (Receptacle) pin 79** | **X-470 (Receptacle) pin 34** | There should be continuity |
| **X-EC1 (Receptacle) pin 40** | **X-470 (Receptacle) pin 33** | There should be continuity |

A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9010** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Replace the EGR solenoid valve **Z-9000**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **9**.

   B. Fault is not active. Return the machine to normal operation.

9. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17323 (2791-01) - EGR Valve Position Sensor Voltage is Lower than Expected [113270505 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) sensor which is internal inside the EGR solenoid valve **Z-9000**. The EGR solenoid valve **Z-9000** shares the EGR valve position signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a voltage less than **253.20 mV** for more than **500 ms** on the EGR solenoid valve **Z-9000** pressure signal circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the EGR solenoid valve **Z-9000** pressure signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the EGR solenoid valve **Z-9000** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the EGR solenoid valve **Z-9000** at connector **X-9010**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 78** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 79** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 40** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 78** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 79** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 40** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Check the EGR solenoid valve **Z-9000** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 35** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 34** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 33** | Chassis ground | There should be no continuity |

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 35** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 34** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 33** | All other pins on **X-9138B** | There should be no continuity |
| **X-9010 (Receptacle) pin 4** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 2** | All other pins on **X-9010** | There should be no continuity |
| **X-9010 (Receptacle) pin 6** | All other pins on **X-9010** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9010** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the EGR solenoid valve **Z-9000**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17345 (518500-19) - Glow Plugs: DFC for Faulty Diagnostic Data Transmission or Protocol Error [113270507 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the correct operation of the preheating glow plug control unit **A-010**. If there is a relay between the ECU **A-001** and the glow plug, the fault may be caused by the relay and not the glow plug. If there is no smart relay, an electrical fault in the glow plug cannot be detected. When the ECU **A-001** senses a diagnostic data transmission or a protocol error, this fault will occur.

**Cause:**
The ECU **A-001** has detected a diagnostic data transmission or a protocol error on the preheating glow plug control unit **A-010** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty preheating glow plug **R-9001**, internal failure.
3. Faulty preheating glow plug **R-9002**, internal failure.
4. Faulty preheating glow plug **R-9003**, internal failure.
5. Faulty preheating glow plug **R-9004**, internal failure.
6. Faulty preheating glow plug control unit **A-010**, internal failure.
7. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the preheating glow plug control unit **A-010**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the preheating glow plug control unit **A-010** circuit for an open circuit.

   Disconnect the harness from the preheating glow plug control unit **A-010** at connector **X-469**.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 53** | **X-469 pin 3** | There should be continuity |
| **X-EC2 (Receptacle) pin 57** | **X-469 pin 8** | There should be continuity |
| **X-EC2 (Receptacle) pin 26** | **X-469 pin 5** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **3**.

   B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-469** and **X-EC2** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

3. Replace the preheating glow plugs **R-9001**, **R-9002**, **R-9003** and **R-9004** one at a time and then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

B. Fault is not active. Return the machine to normal operation.

4. Replace the preheating glow plug control unit **A-010**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17347 (676-05) - Glow plugs: No Load Error for Low Voltage System [113270489 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the correct operation of the preheating glow plug control unit **A-010**. If there is a relay between the ECU **A-001** and the glow plug, the fault may be caused by the relay and not the glow plug. If there is no smart relay, an electrical fault in the glow plug cannot be detected. When the ECU **A-001** senses an open circuit on the preheating glow plug control unit **A-010** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit on the preheating glow plug control unit **A-010** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty preheating glow plug **R-9001**, internal failure.
3. Faulty preheating glow plug **R-9002**, internal failure.
4. Faulty preheating glow plug **R-9003**, internal failure.
5. Faulty preheating glow plug **R-9004**, internal failure.
6. Faulty preheating glow plug control unit **A-010**, internal failure.
7. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the preheating glow plug control unit **A-010**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the preheating glow plug control unit **A-010** circuit for an open circuit.

   Disconnect the harness from the preheating glow plug control unit **A-010** at connector **X-469**.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 53** | **X-469 pin 3** | There should be continuity |
| **X-EC2 (Receptacle) pin 57** | **X-469 pin 8** | There should be continuity |
| **X-EC2 (Receptacle) pin 26** | **X-469 pin 5** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **3**.

   B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-469** and **X-EC2** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

3. Check the glow plugs circuit for an open circuit.

   Disconnect the harness connector **X-9040A** from the harness connector **X-9040B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-469 pin 6** | **X-9040A pin 1** | There should be continuity |
| **X-469 pin 1** | **X-9040A pin 2** | There should be continuity |
| **X-469 pin 7** | **X-9040A pin 3** | There should be continuity |
| **X-469 pin 2** | **X-9040A pin 4** | There should be continuity |

A. If there is continuity on all the checks, continue with Step **5**.

B. If there is no continuity on any of the checks, continue with Step **4**.

4. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-469 pin 6** | **X-470 (Receptacle) pin 57** | There should be continuity |
| **X-469 pin 1** | **X-470 (Receptacle) pin 58** | There should be continuity |
| **X-469 pin 7** | **X-470 (Receptacle) pin 60** | There should be continuity |
| **X-469 pin 2** | **X-470 (Receptacle) pin 61** | There should be continuity |

   A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9040A** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-469** and **X-470** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Replace the preheating glow plugs **R-9001**, **R-9002**, **R-9003** and **R-9004** one at a time and then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Replace the preheating glow plug control unit **A-010** then recheck the status of this fault.

   A. Fault is active. Continue with Step **7**.

   B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17348 (676-06) - Glow Plugs: Over Temperature Error on ECU Powerstage for Glow Plug Low Voltage System [113270579 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the correct operation of the preheating glow plug control unit **A-010**. If there is a relay between the ECU **A-001** and the glow plug, the fault may be caused by the relay and not the glow plug. If there is no smart relay, an electrical fault in the glow plug cannot be detected. When the ECU **A-001** senses an over temperature error on the preheating glow plug control unit **A-010** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an over temperature error on the preheating glow plug control unit **A-010** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short circuit.
2. Faulty preheating glow plug **R-9001**, internal failure.
3. Faulty preheating glow plug **R-9002**, internal failure.
4. Faulty preheating glow plug **R-9003**, internal failure.
5. Faulty preheating glow plug **R-9004**, internal failure.
6. Faulty preheating glow plug control unit **A-010**, internal failure.
7. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the preheating glow plug control unit **A-010**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the preheating glow plug control unit **A-010** circuit for a short to power.

   Disconnect the harness from the preheating glow plug control unit **A-010** at connector **X-469**.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 53** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 57** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 26** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the checks, there is a short to power in the connector harness (between **X-469** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

3. Check the preheating glow plug control unit **A-010** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 53** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 57** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 26** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 53** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 57** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 26** | All other pins on **X-EC2** | There should be no continuity |

A. If there is no continuity on all the checks, continue with Step **4**.

B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-469** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the preheating glow plugs **R-9001**, **R-9002**, **R-9003** and **R-9004** one at a time and then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Replace the preheating glow plug control unit **A-010** then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17349 (676-03) - Glow Plugs: Short Circuit to Battery Error for Low Voltage System [113270416 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the correct operation of the preheating glow plug control unit **A-010**. If there is a relay between the ECU **A-001** and the glow plug, the fault may be caused by the relay and not the glow plug. If there is no smart relay, an electrical fault in the glow plug cannot be detected. When the ECU **A-001** senses the voltage above normal on the preheating glow plug control unit **A-010** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the preheating glow plug control unit **A-010** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty preheating glow plug **R-9001**, internal failure.
3. Faulty preheating glow plug **R-9002**, internal failure.
4. Faulty preheating glow plug **R-9003**, internal failure.
5. Faulty preheating glow plug **R-9004**, internal failure.
6. Faulty preheating glow plug control unit **A-010**, internal failure.
7. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the preheating glow plug control unit **A-010**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the preheating glow plug control unit **A-010** circuit for a short to power.

   Disconnect the harness from the preheating glow plug control unit **A-010** at connector **X-469**.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 53** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 57** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 26** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the checks, there is a short to power in the connector harness (between **X-469** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

3. Check the preheating glow plug control unit **A-010** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 53** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 57** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 26** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 53** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 57** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 26** | All other pins on **X-EC2** | There should be no continuity |
| **X-469 pin 3** | All other pins on **X-469** | There should be no continuity |
| **X-469 pin 8** | All other pins on **X-469** | There should be no continuity |
| **X-469 pin 5** | All other pins on **X-469** | There should be no continuity |

A. If there is no continuity on all the checks, continue with Step **4**.

B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-469** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the preheating glow plugs **R-9001**, **R-9002**, **R-9003** and **R-9004** one at a time and then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Replace the preheating glow plug control unit **A-010** then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17350 (676-04) - Glow Plugs: Short Circuit to Ground Error for Low Voltage System [113270359 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the correct operation of the preheating glow plug control unit **A-010**. If there is a relay between the ECU **A-001** and the glow plug, the fault may be caused by the relay and not the glow plug. If there is no smart relay, an electrical fault in the glow plug cannot be detected. When the ECU **A-001** senses the voltage is below normal on the preheating glow plug control unit **A-010** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the preheating glow plug control unit **A-010** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty preheating glow plug **R-9001**, internal failure.
3. Faulty preheating glow plug **R-9002**, internal failure.
4. Faulty preheating glow plug **R-9003**, internal failure.
5. Faulty preheating glow plug **R-9004**, internal failure.
6. Faulty preheating glow plug control unit **A-010**, internal failure.
7. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the preheating glow plug control unit **A-010**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the preheating glow plug control unit **A-010** circuit for a short to ground.

   Disconnect the harness from the preheating glow plug control unit **A-010** at connector **X-469**.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 53** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 57** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 26** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 53** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 57** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 26** | All other pins on **X-EC2** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **3**.

   B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-469** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

3. Replace the preheating glow plugs **R-9001**, **R-9002**, **R-9003** and **R-9004** one at a time and then recheck the status of this fault.

A. Fault is active. Continue with Step **4**.

B. Fault is not active. Return the machine to normal operation.

4. Replace the preheating glow plug control unit **A-010** then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17359 (5324-04) - Glow Plug 1 Control Circuit Shorted to Ground [113270529 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the correct operation of the glow plug control unit **A-010**. If there is a relay between the ECU **A-001** and the glow plug, the fault may be caused by the relay and not the glow plug. If there is no smart relay, an electrical fault in the glow plug cannot be detected. When the ECU **A-001** senses the over current condition on the pre-heating glow plug **R-9001**, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the pre-heating glow plug **R-9001**.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty pre-heating glow plug **R-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pre-heating glow plug **R-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the preheating glow plug control unit **A-010** circuit for a short to ground.

   Disconnect the harness from the preheating glow plug control unit **A-010** at the connector **X-469**.

   Disconnect the harness connector **X-9040A** from the harness connector **X-9040B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-469 pin 2** | Chassis ground | There should be no continuity |
| **X-469 pin 2** | All other pins on **X-469** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **4**.

   B. If there is continuity on either check, continue with Step **3**.

3. Check the preheating glow plug control unit **A-010** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 61** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 61** | All other pins on **X-9138B** | There should be no continuity |

   A. If there is no continuity on both checks, there is a short to ground in the connector harness (between **X-470** and **X-469** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to ground in the connector harness (between **X-9138B** and **X-9040A** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the pre-heating glow plug **R-9001**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17360 (5325-04) - Glow Plug 3 Control Circuit Shorted to Ground [113270418 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the correct operation of the glow plug control unit **A-010**. If there is a relay between the ECU **A-001** and the glow plug, the fault may be caused by the relay and not the glow plug. If there is no smart relay, an electrical fault in the glow plug cannot be detected. When the ECU **A-001** senses the over current condition on the pre-heating glow plug **R-9003**, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the pre-heating glow plug **R-9003**.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty pre-heating glow plug **R-9003**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pre-heating glow plug **R-9003**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the preheating glow plug control unit **A-010** circuit for a short to ground.

   Disconnect the harness from the preheating glow plug control unit **A-010** at the connector **X-469**.

   Disconnect the harness connector **X-9040A** from the harness connector **X-9040B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-469 pin 1** | Chassis ground | There should be no continuity |
| **X-469 pin 1** | All other pins on **X-469** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **4**.

   B. If there is continuity on either check, continue with Step **3**.

3. Check the preheating glow plug control unit **A-010** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 58** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 58** | All other pins on **X-9138B** | There should be no continuity |

   A. If there is no continuity on both checks, there is a short to ground in the connector harness (between **X-470** and **X-469** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to ground in the connector harness (between **X-9138B** and **X-9040A** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the pre-heating glow plug **R-9003**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17361 (5326-04) - Glow Plug 4 Control Circuit Shorted to Ground [113270509 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the correct operation of the glow plug control unit **A-010**. If there is a relay between the ECU **A-001** and the glow plug, the fault may be caused by the relay and not the glow plug. If there is no smart relay, an electrical fault in the glow plug cannot be detected. When the ECU **A-001** senses the over current condition on the pre-heating glow plug **R-9004**, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the pre-heating glow plug **R-9004**.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty pre-heating glow plug **R-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pre-heating glow plug **R-9004**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the preheating glow plug control unit **A-010** circuit for a short to ground.

   Disconnect the harness from the preheating glow plug control unit **A-010** at the connector **X-469**.

   Disconnect the harness connector **X-9040A** from the harness connector **X-9040B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-469 pin 6** | Chassis ground | There should be no continuity |
| **X-469 pin 6** | All other pins on **X-469** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **4**.

   B. If there is continuity on either check, continue with Step **3**.

3. Check the preheating glow plug control unit **A-010** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 57** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 57** | All other pins on **X-9138B** | There should be no continuity |

   A. If there is no continuity on both checks, there is a short to ground in the connector harness (between **X-470** and **X-469** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to ground in the connector harness (between **X-9138B** and **X-9040A** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the pre-heating glow plug **R-9004**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17362 (5327-04) - Glow Plug 2 Control Circuit Shorted to Ground [113270491 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the correct operation of the glow plug control unit **A-010**. If there is a relay between the ECU **A-001** and the glow plug, the fault may be caused by the relay and not the glow plug. If there is no smart relay, an electrical fault in the glow plug cannot be detected. When the ECU **A-001** senses the over current condition on the pre-heating glow plug **R-9002**, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the pre-heating glow plug **R-9002**.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty pre-heating glow plug **R-9002**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the pre-heating glow plug **R-9002**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the preheating glow plug control unit **A-010** circuit for a short to ground.

   Disconnect the harness from the preheating glow plug control unit **A-010** at the connector **X-469**.

   Disconnect the harness connector **X-9040A** from the harness connector **X-9040B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-469 pin 7** | Chassis ground | There should be no continuity |
| **X-469 pin 7** | All other pins on **X-469** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **4**.

   B. If there is continuity on either check, continue with Step **3**.

3. Check the preheating glow plug control unit **A-010** circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 60** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 60** | All other pins on **X-9138B** | There should be no continuity |

   A. If there is no continuity on both checks, there is a short to ground in the connector harness (between **X-470** and **X-469** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to ground in the connector harness (between **X-9138B** and **X-9040A** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the pre-heating glow plug **R-9002**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17430 (1136-16) - Engine Controller Internal Temperature Out of Range High [113270805 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the ECU temperature sensor, which is internal to the ECU **A-001**. High temperatures can damage the processor of the ECU **A-001** and one or more internal sensors which monitor the temperature. When the ECU **A-001** senses the temperature is higher than **129.96 °C**, this fault will occur.

**Cause:**
The ECU **A-001** has detected an excessively high temperature signal from the control unit.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Let the ECU **A-001** cool down.

   Use the Electronic Service Tool (EST) to confirm if other fault codes are active. Resolve them first then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17431 (1136-18) - Engine Controller Internal Temperature Out of Range Low [113270811 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the ECU temperature sensor, which is internal to the ECU **A-001**. Low temperatures can damage the processor of the ECU **A-001** and one or more internal sensors which monitor the temperature. When the ECU **A-001** senses the temperature is less than **-39.04 °C**, this fault will occur.

**Cause:**
The ECU **A-001** has detected an excessively low temperature signal from the control unit.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Take the vehicle to a place with a higher ambient temperature and wait for the engine control unit to reach the same temperature as the ambient temperature. Let the ECU **A-001** cool down.

   Use the Electronic Service Tool (EST) to confirm if other fault codes are active. Resolve them first then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17444 (520195-05) - Intake Throttle Valve: Open Load Error for Powerstage [113270501 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. The ECU **A-001** controls the throttle solenoid valve **Z-9001** with the Pulse Width Modulated (PWM) signal. When the ECU **A-001** senses a no voltage on the throttle solenoid valve **Z-9001** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the throttle solenoid valve **Z-9001** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the throttle solenoid valve **Z-9001** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 16** | **X-9011 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 98** | **X-9011 (Receptacle) pin 5** | There should be continuity |
| **X-EC1 (Receptacle) pin 97** | **X-9011 (Receptacle) pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 8** | **X-9011 (Receptacle) pin 6** | There should be continuity |
| **X-EC1 (Receptacle) pin 9** | **X-9011 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **4**.

   B. If there is no continuity on any of the checks, continue with Step **3**.

3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 41** | **X-9011 (Receptacle) pin 1** | There should be continuity |
| **X-9138B (Plug) pin 42** | **X-9011 (Receptacle) pin 5** | There should be continuity |
| **X-9138B (Plug) pin 43** | **X-9011 (Receptacle) pin 3** | There should be continuity |
| **X-9138B (Plug) pin 37** | **X-9011 (Receptacle) pin 6** | There should be continuity |
| **X-9138B (Plug) pin 38** | **X-9011 (Receptacle) pin 2** | There should be continuity |

A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the throttle solenoid valve **Z-9001**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17445 (520195-06) - Over Current Error for H-bridge [113270294 - V7 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. The ECU **A-001** controls the throttle solenoid valve **Z-9001** with the Pulse Width Modulated (PWM) signal. When the ECU **A-001** senses a short circuit condition on the throttle solenoid valve **Z-9001** control circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short circuit condition on the throttle solenoid valve **Z-9001** control circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short circuit.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the throttle solenoid valve **Z-9001** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 8** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 9** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.
3. Check the throttle solenoid valve **Z-9001** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 8** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 9** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 8** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 9** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, continue with Step **4**.
4. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 37** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 38** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9011** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 37** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 38** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 37** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 38** | All other pins on **X-9138B** | There should be no continuity |
| **X-9011 (Receptacle) pin 6** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 2** | All other pins on **X-9011** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9011** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the throttle solenoid valve **Z-9001**, reconnect the harness, then recheck the status of this fault.

A. Fault is active. Continue with Step **7**.

B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17446 (520195-15) - Intake Throttle Valve: Over Temperature Error for H-bridge [113270795 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. The ECU **A-001** controls the throttle solenoid valve **Z-9001** with the Pulse Width Modulated (PWM) signal. When the ECU **A-001** senses an excessive temperature on the throttle solenoid valve **Z-9001** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the throttle solenoid valve **Z-9001** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the correct operation of the battery.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the component side:

| From | To | Value |
|---|---|---|
| Battery + | Battery – | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is not approximately **12 V**, charge or replace the battery as required. Recheck the voltage, then return the machine to normal operation.

3. Check the throttle solenoid valve **Z-9001** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 16** | **X-9011 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 98** | **X-9011 (Receptacle) pin 5** | There should be continuity |
| **X-EC1 (Receptacle) pin 97** | **X-9011 (Receptacle) pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 8** | **X-9011 (Receptacle) pin 6** | There should be continuity |
| **X-EC1 (Receptacle) pin 9** | **X-9011 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **5**.

   B. If there is no continuity on any of the checks, continue with Step **4**.

4. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 41** | **X-9011 (Receptacle) pin 1** | There should be continuity |
| **X-9138B (Plug) pin 42** | **X-9011 (Receptacle) pin 5** | There should be continuity |
| **X-9138B (Plug) pin 43** | **X-9011 (Receptacle) pin 3** | There should be continuity |
| **X-9138B (Plug) pin 37** | **X-9011 (Receptacle) pin 6** | There should be continuity |
| **X-9138B (Plug) pin 38** | **X-9011 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Replace the throttle solenoid valve **Z-9001**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17447 (520195-03) - Intake Throttle Valve: Short Circuit to Battery on Out1 Error for H-bridge [113270455 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. The ECU **A-001** controls the throttle solenoid valve **Z-9001** with the Pulse Width Modulated (PWM) signal. When the ECU **A-001** senses a voltage above normal on the throttle solenoid valve **Z-9001** output 1 control circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the output 1 of the throttle solenoid valve **Z-9001** control circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the throttle solenoid valve **Z-9001** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 98** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 97** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 9** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the checks, continue with Step **4**.
3. Check the throttle solenoid valve **Z-9001** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 98** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 97** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 9** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, continue with Step **4**.

4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 42** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 43** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 38** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **5**.

   B. If there is voltage on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 42** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 43** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 38** | All other pins on **X-9138B** | There should be no continuity |
| **X-9011 (Receptacle) pin 5** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 3** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 2** | All other pins on **X-9011** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the throttle solenoid valve **Z-9001** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 98** | **X-9011 (Receptacle) pin 5** | There should be continuity |
| **X-EC1 (Receptacle) pin 97** | **X-9011 (Receptacle) pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 9** | **X-9011 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **8**.

   B. If there is no continuity on any of the checks, continue with Step **7**.

7. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 98** | **X-470 (Receptacle) pin 42** | There should be continuity |
| **X-EC1 (Receptacle) pin 97** | **X-470 (Receptacle) pin 43** | There should be continuity |
| **X-EC1 (Receptacle) pin 9** | **X-470 (Receptacle) pin 38** | There should be continuity |

   A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Replace the throttle solenoid valve **Z-9001**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **9**.

   B. Fault is not active. Return the machine to normal operation.

9. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17448 (520194-03) - Intake Throttle Valve: Short Circuit to Battery on Out2 Error for H-bridge [113270457 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. The ECU **A-001** controls the throttle solenoid valve **Z-9001** with the Pulse Width Modulated (PWM) signal. When the ECU **A-001** senses a voltage above normal on the throttle solenoid valve **Z-9001** output 2 control circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the output 2 of the throttle solenoid valve **Z-9001** control circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the throttle solenoid valve **Z-9001** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 98** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 97** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 9** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **3**.

   B. If there is voltage on any of the checks, continue with Step **4**.
3. Check the throttle solenoid valve **Z-9001** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 98** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 97** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 9** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, continue with Step **4**.

4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 42** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 43** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 38** | Chassis ground | There should be no voltage |

   A. If there is no voltage on all the checks, continue with Step **5**.

   B. If there is voltage on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 42** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 43** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 38** | All other pins on **X-9138B** | There should be no continuity |
| **X-9011 (Receptacle) pin 5** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 3** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 2** | All other pins on **X-9011** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the throttle solenoid valve **Z-9001** circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 98** | **X-9011 (Receptacle) pin 5** | There should be continuity |
| **X-EC1 (Receptacle) pin 97** | **X-9011 (Receptacle) pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 9** | **X-9011 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **8**.

   B. If there is no continuity on any of the checks, continue with Step **7**.

7. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 98** | **X-470 (Receptacle) pin 42** | There should be continuity |
| **X-EC1 (Receptacle) pin 97** | **X-470 (Receptacle) pin 43** | There should be continuity |
| **X-EC1 (Receptacle) pin 9** | **X-470 (Receptacle) pin 38** | There should be continuity |

   A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Replace the throttle solenoid valve **Z-9001**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **9**.

   B. Fault is not active. Return the machine to normal operation.

9. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17449 (520195-04) - Intake Throttle Valve: Short Circuit to Ground on Out1 Error for H-bridge [113270383 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. The ECU **A-001** controls the throttle solenoid valve **Z-9001** with the Pulse Width Modulated (PWM) signal. When the ECU **A-001** senses a voltage below normal on the throttle solenoid valve **Z-9001** output 1 control circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the output 1 of the throttle solenoid valve **Z-9001** control circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the throttle solenoid valve **Z-9001** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 16** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 98** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 8** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 16** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 98** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 8** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 41** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 42** | Chassis ground | There should be no continuity |

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 37** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 41** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 42** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 37** | All other pins on **X-9138B** | There should be no continuity |
| **X-9011 (Receptacle) pin 1** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 5** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 6** | All other pins on **X-9011** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9011** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the throttle solenoid valve **Z-9001**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17450 (520194-04) - Intake Throttle Valve: Short Circuit to Ground on Out2 Error for H-bridge [113270385 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. The ECU **A-001** controls the throttle solenoid valve **Z-9001** with the Pulse Width Modulated (PWM) signal. When the ECU **A-001** senses a voltage below normal on the throttle solenoid valve **Z-9001** output 2 control circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the output 2 of the throttle solenoid valve **Z-9001** control circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the throttle solenoid valve **Z-9001** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 16** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 98** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 8** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 9** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 98** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 8** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 41** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 42** | Chassis ground | There should be no continuity |

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 37** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 41** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 42** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 37** | All other pins on **X-9138B** | There should be no continuity |
| **X-9011 (Receptacle) pin 1** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 5** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 6** | All other pins on **X-9011** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9011** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the throttle solenoid valve **Z-9001**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17451 (520194-15) - Intake Throttle Valve: Short Circuit Over Load Error for H-bridge [113270459 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. The ECU **A-001** controls the throttle solenoid valve **Z-9001** with the Pulse Width Modulated (PWM) signal. When the ECU **A-001** senses a short circuit condition on the throttle solenoid valve **Z-9001** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short circuit condition on the throttle solenoid valve **Z-9001** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short circuit.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the throttle solenoid valve **Z-9001** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 8** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 9** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.
3. Check the throttle solenoid valve **Z-9001** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 8** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 9** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 8** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 9** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, continue with Step **4**.
4. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 37** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 38** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9011** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 37** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 38** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 37** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 38** | All other pins on **X-9138B** | There should be no continuity |
| **X-9011 (Receptacle) pin 6** | All other pins on **X-9011** | There should be no continuity |
| **X-9011 (Receptacle) pin 2** | All other pins on **X-9011** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-EC1** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9011** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the throttle solenoid valve **Z-9001**, reconnect the harness, then recheck the status of this fault.

A. Fault is active. Continue with Step **7**.

B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17453 (520194-05) - Intake Throttle Valve: Under Voltage Error for H-bridge [113270387 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. The ECU **A-001** controls the throttle solenoid valve **Z-9001** with the Pulse Width Modulated (PWM) signal. When the ECU **A-001** senses a no voltage on the throttle solenoid valve **Z-9001** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the throttle solenoid valve **Z-9001** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the throttle solenoid valve **Z-9001** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the throttle solenoid valve **Z-9001** at connector **X-9011**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 8** | **X-9011 (Receptacle) pin 6** | There should be continuity |
| **X-EC1 (Receptacle) pin 9** | **X-9011 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **4**.

   B. If there is no continuity on either check, continue with Step **3**.

3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-470 (Receptacle) pin 37** | **X-EC1 (Receptacle) pin 8** | There should be continuity |
| **X-470 (Receptacle) pin 38** | **X-EC1 (Receptacle) pin 9** | There should be continuity |

   A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9011** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the throttle solenoid valve **Z-9001**, reconnect the harness, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17517 (F-519645-16) - SCR Inducement: Level 1 (Torque Reduction), Triggered by EGR Valve Blocked Fault [113270314 - V4 - 28 January 2025]

## Control Module: ECU

**Fault Description:**
This fault report is provided for information purposes only, therefore no further actions are required other than resolving the active error that has caused this fault. One of the faults at the exhaust gas recirculation system valve (EGR) or related components active for a longer period causes this fault to occur.

# 17519 (F-519645-00) - Electronic Module Engine Control Module - Degraded [113270803 - V4 - 28 January 2025]

## Control Module: ECU

**Fault Description:**
This fault report is provided for information only, therefore no further actions are required other than resolving the active error that has caused this fault. One of the faults at the exhaust gas recirculation system valve (EGR) or related components causes this fault to occur.

# 17525 (2659-18) - EGR Low Flow Detected [113270932 - V6 - 19 December 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the EGR system to ensure it is working properly. To detect low flow (obstructed or tampered EGR path), pressure signals before the intake valve and/or pressure in the exhaust manifold upstream of the turbine are evaluated. The function must be performed every time after starting the engine. The closed EGR valve carries out a closed/open/closed sequence. During this sequence, the pressure signals in the intake manifold (P2) and the pressure in the gradients of the exhaust manifold (P3) are checked and if a deviation from the expected behaviour is detected, the error appears. Monitoring is active when the ECU **A-001** initialized since at least **12.00 s** while engine isn't running yet, while engine is not in cranking mode, **12.00 s** after startup if engine is running, if ECU **A-001** is not in afterrun and if terminal 15 is ON. Monitor released if engine speed is within **820.00 RPM** and **1230.00 RPM**, the engine temperature is between **59.96 °C** (**139.93 °F**) and **89.96 °C** (**193.93 °F**), not in regeneration mode, the EGR valve position is lower than **5.00%**, P2 is not in transient condition, variation is lower than 20.00hPa/s, the fuel quantity rate is lower than **50.00%** and the exhaust flap position deviation from set value is lower than **5.00%**, this fault will occur.

**Cause:**
The ECU **A-001** detects a slow response in the EGR solenoid valve **Z-9000**.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the EGR solenoid valve **Z-9000**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Connect the Electronic Service Tool (EST) and perform the "EGR Valve Test".

   Click the "START Test" button and follow the on-screen instructions.

   A. Test results indicate that the EGR valve is working properly. Continue with Step **4**.

   B. Test results indicate that the EGR valve is not working properly. Replace the EGR valve.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17526 (F-6819-31) - Inducement System is Locked Due to 3 Detections in 40 Hours (Repeat Offender). The System must be Reset Using the Dealer Service Tool Screen "Engine Restart Counter Reset" [113270799 - V4 - 27 January 2025]

## Control Module: ECU

**Fault Description:**
Part of the selective catalytic reduction (SCR) system, the inducement, is the detection of abnormal functions in the system. Within this detection, When the Engine Control Unit (ECU) **A-001** senses the **DEF/AdBlue®** consumption is too low, this fault will occur. Despite no corrective actions are required as a response to this particular fault, other active faults or conditions have caused this fault.

# 17539 (F-518164-31) - ECU Internal Failure - Injection Quantity Limited by Level 2 Controller Check [113270581 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** will internally monitor the fuel quantity level to be delivered to the fuel metering unit **Y-9000**. When the ECU **A-001** senses that the fuel quantity level 2 is less than the fuel quantity level 1, this fault will occur.

**Cause:**
The ECU **A-001** has detected a fuel quantity level 2 that is less than the fuel quantity level 1.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17540 (F-518165-31) - ECU Internal Failure - Torque Limited by Level 2 Controller Check to give Stable Idle Speed [113270583 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** will internally monitor the fuel quantity level to be delivered to the fuel metering unit **Y-9000**. When the level 2 of fuel quantity is incorrect, the ECU **A-001** will provide a minimum stable speed at the set torque, until the correct quantity of fuel of level 2 is provided. When the ECU **A-001** senses that the level 2 of fuel quantity is incorrect, this fault will occur. And the ECU **A-001** will set the engine speed to idle.

**Cause:**
The ECU **A-001** has detected an incorrect level 2 of fuel quantity.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17541 (F-518217-31) - ECU Internal Failure - Conditions Where Not Correct to Allow Starter Cranking to Start or to Continue or Maximum Crank Time Exceeded [113270612 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The start-up behavior of the engine is a fundamental safety function. Therefore, an additional monitoring check (level 2) is performed to see if the Engine Control Unit (ECU) **A-001** is working properly. When the ECU **A-001** senses that the level 2 senses an implausible behavior of the start request while level 1 monitoring does not detect any problems, the ECU **A-001** is not working properly and this fault will occur. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17542 (F-518162-31) - ECU Internal Failure - Injector Energizing Time Fault [113270614 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** torque request can be influenced from a lot of vehicle functions which are in some cases additive, in some cases as maximum, and in some cases as limitation. This complex structure can lead to a torque request, which is higher than accepted by the engine. Therefore the total requested engine torque is compared to a maximum allowed engine torque, which is calculated by a redundant procedure. When the ECU **A-001** senses that the averaged actual energizing time is exceeding the permitted threshold **200 ms** at **1,080 RPM**, this fault will occur. Replacement of the ECU **A-001** is necessary. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17543 (F-518161-31) - ECU Internal Failure - Torque Comparison Fault [113270616 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** torque request can be influenced from a lot of vehicle functions which are in some cases additive, in some cases as maximum, and in some cases as limitation. This complex structure can lead to a torque request, which is higher than accepted by the engine. Therefore the total requested engine torque is compared to a maximum allowed engine torque, which is calculated by a redundant procedure. A torque integral accumulates the difference between permitted and actual torques. When the ECU **A-001** senses that the accumulated integral value is exceeding the maximum threshold **800 ms**, this fault will occur. Replacement of the ECU **A-001** is necessary. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17587 (F-2797-01) - ECU Internal Failure - Injector Booster voltage too low [113270304 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the internal fuel injector control module performance for electrical problems. When the ECU **A-001** senses the fuel injection booster voltage is below its minimum threshold, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17610 (F-518219-31) - ECU Internal Failure - Error in the Operating Mode at Level 1 [113270608 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The engine performance (torque generation) is supported by the addition of pilot injections, main injections, and post-injections. The Engine Control Unit (ECU) **A-001** monitors these injections and compares their values against a model. When the ECU **A-001** senses that the injection (level 1) is not within the relative range of plausible values, this fault will occur. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17611 (F-518220-31) - ECU Internal Failure - Error in Total Injection Quantity at Level 2 [113270610 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
Engine performance (torque generation) is supported by the addition of pilot injections, main injections and post-injections. The Engine Control Unit (ECU) **A-001** monitors these injections and compares their values against a model. When the ECU **A-001** senses that the injection (level 2) does not fall within the range of plausible values, this fault will occur. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17632 (F-518241-31) - ECU Internal Failure - Diagnostic Fault Check to Report "ABE Active" [113270761 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the communication, inside the ECU **A-001**, between the supply stages and the voltage power supply of the supply stage. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17633 (F-518242-31) - ECU Internal Failure - Diagnostic Fault Check to Report "Errorpin Active" [113270763 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the communication, inside the ECU **A-001**, between the supply stages and the voltage power supply of the supply stage. When the ECU **A-001** senses that the supply stages are interrupted due to an active pin error, this fault will occur. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17646 (F-18-14) - Maximum Rail Pressure in Limp Home Mode Exceeded Limit [113270829 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure of the fuel supply rail in limp home mode with the Pressure Control Valve (PCV). When the ECU **A-001** senses the fuel rail pressure is greater than **1200 bar**, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the fuel rail pressure has exceeded the specified limit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty Pressure Control Valve (PCV), internal failure.
3. Faulty fuel metering unit **Y-9000**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the fuel metering unit **Y-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the fuel metering unit **Y-9000** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the fuel metering unit **Y-9000** at connector **X-9007**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 6** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 7** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.

3. Check the fuel metering unit **Y-9000** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 6** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 7** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 6** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 7** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **6**.

   B. If there is continuity on any of the checks, continue with Step **4**.

4. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 1** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 2** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9007** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 2** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 1** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 2** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 1** | All other pins on **X-9138B** | There should be no continuity |
| **X-9007 pin 1** | **X-9007 pin 2** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity any of the checks, there is a short circuit in the connector harness (between **X-9138B** and **X-9007** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the fuel metering unit **Y-9000** circuit for an open circuit.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9007 pin 1** | **X-EC1 (Receptacle) pin 7** | There should be continuity |
| **X-9007 pin 2** | **X-EC1 (Receptacle) pin 6** | There should be continuity |

A. If there is continuity on both checks, continue with Step **8**.

B. If there is no continuity on either check, continue with Step **7**.

7. Locate the circuit for an open circuit.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 7** | **X-470 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 6** | **X-470 (Receptacle) pin 2** | There should be continuity |

A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9007** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Check the return pipe in the Pressure Control Valve (PCV) to the tank for correct operation and any clogging.

And then recheck the status of this fault.

A. Fault is active. Continue with Step **9**.

B. Fault is not active. Return the machine to normal operation.

9. Replace the fuel metering unit **Y-9000**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **10**.

   B. Fault is not active. Return the machine to normal operation.

10. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17663 (F-518261-14) - CAN Message Corruption Between Vehicle Controller and ECU Controller - VM2EDC Message [113270971 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** can connect and ensure communication between two distinct CAN (Controller Area Network) networks. The correct configuration and monitoring of the two networks configured with pairs of twisted wires is also a function of the ECU **A-001**. Node 1 of the CAN BUS is the main vehicle interface bus. The ECU **A-001** supplies a CAN termination resistor for node 1 of the CAN BUS inside the ECU **A-001**. The ECU **A-001** receives the CAN message VM2EDC which is the proprietary CAN message from the vehicle control unit to the ECU **A-001** containing the minimum position and intermediate speed parameters. When ECU **A-001** senses a checksum error for message VM2EDC constantly, this fault will occur. This fault requires no further actions except for checking the presence of other faults in the fault memory which could influence the CAN communication between the vehicle control unit and the ECU **A-001**. If another fault is present, follow its troubleshooting procedure. If there are no other faults, check the ECU **A-001** to search the appropriate software and reprogram if necessary.

# 17664 (F-5310-00) - HC Accumulated in the Exhaust Reached First Warning Limit [113270883 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Hydrocarbon (HC) levels accumulated in the exhaust system. This fault indicates a warning for component protection caused from excessive Hydrocarbon (HC) levels that have accumulated in the exhaust system. This may occur even when the engine is left to run at a low load level for a prolonged period of time or idling at low temperatures. To delete this fault, follow the maintenance instructions for the Selective Catalytic Reduction (SCR) exhaust gas treatment system, or run the engine with a high load to increase the temperature of the engine and exhaust gases. With higher operating temperatures the accumulation of unburnt hydrocarbons will be limited or reduced.

# 17665 (F-5310-14) - HC Accumulated in the Exhaust Reached Second Warning Limit [113270887 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Hydrocarbon (HC) levels accumulated in the exhaust system. This fault indicates a second warning relating to the components protection and is caused by excessive levels of hydrocarbon (HC) accumulated in the exhaust system. This fault occurs after the engine has been restarted and has been left running, and the level of hydrocarbon (HC) has not dropped below the correct value (reset level) of liquid HC in the exhaust system. To delete this fault follow the maintenance instructions for the exhaust treatment of the selective catalytic reduction system (SCR).

# 17667 (F-518203-31) - ECU Internal Failure - Injection Cut Off Request from Shut Off Path Test [113270598 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** includes the so-called redundant stop paths which deactivate all power stages relevant to injection if certain internal ECU **A-001** errors are detected. In order to test the correct operation of the stop procedure, each path is activate for a short time during the ECU **A-001** boot, then the fuel injection supply phase is activated. However, since the stop procedure is active, there is no injection if the procedure operates correctly.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17668 (F-518183-31) - ECU Internal Failure - Error in the Plausibility of the Energizing Times of the Zero Fuel quantity Calibration [113270602 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The plausibility of the excitation start time of the injectors is monitored by the monitoring software (level 2) of the Engine Control Unit (ECU) **A-001**. The ECU level 2 monitors the software of the ECU level 1 (functional software). When the ECU **A-001** senses an implausible calibration of the quantity of fuel at zero, this fault will occur. Replacement of the ECU **A-001** is necessary. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17669 (F-518204-31) - ECU Internal Failure - Post Build Selectable Monitoring [113270618 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the circuit to check for internal faults during the driving cycle. The ECU **A-001** can select specific components to be monitored with determined parameters of the driving cycle. When the ECU **A-001** senses an excessive number of monitored parameters are not within specifications, this fault will occur. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17678 (F-519847-31) - Torque Limitation Due to Rail Temperature or Pressure [113270571 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
This failure path is only for information. There was an active performance limitation due to excessive fuel temperature or pressure. One or more torque reductions are present. No actions necessary due to this failure alone. When the power reduction occurred due to actual defect, the failure triggering the torque limitation should also be in the failure memory. Follow troubleshooting of the actual defect.

# 17730 (F-3064-07) - Particulate Filter is Damaged or Missing [113270897 - V4 - 27 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the differential pressure sensor on the DPF **B-018**. The differential pressure sensor on the DPF **B-018** shares the integrity of the Diesel Particulate Filter (DPF) with the ECU **A-001** to control the emission operations. In order to determine the integrity of the DPF, a pressure drop is measured on the empty filter (low soot) in stationary conditions is compared with the reference values determined on a new undamaged DPF. When the ECU **A-001** senses that the maximum differential pressure value saved at stationary state is lower than a threshold that depends on the flow of the volume (from **0.00 bar** (**0.00 psi**) at **0.00 m³/hr** (**0.00 US gpm**) over **0.018 bar** (**0.26 psi**) at **600.00 m³/hr** (**2640.00 US gpm**) to **0.045 bar** (**0.65 psi**) at **1500.00 m³/hr** (**6600.00 US gpm**)) and the battery voltage is higher than **10.00 V** since at least **2.00 s**, this fault will occur. This failure is tested during the ECU **A-001** after-run if the maximum volume flow at steady state conditions reached during the current driving cycle (PFlt_dvolMaxSty_mp) lies above the threshold of **450.00 m³/hr** (**1980.00 US gpm**) in after-run, the calculation of the current offset correction for the differential pressure is completed. The errors for the hose line and differential pressure sensor could be tested and are not set.

**Cause:**
The ECU **A-001** has detected that the DPF has failed or disassembled.

**Possible failure modes:**

1. Faulty DPF, failed or disassembled.
2. Faulty differential pressure sensor on the DPF **B-018** hose/line, clogged or damaged.
3. Faulty differential pressure sensor on the DPF **B-018**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harness or connectors as required. Return the machine to normal operation.
2. Check the DPF filter for clogging or damage.

   A. If the DPF filter is not clogged or damaged, continue with Step **3**.

   B. If the DPF filter is clogged or damaged, clean or replace the DPF filter as required. Return the machine to normal operation.
3. Check the differential pressure sensor or line for signs of restriction, clogged or blocked hose, and proper routing.

   Note: Hard lines are etched with “Right” and “Left” approximately 41mm from end of the line (may need to remove the mounting block to view).

   A. If the lines are properly routed, free of clogs and restrictions, continue with Step **4**.

   B. If the routing is not correct and/or clogs and damage are found, clean, repair or replace the lines as required. Return the machine to normal operation. Note: To clean the lines, remove the differential pressure pipes and submerge in warm water to free or dissolve the contaminates.
4. Replace the differential pressure sensor on the DPF **B-018**, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17732 (F-519694-07) - Differential Pressure Sensor: Hoseline Error [113270517 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The engine control unit (ECU) **A-001** monitors the operation of the diesel particulate filter (DPF) delta pressure sensor **B-018** and evaluates the filter differential pressure and the change in filter volume flow over time. By monitoring the flexible hoses it is possible to detect drops, obstructions, or blockages in the hose connections of the particulate filter pressure sensor system. When the ECU **A-001** senses that the filtered differential pressure signal is below the minimum value **-0.010 bar** (**-0.145 psi**) for longer than **6.0 s**, this fault will occur. With atmospheric pressure constantly present on the pressure connection upstream of the particulate filter, this fault indicates the presence of a hose connection upstream of the particulate filter disconnected or completely blocked.

**Cause:**
The ECU **A-001** has detected the filtered differential pressure signal is lower than the minimum pressure value.

**Possible failure modes:**

1. Faulty differential pressure sensor **B-018** hose or line, clogged/damaged.
2. Faulty differential pressure sensor **B-018**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor **B-018**, and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harness or connectors as required. Return the machine to normal operation.
2. Check the DPF filter for clogging or damage.

   A. If the DPF filter is not clogged or damaged, continue with Step **3**.

   B. If the DPF filter is clogged or damaged, clean or replace the DPF filter as required. Return the machine to normal operation.
3. Check the differential pressure sensor or line for signs of restriction, clogged or blocked hose, and proper routing.

   Note: Hard lines are etched with “Right” and “Left” approximately 41mm from end of the line (may need to remove the mounting block to view).

   A. If the lines are properly routed, free of clogs and restrictions, continue with Step **4**.

   B. If the routing is not correct and/or clogs and damage are found, clean, repair or replace the lines as required. Return the machine to normal operation. Note: To clean the lines, remove the differential pressure pipes and submerge in warm water to free or dissolve the contaminates.
4. Reset the offset drift compensation for the differential pressure sensor **B-018**.

   Use the Electronic Service Tool (EST) to recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. Replace the differential pressure sensor **B-018**, then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17735 (F-18-31) - Fuel Rail Pressure is Insufficient to Start / Run the Engine [113270775 - V4 - 31 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the pressure sensor on the rail **B-9004** to control the engine operations. The rail pressure is monitored by various fault paths during active pressure control by the solenoid valve for fuel pressure regulation **Y-9000**. When the ECU **A-001** senses that one of the fault path reports the rail pressure has fallen below a minimum pressure threshold (less than **130 bar** (**1885 psi**)), this fault will occur. This error is the result of a leak in the high or low pressure side of the fuel rail system. On the high pressure side, check for worn or stuck open injector, worn high pressure pump, or leaking pressure relief valve. On the low pressure side, check for low fuel pressure before or after the gear pump, clogged fuel filter, or leakage.

# 17737 (F-152-31) - ECU Internal Failure - External Device Triggered an ECU Reset During Normal ECU Driving [113270779 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** KeepAlive process queries the external devices for problems (e.g. memory errors, incorrect initialization state, unexpected resets of the external device). When a device driver reports an error, the KeepAlive initiates a reset of the ECU **A-001**. The external device drivers can report errors during the initialization (INI) or during the normal runtime (DRV) phases of the ECU **A-001** operations. When the ECU **A-001** senses a device driver reports an error and KeepAlive initiates a reset of the ECU **A-001**, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17738 (F-152-11) - ECU Internal Failure - External Device Triggered an ECU Reset During Normal ECU Initialization [113270781 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** KeepAlive process queries the external devices for problems (e.g. memory errors, incorrect initialization state, unexpected resets of the external device). When a device driver reports an error, the KeepAlive initiates a reset of the ECU **A-001**. The external device drivers can report errors during the initialization (INI) or during the normal runtime (DRV) phases of the ECU **A-001** operations. When the ECU **A-001** senses a device driver reports an error and KeepAlive initiates a reset of the ECU **A-001**, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17740 (F-628-31) - ECU Internal Failure - Read Access to Non Volatile Memory Failed for at Least One Block [113270783 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the internal processes searching for error reports while trying to read or write on non-volatile memory. When the ECU **A-001** senses that it is no longer possible to read a memory block correctly, this fault will occur. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17741 (F-628-14) - ECU Internal Failure - Write Access to Non Volatile Memory Failed for at Least One Block [113270785 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the internal processes searching for error reports when trying to read or write on non-volatile memory. When the ECU **A-001** senses that it is no longer possible to write a memory block, this fault will occur. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17742 (F-518166-31) - ECU Internal Failure - Stack Memory Threshold Overrun Error [113270575 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** contains a variety of electronic components designed to support the performance of the main processors. One of the support functions involves grouping the data to be processed. When the ECU **A-001** senses that this functional group reports an overload of the stack memory threshold, this fault will occur. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17743 (F-518201-31) - ECU Internal Failure - Irregular Power Down Detected [113270787 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** system control provides the execution command as the calculation of the "ECU deactivation time". The "incorrect activation counter" is an instance of an observation counter. The task of it is to observe if the ECU **A-001** was running all the time since the ECU **A-001** was switched ON till it is switched OFF. When the ECU **A-001** was switched OFF irregularly before completing the shut down procedure (due to power failure, power supply reset, or software reset with the key switch signal set to OFF), the reset of the counter will not happen. This causes the subsequent initialization (switching on activation) after reading the counter in order to detect the missed reset and the signalization of this error.

**Cause:**
The ECU **A-001** has been switched off while the engine is running due to a loss of power supply.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check that the error is not sporadic or intermittent.

   A. If the fault is always present, continue with Step **3**.

   B. If the fault is not constant, it is possible that the operator might have disconnected the power supply before the afterrun has completed or immediately after the key off. Adjust the duration of the ECU **A-001** afterrun accordingly.
3. Check to confirm if other fault codes are active.

   Use the Electronic Service Tool (EST) to check for the presence of battery voltage supply faults.

   If any of the faults are present, resolve them first then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17744 (F-518201-11) - ECU Internal Failure - Irregular Power Down Detected [113270815 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** system supplies the execution command as the calculation of the "ECU deactivation time". The "incorrect activation counter" is an instance of an observation counter. The task of it is to observe if the ECU **A-001** was running all the time since the ECU **A-001** was switched ON till it is switched OFF. When the ECU **A-001** has been incorrectly switched off before completing the shut down procedure (due to power failure, power supply reset, or software reset with the key switch signal set to OFF), the counter is not reset. This causes the subsequent initialization (switching on activation) after reading the counter in order to detect the missed reset and the signalization of this error.

**Cause:**
The ECU **A-001** has been switched off while the engine is running.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active. Resolve them first then recheck the status of this fault.
   A. Fault is active. Continue with Step **3**.
   B. Fault is not active. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17761 (F-1136-06) - ECU Internal Failure - ECU Internal Temperature Sensor: Short Circuit to Battery [113270453 - V4 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the ECU temperature sensor, which is internal to the ECU **A-001**. When the ECU **A-001** senses a voltage above normal on the ECU temperature sensor circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the temperature sensor circuit.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17762 (F-518145-04) - ECU Internal Failure - ECU Internal Temperature Sensor: Short Circuit to Ground [113270381 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the ECU **A-001** temperature sensor, which is internal to the ECU **A-001**. When the ECU **A-001** senses a voltage below normal on the temperature sensor circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the temperature sensor circuit.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17763 (F-518146-02) - ECU Internal Failure - ECU Temperature Sensor: Implausible Sensor Measuring [113270473 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the temperature sensor, which is internal to the ECU **A-001**. When the ECU **A-001** senses an implausible temperature signal on the ECU **A-001** temperature sensor circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an implausible signal from the internal ECU **A-001** temperature sensor.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17781 (F-520344-31) - ECU Internal Failure - Safety Management Unit Alarm Group 0 Failure 1 Issued [113270620 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17782 (F-520344-11) - ECU Internal Failure - Safety Management Unit Alarm Group 0 Failure 11 Issued [113270622 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17783 (F-520345-31) - ECU Internal Failure - Safety Management Unit Alarm Group 0 Failure 12 Issued [113270624 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17784 (F-520345-11) - ECU Internal Failure - Safety Management Unit Alarm Group 0 Failure 15 Issued [113270626 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17785 (F-520346-31) - ECU Internal Failure - Safety Management Unit Alarm Group 0 Failure 16 Issued [113270628 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17786 (F-520346-11) - ECU Internal Failure - Safety Management Unit Alarm Group 0 Failure 3 Issued [113270630 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17787 (F-520347-31) - ECU Internal Failure - Safety Management Unit Alarm Group 0 Failure 4 Issued [113270632 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17788 (F-520347-11) - ECU Internal Failure - Safety Management Unit Alarm Group 0 Failure 7 Issued [113270634 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17789 (F-520348-31) - ECU Internal Failure - Safety Management Unit Alarm Group 0 Failure 8 Issued [113270636 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17790 (F-520348-11) - ECU Internal Failure - Safety Management Unit Alarm Group 1 Failure 0 Issued [113270638 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17791 (F-520349-31) - ECU Internal Failure - Safety Management Unit Alarm Group 1 Failure 1 Issued [113270650 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17792 (F-520349-11) - ECU Internal Failure - Safety Management Unit Alarm Group 1 Failure 11 Issued [113270652 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17793 (F-520350-31) - ECU Internal Failure - Safety Management Unit Alarm Group 1 Failure 12 Issued [113270654 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17794 (F-520350-11) - ECU Internal Failure - Safety Management Unit Alarm Group 1 Failure 15 Issued [113270656 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17795 (F-520351-31) - ECU Internal Failure - Safety Management Unit Alarm Group 1 Failure 16 Issued [113270658 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17796 (F-520351-11) - ECU Internal Failure - Safety Management Unit Alarm Group 1 Failure 3 Issued [113270660 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17797 (F-520352-31) - ECU Internal Failure - Safety Management Unit Alarm Group 1 Failure 4 Issued [113270662 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17798 (F-520352-11) - ECU Internal Failure - Safety Management Unit Alarm Group 1 Failure 7 Issued [113270664 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17799 (F-520353-31) - ECU Internal Failure - Safety Management Unit Alarm Group 1 Failure 8 Issued [113270666 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17800 (F-520353-11) - ECU Internal Failure - Safety Management Unit Alarm Group 2 Failure 15 Issued [113270668 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17801 (F-520354-31) - ECU Internal Failure - Safety Management Unit Alarm Group 2 Failure 18 Issued [113270670 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17802 (F-520354-11) - ECU Internal Failure - Safety Management Unit Alarm Group 2 Failure 19 Issued [113270672 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17803 (F-520355-31) - ECU Internal Failure - Safety Management Unit Alarm Group 2 Failure 29 Issued [113270674 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17804 (F-520355-11) - ECU Internal Failure - Safety Management Unit Alarm Group 2 Failure 4 Issued [113270678 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17805 (F-520356-31) - ECU Internal Failure - Safety Management Unit Alarm Group 2 Failure 5 Issued [113270680 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17806 (F-520356-11) - ECU Internal Failure - Safety Management Unit Alarm Group 2 Failure 7 Issued [113270682 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17807 (F-520357-31) - ECU Internal Failure - Safety Management Unit Alarm Group 2 Failure 8 Issued [113270684 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17808 (F-520357-11) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 0 Issued [113270686 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17809 (F-520358-31) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 1 Issued [113270688 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17810 (F-520358-11) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 12 Issued [113270690 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17811 (F-520359-31) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 14 Issued [113270692 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17812 (F-520359-11) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 16 Issued [113270694 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17813 (F-520360-31) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 17 Issued [113270696 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17814 (F-520360-11) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 18 Issued [113270698 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17815 (F-520361-31) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 19 Issued [113270700 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17816 (F-520361-11) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 2 Issued [113270702 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17817 (F-520362-31) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 20 Issued [113270704 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17818 (F-520362-11) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 26 Issued [113270706 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17819 (F-520363-31) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 27 Issued [113270708 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17820 (F-520363-11) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 28 Issued [113270710 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17821 (F-520364-31) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 3 Issued [113270712 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17822 (F-520364-11) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 4 Issued [113270714 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17823 (F-520365-31) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 5 Issued [113270716 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17824 (F-520365-11) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 6 Issued [113270718 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17825 (F-520366-31) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 7 Issued [113270721 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17826 (F-520366-11) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 8 Issued [113270723 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17827 (F-520367-31) - ECU Internal Failure - Safety Management Unit Alarm Group 3 Failure 9 Issued [113270725 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17828 (F-520367-11) - ECU Internal Failure - Safety Management Unit Alarm Group 4 Failure 1 Issued [113270727 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17829 (F-520368-31) - ECU Internal Failure - Safety Management Unit Alarm Group 4 Failure 10 Issued [113270729 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17830 (F-520368-11) - ECU Internal Failure - Safety Management Unit Alarm Group 4 Failure 17 Issued [113270731 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17831 (F-520369-31) - ECU Internal Failure - Safety Management Unit Alarm Group 4 Failure 18 Issued [113270733 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17832 (F-520369-11) - ECU Internal Failure - Safety Management Unit Alarm Group 4 Failure 2 Issued [113270735 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17833 (F-520370-31) - ECU Internal Failure - Safety Management Unit Alarm Group 4 Failure 5 Issued [113270737 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17834 (F-520370-11) - ECU Internal Failure - Safety Management Unit Alarm Group 4 Failure 6 Issued [113270739 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17835 (F-520371-31) - ECU Internal Failure - Safety Management Unit Alarm Group 4 Failure 9 Issued [113270741 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17836 (F-520371-11) - ECU Internal Failure - Safety Management Unit Alarm Group 6 Failure 1 Issued [113270743 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17837 (F-520372-31) - ECU Internal Failure - Safety Management Unit Alarm Group 6 Failure 11 Issued [113270745 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17838 (F-520372-11) - ECU Internal Failure - Safety Management Unit Alarm Group 6 Failure 12 Issued [113270747 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17839 (F-520373-31) - ECU Internal Failure - Safety Management Unit Alarm Group 6 Failure 15 Issued [113270749 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17840 (F-520373-11) - ECU Internal Failure - Safety Management Unit Alarm Group 6 Failure 16 Issued [113270751 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17841 (F-520374-31) - ECU Internal Failure - Safety Management Unit Alarm Group 6 Failure 3 Issued [113270753 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17842 (F-520374-11) - ECU Internal Failure - Safety Management Unit Alarm Group 6 Failure 4 Issued [113270755 - V6 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17843 (F-520375-31) - ECU Internal Failure - Safety Management Unit Alarm Group 6 Failure 7 Issued [113270757 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17844 (F-520375-11) - ECU Internal Failure - Safety Management Unit Alarm Group 6 Failure 8 Issued [113270759 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17849 (1378-00) - Engine Oil Viscosity Low (Most Severe) [113334013 - V3 - 24 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the viscosity of the engine oil to control the engine operations. When the ECU **A-001** senses the consumption of engine oil due to degradation of the oil, this fault will occur.

**Cause:**
The ECU **A-001** has detected the consumption of engine oil due to degradation of the oil.

**Possible failure modes:**

1. Engine oil degraded.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the viscosity of the engine oil.
   A. If the oil viscosity level is correct, continue with Step **3**.
   B. If the oil viscosity level is too low, change the engine oil and reset oil dilution via service tester, recheck the oil viscosity, then return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17851 (F-651-05) - Open Load Error of Injector in Cylinder 1 [113270320 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 1 **Y-9001** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses no voltage on the injector 1 **Y-9001** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the injector 1 **Y-9001** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty injector 1 **Y-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 1 **Y-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 1 **Y-9001** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 1 **Y-9001** at connector **X-9030**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 64** | **X-9030 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 85** | **X-9030 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **4**.

   B. If there is no continuity on either check, continue with Step **3**.
3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 1** | **X-9030 (Receptacle) pin 1** | There should be continuity |
| **X-9139B pin 2** | **X-9030 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-9030** and **X-9139B** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the injector 1 **Y-9001**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9030 (Receptacle) pin 1** | **X-9030 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **5**.

   B. If the measured resistance value is incorrect, the injector 1 **Y-9001** has failed internally. Replace the injector 1 **Y-9001**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17852 (F-652-05) - Open Load Error of Injector in Cylinder 2 [113270324 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 2 **Y-9002** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses no voltage on the injector 2 **Y-9002** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the injector 2 **Y-9002** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty injector 2 **Y-9002**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 2 **Y-9002**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 2 **Y-9002** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 2 **Y-9002** at connector **X-9033**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 43** | **X-9033 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 22** | **X-9033 (Receptacle) pin 1** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **4**.

   B. If there is no continuity on either check, continue with Step **3**.
3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 7** | **X-9033 (Receptacle) pin 2** | There should be continuity |
| **X-9139B pin 8** | **X-9033 (Receptacle) pin 1** | There should be continuity |

   A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-9033** and **X-9139B** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the injector 2 **Y-9002**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9033 (Receptacle) pin 1** | **X-9033 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **5**.

   B. If the measured resistance value is incorrect, the injector 2 **Y-9002** has failed internally. Replace the injector 2 **Y-9002**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17853 (F-653-05) - Open Load Error of Injector in Cylinder 3 [113270326 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 3 **Y-9003** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses no voltage on the injector 3 **Y-9003** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the injector 3 **Y-9003** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty injector 3 **Y-9003**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 3 **Y-9003**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 3 **Y-9003** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 3 **Y-9003** at connector **X-9031**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 45** | **X-9031 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 24** | **X-9031 (Receptacle) pin 1** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **4**.

   B. If there is no continuity on either check, continue with Step **3**.
3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 3** | **X-9031 (Receptacle) pin 2** | There should be continuity |
| **X-9139B pin 4** | **X-9031 (Receptacle) pin 1** | There should be continuity |

   A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-9031** and **X-9139B** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the injector 3 **Y-9003**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9031 (Receptacle) pin 1** | **X-9031 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **5**.

   B. If the measured resistance value is incorrect, the injector 3 **Y-9003** has failed internally. Replace the injector 3 **Y-9003**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17854 (F-654-05) - Open Load Error of Injector in Cylinder 4 [113270322 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 4 **Y-9004** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses no voltage on the injector 4 **Y-9004** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the injector 4 **Y-9004** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty injector 4 **Y-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 4 **Y-9004**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 4 **Y-9004** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 4 **Y-9004** at connector **X-9032**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 66** | **X-9032 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 87** | **X-9032 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **4**.

   B. If there is no continuity on either check, continue with Step **3**.
3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 5** | **X-9032 (Receptacle) pin 1** | There should be continuity |
| **X-9139B pin 6** | **X-9032 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-9032** and **X-9139B** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the injector 4 **Y-9004**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9032 (Receptacle) pin 1** | **X-9032 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **5**.

   B. If the measured resistance value is incorrect, the injector 4 **Y-9004** has failed internally. Replace the injector 4 **Y-9004**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17861 (F-651-04) - Short Circuit of Low Side of Injector in Cylinder 1 [113270328 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 1 **Y-9001** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses an expected combination of errors is detected, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the injector 1 **Y-9001** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty injector 1 **Y-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 1 **Y-9001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 1 **Y-9001** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 1 **Y-9001** at connector **X-9030**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 64** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 85** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 64** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 85** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Check the injector 1 **Y-9001** circuit for a short to ground.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 1** | Chassis ground | There should be no continuity |
| **X-9139B pin 2** | Chassis ground | There should be no continuity |
| **X-9139B pin 1** | All other pins on **X-9139B** | There should be no continuity |
| **X-9139B pin 2** | All other pins on **X-9139B** | There should be no continuity |
| **X-9030 (Receptacle) pin 1** | All other pins on **X-9030** | There should be no continuity |
| **X-9030 (Receptacle) pin 2** | All other pins on **X-9030** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9030** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the injector 1 **Y-9001**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9030 (Receptacle) pin 1** | **X-9030 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **5**.

   B. If the measured resistance value is incorrect, the injector 1 **Y-9001** has failed internally. Replace the injector 1 **Y-9001**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17862 (F-652-04) - Short Circuit of Low Side of Injector in Cylinder 2 [113270332 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 2 **Y-9002** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses an expected combination of errors is detected, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the injector 2 **Y-9002** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty injector 2 **Y-9002**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 2 **Y-9002**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 2 **Y-9002** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 2 **Y-9002** at connector **X-9033**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 43** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 22** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 43** | All other pins in **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 22** | All other pins in **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Check the injector 2 **Y-9002** circuit for a short to ground.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 7** | Chassis ground | There should be no continuity |
| **X-9139B pin 8** | Chassis ground | There should be no continuity |
| **X-9139B pin 7** | All other pins on **X-9139B** | There should be no continuity |
| **X-9139B pin 8** | All other pins on **X-9139B** | There should be no continuity |
| **X-9033 (Receptacle) pin 1** | All other pins on **X-9033** | There should be no continuity |
| **X-9033 (Receptacle) pin 2** | All other pins on **X-9033** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9033** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the injector 2 **Y-9002**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9033 (Receptacle) pin 1** | **X-9033 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **5**.

   B. If the measured resistance value is incorrect, the injector 2 **Y-9002** has failed internally. Replace the injector 2 **Y-9002**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17863 (F-653-04) - Short Circuit of Low Side of Injector in Cylinder 3 [113270334 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 3 **Y-9003** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses an expected combination of errors is detected, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the injector 3 **Y-9003** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty injector 3 **Y-9003**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 3 **Y-9003**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 3 **Y-9003** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 3 **Y-9003** at connector **X-9031**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 45** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 24** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 45** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 24** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Check the injector 3 **Y-9003** circuit for a short to ground.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 3** | Chassis ground | There should be no continuity |
| **X-9139B pin 4** | Chassis ground | There should be no continuity |
| **X-9139B pin 3** | All other pins on **X-9139B** | There should be no continuity |
| **X-9139B pin 4** | All other pins on **X-9139B** | There should be no continuity |
| **X-9031 (Receptacle) pin 1** | All other pins on **X-9031** | There should be no continuity |
| **X-9031 (Receptacle) pin 2** | All other pins on **X-9031** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9031** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the injector 3 **Y-9003**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9031 (Receptacle) pin 1** | **X-9031 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **5**.

   B. If the measured resistance value is incorrect, the injector 3 **Y-9003** has failed internally. Replace the injector 3 **Y-9003**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17864 (F-654-04) - Short Circuit of Low Side of Injector in Cylinder 4 [113270330 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 4 **Y-9004** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses an expected combination of errors is detected, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the injector 4 **Y-9004** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty injector 4 **Y-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 4 **Y-9004**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 4 **Y-9004** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 4 **Y-9004** at connector **X-9032**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 66** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 87** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 66** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 87** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Check the injector 4 **Y-9004** circuit for a short to ground.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9139B pin 5** | Chassis ground | There should be no continuity |
| **X-9139B pin 6** | Chassis ground | There should be no continuity |
| **X-9139B pin 5** | All other pins on **X-9139B** | There should be no continuity |
| **X-9139B pin 6** | All other pins on **X-9139B** | There should be no continuity |
| **X-9032 (Receptacle) pin 1** | All other pins on **X-9032** | There should be no continuity |
| **X-9032 (Receptacle) pin 2** | All other pins on **X-9032** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9032** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the injector 4 **Y-9004**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9032 (Receptacle) pin 1** | **X-9032 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

   A. If the measured resistance value is correct, continue with Step **5**.

   B. If the measured resistance value is incorrect, the injector 4 **Y-9004** has failed internally. Replace the injector 4 **Y-9004**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17871 (F-651-03) - Short Circuit Error of Injector in Cylinder 1 [113270336 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 1 **Y-9001** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses a voltage above normal on the injector 1 **Y-9001** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the injector 1 **Y-9001** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty injector 1 **Y-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 1 **Y-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the injector 1 **Y-9001** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 1 **Y-9001** at connector **X-9030**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 64** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 85** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.

3. Check the injector 1 **Y-9001** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 64** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 85** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **4**.

4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9139B pin 1** | Chassis ground | There should be no voltage |
| **X-9139B pin 2** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-EC1** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9139B pin 1** | All other pins on **X-9139B** | There should be no continuity |
| **X-9139B pin 2** | All other pins on **X-9139B** | There should be no continuity |

A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-EC1** and **X-9138B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9030** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the continuity, then return the machine to normal operation.

6. Check the injector 1 **Y-9001**.

With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9030 (Receptacle) pin 1** | **X-9030 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

A. If the measured resistance value is correct, continue with Step **7**.

B. If the measured resistance value is incorrect, the injector 1 **Y-9001** has failed internally. Replace the injector 1 **Y-9001**.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17872 (F-652-03) - Short Circuit Error of Injector in Cylinder 2 [113270340 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 2 **Y-9002** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses a voltage above normal on the injector 2 **Y-9002** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the injector 2 **Y-9002** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty injector 2 **Y-9002**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 2 **Y-9002**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 2 **Y-9002** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 2 **Y-9002** at connector **X-9033**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 43** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 22** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.
3. Check the injector 2 **Y-9002** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 43** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 22** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **4**.
4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9139B pin 7** | Chassis ground | There should be no voltage |
| **X-9139B pin 8** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9139B pin 7** | All other pins on **X-9139B** | There should be no continuity |
| **X-9139B pin 8** | All other pins on **X-9139B** | There should be no continuity |

A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9033** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the continuity, then return the machine to normal operation.

6. Check the injector 2 **Y-9002**.

With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9033 (Receptacle) pin 1** | **X-9033 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

A. If the measured resistance value is correct, continue with Step **7**.

B. If the measured resistance value is incorrect, the injector 2 **Y-9002** has failed internally. Replace the injector 2 **Y-9002**.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17873 (F-653-03) - Short Circuit Error of Injector in Cylinder 3 [113270342 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 3 **Y-9003** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses a voltage above normal on the injector 3 **Y-9003** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the injector 3 **Y-9003** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty injector 3 **Y-9003**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 3 **Y-9003**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 3 **Y-9003** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 3 **Y-9003** at connector **X-9031**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 45** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 24** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.
3. Check the injector 3 **Y-9003** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 45** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 24** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **4**.
4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9139B pin 3** | Chassis ground | There should be no voltage |
| **X-9139B pin 4** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9139B pin 3** | All other pins on **X-9139B** | There should be no continuity |
| **X-9139B pin 4** | All other pins on **X-9139B** | There should be no continuity |

A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9031** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the continuity, then return the machine to normal operation.

6. Check the injector 3 **Y-9003**.

With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9031 (Receptacle) pin 1** | **X-9031 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

A. If the measured resistance value is correct, continue with Step **7**.

B. If the measured resistance value is incorrect, the injector 3 **Y-9003** has failed internally. Replace the injector 3 **Y-9003**.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17874 (F-654-03) - Short Circuit Error of Injector in Cylinder 4 [113270338 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 4 **Y-9004** to control the engine operations. Hardware errors in the injectors and their respective ECU **A-001** power stages are investigated within the ECU **A-001**. The ECU **A-001** diagnostic procedure uses pattern detection to identify specific errors. When the ECU **A-001** senses a voltage above normal on the injector 4 **Y-9004** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the injector 4 **Y-9004** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty injector 4 **Y-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 4 **Y-9004**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the injector 4 **Y-9004** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the injector 4 **Y-9004** at connector **X-9032**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 66** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 87** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.
3. Check the injector 4 **Y-9004** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 66** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 87** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **4**.
4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-9139B** from the harness connector **X-471**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9139B pin 5** | Chassis ground | There should be no voltage |
| **X-9139B pin 6** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9139B pin 5** | All other pins on **X-9139B** | There should be no continuity |
| **X-9139B pin 6** | All other pins on **X-9139B** | There should be no continuity |

A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-EC1** and **X-471** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9032** and **X-9139B** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harnesses, recheck the continuity, then return the machine to normal operation.

6. Check the injector 4 **Y-9004**.

With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9032 (Receptacle) pin 1** | **X-9032 (Receptacle) pin 2** | The resistance should be between **0.2 – 0.5 Ω** |

A. If the measured resistance value is correct, continue with Step **7**.

B. If the measured resistance value is incorrect, the injector 4 **Y-9004** has failed internally. Replace the injector 4 **Y-9004**.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17881 (651-31) - Missing Adjustment Value Programming for Injector in Cylinder 1 [113270585 - V4 - 27 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 1 **Y-9001** to control the engine operations. The ECU **A-001** uses an Injector Quantity Adjustment (IMA) code to correct the fuel trim for each fuel injector equipped with the engine at every key ON. When the ECU **A-001** senses that this trim correction for the injector 1 **Y-9001** cannot be performed, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the injector 1 **Y-9001** fuel trim correction can not be performed.

**Possible failure modes:**

1. Faulty injector 1 **Y-9001**, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 1 **Y-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Use the Electronic Service Tool (EST) to ensure that the correct IMA code is programmed to the injector 1 **Y-9001**.

   Reprogram the injector 1 **Y-9001** then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.

   ***NOTE:*** *The IMA code may be under the paint on the fuel injector.*
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17883 (654-31) - Missing Adjustment Value Programming for Injector in Cylinder 4 [113270587 - V4 - 27 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 4 **Y-9004** to control the engine operations. The ECU **A-001** uses an Injector Quantity Adjustment (IMA) code to correct the fuel trim for each fuel injector equipped with the engine at every key ON. When the ECU **A-001** senses that this trim correction for the injector 4 **Y-9004** cannot be performed, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the injector 4 **Y-9004** fuel trim correction can not be performed.

**Possible failure modes:**

1. Faulty injector 4 **Y-9004**, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 4 **Y-9004**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Use the Electronic Service Tool (EST) to ensure that the correct IMA code is programmed to the injector 4 **Y-9004**.

   Reprogram the injector 4 **Y-9004** then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.

   ***NOTE:*** *The IMA code may be under the paint on the fuel injector.*
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17885 (653-31) - Missing Adjustment Value Programming for Injector in Cylinder 3 [113270592 - V4 - 27 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 3 **Y-9003** to control the engine operations. The ECU **A-001** uses an Injector Quantity Adjustment (IMA) code to correct the fuel trim for each fuel injector equipped with the engine at every keyswitch is ON. When the ECU **A-001** senses that this trim correction for injector 3 **Y-9003** cannot be performed, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the injector 3 **Y-9003** fuel trim correction cannot be performed.

**Possible failure modes:**

1. Faulty injector 3 **Y-9003**, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 3 **Y-9003**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Use the Electronic Service Tool (EST) to ensure that the correct IMA code is programmed to the injector 3 **Y-9003**.

   Reprogram the injector 3 **Y-9003** then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.

   ***NOTE:*** *The IMA code may be under the paint on the fuel injector.*
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17886 (652-31) - Missing Adjustment Value Programming for Injector in Cylinder 2 [113270590 - V4 - 27 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the injector 2 **Y-9002** to control the engine operations. The ECU **A-001** uses an Injector Quantity Adjustment (IMA) code to correct the fuel trim for each fuel injector equipped with the engine at every key ON. When the ECU **A-001** senses that this trim correction for the injector 2 **Y-9002** cannot be performed, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the injector 2 **Y-9002** fuel trim correction can not be performed.

**Possible failure modes:**

1. Faulty injector 2 **Y-9002**, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the injector 2 **Y-9002**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Use the Electronic Service Tool (EST) to ensure that the correct IMA code is programmed to the injector 2 **Y-9002**.

   Reprogram the injector 2 **Y-9002** then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.

   ***NOTE:*** *The IMA code may be under the paint on the fuel injector.*
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17891 (F-520494-15) - Fault Code Memory Space Erase Command was Sent Incorrectly Multiple Times an thus Erase Disabled [113270521 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the internal controller memory to control the machine's operations. The number of failure memory delete requests is monitored. When the counter exceeds 250 requests, failure memory delete is inhibited unless the counter is reset by a seed and key protected service or at least 250 driving cycles without failure delete request is reached. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17894 (F-1074-31) - ECU Internal Failure - Engine Exhaust Flap Brake Release Error [113270600 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** calculates the activation status of the engine brake actuators based on the activation status of the low and high side power supply phases. It also provides information regarding the diagnostic error relating to the engine brake power supply phases. The supply phases of the exhaust baffle are monitored and a plausibility error is detected relative to the release of the exhaust baffle between level 1 and level 2. When the ECU **A-001** senses an engine exhaust flap brake release error, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17898 (F-3509-06) - ECU 5 Volt Sensor Supply 1 High Side Output Driver Over Temperature Failure [113270288 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides the **5 V** supplies to the sensors. These voltages are monitored by hardware within the ECU **A-001** to ensure the voltages are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses an over temperature on the sensor supply reference voltage 1 circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an over temperature on the sensor supply 1 reference voltage.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty differential pressure sensor on the Diesel Particulate Filter (DPF) **B-018**, internal failure.
3. Faulty exhaust gas pressure sensor **B-9005**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, the exhaust gas pressure sensor **B-9005**, the fuse (if applicable) and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the exhaust gas pressure sensor **B-9005** supply circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas pressure sensor **B-9005** at connector **X-9018**.

   Disconnect the harness from the differential pressure sensor on the DPF **B-018** at connector **X-331**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 42** | All other pins on **X-EC2** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **4**.

   B. If there is continuity on either check, continue with Step **3**.
3. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 21** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 21** | All other pins on **X-9138B** | There should be no continuity |
| **X-9018 pin 1** | All other pins on **X-9018** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-470** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9138B** and **X-9018** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the differential pressure sensor on the DPF **B-018** supply circuit for a short to ground.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | Chassis ground | There should be no continuity |
| **X-EC2 (Receptacle) pin 42** | All other pins on **X-EC2** | There should be no continuity |
| **X-331 (Receptacle) pin 1** | All other pins on **X-331** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **5**.

   B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-EC2** and **X-331** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Replace the differential pressure sensor on the DPF **B-018** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Replace the exhaust gas pressure sensor **B-9005** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **7**.

   B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17899 (F-3509-03) - ECU 5 Volt Sensor Supply 1 Over Voltage Failure [113270296 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides the **5 V** supplies to the sensors. These voltages are monitored by hardware within the ECU **A-001** to ensure the voltages are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses a sensor supply 1 reference voltage is exceeding the set threshold, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the sensor supply 1 reference voltage.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the Diesel Particulate Filter (DPF) **B-018**, the exhaust gas pressure sensor **B-9005**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the exhaust gas pressure sensor **B-9005** supply circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas pressure sensor **B-9005** at connector **X-9018**.

   Disconnect the harness from the differential pressure sensor on the DPF **B-018** at connector **X-331**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **3**.

   B. If there is voltage, continue with Step **4**.
3. Check the exhaust gas pressure sensor **B-9005** supply circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | All other pins on **X-EC2** | There should be no continuity |

   A. If there is no continuity, continue with Step **6**.

   B. If there is continuity, continue with Step **4**.
4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 21** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **5**.

B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9018** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 21** | All other pins on **X-9138B** | There should be no continuity |
| **X-9018 pin 1** | All other pins on **X-9018** | There should be no continuity |

A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-470** and **X-EC2** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9018** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the differential pressure sensor on the DPF **B-018** supply circuit for a short to power.

With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **7**.

B. If there is voltage, there is a short to power in the connector harness (between **X-EC2** and **X-331** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

7. Check the differential pressure sensor on the DPF **B-018** supply circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | All other pins on **X-EC2** | There should be no continuity |
| **X-331 (Receptacle) pin 1** | All other pins on **X-331** | There should be no continuity |

A. If there is no continuity on both checks, continue with Step **8**.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-EC2** and **X-331** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

8. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17901 (F-3509-05) - ECU 5 Volt Sensor Supply 1 Under Voltage Failure [113270306 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides the **5 V** supplies to the sensors. These voltages are monitored by hardware within the ECU **A-001** to ensure the voltages are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses an under voltage on the ECU **A-001** sensor supply reference voltage 1 circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the sensor supply 1 reference voltage.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty differential pressure sensor on the Diesel Particulate Filter (DPF) **B-018**, internal failure.
3. Faulty exhaust gas pressure sensor **B-9005**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, the exhaust gas pressure sensor **B-9005**, the fuse (if applicable) and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the exhaust gas pressure sensor **B-9005** supply circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas pressure sensor **B-9005** at connector **X-9018**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | **X-9018 pin 1** | There should be continuity |

   A. If there is continuity, continue with Step **4**.

   B. If there is no continuity, continue with Step **3**.
3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | **X-470 (Receptacle) pin 21** | There should be continuity |

   A. If there is continuity, there is an open circuit in the connector harness (between **X-9138B** and **X-9018** connector harness). Locate and repair the an open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity, there is an open circuit in the connector harness (between **X-470** and **X-EC2** connector harness). Locate and repair the an open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the differential pressure sensor on the DPF **B-018** supply circuit for an open circuit.

   Disconnect the harness from the differential pressure sensor on the DPF **B-018** at connector **X-331**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 42** | **X-331 (Receptacle) pin 1** | There should be continuity |

   A. If there is continuity, continue with Step **5**.

   B. If there is no continuity, there is an open circuit in the connector harness (between **X-EC2** and **X-331** connector harness). Locate and repair the an open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Replace the exhaust gas pressure sensor **B-9005** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Replace the differential pressure sensor on the DPF **B-018** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **7**.

   B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17902 (F-3510-06) - ECU 5 Volt Sensor Supply 2 High Side Output Driver Over Temperature Failure [113270290 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides six independent **5 V** supplies for the sensors. These voltages are monitored by hardware within the ECU **A-001** to make sure they are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses an over temperature condition on the sensor supply 2 reference voltage circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an over temperature condition on the sensor supply 2 reference voltage circuit.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Cycle the power or reset the ECU **A-001** then recheck the status of this fault.
   A. Fault is active. Continue with Step **2**.
   B. Fault is not active. Return the machine to normal operation.
2. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **3**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17903 (F-3510-03) - ECU 5 Volt Sensor Supply 2 Over Voltage Failure [113270298 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides six independent **5 V** supplies for the sensors. These voltages are monitored by hardware within the ECU **A-001** to make sure they are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses a sensor supply 2 reference voltage is above the threshold, this fault will occur.

**Cause:**
The ECU **A-001** has detected a sensor supply 2 reference voltage is above the threshold.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Cycle the power or reset the ECU **A-001** then recheck the status of this fault.
   A. Fault is active. Continue with Step **2**.
   B. Fault is not active. Return the machine to normal operation.
2. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **3**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17905 (F-3510-05) - ECU 5 Volt Sensor Supply 2 Under Voltage Failure [113270308 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides six independent **5 V** supplies for the sensors. These voltages are monitored by hardware within the ECU **A-001** to make sure they are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses a sensor supply 2 reference voltage is below the threshold, this fault will occur.

**Cause:**
The ECU **A-001** has detected a sensor supply 2 reference voltage is below the threshold.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Cycle the power or reset the ECU **A-001** then recheck the status of this fault.
   A. Fault is active. Continue with Step **2**.
   B. Fault is not active. Return the machine to normal operation.
2. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **3**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17906 (F-3511-06) - ECU 5 Volt Sensor Supply 3 High Side Output Driver Over Temperature Failure [113270292 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides the **5 V** supplies to the sensors. These voltages are monitored by hardware within the ECU **A-001** to ensure the voltages are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses an over temperature in the sensor supply 3 reference voltage circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an over temperature on the sensor supply 3 reference voltage circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty pressure sensor on the rail **B-9004**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, the pressure sensor on the rail **B-9004**, the fuse (if applicable) and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the overpressure air temperature and pressure sensor **B-9001** supply circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 38** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **4**.

   B. If there is continuity on either check, continue with Step **3**.

3. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 17** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 17** | All other pins on **X-9138B** | There should be no continuity |
| **X-9003 pin 3** | All other pins on **X-9018** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the pressure sensor on the rail **B-9004** supply circuit for a short to ground.

   Disconnect the harness from the pressure sensor on the rail **B-9004** at connector **X-9026**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 62** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **5**.

5. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 6** | All other pins on **X-9138B** | There should be no continuity |
| **X-9026 (Receptacle) pin 2** | All other pins on **X-9026** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the overpressure air temperature and pressure sensor **B-9001** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **7**.

   B. Fault is not active. Return the machine to normal operation.

7. Replace the pressure sensor on the rail **B-9004** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **8**.

   B. Fault is not active. Return the machine to normal operation.

8. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17907 (F-3511-03) - ECU 5 Volt Sensor Supply 3 Over Voltage Failure [113270300 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides the **5 V** supplies to the sensors. These voltages are monitored by hardware within the ECU **A-001** to ensure the voltages are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses a sensor supply 3 reference voltage is exceeding the set threshold, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the sensor supply 3 reference voltage.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, the pressure sensor on the rail **B-9004**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the overpressure air temperature and pressure sensor **B-9001** supply circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **3**.

   B. If there is voltage, continue with Step **4**.

3. Check the overpressure air temperature and pressure sensor **B-9001** supply circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity, continue with Step **6**.

   B. If there is continuity, continue with Step **4**.

4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 17** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **5**.

B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 17** | All other pins on **X-9138B** | There should be no continuity |
| **X-9003 pin 3** | All other pins on **X-9003** | There should be no continuity |

A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Check the pressure sensor on the rail **B-9004** supply circuit for a short to power.

Disconnect the harness from the pressure sensor on the rail **B-9004** at connector **X-9026**.

With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **7**.

B. If there is voltage, continue with Step **8**.

7. Check the pressure sensor on the rail **B-9004** supply circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | All other pins on **X-EC1** | There should be no continuity |

A. If there is no continuity, continue with Step **10**.

B. If there is continuity, continue with Step **8**.

8. Locate the circuit for a short to power.

Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | Chassis ground | There should be no voltage |

A. If there is no voltage, continue with Step **9**.

B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

9. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 6** | All other pins on **X-9138B** | There should be no continuity |
| **X-9026 (Receptacle) pin 2** | All other pins on **X-9026** | There should be no continuity |

A. If there is no continuity on both checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

10. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17909 (F-3511-05) - ECU 5 Volt Sensor Supply 3 Under Voltage Failure [113270310 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** provides the **5 V** supplies to the sensors. These voltages are monitored by hardware within the ECU **A-001** to ensure the voltages are within a given range. This given range is defined by the ECU **A-001** hardware and cannot be calibrated. When the ECU **A-001** senses an under voltage on the ECU **A-001** sensor supply reference voltage 3 circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the sensor supply 3 reference voltage.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty pressure sensor on the rail **B-9004**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, the pressure sensor on the rail **B-9004**, the fuse (if applicable) and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the overpressure air temperature and pressure sensor **B-9001** supply circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | **X-9003 pin 3** | There should be continuity |

   A. If there is continuity, continue with Step **4**.

   B. If there is no continuity, continue with Step **3**.
3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 38** | **X-470 (Receptacle) pin 17** | There should be continuity |

   A. If there is continuity, there is an open circuit in the connector harness (between **X-9138B** and **X-9003** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity, there is an open circuit in the connector harness (between **X-470** and **X-EC1** harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the pressure sensor on the rail **B-9004** supply circuit for an open circuit.

   Disconnect the harness from the pressure sensor on the rail **B-9004** at connector **X-9026**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | **X-9026 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity, continue with Step **6**.

   B. If there is no continuity, continue with Step **5**.

5. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 62** | **X-470 (Receptacle) pin 6** | There should be continuity |

   A. If there is continuity, there is an open circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is no continuity, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the overpressure air temperature and pressure sensor **B-9001** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **7**.

   B. Fault is not active. Return the machine to normal operation.

7. Replace the pressure sensor on the rail **B-9004** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **8**.

   B. Fault is not active. Return the machine to normal operation.

8. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17914 (5466-16) - Particulate Filter Overloaded (Level 2) [113270807 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the particulate filter to control the emission operations. When the regeneration of the filter is insufficient due to low exhaust temperatures for a prolonged period of time (engine running at idle or low load for a prolonged period), or in the presence of a damaged Diesel Oxidation Catalyst (DOC) (not producing supply gas), the flow resistance of the filter can increase to values above the critical values. When the ECU **A-001** senses the soot load level is high or the pressure differential in the Diesel Particulate Filter (DPF) exceeds the limits defined by the ECU **A-001** based on the exhaust flow, the filter is overloaded (the flow resistance is too high), this fault will occur.

**Cause:**
The ECU **A-001** has detected that the particulate filter regeneration switch is overloaded (level 2).

**Possible failure modes:**

1. Faulty particulate filter regeneration switch, internal failure.
2. Faulty differential pressure sensor on the DPF **B-018**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the particulate filter regeneration switch for correct operation and proper insulation.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the correct operation of the particulate filter regeneration switch by performing the regeneration of the particulate filter.

   Use the Electronic Service Tool (EST) to carry out the regeneration of the particulate filter regeneration switch. After having carried out the regeneration reset the switch use counter.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Replace the particulate filter regeneration switch and then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. Replace the differential pressure sensor on the DPF **B-018** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17915 (5466-00) - Particulate Filter Overloaded (Level 3) [113270809 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the particulate filter to control the emission operations. When the regeneration of the filter is insufficient due to low exhaust temperatures for a prolonged period of time (engine running at idle or low load for a prolonged period), or in the presence of a damaged Diesel Oxidation Catalyst (DOC) (not producing supply gas), the flow resistance of the filter can increase to values above the critical values. When the ECU **A-001** senses the soot load level is high or the pressure differential in the Diesel Particulate Filter (DPF) exceeds the limits defined by the ECU **A-001** based on the exhaust flow, the filter is overloaded (the flow resistance is too high), this fault will occur.

**Cause:**
The ECU **A-001** has detected that the particulate filter regeneration switch is overloaded (level 3).

**Possible failure modes:**

1. Faulty particulate filter regeneration switch, internal failure.
2. Faulty differential pressure sensor on the DPF **B-018**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor on the DPF **B-018**, and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the particulate filter regeneration switch for correct operation and proper insulation.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the correct operation of the particulate filter regeneration switch by performing the regeneration of the particulate filter.

   Use the Electronic Service Tool (EST) to carry out the regeneration of the particulate filter regeneration switch. After having carried out the regeneration reset the switch use counter.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Replace the particulate filter regeneration switch and then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.
5. Replace the differential pressure sensor on the DPF **B-018** and then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17916 (F-519695-07) - Differential Pressure Sensing Hose Line Upstream from Catalyst Filter is Detached or Completely Blocked. [113270471 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the operation of the diesel particulate filter (DPF) delta pressure sensor **B-018** and evaluates the filter differential pressure and the change in filter volume flow over time. By monitoring the flexible hoses, it is possible to detect drops, obstructions, or blockages in the hose connections of the particulate filter pressure sensor system. This error is generated when implausible behavior of the volume flow signal and the pressure of the differential is detected. When the ECU **A-001** senses a change in the differential pressure is lower than the minimum positive value or higher than the minimum negative value, this fault will occur. With atmospheric pressure constantly present on the pressure connection upstream of the particulate filter, this fault indicates the presence of a hose connection upstream of the particulate filter disconnected or completely blocked.

**Cause:**
The ECU **A-001** has detected a blockage or the upstream differential pressure sensing hose line from the catalyst filter has been detached.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty differential pressure sensor **B-018** hose or line, clogged/damaged.
3. Faulty differential pressure sensor **B-018**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the differential pressure sensor **B-018**, and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harness or connectors as required. Return the machine to normal operation.
2. Check the DPF filter for clogging or damage.

   A. If the DPF filter is not clogged or damaged, continue with Step **3**.

   B. If the DPF filter is clogged or damaged, clean or replace the DPF filter as required. Return the machine to normal operation.
3. Check the differential pressure sensor or line for signs of restriction, clogged or blocked hose, and proper routing.

   Note: Hard lines are etched with “Right” and “Left” approximately 41mm from end of the line (may need to remove the mounting block to view).

   A. If the lines are properly routed, free of clogs and restrictions, continue with Step **4**.

   B. If the routing is not correct and/or clogs and damage are found, clean, repair or replace the lines as required. Return the machine to normal operation. Note: To clean the lines, remove the differential pressure pipes and submerge in warm water to free or dissolve the contaminates.
4. Check the differential pressure sensor **B-018** for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the differential pressure sensor **B-018** at connector **X-331**.

With the key switch in the OFF position, use a multimeter to check the continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-331 (Receptacle) pin 1** | **X-EC2 (Receptacle) pin 42** | There should be continuity |
| **X-331 (Receptacle) pin 3** | **X-EC2 (Receptacle) pin 16** | There should be continuity |
| **X-331 (Receptacle) pin 2** | **X-EC2 (Receptacle) pin 15** | There should be continuity |

A. If there is continuity on all the checks, continue with Step **5**.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-EC2** and **X-331** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Reset the offset drift compensation for the differential pressure sensor **B-018**.

   Use the Electronic Service Tool (EST) to recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Replace the differential pressure sensor **B-018**, then recheck the status of this fault.

   A. Fault is active. Continue with Step **7**.

   B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17921 (F-520379-11) - ECU Internal Failure - Safety Management Unit Alarm Group 2 Failure 30 Issued [113270676 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** internally performs extensive monitoring of the Error Management Module (EMM) alarms, which are reported by the hardware of the Safety Management Unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behavior of the microcontroller in the event that it fails. The SMU centralizes all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17933 (F-4781-00) - Maximum Catalyst Soot Mass Exceeded [113270974 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the regeneration of the particulate filter. The regeneration function of the particulate filter allows the filter to be restored by means of the dedicated diagnostic tool on the vehicle. Filter regeneration is triggered when the soot load exceeds the limit value. When the ECU **A-001** senses that the particulate filter is overloaded with an excessive accumulation of soot, greater than **13.30 g**, this fault will occur.

**Cause:**
The ECU **A-001** has detected the particulate filter regeneration has not been carried out for too much time.

**Possible failure modes:**

1. Faulty particulate filter, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the correct operation of the particulate filter regeneration switch and the wiring to which it is connected.

   Check the correct insulation and check there are no problems with the contacts then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Replace the particulate filter regeneration switch and then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17934 (5466-15) - SCR Catalyst is Becoming Full. Manual Catalyst Management is Recommended. (Filter Plugged - Level 3) [113334028 - V3 - 29 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors soot load levels as long as the battery voltage is greater than **10 V** and the engine speed is greater than **50 RPM**. When the soot load level is greater than **9 g/L** but less than **11 g/L** or the pressure differential across the Diesel Particulate Filter (DPF) is above the ECU **A-001** defined limits depending on exhaust flow, the filter is overloaded (flow resistance is too high) and this fault will occur. When filter regeneration is insufficient, due to prolonged low exhaust temperatures (extensive idling or light loading) or a damaged Diesel Oxidation Catalyst (DOC) (no feed gas produced), filter flow resistance can increase above critical values. Manual Catalyst Management (MCM) with forced thermal treatment possible of **570 °C** (**1058 °F**) at the Selective Catalytic Reduction on Filter (SCRoF) inlet or filter cleaning is required.

**Cause:**
The ECU **A-001** has detected the MCM with forced thermal treatment is required due to the SCR is full.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in a shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check for other faults related to the differential pressure sensor or if fault **3611 – Catalyst efficiency lower than first NOx prediction threshold level** is present.

   A. If no other faults are active, continue with Step **3**.

   B. If other differential pressure sensor faults are active, indicate the differential pressure sensor faults that are active in the comment field, then follow the troubleshooting for those faults.

   C. If the fault **3611 – Catalyst efficiency lower than first NOx prediction threshold level** is present, follow the troubleshooting available for fault **3611 – Catalyst efficiency lower than first NOx prediction threshold level**.
3. Use the Electronic Service Tool (EST) to launch a MCM routine.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check that the differential pressure pipes, at the point of connection with the SCRoF, are not obstructed.

   A. If the pipes are clogged, continue with Step **5**.

   B. If the pipes are not clogged, return the machine to normal operation.
5. Remove the differential pressure pipes and submerge in warm water until the contaminates can be removed.

   Install the cleaned pipes and check to see if the fault has been resolved.

A. Fault is active. Continue with Step **6**.

B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17941 (3703-07) - Active Catalyst Management CAN Inhibit/Postpone Signal from Display/Cluster is Always Commanding Inhibit [113334033 - V3 - 24 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the particulate filter regeneration switch to control the emission operations. The particulate filter regeneration function allows the filter to be rest through intervention of the diagnostic tool or through the dedicated switch on the vehicle. When the ECU **A-001** senses that the switch remains locked in the closed position for longer than expected, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the particulate filter regeneration switch remains blocked in the closed position.

**Possible failure modes:**

1. Faulty particulate filter regeneration switch, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the particulate filter regeneration switch, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the correct operation of the particulate filter regeneration switch by performing the regeneration of the particulate filter.

   Regeneration of the filter must be carried out using the Electronic Service Tool (EST) or through the switch. After having carried out the regeneration reset the switch use counter.

   A. If the switch is not working correctly, continue with Step **3**.

   B. If the switch is working correctly, return the machine to normal operation.
3. Replace the particulate filter regeneration switch, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17944 (7026-03) - Fuel Metering Unit Low Side Driver has a Short Circuit to Battery [113270421 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the operation of the fuel pressure regulation solenoid valve **Y-9000**. When the ECU **A-001** senses a voltage above normal on the fuel pressure regulation solenoid valve **Y-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the fuel pressure regulation solenoid valve **Y-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty fuel pressure regulation solenoid valve **Y-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the fuel pressure regulation solenoid valve **Y-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the fuel pressure regulation solenoid valve **Y-9000** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the fuel pressure regulation solenoid valve **Y-9000** at connector **X-9007**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 6** | Chassis ground | There should be no voltage |
| **X-EC1 (Receptacle) pin 7** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, continue with Step **4**.
3. Check the fuel pressure regulation solenoid valve **Y-9000** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 6** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 7** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **6**.

   B. If there is continuity on either check, continue with Step **4**.
4. Locate the circuit for a short to power.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 2** | Chassis ground | There should be no voltage |
| **X-9138B (Plug) pin 1** | Chassis ground | There should be no voltage |

A. If there is no voltage on both checks, continue with Step **5**.

B. If there is voltage on either check, there is a short to power in the connector harness (between **X-9138B** and **X-9007** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

5. Locate the circuit for a short to power.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 2** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 1** | All other pins on **X-9138B** | There should be no continuity |
| **X-9007 pin 2** | All other pins on **X-9007** | There should be no continuity |
| **X-9007 pin 1** | All other pins on **X-9007** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to power in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to power in the connector harness (between **X-9138B** and **X-9007** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the fuel pressure regulation solenoid valve **Y-9000**, reconnect the connectors, then recheck the status of this fault.

A. Fault is active. Continue with Step **7**.

B. Fault is not active. Return the machine to normal operation.

7. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17945 (7026-04) - Fuel Metering Unit Low Side Driver has a Short Circuit to Ground or ECU Power lost [113270365 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the operation of the fuel pressure regulation solenoid valve **Y-9000**. When the ECU **A-001** senses a voltage below normal on the fuel pressure regulation solenoid valve **Y-9000** circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the fuel pressure regulation solenoid valve **Y-9000** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to ground.
2. Faulty fuel pressure regulation solenoid valve **Y-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the fuel pressure regulation solenoid valve **Y-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the fuel pressure regulation solenoid valve **Y-9000** circuit for a short to ground.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the fuel pressure regulation solenoid valve **Y-9000** at connector **X-9007**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 6** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 7** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 6** | All other pins on **X-EC1** | There should be no continuity |
| **X-EC1 (Receptacle) pin 7** | All other pins on **X-EC1** | There should be no continuity |

   A. If there is no continuity on all the checks, continue with Step **4**.

   B. If there is continuity on any of the checks, continue with Step **3**.
3. Locate the circuit for a short to ground.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 2** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 1** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 2** | All other pins on **X-9138B** | There should be no continuity |
| **X-9138B (Plug) pin 1** | All other pins on **X-9138B** | There should be no continuity |
| **X-9007 pin 2** | All other pins on **X-9007** | There should be no continuity |

| From | To | Value |
|---|---|---|
| **X-9007 pin 1** | All other pins on **X-9007** | There should be no continuity |

A. If there is no continuity on all the checks, there is a short to ground in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is continuity on any of the checks, there is a short to ground in the connector harness (between **X-9138B** and **X-9007** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the fuel pressure regulation solenoid valve **Y-9000**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17946 (156-12) - ECU internal failure - Implausible Injector Temperature Compensation times [113270533 - V6 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the plausibility of the injector valve closing correction times of all configured injection types. The valve closure correction times of VCC or VCA are tested on their plausible value ranges. When the ECU **A-001** senses the valve closing correction times are not plausible, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure or incorrect calibration is detected.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17947 (156-31) - ECU Internal Failure - Implausible Valve Closing Correction Times [113270513 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the plausibility of the injector valve closing correction times of all configured injection types. The valve closure correction times of VCC or VCA are tested on their plausible value ranges. When the ECU **A-001** senses the valve closing correction times are not plausible, this fault will occur.

**Cause:**
The ECU **A-001** has detected an internal failure or incorrect calibration is detected.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17948 (516396-09) - Rail Pressure Relief Valve Kick-Off Opening Counter High [113334020 - V3 - 27 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the mechanical Pressure Relief Valve (PRV), integrated in the fuel supply rail, opens if excessive pressure is present in the rail. The ECU **A-001** detects and counts the sudden pressure drops in the rail due to the opening of the PRV valve. When the ECU **A-001** senses more openings than the maximum limit, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the internal PRV opening counter has exceeded the maximum limit.

**Possible failure modes:**

1. Faulty PRV, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the PRV, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active.

   Check the status of the following related faults:

   **1240-31 – Fuel Pump Pressure has Exceeded Desired Pressure Limits**

   **1442-00 – Fuel Rail Pressure has Exceeded Maximum Limit**

   **519744-18 – Fuel Rail Pressure has Exceeded Maximum Positive Deviation Limits**

   **519744-15 – Fuel Rail Pressure has Exceeded Maximum Negative Deviation Limits**

   Resolve them first then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Replace the PRV, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17949 (516396-31) - Rail Pressure Relief Valve Forced Opening Error Detected [113334034 - V3 - 24 January 2025]

## Control Module: ECU

**Fault Description:**
This fault is for information purpose only. The Engine Control Unit (ECU) **A-001** monitors the Pressure Relief Valve (PRV) to control the engine operations. The forced opening of the PRV is not possible due to the high amount of injected fuel. When the ECU **A-001** senses whether a sufficient increase in rail pressure is possible, the PRV opening request is required to bring the system into Limp Home mode, and the fault will occur. Check and repair the error that forced the PRV opening request. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17954 (2791-07) - EGR Valve is Stuck in the Closed Position [113270545 - V7 - 18 December 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) sensor which is internal inside the EGR solenoid valve **Z-9000**. The EGR solenoid valve **Z-9000** shares the EGR valve position signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses the position of the EGR solenoid valve **Z-9000** is lower than **5%** in relation to the calculated position, this fault will occur.

**Cause:**
The ECU **A-001** has detected a EGR solenoid valve **Z-9000** is stuck in the closed position.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Go to Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Connect the Electronic Service Tool (EST) and perform the "EGR Valve Test".

   Click the "START Test" button and follow the on-screen instructions.

   A. Test results indicate that the EGR valve is working properly. Go to Step **3**.

   B. Test results indicate that the EGR valve is not working properly. Replace the EGR valve.
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17955 (519201-07) - EGR Valve is Stuck in the Open Position [113270547 - V8 - 19 December 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the Exhaust Gas Recirculation (EGR) solenoid valve **Z-9000** to control the engine operations. The EGR solenoid valve **Z-9000** with internal position sensor provides feedback to the ECU **A-001**. If there is a deviation between the position requested and the position detected, a deviation error is triggered. The system then attempts to "unlock" the closing or opening of the actuator. If it is not possible to "unlock" the actuator, the "Valve locked" fault is triggered. The valve is detected as locked in the open state if the deviation is permanent, attempts to release the valve have failed or the position of the EGR actuator is higher than or equal to **5%** in relation to the calculated position. When the ECU **A-001** senses the EGR solenoid valve **Z-9000** is stuck in the open position, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the EGR solenoid valve **Z-9000** is stuck in the open position.

**Possible failure modes:**

1. Faulty EGR solenoid valve **Z-9000**, stuck or blocked.
2. Faulty EGR solenoid valve **Z-9000**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Go to Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the EGR solenoid valve **Z-9000** for any blockage.

   Check the EGR solenoid valve **Z-9000** for proper alignment (open or close).

   Repair or replace the EGR solenoid valve **Z-9000** as required.

   Then recheck the status of this fault.

   A. Fault is active. Go to Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Connect the Electronic Service Tool (EST) and perform the "EGR Valve Test".

   Click the "START Test" button and follow the on-screen instructions.

   A. Test results indicate that the EGR valve is working properly. Go to Step **4**.

   B. Test results indicate that the EGR valve is not working properly. Replace the EGR valve.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17956 (8631-14) - Turbocharger Protection Active for Cold Start [113270870 - V5 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
In a cold start condition, the turbocharger speed may be limited (turbocharger cold start protection active). When this condition occurs, the ECU **A-001** activates this information error. Monitoring is active if cold start is detected. No intervention needed.

# 17957 (520194-07) - Throttle Valve Stuck in the Closed State [113270551 - V4 - 04 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. When the ECU **A-001** senses the throttle solenoid valve **Z-9001** in the stuck close condition, this fault will occur.

**Cause:**
The ECU **A-001** has detected a block on the throttle solenoid valve **Z-9001** in the closed position.

**Possible failure modes:**

1. Faulty throttle solenoid valve **Z-9001** mechanically blocked, dirty.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the correct operation of the throttle solenoid valve **Z-9001**, check the correct position, check that there is no dirt preventing the valve from opening and closing.
   A. If it is working correctly. Continue with Step **3**.
   B. If it is not working correctly, replace the throttle solenoid valve **Z-9001**. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17958 (520195-07) - Throttle Valve Stuck in the Open State [113270553 - V4 - 04 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the throttle solenoid valve **Z-9001** to control the engine operations. When the ECU **A-001** senses the throttle solenoid valve **Z-9001** in the stuck open condition, this fault will occur.

**Cause:**
The ECU **A-001** has detected a block on the throttle solenoid valve **Z-9001** in the open position.

**Possible failure modes:**

1. Faulty throttle solenoid valve **Z-9001** mechanically blocked, dirty.
2. Faulty throttle solenoid valve **Z-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the throttle solenoid valve **Z-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the correct operation of the throttle solenoid valve **Z-9001**, check the correct position, check that there is no dirt preventing the valve from opening and closing.
   A. If it is working correctly. Continue with Step **3**.
   B. If it is not working correctly, replace the throttle solenoid valve **Z-9001**. Return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17968 (1209-07) - Turbine Upstream Pressure: Pressure Too Low [113270519 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas pressure sensor **B-9005**. The exhaust gas pressure sensor **B-9005** shares the exhaust gas pressure value with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses a pressure value lower than the predetermined threshold, this fault will occur.

**Cause:**
The ECU **A-001** has detected a pressure loss due to possible leakage in the exhaust gas circuit or a malfunction in the exhaust gas pressure sensor **B-9005**.

**Possible failure modes:**

1. Faulty exhaust gas circuit, leakage.
2. Faulty exhaust gas pressure sensor **B-9005**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas pressure sensor **B-9005**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the exhaust gas circuit for any leaks.
   A. If there are no leaks in the exhaust gas circuit, continue with Step **3**.
   B. If there are leaks in the exhaust gas circuit, repair or replace the exhaust gas circuit.
3. Check the correct operation of the exhaust gas pressure sensor **B-9005**.
   A. If the sensor is working correctly, continue with Step **4**.
   B. If the sensor is not working correctly, replace the exhaust gas pressure sensor **B-9005**.
4. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17969 (27-20) - EGR Valve Position in the Closed State is Drifting Too Much [113334024 - V5 - 18 December 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** continuously monitors the Exhaust Gas Recirculation (EGR) solenoid valve **Z-9000** to control the engine operations. As long as battery voltage is between **10.00 – 17.50 V** for at least **2.00 s**, learning is active, the engine temperature is between **49.96 – 129.96 °C** (**121.93 – 265.93 °F**), and learning is not inhibited by another failure. When the ECU **A-001** senses that the average feedback voltage for the closed position of the stop is not within the limits of **0.75 – 1.30 V**, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the EGR solenoid valve **Z-9000** position feedback signal in the closed position is out of range.

**Possible failure modes:**

1. Faulty EGR solenoid valve **Z-9000**, internal failure.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the EGR solenoid valve **Z-9000**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Ensure the mechanical operation of the EGR solenoid valve **Z-9000**.

   Disconnect and manually operate the EGR solenoid valve **Z-9000**.

   Check the flap seat for dirt or debris and determine if the valve seat fully closes.

   If any contamination is found or mechanical operation is hampered, clean, repair or replace, as required.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Connect the Electronic Service Tool (EST) and perform the "EGR Valve Test".

   Click the "START Test" button and follow the on-screen instructions.

   A. Test results indicate that the EGR valve is working properly. Continue with Step **4**.

   B. Test results indicate that the EGR valve is not working properly. Replace the EGR valve.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 17974 (518844-05) - Starter Relay Drivers are Open Circuit [113270852 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the ignition control contactor **K-103** to control the engine operations. When the ECU **A-001** fails to receive a signal on the ignition control contactor **K-103** control circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the ignition control contactor **K-103** control circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty ignition control contactor **K-103**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the ignition control contactor **K-103**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ignition control contactor **K-103** supply circuit.

   Using a multimeter back probe the harness from the ignition control contactor **K-103** at connector **X-101**.

   With the keyswitch in the ON position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-101 (Power Distribution) pin 1** | Chassis ground | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is greater than **12 V**, check the circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reconnect the harness, recheck the voltage, then return the machine to normal operation.
3. Check the ignition control contactor **K-103** ground circuit.

   Disconnect the harness from the ignition control contactor **K-103** at connector **X-101**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-101 (Power Distribution) pin 9** | Chassis ground | There should be continuity |

   A. If there is continuity, continue with Step **4**.

   B. If there is no continuity, there is an open circuit in the ground circuit harness. Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.
4. Check the ignition control contactor **K-103** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-101 (Power Distribution) pin 7** | **X-EC2 (Receptacle) pin 55** | There should be continuity |
| **X-101 (Power Distribution) pin 3** | **X-EC2 (Receptacle) pin 72** | There should be continuity |

A. If there is continuity on both checks, continue with Step **5**.

B. If there is no continuity on either check, there is an open circuit in the engine (EN) harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Check the ignition control contactor **K-103**.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the component side:

| From | To | Value |
|---|---|---|
| **X-101 (Power Distribution) pin 1** | **X-101 (Power Distribution) pin 9** | There should be no continuity |

A. If there is no continuity, continue with Step **6**.

B. If there is continuity, the ignition control contactor **K-103** has failed internally. Replace the ignition control contactor **K-103**.

6. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19001 (F-168-03) - Battery Voltage is Higher than Expected [113270393 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the battery voltage using internal interfaces to control the machine operations. When the ECU **A-001** senses that the battery voltage is greater than **3.37 V** on the battery circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the battery circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty battery or recharging system.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the battery voltage.

   With engine running, use a multimeter to check the voltage:

| From | To | Value |
|---|---|---|
| Battery terminal (+) | Battery terminal (-) | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is not approximately **12 V**, continue with Step **4**.

3. Check the voltage on the ECU **A-001** supply circuit.

   Using a multimeter back probe the harness from the **A-001** at connector **X-EC2**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 1** | Chassis ground | There should be approximately **12.0 V** |
| **X-EC2 (Receptacle) pin 3** | Chassis ground | There should be approximately **12.0 V** |
| **X-EC2 (Receptacle) pin 5** | Chassis ground | There should be approximately **12.0 V** |

   A. If there is approximately **12 V** on all the checks, continue with Step **4**.

   B. If there is not approximately **12 V** on any of the checks, check the fuse and circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reinstall the fuse, recheck the voltage, then return the machine to normal operation.

4. Check the ECU **A-001** ground circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 2** | Chassis ground | There should be continuity |
| **X-EC2 (Receptacle) pin 4** | Chassis ground | There should be continuity |
| **X-EC2 (Receptacle) pin 6** | Chassis ground | There should be continuity |

A. If there is continuity on all the checks, continue with Step **5**.

B. If there is no continuity on any of the checks, there is an open circuit in the ground circuit harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Check the charging system, repair the charging system as required.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19002 (F-168-04) - Battery Voltage is Lower than Expected [113270344 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the battery voltage using internal interfaces to control the machine operations. When the ECU **A-001** senses that the battery voltage is less than **890 mV** on the battery circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the battery circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty battery or recharging system.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the battery voltage.

   With engine running, use a multimeter to check the voltage:

| From | To | Value |
|---|---|---|
| Battery terminal (+) | Battery terminal (-) | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is not approximately **12 V**, continue with Step **4**.

3. Check the voltage on the ECU **A-001** supply circuit.

   Using a multimeter back probe the harness from the **A-001** at connector **X-EC2**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 1** | Chassis ground | There should be approximately **12.0 V** |
| **X-EC2 (Receptacle) pin 3** | Chassis ground | There should be approximately **12.0 V** |
| **X-EC2 (Receptacle) pin 5** | Chassis ground | There should be approximately **12.0 V** |

   A. If there is approximately **12 V** on all the checks, continue with Step **4**.

   B. If there is not approximately **12 V** on any of the checks, check the fuse and circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reinstall the fuse, recheck the voltage, then return the machine to normal operation.

4. Check the ECU **A-001** ground circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 2** | Chassis ground | There should be continuity |
| **X-EC2 (Receptacle) pin 4** | Chassis ground | There should be continuity |
| **X-EC2 (Receptacle) pin 6** | Chassis ground | There should be continuity |

A. If there is continuity on all the checks, continue with Step **5**.

B. If there is no continuity on any of the checks, there is an open circuit in the ground circuit harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Check the charging system, repair the charging system as required.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19040 (F-4766-14) - Upstream Oxidation Catalyst Temperature Sensor Comparison to a Calculated Temperature Value Failure [113270819 - V6 - 22 October 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas temperature sensor upstream of the Diesel Oxidation Catalyst (DOC) **B-011** to control the engine operations. When the ECU **A-001** senses the value detected by the exhaust gas temperature sensor upstream of the DOC **B-011** is above or below the operating limit depending on the RPM, the load and the ambient conditions set by the ECU **A-001**, this fault will occur.

**Cause:**
The ECU **A-001** has detected an excessive difference in the temperature between the measured and calculated temperature values.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty exhaust gas temperature sensor upstream of the DOC **B-011**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DOC **B-011**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. On a cold machine, with the key switch in the ON position and the engine not running.

   Use EST to monitor parameters of the following sensors:
   - DOC Inlet Temperature
   - DOC Outlet Temperature (if equipped)
   - SCR Catalyst Intake Exhaust Temperature
   - SCR Catalyst Outlet Exhaust Temperature
   - Intake Manifold Temperature
   - Exhaust Fluid Doser Absolute Pressure

   Temperature sensor readings should be close to one another.

   Pressure sensor readings should be close to barometric pressure.

   A. The sensor readings are within range. Continue with Step **3**.

   B. One or more of the sensor readings are out of range. Check the installation, condition of the connectors and circuit of suspected sensor. Repair or replace as needed.
3. Connect the Electronic Service Tool (EST) and turn the key switch to the ON position without starting the engine.

   Perform the Engine Restart Counter Reset / Unlock Inducement configuration.

Create a parameter list with the following parameters:

- NOx Sensor Concentration - Upstream
- DOC Inlet Temperature
- SCR Catalyst Intake Exhaust Temperature
- SCR Catalyst Outlet Exhaust Temperature
- DOC Outlet Temperature
- NOx Sensor Concentration - Downstream

Select a sampling rate of **10 ms** and a maximum disc space of **90 MB**.

Run the machine under a load to obtain highest possible exhaust temperatures for **30 min**.

Check that the temperature sensors decreases in temperature value, starting from the one closest to the engine:

- DOC Inlet Temperature
- DOC Outlet Temperature
- SCR Catalyst Intake Exhaust Temperature
- SCR Catalyst Outlet Exhaust Temperature

Temperature is expected to drop approximately **10.0 °C** (**50.0 °F**) between sensors.

A. The decreasing the temperature trend is not observed. Check all of the exhaust temperature sensor for proper installation and that the electrical connectors are connected to the correct sensor. Check all of the main exhaust joints for leaks or areas for heat to escape. Inspect the turbocharger. See **Turbocharger - Inspect (10.250)**. Repair or replace as needed.

B. The temperature trend decreases. Continue with Step **4**

4. Check for other active fault codes related to exhaust gas temperature sensor upstream of the DOC **B-011**.

   And then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the exhaust gas temperature sensor upstream of the DOC **B-011**.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DOC **B-011** at connector **X-617**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-617 (Receptacle) pin 1** | **X-617 (Receptacle) pin 2** | The resistance should be between **169.7 – 738.2 Ω** at the temperature on the exhaust **-40 – 800 °C** (**-40 – 1472 °F**) |

   A. If the resistance is within the limit, continue with Step **6**.

   B. If the resistance is not within the limit, the exhaust gas temperature sensor upstream of the DOC **B-011** has failed internally. Replace the exhaust gas temperature sensor upstream of the DOC **B-011**.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19041 (F-3242-31) - Upstream SCR Temperature Sensor Comparison to a Calculated Temperature Value Failure [113270817 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas temperature sensor upstream of the DPF **B-012** to control the engine operations. When the ECU **A-001** senses that the value measured by the exhaust gas temperature sensor upstream of the DPF **B-012** is higher or lower (which depends on the engine speed, on the load, and on ambient conditions) than the set certain operational limit, this fault will occur.

**Cause:**
The ECU **A-001** has detected an excessive difference between the measured and calculated temperature values.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty exhaust gas temperature sensor upstream of the DPF **B-012**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DPF **B-012**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are present.

   A. If no other fault codes are present, continue with Step **3**.

   B. If other fault codes are present, resolve those fault codes first.
3. Check the exhaust gas temperature sensor upstream of the DPF **B-012**.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DPF **B-012** at connector **X-303**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-303 (Receptacle) pin 1** | **X-303 (Receptacle) pin 2** | The value must be between **169.7 – 738.2 Ω** dependant upon the temperature at the exhaust **-40 – 800 °C** (**-40 – 1472 °F**) |

   A. If the measured resistance value is within the limit, continue with Step **4**.

   B. If the measured resistance value is not within the limit, the exhaust gas temperature sensor upstream of the DPF **B-012** has failed internally. Replace the exhaust gas temperature sensor upstream of the DPF **B-012**.
4. Use the Electronic Service Tool (EST), and perform the Engine Restart Counter Reset / Unlock Inducement Configuration.

   Use the EST to recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19066 (4765-03) - Oxidation Catalyser Upstream Temperature Sensor: Signal value above maximum limit (SIgnal High) [113270302 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas temperature sensor upstream of the Diesel Oxidation Catalyst (DOC) **B-011** to control the engine operations. When the ECU **A-001** senses a voltage greater than **3.58 V** on the exhaust gas temperature sensor upstream of the DOC **B-011** circuit, this fault occurs. When this fault occurs, the temperature value is locked by the ECU **A-001** on the last valid value detected or on a fixed replacement value, once the fault is validated.

**Cause:**
The ECU **A-001** has detected a short to power condition on the exhaust gas temperature sensor upstream of the DOC **B-011** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty exhaust gas temperature sensor upstream of the DOC **B-011**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DOC **B-011**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the exhaust gas temperature sensor upstream of the DOC **B-011** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DOC **B-011** at connector **X-617**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 27** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 30** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, there is a short to power in the connector harness (between **X-EC2** and **X-617** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

3. Check the exhaust gas temperature sensor upstream of the DOC **B-011** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 27** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 30** | All other pins on **X-EC2** | There should be no continuity |

A. If there is no continuity on both checks, continue with Step **4**.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-EC2** and **X-617** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Check the exhaust gas temperature sensor upstream of the DOC **B-011**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-617 (Receptacle) pin 1** | **X-617 (Receptacle) pin 2** | The resistance should be between **169.7 – 738.2 Ω** at the temperature on the exhaust **-40 – 800 °C** (**-40 – 1472 °F**) |

   A. If the resistance is within the limit, continue with Step **5**.

   B. If the resistance is not within the limit, the exhaust gas temperature sensor upstream of the DOC **B-011** has failed internally. Replace the exhaust gas temperature sensor upstream of the DOC **B-011**.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19126 (F-5246-15) - SCR Inducement: Warning, Triggered by Tampering Fault [113270561 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
This fault signalization is supplied only for information and no other actions are required other than resolving the active error that has caused this fault. Any of the tampering detection faults **Diesel Exhaust Fluid (DEF)/AdBlue®** of the Selective Catalytic Reduction (SCR) system has caused this fault. The active error that causes this fault must be identified and resolved in order to prevent engine power reduction.

# 19197 (F-172-02) - Plausibility Check Error of the First Fresh Air Temperature Sensor at Cold Start [113270465 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the intake air temperature sensor **B-010** at engine start up. The intake air temperature sensor **B-010** shares the intake air temperature signal with the ECU **A-001** to control the engine operations. The ECU **A-001** will monitor up to five temperature sensors for mutual plausibility check. When the ECU **A-001** senses the intake air temperature sensor **B-010** plausibility check is clearly identified as delivering a non plausible temperature value, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the intake air temperature sensor **B-010** value is non plausible.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty intake air temperature sensor **B-010**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the intake air temperature sensor **B-010**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the intake air temperature sensor **B-010**

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the intake air temperature sensor **B-010**.

   Disconnect the harness from the intake air temperature sensor **B-010** at connector **X-474**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-474 (Receptacle) pin 1** | **X-474 (Receptacle) pin 2** | There should be approximately **2.5 kΩ** at **20.0 °C** (**68.0 °F**) |

   A. If the resistance value is correct, continue with Step **4**.

   B. If the resistance value is incorrect, the intake air temperature sensor **B-010** has failed internally. Replace the intake air temperature sensor **B-010**.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19198 (F-172-14) - Plausibility Check Error of the Second Fresh Air Temperature Sensor at Cold Start [113270467 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the overpressure air temperature and pressure sensor **B-9001** at engine start up. The overpressure air temperature and pressure sensor **B-9001** shares the overpressure air temperature and pressure value with the ECU **A-001** to control the engine operations. The ECU **A-001** will monitor up to five temperature sensors for mutual plausibility check. When the ECU **A-001** senses the overpressure air temperature and pressure sensor **B-9001** plausibility check is clearly identified as delivering a non plausible temperature value, this fault will occur.

**Cause:**
The ECU **A-001** has detected that the overpressure air temperature and pressure sensor **B-9001** value is non plausible.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the overpressure air temperature and pressure sensor **B-9001**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the overpressure air temperature and pressure sensor **B-9001**.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the overpressure air temperature and pressure sensor **B-9001**.

   Disconnect the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9003 pin 1** | **X-9003 pin 3** | There should be approximately **2.5 kΩ** at **20.0 °C** (**68.0 °F**) |

   A. If the resistance value is correct, continue with Step **4**.

   B. If the resistance value is incorrect, the overpressure air temperature and pressure sensor **B-9001** has failed internally. Replace the overpressure air temperature and pressure sensor **B-9001**.
4. Check the ECU **A-001** for the appropriate software and re-flash.

A. Fault is not active. Return the machine to normal operation.

B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19200 (2630-02) - Plausibilty Check Error of the Fuel Temperature Sensor at Cold Start [113334018 - V3 - 24 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the fuel temperature sensor **B-9002**. The fuel temperature sensor **B-9002** shares the fuel temperature signal with the ECU **A-001** to control the engine operations. When the ECU **A-001** senses that position 4 of the plausibility check is delivering a non plausible temperature value, this fault will occur. At the engine start up, the ECU **A-001** will monitor up to five temperature sensors for mutual plausibility.

**Cause:**
The ECU **A-001** has detected a non plausible temperature value.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty fuel temperature sensor **B-9002**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the fuel temperature sensor **B-9002**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active related to the fuel temperature sensor **B-9002**.

   Resolve them first then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Replace the fuel temperature sensor **B-9002**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19202 (F-519551-02) - Error in Case of More than One Not Plausible Fresh Air Temperature at Cold Start [113270469 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the intake air temperature sensor **B-010**, the overpressure air temperature and pressure sensor **B-9001** and the fuel temperature sensor **B-9002** to control the engine operations. When the ECU **A-001** senses that more than one sensor is deviating and it cannot be clearly identified which one is indicating a wrong value, this fault will occur. At the engine start up, the ECU **A-001** will monitor up to five temperature sensors for mutual plausibility.

**Cause:**
The ECU **A-001** has detected a non plausible temperature value.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty intake air temperature sensor **B-010**, internal failure.
3. Faulty overpressure air temperature and pressure sensor **B-9001**, internal failure.
4. Faulty fuel temperature sensor **B-9002**, internal failure.
5. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the intake air temperature sensor **B-010**, the overpressure air temperature and pressure sensor **B-9001**, the fuel temperature sensor **B-9002**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes are active.

   Resolve them first and then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the conditions of each sensor.

   Disconnect the harness from the intake air temperature sensor **B-010** at connector **X-474**.

   Disconnect the harness from the overpressure air temperature and pressure sensor **B-9001** at connector **X-9003**.

   Disconnect the harness from the fuel temperature sensor **B-9002** at connector **X-9005**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-474 (Receptacle) pin 1** | **X-474 (Receptacle) pin 2** | This should be approximately **2.5 kΩ** at **20.0 °C** (**68.0 °F**) |
| **X-9003 pin 1** | **X-9003 pin 3** | |
| **X-9005 (Receptacle) pin 1** | **X-9005 (Receptacle) pin 1** | |

   A. If the measured resistance are within the limit on all the checks, continue with Step **4**.

B. If the measured resistance are not within the limit on any of the checks, that particular sensor has failed internally. Replace that particular sensor.

4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19259 (1659-02) - Engine Coolant System Thermostat: Implausible Data [113271839 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the coolant temperature sensor **B-9003**. The coolant temperature sensor **B-9003** shares the coolant temperature signal with the ECU **A-001** to control the engine operations. The ECU **A-001** monitors the value of the coolant temperature sensor **B-9003** at the engine startup. The value of the coolant temperature sensor **B-9003** is compared to the value of the measured temperature value. When the ECU **A-001** senses a deviation in value from the calculated coolant temperature, this fault will occur.

**Cause:**
The ECU **A-001** has detected a temperature difference between the two temperatures is out of range.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty coolant temperature sensor **B-9003**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the coolant temperature sensor **B-9003**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Before carrying out the required checks, make sure that the engine is not used in extreme environmental conditions.

   Use the Electronic Service Tool (EST) to check the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the coolant temperature sensor **B-9003** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the coolant temperature sensor **B-9003** at connector **X-9006**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 100** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **4**.

   B. If there is voltage, continue with Step **5**.
4. Check the coolant temperature sensor **B-9003** circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 100** | Chassis ground | There should be no continuity |
| **X-EC1 (Receptacle) pin 100** | All other pins on **X-EC1** | There should be no continuity |

A. If there is no continuity on both checks, continue with Step **7**.

B. If there is continuity on either check, continue with Step **5**.

5. Locate the circuit for a short to power.

   Disconnect the harness connector **X-9138B** from the harness connector **X-470**.

   With the keyswitch in the ON position, use a multimeter to check for voltage:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 14** | Chassis ground | There should be no voltage |

   A. If there is no voltage, continue with Step **6**.

   B. If there is voltage, there is a short to power in the connector harness (between **X-9138B** and **X-9006** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

6. Locate the circuit for a short circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-9138B (Plug) pin 14** | Chassis ground | There should be no continuity |
| **X-9138B (Plug) pin 14** | All other pins on **X-9138B** | There should be no continuity |
| **X-9006 (Receptacle) pin 1** | All other pins on **X-9006** | There should be no continuity |

   A. If there is no continuity on all the checks, there is a short circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is continuity on any of the checks, there is a short circuit in the connector harness (between **X-9138B** and **X-9006** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

7. Check the coolant temperature sensor **B-9003** signal circuit for an open circuit.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 100** | **X-9006 (Receptacle) pin 1** | There should be continuity |
| **X-EC1 (Receptacle) pin 99** | **X-9006 (Receptacle) pin 2** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **9**.

   B. If there is no continuity on either check, continue with Step **8**.

8. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 100** | **X-470 (Receptacle) pin 14** | There should be continuity |
| **X-EC1 (Receptacle) pin 99** | **X-470 (Receptacle) pin 13** | There should be continuity |

   A. If there is continuity on both checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9006** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

   B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-470** and **X-EC1** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

9. Check the coolant temperature sensor **B-9003**.

   With the keyswitch in the OFF position, use a multimeter to check for resistance on the component side:

| From | To | Value |
|---|---|---|
| **X-9006 (Receptacle) pin 1** | **X-9006 (Receptacle) pin 2** | There should be approximately **100 – 50,000 Ω** |

   A. If the measured resistance is within the limit, continue with Step **10**.

   B. If the measured resistance is not within the limit, the coolant temperature sensor **B-9003** has failed internally. Replace the coolant temperature sensor **B-9003**.

10. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19323 (F-518653-31) - External Engine Shutdown Request Received [113270397 - V4 - 20 January 2025]

## Control Module: ECU

**Fault Description:**
This fault code does not describe a failure but rather acknowledges an external shut OFF request. By adding engine shut OFF paths in the inhibit matrix, an engine shut OFF will be caused according to different shut OFF possibilities. Monitoring is active while none of the Controller Area Network (CAN) controllers are in bus-OFF state. While none of the CAN controllers are in bus-OFF state for at least **6.00 s**, the Engine Control Unit (ECU) **A-001** is not in after-run and terminal 15 (key switch signal) is ON. This is an informational failure, no intervention is necessary except to check the failure source for the engine shut OFF request.

# 19361 (F-158-16) - Battery Voltage is Too High to Allow Proper Diagnosis of Output Powerstages [113270523 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the battery voltage using internal interfaces to control the machine operations. When the ECU **A-001** senses that the battery voltage is greater than **16.5 V** on the battery circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to power condition on the battery circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty battery or recharging system.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the battery voltage.

   With engine running, use a multimeter to check the voltage:

| From | To | Value |
|---|---|---|
| Battery terminal (+) | Battery terminal (-) | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is not approximately **12 V**, continue with Step **4**.

3. Check the voltage on the ECU **A-001** supply circuit.

   Using a multimeter back probe the harness from the **A-001** at connector **X-EC2**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 1** | Chassis ground | There should be approximately **12.0 V** |
| **X-EC2 (Receptacle) pin 3** | Chassis ground | There should be approximately **12.0 V** |
| **X-EC2 (Receptacle) pin 5** | Chassis ground | There should be approximately **12.0 V** |

   A. If there is approximately **12 V** on all the checks, continue with Step **4**.

   B. If there is not approximately **12 V** on any of the checks, check the fuse and circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reinstall the fuse, recheck the voltage, then return the machine to normal operation.

4. Check the ECU **A-001** ground circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 2** | Chassis ground | There should be continuity |
| **X-EC2 (Receptacle) pin 4** | Chassis ground | There should be continuity |
| **X-EC2 (Receptacle) pin 6** | Chassis ground | There should be continuity |

A. If there is continuity on all the checks, continue with Step **5**.

B. If there is no continuity on any of the checks, there is an open circuit in the ground circuit harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Check the charging system, repair the charging system as required.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19362 (F-158-18) - Battery Voltage is Too Low to Allow Proper Diagnosis of Output Powerstages [113270880 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the battery voltage using internal interfaces to control the machine operations. When the ECU **A-001** senses that the battery voltage is less than **9 V** on the battery circuit, this fault will occur.

**Cause:**
The ECU **A-001** has detected a short to ground condition on the battery circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short or open circuit.
2. Faulty battery or recharging system.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the battery voltage.

   With engine running, use a multimeter to check the voltage:

| From | To | Value |
|---|---|---|
| Battery terminal (+) | Battery terminal (-) | There should be approximately **12 V** |

   A. If there is approximately **12 V**, continue with Step **3**.

   B. If there is not approximately **12 V**, continue with Step **4**.

3. Check the voltage on the ECU **A-001** supply circuit.

   Using a multimeter back probe the harness from the **A-001** at connector **X-EC2**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 1** | Chassis ground | There should be approximately **12.0 V** |
| **X-EC2 (Receptacle) pin 3** | Chassis ground | There should be approximately **12.0 V** |
| **X-EC2 (Receptacle) pin 5** | Chassis ground | There should be approximately **12.0 V** |

   A. If there is approximately **12 V** on all the checks, continue with Step **4**.

   B. If there is not approximately **12 V** on any of the checks, check the fuse and circuit wiring for damage. Locate and repair the shorted circuit or replace the harness or connectors as required. Reinstall the fuse, recheck the voltage, then return the machine to normal operation.

4. Check the ECU **A-001** ground circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 2** | Chassis ground | There should be continuity |
| **X-EC2 (Receptacle) pin 4** | Chassis ground | There should be continuity |
| **X-EC2 (Receptacle) pin 6** | Chassis ground | There should be continuity |

A. If there is continuity on all the checks, continue with Step **5**.

B. If there is no continuity on any of the checks, there is an open circuit in the ground circuit harness. Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Check the charging system, repair the charging system as required.

   Then recheck the status of this fault.

   A. Fault is active. Continue with Step **6**.

   B. Fault is not active. Return the machine to normal operation.

6. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19454 (F-108-20) - ECU Internal Failure - Ambient Air Pressure Too High [113270765 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** analyses the measured signal of the ambient air pressure sensor for implausible values by means of diverse criteria. In fault cases the signals will be set invalid and a defect is reported. The measured pressure is checked for plausibility. The ambient pressure sensor is located inside ECU **A-001**. When the ECU **A-001** senses an ambient pressure higher than the correct value, this fault will occur. If the ECU **A-001** is not located at an extremely low altitude (below sea level), and since this fault is the result of an internal failure.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19455 (F-108-21) - ECU Internal Failure - Ambient Air Pressure Too Low [113270767 - V5 - 21 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** analyses the measured signal of the ambient air pressure sensor for implausible values by means of diverse criteria. In fault cases the signals will be set invalid and a defect is reported. The measured pressure is checked for plausibility. The ambient pressure sensor is located inside ECU **A-001**. When the ECU **A-001** senses an environmental pressure less than the correct pressure, this fault will occur. If the ECU **A-001** is not located at an extremely high altitude and since this fault is the result of an internal failure.

**Cause:**
The ECU **A-001** has detected an internal failure.

**Possible failure modes:**

1. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19585 (5055-17) - Engine Oil Viscosity Low (Least Severe) [113334014 - V3 - 24 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the viscosity of the engine oil to control the engine operations. When the ECU **A-001** senses that the viscosity of the oil is lower than the first predetermined threshold, this fault will occur.

**Cause:**
The ECU **A-001** has detected the consumption of engine oil due to degradation of the oil.

**Possible failure modes:**

1. Engine oil degraded.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the viscosity of the engine oil.

   A. If the oil viscosity level is correct, continue with Step **3**.

   B. If the oil viscosity level is too low, change the engine oil and reset oil dilution via service tester, recheck the oil viscosity, then return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19588 (5055-18) - Engine Oil Viscosity Low (Moderate Severe) [113334022 - V3 - 24 January 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the viscosity of the engine oil to control the engine operations. When the ECU **A-001** senses that the engine oil has not been changed after the second level indication on the instrument panel, this fault will occur.

**Cause:**
The ECU **A-001** has detected the consumption of engine oil due to degradation of the oil.

**Possible failure modes:**

1. Engine oil degraded.
2. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the ECU **A-001** wiring harnesses, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.
   A. The connectors are secure and no damage is found. Continue with Step **2**.
   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the viscosity of the engine oil.
   A. If the oil viscosity level is correct, continue with Step **3**.
   B. If the oil viscosity level is too low, change the engine oil and reset oil dilution via service tester, recheck the oil viscosity, then return the machine to normal operation.
3. Check the ECU **A-001** for the appropriate software and re-flash.
   A. Fault is not active. Return the machine to normal operation.
   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19618 (5018-18) - Diesel Oxidation Catalyst Temperature Monitoring - Catalyst Deteriorated or Removed [113270832 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the conversion of Hydro Carbon (HC) in the catalyst, namely, the performance of the catalyst according to On Board Diagnosis (OBD) regulations by calculating the minimum expected exothermic energy input in the exhaust (i.e. temperature increase) and comparing it with the measured energy input (temperature increase compared to oxicat). The following temperatures are used: temperature measured before oxicat (signal of the temperature sensor before turbine), measured temperature after oxicat (measured thermal energy) (signal from temperature sensor before turbine), calculated temperature after oxicat (including thermal energy due to HC conversion) (temperature after turbine), calculated temperature after oxicat without heat energy by HC conversion (reference temperature) (temperature after the turbine). When the ECU **A-001** senses that the "expected/measured" ratio of HC conversion energy is lower than the predetermined threshold, this fault will occur. This fault may occur because of temperature sensors before and after oxicat exchanged. And post-injection does not work when this fault is active.

**Cause:**
The ECU **A-001** detected that the thermal oxicat aged (efficiency too low) or damaged.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty wiring or connections, open circuit.
3. Faulty exhaust gas temperature sensor upstream of the Diesel Oxidation Catalysts (DOC) **B-011**, internal failure.
4. Faulty exhaust gas temperature sensor upstream of the Diesel Particulate Filter (DPF) **B-012**, internal failure.
5. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DOC **B-011**, the exhaust gas temperature sensor upstream of the DPF **B-012**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check to confirm if other fault codes related to the emission are present.

   A. If no other fault codes are present, continue with Step **3**.

   B. If other fault codes are present, resolve those fault codes first.
3. Check whether the exhaust gas temperature sensor upstream of the DOC **B-011**, the exhaust gas temperature sensor upstream of the DPF **B-012** have been interchanged.

   A. If the sensors have not been switched, continue with Step **4**.

   B. If the sensors have been switched, reinstall to the correct position.
4. Check the exhaust gas temperature sensor upstream of the DOC **B-011** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DOC **B-011** at connector **X-617**.

With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-617 (Receptacle) pin 1** | **X-EC2 (Receptacle) pin 30** | There should be continuity |
| **X-617 (Receptacle) pin 2** | **X-EC2 (Receptacle) pin 27** | There should be continuity |

A. If there is continuity on both checks, continue with Step **5**.

B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-EC2** and **X-617** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

5. Check the exhaust gas temperature sensor upstream of the DPF **B-012** circuit for an open circuit.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DPF **B-012** at connector **X-303**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-303 (Receptacle) pin 1** | **X-EC2 (Receptacle) pin 28** | There should be continuity |
| **X-303 (Receptacle) pin 2** | **X-EC2 (Receptacle) pin 27** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **6**.

   B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-EC2** and **X-303** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

6. Replace the exhaust gas temperature sensor upstream of the DOC **B-011** then recheck the status of this fault.

   A. Fault is active. continue with Step **7**.

   B. Fault is not active. Return the machine to normal operation.

7. Replace the exhaust gas temperature sensor upstream of the DPF **B-012** then recheck the status of this fault.

   A. Fault is active. continue with Step **8**.

   B. Fault is not active. Return the machine to normal operation.

8. Check the correct operation of the DOC oxidation catalyst.

   A. If the DOC oxidation catalyst is working correctly, continue with Step **9**.

   B. If the DOC oxidation catalyst is not working correctly, replace the DOC oxidation catalyst.

9. Check the correct operation of injectors **Y-9001**, **Y-9002**, **Y-9003**, and **Y-9004**.

   A. If the injectors are working correctly, continue with Step **10**.

   B. If the injectors are not working correctly, replace the injectors which are not working correctly.

10. Check the ECU **A-001** for the appropriate software and re-flash.

    A. Fault is not active. Return the machine to normal operation.

    B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19666 (5571-12) - Pressure Relief Valve Shock Test Failed Because Fuel Quality is Not in Range [113334016 - V4 - 22 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the rail pressure sensor **B-9004** to control the engine operations. To determine mechanical exhaustion, the pressure relief valve can be forced to open by performing a rail pressure shock defined in two stages: waiting for the rail pressure to rise and performing pressure shocks. The two steps are recorded in the fault memory. Pressure shock is only possible in a defined range of engine speed/injection quantity. The ECU **A-001** reports the error when the pressure shock is rejected because the amount of fuel is outside the predetermined range. When the ECU **A-001** senses a pressure shock request outside of the possible range due to the rail pressure sensor **B-9004** failure, this fault will occur.

**Cause:**
The ECU **A-001** has detected an open circuit condition on the rail pressure sensor **B-9004** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty rail pressure sensor **B-9004**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the rail pressure sensor **B-9004**, the fuse (if applicable), and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the rail pressure sensor **B-9004** for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC1**.

   Disconnect the harness from the rail pressure sensor **B-9004** at connector **X-9026**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 42** | **X-9026 (Receptacle) pin 3** | There should be continuity |
| **X-EC1 (Receptacle) pin 62** | **X-9026 (Receptacle) pin 2** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-9026 (Receptacle) pin 1** | There should be continuity |

   A. If there is continuity on all the checks, continue with Step **4**.

   B. If there is no continuity on any of the checks, continue with Step **3**.

3. Locate the circuit for an open circuit.

   Disconnect the harness connector **X-470** from the harness connector **X-9138B**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC1 (Receptacle) pin 42** | **X-470 (Receptacle) pin 7** | There should be continuity |
| **X-EC1 (Receptacle) pin 62** | **X-470 (Receptacle) pin 6** | There should be continuity |
| **X-EC1 (Receptacle) pin 63** | **X-470 (Receptacle) pin 5** | There should be continuity |

A. If there is continuity on all the checks, there is an open circuit in the connector harness (between **X-9138B** and **X-9026** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

B. If there is no continuity on any of the checks, there is an open circuit in the connector harness (between **X-9026** and **X-470** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the rail pressure sensor **B-9004**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19786 (F-519647-15) - SCR Inducement: Warning, Triggered by Customer Moderate Fault [113270801 - V4 - 28 January 2025]

## Control Module: ECU

**Fault Description:**
This fault is for informational purposes only and requires no action other than the resolution of the active fault causing this fault to occur. Any of the various faults that could occur in the engine causes the generation of this fault.

# 19787 (F-5840-16) - SCR Inducement: Level 1 (Torque Reduction), Triggered by DEF/AdBlue Dosing Interruption Fault [113270936 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
This fault is reported for information purposes only and no actions are required other than resolving the active error that has caused this fault. Any of the **Diesel Exhaust Fluid (DEF)/AdBlue®** fluid injection interruption faults of the Selective Catalytic Reduction (SCR) system that remain active for too long will cause this fault.

# 19788 (F-5840-00) - SCR Inducement: Level 3 (Creep Mode), Triggered by DEF/AdBlue Dosing Interruption Fault [113270939 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
This fault is reported for information purposes only and no actions are required other than resolving the active error that has caused this fault. Any of the **Diesel Exhaust Fluid (DEF)/AdBlue®** fluid injection interruption faults of the Selective Catalytic Reduction (SCR) system at remain active for a period longer than the threshold causes this fault.

# 19789 (F-5840-15) - SCR Inducement: Warning, Triggered by DEF/AdBlue Dosing Interruption Fault [113270943 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
This fault is generated for information purposes only, therefore no other corrective actions are required other than resolving the active error that has caused this fault. Any interruption in the injection **Diesel Exhaust Fluid (DEF)/ AdBlue®** in the Selective Catalytic Reduction (SCR) system has caused this fault. The active error that causes this fault must be identified and resolved within a certain operating time in order to prevent engine power reduction.

# 19800 (F-5246-16) - SCR Inducement: Level 1 (Torque Reduction), Triggered by Tampering Fault [113270316 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
This fault is generated for information purposes only, therefore no other corrective actions are required other than resolving the active error that has caused this fault. Any interruption in the injection **Diesel Exhaust Fluid (DEF)/ AdBlue®** in the Selective Catalytic Reduction (SCR) system has caused this fault. The active error that causes this fault must be identified and resolved within a certain operating time in order to prevent engine power reduction.

# 19801 (F-5246-00) - SCR Inducement: Level 3 (Creep Mode), Triggered by Tampering Fault [113270318 - V4 - 21 January 2025]

## Control Module: ECU

**Fault Description:**
This fault is reported for information purposes only and no actions are required other than resolving the active error that has caused this fault. Any of the **Diesel Exhaust Fluid (DEF)/AdBlue®** tampering detection faults of the Selective Catalytic Reduction (SCR) system that remain active for too long will cause this fault.

# 19809 (F-519644-31) - Inducement Validation Restart Mode Activated (Full Power Restart for Inducement Validation) [113270563 - V5 - 24 February 2025]

## Control Module: ECU

**Fault Description:**
This fault is reported for information purposes only and no actions are required other than resolving the active error that has caused this fault. When the Engine Control Unit (ECU) **A-001** senses that the validation mode is active, this fault will occur. The validation mode is an inducement deactivation for three full-power restarts. During this validation mode, the vehicle will be at full power to allow the detection of any components which have been replaced or the elimination of a previously active fault.

# 19825 (4766-16) - Downstream Oxidation Catalyst Temperature is Too High [113270890 - V5 - 28 February 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas temperature sensor upstream of the Diesel Particulate Filter (DPF) **B-012**. When the ECU **A-001** senses the temperature signal greater than **999.96 °C** on the exhaust gas temperature sensor upstream of the DPF **B-012** circuit, this fault will occur. When this fault occurs, the temperature value is locked by the ECU **A-001** on the last valid value detected or on a fixed replacement value, once the fault is validated.

**Cause:**
The ECU **A-001** has detected an excessive temperature on the exhaust gas temperature sensor upstream of the DPF **B-012** circuit.

**Possible failure modes:**

1. Faulty wiring or connections, open circuit.
2. Faulty exhaust gas temperature sensor upstream of the DPF **B-012**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DPF **B-012**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check the exhaust gas temperature sensor upstream of the DPF **B-012** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DPF **B-012** at connector **X-303**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-303 (Receptacle) pin 1** | **X-EC2 (Receptacle) pin 28** | There should be continuity |
| **X-303 (Receptacle) pin 2** | **X-EC2 (Receptacle) pin 27** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **3**.

   B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-EC2** and **X-303** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.
3. Replace the exhaust gas temperature sensor upstream of the DPF **B-012** then recheck the status of this fault.

   A. Fault is active. Continue with Step **4**.

   B. Fault is not active. Return the machine to normal operation.
4. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19826 (4766-03) - Oxidation Catalyser Downstream Temperature Sensor: Signal Range Check High (Voltage High) [113270463 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas temperature sensor upstream of the Diesel Particulate Filter (DPF) **B-012**. When the ECU **A-001** senses a voltage greater than **3.58 V** on the exhaust gas temperature sensor upstream of the DPF **B-012**, this fault will occur. When this fault is active, the temperature value will be frozen by the ECU **A-001** the last valid value or to a fixed replacement value.

**Cause:**
The ECU **A-001** has detected a short to power condition on the exhaust gas temperature sensor upstream of the DPF **B-012** pressure signal circuit.

**Possible failure modes:**

1. Faulty wiring or connections, short to power.
2. Faulty exhaust gas temperature sensor upstream of the DPF **B-012**, internal failure.
3. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DPF **B-012**, and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.

2. Check the exhaust gas temperature sensor upstream of the DPF **B-012** circuit for a short to power.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DPF **B-012** at connector **X-303**.

   With the keyswitch in the ON position, use a multimeter to check for voltage on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 27** | Chassis ground | There should be no voltage |
| **X-EC2 (Receptacle) pin 28** | Chassis ground | There should be no voltage |

   A. If there is no voltage on both checks, continue with Step **3**.

   B. If there is voltage on either check, there is a short to power in the connector harness (between **X-EC2** and **X-303** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the voltage, then return the machine to normal operation.

3. Check the exhaust gas temperature sensor upstream of the DPF **B-012** circuit for a short to power.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-EC2 (Receptacle) pin 27** | All other pins on **X-EC2** | There should be no continuity |
| **X-EC2 (Receptacle) pin 28** | All other pins on **X-EC2** | There should be no continuity |

   A. If there is no continuity on both checks, continue with Step **4**.

B. If there is continuity on either check, there is a short to power in the connector harness (between **X-EC2** and **X-303** connector harness). Locate and repair the shorted circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the exhaust gas temperature sensor upstream of the DPF **B-012**, reconnect the connectors, then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

# 19827 (4765-16) - Oxidation Catalyser Upstream Temperature Sensor: Physical Signal Above Maximum Limit (Signal High) [113270894 - V6 - 18 August 2025]

## Control Module: ECU

**Fault Description:**
The Engine Control Unit (ECU) **A-001** monitors the exhaust gas temperature sensor upstream of the Diesel Oxidation Catalyst (DOC) **B-011** to control engine operations. When the ECU **A-001** senses a temperature signal of greater than **899.96 °C** on the exhaust gas temperature sensor upstream of the DOC **B-011** circuit, this fault will occur. When this fault occurs, the temperature value is locked by the ECU **A-001** on the last valid value detected or on a fixed replacement value, once the fault is validated.

**Cause:**
The ECU **A-001** has detected an excessive temperature on the exhaust gas temperature sensor upstream of the DOC **B-011** circuit.

**Possible failure modes:**

1. Other active fault codes.
2. Faulty wiring or connections, open circuit.
3. Faulty exhaust gas temperature sensor upstream of the DOC **B-011**, internal failure.
4. Faulty ECU **A-001**, software or internal failure.

**Solution:**

1. Visually inspect the wiring harnesses from the ECU **A-001** to the exhaust gas temperature sensor upstream of the DOC **B-011**, the fuse (if applicable) and all related connectors for any signs of corrosion or damage that may result in the shorted circuit condition.

   A. The connectors are secure and no damage is found. Continue with Step **2**.

   B. The connectors are not secure and/or damage has been found. Repair or replace the harnesses or connectors as required. Return the machine to normal operation.
2. Check for other active fault codes related to exhaust gas temperature sensor upstream of the DOC **B-011**.

   And then recheck the status of this fault.

   A. Fault is active. Continue with Step **3**.

   B. Fault is not active. Return the machine to normal operation.
3. Check the exhaust gas temperature sensor upstream of the DOC **B-011** circuit for an open circuit.

   Disconnect the harness from the ECU **A-001** at connector **X-EC2**.

   Disconnect the harness from the exhaust gas temperature sensor upstream of the DOC **B-011** at connector **X-617**.

   With the keyswitch in the OFF position, use a multimeter to check for continuity on the harness side:

| From | To | Value |
|---|---|---|
| **X-617 (Receptacle) pin 1** | **X-EC2 (Receptacle) pin 30** | There should be continuity |
| **X-617 (Receptacle) pin 2** | **X-EC2 (Receptacle) pin 27** | There should be continuity |

   A. If there is continuity on both checks, continue with Step **4**.

   B. If there is no continuity on either check, there is an open circuit in the connector harness (between **X-EC2** and **X-617** connector harness). Locate and repair the open circuit or replace the harness or connectors as required. Recheck the continuity, then return the machine to normal operation.

4. Replace the exhaust gas temperature sensor upstream of the DOC **B-011** then recheck the status of this fault.

   A. Fault is active. Continue with Step **5**.

   B. Fault is not active. Return the machine to normal operation.

5. Check the ECU **A-001** for the appropriate software and re-flash.

   A. Fault is not active. Return the machine to normal operation.

   B. Fault is active. Submit a Technical Help Desk (THD) request before replacing the ECU **A-001**.

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